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ABSTRACT

Reported are the results of the National Speech and Hearing Survey conducted to estimate the prevalence of speech and hearing disorders in the public school populations, grades 1-12, in coterminous United States, and to obtain descriptive information about normal and abnormal speech and hearing behavior. Results of the survey, involving approximately 38,000 Ss, are presented in the first half of the document, primarily in tabular form (153 tables and nine figures). The second half of the document consists of appended material such as speech testing materials, data recording forms, and total sample and detailed tables of misarticulations and articulation deviations (182 tables in appendixes). Findings included the following: the combined prevalence of speech disorders was 5.7%; the greatest number of Ss with moderate and extreme articulation deviations were found in the first grade, and the number decreased along with increased grade level; 2.6% of the Ss had hearing characteristics which were classified as impaired; hearing sensitivity improved with grade level; and females performed better than males in both speech and hearing. (IM)

Final Report

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NATIONAL SPEECH AND HEARING SURVEY

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CONTENTS

ORGANIZATION OF TABLES

ORGANIZATION OF TABLES (continued)

ORGANIZATION OF TABLES (continued)

ORGANIZATION OF TABLES (continued)

ORGANIZATION OF TABLES (continued)

ORGANIZATION OF TABLES (continued)

ORGANIZATION OF FIGURES

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INTRODUCTION

The prevalence of speech and hearing disorders has been a subject of interest to audiologists, speech pathologists, physicians, and educators for many years. Blanton (1916) reported the prevalence of speech disorders to be 5.69% of a sample of Wisconsin school children. At a later time, Fowler and Fletcher (1926) estimated the prevalence of hearing disorders in a sample of New York City public schools to be 14%. Subsequently, well over 100 surveys have been conducted in the United States to estimate the prevalence of both speech and hearing disorders. For example, studies by Burdin (1940), Carhart (1939), Louttit and Halls (1936), Mills and Streit (1942), and Morley (1952), among others, have reported the prevelance of speech disorders for different age groups.

Typically, surveys have been conducted in restricted geographical areas with selected samples and have employed diverse data collection techniques. These inconsistencies in survey design prevent reliable application of the general population.

Two studies illustrate some of these inconsistencies. Irwin (1948) found a prevalence of speech disorders among approximately 6000 children in the kindergarten and the first six grades of the Cleveland, Ohio, public schools to be 10%. In another study, Pronovost (1951) reported a prevalence figure of 7.8% for a sample of 87,288 subjects of all ages in New England. Irwin's results merely indicate the extent of problems in the preschool and elementary grades in the Cleveland public schools while Pronovost's suggest the magnitude of the problem for all ages in New England. Furthermore, while Irwin used trained speech specialists to test subjects, Pronovost used nurses, teachers, speech clinicians, and others for testing.

Results of previous surveys have also varied widely. The White House Conference on Child Health and Protection (1931) reported a speech disorder prevalence among 10,033 school children in Madison, Wisconsin, of 6.9% when speech pathologists tested the subjects. When questionnaires were used to obtain information, the figures ranged from 1.0% in Philadelphia to 21.4% in Fresno, California. In a more recent report, the ASHA Committee on the Midcentury White House Conference (1952) estimated the prevalence of speech disorders among children between the ages of 5 to 21 years to be 5.0%.

The prevalence of hering disorders has been reported by Eagles et al. (1963), Kinney (1945), NINDB Research Profile No. 4 (1967), and Weber, McGovern, and Zink (1967).

Studies of hearing disorders demonstrate the same inconsistencies of design and variation of results noted in the speech surveys. The status of the available knowledge about the prevalence of hearing disorders among school-age children is clearly summarized by Alpiner (1971):

> Connor (1961) in reviewing 31 separate studies reported that the number of school age children with defective hearing ranged from about 2 to 21%. He commmented that despite decades of testing and research, it remains almost impossible to reach general agreement concerning the prevalence of children's hearing impairment in the United States. Various groups and individuals have reported on the incidence of hearing loss from 1926 to 1960. Discrepancies in the reports exist because of different calibration procedures and test environment, the multiplicity of hearing tests employed, the qualification of the testers, and student motivation. The various investigators also have utilized different criteria to determine what constitutes the normal range of hearing.

Clearly, no reliable estimate of the prevalence of speech and hearing disorders exists at the present time. Yet, as Hull and Timmons (1966) have pointed out, realistic planning for future services for children with speech and hearing disorders requires reliable estimates of the magnitude of the problem.

In 1964 the U.S. Office of Education preliminarily explored the possibility of a prevalence study and, in 1965, awarded a grant (Project No. 52168) to Colorado State University for a feasibility study of a speech and hearing survey of school-age children throughout the United States. During the period from June 1965 to September 1968, several survey methodologies were formulated, tested, evaluated, and modified in a continuous process of developing a practical procedure for collecting and analyzing speech and hearing data on a large random sample of public-school subjects. Included in the planning were two substantial pilot studies involving samples of approximately 900 and 7000 public-school subjects. The goal of the early planning and subsequent pilot studies was to formulate reliable procedures for selection of the sample and the collection of data.

The primary purpose of the National Speech and Hearing Survey was to reliably estimate the prevalence of speech and hearing disorders among public-school children. But the survey also offered a unique opportunity to obtain updated normative speech and hearing data for a large group

of randomly selected school-age subjects. These two goals directed the design of sampling procedures and data collection methods.

METHOD

Sample

The sample utilized in this study was selected from a specific frame of public-school students: a conceptual list of students in Grades 1-12, categorized by public-school districts. Selected school districts had enrollment totals of at least 300 at the time of the survey and were located in the 48 conterminous states and the District of Columbia.

Three stages of stratification were employed in the frame construction. The first stage of stratification was the geographic partitioning into the nine census divisions defined by the U.S. Bureau of the Census. The second stage consisted of a mutually exclusive partitioning of the districts within each census division of the frame into five district-size groups according to their enrollment totals. The purpose of the second-stage stratification was to avoid a disproportionate representation of similar-size communities. The third stage was the partitioning, by states, of the districts within each district-size group of a census division.

The choice of the five school-district-size groups used in this study was based on nationwide data published by the U.S. Office of Education (1965). Table 1 shows the proportion of total districts and proportion of total students in each of the five district-size groups within the entire United States. Table 1 also shows that only 2.3% of the students in the United States were excluded from the five district-size groups used in this survey even though 52.9% of the associated districts were excluded. A practical reason for imposing the lower bound on district size was to insure that a minimal number of students would be available for testing purposes at any location which would be selected from the frame.

TABLE 1.

School-district-size group composition for United States. X denotes district size.

District-Size Group	Percent of Districts	Percent of Students
Group 1: $25{,}000 \leq X$	.6	27.5
Group 2: $12{,}000 \leq X < 25{,}000$	1.2	12.4
Group 3: $6{,}000 \leq X < 12{,}000$	3.0	15.7
Group 4: $3{,}000 \leq X < 6{,}000$	6.2	16.5
Group 5: $300 \leq X < 3{,}000$	36.1	25.6
Remainder: $X < 300$	52.9	2.3

The sample survey design prescribed screening 40,000 of the 41,088,138 students comprising the frame at 100 sampling points during the 1968-69 school year. Specifically, 400 students were to be screened at every sampling point with 33 or 34 students selected from each of the grades 1-12.

One hundred school districts were selected from the conceptual frame of students by means of a systematic sample. If the selected district contained all grades 1-12, then it was defined as the sampling point. If, however, a selected district did not contain all grades (e.g., a district containing only grades 7-12), it had to be coupled with another district (or districts) in the immediate vicinity to assure that 33 or 34 students would be available in each of the twelve grades. In this instance the coupled districts were collectively termed the sampling point. A selected sampling point, in effect, designated a specific geographical location. This procedure was very useful when five of the 100 originally selected sampling points did not participate. In each instance, a substitute public-school system was chosen in the immediate vicinity. The philosophy underlying these sampling procedures is discussed elsewhere (cf. Cochran, 1963 and Kish, 1965).

The states, listed by census division, in which sampling points were located are shown in Table 2. As indicated in the table, data were collected in 37 states including the District of Columbia. The 100 sampling points (cities where data were collected) are listed in Table 3.

Since an equal number of students was selected from each grade at a sampling point, each student of a given grade had about the same chance of being selected. However, a first-grade student had less chance of being selected than a twelfth-grade student since there were more first-grade students than twelfth-grade students listed in the frame. Within each sampling point, students were selected randomly by class groups within each grade if class assignments were random. But the selection procedure additionally accounted for proportionate numbers of students in accelerated or special education classes.

Table 4 illustrates the composition of the 38,884 students screened in this sample. Hearing data from 316 of these subjects were considered unreliable for one or more of the following reasons: (1) the child's behavior; (2) environmental factors; or (3) a physical deformity. Speech responses collected on 82 of the subjects were considered unreliable because of inadequate English skills or for other reasons. Thus, the present study involves hearing tests and speech tests administered to a random selection of 38,568 and 38,802 students, respectively.

TABLE 2.

The State composition of each of the nine census divisions of the 48 coterminous states and the District of Columbia.

Census Division No. 1

*Connecticutt
Maine
*Massachusetts
New Hampshire
Rhode Island
Vermont

Census Division No. 2

*New Jersey
*New York
*Pennsylvania

Census Division No. 3

*Illinois
*Indiana
*Michigan
*Ohio
*Wisconsin

Census Division No. 4

*Alabama
*Kentucky
*Mississippi
*Tennessee

Census Division No. 5

*Iowa
*Kansas
*Minnesota
*Missouri
*Nebraska
N. Dakota
*S. Dakota

Census Division No. 6

*District of Columbia
Delaware
*Florida
*Georgia
*Maryland
*N. Carolina
*S. Carolina
*Virginia
*W. Virginia

Census Division No. 7

*Arkansas
*Louisiana
Oklahoma
*Texas

Census Division No. 8

Arizona
*Colorado
Idaho
*Montana
*Nevada
New Mexico
Utah
Wyoming

Census Division No. 9

*California
*Oregon
*Washington

*States where sampling points were located and testing conducted.

TABLE 3.

100 Sampling Points from which data for the National Speech and Hearing Survey were collected (1968-69).

1.	Birmingham, AL	51.	Troy, MO
2.	Cullman, AL	52.	Sidney, MT
3.	Tuscaloosa, AL	53.	Omaha, NB
4.	Phoenix, AZ	54.	Las Vegas, NV
5.	Magnolia, AR	55.	Reno, NV
6.	Pine Bluff, AR	56.	Cresskill, NJ
7.	Anaheim, CA	57.	Lakewood, NJ
8.	Campbell, CA	58.	Madison (Old Bridge) NJ
9.	Dos Palos, CA	59.	Buffalo, NY
10.	Edwards, CA	60.	Burnt Hills, NY
11.	Fresno, CA	61.	Cohoes, NY
12.	Los Angeles, CA	62.	Monroe, NY
13.	Monterrey, CA	63.	New City, NY
14.	Paramount, CA	64.	New York, NY
15.	San Francisco, CA	65.	New York, NY
16.	Simi, CA	66.	Niagra Falls, NY
17.	Denver, CO	67.	Ashville, NC
18.	Branford, CT	68.	Durham, NC
19.	Colchester, CT	69.	Gastonia, NC
20.	Manchester, CT	70.	Greensboro, NC
21.	Shelton, CT	71.	Centerville, OH
22.	Washington, D.C.	72.	Cleveland, OH
23.	Gainsville, FL	73.	Genoa, OH
24.	Jacksonville, FL	74.	Lakewood, OH
25.	St. Petersburg, FL	75.	Parma, OH
26.	Columbus, GA	76.	Heppner, OR
27.	Newnan, GA	77.	Oregon City, OR
28.	Chicago, IL	78.	Conemaugh, PA
29.	Elmhurst, IL	79.	Media, PA
30.	Jerseyville, IL	80.	Philadelphia, PA
31.	Marissa, IL	81.	Uniontown, PA
32.	Rockford, IL	82.	Cayce, SC
33.	Batcleground, IN	83.	Spartanburg, SC
34.	Indianapolis, IN	84.	Huron, SD
35.	Marshalltown, IA	85.	Rapid City, SD
36.	Arkansas City, KS	86.	Winner, SD
37.	Boone, KY	87.	Johnson City, TN
38.	Alexandria, LA	88.	Brownsfield, TX
39.	New Orleans, LA	89.	Dallas, TX
40.	Baltimore, MD	90.	Karnes City, TX
41.	North Brookfield, MA	91.	Laporte, TX
42.	Benton Harbor, MI	92.	Longview, TX
43.	Gobles, MI	93.	San Antonio, TX
44.	Livonia, MI	94.	Winchester, VA
45.	Scottville, MI	95.	Parkersburg, WV
46.	Wayne County (Detroit) MI	96.	Point Pleasant, WV
47.	Mound, MN	97.	Spokane, WA
48.	Clarksdale, MS	98.	Belleville, WI
49.	Jackson, MS	99.	Milwaukee, WI
50.	Ripley, MS	100.	Oak Creek, WI

TABLE 4.

Census division and sex composition of subjects tested.

Census Division	Males	Percent	Females	Percent	Total
1	994	50.8	962	49.2	1,956
2	3,061	52.3	2,792	47.7	5,853
3	4,042	51.9	3,744	48.1	7,786
4	1,528	49.2	1,577	50.8	3,105
5	1,608	51.5	1,516	48.5	3,124
6	3,158	51.5	2,977	48.5	6,135
7	2,010	51.8	1,868	48.2	3,878
8	1,007	51.9	933	48.1	1,940
9	2,593	50.8	2,514	49.2	5,107
Total	20,001	51.4	18,883	48.6	38,884

Testing Environment

All data were collected in six custom-manufactured mobile units designed by the survey personnel at Colorado State University. Specifications for the size, sound-attenuation characteristics of the units, and location of the data-collection spaces were determined by preconstruction tests.

Each unit contained two sound-treated rooms used for speech evaluations and tape recordings. Hearing tests were conducted in an IAC (Model 401) chamber located centrally in the unit. The IAC rooms were selected after determining, through laboratory experiments, that they provided sufficient sound attenuation at the test frequencies involved to permit zero-level threshold measurements (ANSI-1969) in the presence of high levels of school-environment noise.

Electrical power was supplied by means of a 100-ft shoreline which carried 220-volt current from the main circuit in the school building. The power supply was controlled through a constant-voltage transformer and other circuitry which furnished constant 110-volt current for the audiometers, calibration equipment, and tape recorders and also 220-volt current to operate the heating and air-conditioning equipment.

Equipment and Materials

Audiometers and Calibration Equipment. Measures of auditory sensitivity were obtained with modified audiometers (Maico, Model MA 11) equipped with TDH-39/10Z earphones in MX-41/AR cushions. The major modification included the addition of potentiometers to permit simple physical corrections in the output of the instruments by personnel in

the field. Each mobile unit was equipped with two audiometers, one for testing and the other as a replacement when needed. An artificial ear (Rudmose, Model RA 106) and a voltmeter (Simpson, Model 715) were used for the twice-daily field calibrations and trouble shooting.

Tape Recorders. A dual-track tape recorder (Uher, 4000 L Report) was located in each of the two speech-testing rooms. Recordings of all speech samples were made at a tape speed of 3 1/4 ips.

Speech Testing Materials. Two types of speech responses from each subject were evaluated. One was comprised of a series of single-word responses to a standard articulation test (The Goldman-Fristoe Test of Articulation). See APPENDIX A.1. The other was an aggregate of connected-speech samples elicited by stimulus pictures, questions, and verbally stimulated sentence repetitions. See APPENDIX A.2, A.3, A.4, and A.5.

Personnel

The survey was conducted by a staff of 32. During data collection, operation of the survey was divided into two main functions: central coordinating activities and data collection in the field.

Survey Team. The data were collected from the 100 sampling points by the six survey teams. Each team consisted of a coordinator and three evaluators. The coordinator traveled ahead of the testing team and made final arrangements with school administrators for the collection of data at each sampling point. The three evaluators traveled with the mobile unit and administered the various tests.

Training Program. The 18 evaluators and six team coordinators participated in a six-week training program prior to the beginning of the data collection. The two primary purposes of the training program were to (1) familiarize personnel with the overall organization of the survey, testing procedures and materials, and operation and maintenance of the electronic equipment and the mobile unit; and (2) establish an acceptable level of reliability for evaluating speech and hearing behavior.

Evaluator Reliability. Because of the different previous professional training of team members there was a likelihood of individual differences in judging speech performance and testing hearing. Therefore reliability training was introduced to establish agreement on common criteria for all judgments of speech and hearing.

Speech reliability training consisted of several sessions of listening to taped recordings of connected speech representing different age levels, male and female speakers, different dialectal patterns, and a range of deviations of articulation, voice, and fluency, including stuttering. The listening sessions were interspersed with discussions of criteria to be used for judging connected speech and in the use of the rating scales. Reliability training also included judgments of responses to the Goldman-Fistoe Test of Articulation.

To assess the reliability of connected speech ratings, the 18 evaluators listened to five specially recorded tapes each containing 25 samples of connected speech. Different age levels, both sexes, and different types of speech patterns were represented in the 25 speech samples. The five tapes were judged twice to calculate intra- and inter-reliability. The time delay between listening sessions was one day for the pre- and post-data collection reliability assessments and one week during the collection of data. Reliability was assessed two times prior to the collection of data, four times during data collection, and once after the collection of data was completed.

Reliability for rating articulation performance of connected speech was assessed by calculating the mean percentage of agreement for 18 evaluators. The results shown in Table 5 are based on ratings of two tapes for the pre-data collection period (during training), four tapes during data collection, and one tape for the post-data collection assessment.

TABLE 5.

Evaluator reliability for articulation, voice, stuttering and overall performance ratings calculated as mean percentage of agreement for 18 evaluations.

	Pre-Data* Collection		During Data** Collection		Post-Data*** Collection	
	Inter	Intra	Inter	Intra	Inter	Intra
Articulation	78	85	75	87	80	90
Voice	66	74	67	84	73	82
Stuttering	98	99	99	100	100	100
Overall	58	65	67	83	83	85

*Mean for two assessments.
**Mean for four assessments.
***Mean for one assessment.

Reliability assessments of the evaluators' performance on the audiological procedure were conducted throughout the survey. In 63 of the 100 sampling points where data were gathered, one first-grade student was selected for test-retest measurements by the evaluators of each team. First-grade subjects were chosen on the assumption they would be most likely to show test-retest inconsistencies. Analyses of both inter- and intra-test consistency were accomplished with percentages of agreement after administering the first and second tests on separate days. Percentages were calculated for perfect agreement and for plus-or-minus one, two, three, and four units (a four-unit disagreement was the largest observed). These units represented progressive 5 dB-interval deviations from the reference measures. Perfect agreement required identical responses at all five frequencies in both ears. A one unit (5 dB) variation at any test frequency reduced the percentage of agreements by 10 points, etc. It was recognized that variability in subjects' performances could also have influenced these measures to an unknown degree.

Table 6 presents the mean percentages of agreement on all reliability assessments for all evaluators. It may be noted that, for both inter- and intrareliability values for the plus-or-minus one category, the percentage of agreement was equal to or greater than 90%.

TABLE 6.

Means of percentages of agreement indices for all assessments of reliability of hearing measures for 18 evaluators. Values rounded to the nearest whole number.

	Survey Reliability	
	Inter	Intra
Agree	55	56
± 1	91	90
± 2	97	99
± 3	98	99
± 4	99	100

Data Collection Procedures

The procedures used in collecting the speech and hearing data were the same for each subject in the total sample. Each day one evaluator measured hearing and the other two gathered speech data, hence each evaluator tested hearing for one day, conducted speech evaluations for two consecutive days, and tested hearing again on the fourth day. Results were recorded on data sheets, (APPENDIX B.1 and B.2).

All subjects were assigned to the mobile unit in groups of four. Since the speech evaluation required approximately 10 minutes and the hearing test required about 5 minutes, the two speech evaluators and one hearing evaluator could process four subjects in a 20-minute period. Approximately half of the subjects first had the hearing test followed by the speech evaluations while the procedure was reversed for the remainder of the subjects. This was done to nullify the possible effects of ordering for the hearing testing and the speech evaluation procedures. Results were recorded on data sheets, (APPENDIX B.1 and B.2). The only difference between the two data sheets is the testing order for the right and left ear and the order of testing the five frequencies.

Speech Measures

The procedure for collecting speech data required that the subject respond verbally in a variety of stimulus-response activities. The order which was constant for all subjects was as follows:

1. Administration of the Goldman-Fristoe Test of Articulation.
2. Verbal stimulation of the consonants misarticulated during the articulation test. Misarticulated consonants were presented to the subject in a non-sense syllable combination with the consonant placed in the same position with the vowel /uh/ it occupied in the stimulus word during the formal articulation testing condition. For example, if /th/ had been misarticulated in the initial position (thumb) the subject was stimulated with "thuh" (CV), and so forth.
3. Pictures designed to elicit connected speech were shown to elementary-level (grades 1-6) and junior-high school level (grades 7-9) subjects. The subjects were asked to talk about or tell a story about the pictures. See APPENDIX A.2.
4. All subjects were asked to talk about various topics. See APPENDIX A.3.
5. All subjects were asked to repeat four sentences. See APPENDIX A.4.

Standard for Articulation Performance. The adult General American dialect pattern was used as the standard for comparison in assessing the articulation test results and in rating connected speech performance. The Adult General American standard was operationally defined on the basis of two primary criteria.

The first criterion assumes the existence of a mature articulation pattern that is more closely identified with the adult speaker rather than with a child whose articulation patterns will be influenced by subsequent normal growth and development. The adult pattern would include some minor articulation deviations that would vary among individuals and yet be considered acceptable.

The second criterion includes the concept that different speech patterns are typical of some geographical regions of the United States. Traditionally, these patterns have been designated by phoneticians as regional dialects, as for example, Eastern American, Southern American, and General American. The authors are aware of the fact that it has become increasingly difficult to delimit regional dialects because of the decreased cultural isolation. However, a decision was made to select, as a standard for comparison, a speech pattern that would be recognized generally as one which is used by the greatest proportion of English speakers in the United States. There appears to be some general agreement among phoneticians that the General American dialect, as described by Carrell and Tiffany (1960, Chapter 22), and Wise (1958, Chapter 6) and which includes, in part, the Central Midland region speech described by Thomas (1958, Chapter 22), is used more widely in the United States than any other dialect.

Adoption of a standard which includes the dual criteria of adult articulation and a General American dialect pattern offers a certain advantage to the evaluator since he must determine only if and to what degree the speech deviates from the standard in order to make a judgment.

Connected Speech. Following the articulation testing and listening to the connected speech responses, the evaluator made four judgments regarding the quality of performance based on deviations from a predetermined standard of speech behavior.

For articulation performance the evaluator rated the subject's speech on a three-point scale in terms of deviation from the Adult General American (AGA) dialect, as described earlier. The scale used was:

0 – No deviation from the AGA pattern.
1 – Mild deviation from the AGA pattern.
2 – Extreme deviation from the AGA pattern.

The zero (0), no-deviation rating was specifically defined as minimal deviation in which case a subject might have produced all consonants correctly during the articulation test and also exhibited speech patterns during the connected-speech-response activity that were acceptable. Acceptable

speech implies that, although there may have been some articulation errors, they were not considered to be outside the range of acceptability. The one (1) mild-deviation rating indicates that there were noticeable articulation errors either during the articulation testing or connected speech activity, or both. The judgment was not based on the evaluator's opinion as to whether a given subject was in need of corrective training but to what extent the observed speech deviated from the AGA. The two (2) extreme-deviation rating indicates that the observed speech deviated quite markedly from the AGA pattern. Furthermore it can be assumed that, in the judgment of the evaluator, such a speech pattern was not only noticeable but possibly difficult to understand and thus in need of corrective training. However the evaluator was neither trained nor instructed to apply the concept of a speech disorder in making the judgment.

The evaluator made two types of judgments regarding voice. One resulted in a rating of voice output on a three-point scale in terms of deviation from an acceptably clear laryngeal tone which was appropriate in pitch level for the age and sex of the subject. The other was related to the type of deviation which included the three quality characteristics of resonance (hypernasality and hyponasality), breathiness, and hoarseness. The three point scale used for rating the degree of deviation was as follows:

0 — No deviation from the accepted standard as described.
1 — Mild deviation from the standard.
2 — Extreme deviation from the standard.

Each subject who received a voice rating of one (1) or two (2) also received a rating which indicated the type of deviation.

The third basic judgment performed by the evaluator was a determination of the presence of stuttering (nonfluency). Stuttering was judged to be present if the two following characteristics were observed during spontaneous speech:

1. Obvious prolongations and repetitions of speech utterances which disrupted the normal flow of speech.
2. Other behavioral characteristics of speech associated phenomena.

Rating the overall impression of connected speech was the final judgment made by the evaluator. A four-point scale was used to rate the overall quality of speech production. Essentially overall impression refers to intelligibility which takes into account articulation, voice, and fluency (stuttering) as contributors to the total speech pattern.

Thus, an overall impression may be influenced by the characteristics of articulation, voice or fluency or any combination of the three. In terms of judged overall impression the four-point scale used was:

0 — No deviation from the standard pattern.
1 — Some deviation from the standard pattern; intelligibility is affected to a mild degree.
2 — Intelligibility is affected to a greater degree than a rating of 1.
3 — Intelligibility is affected to the degree that communication is impaired appreciably. In some instances speech cannot be understood.

Hearing Measures

Subject Preparation. An average time of five minutes was alloted to establish the bilateral, pure-tone, air-conduction thresholds for each child. As the subject entered the test chamber he was seated so that he could not see the audiometer or the evaluator's arm, hand, or eye movement.

Threshold Determination Technique. A 1000-Hz tone was initially presented to each subject as a "learning" frequency which served to orient the child to the test situation. An ascending technique was utilized for this and for subsequent threshold explorations. Specifically, the first test tone (the 1000-Hz learning tone) was presented at 40 dB re ISO 1964 audiometric zero. This level permitted the child to become familiar with the type of test stimulus to which he must attend. Following his response at this level, the tone was presented in successively decreasing 10-dB steps until the child failed to respond. The stimulus was then increased in 5-dB increments until a response was once again obtained. This "down ten — up five" procedure was repeated until a hearing level was established at which the child responded at least 50% of the time. A minimum of three ascents was made for each threshold measurement. Except for the learning tone, the values obtained in this manner were recorded as the child's threshold. After orientation, the procedure for formal measurements was modified slightly by substituting a beginning test level of 20 dB for the original 40-dB level. Pilot experiments revealed that thresholds obtained in this manner were as reliable as the 40-dB procedure and resulted in a substantial saving of time. In instances where a child responded at 0 dB, a minimum of three stimulus presentations were made to confirm this response level. No effort was made to obtain responses below audiometric zero.

Although the audiometers had a maximum output level of 110 dB for each of the test frequencies used, all thresholds

exceeding 95 dB were recorded as 99 in order to accommodate computer programming of results. No important information was lost by this decision since, for all practical purposes, a hearing level of 95 dB represents 100% impairment on the AAOO percentage-method scale (Davis and Kranz, 1964).

Whenever a child failed to respond at the initial measurement level (20 dB), the stimulus was increased in 20-dB steps until a response was elicited. The usual procedure for threshold determination then ensued.

Masking Procedures. Unmasked air-conduction thresholds were initially established on both ears of every child. In instances where the hearing levels in the child's two ears differed by 40 dB or more at any frequency, 85 dB (SPL) of white noise was supplied to the child's better ear while his poorer ear was retested. Thresholds in the poorer ear were reestablished under this condition for all frequencies and recorded as organic-threshold values.

SPEECH RESULTS

Articulation and voice ratings and a determination of the presence of stuttering were compiled for the total sample of 38,802 subjects on which reliable data were collected. The grade and sex distribution is shown in Table S.1; the age range and median age values are displayed in Table S.2.

TABLE S.1

Grade and sex distribution of total sample on which speech data were collected and analyzed.

Grade	Males		Females		Total
	Number	Percent	Number	Percent	Number
1	1670	52	1530	48	3200
2	1645	51	1573	49	3218
3	1651	51	1557	49	3208
4	1708	53	1530	47	3238
5	1693	53	1504	47	3197
6	1558	49	1633	51	3218
7	1673	51	1589	49	3262
8	1662	51	1596	49	3258
9	1668	51	1577	49	3245
10	1658	51	1614	49	3272
11	1691	52	1561	48	3252
12	1669	52	1565	48	3234
Total	19973	51	18829	49	38802

TABLE S.2

The age range and median age for the total speech sample of 38,802 subjects. The age information is shown in years-months. Total N = 38802; Males = 19972; Females = 18829.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	5-5 : 8-8	6-10	5-4 : 9-2	6-10	5-4 : 9-2	6-10
2	6-10: 10-6	7-10	6-0 : 10-1	7-10	6-0 : 10-6	7-10
3	7-9 : 12-2	8-11	7-1 : 14-2	8-10	7-1 : 14-2	8-10
4	8-6 : 13-6	9-11	8-0 : 12-7	9-10	8-0 : 13-6	9-11
5	6-6 : 14-10	10-11	9-1 : 13-10	10-10	6-6 : 14-10	10-11
6	9-6 : 15-1	11-11	10-0 : 15-7	11-10	9-6 : 15-7	11-11
7	11-0 : 18-10	12-11	11-0 : 16-3	12-10	11-0 : 18-10	12-11
8	12-1 : 16-9	13-11	11-5 : 17-0	13-10	11-5 : 17-0	13-10
9	13-1 : 18-9	14-11	13-1 : 17-11	14-10	13-1 : 18-9	14-10
10	14-1 : 18-11	15-11	13-11: 18-10	15-10	13-11: 18-11	15-10
11	14-7 : 19-7	16-10	15-0 : 20-2	16-9	14-7 : 20-2	16-10
12	15-6 : 22-7	17-10	15-5 : 20-8	17-9	15-5 : 22-7	17-9

Connected Speech Ratings

The initial ratings of articulation and voice performance for each of the subjects yielded a subjective label of acceptable articulation (0), mild articulation deviation (1) or extreme articulation deviation (2); acceptable voice (0), mild voice deviation (1) or extreme voice deviation (2); an overall performance rating of acceptable overall performance (0), mild overall deviation (1), moderate overall deviation (2), moderate overall deviation (3) or extreme overall deviation (4). A set of different ratings were derived for articulation performance and voice performance for each subject by combining the rated articulation performance with the overall performance rating into a single rating for articulation and similarity for voice. This procedure provided a four-category level of performance scale as shown in Table S.3. It will be noted, for example, that the Acceptable Articulation (AA) group is comprised of subjects who initially received a rating of zero (0) articulation and an overall rating of either zero (0) or one (1) and those who received an articulation rating of one (1) and also an overall rating of either zero (0) or (1). This group of subjects included 90.9% of the total sample. The Mild Voice Deviation (MIVD) group consists of two subgroups, the MIVD^a and MIVD^b as shown. The deviation procedure resulted in four mutually exclusive performance groups for both articulation and voice.

TABLE S.3

Articulation and voice performance levels derived by combining judged performance ratings (articulation or voice) with overall ratings to expand the number of performance levels from three to four groups.

Derived Performance Level	Judged Ratings									
	Articulation			Voice			Overall			
	0	1	2	0	1	2	0	1	2	3
Acceptable Articulation (AA)	X	X					X	X		
Mild Articulation Deviation (MIAD)		X							X	X
Moderate Articulation Deviation (MAD)			X						X	
Extreme Articulation Deviation (EAD)			X							X
Acceptable Voice (AV)				X	X		X	X		
Mild Voice Deviation (MIVD)[1]										
(MIVD^a)					X			X	X	
(MIVD^b)						X	X	X		
Moderate Voice Deviation (MVD)						X			X	
Extreme Voice Deviation (EVD)						X				X

[1]The Mild Voice Deviation (MIVD) group is made up of two subgroups of subjects MIVD^a and MIVD^b.

Articulation Performance Levels

The four articulation performance groups, on which analyses of the articulation test results were conducted, are summarized in tables and figures which follow.

Acceptable Articulation (AA). As seen in Table S.4 this group of subjects included 90.9% of the total sample. The percent of subjects included in this group increased steadily from grade one at 71.8% to grade 12 at 97.4% — an indication that articulation performance improved as a function of increasing grade level. It will also be noted that there was a greater percent of females than males at each grade level which suggests that females performed better than males. The age range and median age characteristics are summarized in Table S.5. The results for males and females in Table S.4 are shown plotted in Figure S.1 which graphically displays the sex differences and changes in performance as a function of increasing grade level.

TABLE S.4

Acceptable Articulation (AA)

Grade and sex distribution of subjects in the Acceptable Articulation (AA) performance group.

Grade	Males		Females		Total	
	Number	Percent[1]	Number	Percent[1]	Number	Percent[1]
1	1098	65.8	1198	78.3	2296	71.8
2	1239	75.3	1350	85.8	2589	80.5
3	1392	84.3	1403	90.1	2795	87.1
4	1496	87.6	1434	93.7	2930	90.5
5	1514	89.4	1412	93.9	2926	91.5
6	1450	91.5	1554	95.2	3004	93.4
7	1546	92.4	1532	96.4	3078	94.4
8	1534	92.3	1542	96.6	3076	94.4
9	1567	93.9	1521	96.5	3088	95.2
10	1595	96.2	1574	97.5	3169	96.9
11	1636	96.8	1535	98.3	3171	97.5
12	1622	97.2	1529	97.7	3151	97.4
Total	17689	88.6	17584	93.4	35273	90.9

[1]Rounded value.

TABLE S.5

Acceptable Articulation (AA)

The age range and median age for the acceptable articulation group of subjects. The age information is shown in years-months.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	5-5 : 8-7	6-11	5-4 : 8-6	6-10	5-4 : 8-7	6-10
2	6-10: 9-10	7-11	6-0 : 10-1	7-10	6-0 : 10-1	7-10
3	7-9 : 12-2	8-11	7-1 : 14-2	8-10	7-1 : 14-2	8-10
4	8-6 : 13-6	9-11	8-0 : 12-7	9-10	8-0 : 13-6	9-10
5	6-6 : 13-9	10-11	9-1 : 13-9	10-10	6-6 : 13-9	10-10
6	9-6 : 15-0	11-11	10-0 : 15-7	11-10	9-6 : 15-7	11-10
7	11-0 : 15-9	12-11	11-0 : 16-3	12-10	11-0 : 16-3	12-10
8	12-1 : 16-9	13-11	11-5 : 17-0	13-10	11-5 : 17-0	13-10
9	13-1 : 18-7	14-11	13-1 : 17-11	14-10	13-1 : 18-7	14-10
10	14-1 : 18-11	15-11	13-11: 18-10	15-10	13-11: 18-11	15-10
11	14-7 : 19-7	16-10	15-0 : 19-4	16-9	14-7 : 19-7	16-10
12	15-6 : 21-9	17-10	15-5 : 20-8	17-9	15-5 : 21-9	17-9

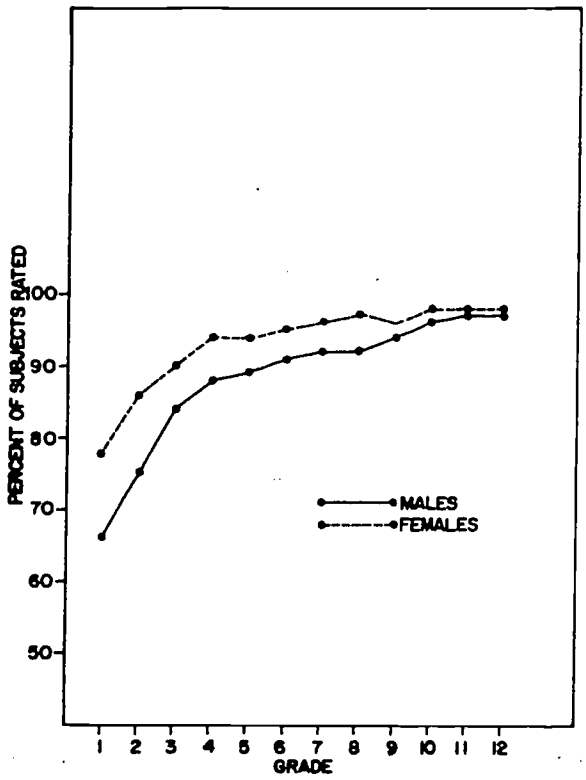

Figure S.1. Acceptable Articulation. Percent of males and females rated with acceptable articulation performance at each grade level. The curves are plots of the results for males and females in Table S.4.

Mild Articulation Deviation (MIAD). A total of 7.1% of the total sample are included in this articulation performance group as shown in Table S.6. Improvement in articulation performance as a function of increasing grade level is indicated when the percent figure of 18.6% for the first grade is compared with 2.1% in the twelfth grade in the "Total" column of Table S.6. Again females performed better than males. The sex ratio was 1.7:1 in favor of males. The age-range and median age characteristic for this group are summarized in Table S.7. The results for males and females in Table S.6 are graphically shown in Figure S.2 where it is interesting to note the rapid decrease in the percent of both sexes during the first four grades; in grades beyond the fourth the decrease is not as marked.

TABLE S.6

Mild Articulation Deviation (MIAD)

Grade and sex distribution of subjects in the mild articulation deviation group.

Grade	Males		Females		Total	
	Number	Percent[1]	Number	Percent[1]	Number	Percent[1]
1	375	22.7	220	14.4	595	18.6
2	301	18.3	179	11.4	480	14.9
3	219	13.3	130	8.4	349	10.9
4	179	10.5	82	5.4	261	8.1
5	149	8.8	71	4.7	220	6.9
6	119	7.5	66	4.0	185	5.8
7	111	6.6	48	3.0	159	4.9
8	120	7.2	44	2.8	164	5.0
9	86	5.2	48	3.0	134	4.1
10	55	3.3	31	1.9	86	2.6
11	45	2.7	20	1.3	65	2.0
12	37	2.2	30	1.9	67	2.1
Total	1796	9.0	969	5.2	2765	7.1

TABLE S.7

Mild Articulation Deviation (MIAD)

The age range and median age for the mild articulation deviation group of subjects. The age information is shown in years-months.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	5-9 : 8-6	6-10	5-11: 8-8	6-9	5-9 : 8-8	6-10
2	7-0 : 10-6	7-10	7-0 : 9-5	7-10	7-0 : 10-6	7-10
3	7-11: 12-0	8-11	7-10: 14-2	8-10	7-10: 14-2	8-11
4	8-11: 13-0	10-0	8-9 : 12-4	9-11	8-9 : 13-0	9-11
5	9-8 : 13-5	11-0	10-2 : 13-6	11-1	9-8 : 13-6	11-0
6	10-2 : 15-1	12-0	11-2 : 14-4	12-0	10-2 : 15-1	12-0
7	11-1 : 15-5	13-0	11-9 : 14-6	12-11	11-1 : 15-5	13-0
8	12-4 : 16-9	14-1	12-10: 16-3	14-0	12-4 : 16-9	14-1
9	14-1 : 17-3	15-1	13-6 : 17-5	14-11	13-6 : 17-5	15-0
10	15-0 : 18-3	15-11	15-1 : 18-1	15-11	15-0 : 18-3	15-11
11	16-2 : 19-5	17-0	15-6 : 20-0	16-10	15-6 : 20-0	17-0
12	16-6 : 22-7	17-10	17-0 : 19-5	17-9	16-6 : 22-7	17-9

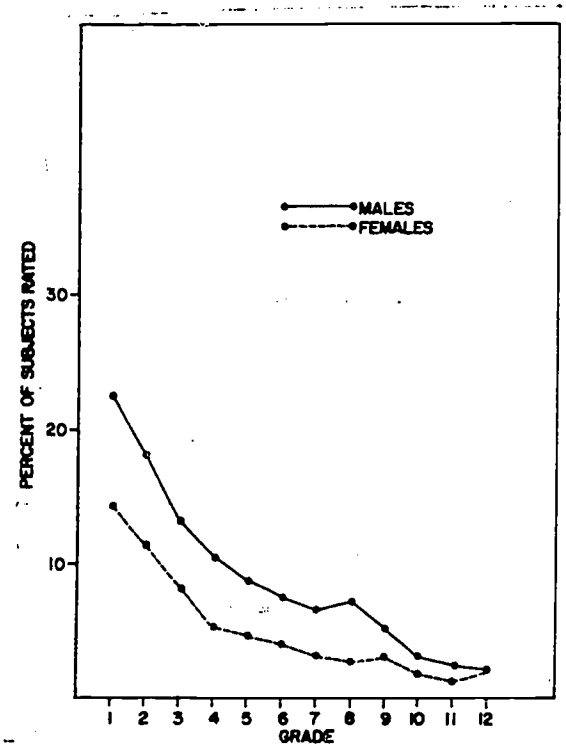

Figure S.2. Mild Articulation Deviation. Percent of males and females rated with a mild articulation deviation at each grade level. The curves are plots of the results for males and females in Table S.6.

Moderate Articulation Deviation (MAD). The number and percent of subjects by grade and by sex are summarized for the MAD performance group in Table S.8. Articulation performance improves with increasing grade level; females perform better than males; and the sex ratio is 1.5:1 in favor of males. Table S.9 presents the age-range and median age information. A plot of the results for males and females in Table S.8 appears in Figure S.3. Note the rapid decrease in the percent of subjects from grade one to grade four.

TABLE S.8

Moderate Articulation Deviation (MAD)

Grade and sex distribution of subjects in the moderate articulation deviation group.

Grade	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent
1	81	4.9	43	2.8	125	3.9
2	59	3.6	26	1.7	85	2.6
3	23	1.4	15	1.0	38	1.2
4	18	1.1	11	0.7	29	1.0
5	20	1.2	17	1.1	37	1.2
6	8	0.5	9	0.6	17	0.5
7	10	0.6	4	0.3	14	0.4
8	7	0.4	3	0.2	10	0.3
9	10	0.6	6	0.4	16	0.5
10	4	0.2	6	0.4	10	0.3
11	4	0.2	5	0.3	9	0.3
12	2	0.1	4	0.3	6	0.2
Total	246	1.2	149	.8	395	1.0

TABLE S.9

Moderate Articulation Deviation (MAD)

The age range and median age for the moderate articulation deviation group of subjects. The age information is shown in years-months.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	5-5 : 8-0	6-9	5-9 : 8-8	6-9	5-5 : 8-8	6-9
2	6-11: 9-1	7-9	7-1 : 9-9	7-9	6-11: 9-9	7-9
3	8-1 : 9-0	9-0	8-1 : 10-1	8-10	8-1 : 11-1	9-0
4	8-9 : 10-10	10-0	9-1 : 11-5	10-3	8-9 : 11-5	10-2
5	10-2 : 13-5	11-4	10-4 : 13-10	11-6	10-2 : 13-10	11-5
6	11-4 : 13-6	12-1	11-6 : 13-10	12-0	11-4 : 13-10	12-0
7	12-1 : 13-9	13-2	12-8 : 13-9	12-10	12-1 : 13-9	13-0
8	12-1 : 14-11	14-5	13-6 : 16-5	13-9	12-1 : 16-5	13-9
9	14-1 : 15-7	14-11	14-3 : 16-9	14-10	14-1 : 16-9	14-11
10	15-2 : 17-5	15-5	14-10: 5-11	15-5	14-10: 17-5	15-5
11	16-5 : 18-6	17-0	16-10: 20-2	17-5	16-5 : 20-2	17-4
12	17-4 : 19-6	17-4	16-11: 18-5	17-8	16-11: 19-6	17-8

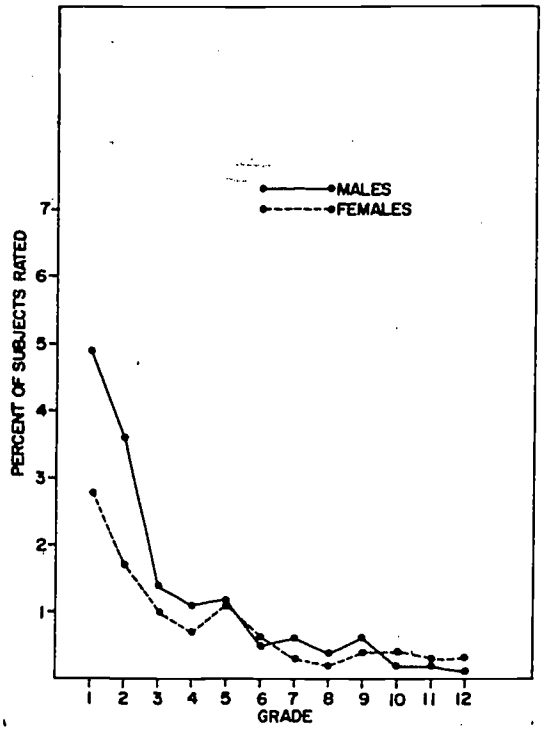

Figure S.3. Moderate Articulation Deviation. Percent of males and females rated with a moderate articulation deviation at each grade level. The curves are plots of the results for males and females in Table S.8.

Extreme Articulation Deviation (EAD). As shown in Table S.10, the EAD performance group includes the smallest percent of subjects when compared to the two previously described articulation deviation groups. The trend for females to perform better than males is evident and the improvement in articulation performance with increasing grade level continues. Of particular interest is the very sharp decrease in the percent of subjects from 5.6% in grade one to 1.9% in grade two. The age range and median age results are summarized in Table S.11. The rapid change in performance from grade one to grade two is noted in Figure S.4 when the male and female results from Table S.10 are plotted.

TABLE S.10

Extreme Articulation Deviation (EAD)

Grade and sex distribution of subjects in the extreme articulation deviation group.

Grade	Males		Females		Total	
	Number	Percent[1]	Number	Percent[1]	Number	Percent[1]
1	115	6.9	69	4.5	184	5.6
2	44	2.7	18	1.1	62	1.9
3	17	1.0	8	0.5	25	0.8
4	15	0.9	3	0.2	18	0.6
5	9	0.5	4	0.3	13	0.4
6	7	0.4	3	0.2	10	0.3
7	6	0.4	5	0.3	11	0.3
8	1	0.1	7	0.4	8	0.3
9	5	0.3	2	0.1	7	0.2
10	4	0.2	3	0.2	7	0.2
11	6	0.4	1	0.1	7	0.2
12	8	0.5	2	0.1	10	0.3
Total	237	1.2	125	0.7	362	0.9

[1]Rounded value.

TABLE S.11

Extreme Articulation Deviation (EAD)

The age range and median age for the extreme articulation deviation group of subjects. The age information is shown in years-months.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	6-0 : 8-8	6-9	5-11: 9-2	6-10	5-11: 9-2	6-9
2	7-0 : 10-3	7-11	7-2 : 9-0	7-11	7-0 : 10-3	7-11
3	8-0 : 10-8	9-3	8-1 : 11-0	8-11	8-0 : 11-0	9-3
4	9-4 : 12-4	10-2	9-6 : 12-6	9-11	9-4 : 12-6	10-2
5	10-6 : 12-3	11-4	10-7 : 11-8	10-10	10-6 : 12-3	11-3
6	11-7 : 13-5	12-6	11-3 : 13-0	12-3	11-3 : 13-5	12-5
7	12-3 : 18-10	13-2	12-7 : 15-8	13-6	12-3 : 18-10	13-5
8	14-8 : 14-8	14-5	13-5 : 16-2	14-0	13-5 : 16-2	14-0
9	14-7 : 18-9	15-4	15-7 : 16-4	15-5	14-7 : 18-9	15-5
10	15-9 : 18-4	16-4	15-8 : 16-8	16-5	15-8 : 18-4	16-5
11	16-11: 18-8	17-5	16-6 : 16-6	16-6	16-6 :18-8	17-5
12	17-7 : 18-4	18-4	17-4 : 18-2	17-4	17-4 : 19-7	18-4

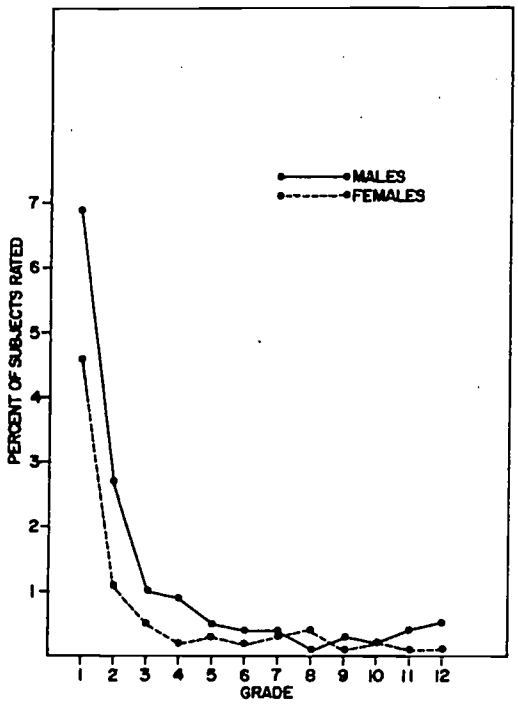

Figure S.4. Extreme Articulation Deviation. Percent of males and females rated with an extreme articulation deviation at each grade level. The curves are plots of the results for males and females in Table S.10.

Analysis of Articulation Test Results

Three separate analyses were completed on the articulation test responses for each of the articulation performance groups and the total sample of 38,802 subjects. These were: the cumulative number of consonants misarticulated, the ten most frequently misarticulated consonants and the consonants misarticulated by class. Each of the three analyses was completed for the total grades and also each of the 12 grades within the performance group. Results of each analysis yielded comparative information by sex, grade and test condition (initial test versus verbal stimulation). Intergroup comparisons between, for example, the Moderate Articulation Deviation (MAD) performance group and the Extreme Articulation Deviation (EAD) performance group were possible since the analyses were identical for all. These analyses provided useful information about one aspect of articulation behavior as it relates to a number of factors regarding speech performance in which speech and hearing specialists have been interested for many years. Such information is also useful in describing important characteristics which would help in determining differences between the rated levels of speech performance.

It would be unrealistic to attempt to report in a single-volume document all of the data-analysis results that have been accumulated on the 38,802 subjects screened in the survey. The mass of descriptive information gleaned from the basic data collected in the field is too comprehensive and detailed to permit adequate interpretation in a limited amount of space. For such reasons only results related to the articulation tests for Moderate Articulation Deviation (MAD) and Extreme Articulation Deviation (EAD) performance groups are discussed in the body of the report. Results for the Total Sample, Acceptable Articulation (AA), and Mild Articulation Deviation (MIAD) groups are to be found in the Appendix.

The MAD and EAD groups were selected for detailed discussion because a preliminary examination of the articulation test results indicated that these subjects exhibited articulation deviations of an order which separated them rather sharply from the subjects in the other rated performance groups, especially in the Acceptable Articulation (AA) group. Furthermore, it was thought that these two groups (MAD and EAD) included, for the most part, subjects who posses articulation disorders, Thus, a detailed description of their articulation performance would be useful. The /hw/ was excluded from some analyses since about 50% of all subjects in the United States interchange it with /w/ and there are many who believe that either consonant is acceptable.

Moderate Articulation Deviation (MAD)

Cumulative Number of Consonants Misarticulated. Results of the analysis showing the cumulative number of consonants misarticulated by a calculated percent of all the subjects in the Moderate Articulation Deviation (MAD) performance group are summarized in Table S.12 and for each of the 12 grades in Tables S.13 - S.24. The information in this set of tables was extracted from detailed tables included in APPENDIX I, Tables IS.1 - IS.13.

The results displayed in Table S.12 (total grades 1-12) show that during the administration of the Goldman-Fristoe Test of Articulation only .41% of the male subjects and .67% of the females correctly produced all of the 72 consonants. However, when the subjects who misarticulated one or more consonants were then stimulated verbally with the consonant or consonants they misarticulated during the test, the percent of subjects who correctly articulated all consonants increased to 4.88% for males and 4.70% for females as shown in the two right-hand columns of the table. The tabled values also show that 12.20% of the males and 13.42% of the females misarticulated five or fewer consonants during the test administration and that, with appropriate stimulation, the figures increased to 40.24% and 45.64% for males and females, respectively. Considering these results in another way, it can be determined by subtraction that, 87.80% (100 - 12.20) of the males and 86.58% (100 - 13.42) of the females misarticulated more than 20 consonants during the test. Interpretation of these results with regard to severity of deviant articulation performance should be approached with caution because 54 of the 72 consonants tested were, in fact 18 single consonants tested in all three positions (initial, medial, final) in words while the remaining 18 consisted of some consonants and consonant blends that were not tested in all word positions. (See APPENDIX A, Table A.1.) This analysis does not distinguish which consonants were misarticulated.

A comparison of the initial test and verbal stimulation conditions for both males and females indicates that many of the consonants were stimulable (produced correctly when verbally stimulated one time). For example only 12.20% of the males misarticulated five or fewer consonants during the test but the figure changed to 40.24% with stimulation, better than a three-fold increase. This also holds true for females. The results also show that a higher percent of the females misarticulated fewer consonants than the males in both the test and verbal stimulation conditions. The logical, if not necessarily defensible, interpretation is that females appeared to perform better than males.

TABLE S.12

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Total Grades (1-12). Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 246, Females 149.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	.41	.67	4.88	4.70
5	12.20	13.42	40.24	45.64
10	41.46	52.35	74.80	81.21
15	69.11	79.19	92.28	93.29
20	87.40	93.96	97.56	98.66

TABLE S.13

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 1. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 81, Females, 43.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	2.47	2.33
5	7.41	9.30	32.10	39.53
10	32.10	39.53	65.43	74.42
15	58.02	65.12	85.19	93.02
20	79.01	90.70	93.83	97.67

TABLE S.14

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 2. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 59, Females 26.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	3.39	7.69
5	10.17	3.85	38.98	46.15
10	33.90	53.85	74.58	80.77
15	62.71	80.77	91.53	88.46
20	83.05	88.46	100.00	100.00

TABLE S.15

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 3. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 23, Females 15.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	8.70	6.67
5	4.35	6.67	34.78	40.00
10	34.78	53.33	69.57	86.67
15	73.91	80.00	95.65	93.33
20	91.30	100.00	95.65	100.00

TABLE S.16

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 4. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 18, Females 11.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	5.56	0.00
5	16.67	9.09	38.89	45.45
10	61.11	54.55	77.78	90.91
15	83.33	90.91	100.00	100.00
20	100.00	100.00	100.00	100.00

TABLE S.17

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 5. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 20, Females 17.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	15.00	0.00
5	25.00	29.41	65.00	58.82
10	65.00	58.82	100.00	76.47
15	90.00	76.47	100.00	88.24
20	95.00	88.24	100.00	94.12

TABLE S.18

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 6. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 8, Females 9.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	11.11
5	12.50	22.22	50.00	44.44
10	62.50	77.78	87.50	88.89
15	87.50	88.89	100.00	100.00
20	100.00	100.00	100.00	100.00

TABLE S.19

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 7. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 10, Females 4.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	0.00
5	20.00	0.00	40.00	25.00
10	40.00	0.00	70.00	100.00
15	80.00	100.00	100.00	100.00
20	90.00	100.00	100.00	100.00

TABLE S.20

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 8. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 7, Females 3.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	0.00
5	14.29	33.33	57.14	33.33
10	71.43	33.33	85.71	66.67
15	85.71	100.00	100.00	100.00
20	100.00	100.00	100.00	100.00

TABLE S.21

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 9. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 10, Females 6.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	10.00	0.00
5	30.00	16.67	60.00	66.67
10	40.00	100.00	90.00	100.00
15	80.00	100.00	100.00	100.00
20	100.00	100.00	100.00	100.00

TABLE S.22

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 10. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulations conditions and also between males and females are shown. N = Males 4, Females 6.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	16.67	0.00	33.33
5	25.00	33.33	50.00	66.67
10	50.00	66.67	50.00	100.00
15	50.00	100.00	75.00	100.00
20	100.00	100.00	100.00	100.00

TABLE S.23

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 11. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulations conditions and also between males and females are shown. N = Males 4, Females 5.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	25.00	0.00	25.00	0.00
5	25.00	0.00	50.00	40.00
10	75.00	60.00	100.00	60.00
15	75.00	80.00	100.00	80.00
20	100.00	100.00	100.00	100.00

TABLE S.24

Cumulative Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 12. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulations conditions and also between males and females are shown. N = Males 2, Females 4.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	0.00
5	0.00	50.00	0.00	50.00
10	50.00	50.00	100.00	75.00
15	100.00	75.00	100.00	100.00
20	100.00	100.00	100.00	100.00

46

A comparison of the results in Tables S.13 - S.24 shows the relationship between the number of consonants misarticulated and increasing grade level. The trend toward improvement is observable if Tables S.14 (Grade 2), S.15 (Grade 3) and S.16 (Grade 4) are compared with Table S.13 (Grade 1). For example, consider the percent of males who misarticulated 10 or fewer consonants. As seen, the results for males were 32.10%, 33.90%, 34.78% and 61.11% in grades 1, 2, 3 and 4, respectively. The changes beyond grade five are not remarkable - possibly related to the small number of subjects in the upper grades.

In summary, the results of this type of analysis reveals the following characteristics and trends associated with this sample of school-age subjects judged to have a moderate articulation deviation:

1. Approximately 50% of all subjects misarticulated 10 or fewer consonants.
2. Almost without exception many, in some instances, an impressive number of the misarticulated consonants were stimulable.
3. Overall, females performed better than males.
4. Articulation performances improved as grade level (age) increased.

Ten Most Frequently Misarticulated Consonants. The ten most frequently misarticulated single consonants for all subjects in the MAD performance group are shown in Table S.25 and for each of the 12 grades in Tables S.26 - S.37. It will be noted that no consonant appears more than once in each ranked list. For example, in Table S.25, /-z/ ranked first for all males but neither /-z-/ nor /z-/ are shown when, in fact, /z-/ was misarticulated more often than /-th-/ which ranked third, as shown. The purpose served by displaying the results in this manner was to show which of the different single consonants were most frequently misarticulated rather than just an indication of the number of articulation errors that were committed. In fact the blend /sl-/ was misarticulated most frequently followed by /-z/, /skw-/, /s-/, /z-/, /-z-/, /-s/, /-th-/, /st-/ and /-s-/ which means that only three single consonants and three blends made up the list of ten primarily because /z/ and /s/ were misarticulated quite often in all three word positions. The argument that the high-frequency count of misarticulated /z/ and /s/ may be the primary contributing factor to the moderate articulation deviation rating has merit. On the other hand it can be argued that to find that /-g/ (a consonant usually mastered by four years of age) was the tenth most frequently misarticulated single consonant might be an even stronger indication that this group of subjects did in fact have significant articulation deviations. Of course there are several ways such findings can be tabulated and the procedure used here does provide some very useful information about this group of subjects.

TABLE S.25

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Total Grades (1-12). Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 246, Females 149.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-z	55.28	32.93	z-	51.01	36.24
s-	52.03	33.74	-r	45.64	30.20
-th-	46.75	23.98	s-	42.28	31.54
-ch	37.40	19.11	-th-	36.91	16.78
-r	33.74	17.48	-ch	36.24	22.15
-sh-	32.11	18.70	-sh-	31.54	18.12
v-	29.67	5.28	v-	28.19	8.05
-th-	27.24	13.01	th-	26.17	11.41
-j	23.17	12.20	-j	25.50	15.44
-g	10.57	2.44	-g	12.08	6.71

TABLE S.26

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 1. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 81, Females 43.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	61.73	33.33	z-	69.77	41.86
z-	54.32	40.74	-r	55.81	37.21
-s	48.15	32.10	v-	46.51	11.63
v-	40.74	7.41	-ch	46.51	25.58
-r	40.74	22.22	-th	46.51	23.26
-th-	37.04	17.28	-sh-	39.53	23.26
-sh	33.33	20.99	-j	34.88	13.95
-ch	32.10	14.81	-th-	32.56	16.28
-j	20.99	8.64	-g	20.93	11.63
-g	14.81	3.70	-k	11.63	4.65

TABLE S.27

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 2. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 59, Females 26.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
z-	61.02	37.29	-r	57.69	42.31
s-	52.54	27.12	-th-	42.31	19.23
-th-	49.15	23.73	v-	38.46	15.38
ch-	42.37	18.64	z-	34.62	26.92
v-	38.98	5.08	ch-	34.62	7.69
-sh-	38.98	20.34	th-	34.62	15.38
-r	33.90	16.95	-sh-	30.77	23.08
-th-	30.51	15.25	s-	30.77	26.92
-j	25.42	11.86	-ng	19.23	3.85
-l-	16.95	8.47	-j	15.38	11.54

TABLE S.28

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 3. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 23, Females 15.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
z-	65.22	30.43	-r	53.33	46.67
-s-	65.22	52.17	-s-	53.33	33.33
-ch-	56.52	21.74	-th-	46.67	0.00
sh-	43.48	21.74	z-	40.00	20.00
-th-	43.48	21.74	ch-	33.33	26.67
-j	39.13	21.74	sh-	20.00	0.00
-r	34.78	13.04	-v-	20.00	13.33
v-	26.09	4.35	th-	20.00	0.00
th-	21.74	17.39	-j	20.00	20.00
-ng	8.70	4.35	-ng	20.00	0.00

TABLE S.29

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 4. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 18, Females 11.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
z-	72.22	50.00	z-	63.64	54.55
s-	72.22	66.67	s-	63.64	36.36
sh-	38.89	22.22	-ch-	63.64	36.36
-ch-	27.78	16.67	sh-	45.45	27.27
r-	22.22	22.22	-th-	45.45	18.18
-j	22.22	11.11	v-	27.27	9.09
-th-	22.22	16.67	th-	27.27	18.18
v-	16.67	0.00	-r	18.18	9.09
-th-	16.67	16.67	-f-	9.09	0.00
-ng	16.67	11.11	-j	9.09	0.00

TABLE S.30

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 5. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 20, Females 17.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
s-	65.00	30.00	-s	64.71	58.82
-z	45.00	15.00	-z	58.82	41.18
-ch-	40.00	15.00	th-	41.18	17.65
-th-	40.00	20.00	-th-	41.18	23.53
v-	30.00	10.00	-ch	35.29	23.53
sh-	30.00	5.00	-sh	35.29	23.53
-th-	25.00	10.00	-r	29.41	17.65
-r-	20.00	15.00	-j	29.41	23.53
-k	10.00	0.00	v-	23.53	5.88
-g	10.00	0.00	-f	11.76	0.00

TABLE S.31

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 6. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 8, Females 9.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-z	75.00	50.00	-j	55.56	33.33
th-	75.00	12.50	-z-	44.44	33.33
-s-	62.50	50.00	ch-	44.44	33.33
-th	37.50	25.00	-th	44.44	11.11
-g	37.50	12.50	-s	33.33	33.33
-v	37.50	0.00	sh-	33.33	33.33
-k	25.00	12.50	-k	22.22	11.11
-sh	25.00	25.00	-r	22.22	0.00
-d-	12.50	0.00	th-	22.22	0.00
-r	12.50	0.00	-g	22.22	0.00

TABLE S.32

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 7. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 10, Females 4.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-z	80.00	40.00	-r	100.00	75.00
s-	60.00	20.00	sh-	75.00	50.00
-ch	50.00	30.00	-th-	75.00	0.00
-th-	50.00	10.00	-sh	75.00	75.00
-r	40.00	20.00	-s	50.00	25.00
-j	30.00	30.00	v-	50.00	25.00
-k	20.00	0.00	-g	50.00	50.00
-v-	20.00	0.00	w-	25.00	0.00
th-	20.00	0.00	z-	25.00	25.00
-d	20.00	20.00	-k	25.00	0.00

TABLE S.33

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 8. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 7, Females 3.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
s-	85.71	71.43	s-	100.00	66.67
-z	71.43	57.14	z-	66.67	66.67
ch-	57.14	14.29	-ch-	66.67	66.67
th-	57.14	14.29	sh-	66.67	33.33
-sh-	42.86	14.29	j-	33.33	33.33
-j	28.57	14.29	-	-	-
-th-	28.57	0.00	-	-	-
h-	14.29	0.00	-	-	-
-r	14.29	14.29	-	-	-
-	-	-	-	-	-

TABLE S.34

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 9. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 10, Females 6.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-ch	60.00	40.00	-r	50.00	33.33
-s	50.00	30.00	z-	33.33	33.33
-r	50.00	10.00	-ch-	33.33	0.00
-sh	50.00	20.00	th-	33.33	33.33
-z-	40.00	20.00	-th	33.33	33.33
-j	40.00	30.00	-s	16.67	16.67
-th-	30.00	20.00	-z-	16.67	16.67
-k-	20.00	0.00	-k	16.67	16.67
-th-	20.00	10.00	-j	16.67	16.67
-t	20.00	0.00	-ng-	16.67	0.00

TABLE S.35

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 10. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 4, Females 6.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-r	100.00	75.00	-s-	83.88	50.00
-z	50.00	25.00	-z-	66.67	50.00
-ch	50.00	50.00	-r	33.33	0.00
-s-	50.00	25.00	-k	16.67	0.00
-k	25.00	25.00	sh-	16.67	16.67
sh-	25.00	25.00	-ch	16.67	0.00
-b-	25.00	0.00	-t	16.67	0.00
-th-	25.00	0.00	-j	16.67	16.67
-th-	25.00	25.00	-b	16.67	16.67
j-	25.00	25.00	-g	16.67	0.00

TABLE S.36

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 11. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 4, Females 5.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-s	50.00	25.00	s-	80.00	60.00
z-	50.00	0.00	z-	60.00	60.00
-l-	50.00	50.00	-r	40.00	20.00
-f	25.00	25.00	-sh-	40.00	40.00
v-	25.00	25.00	-ch	40.00	40.00
-ch-	25.00	25.00	th-	40.00	40.00
sh-	25.00	0.00	-j	40.00	20.00
-r	25.00	25.00	th-	40.00	20.00
th-	25.00	25.00	-k	20.00	20.00
-j	25.00	25.00	-l-	20.00	0.00

TABLE S.37

Ten Most Frequently Misarticulated Consonants
(Moderate Articulation Deviation)

Grade 12. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 2, Females 4.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-z-	100.00	50.00	z-	75.00	50.00
-s-	100.00	100.00	-s	50.00	25.00
-ch-	50.00	0.00	-ch-	50.00	25.00
-r	50.00	50.00	-sh-	50.00	25.00
-th-	50.00	0.00	-r	25.00	25.00
-v	50.00	0.00	-j	25.00	25.00
-	-	-	-th-	25.00	25.00
-	-	-	-		
-	-	-	-		
-	-	-	-		

In Table S.25 it can be seen that the list of the single consonants most frequently misarticulated is different for males compared to females and, in some instances, the rank order also differs for consonants common to both sexes. Females performed better than males for some of those consonants that can be compared. The results show that all consonants were stimulable for both males and females with males holding a slight, but not necessarily, significant edge in terms of percent reduction in errors. For example, 46.75% of the males misarticulated /-th-/ initially and 23.98% with verbal stimulation, a reduction difference of 22.77%; for females the figures were 36.91% initially and 16.78% with stimulation, a reduction difference of 20.13%. This trend, although slight, applies to other consonants but cannot be interpreted as a mark of male superiority necessarily.

A consideration of the ten most frequently misarticulated consonants as a function of increasing grade level can be accomplished by comparing the results in Tables S.26 - S.37. The number of subjects in each grade decreases as the grade level increases and, somewhat abruptly after the second grade as might be expected. At the same time it might be expected that the percent values for the misarticulation of a given consonant might also decrease. However this is not true in all instances if the results for /-th-/ for males in the initial test condition are compared through the 12 grades. For example, this consonant is misarticulated at essentially the same percentage level in the seventh grade (Table S.32) as in the second grade (Table S.27). Furthermore there is a trend for several consonants, namely, /s/, /z/, /th/ and /r/, to rank consistently high throughout all of the grades. Although essentially all misarticulated consonants responded to verbal stimulation, resistance to this appears to increase in the upper grades.

In summary it would appear that at all grade levels a consistent group of consonants, namely /s/, /z/, /th/ and /r/, were misarticulated most frequently. The rank of the consonants was not the same for males and females and in some grades certain consonants which appeared in the top ten for the males did not do so for the females. All consonants responded to verbal stimulation in varying degrees but resistance to verbal stimulation appeared to increase at the upper grade levels.

Consonants Misarticulated by Class. The traditional method of classifying English consonants according to the categories of place of articulation, manner of reproduction and voicing characteristics is a meaningful procedure since it provides useful descriptive information about some important characteristics of such speech sounds. By using this three-category system it is possible to place most consonants

into descriptive groups which have certain characteristics in common. Therefore each consonant can be classified according to three characteristics. A given consonant may have as many as two characteristics in common with another but never all three. Thus, there is always at least one of the three characteristics which will distinguish one consonant from another. The 24 single consonants assessed in this survey were classified using the method described above and are shown in APPENDIX A, Table A.5.

Results of the misarticulated consonants according to class are shown in Table S.38 for total subjects in the MAD group and for each of the 12 grades in Tables S.39 - S.50. The three classification categories are shown in the extreme left-hand column of Table S.38. The place of articulation category includes labial, labiodental, linguadental, linguaalveolar, linguapalatal, linguavelar and glottal consonants, shown in the first seven rows. The manner of production category includes the glide, semivowel, nasal, stop, fricative and affricate consonants, the next six rows. The last two rows, voicing characteristics, include voiceless and voiced consonants. As an example of how the classification system works, consider /th/ which is classified as a linguadental-fricative-voiceless consonant; /th/ is a linguadental-fricative-voiced consonant. The difference between the two is the voicing characteristic; otherwise they are the same.

In Table S.38 it can be seen that, on the basis of place of articulation, the highest percent of misarticulated consonants was the linguadental for both males and females, in each of the three word positions and during the initial testing as well as after verbal stimulation. The consonants /th/ and /th/ are the two that make up this category. The percent figures are highest for the fricative class in the manner of production category for males and females in all three word positions, and during the initial testing as well as after verbal stimulation. The fricative consonants include /f/, /v/, /th/, /th/, /s/, /z/, /sh/ and /h/. The higher percent of misarticulated consonants based on voicing characteristics occurred for the voiceless class. Improvement with verbal stimulation occurred for all classes, an expected finding when results of the two previous analysis are considered.

If a relatively high percent of misarticulation can be viewed as an indicator of difficultness one is tempted to interpret these results to mean that consonants requiring adjustments of the tongue and teeth to produce continuous friction-like speech sounds (linguadental fricatives, th and th) were the most difficult for this group of subjects to produce accurately and therefore are implicated as contributors to the judged moderate articulation deviation. However

TABLE S.38

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Total Grades (1-12). Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 246, Females 149.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.91	1.36	3.66	.50	1.12	3.80
Labiodental	15.65	9.15	10.77	14.09	6.71	8.72
Linguadental	28.66	36.99	41.87	26.17	26.85	36.24
Lingua-alveolar	18.29	17.89	20.46	15.88	15.55	16.89
Linguapalatal	20.89	25.61	30.79	20.54	25.00	33.56
Linguavelar	.81	3.93	8.94	.34	2.91	10.29
Glottal	.41	-	-	0.00	-	-
Glide	3.05	-	-	1.34	-	-
Semivowel	14.63	18.90	19.92	14.09	16.11	24.83
Nasal	.41	2.98	3.66	.67	2.91	3.80
Stop	.68	2.10	6.78	.34	1.23	7.16
Fricative	27.79	30.84	32.52	25.34	26.17	27.63
Affricate	22.97	21.34	30.28	22.15	20.47	30.87
Voiceless	16.62	20.02	22.71	14.62	17.95	20.55
Voice	12.23	13.14	15.04	11.51	10.74	15.19

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.10	.14	.41	0.00	.22	.89
Labiodental	3.25	1.22	2.03	4.03	1.68	.67
Linguadental	15.24	18.50	24.80	13.42	13.42	19.46
Lingua-alveolar	12.06	11.92	12.74	11.30	10.29	11.30
Linguapalatal	12.52	15.96	16.67	13.83	15.94	21.48
Linguavelar	.41	.81	2.85	.34	.67	4.92
Glottal	0.00	-	-	0.00	-	-
Glide	.41	-	-	.34	-	-
Semivowel	11.79	13.82	10.37	12.75	12.08	16.11
Nasal	0.00	.81	1.49	0.00	.89	1.12
Stop	.27	.14	1.36	.11	0.00	3.13
Fricative	15.40	17.65	19.51	15.02	15.63	16.67
Affricate	11.99	11.59	15.65	12.75	11.07	18.79
Voiceless	9.85	11.74	13.06	9.25	9.90	11.91
Voiced	6.50	6.98	7.02	6.87	6.60	8.79

TABLE S.39

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 1. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 81, Females 43.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	1.54	1.65	5.35	.58	1.55	6.20
Labiodental	20.99	16.05	14.20	23.26	11.63	11.63
Linguadental	38.27	49.38	59.26	33.72	36.05	46.51
Lingua-alveolar	17.28	16.87	22.43	17.83	16.67	17.44
Linguapalatal	22.22	23.77	31.79	21.40	30.23	42.44
Linguavelar	1.85	5.35	10.29	0.00	4.65	13.18
Glottal	0.00	-	-	0.00	-	-
Glide	4.32	-	-	1.16	-	-
Semivowel	22.22	24.07	25.93	17.44	22.09	31.40
Nasal	.62	2.47	3.70	0.00	2.33	3.10
Stop	1.03	3.29	9.47	0.00	3.49	10.47
Fricative	30.71	34.74	37.24	31.40	31.56	31.01
Affricate	18.52	14.81	26.54	20.93	20.93	40.70
Voiceless	17.15	20.06	26.39	16.02	20.06	24.71
Voiced	14.53	15.64	16.84	14.31	14.53	18.60

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	.41	0.00	0.00	2.33
Labiodental	4.32	1.85	3.09	5.81	3.49	1.16
Linguadental	21.60	25.31	35.80	17.44	19.77	23.26
Lingua-alveolar	12.55	12.55	14.20	11.24	10.08	10.08
Linguapalatal	13.58	15.43	16.67	14.42	19.19	24.42
Linguavelar	.62	1.23	3.70	0.00	.78	7.75
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	16.67	16.67	14.81	15.12	18.60	19.77
Nasal	0.00	.82	1.23	0.00	.78	2.33
Stop	.21	.41	2.26	0.00	0.00	4.26
Fricative	18.06	19.93	22.63	16.57	18.60	17.05
Affricate	8.64	8.64	11.73	11.63	8.14	19.77
Voiceless	10.43	12.35	14.20	9.82	10.76	11.92
Voiced	7.88	8.02	8.42	7.51	8.33	10.78

TABLE S.40

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 2. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 59, Females 26.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.42	1.13	3.95	0.00	2.56	6.41
Labiodental	20.34	6.78	11.86	19.23	9.62	5.77
Linguadental	27.97	39.83	49.15	28.85	32.69	38.46
Lingua-alveolar	20.34	18.93	19.21	11.54	12.82	12.18
Linguapalatal	23.05	30.93	33.05	24.62	22.12	32.69
Linguavelar	0.00	5.08	7.34	0.00	5.13	10.26
Glottal	0.00	-	-	0.00	-	-
Glide	3.39	-	-	1.92	-	-
Semivowel	15.25	25.42	19.49	25.00	21.15	30.77
Nasal	0.00	4.52	3.95	0.00	7.69	7.69
Stop	.28	2.26	5.65	.64	1.28	5.77
Fricative	29.45	31.48	33.90	23.08	25.27	22.44
Affricate	30.51	25.42	33.05	23.08	11.54	25.00
Voiceless	17.14	21.19	23.52	12.82	16.35	17.31
Voiced	13.95	14.97	15.10	13.31	11.86	15.03

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.42	0.00	1.13	0.00	1.28	0.00
Labiodental	3.39	.85	1.69	7.69	0.00	0.00
Linguadental	16.95	19.49	30.51	15.38	17.31	23.08
Lingua-alveolar	11.58	10.17	11.02	8.97	8.33	8.33
Linguapalatal	12.20	18.64	16.10	14.62	13.46	21.15
Linguavelar	0.00	1.69	1.69	0.00	1.28	2.56
Glottal	0.00	-	-	0.00	-	-
Glide	.85	-	-	0.00	-	-
Semivowel	11.86	17.80	9.32	23.08	13.46	23.08
Nasal	0.00	1.69	2.26	0.00	2.56	1.28
Stop	0.00	0.00	.56	0.00	0.00	1.28
Fricative	15.04	16.22	18.93	14.42	15.38	13.46
Affricate	13.56	13.56	15.25	5.77	1.92	13.46
Voiceless	9.42	10.17	13.35	7.26	9.13	9.62
Voiced	6.78	8.33	6.01	8.28	6.09	8.04

TABLE S.41

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 3. Percent of time each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 23, Females 15.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	1.09	1.45	0.00	1.67	0.00	6.67
Labiodental	15.22	4.35	6.52	6.67	10.00	3.33
Linguadental	21.74	28.26	26.09	16.67	26.67	26.67
Lingua-alveolar	22.46	21.74	18.12	15.56	15.56	15.56
Linguapalatal	26.09	34.78	38.04	21.33	20.00	21.67
Linguavelar	0.00	1.45	5.80	3.33	0.00	11.11
Glottal	0.00	-	-	0.00	-	-
Glide	4.35	-	-	0.00	-	-
Semivowel	10.87	15.22	17.39	26.67	23.33	30.00
Nasal	0.00	4.35	2.90	6.67	0.00	8.89
Stop	1.45	0.00	2.17	2.22	0.00	6.67
Fricative	30.43	32.92	28.26	18.33	25.71	18.89
Affricate	30.43	34.78	45.65	16.67	10.00	13.33
Voiceless	19.81	26.09	21.20	13.33	16.67	12.50
Voiced	12.71	11.23	13.44	10.77	9.44	15.15

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	1.45	0.00	0.00	0.00	0.00
Labiodental	2.17	0.00	0.00	0.00	6.67	0.00
Linguadental	15.22	13.04	17.39	0.00	0.00	13.33
Lingua-alveolar	13.04	13.77	12.32	7.78	10.00	7.78
Linguapalatal	13.91	18.48	19.57	14.67	13.33	18.33
Linguavelar	0.00	0.00	1.45	3.33	0.00	4.44
Glottal	0.00	-	-	0.00	-	-
Glide	2.17	-	-	0.00	-	-
Semivowel	8.70	8.70	6.52	23.33	16.67	23.33
Nasal	0.00	1.45	1.45	0.00	0.00	0.00
Stop	.72	0.00	0.00	1.11	0.00	3.33
Fricative	16.30	19.25	18.84	5.83	10.48	10.00
Affricate	13.04	15.22	21.74	13.33	10.00	10.00
Voiceless	11.11	15.22	13.04	6.67	6.67	6.67
Voiced	6.35	5.43	6.32	5.13	6.11	8.48

TABLE S.42

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 4. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 18, Females 11.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	1.39	1.85	0.00	0.00	0.00	0.00
Labiodental	8.33	0.00	0.00	13.64	4.55	4.55
Linguadental	16.67	19.44	16.67	27.27	27.27	27.27
Lingua-alveolar	24.07	16.67	18.52	21.21	19.70	19.70
Linguapalatal	17.78	16.67	19.44	21.82	34.09	22.73
Linguavelar	0.00	1.85	5.56	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	2.78	-	-	0.00	-	-
Semivowel	11.11	11.11	8.33	9.09	9.09	9.09
Nasal	2.78	3.70	5.56	0.00	0.00	0.00
Stop	0.00	0.00	1.85	0.00	0.00	0.00
Fricative	29.17	21.43	21.30	31.82	32.47	28.79
Affricate	11.11	16.67	25.00	22.73	36.36	27.27
Voiceless	15.43	13.89	13.19	20.20	28.41	18.18
Voiced	11.54	8.80	10.61	10.49	7.58	9.09

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	0.00	0.00	4.55	0.00	0.00
Linguadental	5.56	16.67	11.11	18.18	13.64	27.27
Lingua-alveolar	19.44	14.81	13.89	15.15	12.12	16.67
Linguapalatal	11.11	12.50	12.50	14.55	18.18	15.91
Linguavelar	0.00	0.00	3.70	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	11.11	11.11	5.56	9.09	9.09	4.55
Nasal	0.00	0.00	3.70	0.00	0.00	0.00
Stop	0.00	0.00	0.00	0.00	0.00	0.00
Fricative	18.75	19.05	17.59	20.45	16.88	22.73
Affricate	5.56	8.33	13.89	13.64	18.18	22.73
Voiceless	11.73	11.81	10.42	12.12	12.50	15.91
Voiced	5.98	6.48	6.57	7.69	6.06	5.79

TABLE S.43

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 5. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 20, Females 17.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	3.33	0.00	0.00	0.00
Labiodental	17.50	15.00	7.50	11.76	2.94	14.71
Linguadental	22.50	32.50	30.00	32.35	26.47	41.18
Lingua-alveolar	16.67	13.33	18.33	16.67	14.71	24.51
Linguapalatal	13.00	23.75	17.50	17.65	19.12	32.35
Linguavelar	0.00	0.00	8.33	0.00	1.96	9.80
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	2.94	-	-
Semivowel	2.50	10.00	7.50	8.82	11.76	17.65
Nasal	0.00	0.00	1.67	0.00	1.96	5.88
Stop	.83	.83	6.67	0.00	0.00	4.90
Fricative	25.62	28.57	26.67	27.21	22.69	38.24
Affricate	15.00	22.50	20.00	17.65	20.59	32.35
Voiceless	17.22	18.75	19.37	13.73	13.97	25.74
Voiced	6.92	10.00	9.55	11.76	9.80	15.51

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	7.50	2.50	0.00	2.94	0.00	2.94
Linguadental	7.50	15.00	10.00	17.65	17.65	23.53
Lingua-alveolar	10.83	8.33	8.33	13.73	10.78	18.63
Linguapalatal	5.00	11.25	8.75	11.76	11.76	22.06
Linguavelar	0.00	0.00	1.67	0.00	0.00	5.88
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	2.94	-	-
Semivowel	2.50	7.50	2.50	8.82	8.82	11.76
Nasal	0.00	0.00	1.67	0.00	0.00	1.96
Stop	.83	0.00	0.00	0.00	0.00	2.94
Fricative	11.87	14.29	12.50	16.91	14.29	25.49
Affricate	7.50	7.50	7.50	11.76	14.71	23.53
Voiceless	7.78	10.00	9.38	9.80	8.82	16.91
Voiced	3.85	4.17	2.27	7.24	6.37	10.16

TABLE S.44

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 6. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 8, Females 9.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	4.17	0.00	0.00	0.00
Labiodental	0.00	6.25	18.75	5.56	0.00	11.11
Linguadental	50.00	25.00	37.50	11.11	11.11	44.44
Lingua-alveolar	14.58	20.83	18.75	9.26	12.96	12.96
Linguapalatal	5.00	6.25	15.63	24.44	25.00	38.89
Linguavelar	0.00	4.17	25.00	0.00	0.00	14.81
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	0.00	0.00	6.25	0.00	0.00	11.11
Nasal	0.00	4.17	4.17	0.00	0.00	0.00
Stop	0.00	2.08	12.50	0.00	0.00	9.26
Fricative	25.00	26.79	35.42	15.28	19.05	27.78
Affricate	6.25	6.25	12.50	44.44	33.33	50.00
Voiceless	11.11	14.06	17.19	12.35	15.28	23.61
Voiced	8.65	9.38	18.18	7.69	6.48	14.14

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	6.25	0.00	0.00	0.00	0.00
Linguadental	6.25	25.00	25.00	0.00	11.11	11.11
Lingua-alveolar	12.50	14.58	14.58	9.26	9.26	7.41
Linguapalatal	2.50	3.13	12.50	20.00	19.44	27.78
Linguavelar	0.00	0.00	8.33	0.00	0.00	3.70
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	0.00	0.00	0.00	0.00	0.00	0.00
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	4.17	0.00	0.00	1.85
Fricative	12.50	23.21	22.92	11.11	14.29	14.81
Affricate	0.00	0.00	12.50	33.33	27.78	38.89
Voiceless	5.56	10.94	14.06	11.11	11.11	16.67
Voiced	3.85	6.25	6.82	4.27	5.56	4.04

TABLE S.45

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 7. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 10, Females 4.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	2.50	3.33	3.33	6.25	8.33	0.00
Labiodental	5.00	10.00	10.00	25.00	0.00	25.00
Linguadental	20.00	30.00	50.00	12.50	37.50	75.00
Lingua-alveolar	11.67	21.67	25.00	8.33	4.17	16.67
Linguapalatal	24.00	22.50	40.00	25.00	31.25	50.00
Linguavelar	5.00	0.00	13.33	0.00	8.33	25.00
Glottal	0.00	-	-	0.00	-	-
Glide	5.00	-	-	12.50	-	-
Semivowel	10.00	10.00	20.00	0.00	0.00	50.00
Nasal	0.00	3.33	3.33	0.00	16.67	0.00
Stop	1.67	1.67	10.00	0.00	0.00	16.67
Fricative	18.75	31.43	40.00	25.00	21.43	45.83
Affricate	35.00	25.00	40.00	25.00	37.50	12.50
Voiceless	17.78	21.25	27.50	13.89	21.88	31.25
Voiced	7.69	11.67	19.09	11.54	8.33	22.73

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	0.00	0.00	12.50	0.00	0.00
Linguadental	5.00	5.00	10.00	0.00	0.00	0.00
Lingua-alveolar	5.00	13.33	18.33	4.17	0.00	12.50
Linguapalatal	24.00	22.50	27.50	20.00	18.75	43.75
Linguavelar	5.00	0.00	3.33	0.00	8.33	16.67
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	10.00	10.00	10.00	0.00	0.00	37.50
Nasal	0.00	0.00	0.00	0.00	8.33	0.00
Stop	1.67	0.00	5.00	0.00	0.00	12.50
Fricative	8.75	15.71	21.67	12.50	3.57	20.83
Affricate	35.00	25.00	30.00	25.00	25.00	12.50
Voiceless	12.22	15.00	15.00	8.33	6.25	15.63
Voiced	4.62	5.00	10.91	5.77	4.17	15.91

TABLE S.46

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 8. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 7, Females 3.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	0.00	0.00	0.00	0.00	0.00
Linguadental	28.57	21.43	0.00	0.00	0.00	0.00
Lingua-alveolar	19.05	19.05	23.81	27.78	22.22	16.67
Linguapalatal	17.14	17.86	25.00	33.33	41.67	33.33
Linguavelar	0.00	0.00	0.00	0.00	0.00	0.00
Glottal	14.29	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	7.14	7.14	7.14	0.00	0.00	0.00
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	0.00	0.00	0.00	0.00
Fricative	25.00	28.57	26.19	29.17	28.57	27.78
Affricate	28.57	7.14	35.71	50.00	50.00	33.33
Voiceless	19.05	17.86	16.07	25.93	25.00	25.00
Voiced	7.69	7.14	10.39	7.69	8.33	3.03

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	0.00	0.00	0.00	0.00	0.00
Linguadental	7.14	0.00	0.00	0.00	0.00	0.00
Lingua-alveolar	11.90	11.90	21.43	22.22	22.22	16.67
Linguapalatal	5.71	10.71	14.29	20.00	41.67	16.67
Linguavelar	0.00	0.00	0.00	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	7.14	7.14	7.14	0.00	0.00	0.00
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	0.00	0.00	0.00	0.00
Fricative	10.71	12.24	21.43	20.83	28.57	22.22
Affricate	7.14	7.14	21.43	33.33	50.00	16.67
Voiceless	9.52	8.93	12.50	14.81	25.00	16.67
Voiced	2.20	3.57	7.79	7.69	8.33	3.03

TABLE S.47

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 9. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 10, Females 6.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	10.00	0.00	0.00	0.00
Labiodental	0.00	0.00	10.00	0.00	0.00	0.00
Linguadental	15.00	25.00	20.00	33.33	8.33	33.33
Lingua-alveolar	11.67	13.33	20.00	8.33	5.56	5.56
Linguapalatal	22.00	32.50	50.00	10.00	20.83	20.83
Linguavelar	0.00	13.33	13.33	0.00	5.56	5.56
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	5.00	5.00	25.00	8.33	25.00	25.00
Nasal	0.00	3.33	10.00	0.00	5.56	0.00
Stop	0.00	5.00	11.67	0.00	0.00	2.78
Fricative	16.25	24.29	30.00	14.58	7.14	11.11
Affricate	35.00	40.00	50.00	16.67	16.67	16.67
Voiceless	13.33	22.50	28.75	9.26	8.33	10.42
Voiced	6.92	10.00	18.18	6.41	6.94	7.58

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	0.00	5.00	0.00	0.00	0.00
Linguadental	15.00	15.00	20.00	25.00	0.00	33.33
Lingua-alveolar	8.33	8.33	8.33	8.33	5.56	5.56
Linguapalatal	18.00	17.50	25.00	6.67	8.33	12.50
Linguavelar	0.00	0.00	0.00	0.00	0.00	5.56
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	5.00	5.00	5.00	8.33	16.67	16.67
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	0.00	0.00	0.00	2.78
Fricative	12.50	14.29	16.67	12.50	4.76	11.11
Affricate	30.00	20.00	35.00	8.33	0.00	8.33
Voiceless	11.11	12.50	13.75	5.56	2.08	8.33
Voiced	5.38	4.17	6.36	6.41	4.17	6.06

TABLE S.48

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 10. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 4, Females 6.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	8.33	0.00	0.00	0.00	5.56
Labiodental	0.00	0.00	12.50	0.00	0.00	8.33
Linguadental	12.50	25.00	25.00	0.00	0.00	0.00
Lingua-alveolar	8.33	12.50	16.67	16.67	25.00	22.22
Linguapalatal	25.00	31.25	43.75	3.33	0.00	16.67
Linguavelar	0.00	0.00	16.67	0.00	0.00	11.11
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	25.00	25.00	62.50	0.00	0.00	16.67
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	4.17	8.33	0.00	0.00	11.11
Fricative	12.50	21.43	25.00	14.58	21.43	22.22
Affricate	25.00	25.00	25.00	0.00	0.00	16.67
Voiceless	8.33	15.63	18.75	7.41	10.42	12.50
Voiced	9.62	12.50	20.45	3.85	5.56	15.15

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	5.56
Labiodental	0.00	0.00	12.50	0.00	0.00	0.00
Linguadental	12.50	12.50	25.00	0.00	0.00	0.00
Lingua-alveolar	8.33	8.33	12.50	11.11	16.67	11.11
Linguapalatal	25.00	31.25	31.25	3.33	0.00	4.17
Linguavelar	0.00	0.00	16.67	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	25.00	25.00	50.00	0.00	0.00	0.00
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	8.33	0.00	0.00	2.78
Fricative	12.50	14.29	16.67	10.42	14.29	11.11
Affricate	25.00	25.00	25.00	0.00	0.00	8.33
Voiceless	8.33	12.50	15.63	5.56	6.25	2.08
Voiced	9.62	8.33	15.91	2.56	4.17	7.58

TABLE S.49

Consonants Misarticulaed by Class
(Moderate Articulation Deviation)

Grade 11. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 4, Females 5.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	12.50	0.00	12.50	0.00	0.00	10.00
Linguadental	12.50	12.50	0.00	40.00	20.00	20.00
Lingua-alveolar	16.67	20.83	20.83	23.33	26.67	23.33
Linguapalatal	15.00	18.75	18.75	12.00	25.00	40.00
Linguavelar	0.00	0.00	0.00	0.00	0.00	6.67
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	12.50	25.00	25.00	0.00	20.00	20.00
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	0.00	0.00	0.00	10.00
Fricative	18.75	17.86	20.83	30.00	31.43	30.00
Affricate	25.00	25.00	25.00	20.00	20.00	40.00
Voiceless	8.33	12.50	12.50	17.78	20.00	22.50
Voiced	11.54	10.42	11.36	9.23	11.67	16.36

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	12.50	0.00	12.50	0.00	0.00	0.00
Linguadental	12.50	0.00	0.00	30.00	20.00	20.00
Lingua-alveolar	4.17	16.67	4.17	20.00	16.67	20.00
Linguapalatal	10.00	12.50	18.75	12.00	25.00	25.00
Linguavelar	0.00	0.00	0.00	0.00	0.00	6.67
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	12.50	25.00	12.50	0.00	10.00	10.00
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	0.00	0.00	0.00	10.00
Fricative	6.25	7.14	8.33	25.00	25.71	20.00
Affricate	25.00	25.00	25.00	20.00	20.00	30.00
Voiceless	2.78	6.25	9.38	13.33	17.50	20.00
Voiced	7.69	8.33	4.55	9.23	8.33	9.09

TABLE S.50

Consonants Misarticulated by Class
(Moderate Articulation Deviation)

Grade 12. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are tha average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 2, Females 4.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	0.00	25.00	0.00	0.00	0.00
Linguadental	0.00	25.00	0.00	12.50	12.50	0.00
Lingua-alveolar	16.67	33.33	25.00	20.83	12.50	16.67
Linguapalatal	10.00	25.00	12.50	20.00	31.25	31.25
Linguavelar	0.00	0.00	0.00	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	25.00	25.00	25.00	0.00	0.00	12.50
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	0.00	0.00	0.00	0.00
Fricative	12.50	35.71	33.33	21.88	21.43	20.83
Affricate	0.00	25.00	0.00	37.50	37.50	37.50
Voiceless	5.56	18.75	6.25	16.67	18.75	15.63
Voiced	7.69	16.67	18.18	7.69	6.25	9.09

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	0.00	0.00	0.00	0.00	0.00
Linguadental	0.00	0.00	0.00	12.50	12.50	0.00
Lingua-alveolar	16.67	25.00	16.67	16.67	12.50	12.50
Linguapalatal	10.00	12.50	12.50	10.00	12.50	18.75
Linguavelar	0.00	0.00	0.00	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	25.00	25.00	25.00	0.00	0.00	12.50
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	0.00	0.00	0.00	0.00	0.00	0.00
Fricative	12.50	21.43	16.67	18.75	17.86	12.50
Affricate	0.00	0.00	0.00	12.50	12.50	25.00
Voiceless	5.56	12.50	6.25	13.89	12.50	6.25
Voiced	7.69	8.33	9.09	3.85	4.17	9.09

other factors such as the friction-like characteristics of the fricative class of consonants (/s/, /z/, and /sh/) and the voiceless characteristics also must be considered. When summed up it would appear the deviations of linguadental placement, fricative manner and voicelessness are articulation features which characterize the MAD group.

A comparison of Tables S.39 - S.50, grades 1-12, reveals that essentially the same classes of consonants were misarticulated most frequently in each of the 12 grades. This was especially true for the first three grades. For these reasons, it follows that there is very little difference between the individual grades especially the first three, and the total group (Table S.38) with respect to the classes of consonants most frequently misarticulated. As in the previous analyses, discussion of the results for the upper grades is difficult because of the small numbers of subjects in those grades. Also, improvement in performance is related to increasing grade level.

Extreme Articulation Deviation (EAD)

Cumulative Number of Consonants Misarticulated. The Extreme Articulation Deviation (EAD) performance group of subjects can be compared with the Moderate Articulation Deviation (MAD) group since the three analyses of the articulation test results were identical for both groups. Comparisons of the two groups is of interest because difference as well as similarities with respect to performance trends can be noted easily. Results of the analysis for all subjects in the group are summarized in Table S.51 and for each of the 12 grades in Tables S.52 - S.63. Again, information in this set of tables has been extracted from detailed tables appearing in APPENDIX J, Tables JS.1 - JS.13.

Results in Table S.51 show that .42% of the males and none of the females produced all of the consonants correctly during administration of the articulation test. With verbal stimulation the figures increased to 2.95% and 2.40% for males and females, respectively. As in the MAD group these results show that females performed better than males during the initial testing as well as following verbal stimulation. One interesting comparison between the MAD and EAD groups which indicates a marked difference in terms of implied severity is to consider the results for the percent of subjects who misarticulated 20 or fewer consonants. As discussed earlier the percent of subjects who misarticulated more than 20 consonants can be determined by subtraction. Therefore 47.26% (100 - 52.74) of the males and 41.60% (100 - 58.40) of the females in the EAD group (Table S.51) misarticulated more than 20 consonants as compared to 12.60% of the males and 6.04% of the females in the MAD group (Table S.12). These comparative results strongly suggest that the two

TABLE S.51

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Total Grades (1-12). Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 237, Females 125.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.41	0.00	2.95	2.40
5	2.53	4.00	20.25	26.40
10	17.72	20.00	46.41	48.00
15	25.44	37.60	63.29	73.60
20	52.74	58.40	75.95	84.00

TABLE S.52

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 1. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 115, Females 69.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	2.90
5	.87	2.90	13.91	20.29
10	7.83	14.49	37.39	43.48
15	23.48	33.33	55.65	68.12
20	41.74	49.28	70.43	79.71

TABLE S.53

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 2. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 44, Females 18.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	0.00
5	2.27	0.00	15.91	22.22
10	18.18	22.22	54.55	50.00
15	34.09	27.78	68.18	83.33
20	61.36	66.67	84.09	94.44

TABLE S.54

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 3. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 17, Females 8.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	5.88	0.00
5	5.88	0.00	23.53	50.00
10	29.41	37.50	47.06	62.50
15	35.29	50.00	58.82	100.00
20	47.06	87.50	70.59	100.00

TABLE S.55

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 4. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 15, Females 3.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	13.33	0.00
5	0.00	0.00	26.67	0.00
10	20.00	0.00	46.67	33.33
15	40.00	33.33	60.00	66.67
20	53.33	33.33	66.67	100.00

TABLE S.56

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 5. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 9, Females 4.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	11.11	0.00
5	0.00	25.00	22.22	75.00
10	33.33	25.00	66.67	75.00
15	55.56	50.00	88.89	75.00
20	77.78	75.00	88.89	100.00

TABLE S.57

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 6. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 7, Females 3.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	14.29	0.00
5	14.29	0.00	57.14	33.33
10	28.57	0.00	57.14	66.67
15	71.43	33.33	85.71	100.00
20	71.43	100.00	100.00	100.00

TABLE S.58

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 7. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 6, Females 5.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	20.00
5	0.00	0.00	50.00	60.00
10	33.33	80.00	66.67	80.00
15	66.67	80.00	83.33	80.00
20	66.67	80.00	83.33	80.00

TABLE S.59

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 8. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1, Females 7.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	0.00
5	0.00	14.29	100.00	28.57
10	100.00	14.29	100.00	42.86
15	100.00	57.14	100.00	71.43
20	100.00	71.43	100.00	71.43

TABLE S.60

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 9. Summary of results showning percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 5, Females 2.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	0.00
5	0.00	0.00	40.00	0.00
10	20.00	0.00	40.00	0.00
15	40.00	0.00	80.00	0.00
20	80.00	0.00	80.00	50.00

TABLE S.61

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 10. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 4, Females 3.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	33.33
10	50.00	33.33	50.00	66.67
15	75.00	66.67	75.00	100.00
20	75.00	100.00	75.00	100.00

TABLE S.62

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 11. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 6, Females 1.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	0.00	0.00	0.00	0.00
5	16.67	0.00	16.67	0.00
10	16.67	0.00	33.33	0.00
15	50.00	0.00	50.00	0.00
20	50.00	0.00	83.33	0.00

TABLE S.63

Cumulative Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 12. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 8, Females 2.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	12.50	0.00	25.00	0.00
5	12.50	50.00	50.00	50.00
10	62.50	50.00	87.50	50.00
15	87.50	50.00	87.50	100.00
20	87.50	50.00	87.50	100.00

groups are different. The same trend for many of the misarticulated consonants to be stimuable is shown for the EAD group as was found for the MAD group. For the EAD group changes in the number of misarticulated consonants as a function of increasing grade level are shown in Tables S.52 - S.63.

In Tables S.52 - S.63, it is interesting to note that the total number of subjects decreased significantly from 184 in grade one to 62 in the second grade and 25 in the third. From the fourth grade upward the changes were less pronounced. Improvement with increasing grade level will be noted from the first through the fifth grade but, beyond that level, the results cannot be considered seriously because of the small number of subjects in each grade. The observed trend for females to perform better than males in the MAD group is not as evident in the EAD group in some grades, as for example, grade four (Table S.55) and grade five (Table S.56). Again the small numbers of subjects in these grades may have been an influential factor.

Ten Most Frequently Misarticulated Consonants. Results of the analysis for all subjects in the Extreme Articulation Deviation (EAD) group are shown in Table S.64 and for each of the 12 grades in Tables S.65 - S.76. Superiority of female over male performance is not consistent when comparisons can be made for consonants in the same word position.

As seen in Table S.64 the list of ten most frequently misarticulated consonants contained the same phonemes for both male and female subjects. Of these, nine were in the same word position; the one exception was /s/. Superiority of female over male performance is not consistent for the nine comparable consonants because a lower percent of males misarticulated four consonants (/z/, /ch/, /v/, /s/) and females misarticulated five (/th/, /r/, /sh/, /th/, /l/). Although females were slightly more stimulable, the group performance results indicate a great deal of similarity between males and females.

Quality of performance does not improve as a function of increasing grade level as noted when the results in Tables S.67 - S.76 are compared. For example, -th- was misarticulated by 76.52% of the males during the initial testing in grade one (Table S.65), 61.35% in grade two (Table S.66), 76.47% in grade three (Table S.67) and 77.78% in grade five (Table S.69). A similar pattern is noted for females with respect to /z-/ which was misarticulated 71.01% of the time in grade one, 72.22% in grade two, 50% in grade three, and 75% in grade five.

TABLE S.64

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Total Grades (1-12). Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 237, Females 125.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	71.31	40.93	z-	68.10	43.20
z-	63.71	44.73	-th-	66.40	36.80
-r	56.12	42.62	-ch	60.00	34.40
-sh	55.70	38.82	-sh	54.40	35.20
-ch	53.59	34.60	-r	52.80	35.20
-th-	51.48	34.60	-s	50.40	29.60
s-	50.63	33.33	v-	48.00	12.80
v-	50.21	21.52	-th-	45.60	22.40
-j	39.24	24.05	-j	42.40	25.60
-l-	24.47	10.97	-l-	20.80	6.40

TABLE S.65

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 1. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 115, Females 69.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	76.52	46.09	-th-	73.91	43.48
z-	66.09	46.09	z-	71.01	43.48
v-	65.22	30.43	-sh	63.77	37.68
-th-	60.87	44.35	-ch	62.32	37.68
-sh	60.87	40.87	v-	55.07	10.14
-r	58.26	45.22	-r	53.62	40.58
-ch	56.52	37.39	-th-	53.62	24.64
-s	52.17	32.17	-s-	53.62	31.88
-j	40.87	22.61	-j	46.38	27.54
-l	28.70	15.65	-g	36.23	10.14

TABLE S.66

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 2. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 44, Females 18.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-z	68.18	40.91	-th-	88.89	38.89
-sh	65.91	45.45	z-	72.22	50.00
-th-	61.36	31.82	-ch	61.11	33.33
s-	59.09	36.36	-s	50.00	27.78
-r	59.09	47.73	v-	50.00	16.67
-ch	56.82	29.55	-r	50.00	16.67
-th	47.73	29.55	-th	50.00	22.22
-j	38.64	22.73	-j	44.44	27.78
v-	36.36	6.82	-sh	38.89	27.78
-l-	18.18	9.09	-l-	27.78	5.56

TABLE S.67

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 3. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 17, Females 8.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-z	82.35	52.94	-sh	62.50	50.00
-th-	76.47	29.41	z-	50.00	25.00
s-	70.59	52.94	-r	50.00	25.00
-ch-	64.71	47.06	-ch	50.00	12.50
sh-	64.71	47.06	-th	50.00	25.00
-r	64.71	47.06	-s	37.50	25.00
-th-	41.18	23.53	v-	37.50	0.00
-j	41.18	35.29	th-	37.50	12.50
-g	41.18	17.65	-j	37.50	25.00
-l-	35.29	11.76	-b	37.50	12.50

TABLE S.68

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 4. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 15, Females 3.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-z-	73.33	60.00	-s	66.67	33.33
-s	66.67	46.67	-z	66.67	33.33
sh-	66.67	33.33	-ch-	66.67	66.67
-th	66.67	40.00	-r	66.67	33.33
-ch	60.00	33.33	th-	66.67	66.67
-r	53.33	33.33	th-	66.67	0.00
-th-	46.67	26.67	j-	66.67	33.33
-j	46.67	40.00	-sh	66.67	33.33
-k	33.33	0.00	-f-	33.33	0.00
-g	33.33	13.33	-p	33.33	0.00

TABLE S.69

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 5. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 9, Females 4.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
z-	77.78	44.44	z-	75.00	50.00
-th-	77.78	22.22	v-	75.00	50.00
v-	55.56	11.11	-ch	75.00	0.00
-r	55.56	33.33	-s	50.00	25.00
-s	44.44	22.22	-f	50.00	0.00
-sh-	44.44	33.33	-sh-	50.00	50.00
-j	44.44	22.22	-th	50.00	0.00
g-	33.33	11.11	g-	25.00	25.00
-ch-	33.33	22.22	-d-	25.00	25.00
-th-	33.33	11.11	-k-	25.00	25.00

TABLE S.70

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 6. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 7, Females 3.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-z-	71.43	14.29	-n	100.00	33.33
s-	57.14	28.57	-sh-	100.00	0.00
-th-	57.14	28.57	-s-	100.00	66.67
v-	42.86	14.29	z-	66.67	33.33
-ch-	42.86	28.57	-v-	66.67	0.00
sh-	42.86	28.57	-ch	66.67	33.33
th-	42.86	14.29	th-	66.67	0.00
-r-	42.86	28.57	-t	66.67	0.00
-j	28.57	14.29	-j	66.67	66.67
-b	28.57	14.29	-th-	66.67	0.00

TABLE S.71

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 7. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 6, Females 5.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-s-	83.33	50.00	-r	80.00	60.00
-th-	83.33	50.00	z-	60.00	40.00
z-	66.67	33.33	-th-	60.00	40.00
-r	66.67	50.00	-j	60.00	20.00
-sh	66.67	66.67	-th-	60.00	40.00
-ch-	50.00	16.67	-d-	40.00	20.00
-th-	50.00	16.67	s-	40.00	40.00
-j	50.00	33.33	-ch	40.00	0.00
-f	33.33	33.33	-g	40.00	20.00
y-	33.33	16.67	-l	40.00	40.00

TABLE S.72

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 8. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1, Females 7.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-l-	100.00	0.00	-z	85.71	57.14
m-	100.00	0.00	-s	71.43	42.86
th-	100.00	0.00	-r	71.43	42.86
-r-	100.00	100.00	-sh-	42.86	28.57
-j	100.00	0.00	-ch-	28.57	14.29
-	-	-	-l	42.86	28.57
-	-	-	-v	42.86	0.00
-	-	-	-n	28.57	0.00
-	-	-	-th-	28.57	28.57
-	-	-	-th-	28.57	28.57

TABLE S.73

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 9. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 5, Females 2.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
z-	80.00	60.00	z-	100.00	100.00
r-	80.00	80.00	s-	100.00	50.00
-s	60.00	20.00	-ch-	100.00	100.00
-l-	60.00	20.00	-sh-	100.00	50.00
ch-	60.00	20.00	-j-	50.00	50.00
-th-	60.00	40.00	-ng-	100.00	100.00
v-	40.00	20.0	-k-	50.00	0.00
-sh-	40.00	0.00	y-	50.00	50.00
-th-	40.00	40.00	v-	50.00	0.00
-v	40.00	0.00	l-	50.00	50.00

TABLE S.74

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 10. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 4, Femal

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	100.00	75.00	ch-	66.67	33.33
ch-	75.00	50.00	-s	33.33	33.33
-s	50.00	50.00	k-	33.33	33.33
z-	50.00	50.00	g-	33.33	0.00
-r	50.00	50.00	-f	33.33	0.00
-th-	50.00	25.00	z-	33.33	33.33
-f-	25.00	25.00	sh-	33.33	33.33
k-	25.00	25.00	-r	33.33	33.33
g-	25.00	25.00	-v	33.33	33.33
-d-	25.00	25.00	th-	33.33	0.00

TABLE S.75

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 11. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 6, Females 1.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
ch-	66.67	50.00	-s	100.00	100.00
-th-	66.67	66.67	t-	100.00	100.00
s-	50.00	33.33	z-	100.00	100.00
-z	50.00	33.33	-l-	100.00	100.00
sh-	50.00	16.67	-ch-	100.00	100.00
-r	50.00	33.33	sh-	100.00	100.00
th-	50.00	33.33	-th-	100.00	100.00
v-	33.33	16.67	-j	100.00	0.00
-j	33.33	33.33	-th-	100.00	100.00
h-	16.67	0.00	-	-	-

TABLE S.76

Ten Most Frequently Misarticulated Consonants
(Extreme Articulation Deviation)

Grade 12. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 8, Females 2.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	62.50	25.00	v-	100.00	50.00
z-	50.00	37.50	-s-	100.00	100.00
v-	50.00	25.00	z-	50.00	0.00
-th-	50.00	25.00	-k	50.00	50.00
sh-	37.50	12.50	y-	50.00	0.00
-r	37.50	25.00	-ch-	50.00	0.00
-g-	25.00	12.50	sh-	50.00	0.00
-l-	25.00	12.50	-r	50.00	50.00
-ch-	25.00	12.50	-th-	50.00	50.00
-j-	25.00	0.00	-r-	50.00	50.00

A comparison of the EAD group (Table S.64) with the MAD group (Table S.25) reveals that the list of the ten most frequently misarticulated consonants was almost identical in both groups although the word position and rank order of the consonants differed. One difference between the two performances which stands out is the higher percent of males and females in the EAD group who misarticulated the same consonants, as for example, /-th/.

Consonants Misarticulated by Class. The results of the analysis of consonants misarticulated by class for the EAD group are displayed in Table S.77 for all subjects and in Tables S.78 - S.89 for each of the 12 grades. Results for all subjects, seen in Table S.77 show that, with respect to the place of articulation class, the highest percent of misarticulation occurred for the linguadental consonants in all three word positions and for both males and females. For the manner of production class, fricative consonants ranked first and voiceless consonants also ranked first with respect to voicing characteristics. The percentage of errors was highest in the final position of words for males and females in all of the three classes. However, within a class, the final position was not always the one most frequently misarticulated in all grades. In grade two (Table S.79), for example, the linguadentals were most frequently misarticulated in the medial position rather than the final position as shown in Table S.78 (Grade 1).

Comparison of the 12 grades (Tables S.78 - S.89) indicates some consistency in performance from grade to grade. The linguadental and linguapalatal (place of articulation) consonants and the fricative and affricate (manner of production) consonants usually ranked as the top two categories within their respective classes with respect to frequency of misarticulation. Some improvement in quality of performance can be noted with increasing grade; the most pronounced change occurs in grade two (Table S.79) compared to grade three (Table S.78).

Prevalence of Articulation Disorders

It is clear from the preceding discussion of the MAD and EAD articulation performance groups that they were similar in some respects but different in others. On the basis of the analysis of the articulation test results a relatively high percentage of subjects in both groups misarticulated a large number of consonants even though there were differences. Since the task is to determine if subjects from both groups should be considered to be those who have an articulation disorder, part of the results of the three reported analyses for the MAD and EAD groups were compared with those of the Acceptable Articulation (AA) group.

TABLE S.77

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Total Grades (1-12). Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 237, Females 125.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	2.85	5.63	7.88	1.60	4.80	9.60
Labiodental	28.69	18.99	23.84	27.60	19.60	24.40
Linguadental	47.89	61.39	64.14	44.00	56.00	59.20
Lingua-alveolar	23.28	25.46	27.85	23.07	24.40	28.40
Linguapalatal	35.95	41.77	51.16	31.84	39.20	52.40
Linguavelar	9.07	11.81	14.77	6.80	13.07	2 .00
Glottal	2.53	-	-	2.40	-	-
Glide	12.24	-	-	7.60	-	-
Semivowel	32.07	33.76	38.82	26.40	30.40	38.00
Nasal	2.53	8.30	6.33	1.60	9.07	10.67
Stop	4.15	8.30	13.64	3.73	8.93	16.40
Fricative	40.03	45.21	46.69	37.60	42.97	44.67
Affricate	32.91	37.13	46.41	34.40	32.80	51.20
Voiceless	24.80	30.64	34.49	22.84	30.20	35.00
Voiced	21.65	23.98	25.05	19.82	22.20	26.98

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.95	1.13	2.95	.60	2.13	2.67
Labiodental	12.45	8.65	9.70	8.00	6.40	7.60
Linguadental	30.38	37.76	42.62	24.80	29.60	36.80
Lingua-alveolar	15.40	14.91	16.67	13.87	13.87	16.13
Linguapalatal	25.74	29.64	35.02	20.80	25.20	32.60
Linguavelar	4.43	3.94	6.05	3.60	4.27	8.80
Glottal	.42	-	-	0.00	-	-
Glide	5.70	-	-	2.00	-	-
Semivowel	25.11	23.63	28.06	19.60	20.00	24.40
Nasal	.84	3.09	3.38	1.20	3.73	3.47
Stop	1.76	2.18	5.41	1.87	3.20	6.53
Fricative	25.00	28.75	28.62	20.50	24.00	25.87
Affricate	23.00	22.57	29.32	20.80	18.40	30.00
Voiceless	16.08	18.78	20.99	13.42	17.10	19.70
Voiced	13.47	13.82	14.65	10.89	11.53	14.18

TABLE S.78

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 1. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 115, Females 69.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	1.74	6.96	8.70	2.17	7.25	12.08
Labiodental	36.96	23.04	29.13	31.88	23.91	27.54
Linguadental	56.96	68.70	75.65	71.45	63.77	71.01
Lingua-alveolar	24.93	26.23	30.58	24.88	26.33	29.71
Linguapalatal	37.57	44.35	54.13	36.52	43.84	56.52
Linguavelar	10.87	13.04	15.94	7.25	13.53	23.67
Glottal	2.61	-	-	4.35	-	-
Glide	13.04	-	-	9.42	-	-
Semivowel	36.96	36.96	43.48	31.88	35.51	39.86
Nasal	1.30	9.28	7.25	2.17	9.18	11.11
Stop	4.93	9.28	15.36	4.35	11.35	19.57
Fricative	44.57	49.32	51.59	42.39	47.62	49.76
Affricate	33.91	37.83	48.70	36.96	35.51	54.35
Voiceless	26.86	33.48	38.59	26.09	33.88	39.67
Voiced	24.21	25.87	27.19	22.41	25.00	29.12

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.65	.87	3.48	1.09	2.90	4.35
Labiodental	17.83	10.43	13.04	6.52	8.70	7.25
Linguadental	38.26	45.22	50.43	30.43	34.06	46.38
Lingua-alveolar	16.09	15.51	17.54	14.25	13.29	16.67
Linguapalatal	26.61	31.74	36.52	23.77	28.62	35.87
Linguavelar	4.78	4.06	6.67	3.62	3.38	9.66
Glottal	0.00	-	-	0.00	-	-
Glide	6.52	-	-	2.17	-	-
Semivowel	29.57	25.65	30.43	23.19	23.91	27.54
Nasal	0.00	2.90	3.19	2.17	2.42	3.86
Stop	1.74	2.03	6.38	2.17	3.62	7.97
Fricative	28.37	32.42	31.59	22.10	25.88	27.78
Affricate	22.17	23.48	30.00	22.46	20.29	32.61
Voiceless	17.29	20.33	23.48	14.98	18.66	21.92
Voiced	15.25	15.29	15.49	11.93	12.44	15.55

TABLE S.79

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 2. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 44, Females 18.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	1.14	3.03	5.30	1.39	0.00	1.85
Labiodental	20.45	13.64	14.77	27.78	16.67	19.44
Linguadental	43.18	54.55	50.00	38.89	69.44	55.56
Lingua-alveolar	23.86	25.00	23.86	22.22	20.37	22.22
Linguapalatal	39.55	39.77	55.11	26.67	37.50	48.61
Linguavelar	4.55	9.85	9.85	8.33	12.96	9.26
Glottal	2.27	-	-	0.00	-	-
Glide	7.95	-	-	5.56	-	-
Semivowel	30.68	28.41	35.23	22.22	38.89	27.78
Nasal	2.27	6.82	3.03	0.00	11.11	3.70
Stop	1.89	6.06	8.71	2.78	3.70	8.33
Fricative	39.20	42.21	43.56	35.42	40.48	38.89
Affricate	38.64	37.50	47.73	33.33	33.33	52.78
Voiceless	21.01	28.13	32.39	22.22	26.39	29.17
Voiced	19.23	21.59	20.87	17.09	22.69	20.20

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	.76	0.00	0.00	0.00
Labiodental	3.41	4.55	5.68	11.11	8.33	11.11
Linguadental	21.59	30.68	31.82	25.00	30.56	33.33
Lingua-alveolar	14.77	14.02	14.77	13.89	11.11	11.11
Linguapalatal	29.55	29.55	36.36	17.78	25.00	26.39
Linguavelar	2.27	3.03	3.79	5.56	7.41	3.70
Glottal	0.00	-	-	0.00	-	-
Glide	4.55	-	-	2.78	-	-
Semivowel	22.73	21.59	28.41	11.11	22.22	8.33
Nasal	1.14	1.52	2.27	0.00	3.70	0.00
Stop	.76	.76	2.27	1.85	2.78	3.70
Fricative	22.16	26.30	26.89	22.22	22.22	23.15
Affricate	26.14	22.73	26.14	19.44	19.44	30.56
Voiceless	16.41	17.90	18.18	13.58	14.58	18.06
Voiced	11.01	11.55	13.22	10.26	12.50	8.59

Table S.80

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 3. Percent of times each of the classes of consonants was misarticulated in each word position. Percentages figures are the average of the percent of misarticulation of the consonants of each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 17, Females 8.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	2.94	5.88	11.76	3.13	8.33	12.50
Labiodental	20.59	11.76	20.59	18.75	6.25	18.75
Linguadental	35.29	58.82	58.82	31.25	25.00	50.00
Lingua-alveolar	20.59	28.43	32.35	12.50	8.33	16.67
Linguapalatal	37.65	52.94	55.88	30.00	21.88	50.00
Linguavelar	5.88	7.84	19.61	0.00	4.17	8.33
Glottal	0.00	-	-	0.00	-	-
Glide	14.71	-	-	12.50	-	-
Semivowel	20.59	44.12	41.18	18.75	0.00	31.25
Nasal	0.00	7.84	3.92	0.00	0.00	4.17
Stop	1.96	5.88	19.61	2.08	6.25	12.50
Fricative	37.50	45.38	49.02	26.56	23.21	35.42
Affricate	32.35	50.00	52.94	25.00	18.75	43.75
Voiceless	25.49	33.82	34.56	13.89	20.31	29.69
Voiced	16.74	24.51	30.48	16.35	6.25	19.32

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	1.96	0.00	0.00	4.17	4.17
Labiodental	5.88	5.88	5.88	0.00	0.00	12.50
Linguadental	23.53	26.47	47.06	12.50	0.00	25.00
Lingua-alveolar	17.65	16.67	20.59	6.25	4.17	8.33
Linguapalatal	32.94	45.59	47.06	17.50	15.63	28.13
Linguavelar	0.00	1.96	7.84	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	8.82	-	-	0.00	-	-
Semivowel	17.65	29.41	29.41	18.75	0.00	12.50
Nasal	0.00	0.00	1.96	0.00	0.00	0.00
Stop	0.00	1.96	6.86	0.00	2.08	2.08
Fricative	26.47	30.25	33.33	9.38	8.33	25.00
Affricate	32.35	38.24	44.12	18.75	12.50	18.75
Voiceless	18.95	24.26	25.00	6.94	9.38	15.63
Voiced	12.22	13.73	17.65	6.73	2.08	9.09

TABLE S.81

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 4. Percent of times each of the classes of consonants was misarticulated in each word position. Percentages figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 15, Females 3.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	10.00	11.11	4.44	0.00	0.00	11.11
Labiodental	10.00	16.67	26.67	33.33	33.33	16.67
Linguadental	46.67	53.33	66.67	66.67	16.67	33.33
Lingua-alveolar	24.44	33.33	35.56	22.22	27.78	27.78
Linguapalatal	38.67	51.67	53.33	46.67	41.67	58.33
Linguavelar	6.67	20.00	28.89	16.67	22.22	11.11
Glottal	0.00	-	-	0.00	-	-
Glide	16.67	-	-	0.00	-	-
Semivowel	30.00	36.67	36.67	33.33	16.67	33.33
Nasal	10.00	17.78	13.33	16.67	22.22	0.00
Stop	3.33	12.22	18.89	5.56	11.11	16.67
Fricative	37.50	49.52	52.22	41.67	33.33	44.44
Affricate	36.67	46.67	53.33	66.67	50.00	50.00
Voiceless	25.93	35.00	40.83	29.63	33.33	37.50
Voiced	21.03	30.00	29.09	25.64	19.44	21.21

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	5.00	2.22	0.00	0.00	0.00	0.00
Labiodental	6.67	6.67	3.33	33.33	0.00	0.00
Linguadental	33.33	36.67	40.00	33.33	16.67	33.33
Lingua-alveolar	18.89	24.44	24.44	11.11	16.67	16.67
Linguapalatal	22.67	31.67	33.33	33.33	25.00	41.67
Linguavelar	6.67	4.44	8.89	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	6.67	-	-	0.00	-	-
Semivowel	16.67	26.67	26.67	33.33	16.67	16.67
Nasal	6.67	11.11	8.89	0.00	11.11	0.00
Stop	2.22	2.22	5.56	0.00	0.00	5.56
Fricative	25.83	31.43	27.78	25.00	14.29	22.22
Affricate	30.00	30.00	36.67	50.00	33.33	50.00
Voiceless	17.78	20.00	19.17	14.81	16.67	25.00
Voiced	13.85	18.33	18.18	17.95	8.33	9.09

TABLE S.82

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 5. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 9, Females 4.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	7.41	14.81	0.00	0.00	0.00
Labiodental	33.33	22.22	22.22	37.50	25.00	25.00
Linguadental	27.78	55.56	77.78	12.50	25.00	50.00
Lingua-alveolar	20.37	20.37	24.07	25.00	20.83	25.00
Linguapalatal	22.22	33.33	38.89	15.00	25.00	37.50
Linguavelar	16.67	7.41	11.11	12.50	16.67	25.00
Glottal	0.00	-	-	0.00	-	-
Glide	11.11	-	-	0.00	-	-
Semivowel	22.22	11.11	33.33	12.50	0.00	12.50
Nasal	0.00	3.70	7.41	0.00	8.33	8.33
Stop	7.41	11.11	14.81	4.17	8.33	12.50
Fricative	30.56	41.27	42.59	31.25	35.71	45.83
Affricate	16.67	33.33	33.33	25.00	25.00	37.50
Voiceless	11.11	29.17	27.78	13.89	21.88	37.50
Voiced	22.22	18.52	25.25	17.31	16.67	15.91

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	3.70	7.41	0.00	0.00	0.00
Labiodental	5.56	5.56	0.00	25.00	12.50	0.00
Linguadental	11.11	16.67	33.33	0.00	0.00	0.00
Lingua-alveolar	12.96	9.26	9.26	16.67	16.67	8.33
Linguapalatal	13.33	19.44	25.00	10.00	12.50	12.50
Linguavelar	5.56	0.00	3.70	12.50	8.33	8.33
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	16.67	5.56	16.67	12.50	0.00	12.50
Nasal	0.00	3.70	7.41	0.00	0.00	0.00
Stop	1.85	0.00	1.85	4.17	8.33	4.17
Fricative	13.89	19.05	18.52	18.75	21.43	12.50
Affricate	16.67	16.67	22.22	12.50	0.00	0.00
Voiceless	7.41	2.50	12.50	8.33	15.63	9.38
Voiced	9.40	7.41	11.11	11.54	6.25	4.55

TABLE S.83

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 6. Percent of times each of the classes of consonants was misarticulated in each word postion. Percentage fiqures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 7, Females 3.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	7.14	0.00	9.52	0.00	0.00	22.22
Labiodental	21.43	14.29	28.57	16.67	33.33	16.67
Linguadental	42.86	35.71	28.57	66.67	50.00	33.33
Lingua-alveolar	23.81	21.43	26.19	22.22	33.33	50.00
Linguapalatal	20.00	39.29	32.14	26.67	41.67	50.00
Linguavelar	0.00	0.00	9.52	0.00	0.00	22.22
Glottal	0.00	-	-	0.00	-	-
Glide	7.14	-	-	0.00	-	-
Semivowel	21.43	28.57	21.43	0.00	16.67	33.33
Nasal	14.29	0.00	4.76	0.00	0.00	44.44
Stop	0.00	2.38	14.29	5.56	0.00	27.78
Fricative	35.71	34.69	35.71	37.50	61.90	33.33
Affricate	14.29	35.71	35.71	50.00	33.33	66.67
Voiceless	19.05	21.43	21.43	18.52	37.50	29.17
Voiced	17.58	17.86	23.38	20.51	19.44	42.42

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	4.76	0.00	0.00	0.00
Labiodental	7.14	7.14	7.14	16.67	0.00	16.67
Linguadental	21.43	21.43	28.57	0.00	0.00	0.00
Lingua-alveolar	9.52	4.76	14.29	11.11	16.67	22.22
Linguapalatal	11.43	21.43	21.43	6.67	8.33	33.33
Linguavelar	0.00	0.00	0.00	0.00	0.00	11.11
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	14.29	14.29	21.43	0.00	0.00	0.00
Nasal	0.00	0.00	0.00	0.00	0.00	22.22
Stop	0.00	0.00	2.38	0.00	0.00	0.00
Fricative	17.86	16.33	21.43	16.67	14.29	27.78
Affricate	0.00	14.29	21.43	0.00	16.67	50.00
Voiceless	9.52	12.50	14.29	7.41	12.50	12.50
Voiced	6.59	5.95	10.39	5.13	2.78	21.21

TABLE S.84

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 7. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 6, Females 5.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	12.50	5.56	16.67	0.00	0.00	13.33
Labiodental	25.00	25.00	33.33	20.00	10.00	20.00
Linguadental	25.00	66.67	66.67	40.00	60.00	40.00
Lingua-alveolar	19.44	33.33	25.00	16.67	23.33	20.00
Linguapalatal	30.00	50.00	58.33	12.00	5.00	45.00
Linguavelar	8.33	16.67	22.22	0.00	6.67	26.67
Glottal	16.67	-	-	0.00	-	-
Glide	25.00	-	-	0.00	-	-
Semivowel	8.33	33.33	41.67	10.00	20.00	60.00
Nasal	8.33	11.11	16.67	0.00	6.67	20.00
Stop	8.33	13.89	19.44	0.00	6.67	16.67
Fricative	31.25	54.76	47.22	30.00	31.43	20.00
Affricate	33.33	41.67	50.00	10.00	0.00	50.00
Voiceless	20.37	39.58	37.50	17.78	12.50	20.00
Voiced	20.51	27.78	30.30	9.23	18.33	30.91

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	8.33	5.56	16.67	0.00	0.00	0.00
Labiodental	25.00	25.00	25.00	0.00	0.00	10.00
Linguadental	8.33	33.33	50.00	20.00	40.00	20.00
Lingua-alveolar	13.89	22.22	22.22	13.33	13.33	16.67
Linguapalatal	33	37.50	45.83	8.00	5.00	20.00
Linguavelar	33	16.67	16.67	0.00	6.67	6.67
Glottal	16.67	-	-	0.00	-	-
Glide	8.33	-	-	0.00	-	-
Semivowel	8.33	33.33	33.33	10.00	10.0	50.00
Nasal	8.33	11.11	16.67	0.00	6.67	0.00
Stop	8.33	13.89	16.67	0.00	3.33	6.67
Fricative	22.92	35.71	38.89	15.00	20.00	13.33
Affricate	25.00	16.67	33.33	10.00	0.00	10.00
Voiceless	18.52	27.08	33.33	11.11	10.00	7.50
Voiced	12.82	20.83	22.73	4.62	10.00	16.36

TABLE S.85

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 8. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1, Females 7.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	25.00	0.00	0.00	0.00	4.76	9.52
Labiodental	0.00	0.00	0.00	7.14	14.29	21.43
Linguadental	50.00	0.00	0.00	21.43	28.57	14.29
Lingua-alveolar	0.00	16.67	0.00	19.05	26.19	42.86
Linguapalatal	0.00	25.00	25.00	17.14	39.29	42.86
Linguavelar	0.00	0.00	0.00	0.00	9.52	19.05
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	0.00	100.00	0.00	21.43	35.71	57.14
Nasal	50.00	0.00	0.00	0.00	4.76	19.05
Stop	0.00	0.00	0.00	0.00	7.14	14.29
Fricative	12.50	0.00	0.00	23.21	36.73	42.86
Affricate	0.00	0.00	50.00	14.29	28.57	28.57
Voiceless	0.00	0.00	0.00	11.11	21.43	25.00
Voiced	15.38	16.67	9.09	12.09	22.62	33.77

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	4.76	0.00
Labiodental	0.00	0.00	0.00	7.14	0.00	0.00
Linguadental	0.00	0.00	0.00	14.29	28.57	14.29
Lingua-alveolar	0.00	0.00	0.00	14.29	16.67	23.81
Linguapalatal	0.00	25.00	0.00	14.29	25.00	32.14
Linguavelar	0.00	0.00	0.00	0.00	0.00	14.29
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	0.00	50.00	0.00	21.43	21.43	35.71
Nasal	0.00	0.00	0.00	0.00	4.76	4.76
Stop	0.00	0.00	0.00	0.00	2.38	7.14
Fricative	0.00	0.00	0.00	17.86	24.49	26.19
Affricate	0.00	0.00	0.00	7.14	14.29	21.43
Voiceless	0.00	0.00	0.00	9.52	14.29	17.86
Voiced	0.00	8.33	0.00	8.79	13.10	16.88

TABLE S.86

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 9. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 5, Females 2.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	6.67	0.00	0.00	0.00	0.00
Labiodental	20.00	10.00	30.00	25.00	0.00	25.00
Linguadental	30.00	50.00	40.00	25.00	50.00	50.00
Lingua-alveolar	30.00	30.00	26.67	41.67	41.67	41.67
Linguapalatal	36.00	20.00	40.00	50.00	75.00	75.00
Linguavelar	0.00	6.67	6.67	0.00	50.00	33.33
Glottal	0.00	-	-	0.00	-	-
Glide	10.00	-		25.00	-	-
Semivowel	60.00	30.00	40.	50.00	25.00	50.00
Nasal	0.00	13.33	0.00	0.00	50.00	33.33
Stop	0.00	3.33	3.33	0.00	8.33	8.33
Fricative	32.50	37.14	43.33	37.50	57.14	58.33
Affricate	30.00	20.00	40.00	75.00	75.00	75.00
Voiceless	20.00	22.50	30.00	22.22	50.00	31.25
Voiced	21.54	20.00	18.18	30.77	33.33	45.45

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	6.67	0.00	0.00	0.00	0.00
Labiodental	10.00	0.00	10.00	0.00	0.00	0.00
Linguadental	30.00	40.00	40.00	25.00	50.00	50.00
Lingua-alveolar	20.00	20.00	13.33	33.33	41.67	25.00
Linguapalatal	28.00	5.00	15.00	50.00	62.50	62.50
Linguavelar	0.00	6.67	6.67	0.00	33.33	33.33
Glottal	0.00	-	-	0.00	-	-
Glide	10.00	-	-	25.00	-	-
Semivowel	60.00	10.00	20.00	50.00	25.00	50.00
Nasal	0.00	13.33	0.00	0.00	50.00	33.33
Stop	0.00	3.33	3.33	0.00	0.00	0.00
Fricative	22.50	22.86	23.33	25.00	50.00	33.33
Affricate	10.00	10.00	10.00	75.00	75.00	75.00
Voiceless	11.11	10.00	15.00	16.67	37.50	18.75
Voiced	18.46	15.00	9.09	26.92	33.33	36.36

TABLE S.87

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 10. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 4, Females 3.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	25.00	25.00	25.00	0.00	0.00	33.33
Linguadental	50.00	75.00	0.00	16.67	16.67	33.33
Lingua-alveolar	16.67	16.67	16.67	11.11	11.11	16.67
Linguapalatal	35.00	18.75	43.75	33.33	33.33	33.33
Linguavelar	25.00	16.67	16.67	33.33	22.22	22.22
Glottal	0.00	-	-	0.00	-	-
Glide	12.50	-	-	0.00	-	-
Semivowel	25.00	12.50	25.00	16.67	16.67	16.67
Nasal	0.00	0.00	8.33	0.00	0.00	0.00
Stop	8.33	12.50	4.17	11.11	11.11	16.67
Fricative	31.25	42.86	33.33	16.67	19.05	33.33
Affricate	50.00	12.50	37.50	50.00	33.33	33.33
Voiceless	27.78	25.00	21.88	18.52	20.83	29.17
Voiced	17.31	18.75	18.18	12.82	11.11	15.15

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	12.50	25.00	25.00	0.00	0.00	16.67
Linguadental	50.00	50.00	0.00	0.00	16.67	0.00
Lingua-alveolar	12.50	8.33	12.50	11.11	11.11	16.67
Linguapalatal	20.00	18.75	43.75	26.67	16.67	33.33
Linguavelar	25.00	16.67	8.33	16.67	0.00	22.22
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	12.50	12.50	25.00	16.67	16.67	16.67
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	8.33	12.50	4.17	5.56	0.00	16.67
Fricative	25.00	28.57	29.17	12.50	19.05	22.22
Affricate	37.50	12.50	37.50	33.33	0.00	33.33
Voiceless	19.44	18.75	21.88	14.81	12.50	20.83
Voiced	13.46	14.58	13.64	7.69	5.56	15.15

TABLE S.88

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 11. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 6, Females 1.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	8.33	0.00	0.00	0.00	0.00	0.00
Labiodental	25.00	8.33	8.33	0.00	0.00	0.00
Linguadental	33.33	50.00	66.67	0.00	100.00	100.00
Lingua-alveolar	16.67	11.11	13.89	66.67	66.67	50.00
Linguapalatal	40.00	25.00	41.67	40.00	50.00	75.00
Linguavelar	16.67	5.56	5.56	0.00	0.00	0.00
Glottal	16.67	-	-	0.00	-	-
Glide	16.67	-	-	0.00	-	-
Semivowel	33.33	33.33	33.33	50.00	50.00	50.00
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	8.33	2.78	2.78	16.67	16.67	0.00
Fricative	33.33	26.19	30.56	37.50	71.43	66.67
Affricate	41.67	16.67	41.67	50.00	50.00	100.00
Voiceless	25.93	18.75	22.92	44.44	62.50	50.00
Voiced	20.51	12.50	15.15	15.38	25.00	27.27

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	16.67	8.33	8.33	0.00	0.00	0.00
Linguadental	25.00	50.00	66.67	0.00	100.00	100.00
Lingua-alveolar	11.11	8.33	11.11	50.00	66.67	50.00
Linguapalatal	30.00	12.50	33.33	20.00	50.00	50.00
Linguavelar	16.67	0.00	5.56	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	8.33	-	-	0.00	-	-
Semivowel	25.00	25.00	25.00	0.00	50.00	50.00
Nasal	0.00	0.00	0.00	0.00	0.00	0.00
Stop	5.56	0.00	2.78	16.67	16.67	0.00
Fricative	20.83	21.43	25.00	37.50	71.43	66.67
Affricate	33.33	8.33	41.67	0.00	50.00	50.00
Voiceless	16.67	14.58	20.83	33.33	62.50	50.00
Voiced	14.10	8.33	12.12	7.69	25.00	18.18

TABLE S.89

Consonants Misarticulated by Class
(Extreme Articulation Deviation)

Grade 12. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 8, Females 2.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	3.13	0.00	8.33	0.00	0.00	0.00
Labiodental	25.00	18.75	0.00	50.00	0.00	25.00
Linguadental	37.50	56.25	50.00	50.00	50.00	50.00
Lingua-alveolar	12.50	12.50	14.58	16.67	25.00	25.00
Linguapalatal	20.00	18.75	18.75	20.00	37.50	25.00
Linguavelar	12.50	16.67	4.17	0.00	16.67	16.67
Glottal	0.00	-	-	0.00	-	-
Glide	6.25	-	-	25.00	-	-
Semivowel	25.00	25.00	25.00	0.00	25.00	50.00
Nasal	0.00	4.17	4.17	0.00	16.67	0.00
Stop	6.25	8.33	8.33	0.00	0.00	8.33
Fricative	28.13	26.79	18.75	43.75	42.86	33.33
Affricate	6.25	25.00	12.50	0.00	25.00	25.00
Voiceless	12.50	12.50	14.06	16.67	31.25	25.00
Voiced	17.31	20.83	12.50	19.23	16.67	18.18

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	3.13	0.00	8.33	0.00	0.00	0.00
Labiodental	12.50	6.25	0.00	25.00	0.00	0.00
Linguadental	18.75	25.00	12.50	50.00	50.00	50.00
Lingua-alveolar	10.42	6.25	8.33	0.00	25.00	25.00
Linguapalatal	12.50	9.38	12.50	0.00	12.50	12.50
Linguavelar	0.00	4.17	0.00	0.00	16.67	16.67
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	25.00	18.75	18.75	0.00	25.00	50.00
Nasal	0.00	0.00	0.00	0.00	16.67	0.00
Stop	2.08	4.17	8.33	0.00	0.00	8.33
Fricative	15.63	10.71	6.25	18.75	35.71	25.00
Affricate	6.25	6.25	6.25	0.00	0.00	0.00
Voiceless	4.17	4.69	7.81	5.56	18.75	18.75
Voiced	12.50	9.38	6.82	7.69	16.67	13.64

The Acceptable Articulation (AA) group represents 90.91% of the total sample and includes a large number of subjects who committed no errors on the articulation test and, for the most part, performed at a much higher level than did either of the articulation deviation groups. Such differences will be noted in Table S.90 which presents a partial summary of the cumulative number of consonants misarticulated for total subjects and the first grade in each of the three performance groups. Results in Table S.90 are converted percent values of those extracted from Tables S.12, S.13, S.51, S.52 and Tables DS.1 and DS.2 in APPENDIX D.* A comparison of the results for the percent of subjects who correctly produced all of the consonants illustrates the magnitude of difference between the three groups. The MAD and EAD groups are very similar but both differ markedly from the AA group.

Differences between the groups are apparent when compared on the basis of the ten most frequently misarticulated consonants as shown in Table S.91. The significance of the observed differences with regard to specific consonants is difficult to evaluate, however. If only the top five consonants are considered, the three groups are quite similar.

The three groups did not differ on basis of the three classes of consonants misarticulated since all three misarticulated the linguadental-fricative-voiceless consonants most frequently.

In summary, the sheer number of misarticulated consonants appears to be the primary factor related to the magnitude of an articulation deviation overall. If the number of articulation errors is correlated with intelligibility it seems logical to conclude that the quality of articulation performance was judged on the basis of intelligibility in this study.

Furthermore, results of the analyses and comparison of the rated articulation performance groups on the basis of these findings supports a conclusion that the articulation performance of the subjects in both the MAD and EAD groups deviated enough from the standard to be classified as defective. Therefore, based on the results of this survey, the prevalence of articulation disorders was found to be 1.9%.

*The percent values (Tables S.12, S.13, S.51, S.52 and Tables DS.1 and DS.2) which indicated the number of subjects who misarticulated 5, 10, 15, 20 or fewer consonants, were converted to the percent of subjects who misarticulated more than 5, 10, 15 or 20 consonants by subtracting the original values from 100%.

TABLE S.90

Summary comparison of the AA, MAD and EAD articulation performance groups on the basis of the percent of subjects who misarticulated a specific number of consonants. Results are recorded for the initial articulation test condition.

No. Cons. Misart.	AA GROUP				MAD GROUP				EAD GROUP			
	Total Subjects		Grade 1		Total Subjects		Grade 1		Total Subjects		Grade 1	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0	61.08	63.63	33.97	35.56	0.41	0.67	0.00	0.00	0.42	0.00	0.00	0.00
5	6.35	4.70	17.76	14.11	87.80	86.58	92.59	90.70	97.47	96.00	99.13	97.10
10	1.27	0.73	4.92	2.17	58.54	47.65	67.90	60.47	82.28	80.00	92.17	85.51
15	0.21	0.07	1.46	0.25	30.89	20.81	41.98	34.88	64.56	62.40	76.52	66.67
20	0.03	0.01	0.18	0.08	12.60	6.04	20.99	9.30	47.26	41.60	58.26	50.72

TABLE S.91

Summary comparison of the AA, MAD and EAD articulation performance groups on the basis of the ten most frequently misarticulated single consonants. Results are shown for all subjects (total grades) and grade one for each of the groups.

Rank	AA GROUP				MAD GROUP				EAD GROUP			
	Total Subjects		Grade 1		Total Subjects		Grade 1		Total Subjects		Grade 1	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	-th-	-th-	-th-	-th-	-z	z-	-th-	z-	-th-	z-	-th-	-th-
2	-r	-r	v-	v-	s-	-r	z-	-r	z-	-th-	z-	z-
3	-t	-t	z-	z-	-th-	s-	-s	v-	-r	-ch	v-	-sh
4	-s	z-	-s	-s	-ch	-th-	v-	-ch	-sh	-sh	-th-	-ch
5	z-	-s	th-	-r	-r	-ch	-r	-th	-ch	-r	-sh	v-
6	th-	-ng	-r	-ng	-sh-	-sh-	-th-	-sh-	-th-	-s	-r	-r
7	-b	-sh	-sh	ch-	v-	v-	-sh	-j	s-	v-	-ch	-th-
8	v-	v-	ch-	-t	-th-	th-	-ch	-th-	v-	-th-	-s	-s-
9	-k	-b	-t	th-	-j	-j	-j	-g	-j	-j	-j	-j
10	-sh	th-	-ng	-sh	-g	-g	-g	-k	-l	-l	-l	-g

Prevalence of Voice Disorders

The judged ratings of voice, which yielded three levels of voice performance groups (acceptable voice, mild voice deviation, and extreme voice deviation), were combined with the four overall impression ratings in a manner similar to the technique employed to derive the articulation performance groups. See Table S.2. The four derived voice performance groups were: Acceptable Voice (AV), Mild Voice Deviation (MIVD), Moderate Voice Deviation (MVD), and Extreme Voice Deviation (EVD). Summaries of these four voice performance groups are shown in Tables S.92 - S.98 and Figures S.5 - S.8.

It can be seen in Table S.92 that 89.9% of the subjects in the total sample were rated with acceptable voice and that a higher percent of females were judged to have acceptable voice than were males at each grade level. It also can be seen that improvement in voice performance increased with increasing grade level as indicated by the higher percent values. The age range and median age values for this group are shown in Table S.93. The curves in Figure S.5 are plots of the results for males and females by grade level taken from Table S.92.

The distribution of subjects by grade and sex, who received a rating of Mild Voice Deviation (MIVD), is shown in Table S.94 As seen, 7.2% of the total sample were included in this group; the sex ratio was 1.7:1 in favor of males. The results show that the percent of males judged to have a mild voice deviation was higher than females in all grades and furthermore, the percent of subjects decreased with increasing grade level for both sexes. The age range and median age values are displayed in Table S.95. The plotted curves in Figure S.6, taken from the results in Table S.94, illustrate the decrease in the percent of subjects judged to have a mild voice deviation as the grade level increases.

The results in Table S.96 show the distribution of males and females by grade level who were judged to have a Moderate Voice Deviation (MVD). As can be seen, this group included 2.3% of the total sample with a sex ratio of 1.7:1. As was found with the MIVD groups, there was a higher percentage of males than females at each grade level. The number and percent of both males and females decreased as a function of increasing grade level, over the 12 grades although there were reversals at some grade levels. The age range and median age values are summarized by grade in Table S.97. The curves in Figure S.7 are plots of the percentage figures in Table S.96. It is of interest to observe that apparent improvement (reduced percentage) did not occur as a smooth transition from grade to grade as,

TABLE S.92

Acceptable Voice (AV)

Grade and sex distribution of subjects with a rating of acceptable voice. N = Males 17460; Females 17417.

Grade	Males		Females		Total	
	Number	Percent[1]	Number	Percent[1]	Number	Percent[1]
1	1185	71.0	1235	80.7	2420	75.6
2	1255	76.3	1344	85.4	2599	80.8
3	1344	81.4	1370	88.0	2714	84.6
4	1442	84.4	1404	91.8	2846	87.9
5	1477	87.2	1391	92.5	2868	89.7
6	1417	89.4	1529	93.6	2946	91.6
7	1512	90.4	1511	95.1	3023	92.7
8	1503	90.4	1522	95.4	3025	92.9
9	1532	91.9	1505	95.4	3037	93.6
10	1568	94.6	1567	97.1	3135	95.8
11	1623	96.0	1518	97.3	3141	96.6
12	1602	96.0	1521	97.2	3123	96.6
Total	17460	87.4	17417	92.5	34877	89.9

[1]Rounded value

TABLE S.93

Acceptable Voice (AV)

The age range and median age for the acceptable voice group of subjects. The age information is shown in years-months. N = Males 17460; Females 17417.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	5-5 : 8-7	6-10	5-4: 8-6	6-10	5-4: 8-7	6-10
2	6-10 : 10-3	7-11	6-0: 10-1	7-10	6-0: 10-3	7-10
3	7-9 : 12-2	8-11	7-1: 14-2	8-10	7-1: 14-2	8-10
4	8-6 : 13-6	9-11	8-0: 12-7	9-10	8-0: 13-6	9-10
5	6-6 :14-10	10-11	9-1: 13-9	10-10	6-6: 14-10	10-10
6	9-6 : 15-0	11-11	10-0: 15-7	11-10	9-6: 15-7	11-10
7	11-0 :18-10	12-11	11-0: 16-3	12-10	11-0: 18-10	12-10
8	12-1 : 16-9	13-11	11-5: 17-0	13-10	11-5: 17-0	13-10
9	13-1 : 18-7	14-11	13-1:17-11	14-10	13-1: 18-7	14-10
10	14-4 :18-11	15-11	13-11:18-10	15-10	13-11: 18-11	15-10
11	14-7 : 19-7	16-10	15-0: 20-2	16-9	14-7: 20-2	16-10
12	15-6 : 21-9	17-10	15-5: 20-8	17-9	15-5: 21-9	17-9

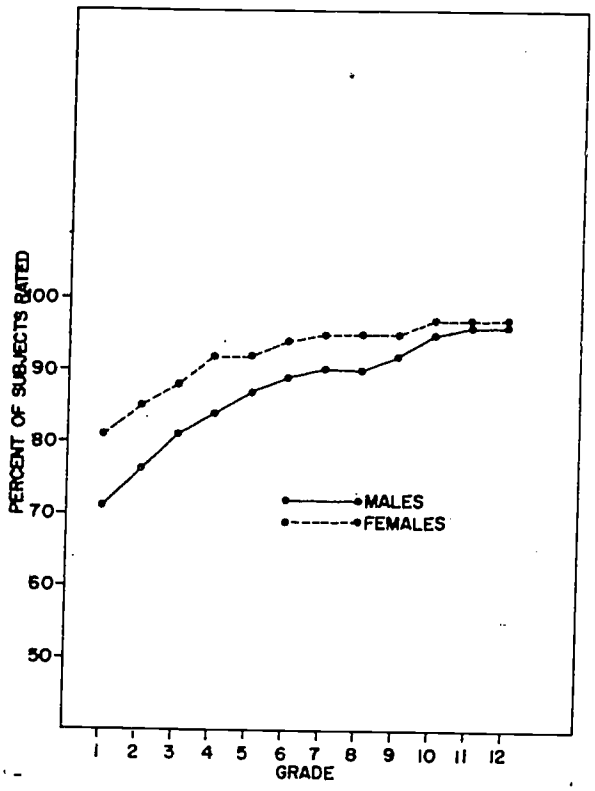

Figure S.5. Acceptable Voice (AA). Ratings of voice performance for males and females. Curves are plots of results in Table S.92.

TABLE S.94

Mild Voice Deviation (MIVD)

Grade and sex distribution of subjects with a rating of mild voice deviation. N = Males 1782; Females 1016.

Grade	Males		Females		Total	
	Number	Percent[1]	Number	Percent[1]	Number	Percent[1]
1	366	21.9	233	15.2	599	18.7
2	282	17.1	155	9.9	437	13.6
3	205	12.4	129	8.3	334	10.4
4	185	10.8	88	5.8	273	8.4
5	146	8.6	84	5.6	230	7.2
6	114	7.2	72	4.4	186	5.8
7	108	6.5	55	3.5	163	5.0
8	107	6.4	53	3.3	160	4.9
9	106	6.4	51	3.2	157	4.8
10	65	3.9	34	2.1	99	3.0
11	49	2.9	31	2.0	80	2.5
12	49	2.9	31	2.0	80	2.5
Total	1782	8.9	1016	5.4	2798	7.2

[1] Rounded value

TABLE S.95

Mild Voice Deviation (MIVD)

The age range and median age for the mild voice deviation group of subjects. The age information is shown in years-months. N = Males 1782; Females 1016.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	5-5 : 8-8	6-10	5-8 : 8-8	6-10	5-5 : 8-8	6-10
2	7-0 : 10-6	7-10	7-0 : 9-5	7-10	7-0 : 10-6	7-10
3	7-11: 10-7	8-11	7-10:14-2	8-10	7-10: 14-2	8-11
4	9-0 : 13-0	10-0	8-9 :12-1	9-11	8-9 : 13-6	9-11
5	9-5 : 13-5	11-0	9-6 :13-2	11-0	9-5 : 13-5	11-0
6	10-9 : 15-1	11-11	11-2 :13-10	12-6	10-9 : 15-1	11-11
7	11-9 : 15-2	13-1	12-2 :14-6	12-9	11-9 : 15-2	13-0
8	13-0 : 16-3	14-0	12-10:16-5	13-10	12-10: 16-5	13-11
9	14-0 : 18-9	14-10	13-6 :17-5	14-10	13-6 : 18-9	14-10
10	14-1 : 18-4	15-11	14-10:17-3	15-9	14-1 : 18-4	15-10
11	16-2 : 19-3	16-11	15-6 :19-8	17-0	15-6 : 19-8	16-11
12	16-6 : 22-7	17-10	17-6 :19-3	17-9	16-6 : 22-7	17-9

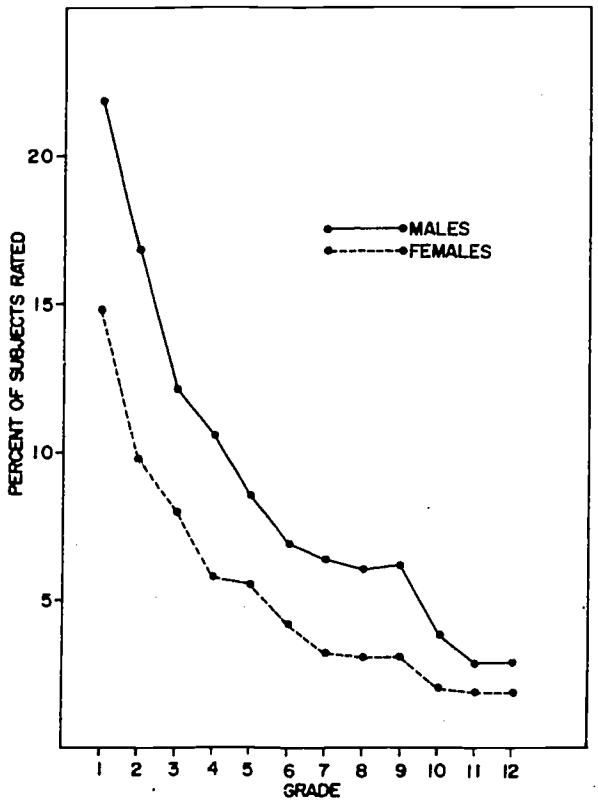

Figure S.6. Mild Voice Deviation (MIVD). Ratings of voice performance for males and females. Curves are plots of results in Table S.94.

105

TABLE S.96

Moderate Voice Deviation (MVD)

Grade and sex distribution of subjects with a rating of moderate voice deviation. N = Males 550; Females 322.

Grade	Males		Females		Total	
	Number	Percent[1]	Number	Percent[1]	Number	Percent[1]
1	77	4.6	45	2.9	122	3.8
2	70	4.3	57	3.6	127	4.0
3	79	4.9	51	3.3	130	4.1
4	66	3.9	32	2.1	98	3.0
5	52	3.1	23	1.5	75	2.4
6	43	2.7	27	1.7	70	2.2
7	48	2.9	22	1.4	70	2.2
8	44	2.7	17	1.1	61	1.9
9	23	1.4	13	0.8	36	1.1
10	18	1.1	11	0.7	29	0.9
11	17	1.0	12	0.8	29	0.9
12	13	0.8	12	0.8	25	0.8
Total	550	2.8	322	1.7	872	2.3

[1] Rounded value

TABLE S.97

Moderate Voice Deviation (MVD)

The age range and median age for the moderate voice deviation group of subjects. The age information is shown in years-months. N = Males 550; Females 322.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	6-0 : 8-6	6-9	6-1 : 8-0	6-9	6-0 : 8-6	6-9
2	7-1 : 9-5	7-8	7-0 : 9-6	7-10	7-0 : 9-6	7-9
3	7-10 :10-8	9-0	7-11:11-3	8-10	7-10 :11-3	8-11
4	8-11 :12-2	10-0	9-3 :12-4	9-11	8-11 :12-4	10-0
5	10-1 :13-4	11-0	9-2 :13-10	11-0	9-2 :13-10	11-0
6	10-5 :13-4	12-1	11-1 :12-8	11-7	10-5 :13-4	11-11
7	11-1 :15-5	12-10	12-1 :13-9	12-9	11-1 :15-5	12-10
8	12-11 :16-0	14-1	13-0 :15-6	13-10	12-11 :16-0	14-0
9	14-3 :16-9	15-1	14-4 :17-0	14-8	14-3 :17-0	14-11
10	14-10 :17-11	16-1	15-1 :17-2	15-11	14-10 :17-11	16-0
11	15-5 :19-2	16-11	15-11:17-8	16-7	15-5 :19-2	16-10
12	17-2 :19-7	17-11	17-2 :18-8	17-10	17-2 :19-7	17-11

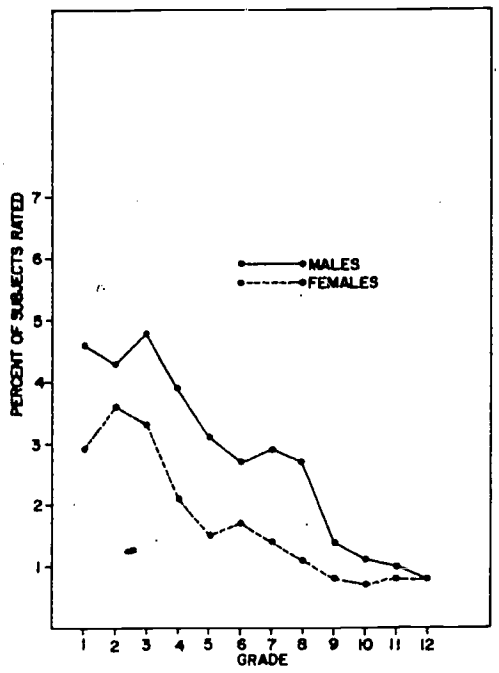

Figure S.7 Moderate Voice Deviation (MVD). Ratings of voice performance for males and females. Curves are plots of results in Table S.96.

TABLE S.98

Extreme Voice Deviation (EVD)

Grade and sex distribution of subjects with a rating of extreme voice deviation. N = Males 181; Females 74.

	Males		Females		Total	
Grade	Number	Percent[1]	Number	Percent[1]	Number	Percent[1]
1	42	2.5	17	1.1	59	1.8
2	38	2.3	17	1.1	55	1.7
3	23	1.4	7	0.5	30	0.9
4	15	0.9	6	0.4	21	0.7
5	18	1.1	6	0.4	24	0.8
6	11	0.7	5	0.3	16	0.5
7	5	0.3	1	0.1	6	0.2
8	8	0.5	4	0.3	12	0.4
9	7	0.4	8	0.5	15	0.5
10	7	0.4	2	0.1	9	0.3
11	2	0.1	0	0.0	2	0.1
12	5	0.3	1	0.1	6	0.2
Total	181	0.9	74	0.4	255	0.7

[1]Rounded value

TABLE S.99

Extreme Voice Deviation (EVD)

The age range and median age for the extreme voice deviation group of subjects. The age information is shown in years-months. N = Males 181; Females 74.

Grade	Males Range	Males Median	Females Range	Females Median	Total Range	Total Median
1	6-0 : 8-3	6-10	6-3 : 9-2	7-0	6-0 : 9-2	6-10
2	7-5 : 9-3	8-0	7-4 : 8-11	7-10	7-4 : 9-3	7-11
3	7-11 :10-5	9-1	8-1 : 9-6	8-7	7-11 :10-5	9-0
4	9-1 :10-9	10-1	9-6 :11-5	9-10	9-1 :11-5	10-0
5	10-1 :12-3	10-9	10-4 :11-4	10-11	10-1 :12-3	10-9
6	11-2 :14-11	11-11	11-5 :12-8	11-5	11-2 :14-11	11-11
7	12-4 :15-1	13-2	13-11:13-11	13-6	12-4 :15-1	13-2
8	12-4 :16-3	13-3	13-5 :15-0	13-6	12-4 :16-3	13-6
9	14-4 :16-11	14-11	14-2 :16-7	14-8	14-2 :16-11	14-11
10	15-5 :16-10	16-2	15-1 :15-3	15-3	15-1 :16-10	16-0
11	17-2 :18-8	17-2	*-- : --	--	17-2 :18-8	17-2
12	17-0 :19-6	18-4**	17-9 :17-9	17-9	17-0 :19-6	17-9

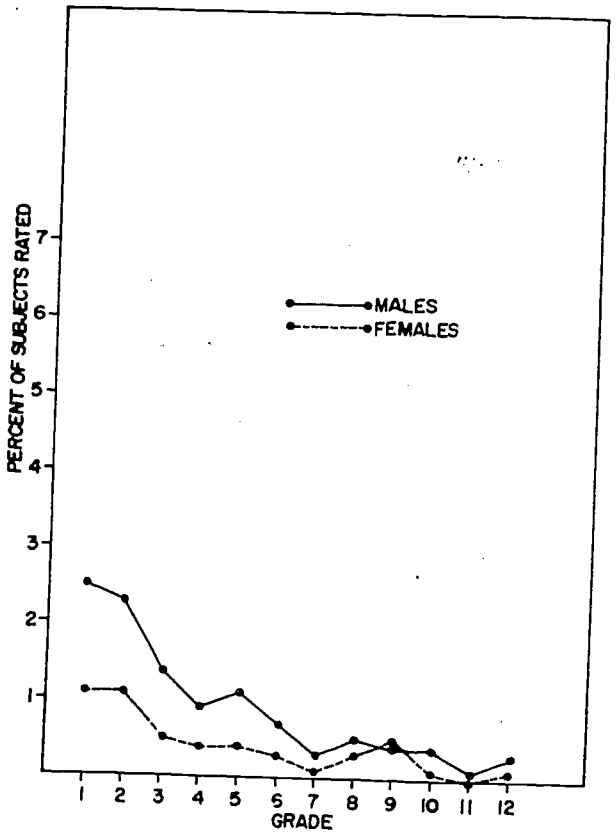

Figure S.8. Extreme Voice Deviation (MVD). Ratings of voice performance for males and females. Curves are plots of results in Table S.98.

for example, between the first and second grade for females and between the second and third grade for males when the percent values increased rather than decreased, as would have been expected.

Table S.98 shows the distribution of subjects by sex and grade who were judged to have an extreme voice deviation. This group includes 0.7% of the total sample with a sex ratio of 2.3:1 in favor of males. Except for the ninth grade, females performed better than males and, there was an overall reduction in the percent of subjects as a function of increasing grade level. The age range and median age values shown by sex and grade are displayed in Table S.99. Plots of the percent values for males and females for each grade, taken from Table S.98 are shown in Figure S.8.

Results of the voice ratings suggest that the subjects in both the Moderate Voice Deviation (MVD) group with 2.3% of the total sample and the Extreme Voice Deviation (EVD) group with 0.7% of the total sample manifested voice patterns which deviate enough from the standard to qualify as voice disorders. This would result in a prevalence figure of 3.0% for voice disorders. In view of some recently reported prevalence figures for voice disorders this may seem somewhat low. However these results are conservative estimates and the data on which they are based was collected by means of screening techniques rather than in-depth studies.

Prevalence of Stuttering

The grade and sex distribution of the subjects in the total sample who were judged to have exhibited stuttering behavior are shown in Table S.100. As can be seen, stuttering was observed in 0.8% of the subjects in the total sample. The percent of males exceeded that of females in each of the 12 grades; the sex ratio for total subjects was 3:1 in favor of males. Indicated improvement can be observed as a function of increasing grade level although the reduction in percent figures is by no means consistently smooth. Some reversal in trends from one grade to another occurs for both males and females. Table S.101 shows the age range and median age values for males and females by grade level. The curves in Figure S.9 illustrate graphically the results from which they were taken in Table S.102.

As an estimate of the prevalence of stuttering, 0.8% is a reasonable figure. Various estimates in the past have indicated a prevalence range of from 0.7% to 1.00%; estimates based on the results of the present survey are comfortably located within that range. No attempt was made

to rate stuttering on a severity scale because the speech testing environment was not at all appropriate for any such judgments.

TABLE S.100

Stuttering

Grade and sex distribution of subjects rated with stuttering based on comparisons of connected speech patterns with a predetermined speech standard. N = Males 242; Females 78.

Grade	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent
1	29	1.7	6	0.4	35	1.1
2	35	2.1	8	0.5	43	1.3
3	20	1.2	14	0.9	34	1.1
4	18	1.1	12	0.8	30	0.9
5	29	1.7	10	0.7	39	1.2
6	14	0.9	4	0.2	18	0.6
7	22	1.3	4	0.3	26	0.8
8	23	1.4	4	0.3	27	0.8
9	18	1.1	5	0.3	23	0.7
10	12	0.7	4	0.3	16	0.5
11	10	0.6	6	0.4	16	0.5
12	12	0.7	1	0.1	13	0.4
Total	242	1.2	78	0.4	320	0.8

TABLE S.101

Stuttering

Age range and median age for subjects rated with stuttering. The age information is shown in years-months. N = Males 242; Females 78.

Grade	Males		Females		Total	
	Range	Median	Range	Median	Range	Median
1	6-0 : 7-8	6-10	6-1 : 6-7	6-5	6-0 : 7-8	6-10
2	7-3 : 9-5	7-10	7-0 : 8-8	7-6	7-0 : 9-5	7-9
3	8-1 :10-8	8-11	8-3 : 9-10	8-9	8-1 :10-8	8-10
4	9-5 :12-3	10-2	9-3 :12-0	10-2	9-3 :12-3	10-2
5	10-3 :12-3	10-11	10-4 :13-6	10-11	10-3 :13-6	10-11
6	11-6 :12-11	11-10	11-8 :12-2	11-9	11-6 :12-11	11-10
7	12-0 :14-7	12-11	12-2 :12-11	12-4	12-0 :14-7	12-11
8	13-0 :16-9	14-0	13-5 :13-7	13-6	13-0 :16-9	13-11
9	14-0 :16-0	14-8	14-0 :15-2	14-11	14-0 :16-0	14-10
10	15-2 :17-4	16-5	15-2 :16-9	15-11	15-2 :17-4	15-11
11	16-3 :19-3	17-1	15-6 :20-0	17-0	15-6 :20-0	17-1
12	17-1 :19-7	18-1	17-6 :17-6	17-6	17-1 :19-7	18-1

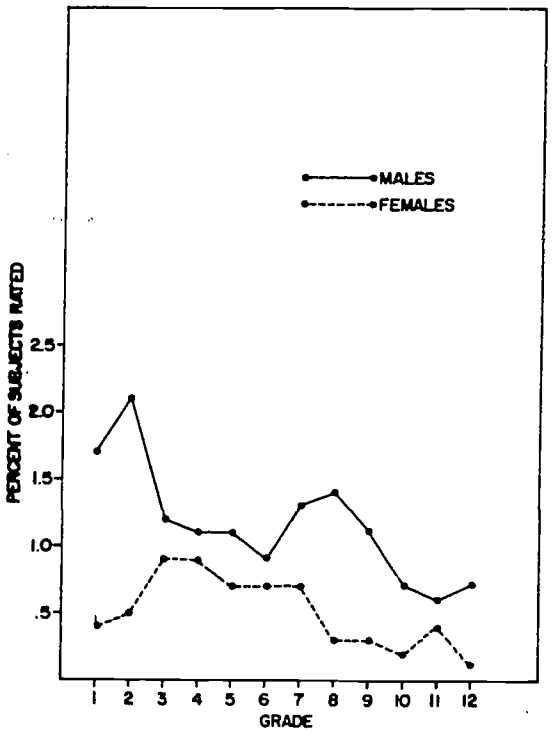

Figure S.9. Stuttering. Percent of subjects whose speech performance was rated as "stuttering." The curves are plots of results in Table S.100

HEARING RESULTS

The hearing survey data reported herein represent a departure from the style in which previous data of this nature are reported in the literature. Such reports routinely establish the fact that there is little difference between the mean or median response characteristics of the left and right ears at each test frequency, and then proceed to describe these characteristics for either one ear or for left and right ears separately. Such an approach, in effect, leaves one without knowledge of how two-eared individuals in a given population actually hear. That is, one is left wondering whether left ear impairments and right ear impairments occurred in the same listeners, and in what relationship of hearing levels. The following tables are designed to afford prevalence data that reflect the number and percent of subjects for each grade and sex in terms of bilateral pure-tone averages (PTA). Also shown are the percent of responses at each audiometric hearing level (HL), and an analysis of hearing level as a function of frequency.

The criterion for impairment in these analyses was based on the method for calculating percentage of hearing loss established by the American Academy of Ophthalmology and Otolaryngology (AAOO) (Davis and Kranz, 1964). This system defines the range of normal sensitivity as PTA's from 0-25 dB (ANSI, 1969). Thus, anything over 25 dB is defined as an impairment of hearing. On this basis the following tables permit one to note the number and percent of subjects, by sex and grade level, who have either bilateral or unilateral impairments. In the latter instance, the appropriate ear is also identified. The other HL classifications, 6-25 dB and $\leq$5 dB provide figures for those school children who fell into the range of normal hearing sensitivity and those in whom auditory sensitivty is especially acute ($\leq$5 dB), respectively.

Pure Tone Average Characteristics

Table H.1 presents the PTA's for male subjects in grade one. The following examples may facilitate inspection of this and subsequent tables. The extreme upper left-hand values show the number and percent of subjects (424 or 26.30%) who exhibited PTA's which were $\leq$5 dB in both right and left ears. In other words, those children had extremely good hearing, bilaterally; moving diagonally from these values toward the totals in the extreme lower right-hand portion of the table one may observe the results of the other HL classifications where subjects' ears were also bilaterally equivalent. Specifically, 45.22% of first-grade males had hearing sensitivity in both ears which fell in the

6-25 dB range and 2.11% of them had HL's which exceeded 25 dB, bilaterally. By adding the values of the first two classifications together, the total number and percent of subjects who had bilaterally normal hearing can be assessed (424/26.30% + 279/45.22% = 1153/71.52%) and quickly compared with the number having bilateral impairments. The remaining values in the table show the figures for subjects whose two ears fell into different HL categories. For example, the figures shown at the top of column two reveal that 11.60% of the first-grade males had right-ear averages in the 6-25 dB range while the left ears for these same subjects had PTA's which were ≤5 dB. Moving further to the right, column three, .19% of these subjects had impairments in the 26-100 dB range of their right ears, whereas they had very sensitive hearing (≤5 dB) in their left ears. Several points of interest may be observed in Table H.1:

1. About one-fourth (26.30%) of the first-grade males had bilateral hearing sensitivity which approached the ANSI, 1969 standard for audiometric zero — that is, had extremely sensitive hearing (≤5 dB) in the 500-2000 Hz range.
2. Nearly 95% of the first-grade males had hearing which fell within the normal criterion range, bilaterally.
3. Conversely, 5.46% of the first-grade males had a hearing impairment in at least one ear with left and right ears about equally represented.
4. Bilateral impairments were found in 2.11%. Thus, a greater proportion of subjects had unilateral impairments (3.35%) than those having a loss of hearing in both ears (2.11%) by approximately a three to two margin.

Tables H.2 and H.3 show the data for first-grade females and total first-grade subjects, respectively, using the same analysis format. A high degree of similarity may be noted between the results of males and females for this youngest group of the survey population. Thus, although the results for the total group of first graders are provided, the data for either males or females afford a fairly accurate estimate of the hearing characteristics of the first graders studied.

Tables H.4 - H.6 present the results for second-grade subjects which show a slight improvement over first-graders. This is reflected both in an increased percentage of subjects falling into the ≤5 dB category as well as in a lower percentage of subjects who would be classified as having a loss of hearing (26-100 dB HL). A slight superiority also occurred among the females for each of these aspects. This is especially true for the ≤5 dB response category. Moreover, a substantial increase may be observed in the

proportion of unilateral-to-bilateral impairments - about three to one (2.94% vs 0.99%).

The data for third-grade subjects are represented in Tables H.7 - H.9 and show a continued progression of performance toward: 1) a higher percentage of subjects with keen hearing sensitivity ($\leq$5 dB PTA's); 2) a lower percentage of subjects failing the AAOO hearing-loss criterion; and 3) females demonstrating a more marked superiority in performance. Unilateral impairments again exceeded bilateral losses about three to one.

TABLE H.1
Hearing Sensitivity

Grade 1. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1612. Chi Square = 857.60

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	424 26.30%	187 11.60%	3 .19%	614 38.09%
	6*-25	184 11.41%	729 45.22%	26 1.61%	939 58.25%
	AAOO Limit for Normal 26*-100	6 .37%	19 1.18%	34 2.11%	59 3.66%
	Total	614 38.09%	935 58.00%	63 3.91%	1612 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.2
Hearing Sensitivity

Grade 1. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1496. Chi Square = 574.26

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	373 24.93%	186 12.43%	5 .33%	564 37.70%
	6*-25	170 11.36%	684 45.72%	32 2.14%	886 59.22%
	AAOO Limit for Normal 26*-100	2 .13%	22 1.47%	22 1.47%	46 3.07%
	Total	545 36.43%	892 59.63%	59 3.94%	1496 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.3
Hearing Sensitivity

Grade 1. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3108. Chi Square = 1422.21

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	797 25.64%	373 12.00%	8 .26%	1178 37.90%
	6*-25 AAOO Limit for Normal	354 11.39%	1413 45.46%	58 1.87%	1825 58.72%
	26*-100	8 .26%	41 1.32%	56 1.80%	105 3.38%
	Total	1159 37.29%	1827 58.78%	122 3.93%	3108 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.4
Hearing Sensitivity

Grade 2. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1617. Chi Square = 650.95

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	437 27.03%	197 12.18%	0 0.00%	634 39.21%
	6*-25 AAOO Limit for Normal	176 10.88%	743 45.95%	19 1.18%	938 58.01%
	26*-100	5 .31%	24 1.48%	16 .99%	45 2.78%
	Total	618 38.22%	964 59.62%	35 2.16%	1617 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.5
Hearing Sensitivity

Grade 2. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1553. Chi Square = 544.41

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	451 29.04%	212 13.65%	2 .13%	665 42.82%
	6*-25 AAOO Limit for Normal	168 10.82%	670 43.14%	22 1.42%	860 55.38%
	26*-100	3 .19%	14 .90%	11 .71%	28 1.80%
	Total	622 40.05%	896 57.69%	35 2.25%	1553 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.6
Hearing Sensitivity

Grade 2. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3170. Chi Square = 1192.79

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	888 28.01%	409 12.90%	2 .06%	1299 40.98%
	6*-25 AAOO Limit for Normal	344 10.85%	1413 44.57%	41 1.29%	1798 56.72%
	26*-100	8 .25%	38 1.20%	27 .85%	73 2.30%
	Total	1240 39.12%	1860 58.68%	70 2.21%	3170 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.7
Hearing Sensitivity

Grade 3. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1640. Chi Square = 661.25

(ANSI-1969) HL		PTA = Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	512 31.22%	199 12.13%	2 .12%	713 43.48%
	6*-25 AAOO Limit for Normal	176 10.73%	692 42.20%	19 1.16%	887 54.09%
	26*-100	1 .06%	25 1.52%	14 .85%	40 2.44%
	Total	689 42.01%	916 55.85%	35 2.13%	1640 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.8
Hearing Sensitivity

Grade 3. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1536. Chi Square = 639.83

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	504 32.81%	206 13.54%	2 .13%	714 46.48%
	6*-25 AAOO Limit for Normal	161 10.48%	620 40.36%	10 .65%	791 51.50%
	26*-100	2 .13%	18 1.17%	11 .72%	31 2.02%
	Total	667 43.42%	846 55.08%	23 1.50%	1536 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.9
Hearing Sensitivity

Grade 3. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3176. Chi Square = 1292.42

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*100	Total
PTA - Left Ear	≤5	1016 31.99%	407 12.81%	4 .13%	1427 44.93%
	6*-25 AAOO Limit for Normal	337 10.61%	1312 41.31%	29 .91%	1678 52.83%
	26*-100	3 .09%	43 1.35%	25 .79%	71 2.24%
	Total	1356 42.70%	1762 55.48%	58 1.83%	3176 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

Results for subjects in grade four, Tables H.10 - H.12, revealed a continuing trend toward an increasing percentage of male students with PTA's in the ≤5 dB HL classification and a decreasing percentage having hearing impairments. The same trend is exhibited by the females except that, interestingly, they showed an increase in the percentage having impaired hearing, rising above the males for the first time. Otherwise, their performance superiority remained intact. The percentage of unilateral losses still dominated bilaterals.

Subjects in grade five, Tables H.13 - H.15 reflect a still further increase in the percent of students with PTA's of ≤5 dB. The females also reversed their broken pattern and showed the lowest percentage thus far in the hearing loss category while maintaining a greater percentage than males in the ≤5 dB HL classification. The fifth-grade males showed a form reversal for the first time by having a higher percentage of subjects with PTA's in excess of 25 dB than was found among fourth-grade males. A higher percentage of unilateral impairments are again observable.

Tables H.16 - H.18 present the data for subjects in the sixth grade. Once more males showed improvement in the major trend characteristics noted previously, but the females again showed an increase in the percent with hearing loss. Of even greater significance, perhaps, was the fact that sixth-grade females broke a perfect progression for both sexes in all grades thus for discussed by showing a decrease in percentage of subjects with PTA's ≤5 dB. The end result was, for the first time, male and female performance had nearly equivalent percentages in this category. The percentage of unilateral impairments still exceed that of bilaterials.

The performance of seventh-grade subjects is shown in Tables H.19 - H.21. It may be seen that males continued to improve in terms of the percentage exhibiting keen sensitivity as well as lower percentage of impairment. In fact, a marked drop in the latter may be observed. Seventh-grade females rebounded from the reversals noted for sixth-grade females, and reestablished their advantage over males in the percentage of subjects demonstrating PTA's ≤5 dB. However, the percent of females with hearing loss was more than twice that of males. Unilateral losses were again dominant.

A noticeable interruption of the increasing percentage values in the ≤5 dB HL category may be seen for both males and females among eight-grade subjects in Tables H.22 and H.23. However, the trend resumes again (Tables H.25 - H.39) for both sexes until grade twelve where a reversal of this pattern was repeated for both males and females. The percentage of subjects exceeding the 25 dB HL criterion — the percentage showing a loss of hearing, becomes much less orderly in grades 8-12. That is, the direction of change in the percentage values is quite variable as opposed to those in the first seven grades. However, the dominance of unilateral over bilateral impairments continued for both sexes in each grade — a condition which was unaltered for all twelve grades.

TABLE H.10
Hearing Sensitivity

Grade 4. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1697. Chi Square = 769.92

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	549 32.35%	193 11.37%	3 .18%	745 43.90%
	6*-25	215 12.67%	699 41.19%	14 .82%	928 54.68%
	AAOO Limit for Normal				
	26*-100	0 0.00%	12 .71%	12 .71%	24 1.41%
	Total	764 45.02%	904 53.27%	29 1.71%	1697 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.11
Hearing Sensitivity

Grade 4. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1522. Chi Square = 894.66

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	577 37.91%	193 12.68%	1 .07%	771 50.66%
	6*-25 AAOO Limit for Normal	165 10.84%	531 34.89%	13 .85%	709 46.58%
	26*-100	5 .33%	14 .92%	23 1.51%	42 2.76%
	Total	747 49.08%	738 48.49%	37 2.43%	1522 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.12
Hearing Sensitivity

Grade 4. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3219. Chi Square = 1703.46

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1126 34.98%	386 11.99%	4 .12%	1516 47.10%
	6*-25 AAOO Limit for Normal	380 11.80%	1230 38.21%	27 .84%	1637 50.85%
	26*-100	5 .16%	26 .81%	35 1.09%	66 2.05%
	Total	1511 46.94%	1642 51.01%	66 2.05%	3219 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.13
Hearing Sensitivity

Grade 5. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1685. Chi Square = 696.28

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	589 34.96%	199 11.81%	6 .36%	794 47.12%
	6*-25 AAOO Limit for Normal	233 13.23%	614 36.44%	17 1.01%	854 50.68%
	26*-100	4 .24%	16 .95%	17 1.01%	37 2.20%
	Total	816 48.43%	829 49.20%	40 2.37%	1685 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.14
Hearing Sensitivity

Grade 5. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1494. Chi Square = 748.27

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	589 39.42%	211 14.12%	3 .20%	803 53.75%
	6*-25 AAOO Limit for Normal	167 11.18%	493 33.00%	11 74%	671 44.71%
	26*-100	1 .07%	7 .47%	12 .80%	20 1.34%
	Total	757 50.67%	711 47.59%	26 1.74%	1494 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.15
Hearing Sensitivity

Grade 5. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3179. Chi Square = 1412.67

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1178 37.06%	410 12.90%	9 .28%	1597 50.24%
	6*-25 AAOO Limit for Normal	390 12.27%	1107 24.82%	28 .88%	1525 47.97%
	26*-100	5 .16%	23 .72%	29 .91%	57 1.79%
	Total	1573 49.48*	1540 48.44%	66 2.08%	3179 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.16
Hearing Sensitivity

Grade 6. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1578. Chi Square = 571.18

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	600 38.02%	191 12.10%	3 .19%	794 50.32%
	6*-25 AAOO Limit for Normal	189 11.98%	563 35.68%	11 .70%	763 48.35%
	26*-100	3 .19%	11 .70%	7 .44%	21 1.33%
	Total	792 50.19%	765 48.48%	21 1.33%	1578 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.17
Hearing Sensitivity

Grade 6. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1632. Chi Square = 653.05

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	631 38.66%	239 14.64%	4 .25%	874 53.55%
	6*-25 AAOO Limit for Normal	173 10.60%	537 32.90%	12 .74%	722 44.24%
	26*-100	5 .31%	17 1.04%	14 .86%	36 2.21%
	Total	809 49.57%	793 48.59%	30 1.84%	1632 100.00%

*These values actually represent 7 adn 27, respectively, since rounded PTA's never end in 6.

TABLE H.18
Hearing Sensitivity

Grade 6. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3210. Chi Square = 1237.46

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1231 38.35%	430 13.40%	7 .22%	1668 51.96%
	6*-25 AAOO Limit for Normal	362 11.28%	1100 34.27%	23 .72%	1485 46.26%
	26*-100	8 .25%	28 .87%	21 .65%	57 1.78%
	Total	1601 49.88%	1558 48.54%	51 1.59%	3210 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

124

TABLE H.19
Hearing Sensitivity

Grade 7. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1664. Chi Square = 796.85

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	665 39.96%	212 12.74%	0 0.00%	877 52.70%
	6*-25 AAOO Limit for Normal	183 11.00%	584 35.10%	7 .42%	774 46.51%
	26*-100	2 .12%	5 .30%	6 .36%	13 .78%
	Total	850 51.08%	801 48.14%	13 .78%	1664 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.20
Hearing Sensitivity

Grade 7. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1585. Chi Square = 1012.19

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	713 44.98%	199 12.56%	2 .13%	914 57.67%
	6*-25 AAOO Limit for Normal	163 10.28%	480 30.28%	9 .57%	652 41.14%
	26*-100	1 .06%	5 .32%	13 .82%	19 1.20%
	Total	877 55.33%	684 43.15%	24 1.51%	1485 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.21
Hearing Sensitivity

Grade 7. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3249. Chi Square = 1860.80

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1378 42.41%	411 12.65%	2 .06%	1791 55.12%
	6*-25 AAOO Limit for Normal	346 10.65%	1064 32.75%	16 .49%	1426 43.89%
	26*-100	3 .09%	10 .31%	19 .58%	32 .98%
	Total	1727 53.15%	1485 45.71%	37 1.14%	3249 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.22
Hearing Sensitivity

Grade 8. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1662. Chi Square = 762.30

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	632 38.03%	218 13.12%	2 .12%	852 51.26%
	6*-25 AAOO Limit for Normal	179 10.77%	605 36.40%	8 .48%	792 47.65%
	26*-100	0 0.00%	10 .60%	8 .48%	18 1.08%
	Total	811 48.80%	833 50.12%	18 1.08%	1662 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.23
Hearing Sensitivity

Grade 8. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1596. Chi Square = 688.46

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	710 44.49%	206 12.91%	3 .19%	919 57.58%
	6*-25 AAOO Limit for Normal	180 11.28%	468 29.32%	7 .44%	655 41.04%
	26*-100	3 .19%	10 .63%	9 .56%	33 1.38%
	Total	893 55.95%	684 42.86%	19 1.19%	1596 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.24
Hearing Sensitivity

Grade 8. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3258. Chi Square = 1456.48

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1342 41.19%	424 13.01%	5 .15%	1771 54.36%
	6*-25 AAOO Limit for Normal	359 11.02%	1073 32.93%	15 .46%	1441 44.41%
	26*-100	3 .09%	20 .61%	17 .52%	40 1.23%
	Total	1704 52.30%	1517 46.56%	37 1.14%	3258 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.25
Hearing Sensitivity

Grade 9. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1665. Chi Square = 471.27

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	669 40.18%	195 11.71%	2 .12%	866 52.01%
	6*-25 AAOO Limit for Normal	204 12.25%	564 33.87%	11 .66%	779 46.79%
	26*-100	9 .54%	8 .48%	3 .18%	20 1.20%
	Total	882 52.97%	767 46.07%	16 .96%	1665 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.26
Hearing Sensitivity

Grade 9. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1576. Chi Square = 474.89

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	742 47.08%	207 13.13%	3 .19%	952 60.41%
	6*-25 AAOO Limit for Normal	175 11.10%	425 26.97%	5 .32%	605 38.39%
	26*-100	5 .32%	10 .63%	4 .25%	19 1.21%
	Total	922 58.50%	642 40.74%	12 .76%	1576 100.00%

*These values actaully represent 7 and 27, respectively, since rounded PTA's never end int 6.

TABLE H.27
Hearing Sensitivity

Grade 9. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3241. Chi Square = 939.58

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1411 43.54%	402 12.40%	5 .15%	1818 56.09%
	6*-25 AAOO Limit for Normal	379 11.69%	989 30.53%	16 .49%	1384 42.70%
	26*-100	14 .43%	18 .56%	7 .22%	39 1.20%
	Total	1804 55.66%	1409 43.47%	28 .86%	3241 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.28
Hearing Sensitivity

Grade 10. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1659. Chi Square = 728.86

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	686 41.35%	194 11.69%	3 .18%	883 53.22%
	6*-25 AAOO Limit for Normal	206 12.42%	531 32.01%	12 .72%	749 45.15%
	26*-100	4 .34%	11 .66%	12 .72%	27 1.63%
	Total	896 59.32%	736 39.57%	27 1.11%	1659 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.29
Hearing Sensitivity

Grade 10. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1615. Chi Square = 683.90

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	769 47.62%	220 13.62%	2 .12%	991 61.36%
	6*-25 AAOO Limit for Normal	183 11.33%	413 25.57%	7 .43%	603 37.34%
	26*-100	6 .37%	6 .37%	9 .56%	21 1.30%
	Total	958 59.32%	639 39.57%	18 1.11%	1615 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.30
Hearing Sensitivity

Grade 10. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects. N = 3274. Chi Square = 1412.63

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1455 44.44%	414 12.65%	5 .15%	1874 57.24%
	6*-25 AAOO Limit for Normal	389 11.88%	944 28.83%	19 .58%	1352 41.30%
	26*-100	10 .31%	17 .52%	21 .64%	48 1.47%
	Total	1854 56.63%	1375 42.00%	45 1.37%	3274 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.31
Hearing Sensitivity

Grade 11. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1690. Chi Square = 813.92

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	734 43.43%	176 10.41%	5 .30%	915 54.14%
	6*-25 AAOO Limit for Normal	199 11.78%	549 32.49%	6 .36%	754 44.62%
	26*-100	0 0.00%	12 .71%	9 .53%	21 1.24%
	Total	933 55.21%	737 43.61%	20 1.18%	1690 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.32
Hearing Sensitivity

Grade 11. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1562. Chi Square = 1079.58

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	747 47.82%	223 14.28%	4 .26%	974 62.36%
	6*-25 AAOO Limit for Normal	158 10.12%	423 27.08%	2 .13%	583 37.32%
	26*-100	0 0.00%	0 0.00%	5 .32%	5 .32%
	Total	905 57.94%	646 41.36%	11 .70%	1562 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.33
Hearing Sensitivity

Grade 11. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects. N = 3252. Chi Square = 1644.19

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1481 45.54%	399 12.27%	9 .28%	1889 58.09%
	6*-25 AAOO Limit for Normal	357 10.98%	972 29.89%	8 .25%	1337 41.11%
	26*-100	0 0.00%	12 .37%	14 .43%	26 .80%
	Total	1838 56.52%	1383 42.53%	31 .95%	3252 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.34
Hearing Sensitivity

Grade 12. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 1666. Chi Square = 470.12

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	696 41.78%	202 12.12%	3 .18%	901 54.08%
	6*-25 AAOO Limit for Normal	212 12.73%	524 31.45%	9 .54%	745 44.72%
	26*-100	7 .42%	9 .54%	4 .24%	20 1.20%
	Total	915 54.92%	735 44.12%	16 .96%	1666 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.35
Hearing Sensitivity

Grade 12. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 1566. Chi Square = 726.50

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	745 47.57%	213 13.60%	3 .19%	961 61.37%
	6*-25 AAOO Limit for Normal	169 10.79%	417 26.63%	6 .38%	592 37.80%
	26*-100	1 .06%	5 .32%	7 .45%	13 .83%
	Total	915 58.43%	635 40.55%	16 1.02%	1566 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.36
Hearing Sensitivity

Grade 12. Pure-Tone averages (500-2000 Hz) in dB HL.
Total Subjects, N = 3232. Chi Square = 1116.66

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	1441 44.59%	415 12.84%	6 .19%	1862 57.61%
	6*-25 AAOO Limit for Normal	381 11.79%	941 29.12%	15 .46%	1337 41.37%
	26*-100	8 .25%	14 .43%	11 .34%	33 1.02%
	Total	1830 56.62%	1370 42.39%	32 .99%	3232 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.37
Hearing Sensitivity

Grades 1-12. Pure-Tone Averages (500-2000 Hz) in dB HL.
Males, N = 19835. Chi Square = 8501.07

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	7193 36.26%	2363 11.91%	32 .16%	9588 48.34%
	6*-25 AAOO Limit for Normal	2346 11.83%	7397 37.29%	159 .80%	9902 49.92%
	26*-100	41 .21%	162 .82%	142 .72%	345 1.74%
	Total	9580 48.30%	9922 50.02%	333 1.68%	19835 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.38
Hearing Sensitivity

Grades 1-12. Pure-Tone Averages (500-2000 Hz) in dB HL.
Females, N = 18733. Chi Square = 8441.74

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	7551 40.31%	2517 13.44%	34 .18%	10102 53.93%
	6*-25 AAOO Limit for Normal	20.32 10.85%	6161 32.89%	136 .73%	8329 44.46%
	26*-100	34 .18%	128 .68%	140 .75%	302 1.61%
	Total	9617 51.34%	8806 47.01%	310 1.65%	18733 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

TABLE H.39
Hearing Sensitivity

Grades 1-12. Pure-Tone Averages (500-2000 Hz) in dB HL.
Total Subjects, N = 38568. Chi Square = 16937.24

(ANSI-1969) HL		PTA - Right Ear ≤5	6*-25	26*-100	Total
PTA - Left Ear	≤5	14744 38.23%	4880 12.65%	66 .17%	19690 51.05%
	6*-25 AAOO Limit for Normal	4378 11.35%	13558 35.15%	295 .76%	18231 47.27%
	26*-100	75 .19%	290 .75%	282 .73%	647 1.68%
	Total	19197 49.77%	18728 48.56%	643 1.67%	38568 100.00%

*These values actually represent 7 and 27, respectively, since rounded PTA's never end in 6.

In summarizing the grade-level x sex data, the following highlights were identified: 1) With few exceptions, a steady increase-with-grade-level was noted in the percentage of subjects of both sexes who exhibited HL's ≤5 dB. Stated differently, group hearing sensitivity data improved with age. In males it ranged from 26.30% in the first grade to 41.78% in the twelfth grade (increase of 15.48%) while females ranged from 24.93% among first graders to 47.57% among twelfth graders (increase of 22.64%); 2) In general both sexes showed progressively lower percentages of hearing loss as a function of increasing grade level; 3) The percentage of unilateral impairments (PTA's which exceeded 25 dB) was always higher, for both sexes and in all grades, than the percentage of bilateral impairments. The unilaterals' advantage (except for a unique eight to one ratio for ninth-grade subjects) ranged from about 3/2 for first graders to 4/1 for twelfth graders, and; 4) Females demonstrated a rather consistent superiority in all characteristics of performance when compared with males, and did so at nearly all grade levels. In general, females showed higher percentages of subjects with PTA's ≤5 dB and lower percentages that were classified as hearing impairments.

Summary of Pure Tone Average Data

To afford greater convenience of comparison, these total-data results for all twelve grades were combined in Table H.40. One can readily see, in column one of this table, the orderly increase in percentage values for subjects whose bilateral PTA's were ≤5 dB as the grade level also increases. Columns two and three provide the

percentage values, by grade, for subjects whose PTA's were within normal limits (0-25 dB), bilaterally, but in whom the PTA was better in one ear than in the other. Although the percentages for these two conditions are generally equivalent for subjects at each grade level, a consistently smaller percentage is shown for the combination (column 2) where the left ear is poorer than the right ear. In other words, more children who had a better and poorer ear within the normal hearing range had slightly greater sensitivity in their right ears.

Columns 4 and 5 of Table H.40 present the percentage of left and right ear combinations for the subjects whose sensitivity was ≤5 dB in one ear, but who had a hearing impairment (26-100 dB) in the other ear. The percentages were small and grossly similar for the two conditions, revealing impairment to be about equally divided between left and right ears. Moreover, there is no apparent pattern of results among the various grade levels. The mean percentage values in the grades 1-12 row confirm the close agreement between these two conditions.

Column 6 lists percentage values for subjects in whom the two ears fell into the normal range of hearing, but in whom neither ear was ≤5 dB. In general, these values became smaller as grade increased. This trend held fairly consistently through grade 10 where the values plateaued. It would appear that, in view of the column 1 results where the values move in the opposite direction, as children grow older their improving sensitivity takes them out of the 6 - 25 dB grouping and moves them into the ≤5 dB category. This explanation seems quite reasonable since the 26-100 dB values do not become likewise inflated with progressing grade level. One might argue that such results indicate that hearing sensitivity increases with age or that children respond with greater compulsion to threshold-level stimuli as they grow older, perhaps by virtue of maturation and/or social conditioning.

Columns 7 and 8 present the results for left-right ear combinations of the 6-25 dB and 26-100 dB HL's. Thus, as with columns 4 and 5, these data reflect the percentages of subjects who have one normal ear and one abnormal ear except that, in this instance, the normal ear falls into the 6-25 dB range. The percentages again show a high degree of similarity between the two conditions, as did columns 4 and 5. That is, impairments are about equally distributed between left and right ears. The values are somewhat greater than the previous unilateral conditions (columns 4 and 5) and gradually decrease in magnitude in the upper grades.

The percentage of bilateral impairments are presented in column 9. The values range from .22% in grade nine to 1.80% in grade one, with the greatest prevalence figures shown among subjects in the first five grades.

Table H.41 consolidates the percentages for the unilateral, bilateral, and total impairments shown in Table H.40. Here, one can more readily see the relatively equal distribution of unilateral impairments between left and right ears, the ratio of unilateral to bilateral impairments, the grand total of impairments, and the gradually decreasing prevalence of impairment in the higher grades. Of course, the combined totals of unilateral and bilateral impairments follow the same pattern. The 1-12 grade category presents the mean PTA percentage values for the total survey population with all grades represented. It shows almost identical percentage values for left and right ears with unilateral impairments (LE = .94% and RE = .93%), and a total of 1.87% of unilateral impairments compared with .73% for bilateral impairments – an overall ratio of about 2.5/1. The grand total of impairments, both unilateral and bilateral, was 2.60%. These are the percentage values that would be applicable to estimating the number of public school children having hearing impairments. On the basis of the U.S. Office of Education's estimate (1974) of about 51 million children attending schools in the United States, 2.60% (or 1,326,000 children) of them may be classified as hearing handicapped by the AAOO standard.

On the basis of these figures, the total percentage of impairments is only half of the 5% which is most commonly quoted. However, it must be kept in mind that the present data represent impairments for very specific criteria – pure-tone averages and the AAOO's implied impairment boundary. These values are certain to change when discrete frequency data, especially those involving 4000 Hz, are analyzed.

Table (H.42) presents the chi-square values which were listed with Tables H.1 - H.41. While they may not be especially meaningful, in view of the diverse hearing-level classifications employed, the magnitudes of their probable occurrence are extremely high.

Discrete Hearing Threshold Levels

The data were next analyzed in terms of the percent of responses recorded for each threshold level on the audiometric scale. Tables H.43 - 45 show the results for males, females, and total student population for the twelve grade levels combined. Individual grade level x sex data are not included in the text since the pattern of results was similar

TABLE H.40

Summary of pure-tone average data (500-2000 Hz) in dB HL for total subjects in grades 1-12. Values reported in percent of subjects responding within selected left and right ear combinations of hearing-level categories. N = 38568.

Grade	Right PTA Hearing Level (dB HL) - ANSI, 1969								
	Left	≤5	≤5	6-25	≤5	26-100	6-25	6-25	26-100	26-100
	Column	≤5	6-25	≤5	26-100	≤5	6-25	26-100	6-25	26-100
		1	2	3	4	5	6	7	8	9
1		25.64	11.39	12.00	.26	.26	45.46	1.32	1.87	1.80
2		28.01	10.85	12.90	.25	.06	44.57	1.20	1.29	.85
3		31.99	10.61	12.81	.09	.13	41.31	1.35	.91	.79
4		34.98	11.80	11.99	.16	.12	38.21	.81	.84	1.09
5		37.06	12.27	12.90	.16	.28	34.82	.72	.88	.91
6		38.35	11.28	13.40	.25	.22	34.27	.87	.72	.65
7		42.41	10.65	12.65	.09	.06	32.75	.31	.49	.58
8		41.19	11.02	13.01	.09	.15	32.93	.61	.46	.52
9		43.54	11.69	12.40	.43	.15	30.52	.56	.49	.22
10		44.44	11.88	12.65	.31	.15	28.83	.52	.58	.64
11		45.54	10.98	12.27	.00	.28	29.89	.37	.25	.43
12		44.59	11.79	12.84	.25	.19	29.12	.43	.46	.34
1-12		38.23	11.35	12.65	.19	.17	35.15	.75	.76	.73

TABLE H.41

Summary of prevalence of unilateral and bilateral impairments shown in Table H.40. Values are in percent of the total population (38568) with pure-tone averages in excess of 25 dB (ANSI-1969).

Row		Grade 1	2	3	4	5	6	7
1	Unilateral - LE	1.58	1.45	1.44	.97	.88	1.12	.40
2	Unilateral - RE	2.13	1.35	1.04	.96	1.16	.94	.55
3	Total Unilateral (Σ of Rows 1 & 2)	3.71	2.80	2.48	1.93	2.04	2.06	.95
4	Total Bilateral	1.80	.85	.79	1.09	.91	.65	.58
5	Total Unilateral and Bilateral (Σ of Rows 3 & 4)	5.51	3.65	3.27	3.02	2.95	2.71	1.63

Row		Grade 8	9	10	11	12	1-12
1	Unilateral - LE	.70	.99	.83	.37	.68	.94
2	Unilateral - RE	.61	.64	.73	.53	.65	.93
3	Total Unilateral (Σ of Rows 1 & 2)	1.31	1.63	1.56	.90	1.33	1.87
4	Total Bilateral	.52	.22	.64	.43	.34	.73
5	Total Unilateral and Bilateral (Σ of Rows 3 & 4)	1.83	1.85	2.20	1.33	1.67	2.60

TABLE H.42
Hearing Sensitivity

Chi Square by grade and sex for PTA tables.*

Grade	Males	Females	Total
1	857.60	574.26	1422.21
2	650.95	544.41	1192.79
3	661.25	639.83	1292.42
4	769.92	894.66	1703.46
5	696.28	748.27	1412.67
6	671.18	653.05	1237.46
7	796.85	1012.19	1860.80
8	762.30	688.46	1456.48
9	471.27	474.89	939.58
10	728.66	683.90	1412.63
11	813.92	1079.58	1644.19
12	470.12	726.50	1116.66
1-12	8501.07	8441.74	16937.24

*Values greater than or equal to 20.50 are significant at the .001 level of confidence.

at each grade level. That data is included in Appendix AH, however, for the reader who wishes to examine it in detail. Table H.43 shows the response characteristics for the overall population of males. The table shows that 500 and 3000 Hz are the frequencies with the lowest 0 dB-level percentage values. Stated another way, the males in this survey had poorer sensitivity at 500 and 3000 Hz than they did for the other test frequencies. This was particularly true for 500 Hz which had the poorest response for both left and right ears. Conversely, the best sensitivity in each ear was at 2000 Hz as reflected by the highest percentage of response values. The order of sensitivity by frequency was 2000, 1000, 4000, 3000, and 500 Hz in both left and right ears. The largest response values are clustered in the 0-15 dB HL range by a substantial margin. Approximately 90% or more of the responses at each frequency fell into that HL range, and the response values diminish dramatically above 15 dB and especially above the 25 dB criterion standard for normal hearing. Also shown in this table are the summed percents of response at each test frequency for values that exceeded 25 dB, thereby representing the percents of impairment at each frequency as defined by the 25 dB criterion standard. The highest percent of impairment was shown at 4000 Hz, followed in order by 3000 Hz and 500 Hz, and the higher percents of impairment were shown for left ears.

The data for females is presented in Table H.44 and differs from that for males by showing lower response values

TABLE H.43
Hearing Sensitivity

Grades 1-12. Percent of responses at each hearing level and test frequency. Males, N = 19834.

HL re. ANSI-1969	Right Ear Frequency					Left Ear Frequency				
	500	1000	2000	3000	4000	500	1000	2000	3000	4000
0	7.42	32.82	37.76	14.36	26.62	7.51	33.18	37.82	13.59	23.85
5	33.32	40.17	35.50	28.41	29.30	33.69	39.92	33.77	27.93	26.84
10	30.77	15.28	14.92	25.42	19.87	30.15	14.68	14.61	24.69	21.06
15	18.46	6.95	7.19	19.45	12.92	18.88	7.35	8.12	19.11	14.60
20	5.70	1.92	2.12	5.95	4.16	5.51	2.27	2.60	6.95	5.17
25	2.22	.98	.99	2.81	2.17	2.19	1.04	1.34	3.50	3.06
30	.85	.57	.45	1.15	1.25	.78	.50	.56	1.49	1.36
35	.50	.48	.41	.79	.98	.47	.31	.40	.82	1.18
40	.23	.22	.20	.47	.55	.28	.23	.24	.51	.60
45	.15	.15	.11	.33	.50	.17	.18	.16	.38	.54
50	.12	.13	.08	.19	.37	.12	.06	.11	.28	.38
55	.07	.10	.04	.17	.40	.09	.06	.07	.20	.43
60	.04	.03	.04	.15	.29	.04	.06	.04	.14	.28
65	.04	.04	.02	.10	.21	.04	.04	.04	.13	.21
70	.02	.02	.04	.06	.14	.01	.03	.04	.08	.16
75	.01	.02	.03	.02	.07	.02	.02	.01	.07	.10
80	.03	.02	.02	.03	.03	.01	.01	.02	.03	.06
85	.01	.02	.01	.02	.04	.01	0.00	.01	.02	.02
90	.02	.01	.01	.02	.03	.02	.02	.02	.02	.03
95	.01	.02	.02	.03	.02	.01	0.00	0.00	.02	.01
100*	.06	.05	.06	.08	.09	.03	.06	.05	.07	.07
Sum of HL Values 30-100	2.16	1.89	1.54	3.61	4.91	2.10	1.58	1.77	4.26	5.43

*This value represents all HLs over 95 dB.

141

TABLE H.44
Hearing Sensitivity

Grades 1-12. Percent of responses at each hearing level and test frequency. Females, N = 18733.

HL	Right Ear Frequency					Left Ear Frequency				
	500	1000	2000	3000	4000	500	1000	2000	3000	4000
0	8.02	35.77	40.20	19.45	32.50	8.27	39.09	43.59	20.99	30.41
5	24.50	38.57	34.90	30.80	29.53	35.36	37.31	33.59	31.70	29.25
10	30.30	14.27	14.44	23.38	19.11	29.75	13.03	12.97	22.55	20.13
15	17.26	6.48	6.48	16.00	10.66	16.90	5.87	5.74	15.32	11.80
20	5.40	2.13	1.73	5.32	3.64	5.34	2.11	1.94	4.68	3.92
25	2.26	.99	.82	2.36	1.96	2.17	1.01	.78	2.11	1.86
30	.94	.51	.45	1.00	.79	.95	.50	.41	.95	.82
35	.50	.48	.25	.56	.60	.52	.40	.29	.64	.64
40	.28	.25	.18	.38	.32	.25	.20	.15	.30	.32
45	.14	.16	.13	.20	.23	.12	.09	.17	.20	.21
50	.06	.09	.06	.09	.15	.10	.09	.06	.12	.12
55	.05	.03	.05	.10	.12	.05	.04	.04	.06	.13
60	.06	.03	.06	.05	.09	.04	.03	.07	.09	.09
65	.03	.04	.03	.03	.05	.05	.06	.04	.05	.08
70	.02	.03	.05	.05	.05	.03	.04	.02	.06	.04
75	.04	.04	.03	.04	.04	.02	.02	.01	.05	.05
80	.04	.02	.02	.04	.02	.02	.03	.03	.04	.03
85	.02	.02	.01	.02	.01	.01	.03	.02	.01	.02
90	.-2	.01	.02	.01	.02	.02	.01	.01	.01	.02
95	.01	.03	.01	.02	.04	.01	.01	.01	.01	.01
100*	.05	.06	.09	.10	.09	.04	.06	.06	.06	.06
Sum of HL Values 30-100	2.26	1.80	1.44	2.69	2.62	2.23	1.61	1.39	2.65	2.64

HL re. ANSI-1969

*This value represents all HLs over 95 dB.

TABLE H.45
Hearing Sensitivity

Grades 1-12. Percent of responses at each hearing level and test frequency. Total Subjects, N = 38567.

	HL	Right Ear Frequency					Left Ear Frequency				
		500	1000	2000	3000	4000	500	1000	2000	3000	4000
	0	7.71	34.25	38.95	16.83	29.47	7.88	36.05	40.62	17.19	27.04
	5	33.89	39.39	35.21	29.57	29.41	34.50	38.65	33.68	29.76	28.01
	10	30.54	14.79	14.69	24.43	19.50	29.96	13.88	13.81	23.65	20.61
	15	17.88	6.72	6.85	17.78	11.82	17.91	6.63	6.69	17.27	13.24
	20	5.55	2.02	1.93	5.64	3.91	5.43	2.19	2.28	5.84	4.56
	25	2.24	.99	.91	2.60	2.07	2.18	1.03	1.07	2.82	2.48
	30	.89	.54	.45	1.08	1.02	.86	.50	.48	1.23	1.09
	35	.50	.48	.33	.68	.80	.49	.35	.34	.73	.92
	40	.25	.23	.19	.43	.44	.26	.22	.20	.41	.46
	45	.14	.15	.12	.27	.37	.14	.13	.16	.29	.38
	50	.09	.11	.07	.14	.27	.11	.07	.09	.20	.25
	55	.06	.06	.04	.13	.26	.07	.05	.05	.13	.28
	60	.05	.03	.05	.10	.19	.04	.05	.05	.11	.19
	65	.03	.04	.02	.06	.13	.04	.05	.04	.09	.15
	70	.02	.02	.04	.06	.10	.02	.03	.03	.07	.10
	75	.02	.03	.03	.03	.06	.02	.02	.01	.06	.08
	80	.04	.02	.02	.03	.02	.01	.02	.02	.03	.04
	85	.01	.02	.01	.02	.02	.01	.02	.01	.01	.02
	90	.02	.01	.01	.01	.02	.02	.01	.01	.01	.02
	95	.01	.02	.02	.02	.03	.01	.01	.00	.01	.01
HL re. ANSI-1969	100*	.05	.06	.07	.09	.09	.04	.06	.06	.06	.07
Sum of HL Values 30-100		2.18	1.82	1.47	3.15	3.82	2.14	1.59	1.55	3.44	4.06

(better hearing) at 3000 and 4000 Hz, especially in the left ear. In fact, ear differences among females were essentially non-existent. Table H.45 combines the male-female data and serves to represent the detailed HL data for the total school-age population of 38,567 children.

In view of the sample size, the twice-daily field calibrations by the six survey teams working independently in widely separated geographic regions of the United States, and the pre-survey laboratory tests which assured the adequacy of the sound attenuation provided by the test rooms, these results represent a reliable estimate of the hearing level x frequency characteristics of public school children in the United States. Absolute comparisons with existing reference standards (ANSI, 1969) and with other prevalence studies were not drawn since the threshold measurements in this survey were not attempted below 0 dB.

CONCLUSIONS

The primary purpose of the National Speech and Hearing Survey was to estimate the prevalence of speech and hearing disorders in the public-school populations, grades 1-12, in coterminous United States. A secondary purpose was to analyze the data in such a way as to provide some useful descriptive information about normal and abnormal speech and hearing behavior.

Speech

Results of the ratings of connected speech and the analysis of the articulation test responses provided the basis for estimates of the prevalence of speech disorders which are shown in Table S.102. The prevalence figures for moderate speech disorders are values taken from Table S.8 (Moderate Articulation Deviation), Table S.96 (Moderate Voice Deviation) and Table S.100 Stuttering. Similarily, the prevalence figures for severe speech disorders are values taken from Table S.10 (Extreme Articulation Deviation), Table S.98 (Extreme Voice Deviation), and Table S.100 Stuttering. The prevalence figure of 0.8% for stuttering is the same in both the moderate and severe prevalence figures because stuttering was only identified and not rated for severity. Thus prevelance of moderate speech disorders is 4.1% and 2.4% for severe speech disorders. The combined prevalence figure is the sum of the moderate and severe prevelence figures except stuttering. Therefore the prevalence of articulation disorders combined is 1.9% and of voice disorders combined, 3.0%. With a prevalence figure of 0.8% for stuttering, the combined prevalence of speech disorders is 5.7%. The rationale for including the MAD and EAD groups in the articulation disorder category and the MVD and EVD groups in the voice disorder category was discussed previously in the results section.

The detailed analysis of the articulation test results revealed some interesting information regarding the articulation characteristics of the subjects screened in the survey. Some of the interesting and important highlights are summarized below.

1. In general it was found that females performed better than males: they missed fewer consonants and were more stimulable for consonants they misarticulated. This occurred at most grade levels.
2. All subjects were able to correct many misarticulated consonants when stimulated verbally one time.

TABLE S.102

Prevalence of Speech Disorders

The estimated prevalence of articulation and voice disorders and stuttering. Percent figures are based on a national sample of 38,802 subjects. N = Males 19,973; Females = 18,829.

Type of Disorder	Moderate Percent			Severe Percent			Combined Percent		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
Articulation	1.5	0.8	1.0	1.2	0.7	0.9	2.4	1.5	1.9
Voice	2.8	1.7	2.3	0.9	0.4	0.7	3.7	2.1	3.0
Stuttering	1.2	0.4	0.8	1.2	0.4	0.8	1.2	0.4	0.8
Total	5.2	2.9	4.1	3.3	1.5	2.4	7.3	4.0	5.7

3. Somewhat suprisingly, many of the subjects, who were judged to have moderately and extremely deviant speech, were also stimulable on a number of consonants.
4. Articulation performance improved as a function of increasing grade level for both sexes and for all levels of articulation performance.
5. The sheer number of misarticulated consonants was found to be the factor most closely related to articulation performance. When the number of articulation errors increased the articulation was judged to be worse. If one assumes that an increased number of articulation errors will decrease intelligibility, it can be concluded, tentatively at least, that quality or acceptability of speech is judged on the basis of intelligibility.
6. The linguadental-fricative-voiceless consonants (/th/ and /<u>th</u>/) were most frequently misarticulated by all subjects.
7. The greatest number of subjects with moderate and extreme articulation deviations were found in the first grade and the number decreased along with increased grade level. This characteristic is important because it points up the fact that articulation performance continues to improve after a child enters the first grade in school. The importance of this phenomenon — not new of course — is reinforced when one considers the finding that,

in the severe articulation disorder group (EAD), the reduction in the percent of subjects from a high of 5.6% in the first grade to 1.9% in the second grade was the highest percent reduction found, all groups considered. The implications are important with respect to planning articulation intervention programs for children in the first and second grades. Growth and articulation maturation are apparently important factors to be considered.

Although the voice characteristics of the subjects in the survey were not discussed here, the trend toward improved voice patterns was also found to occur with increasing grade level.

Hearing

From a population of 38,568 school children, which were distributed about equally over twelve grade levels and between sexes, 2.60% had hearing characteristics which were classified as impaired. The criterion standard for impairment was a PTA in excess (>) 25 dB as specified by the AAOO. The majority of that population, 1.87%, had unilateral impairments which were almost equally divided into left and right ears. The remaining .73% had bilateral PTAs which exceeded 25 dB. On an estimated 51 million school children in the United States, 2.60% would represent 1,325,000 children with a functional impairment according to the AAOO standard.

Hearing sensitivity in this population improves with grade level (age), and the percent of children with hearing impairment becomes lower in the later school years. The overall results show that although differences between sexes are small, females show superiority in terms of sensitivity levels and lower percents of impaired hearing.

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APPENDIXES

APPENDIX A

Speech Testing Materials

APPENDIX A.1

Consonants assessed by the Goldman-Fristoe Test of Articulation showing picture-plate number, response words, and position of each consonant element tested in the word. Response words are arranged in the order presented to the subject.

Plate	Response	Consonant			Plate	Response	Consonant		
1	house	h-		-s	21	pencils	p-	-s-	
2	telephone	t-	-f-		21	this/that*	th-		
3	cup	k-		-p	22	carrot		-r-	-t
4	gun	g-		-n	22	orange			-j
5	knife	n-		-f	23	bathtub	-th-	-t-	-b
6	window	w-	-d-		23	bath	b-		-th
7	wagon		-g-		24	thumb	th-		
7	wheel	hw-			24	finger		-ng-	
8	chicken		-k-		24	ring			-ng
9	zipper	z-	-p-		25	jumping	j-		
10	scissors	s-	-z-	-z	26	pajamas		-j-	
11	duck	d-		-k	27	airplane/plane*		-pl-/pl-	
11	yellow	y-	-l-		27	blue	bl-		
12	vacuum	v-			28	brush	br-		-sh
13	matches	m-	-ch-		29	drum	dr-		-m
14	lamp	l-			30	flag	fl-		-g
15	shovel	sh-	-v-		31	Santa Claus		-n- -kl-	
16	car			-r	32	Christmas tree	kr-	-m-	-tr-
17	rabbit	r-	-b-		33	squirrel	skw-		-l
18	fishing	f-	-sh-		34	sleeping	sl-		
19	church	ch-		-ch	34	bed			-d
20	feather		-th-		35	stove	st-		-v

*Either response acceptable

APPENDIX A.2

Picture Story Stimulus Cards

Picture cards were used to stimulate subjects in Grades 1-9 to tell a story. The purpose was to evoke connected speech. The nature of the picture cards and thus, the characteristics of the connected speech pattern produced varied answers from one grade group to another.

Grades 1-3

Stimulus cards of the Goldman-Fristoe Sounds-in-Sentences Subtest of the articulation test were used for grades 1, 2, and 3. There are two sets of four-card stories in the subtest.

Story I: A Bad Night for Jerry

Story II: Jack and Ricky

The subjects were stimulated with the story cards according to the instructions in the Goldman-Fristoe Test of Articulation. Only one story was presented to each subject.

Grades 4-6

Two "sets" of pictures were used to evoke connected speech from this group of subjects. All subjects were stimulated with both "sets." One was a single picture and the subject was asked to "make up a story" about the picture.

The second set consisted of a two-picture sequence and the subject was asked to "make up a story" about the two pictures.

Grades 7-9

Two "sets" of pictures were used to evoke connected speech from these subjects. The first was the same picture used for the 4-6 grade group.

The second set consisted of a sequence of eight pictures. The subject was asked to make up a story about the sequence.

APPENDIX A.3

Discussion Topics

All subjects in each of the 12 grades were asked to discuss specific topics. The nature of the topics varied from grade level to grade level but within a grade-level group the evaluator attempted to discuss the same topic.

Grade 1-6

1. Discussion of subject's family.
2. Discussion of subject's favorite TV programs.

Grades 7-9

1. Discussion of subject's family.
2. Age when person should be qualified to have a driver's license.
3. Subject asked to give directions for walking from school to his home.

Grades 10-12

1. Discussion of subject's plans after he had finished high school.
2. Subject's opinion about the legal voting age – 18 or 21 years. (At the time of the screening, the legal voting age was 21 years.)

APPENDIX A.4

Sentence Repetition

Each subject repeated four sentences when stimulated verbally.

1. My papers and pencils are in tne desk.
2. Larry brought his ball and bat to the game.
3. Do you like to drink out of paper cups?
4. Mary ran when she heard the school bell ring.

APPENDIX A.5

Classification of consonants according to place of articulation, manner of production and voicing characteristics.

Place of Articulation	Manner of Production											
	Stop		Fricative		Affricate		Nasal		Glide		Semivowel	
	Voiceless	Voiced	Voiceless	Voiced	Voiceless	Voiced	Voiceless	Voiced	Voiceless	Voiced	Voiceless	Voiced
Labial	p	b						m	hw	w		
Labiodental			f	v								
Linguadental			th	th								
Lingua-alveolar	t	d	s	z				n				l
Linguapalatal			sh	zh	ch	j*				y**		r
Linguavelar	k	g						ng				
Glottal			h									

*j = jump
**y = yes

APPENDIX B

Data Recording Forms

157

NATIONAL SPEECH AND HEARING SURVEY
Colorado State University

CODE: 1

Name _____ S.N. ___ Date: ___

City _____ Sex: ___ Absent: ___

State _____ Age: ___ Census District ___

Grade: ___ School District ___

Team Number ___

Left Ear W/O Masking

4K	.5K	2K	3K	1K

Right Ear W/O Masking

4K	.5K	2K	3K	1K

Ear Masked ___

4K	.5K	2K	3K	1K

Reliability	
Environment	
Child's Behavior	
Physical Deformity	
Evaluator	

Articulation	
Stuttering	
Voice	
Quality	

Dialect	
Rate	
Pitch	
Overall	

Reliability	
Fluency	
Loudness	
Evaluator	

1-h	2-s	3-t	4-f	5-k	6-p	7-g	8-n	9-n	10-f	11-w	12-d

13-g	14-hw	15-k	16-z	17-p	18-s	19-z	20-z	21-d	22-k	23-y	24-l

25-v	26-m	27-ch	28-l	29-sh	30-v	31-r	32-r	33-b	34-f	35-sh	36-ch

37-ch	38-th	39-p	40-s	41-th	42-r	43-t	44-j	45-th	46-t	47-b	48-b

49-th	50-th	51-ng	52-ng	53-j	54-j	55-pl	56-bl	57-br	58-sh	59-dr	60-m

61-fl	62-g	63-n	64-kl	65-kr	66-m	67-tr	68-skw	69-l	70-sl	71-d	72-st

73-v ___

NATIONAL SPEECH AND HEARING SURVEY
Colorado State University

CODE: 2

Name _____ S.N. ___ Date: ___

City _____ Sex: ___ Age: ___ Absent: ___

State _____ Grade: ___ Census District ___ School District ___ Team Number ___

Right Ear W/O Masking

3K	1K	2K	.5K	4K

Left Ear W/O Masking

3K	1K	2K	.5K	4K

Ear Masked ___

3K	1K	2K	.5K	4K

Reliability	
Environment	
Child's Behavior	
Physical Deformity	
Evaluator	

Articulation	
Stuttering	
Voice	
Quality	

Dialect	
Rate	
Pitch	
Overall	

Reliability	
Fluency	
Loudness	
Evaluator	

1-h	2-s	3-t	4-f	5-k	6-p	7-g	8-n	9-n	10-f	11-w	12-d

13-g	14-hw	15-k	16-z	17-p	18-s	19-z	20-z	21-d	22-k	23-y	24-l

25-v	26-m	27-ch	28-l	29-sh	30-v	31-r	32-r	33-b	34-f	35-sh	36-ch

37-ch	38-th	39-p	40-s	41-th	42-r	43-t	44-j	45-th	46-t	47-b	48-b

49-th	50-th	51-ng	52-ng	53-j	54-j	55-pl	56-bl	57-br	58-sh	59-dr	60-m

61-fl	62-g	63-n	64-kl	65-kr	66-m	67-tr	68-skw	69-l	70-sl	71-d	72-st

73-v ___

APPENDIX C

Total Sample

Cumulative Number of Consonants Misarticulated

Ten Most Frequently Misarticulated Consonants

Consonants Misarticulated by Class

TABLE CS.1

Cumulative Number of Consonants Misarticulated
(Total Sample)

Total Grades (1-12). Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 19973, Females 18829.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	55.18	59.87	80.08	84.29
5	87.63	91.66	94.67	96.75
10	95.37	97.39	98.39	99.18
15	98.00	99.01	99.34	99.69
20	99.11	99.58	99.66	99.88

TABLE CS.2

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 1. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1670, Females 1530.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	23.23	28.37	51.80	62.03
5	61.50	72.55	78.08	87.52
10	70.16	88.69	90.96	95.69
15	88.20	94.31	95.57	97.91
20	93.83	96.86	97.37	98.95

TABLE CS.3

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 2. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1645, Females 1573.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	35.81	41.51	64.38	72.03
5	74.35	82.07	87.96	92.69
10	89.30	94.21	96.23	98.09
15	95.20	97.58	98.48	99.24
20	97.87	99.05	99.57	99.94

TABLE CS.4

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 3. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1651, Females 1557.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	47.00	51.70	73.53	78.36
5	83.34	87.80	92.07	95.50
10	93.64	95.95	98.18	99.23
15	97.76	98.97	99.52	99.94
20	99.15	99.94	99.64	100.00

TABLE CS.5

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 4. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1708, Females 1530.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	50.06	58.50	76.35	83.14
5	86.59	91.50	99.38	97.52
10	95.73	98.43	98.48	99.54
15	98.65	99.61	99.53	99.87
20	99.47	99.80	99.71	100.00

TABLE CS.6

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 5. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1693, Females 1504.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	53.10	59.18	80.57	84.64
5	87.42	91.42	96.40	97.41
10	96.75	97.94	99.41	99.47
15	99.00	99.34	99.82	99.73
20	99.70	99.80	99.97	99.93

TABLE CS.7

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 6. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1585, Females 1633.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	57.54	63.38	83.66	86.83
5	90.03	93.39	96.85	97.49
10	97.22	98.22	99.24	99.82
15	99.12	99.51	99.68	100.00
20	99.87	100.00	100.00	100.00

TABLE CS.8

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 7. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1673, Females 1589.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	59.35	64.95	84.16	88.61
5	92.41	95.34	97.73	98.74
10	98.51	98.99	99.64	99.94
15	99.70	99.81	99.94	99.94
20	99.82	99.94	99.94	99.94

TABLE CS.9

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 8. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1662, Females 1592.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	61.37	68.17	86.46	90.48
5	93.62	96.05	98.07	98.62
10	98.56	98.87	99.76	99.56
15	99.70	99.75	100.00	99.87
20	99.94	99.87	100.00	99.87

TABLE CS.10

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 9. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1668, Females 1577.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	64.15	64.55	87.23	89.47
5	94.12	96.13	98.20	98.73
10	98.20	99.18	99.52	99.75
15	99.34	99.68	99.94	99.81
20	99.94	99.81	99.94	99.94

165

TABLE CS.11

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 10. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1658, Females 1614.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	67.37	70.69	89.99	91.33
5	95.66	96.96	98.85	98.76
10	99.16	99.07	99.64	99.81
15	99.82	99.88	99.88	100.00
20	99.94	100.00	99.94	100.00

TABLE CS.12

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 11. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1691, Females 1561.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	71.50	72.20	90.42	90.52
5	96.45	96.99	98.70	98.91
10	98.99	99.36	99.70	99.81
15	99.70	99.81	99.82	99.87
20	99.82	99.87	99.94	99.94

TABLE CS.13

Cumulative Number of Consonants Misarticulated
(Total Sample)

Grade 12. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1669, Females 1565.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	71.48	73.80	92.39	93.04
5	95.99	97.57	98.74	98.79
10	99.22	99.42	99.88	99.81
15	99.82	99.74	99.88	100.00
20	99.94	99.94	99.94	100.00

TABLE CS.14

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Total Grades (1-12). Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 19973, Females 18829.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	19.11	4.98	-th-	15.04	2.83
-r	9.47	2.59	-r	8.30	2.17
-s	8.25	4.38	z-	7.75	3.07
z-	7.94	3.66	-t	5.93	.13
th-	6.27	1.74	-s	5.63	2.68
-t	6.24	.24	v-	4.09	.59
v-	4.87	.74	-sh	4.02	1.98
-sh	4.71	2.58	th-	3.64	.74
-ch	4.36	1.98	ch-	3.52	1.44
-b	3.22	.16	-ng	3.43	1.59

TABLE CS.15

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 1. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1670, Females 1530.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	40.66	16.59	-th-	32.55	9.80
v-	24.13	4.73	z-	18.89	9.02
z-	23.41	13.41	v-	17.91	2.75
-s	20.24	11.44	-s	15.16	7.45
-r	17.25	14.31	-r	14.31	6.54
th-	15.45	9.02	-ch	10.72	4.77
-sh	14.01	10.33	-sh	10.33	5.56
-ch	13.23	10.72	-th-	9.35	4.38
-j	8.80	8.24	-j	8.24	3.20
-t	7.37	7.06	-ng	7.39	3.73

TABLE CS.16

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 2. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1645, Females 1473.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	28.63	9.42	-th-	27.98	6.10
-z	15.26	7.90	-r	12.71	4.20
-s	14.10	8.80	v-	11.82	1.72
-r	13.62	5.71	z-	11.32	4.70
v-	12.52	1.16	-s	9.54	5.21
th-	10.46	2.49	th-	7.18	1.59
-sh	8.94	4.86	-ng	6.48	3.12
ch-	8.81	3.41	ch-	6.36	2.61
-t	6.87	.12	-sh	6.23	2.92
-j	5.96	1.82	-t	5.47	.25

TABLE CS.17

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 3. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1651, Females 1557.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	22.47	5.88	-th-	18.24	3.60
-r	11.51	3.15	z-	8.48	2.95
z-	11.14	5.51	-r	7.90	2.70
-s	10.42	5.63	-s	7.19	3.40
th-	7.63	2.18	v-	6.49	.64
v-	6.72	.61	-t	6.36	.26
-t	6.06	.42	-ng	5.84	2.06
-ch	5.51	2.91	th-	5.33	.83
-sh	5.51	3.03	ch-	5.07	1.99
-j	4.48	1.45	-sh	4.88	2.25

TABLE CS.18

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 4. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1708, Females 1530.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	19.91	5.74	-th-	16.80	3.46
-r	9.66	2.99	-r	8.82	2.88
-s	8.61	4.92	z-	7.19	2.48
z-	8.02	3.98	-t	5.62	.13
th-	7.90	1.58	-s	4.71	2.75
-t	6.03	.18	th-	4.31	.78
-ch	5.04	2.46	-ng	4.25	1.76
v-	4.51	.53	ch-	3.79	1.70
sh-	4.51	2.22	-sh	3.40	1.63
-j	3.34	1.29	-j	3.27	.39

TABLE CS.19

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 5. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1693, Females 1504.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	21.44	4.43	-th-	15.76	2.26
-r	9.45	1.89	-r	8.11	1.93
z-	7.27	2.78	z-	7.91	3.39
-t	6.91	.06	-t	5.72	0.00
th-	6.67	1.54	-s	5.12	2.46
s-	6.56	3.60	th-	4.45	.60
-sh	4.49	2.30	-sh	3.92	1.80
-k	4.02	.24	-ng	3.52	1.66
-b	4.02	.24	-ch	3.19	1.33
-ch	3.66	1.83	-b	2.99	0.00

TABLE CS.20

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 6. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1585, Females 1633.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	18.55	3.34	-th-	13.47	2.14
-r	7.51	1.20	-r	7.29	1.22
-s	7.13	3.53	z-	6.49	2.82
-t	7.07	.32	-t	6.31	0.00
th-	6.94	1.39	-s	4.65	1.71
z-	5.87	2.78	th-	3.43	.37
sh-	3.79	1.45	-b	3.18	.06
-b	3.66	.13	-ng	3.18	1.90
-k	3.28	.13	ch-	2.82	.98
-ch	3.15	1.58	-sh	2.82	1.41

TABLE CS.21

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 7. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1673, Females 1589.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	15.78	3.83	-th-	11.96	1.76
-r	8.61	1.55	-r	8.18	1.45
-s	6.75	3.35	z-	6.48	2.33
-t	5.80	.06	-t	6.42	.13
th-	4.72	.84	-s	3.59	1.51
z-	4.36	1.61	-sh	3.52	1.83
-sh	4.30	2.15	-b	2.83	.06
-ch	3.59	1.85	-ng	2.71	1.45
-g	2.87	.30	-j	2.08	.31
-b	2.51	.18	-ch	1.89	.31

TABLE CS.22

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 8. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1662, Females 1596.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	14.32	1.93	-th-	10.96	1.00
-r	8.78	1.81	-r	7,89	1.32
-t	6.86	.12	z-	6.20	2.07
-s	5.60	2.89	-t	5.08	0.00
-z	4.63	1.68	-s	4.07	1.82
th-	4.27	.96	-b	3.38	.13
-b	3.25	0.00	-sh	2.94	1.50
-sh	2.77	1.38	-j	2.32	.38
-k	2.71	.06	-ng	2.32	1.00
-g	2.47	.18	-ch	2.19	1.13

TABLE CS.23

Ten Most Frequently Misarticulated Consoants
(Total Sample)

Grade 9. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1668, Females 1577.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	14.09	2.94	-th-	11.16	1.08
-r	7.91	1.08	-t	7.48	.13
-s	5.76	2.64	-r	7.29	1.52
-t	5.70	0.00	z-	5.20	1.90
z-	5.10	1.98	-s	3.93	1.46
th-	4.08	.84	-b	3.93	.06
-b	3.36	0.00	-sh	3.55	2.09
-k	2.88	.06	ch-	2.35	1.01
-sh	2.82	1.38	-p	2.03	.06
-ch	2.70	1.02	-ng	2.03	.76

TABLE CS.24

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 10. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1658, Females 1614.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	12.06	1.99	-th-	7.93	.74
-r	6.88	.90	-t	6.44	.06
-t	5.85	.12	-r	5.64	.62
-s	4.95	2.41	z-	5.02	1.67
z-	4.04	1.39	-s	4.03	1.80
-k	3.32	.12	-b	3.28	.19
-b	2.96	.06	-sh	2.60	1.05
-g	2.96	.18	-p	2.11	0.00
-p	2.35	0.00	-g	1.86	.12
-sh	2.11	.90	ch-	1.80	.81

TABLE CS.25

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 11. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1691, Females 1561.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	10.47	1.89	-th-	[illegible]	1.35
-r	5.97	1.30	-r	5.57	.83
-s	5.09	2.07	z-	5.51	1.86
-t	4.97	.06	-t	4.29	.06
z-	3.37	.71	-s	3.27	1.54
-k	2.78	.18	-sh	2.18	1.22
th-	2.54	.53	-b	1.92	.13
-g	2.01	.06	-j	1.54	.32
ch-	1.95	.83	ch-	1.47	.58
-b	1.89	.12	th-	1.41	.58

TABLE CS.26

Ten Most Frequently Misarticulated Consonants
(Total Sample)

Grade 12. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1669, Females 1565.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	11.08	1.74	-th-	7.99	.96
-r	6.47	1.08	-r	6.13	1.02
-t	5.51	.06	-t	4.86	0.00
-s	4.01	1.44	z-	4.73	1.85
z-	3.77	1.14	-s	2.68	1.28
-b	2.88	.12	-sh	2.11	.58
-k	2.64	.06	ch-	1.66	.51
-p	2.34	.12	-j	1.53	.45
th-	2.34	.72	-b	1.21	0.00
-g	2.16	.18	-k	1.09	.13

TABLE CS.27

Consonants Misarticulated by Class
(Total Sample)

Total Grades (1-12). Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 19973, Females 18829.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.11	.15	1.88	.07	.09	1.57
Labiodental	2.50	1.25	1.75	2.07	.97	1.18
Linguadental	6.18	11.36	10.62	3.52	8.62	7.07
Lingua-alveolar	2.58	2.32	4.02	2.13	1.52	3.08
Linguapalatal	2.37	2.71	5.41	1.79	1.98	4.62
Linguavelar	.17	.39	2.91	.07	.27	2.40
Glottal	.09	-	-	.05	-	-
Glide	.30	-	-	.16	-	-
Semivowel	1.60	1.96	5.30	1.00	1.31	4.55
Nasal	.14	.31	1.12	.12	.24	1.35
Stop	.08	.28	3.10	.05	.14	2.48
Fricative	4.48	5.76	5.71	3.29	4.26	4.01
Affricate	2.56	2.40	3.74	2.10	1.67	3.08
Voiceless	2.34	4.03	5.00	1.61	3.04	3.72
Voiced	1.88	1.62	3.11	1.45	1.09	2.59

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.03	.03	.10	.02	.03	.09
Labiodental	.40	.23	.23	.31	.18	.14
Linguadental	2.10	3.20	4.20	.92	1.78	2.13
Lingua-alveolar	1.32	1.17	1.50	.94	.76	.96
Linguapalatal	1.24	1.48	2.05	.86	.97	1.59
Linguavelar	.06	.09	.57	.03	.07	.67
Glottal	.01	-	-	.01	-	-
Glide	.10	-	-	.03	-	-
Semivowel	1.12	1.20	1.55	.66	.77	1.23
Nasal	.04	.08	.44	.05	.08	.56
Stop	.03	.05	.20	.01	.03	.16
Fricative	1.81	2.17	2.54	1.14	1.35	1.58
Affricate	1.12	1.00	1.51	.92	.65	1.12
Voiceless	1.11	1.46	1.72	.69	.89	1.07
Voiced	.72	.71	.91	.49	.47	.75

TABLE CS.28

Consonants Misarticulated by Class
(Total Sample)

Grade 1. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1670, Females 1530.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.39	.76	2.99	.23	.52	2.77
Labiodental	12.51	6.26	6.17	9.18	5.10	3.76
Linguadental	20.21	27.63	31.08	12.45	20.95	21.70
Lingua-alveolar	7.53	7.40	9.42	5.59	4.71	6.96
Linguapalatal	7.98	8.77	13.32	5.58	6.09	10.90
Linguavelar	1.23	1.54	5.39	.39	1.29	5.14
Glottal	.18	-	-	.26	-	-
Glide	1.56	-	-	.78	-	-
Semivowel	7.16	7.57	10.99	4.05	4.71	8.76
Nasal	.51	1.02	2.79	.49	.98	3.16
Stop	.56	1.31	4.68	.24	.87	4.05
Fricative	14.76	16.36	16.32	10.24	11.90	11.34
Affricate	7.43	6.77	11.02	6.34	4.64	9.48
Voiceless	7.62	10.38	12.13	5.26	7.70	9.20
Voiced	6.62	5.92	7.39	4.57	4.05	5.88

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.10	.08	.56	.07	.15	.52
Labiodental	2.60	1.32	1.41	1.44	1.21	.62
Linguadental	9.64	12.40	15.87	4.71	7.09	9.22
Lingua-alveolar	4.40	4.10	4.77	2.79	2.41	3.04
Linguapalatal	4.60	5.33	6.48	2.85	3.42	5.02
Linguavelar	.39	.44	1.76	.16	.39	1.92
Glottal	0.00	-	-	.07	-	-
Glide	.51	-	-	.13	-	-
Semivowel	5.18	4.91	5.57	2.75	3.01	3.89
Nasal	.18	.30	1.14	.26	.35	1.37
Stop	.14	.24	1.02	.10	.22	.80
Fricative	6.95	8.02	8.41	3.98	4.83	5.24
Affricate	3.47	3.29	4.52	2.61	2.09	3.99
Voiceless	3.97	4.98	5.67	2.35	3.00	3.60
Voiced	3.03	2.92	3.16	1.75	1.86	2.48

TABLE CS.29

Consonants Misarticulated by Class
(Total Sample)

Grade 2. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1645, Females 1573.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.18	.20	2.13	.14	.25	1.74
Labiodental	6.35	3.01	3.19	5.94	2.67	2.45
Linguadental	11.28	17.90	18.05	7.31	15.19	12.97
Lingua-alveolar	5.19	4.70	6.78	3.48	2.99	4.71
Linguapalatal	4.96	5.41	9.26	3.36	3.91	7.25
Linguavelar	.24	.69	3.73	.19	.53	3.52
Glottal	.18	-	-	0.00	-	-
Glide	.55	-	-	.22	-	-
Semivowel	4.07	4.56	7.93	2.61	2.99	6.93
Nasal	.36	.55	2.03	.38	.53	2.63
Stop	.10	.45	3.42	.12	.30	2.56
Fricative	8.86	10.28	10.46	6.33	8.04	7.29
Affricate	5.56	4.47	7.23	3.66	3.02	5.02
Voiceless	4.68	6.66	7.85	3.00	5.25	5.49
Voiced	3.88	3.42	5.17	2.93	2.47	4.27

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.02	0.00	.14	.03	.13	.15
Labiodental	.61	.46	.46	.89	.38	.13
Linguadental	3.65	6.11	8.09	2.07	3.72	3.94
Lingua-alveolar	2.81	2.53	3.08	1.62	1.52	1.83
Linguapalatal	2.70	3.13	4.00	1.84	1.89	2.59
Linguavelar	.06	.22	.91	.10	.19	1.21
Glottal	0.00	-	-	0.00	-	-
Glide	.21	-	-	.06	-	-
Semivowel	2.77	3.04	3.43	1.97	1.81	2.26
Nasal	.03	.18	.83	.19	.25	1.12
Stop	.02	.03	.20	.03	.06	.22
Fricative	3.53	4.41	5.11	2.17	2.72	2.86
Affricate	2.34	1.91	2.71	1.59	1.02	1.62
Voiceless	2.27	2.78	3.25	1.34	1.74	1.84
Voiced	1.43	1.61	1.87	1.01	.99	1.36

TABLE CS.30

Consonants Misarticulated by Class
(Total Sample)

Grade 3. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1651, Females 1557.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.18	.16	2.00	.19	.11	1.76
Labiodental	3.42	1.27	1.73	3.24	1.48	1.86
Linguadental	7.27	12.99	12.42	4.82	10.53	9.96
Lingua-alveolar	3.59	3.24	4.78	2.50	1.97	3.82
Linguapalatal	3.04	3.89	6.75	2.40	2.46	4.90
Linguavelar	.06	.38	3.47	.03	.19	3.32
Glottal	.06	-	-	0.00	-	-
Glide	.36	-	-	.29	-	-
Semivowel	2.00	2.73	6.36	1.57	1.64	4.50
Nasal	.18	.38	1.76	.32	.19	2.18
Stop	.07	.25	3.15	.03	.10	2.73
Fricative	5.85	7.16	6.85	4.24	5.45	5.45
Affricate	3.36	3.45	5.00	2.76	1.99	3.40
Voiceless	2.98	5.09	5.63	2.09	3.78	4.59
Voiced	2.48	2.04	3.90	1.94	1.36	3.15

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.03	.06	.06	.05	.02	.09
Labiodental	.30	.24	.09	.32	.22	.22
Linguadental	2.36	3.60	4.60	1.06	2.34	3.60
Lingua-alveolar	1.87	1.78	2.02	1.03	1.04	1.16
Linguapalatal	1.70	2.18	2.63	1.10	1.16	1.75
Linguavelar	0.00	.04	.77	.03	.02	.81
Glottal	.06	-	-	0.00	-	-
Glide	.12	-	-	.03	-	-
Semivowel	1.48	1.76	1.85	1.09	1.22	1.48
Nasal	.03	.06	.71	.06	.04	.73
Stop	.03	.05	.20	.01	.01	.15
Fricative	2.29	2.92	3.09	1.25	1.76	2.10
Affricate	1.73	1.45	2.18	1.12	.58	1.03
Voiceless	1.41	2.00	2.10	.85	1.11	1.38
Voiced	.96	.95	1.19	.54	.60	.88

TABLE CS.31

Consonants Misarticulated by Class
(Total Sample)

Grade 4. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1708, Females 1530.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.13	.14	1.21	.07	.07	1.05
Labiodental	2.25	.97	1.61	1.80	.42	1.27
Linguadental	6.94	11.80	10.07	3.56	9.28	6.93
Lingua-alveolar	2.70	2.48	4.13	2.02	1.32	2.88
Linguapalatal	2.68	3.56	5.61	1.67	2.08	4.75
Linguavelar	.06	.49	2.79	.07	.20	2.70
Glottal	0.00	-	-	0.00	-	-
Glide	.23	-	-	.07	-	-
Semivowel	1.58	2.40	5.56	.75	1.57	4.74
Nasal	.20	.47	1.23	.16	.22	1.55
Stop	.05	.26	2.61	.03	.08	2.22
Fricative	4.82	6.09	5.61	3.10	4.07	3.79
Affricate	2.90	3.04	4.19	2.29	1.83	3.40
Voiceless	2.56	4.44	4.82	1.52	3.24	3.44
Voiced	1.97	1.75	3.09	1.38	.88	2.68

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.07	.02	.02	0.00	.02	.07
Labiodental	.26	.09	.23	.29	.07	.10
Linguadental	1.81	3.40	3.75	.75	1.93	2.16
Lingua-alveolar	1.49	1.33	1.65	.81	.62	.90
Linguapalatal	1.42	1.80	2.31	.81	.90	1.55
Linguavelar	.06	.12	.74	0.00	.02	.65
Glottal	0.00	-	-	0.00	-	-
Glide	.03	-	-	.03	-	-
Semivowel	1.17	1.55	1.76	.39	.85	1.57
Nasal	.15	.20	.62	.03	.04	.61
Stop	.02	.02	.18	0.00	.01	.10
Fricative	1.88	2.35	2.58	.99	1.19	1.48
Affricate	1.32	1.14	1.87	1.08	.62	.85
Voiceless	1.21	1.66	1.76	.65	.89	1.02
Voiced	.75	.77	1.05	.40	.36	.72

TABLE CS.32

Consonants Misarticulated by Class
(Total Sample)

Grade 5. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males females. N = Males 1693, Females 1504.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.10	.14	.30	.05	.04	1.37
Labiodental	1.71	1.00	[illegible]	1.23	.57	1.03
Linguadental	5.76	12.37	[illegible]2	3.36	8.64	6.78
Lingua-alveolar	2.37	1.89	3.69	2.14	1.44	2.98
Linguapalatal	2.03	2.32	5.17	1.81	1.94	4.40
Linguavelar	.09	.16	3.64	.03	.18	2.48
Glottal	.06	-	-	0.00	-	-
Glide	.30	-	-	.10	-	-
Semivowel	.89	1.30	5.05	1.06	1.23	4.45
Nasal	.12	.12	1.32	.10	.16	1.31
Stop	.05	.23	3.67	.01	.06	2.45
Fricative	4.07	5.59	5.54	3.17	4.08	3.80
Affricate	2.27	2.39	3.37	1.70	1.83	2.79
Voiceless	2.11	4.05	5.00	1.47	3.06	3.50
Voiced	1.61	1.32	3.28	1.39	.92	2.54

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.01	.06	.10	.02	0.00	.04
Labiodental	.21	.15	0.00	.17	.10	.13
Linguadental	1.36	2.60	3.54	.70	1.30	1.46
Lingua-alveolar	1.08	.82	1.07	.99	.78	.88
Linguapalatal	.93	1.31	1.74	.85	.90	1.48
Linguavelar	.03	0.00	.69	.03	.04	.69
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	.03	-	-
Semivowel	.53	.77	1.06	.66	.60	1.20
Nasal	.03	.04	.57	.07	.04	.58
Stop	.02	.01	.12	.01	.02	.10
Fricative	1.39	1.69	2.00	1.11	1.19	1.36
Affricate	1.03	1.15	1.39	.76	.70	1.10
Voiceless	.89	1.24	1.42	.64	.81	.91
Voiced	.50	.49	.72	.49	.39	.71

TABLE CS.33

Consonants Misarticulated by Class
(Total Sample)

Grade 6. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1585, Females 1633.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.11	.08	2.17	.03	0.00	1.59
Labiodental	1.01	.57	1.20	.92	.43	1.04
Linguadental	5.62	10.41	9.02	2.88	7.59	5.27
Lingua-alveolar	1.90	1.76	3.56	1.70	1.01	2.81
Linguapalatal	1.70	1.85	4.34	1.41	1.50	3.69
Linguavelar	0.00	.23	2.84	.03	.12	2.39
Glottal	.06	-	-	.06	-	-
Glide	.13	-	-	.06	-	-
Semivowel	.79	1.04	4.13	.58	.95	3.89
Nasal	.13	.23	1.01	.03	.12	1.33
Stop	.02	.14	3.33	.03	.01	2.60
Fricative	3.53	4.81	4.64	2.49	3.36	3.14
Affricate	1.64	1.77	3.03	1.84	1.32	2.33
Voiceless	1.77	3.47	4.53	1.22	2.44	3.08
Voiced	1.36	1.09	2.63	1.09	.75	2.39

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.03	.02	.04	0.00	0.00	.04
Labiodental	.16	.09	.09	.18	.06	.06
Linguadental	1.39	2.02	3.22	.52	1.16	1.04
Lingua-alveolar	.98	.78	1.08	.79	.47	.65
Linguapalatal	.68	.96	1.40	.62	.86	1.19
Linguavelar	0.00	.04	.44	0.00	.06	.71
Glottal	0.00	-	-	0.00	-	-
Glide	.06	-	-	0.00	-	-
Semivowel	.41	.47	.66	.28	.55	.67
Nasal	0.00	.04	.38	0.00	.06	.65
Stop	0.00	.01	.11	0.00	0.00	.08
Fricative	1.30	1.45	1.91	.90	.89	1.03
Affricate	.57	.82	1.20	.77	.67	1.07
Voiceless	.74	1.04	1.35	.51	.63	.70
Voiced	.45	.38	.56	.36	.32	.60

TABLE CS.34

Consonants Misarticulated by Class
(Total Sample)

Grade 7. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1673, Females 1589.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.06	.08	1.35	.02	.02	1.32
Labiodental	.93	.45	1.23	.76	.31	.53
Linguadental	4.15	8.82	7.05	1.95	6.45	5.29
Lingua-alveolar	1.48	1.40	3.11	1.70	1.09	2.41
Linguapalatal	1.59	1.43	4.56	.96	.96	3.92
Linguavelar	.09	.26	2.57	.03	.19	2.12
Glottal	.18	-	-	.19	-	-
Glide	.12	-	-	.09	-	-
Semivowel	.60	.81	4.54	.31	.50	4.37
Nasal	.06	.26	.88	0.00	.21	1.01
Stop	.05	.16	2.71	.01	.06	2.38
Fricative	2.72	3.92	4.14	2.20	2.95	2.80
Affricate	2.00	1.46	2.66	1.10	.94	1.98
Voiceless	1.57	2.84	3.99	1.02	2.16	2.93
Voiced	1.04	.92	2.39	.89	.61	2.12

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.03	.02	.10	0.00	0.00	.02
Labiodental	.21	.09	.12	.06	.06	.09
Linguadental	1.08	2.21	2.81	.22	.98	1.13
Lingua-alveolar	.66	.62	1.00	.61	.45	.57
Linguapalatal	.88	.79	1.60	.30	.38	.98
Linguavelar	.06	.06	.42	0.00	.06	.63
Glottal	.06	-	-	0.00	-	-
Glide	.03	-	-	0.00	-	-
Semivowel	.48	.48	.84	.16	.19	.85
Nasal	.06	.04	.34	0.00	.06	.48
Stop	.04	.06	.17	0.00	.01	.13
Fricative	.99	1.30	1.76	.56	.74	1.01
Affricate	.96	.60	.34	.47	.35	.31
Voiceless	.75	.95	1.31	.29	.50	.63
Voiced	.34	.34	.59	.24	.21	.50

TABLE CS.35

Consonants Misarticulated by Class
(Total Sample)

Grade 8. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1602, Females 1596.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.08	.06	1.89	.05	.04	1.65
Labiodental	.42	.36	.87	.56	.31	.56
Linguadental	3.43	8.06	7.10	1.60	5.89	3.57
Lingua-alveolar	1.38	1.28	3.06	1.49	.90	2.18
Linguapalatal	1.19	1.50	3.91	.99	1.28	3.84
Linguavelar	0.00	.22	2.23	0.00	.17	1.82
Glottal	.12	-	-	.06	-	-
Glide	.06	-	-	.09	-	-
Semivowel	.69	.87	4.69	.28	.72	4.23
Nasal	.09	.18	.68	0.00	.15	1.04
Stop	0.00	.17	2.97	.01	.07	2.19
Fricative	2.25	3.61	3.64	1.91	2.69	2.38
Affricate	1.35	1.41	2.05	1.19	1.19	2.26
Voiceless	1.22	2.75	3.73	.88	2.12	2.60
Voiced	.88	.79	2.30	.81	.55	2.07

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.02	0.00	0.00	.02	.02	.04
Labiodental	.06	.06	.03	.09	0.00	0.00
Linguadental	.99	1.08	1.50	.19	.63	.69
Lingua-alveolar	.53	.42	.80	.61	.44	.55
Linguapalatal	.57	.66	1.14	.50	.61	1.08
Linguavelar	0.00	.04	.26	0.00	0.00	.42
Glottal	0.00	-	-	0.00	-	-
Glide	.03	-	-	.03	-	-
Semivowel	.48	.51	.93	.19	.31	.75
Nasal	0.00	.04	.18	0.00	.02	.36
Stop	0.00	.02	.07	0.00	.02	.08
Fricative	.77	.80	1.25	.63	.64	.86
Affricate	.51	.36	.69	.66	.53	.75
Voiceless	.49	.59	.84	.40	.47	.66
Voiced	.29	.24	.45	.24	.22	.40

TABLE CS.36

C nants Misarticulated by Class
(Total Sample)

Grade 9. P cent of times each of the classes of consonants was misar liated in each word position. Percentage figures are the a rage of the percent of misarticulation of the consonants in each class. Reults show stimulability characteristics of each class of consonants for males and females. N = Males 1668, Females 1577.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.03	.08	1.92	.03	.04	2.05
Labiodental	.45	.36	1.08	.48	.13	.48
Linguadental	3.57	8.09	7.43	1.81	5.80	4.25
Lingua-alveolar	1.56	1.24	2.85	1.28	.78	2.46
Linguapalatal	1.12	1.26	3.84	1.00	1.13	3.74
Linguavelar	.03	.26	2.10	0.00	.15	1.78
Glottal	0.00	-	-	.06	-	-
Glide	.09	-	-	.10	-	-
Semivowel	.51	.54	4.23	.29	.41	3.77
Nasal	0.00	.24	.64	0.00	.15	.78
Stop	.02	.14	2.81	0.00	.05	2.86
Fricative	2.39	3.57	3.71	1.74	2.55	2.54
Affricate	1.35	1.38	2.31	1.40	1.08	2.06
Voiceless	1.23	2.65	3.70	.89	2.05	3.17
Voiced	.93	.76	2.22	.72	.44	1.91

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	.02	.02	0.00	0.00	.04
Labiodental	.12	.06	.12	.10	.03	.13
Linguadental	1.11	1.74	2.70	.35	.57	1.08
Lingua-alveolar	.73	.61	.80	.53	.37	.48
Linguapalatal	.55	.58	1.00	.48	.52	1.41
Linguavelar	0.00	.04	.14	0.00	.04	.34
Glottal	0.00	-	-	0.00	-	-
Glide	.06	-	-	.03	-	-
Semivowel	.36	.24	.63	.19	.22	.82
Nasal	0.00	.06	.12	0.00	.06	.27
Stop	0.00	.03	.03	0.00	0.00	.10
Fricative	.96	1.12	1.48	.58	.59	.98
Affricate	.54	.54	.78	.30	.44	1.01
Voiceless	.62	.80	.98	.35	.42	.75
Voiced	.31	.28	.40	.26	.19	.45

TABLE CS.37

Consonants Misarticulated by Class
(Total Sample)

Grade 10. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1658, Females 1614.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.02	.02	1.81	.02	.02	1.84
Labiodental	.39	.27	.84	.37	.12	.56
Linguadental	1.81	6.66	5.61	.87	4.06	3.16
Lingua-alveolar	1.13	.89	2.53	1.17	.68	2.36
Linguapalatal	.88	.93	2.93	.88	.88	2.82
Linguavelar	.06	.08	2.33	.09	.17	1.73
Glottal	0.00	-	-	0.00	-	-
Glide	.06	-	-	.03	-	-
Semivowel	.24	.57	3.62	.19	.22	3.04
Nasal	0.00	.04	.32	0.00	.12	.58
Stop	.03	.07	2.90	.05	.03	2.68
Fricative	1.57	2.83	2.97	1.38	1.96	2.25
Affricate	1.36	.87	1.36	1.18	.93	1.52
Voiceless	.64	2.15	3.27	.65	1.55	2.74
Voiced	.03	.51	1.86	.64	.35	1.68

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	0.00	.02	0.00	.02	.06
Labiodental	.03	.12	.15	.12	0.00	.06
Linguadental	.51	1.09	1.75	.03	.40	.62
Lingua-alveolar	.49	.37	.74	.50	.40	.57
Linguapalatal	.33	.33	.68	.45	.40	.77
Linguavelar	.06	.04	.24	.03	.02	.35
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semivowel	.15	.18	.57	.12	.09	.34
Nasal	0.00	0.00	.14	0.00	.04	.27
Stop	.02	.04	.09	.01	0.00	.10
Fricative	.59	.71	1.17	.50	.56	.83
Affricate	.33	.27	.45	.62	.37	.71
Voiceless	.36	.52	.76	.32	.36	.57
Voiced	.20	.16	.36	.20	.18	.35

TABLE CS.38

Consonants Misarticulated by Class
(Total Sample)

Grade 11. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1691, Females 1561.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.03	.06	1.10	.02	0.00	1.11
Labiodental	.30	.12	.68	.38	.13	.42
Linguadental	2.10	5.65	4.38	1.22	5.29	3.40
Lingua-alveolar	1.03	.83	2.18	1.40	.80	1.78
Linguapalatal	.82	.90	2.68	.78	.80	2.69
Linguavelar	.06	.12	1.93	.03	.06	1.11
Glottal	.12	-	-	0.00	-	-
Glide	.12	-	-	.03	-	-
Semivowel	.30	.65	3.19	.22	.42	2.95
Nasal	.03	.08	.35	0.00	.04	.43
Stop	.03	.09	2.20	.02	.05	1.70
Fricative	1.51	2.39	2.48	1.65	2.35	2.00
Affricate	1.12	.92	1.54	.90	.64	1.51
Voiceless	.85	1.96	2.76	.78	1.75	2.17
Voiced	.60	.41	1.51	.66	.42	1.36

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	0.00	.02	.08	0.00	0.00	.06
Labiodental	.12	.03	.06	0.00	.03	0.00
Linguadental	.62	1.06	1.54	.54	.90	.64
Lingua-alveolar	.32	.34	.49	.57	.38	.49
Linguapalatal	.41	.33	.92	.31	.37	.78
Linguavelar	.06	.04	.18	0.00	.02	.23
Glottal	0.00	-	-	0.00	-	-
Glide	.03	-	-	0.00	-	-
Semivowel	.21	.30	.68	.10	.16	.45
Nasal	0.00	.02	.10	0.00	0.00	.19
Stop	.01	.02	.10	.01	.02	.09
Fricative	.49	.65	.92	.63	.69	.73
Affricate	.53	.18	.65	.35	.22	.24
Voiceless	.37	.51	.73	.36	.47	.55
Voiced	.17	.13	.29	.21	.16	.29

TABLE CS.39

Consonants Misarticulated by Class
(Total Sample)

Grade 12. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1669, Females 1565.

	Test					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.01	.06	1.76	.02	0.00	.58
Labiodental	.24	.33	.48	.29	.06	.32
Linguadental	2.04	6.02	3.83	.80	4.31	2.24
Lingua-alveolar	1.14	.76	2.15	1.21	.72	1.67
Linguapalatal	.49	.75	2.65	.77	.94	2.81
Linguavelar	.06	.28	1.96	0.00	.06	.75
Glottal	.12	-	-	0.00	-	-
Glide	.03	-	-	.06	-	-
Semivowel	.36	.42	3.30	.19	.54	3.16
Nasal	0.00	.20	.44	.03	.06	.34
Stop	.03	.13	2.65	.01	.02	1.32
Fricative	1.51	2.48	2.22	1.33	2.01	1.64
Affricate	.54	.84	1.17	1.02	.80	1.50
Voiceless	.72	1.91	2.68	.67	1.56	1.87
Voiced	.59	.50	1.63	.56	.38	1.20

	Verbal Stimulation					
	Males			Females		
Class	Initial	Medial	Final	Initial	Medial	Final
Labial	.01	.02	.08	.02	0.00	0.00
Labiodental	.09	.06	.03	.06	0.00	.10
Linguadental	.69	1.08	1.08	.10	.54	.26
Lingua-alveolar	.48	.37	.46	.48	.37	.44
Linguapalatal	.17	.30	.64	.29	.34	.64
Linguavelar	0.00	.02	.28	0.00	.02	.17
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	.03	-	-
Semivowel	.24	.21	.57	.13	.32	.58
Nasal	0.00	0.00	.20	0.00	.02	.15
Stop	.01	.03	.10	0.00	0.00	.02
Fricative	.56	.67	.77	.46	.52	.58
Affricate	.15	.27	.30	.35	.19	.48
Voiceless	.30	.45	.52	.24	.34	.34
Voiced	.20	.18	.31	.20	.17	.31

APPENDIX D

Acceptable Articulation (AA)

Cumulative Number of Consonants Misarticulated

Ten Most Frequently Misarticulated Consonants

Consonants Misarticulated by Class

TABLE DS.1

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Total Grades (1-12). Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 17689, Females 17584.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	61.08	63.63	86.76	88.58
5	93.65	95.30	98.47	98.94
10	98.73	99.27	99.87	99.94
15	99.79	99.93	99.99	99.99
20	99.97	99.99	100.00	99.99

TABLE DS.2

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 1. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1098, Females 1198.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	33.97	35.56	70.67	75.54
5	82.24	85.89	93.08	96.66
10	95.08	97.83	99.00	99.07
15	98.54	99.75	99.91	99.92
20	99.82	99.92	100.00	99.92

TABLE DS.3

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 2. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1239, Females 1350.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	45.60	47.56	78.45	79.93
5	87.73	90.30	97.26	97.78
10	97.82	98.44	99.68	99.85
15	99.52	99.78	100.00	100.00
20	99.84	100.00	100.00	-

TABLE DS.4

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 3. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1392, Females 1403.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	53.88	[illegible]	81.47	84.96
5	90.73	93.37	97.05	98.50
10	97.20	98.57	99.86	99.86
15	99.64	99.86	100.00	100.00
20	99.93	100.00	100.00	-

TABLE DS.5

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 4. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1514, Females 1412.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	55.88	61.65	83.42	86.75
5	93.32	94.35	98.30	99.02
10	98.93	99.51	99.87	99.93
15	99.87	99.86	99.93	100.00
20	100.00	100.00	-	-

TABLE DS.6

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 5. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1496, Females 1434.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	57.86	62.39	86.00	88.53
5	91.94	94.48	98.41	99.01
10	98.68	99.15	99.93	100.00
15	99.87	99.93	100.00	100.00
20	100.00	100.00	-	-

TABLE DS.7

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 6. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1450, Females 1554.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	61.79	66.09	87.45	89.58
5	93.51	95.50	98.83	98.65
10	98.83	99.16	99.86	100.00
15	99.86	100.00	100.00	-
20	100.00	-	-	-

TABLE DS.8

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 7. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1546, Females 1434.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	63.00	66.91	87.71	90.60
5	94.89	97.06	99.03	99.54
10	99.42	99.67	100.00	100.00
15	100.00	100.00	-	-
20	-	-	-	-

TABLE DS.9

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 8. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1534, Females 1542.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	64.80	70.04	90.29	92.15
5	96.15	97.67	99.35	99.42
10	99.28	99.74	100.00	100.00
15	99.93	99.94	100.00	100.00
20	100.00	100.00	-	-

TABLE DS.10

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 9. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1567, Females 1521.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	67.20	66.27	90.24	91.26
5	96.43	97.50	99.49	99.47
10	99.23	99.67	100.00	99.93
15	99.94	99.93	100.00	100.00
20	100.00	99.93	-	100.00

TABLE DS.11

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 10. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1595, Females 1547.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	69.22	72.24	91.72	92.88
5	96.80	97.90	99.75	99.42
10	99.56	99.47	100.00	100.00
15	100.00	100.00	-	-
20	-	-	-	-

TABLE DS.12

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 11. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1636, Females 1535.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	73.35	73.36	92.18	91.79
5	97.62	97.92	99.51	99.48
10	99.51	99.67	99.94	100.00
15	99.94	100.00	100.00	-
20	100.00	-	-	-

TABLE DS.13

Cumulative Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 12. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1622, Females 1529.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	72.93	75.28	93.77	94.57
5	97.10	98.69	99.57	99.61
10	99.75	99.80	100.00	100.00
15	99.94	100.00	100.00	-
20	100.00	-	-	-

TABLE DS.14

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Total Grades (1-12). Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males, 17689 Females 17584.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	16.08	3.27	-th-	13.21	1.97
-r	6.87	1.03	-r	6.53	1.14
-t	6.07	.11	-t	5.68	.05
-s	5.28	2.22	z-	5.53	1.71
z-	4.54	1.39	-s	3.90	1.48
th-	4.47	.80	-ng	2.96	1.33
-b	2.96	.07	-sh	2.86	1.21
v-	2.95	.22	v-	2.85	.28
-k	2.76	.09	-b	2.76	.09
-sh	2.80	1.24	th-	2.72	.35

TABLE DS.15

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 1. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males, 1098, Females 1198.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	31.60	8.93	-th-	26.79	5.51
v-	16.30	1.73	v-	13.19	1.34
z-	11.66	4.55	z-	10.43	3.84
-s	10.20	4.74	-s	8.76	2.67
th-	8.83	2.64	-r	7.51	1.67
-r	7.92	2.28	-ng	6.09	2.67
-sh	5.83	2.91	ch-	5.93	1.42
ch-	5.10	1.28	-t	5.84	.17
-t	4.92	.46	th-	5.68	1.17
-ng	4.55	2.09	-sh	5.18	2.67

TABLE DS.16

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 2. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1239, Females 1350.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	23.16	5.97	-th-	21.63	4.22
v-	9.04	.40	-r	8.44	1.63
-r	7.91	2.18	v-	8.81	.81
-s	7.75	3.71	z-	6.89	2.00
th-	7.02	.89	-s	6.44	3.19
-t	6.94	.08	th-	5.63	.52
z-	6.94	2.10	-ng	5.33	2.59
-sh	4.60	2.10	-t	4.67	.15
ch-	4.20	1.13	-sh	4.74	1.85
-ng	3.71	1.37	ch-	3.85	1.70

TABLE DS.17

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 3. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1392, Females 1403.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	19.47	4.45	-th-	15.89	2.99
-r	8.33	1.51	z-	6.06	1.35
-s	6.75	2.73	-t	5.99	.14
z-	6.54	2.51	-r	5.13	1.21
-t	5.96	.29	-s	5.06	1.92
th	5.60	.93	v-	4.99	.43
v-	4.81	.22	-ng	4.92	1.64
-b	3.30	.07	th-	3.99	.64
-ng	3.16	1.51	-sh	3.71	1.28
-sh	3.30	1.22	ch-	3.42	1.00

TABLE DS.18

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 4. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1496, Females 1434.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	17.58	4.61	-th-	15.76	2.93
th-	6.55	1.07	-r	7.74	2.16
-r	6.48	1.07	-t	5.58	0.00
-t	5.68	0.00	z-	4.81	1.26
-s	5.21	2.47	-ng	3.91	1.60
z-	4.61	2.01	th-	3.63	.35
ch-	3.48	1.20	-s	3.42	1.67
v-	3.34	.07	v-	2.86	.35
-sh	2.94	1.54	-j	2.79	.14
-k	2.14	.13	-ch	2.58	.56

TABLE DS.19

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 5. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1514, Females 1412.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	19.42	3.37	-th-	14.38	1.84
-r	7.86	.86	-r	7.08	1.35
-t	6.87	.07	z-	6.52	2.20
th-	5.48	1.06	-t	5.81	0.00
z-	5.22	1.32	th-	3.68	.35
-s	4.10	2.05	-s	3.54	1.27
-k	3.90	.26	-ng	3.26	1.49
-b	3.70	.07	-sh	3.12	1.13
-g	3.24	.13	-b	2.97	0.00
-sh	3.30	1.25	-g	2.05	.21

TABLE DS.20

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulations)

Grade 6. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1450, Females 1554.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	17.03	2.83	-th-	12.36	1.74
-t	7.24	.28	-r	6.11	.90
-r	6.21	.69	-t	5.86	0.00
th-	5.59	.90	z-	5.08	2.25
-s	5.17	2.00	-s	3.60	1.03
z-	4.07	1.45	-ng	3.09	1.74
-b	3.38	.07	-b	2.90	.06
-k	3.17	.07	th-	2.57	.26
-sh	2.83	1.31	ch-	1.87	.39
-p	2.48	0.00	-sh	1.87	.71

TABLE DS.21

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 7. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1546, Females 1434.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	14.17	3.10	-th-	11.23	1.44
-r	6.99	.91	-r	6.92	.91
-t	5.95	0.00	-t	6.46	0.00
-s	5.69	2.46	z-	5.42	1.70
th-	3.75	.65	-s	3.00	1.11
-sh	3.36	1.29	-sh	2.81	1.24
z-	3.04	.91	-b	2.74	0.00
-g	2.72	.13	-ng	2.55	1.37
-b	2.52	.06	th-	1.96	.20
-ch	2.46	1.10	-k	1.63	.13

TABLE DS.22

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 8. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1534, Females 1542.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	13.10	1.56	-th-	10.44	.71
-r	7.63	1.11	-r	7.26	1.10
-t	7.11	.13	z-	5.12	1.49
-s	4.17	1.69	-t	5.12	0.00
th-	3.65	.65	-b	3.44	.13
-b	3.39	0.00	-s	3.24	1.30
-z	3.19	.91	-ng	2.20	.84
-k	2.74	.07	-sh	2.20	.91
-g	2.48	.13	-j	1.88	.26
-p	2.28	0.00	th-	1.69	.19

TABLE DS.23

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 9. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1567, Females 1521.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	13.02	2.30	-th-	10.32	.99
-r	6.51	.38	-t	7.50	.13
-t	5.74	0.00	-r	6.64	1.12
-s	4.34	1.47	z-	4.47	1.45
z-	3.51	.96	-b	4.08	.07
th-	3.45	.38	-s	3.22	1.05
-b	3.45	0.00	-sh	3.02	1.78
-k	2.55	0.00	-p	2.10	.07
-g	2.17	0.00	-k	1.84	.07
-sh	2.17	1.15	th-	1.84	.26

TABLE DS.24

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 10. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1595, Female 1574.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	11.41	1.69	-th-	7.69	.57
-r	6.21	.44	-t	5.42	.06
-t	5.89	.13	-r	5.21	.51
-s	4.08	1.69	z-	4.19	.95
-k	3.26	.06	-b	3.30	.13
z-	3.26	.82	-s	3.05	1.14
-b	3.01	.06	-sh	2.41	.89
-g	2.76	.06	-p	2.16	0.00
-p	2.38	0.00	-ng	1.65	.83
th-	2.13	.31	-g	1.65	0.00

TABLE DS.25

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 11. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1636, Females 1535.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	9.78	1.53	-th-	8.86	1.24
-r	5.20	.92	-r	5.21	.72
-t	5.01	.06	z-	5.02	1.30
-s	4.40	1.65	-t	4.17	0.00
z-	2.75	.31	-s	2.67	1.04
-k	2.69	.12	-b	1.82	.07
th-	2.02	.31	-sh	1.76	.91
-g	2.02	0.00	-p	1.30	.07
-b	1.89	.06	ch-	1.30	.46
-z	1.77	.37	th-	1.24	.39

TABLE DS.26

Ten Most Frequently Misarticulated Consonants
(Acceptable Articulation)

Grade 12. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1622, Females 1529.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	10.42	1.42	-th-	7.72	.72
-r	5.98	.68	-r	5.62	.72
-t	5.49	0.00	-t	4.71	0.00
-s	3.70	1.17	z-	3.73	1.24
z-	2.96	.55	-s	2.16	.85
-b	2.84	.06	-sh	1.83	.46
-k	2.71	.06	ch-	1.44	.33
-p	2.34	.06	-j	1.24	.20
-g	2.16	.12	-b	1.24	0.00
th-	1.97	.49	-k	.98	0.00

TABLE DS.27

Consonants Misarticulated by Class
(Acceptable Articulation)

Total Grades (1-12). Percent of times each of the classes of consonants was misartuculated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 17689, Females 17584.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.04	.05	1.71	.03	.04	1.42
Labiodental	1.48	.62	1.01	1.43	.55	.73
Linguadental	4.16	9.03	7.82	2.50	7.23	5.47
Lingua-alveolar	1.37	1.09	2.71	1.38	.83	2.27
Linguapalatal	1.04	1.15	3.40	1.00	1.01	3.30
Linguavelar	.02	.14	2.40	.02	.12	2.01
Glottal	.05	-	-	.03	-	-
Glide	.07	-	-	.04	-	-
Semi-vowel	.49	.71	3.68	.40	.58	3.48
Nasal	.06	.14	.80	.05	.11	1.09
Stop	.01	.11	2.79	.01	.04	2.23
Fricative	2.65	3.78	3.59	2.22	3.08	2.77
Affricate	1.24	1.03	1.96	1.27	.84	1.91
Voiceless	1.27	2.77	3.65	.99	2.29	2.88
Voiced	1.04	.74	2.07	.95	.56	1.91

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	.01	.01	.04	.00	.01	.04
Labiodental	.11	.06	.04	.14	.06	.06
Linguadental	1.02	1.90	2.53	.44	1.08	1.31
Lingua-alveolar	.52	.43	.66	.48	.35	.46
Linguapalatal	.40	.46	.85	.37	.36	.82
Linguavelar	0.00	.02	.35	0.00	.02	.48
Glottal	0.00	-	-	0.00	-	-
Glide	.01	-	-	.01	-	-
Semi-vowel	.31	.34	.59	.20	.26	.62
Nasal	.01	.02	.30	.01	.03	.45
Stop	0.00	.01	.08	.00	.01	.05
Fricative	.76	1.01	1.25	.57	.69	.86
Affricate	.37	.26	.56	.44	.22	.46
Voiceless	.47	.71	.88	.34	.48	.59
Voiced	.25	.23	.37	.22	.17	.39

TABLE DS.28

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 1. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1098, Females 1198.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	.09	.21	1.91	.08	.11	2.00
Labiodental	8.24	3.37	2.23	6.64	3.09	1.63
Linguadental	12.07	18.76	20.13	8.18	15.28	15.28
Lingua-alveolar	3.35	3.02	4.42	2.78	1.98	3.83
Linguapalatal	2.64	2.64	5.31	2.50	2.21	5.28
Linguavelar	.14	.21	2.98	.04	.25	3.42
Glottal	0.00	-	-	0.00	-	-
Glide	.27	-	-	.21	-	-
Semi-vowel	1.91	2.23	4.64	1.42	1.46	4.38
Nasal	.14	.21	1.70	.33	.22	2.28
Stop	.06	.36	2.64	.04	.14	2.74
Fricative	7.99	9.04	8.21	6.08	7.33	6.40
Affricate	2.82	1.82	3.73	3.21	1.38	4.22
Voiceless	3.59	5.85	6.39	2.83	4.87	5.67
Voiced	3.25	2.28	3.26	2.60	1.63	3.05

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	.02	.03	.21	.02	0.00	.19
Labiodental	.87	.36	.14	.67	.46	.17
Linguadental	4.14	5.92	7.92	1.92	3.26	4.92
Lingua-alveolar	1.49	1.29	1.70	1.07	.86	.97
Linguapalatal	1.04	1.23	1.66	.80	.92	1.57
Linguavelar	0.00	.09	.85	0.00	.14	.97
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	1.14	1.32	1.55	.67	.79	.96
Nasal	.05	.09	.70	.13	.14	.92
Stop	0.00	.05	.29	0.00	.01	.17
Fricative	2.54	3.03	3.31	1.58	1.96	2.21
Affricate	.77	.59	.73	.75	.46	.96
Voiceless	1.41	1.89	2.23	.85	1.27	1.46
Voiced	.89	.87	.94	.62	.54	.83

TABLE DS.29

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 2. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1239, Females 1350

Test

	Males			Females		
	I	M	F	I	M	F
Labial	.08	.08	1.69	.07	.17	1.28
Labiodental	4.52	1.78	1.69	4.41	1.70	1.67
Linguadental	7.18	13.44	13.08	5.33	12.44	10.00
Lingua-alveolar	2.31	1.82	3.85	2.01	1.62	3.17
Linguapalatal	1.82	1.82	4.76	1.72	1.93	4.74
Linguavelar	.08	.05	2.99	.07	.17	2.89
Glottal	.08	-	-	0.00	-	-
Glide	.08	-	-	.04	-	-
Semi-vowel	1.25	1.49	4.44	.96	1.07	4.59
Nasal	.20	.08	1.45	.07	.15	1.93
Stop	.03	.11	2.97	.05	.15	2.14
Fricative	4.91	6.03	5.84	4.24	5.72	5.05
Affricate	2.22	1.45	3.27	2.11	1.59	2.89
Voiceless	2.30	4.06	5.10	1.84	3.92	4.06
Voiced	2.02	1.38	2.89	1.85	1.28	2.86

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.05	0.00	.10	.02
Labiodental	.20	.12	.08	.41	.15	0.00
Linguadental	1.21	3.47	4.60	.93	2.22	2.81
Lingua-alveolar	.91	.74	1.12	.72	.78	1.00
Linguapalatal	.81	.79	1.49	.81	.59	1.17
Linguavelar	0.00	0.00	.54	.04	.05	.91
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	.04	-	-
Semi-vowel	.93	.89	1.29	.56	.48	.89
Nasal	0.00	0.00	.46	0.00	.07	.86
Stop	0.00	0.00	.11	.01	.04	.06
Fricative	1.16	1.78	2.15	1.01	1.46	2.73
Affricate	.61	.28	.85	.89	.30	.59
Voiceless	.78	1.17	1.50	.72	.99	1.12
Voiced	.41	.45	.65	.36	.36	.67

TABLE DS.30

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 3. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1392, Females 1403.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	.13	.05	1.82	.11	.02	1.54
Labiodental	2.41	.79	1.33	2.49	1.00	1.14
Linguadental	5.24	11.03	9.63	3.64	8.80	7.70
Lingua-alveolar	2.00	1.78	3.32	1.63	1.06	2.80
Linguapalatal	1.36	1.78	4.24	1.28	1.32	3.23
Linguavelar	0.00	.22	2.83	0.00	.17	2.95
Glottal	0.00	-	-	0.00	-	-
Glide	.11	-	-	.07	-	-
Semi-vowel	1.01	1.36	4.49	.53	.61	2.85
Nasal	.18	.19	1.29	.18	.19	1.78
Stop	0.00	.10	2.89	0.00	.02	2.51
Fricative	3.61	5.07	4.60	2.98	3.93	3.84
Affricate	1.58	1.44	2.66	1.75	1.18	2.03
Voiceless	1.64	3.61	4.15	1.35	2.82	3.56
Voiced	1.53	1.11	2.72	1.28	.77	2.24

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	.02	0.00	.05	.02	0.00	.07
Labiodental	.11	.18	0.00	.21	.07	.11
Linguadental	1.22	2.59	3.02	.82	1.75	2.57
Lingua-alveolar	.83	.79	.92	.50	.55	.59
Linguapalatal	.57	.72	1.04	.44	.45	.82
Linguavelar	0.00	0.00	.55	0.00	.02	.62
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	.04	-	-
Semi-vowel	.75	.72	.86	.29	.36	.64
Nasal	.04	0.00	.53	0.00	.05	.57
Stop	0.00	.02	.10	0.00	0.00	.08
Fricative	.99	1.55	1.53	.70	1.06	1.24
Affricate	.54	.36	.72	.53	.25	.39
Voiceless	.57	1.07	1.06	.47	.72	.83
Voiced	.41	.38	.55	.24	.25	.46

TABLE DS.31

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 4. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1496, Females 1434.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.02	0.00	1.09	.07	.07	.95
Labiodental	1.67	.67	.90	1.43	.21	1.08
Linguadental	5.31	9.99	7.69	2.75	8.58	6.07
Lingua-alveolar	1.44	1.19	2.68	1.28	.79	2.32
Linguapalatal	1.47	1.91	3.58	1.02	1.24	3.91
Linguavelar	0.00	.20	2.03	0.00	.12	2.51
Glottal	0.00	-	-	0.00	-	-
Glide	.07	-	-	0.00	-	-
Semi-vowel	.50	1.14	3.61	.38	1.08	4.15
Nasal	.03	.18	.85	.10	.14	1.42
Stop	.02	.11	2.19	.01	.05	2.12
Fricative	3.09	4.28	3.58	2.17	3.27	2.93
Affricate	1.97	1.64	2.44	1.50	1.05	2.68
Voiceless	1.54	3.25	3.52	.96	2.63	2.92
Voiced	1.24	.89	1.92	.98	.56	2.26

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	.02	0.00	.02	0.00	.02	.02
Labiodental	.03	0.00	.10	.17	0.00	.03
Linguadental	1.14	2.57	2.47	.31	1.53	1.53
Lingua-alveolar	.68	.53	.72	.43	.30	.49
Linguapalatal	.59	.75	1.14	.45	.40	.98
Linguavelar	0.00	.02	.45	0.00	0.00	.56
Glottal	0.00	-	-	0.00	-	-
Glide	.03	-	-	0.00	-	-
Semi-vowel	.30	.57	.57	.21	.45	1.19
Nasal	.03	.04	.42	0.00	0.00	.53
Stop	0.00	0.00	.03	0.00	.01	.03
Fricative	.90	1.33	1.40	.51	.74	.88
Affricate	.74	.43	.97	.63	.21	.35
Voiceless	.59	1.03	1.03	.36	.58	.61
Voiced	.32	.27	.43	.20	.16	.48

TABLE DS.32

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 5. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1514, Females 1412.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.07	.07	2.14	.02	.05	1.37
Labiodental	1.02	.36	1.35	.85	.32	.74
Linguadental	4.76	11.00	9.38	2.83	7.79	5.88
Lingua-alveolar	1.53	1.07	2.73	1.56	.90	2.31
Linguapalatal	1.11	1.04	4.00	1.12	1.12	3.40
Linguavelar	0.00	.09	3.41	0.00	.09	2.34
Glottal	.07	-	-	0.00	-	-
Glide	.20	-	-	0.00	-	-
Semi-vowel	.33	.40	4.10	.60	.67	3.79
Nasal	.10	.07	1.17	.04	.07	1.13
Stop	0.00	.13	3.48	0.00	.04	2.42
Fricative	2.83	4.24	3.95	2.37	3.23	2.84
Affricate	1.35	1.16	2.41	1.06	1.06	1.70
Voiceless	1.37	3.15	4.08	.99	2.50	2.89
Voiced	1.10	.71	2.59	1.04	.54	2.07

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	.02	.02	.02	0.00	0.00	.02
Labiodental	.03	0.00	0.00	.07	.04	.11
Linguadental	.96	1.92	2.71	.42	.96	.99
Lingua-alveolar	.53	.40	.63	.53	.38	.41
Linguapalatal	.45	.54	.89	.41	.34	.85
Linguavelar	0.00	0.00	.59	0.00	0.00	.57
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.23	.23	.50	.25	.21	.81
Nasal	.03	0.00	.46	0.00	0.00	.50
Stop	0.00	.01	.09	0.00	0.00	.05
Fricative	.75	.99	1.25	.62	.67	.76
Affricate	.46	.50	.73	.39	.25	.46
Voiceless	.48	.73	.91	.33	.50	.51
Voiced	.24	.22	.42	.25	.14	.43

TABLE DS.33

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 6. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1450, Females 1554.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.02	.05	2.02	0.00	0.00	1.46
Labiodental	.66	.41	.86	.68	.29	.84
Linguadental	4.55	9.38	7.59	2.22	7.01	4.31
Lingua-alveolar	1.20	.99	2.75	1.28	.69	2.24
Linguapalatal	1.03	1.14	3.31	.88	.85	2.73
Linguavelar	0.00	.14	2.51	0.00	.11	2.08
Glottal	.07	-	-	0.00	-	-
Glide	.03	-	-	.03	-	-
Semi-vowel	.38	.62	3.31	.35	.64	3.19
Nasal	0.00	.14	.80	0.00	.11	1.16
Stop	0.00	.09	3.15	0.00	.01	2.32
Fricative	2.51	3.77	3.41	1.87	2.79	2.38
Affricate	1.00	1.00	2.10	1.06	.61	1.48
Voiceless	1.20	2.82	3.84	.87	2.03	2.48
Voiced	.93	.67	1.99	.77	.52	1.92

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.02	.02	0.00	0.00	.02
Labiodental	.10	.03	.07	.10	.06	.03
Linguadental	1.03	1.59	2.83	.39	.97	.77
Lingua-alveolar	.51	.34	.55	.58	.24	.36
Linguapalatal	.30	.48	.79	.30	.45	.60
Linguavelar	0.00	.05	.32	0.00	.04	.62
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.17	.21	.34	.16	.39	.48
Nasal	0.00	.05	.30	0.00	.04	.58
Stop	0.00	.01	.07	0.00	0.00	.04
Fricative	.75	.87	1.22	.63	.59	.60
Affricate	.24	.38	.59	.29	.19	.39
Voiceless	.43	.66	.91	.30	.39	.39
Voiced	.23	.18	.29	.25	.19	.39

TABLE DS.34

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 7. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1546, Females 1532.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.04	1.36	0.00	0.00	1.26
Labiodental	.71	.23	1.07	.49	.16	.29
Linguadental	3.40	7.76	5.69	1.57	5.91	4.44
Lingua-alveolar	1.02	.84	2.62	1.38	.79	2.13
Linguapalatal	1.02	.76	3.49	.65	.55	3.21
Linguavelar	.03	.15	2.37	.03	.13	1.85
Glottal	.06	-	-	.20	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.39	.39	3.62	.20	.26	3.66
Nasal	0.00	.17	.73	0.00	.13	.91
Stop	.01	.06	2.66	.01	.03	2.24
Fricative	2.05	3.05	3.28	1.72	2.47	2.23
Affricate	1.16	.81	1.81	.85	.55	1.57
Voiceless	1.13	2.24	3.42	.77	1.88	2.60
Voiced	.73	.56	1.94	.69	.38	1.74

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.02	0.00	0.00	0.00
Labiodental	.10	0.00	.03	0.00	.03	.03
Linguadental	.87	1.71	2.01	.10	.72	.78
Lingua-alveolar	.41	.37	.65	.40	.30	.36
Linguapalatal	.43	.32	.92	.20	.18	.62
Linguavelar	0.00	0.00	.28	0.00	.02	.50
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.26	.13	.45	.10	.12	.52
Nasal	0.00	0.00	.24	0.00	.02	.46
Stop	0.00	.01	.05	0.00	0.00	.03
Fricative	.66	.89	1.19	.34	.49	.67
Affricate	.36	.19	.74	.33	.20	.16
Voiceless	.46	.61	.86	.17	.35	.44
Voiced	.18	.17	.34	.16	.11	.31

TABLE DS.35

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 8. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misartuculation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1534, Females 1542.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.07	0.00	1.98	.03	.02	1.66
Labiodental	.42	.16	.72	.45	.16	.42
Linguadental	2.77	7.20	6.52	1.26	5.48	3.05
Lingua-alveolar	.95	.78	2.61	1.15	.56	1.81
Linguapalatal	.76	.98	3.19	.64	.73	3.21
Linguavelar	0.00	.17	2.15	0.00	.13	1.64
Glottal	.07	-	-	.06	-	-
Glide	.07	-	-	.03	-	-
Semi-vowel	.23	.46	4.04	.10	.39	3.79
Nasal	.07	.13	.61	0.00	.13	.91
Stop	0.00	.13	3.06	.01	.03	2.13
Fricative	1.73	2.83	2.92	1.48	2.20	1.84
Affricate	.81	.98	1.47	.78	.65	1.69
Voiceless	.87	2.24	3.37	.61	1.78	2.24
Voiced	.64	.49	1.99	.63	.31	1.78

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	.02	0.00	0.00	0.00	0.00	.04
Labiodental	.03	0.00	.03	.03	0.00	0.00
Linguadental	.72	.85	1.04	.13	.36	.52
Lingua-alveolar	.23	.17	.47	.41	.21	.34
Languapalatal	.27	.29	.70	.26	.24	.75
Linguavelar	0.00	.04	.22	0.00	0.00	.30
Glottal	0.00	-	-	0.00	-	-
Glide	.03	-	-	0.00	-	-
Semi-vowel	.16	.20	.55	.03	.10	.55
Nasal	0.00	.04	.15	0.00	0.00	.30
Stop	0.00	.01	.07	0.00	0.00	.03
Fricative	.43	.47	.77	.41	.33	.56
Affricate	.23	.10	.39	.39	.19	.49
Voiceless	.28	.34	.53	.24	.24	.44
Voiced	.14	.11	.28	.14	.08	.28

TABLE DS.36

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 9. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1567, Females 1521.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.02	.06	1.87	.03	.04	2.13
Labiodental	.32	.26	.80	.43	.10	.33
Linguadental	3.03	7.43	6.96	1.51	5.29	3.62
Lingua-alveolar	1.02	.69	2.31	1.02	.53	2.17
Linguapalatal	.61	.64	2.92	.71	.72	3.22
Linguavelar	0.00	.15	1.91	0.00	.04	1.69
Glottal	0.00	-	-	.07	-	-
Glide	.06	-	-	.07	-	-
Semi-vowel	.16	.22	3.45	.13	.20	3.39
Nasal	0.00	.17	.55	0.00	.04	.70
Stop	0.00	.10	2.72	0.00	.03	2.87
Fricative	1.76	2.84	2.92	1.44	2.14	2.05
Affricate	.70	.64	1.50	.92	.69	1.61
Voiceless	.86	2.08	3.20	.67	1.73	2.88
Voiced	.63	.51	1.80	.59	.27	1.69

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	0.00	0.00	0.00	.04
Labiodental	.06	.03	0.00	.07	.03	.10
Linguadental	.73	1.34	2.36	.23	.49	.79
Lingua-alveolar	.36	.27	.43	.35	.20	.31
Linguapalatal	.29	.29	.57	.24	.21	1.07
Linguavelar	0.00	0.00	.11	0.00	0.00	.26
Glottal	0.00	-	-	0.00	-	-
Glide	.03	-	-	0.00	-	-
Semi-vowel	.06	.10	.26	.03	.07	.56
Nasal	0.00	0.00	.11	0.00	0.00	.24
Stop	0.00	.02	.01	0.00	0.00	.08
Fricative	.57	.69	.98	.40	.39	.72
Affricate	.26	.16	.38	.30	.13	.69
Voiceless	.40	.49	.69	.21	.27	.58
Voiced	.13	.13	.18	.15	.08	.31

TABLE DS.37

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 10. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1595, Females 1574.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.02	0.00	1.84	0.00	.02	1.86
Labiodental	.34	.16	.72	.35	.10	.44
Linguadental	1.57	6.21	5.14	.83	3.91	2.99
Lingua-alveolar	.84	.61	2.19	.88	.38	2.02
Linguapalatal	.64	.69	2.51	.71	.68	2.56
Linguavelar	0.00	.04	2.24	.03	.11	1.61
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.13	.41	3.26	.13	.16	2.76
Nasal	0.00	.04	.29	0.00	.11	.59
Stop	.01	.03	2.94	.02	.01	2.60
Fricative	1.25	2.40	2.49	1.12	1.62	1.85
Affricate	.91	.66	1.03	.95	.70	1.30
Voiceless	.61	1.90	3.01	.49	1.33	2.51
Voiced	.51	.34	1.63	.53	.23	1.51

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.02	0.00	.02	.04
Labiodental	0.00	.03	.06	.10	0.00	.03
Linguadental	.34	.91	1.50	.03	.29	.51
Lingua-alveolar	.27	.18	.49	.23	.16	.31
Linguapalatal	.18	.11	.41	.37	.32	.62
Linguavelar	0.00	0.00	.19	0.00	0.00	.28
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.06	.06	.31	.06	.03	.25
Nasal	0.00	0.00	.15	0.00	.02	.28
Stop	0.00	.01	.05	0.00	0.00	.03
Fricative	.34	.44	.82	.29	.30	.54
Affricate	.16	.06	.28	.54	.32	.54
Voiceless	.20	.34	.56	.20	.22	.42
Voiced	.11	.05	.21	.13	.09	.23

TABLE DS.38

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 11. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1636, Females 1535.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.04	1.10	.02	0.00	1.04
Labiodental	.15	.09	.61	.33	.10	.36
Linguadental	1.74	5.20	3.91	1.07	4.85	3.13
Lingua-alveolar	.78	.57	1.95	1.17	.53	1.54
Linguapalatal	.50	.61	2.22	.68	.67	2.36
Linguavelar	0.00	.08	1.83	.03	.07	.98
Glottal	.06	-	-	0.00	-	-
Glide	.03	-	-	.03	-	-
Semi-vowel	.09	.31	2.75	.20	.29	2.74
Nasal	.03	.08	.29	0.00	.04	.39
Stop	0.00	.06	2.19	.01	.03	1.56
Fricative	1.17	2.04	2.10	1.41	2.00	1.68
Affricate	.70	.64	1.19	.78	.52	1.24
Voiceless	.62	1.68	2.50	.63	1.52	1.93
Voiced	.42	.28	1.32	.59	.31	1.20

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.06	0.00	0.00	.04
Labiodental	0.00	0.00	0.00	0.00	0.00	0.00
Linguadental	.46	.79	1.22	.42	.75	.46
Lingua-alveolar	.18	.20	.36	.37	.21	.29
Linguapalatal	.18	.18	.58	.22	.23	.60
Linguavelar	0.00	.02	.12	0.00	.02	.22
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.06	.09	.46	.10	.10	.36
Nasal	0.00	.02	.08	0.00	0.00	.20
Stop	0.00	0.00	.07	0.00	.01	.03
Fricative	.30	.47	.66	.43	.47	.52
Affricate	.21	.03	.34	.26	.10	.39
Voiceless	.24	.37	.53	.25	.33	.39
Voiced	.06	.06	.18	.15	.09	.21

TABLE DS.39

Consonants Misarticulated by Class
(Acceptable Articulation)

Grade 12. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1622, Females 1529.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.06	1.75	0.00	0.00	.59
Labiodental	.09	.25	.43	.16	.07	.23
Linguadental	1.66	5.46	3.45	.52	4.15	2.16
Lingua-alveolar	.89	.55	1.95	.88	.47	1.40
Linguapalatal	.26	.51	2.34	.56	.56	2.45
Linguavelar	0.00	.21	1.93	0.00	.04	.68
Glottal	.12	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.12	.22	3.02	.13	.43	2.84
Nasal	0.00	.18	.39	0.00	.04	.31
Stop	0.00	.08	2.64	.01	.02	1.28
Fricative	1.16	2.14	1.91	.95	1.67	1.33
Affricate	.40	.55	.96	.78	.39	1.18
Voiceless	.53	1.71	2.5ɔ	.47	1.32	1.68
Voiced	.42	.32	1.47	.41	.26	1.01

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.02	.04	0.00	0.00	0.00
Labiodental	.03	.03	.03	.03	0.00	.10
Linguadental	.49	.83	.92	0.00	.39	.13
Lingua-alveolar	.30	.24	.31	.29	.17	.25
Linguapalatal	.04	.15	.40	.13	.18	.41
Linguavelar	0.00	0.00	.23	0.00	0.00	.13
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	.03	.06	.34	.07	.23	.39
Nasal	0.00	0.00	.16	0.00	0.00	.13
Stop	0.00	.01	.05	0.00	0.00	0.00
Fricative	.35	.48	.58	.25	.28	.37
Affricate	.06	.15	.15	.16	.07	.23
Voiceless	.21	.34	.39	.12	.20	.21
Voiced	.09	.09	.20	.11	.08	.20

APPENDIX E

Mild Articulation Deviation (MIAD)

Cumulative Number of Consonants Misarticulated

Ten Most Frequently Misarticulated Consonants

Consonants Misarticulated by Class

TABLE ES.1

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Total Grades (1-12). Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 1796, Females 969.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	11.97	8.67	35.02	29.41
5	50.17	46.85	74.67	74.10
10	80.07	80.29	93.93	94.84
15	92.65	93.50	98.72	98.56
20	98.39	98.35	99.78	100.00

TABLE ES.2

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 1. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 375, Females 220.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	4.00	3.64	23.20	18.64
5	31.20	34.09	64.00	68.18
10	64.80	71.82	89.60	91.36
15	84.53	89.55	97.60	97.27
20	95.73	96.36	98.93	100.00

TABLE ES.3

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 2. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 301, Females 179.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	7.97	6.15	28.24	29.05
5	42.86	39.66	69.77	68.16
10	75.42	75.42	92.36	92.18
15	92.69	90.50	98.01	96.65
20	98.01	96.65	100.00	100.00

TABLE ES.4

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 3. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 219, Females 130.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	11.87	3.08	35.16	20.77
5	50.68	43.08	71.69	73.08
10	82.19	76.92	94.52	96.92
15	93.15	95.38	100.00	100.00
20	99.09	100.00	100.00	-

TABLE ES.5

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 4. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 179, Females 82.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	10.41	13.41	29.61	34.15
5	44.69	56.10	73.74	81.71
10	78.77	89.02	93.30	96.34
15	94.97	98.78	99.44	98.78
20	98.88	98.78	100.00	100.00

TABLE ES.6

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 5. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 149, Females 71.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	15.44	12.68	38.93	32.39
5	55.70	49.30	84.56	76.06
10	85.91	87.32	95.97	95.77
15	93.96	95.77	98.66	98.59
20	98.66	100.00	100.00	-

219

TABLE ES.7

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 6. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 119, Females 66.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	13.45	12.12	47.90	37.88
5	57.98	57.58	78.99	80.30
10	84.87	83.33	94.96	98.48
15	92.44	92.42	96.64	100.00
20	100.00	100.00	-	-

TABLE ES.8

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 7. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 111, Females 48.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	17.12	14.58	46.85	39.58
5	69.37	58.33	87.39	83.33
10	94.59	87.50	99.10	100.00
15	99.10	95.83	100.00	100.00
20	100.00	100.00	-	-

TABLE ES.9

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 9. Summary of results showing percent of subjects who misarticulatcd a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 120, Females 44.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	21.67	18.18	43.33	52.27
5	66.67	56.82	84.17	86.36
10	90.83	86.36	97.50	95.45
15	97.50	100.00	100.00	100.00
20	99.17	-	100.00	-

TABLE ES.10

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 10. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 86, Females 48.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	19.77	20.83	46.51	47.92
5	65.12	66.67	82.56	83.33
10	90.70	87.50	94.19	97.92
15	94.19	95.83	100.00	100.00
20	100.00	100.00	-	-

TABLE ES.11

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 10. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 55, Females 31.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	23.64	9.68	52.73	32.26
5	74.55	70.97	83.64	77.42
10	94.55	90.32	96.36	93.55
15	100.00	96.77	-	100.00
20	-	100.00	-	-

TABLE ES.12

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 11. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 45, Females 20.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	17.78	5.00	44.44	20.00
5	71.11	55.00	84.44	75.00
10	93.33	90.00	100.00	100.00
15	100.00	95.00	-	100.00
20	-	95.00	-	100.00

TABLE ES.13

Cumulative Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 12. Summary of results showing percent of subjects who misarticulated a specified number of 72 consonants, /hw/ excluded. Performance differences between test and verbal stimulation conditions and also between males and females are shown. N = Males 37, Females 30.

No. Misart.	Test		Stimulation	
	Males	Females	Males	Females
0	24.32	13.33	51.35	33.33
5	70.27	50.00	78.38	66.67
10	86.49	90.00	97.30	96.67
15	97.30	93.33	97.30	100.00
20	100.00	100.00	-	-

TABLE ES.14

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Total Grades (1-12). Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 1796, Females 969.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	38.25	14.37	-th-	38.18	11.87
z-	27.90	16.26	z-	33.44	17.44
s-	27.12	17.71	s-	29.41	17.75
-r	25.56	10.63	-r	28.79	12.18
th-	16.48	6.29	v-	17.23	3.51
v-	14.31	2.39	ch-	15.69	7.22
-ch	13.86	6.74	-sh	15.07	9.18
-sh	13.42	8.85	-j	12.90	5.57
-j	9.86	3.73	th-	12.07	3.51
-ng	7.29	3.73	-ng	9.91	5.37

TABLE ES.15

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 1. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 375, Females 220.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	51.47	26.13	-th-	49.55	20.00
z-	37.87	23.20	z-	38.64	20.00
-s	33.60	20.00	-s	34.09	24.09
v-	30.67	4.80	-r	30.91	16.36
-r	26.67	12.00	v-	26.36	6.36
th-	22.13	11.20	-th-	21.36	14.09
-ch	20.27	7.47	-ch	18.18	10.45
-sh	19.47	12.00	-j	17.73	6.36
-j	14.13	4.80	-sh	17.27	8.18
-t	10.40	1.33	-ng	12.73	7.27

TABLE ES.16

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 2. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 301, Females 179.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	42.52	17.61	-th-	41.34	15.08
-z	36.54	22.59	z-	35.20	17.32
s-	31.89	21.93	-r	34.64	16.76
-r	26.58	11.96	s-	28.49	17.32
v-	18.27	2.66	v-	26.82	5.03
th-	17.61	5.32	ch-	16.20	6.15
ch-	14.62	5.65	-th-	14.53	5.59
-sh	13.95	7.97	-sh-	13.97	6.15
-j	10.96	2.99	-j	13.41	4.47
-ng	8.31	5.32	-ng	13.41	7.26

TABLE ES.17

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 3. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 219, Females 130.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	35.16	11.42	-th-	38.46	10.77
z-	31.51	18.26	-z	30.00	15.38
s-	28.77	17.81	s-	29.23	16.92
-r	25.11	9.13	-r	29.23	12.31
th-	17.35	7.31	v-	19.23	3.08
v-	14.61	1.83	-ch	18.46	6.92
ch-	14.61	8.68	th-	15.38	1.54
-sh	13.70	8.68	-ng	14.62	6.92
-ng	11.42	4.57	-sh	13.85	9.23
-j	10.05	3.65	-j	10.00	3.85

TABLE ES.18

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 4. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 179, Females 82.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	35.75	10.61	z-	40.24	15.85
-r	31.84	15.64	-th-	30.49	9.46
s-	29.61	17.32	s-	28.05	13.41
-z	26.82	13.97	-r	24.39	13.41
th-	16.20	3.91	ch-	17.07	7.32
-ch	14.53	5.59	-sh	14.63	9.76
sh-	13.41	8.94	v-	10.98	1.22
v-	11.73	3.25	th-	10.98	3.66
-j	10.61	5.03	-ng	10.98	4.88
-g	8.38	1.68	-j	9.76	3.66

TABLE ES.19

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 5. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 149, Females 71.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	35.57	11.41	-th-	36.62	5.63
s-	25.50	16.78	s-	29.58	18.31
-z	25.50	11.41	-z	25.35	16.90
-r	22.82	10.07	-r	22.54	8.45
sh-	16.11	8.05	sh-	19.72	9.86
th-	14.77	5.37	-ch	18.31	9.86
-ch-	14.09	7.38	-j	12.68	7.04
v-	8.72	1.34	th-	9.86	1.41
-j	7.38	4.03	v-	8.45	0.00
-t	6.71	0.00	-ng	5.63	4.23

TABLE ES.20

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 6. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 119, Females 66.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	34.45	6.72	-th-	36.36	9.09
-s	26.05	16.81	z-	34.85	12.12
-z	25.21	15.13	-r	31.82	9.09
-r	21.85	5.88	-s	24.24	12.12
th-	16.81	5.88	-sh	19.70	12.12
sh-	15.97	8.40	ch-	18.18	10.61
-ch	12.61	8.40	th-	18.18	3.03
-j	10.08	5.04	-t	13.64	0.00
v-	8.40	.84	v-	10.61	3.03
-g	6.72	0.00	-j	10.61	9.09

TABLE ES.21

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 7. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 111, Females 48.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	31.53	10.18	z-	33.33	16.67
-r	25.23	6.31	-r	33.33	6.25
s-	18.02	9.91	s-	25.00	16.67
z-	17.12	7.21	-th-	25.00	8.33
th-	16.22	3.60	-sh	20.83	14.58
ch-	12.61	7.21	-ch-	12.50	2.08
-sh	10.81	8.11	-j	12.50	6.25
-ng	5.41	2.70	v-	10.42	2.08
j-	5.41	2.70	th-	10.42	0.00
v-	4.50	.90	-g	10.42	4.17

TABLE ES.22

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 8. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 120, Females 44.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	29.17	6.67	z-	29.55	11.36
-r	23.33	10.00	-th-	27.27	6.82
-s	20.00	14.17	s-	25.00	11.36
-z	19.17	8.33	-r	20.45	2.27
-ch-	10.00	5.00	ch-	18.18	11.36
-sh	9.17	7.50	-sh	18.18	13.64
th-	8.33	4.17	-j	15.91	4.55
-v-	5.00	1.67	th-	13.64	0.00
-j	5.00	2.50	-k	6.82	2.27
-ng	5.00	1.67	v-	6.82	2.27

TABLE ES.23

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 9. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 86, Females 48.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	29.07	10.47	-th-	35.42	2.08
z-	26.74	15.12	-s	22.92	12.50
-r	26.74	11.63	z-	20.83	8.33
s-	24.42	17.44	-r	20.83	8.33
-ch-	15.12	6.98	-sh	16.67	10.42
th-	12.79	5.81	ch-	14.58	10.42
sh-	8.14	1.16	-t	8.33	0.00
-j	8.14	2.33	-j	8.33	4.17
-k	5.81	0.00	-ng	6.25	0.00
-v	5.81	2.33	-v	6.25	2.08

TABLE ES.24

Ten Most Frequently Misarticulated Consonants
(Mild Articulation Deviation)

Grade 10. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 55, Females 31.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-s	25.45	18.18	-s	41.94	29.03
-z-	23.64	14.55	z-	35.48	29.03
-th-	23.64	8.64	-r	19.35	3.23
-r	16.36	5.45	-th-	19.35	6.45
sh-	9.09	5.45	-ch-	12.90	3.23
-j	9.09	1.82	-sh-	9.68	3.23
-ch-	7.27	5.45	-k	6.45	3.23
-t	5.45	0.00	-t	6.45	0.00
-g	5.45	0.00	-j	6.45	6.45
-d	5.45	1.82	-g	6.45	3.23

TABLE ES.25

Ten Most Frequently Misarticulated Consonants
(Most Articulation Deviation)

Grade 11. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 45, Females 20.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-r	26.67	8.89	-th-	50.00	0.00
-th-	26.67	6.67	-s	35.00	25.00
-s	24.44	13.33	z-	25.00	25.00
z-	17.78	11.11	-r	25.00	5.00
ch-	13.33	6.67	-sh	20.00	15.00
th-	13.33	2.22	-k	15.00	0.00
-sh	11.11	11.11	-g	15.00	0.00
-l-	8.89	0.00	v-	10.00	0.00
-ng	8.89	2.22	-th-	10.00	5.00
-k	4.44	0.00	-t	10.00	0.00

TABLE ES.26

Ten Most Frequently Misarticulated Consonants
(Most Articulation Deviation)

Grade 12. Percent of subjects who misarticulated each of the ten most frequently misarticulated consonants, /hw/ excluded. The consonants are arranged in descending rank order for males and females for the test condition. N = Males 37, Females 30.

Males			Females		
Rank	Test	Stimulation	Rank	Test	Stimulation
-th-	29.73	10.81	z-	43.33	26.67
z-	27.03	16.22	s-	40.00	20.00
s-	24.32	16.22	-r	26.67	10.00
-r	18.92	10.81	-ch-	16.67	3.33
-sh	13.51	10.81	-sh-	16.67	6.67
-ch-	10.81	5.41	-th-	16.67	6.67
th-	10.81	2.70	-t	13.33	0.00
-t	5.41	0.00	-j	13.33	10.00
-j	5.41	2.70	v-	6.67	0.00
-ng	5.41	5.41	th-	6.67	0.00

TABLE ES.27

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Total Grades (1-12). Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 1796, Females 969.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.35	.28	2.58	.46	.28	2.82
Labiodental	7.21	3.98	4.87	8.62	5.21	5.11
Linguadental	17.43	24.16	26.84	13.36	24.82	24.97
Lingua-alveolar	9.60	9.21	11.45	10.82	9.08	12.26
Linguapalatal	8.44	9.80	15.67	9.31	11.25	17.91
Linguavelar	.36	.85	5.59	.21	1.07	5.99
Glottal	.17	-	-	.21	-	-
Glide	.61	-	-	1.24	-	-
Semi-vowel	6.71	7.68	14.84	6.55	8.57	16.51
Nasal	.61	.65	3.23	1.14	1.07	4.61
Stop	.20	.70	4.19	.14	.57	4.40
Fricative	14.62	16.48	17.38	14.90	17.18	17.63
Affricate	8.69	8.66	11.86	10.01	9.80	13.88
Voiceless	7.97	10.70	11.96	8.04	10.78	12.20
Voiced	6.13	5.71	8.80	6.58	6.44	9.93

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	.10	.06	.28	.18	.07	.58
Labiodental	1.22	.67	.58	1.75	1.24	.52
Linguadental	7.13	9.27	12.64	4.64	9.03	9.80
Lingua-alveolar	5.80	5.17	6.18	6.00	5.19	6.45
Linguapalatal	4.76	5.76	7.49	5.18	6.55	8.59
Linguavelar	.03	.22	1.67	0.00	.38	2.51
Glottal	.06	-	-	.10	-	-
Glide	.17	-	-	.21	-	-
Semi-vowel	4.45	4.96	6.29	4.80	5.78	6.97
Nasal	.22	.20	1.37	.67	.52	2.17
Stop	.03	.09	.53	0.00	.09	.89
Fricative	7.19	7.96	9.39	6.73	8.09	9.06
Affricate	4.20	3.98	5.23	5.16	4.49	6.50
Voiceless	4.26	5.12	5.85	4.07	4.72	5.66
Voiced	2.88	2.82	3.62	2.99	3.46	4.35

TABLE ES.28

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 1. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 375, Females 220.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.60	.27	3.91	.34	.45	3.33
Labiodental	15.60	7.47	8.80	13.18	8.86	6.36
Linguadental	28.67	36.13	43.20	19.32	35.45	36.36
Lingua-alveolar	12.31	12.31	14.67	12.42	10.45	14.85
Linguapalatal	11.41	12.40	20.13	9.55	10.68	21.02
Linguavelar	1.33	.98	8.09	.23	2.42	7.12
Glottal	0.00	-	-	.45	-	-
Glide	1.20	-	-	1.14	-	-
Semi-vowel	10.00	10.53	16.27	7.05	9.32	18.41
Nasal	1.33	.53	4.44	.91	2.27	5.45
Stop	.58	1.16	6.27	.08	1.06	5.08
Fricative	21.90	23.58	24.58	18.64	21.69	22.35
Affricate	10.40	9.87	17.20	10.91	9.55	17.95
Voiceless	11.47	14.33	17.63	9.85	12.44	15.85
Voiced	9.33	8.31	11.30	7.76	8.60	11.53

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	.20	0.00	.71	0.00	.15	.76
Labiodental	2.53	1.20	1.07	3.18	2.50	.91
Linguadental	14.13	18.27	24.00	9.32	17.05	18.18
Lingua-alveolar	7.56	6.98	7.69	6.89	5.91	8.64
Linguapalatal	6.29	6.87	9.07	5.18	6.02	10.34
Linguavelar	.13	.18	2.40	0.00	.76	3.48
Glottal	0.00	-	-	.45	-	-
Glide	.27	-	-	.23	-	-
Semi-vowel	6.93	6.40	7.60	5.23	5.45	9.32
Nasal	.67	0.00	1.78	.45	.76	2.88
Stop	.04	.22	1.16	0.00	.30	1.29
Fricative	10.77	12.46	13.02	8.92	11.17	12.35
Affricate	4.53	3.73	6.13	4.77	4.09	8.41
Voiceless	5.96	7.63	8.33	5.05	5.97	7.90
Voiced	4.43	3.98	4.65	3.64	4.47	5.70

TABLE ES.29

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 2. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 301, Females 179.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.42	.11	3.10	.56	.56	4.47
Labiodental	9.14	5.81	5.98	13.41	7.54	6.15
Linguadental	20.27	26.74	27.91	15.92	27.93	27.37
Lingua-alveolar	11.30	10.74	13.79	11.45	10.15	13.50
Linguapalatal	9.10	10.22	16.36	10.28	12.85	18.30
Linguavelar	.33	1.11	5.20	.28	1.30	6.70
Glottal	.33	-	-	0.00	-	-
Glide	.83	-	-	.84	-	-
Semi-vowel	9.63	9.63	16.11	9.78	11.17	18.99
Nasal	.83	.78	3.88	2.79	1.30	7.08
Stop	.11	.66	4.10	.28	.93	4.75
Fricative	16.57	18.94	19.93	16.76	19.71	18.81
Affricate	9.47	7.97	12.46	9.50	9.50	13.41
Voiceless	8.86	11.42	12.50	8.38	11.59	12.22
Voiced	7.31	6.89	10.27	8.17	8.01	11.78

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.22	.28	.19	1.12
Labiodental	1.33	1.16	1.00	2.51	1.40	0.00
Linguadental	8.47	10.80	14.62	6.42	10.34	6.70
Lingua-alveolar	7.09	6.76	7.92	6.15	5.12	6.24
Linguapalatal	4.72	5.90	7.23	6.15	7.68	8.24
Linguavelar	0.00	.44	1.88	0.00	.37	2.98
Glottal	0.00	-	-	0.00	-	-
Glide	.33	-	-	0.00	-	-
Semi-vowel	5.65	6.31	7.48	8.66	8.10	8.94
Nasal	0.00	.44	1.88	1.68	.93	3.17
Stop	0.00	.06	.22	0.00	0.00	.93
Fricative	8.26	9.78	11.41	7.12	8.38	7.82
Affricate	3.82	3.32	4.49	4.47	4.47	4.75
Voiceless	4.95	5.77	6.31	3.91	5.03	4.47
Voiced	3.17	3.60	4.44	3.95	3.86	4.88

TABLE ES.30

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 3. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 219, Females 130.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	.23	.30	2.59	.77	.51	2.82
Labiodental	7.31	3.20	2.28	9.62	5.00	8.08
Linguadental	16.44	20.32	25.11	14.23	25.77	29.23
Lingua-alveolar	10.43	8.60	10.58	9.74	9.87	12.44
Linguapalatal	8.58	10.27	15.64	10.62	11.54	17.88
Linguavelar	0.00	.76	6.09	0.00	.26	6.15
Glottal	.46	-	-	0.00	-	-
Glide	.46	-	-	1.92	-	-
Semi-vowel	5.94	6.85	14.38	8.85	10.38	17.31
Nasal	.23	.61	4.41	1.15	.26	5.64
Stop	.23	.84	3.65	0.00	.51	3.97
Fricative	15.07	14.81	15.68	14.62	18.13	19.10
Affricate	9.59	9.36	11.87	10.77	8.85	14.23
Voiceless	8.02	10.05	11.19	8.03	11.54	13.17
Voiced	6.32	5.21	8.39	6.92	6.41	10.28

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	.11	.15	.15	.38	0.00	0.00
Labiodental	.91	.23	.23	1.54	1.15	.77
Linguadental	6.62	7.31	10.05	2.69	8.85	11.54
Lingua-alveolar	6.09	5.63	6.47	5.64	5.13	6.03
Linguapalatal	5.11	6.39	7.53	5.69	6.54	8.08
Linguavelar	0.00	.15	1.52	0.00	0.00	2.56
Glottal	.46	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	4.11	5.48	5.48	6.15	8.85	7.31
Nasal	0.00	.30	1.67	.77	0.00	2.56
Stop	.15	.08	.38	0.00	0.00	.38
Fricative	7.19	7.83	8.98	6.06	7.80	8.97
Affricate	5.71	4.11	6.16	5.00	2.31	5.38
Voiceless	4.31	4.79	5.76	3.93	4.13	5.77
Voiced	3.02	3.08	3.49	2.84	3.65	3.92

TABLE ES.31

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 4. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 179, Females 82.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	.14	.19	2.05	0.00	0.00	2.44
Labiodental	5.87	2.23	5.59	5.49	2.44	3.66
Linguadental	16.20	22.63	24.58	12.20	18.90	18.29
Lingua-alveolar	9.31	9.22	12.10	11.59	7.11	9.35
Linguapalatal	8.27	12.01	17.18	8.78	10.98	15.24
Linguavelar	0.00	1.12	6.70	.61	.81	6.10
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	1.22	-	-
Semi-vowel	7.26	9.22	18.99	4.88	8.54	13.41
Nasal	.56	1.12	2.98	.61	.81	4.07
Stop	0.00	.56	4.75	.20	.20	3.86
Fricative	14.04	16.04	17.13	14.18	13.24	14.02
Affricate	6.98	9.78	12.57	10.98	9.15	10.98
Voiceless	7.82	10.82	11.80	7.72	9.30	9.30
Voiced	5.50	5.87	9.90	6.19	4.78	8.54

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	.14	0.00	0.00	0.00	0.00	.81
Labiodental	1.68	.28	1.12	.61	1.22	1.22
Linguadental	4.47	6.15	10.61	4.88	6.71	8.54
Lingua-alveolar	5.03	4.66	6.24	5.08	4.07	5.49
Linguapalatal	5.59	6.98	8.52	4.15	6.40	8.23
Linguavelar	0.00	.56	2.23	0.00	.41	2.44
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	.61	-	-
Semi-vowel	6.15	6.70	9.22	1.22	6.10	7.32
Nasal	.56	.55	1.30	.61	.41	2.03
Stop	0.00	0.00	.93	0.00	0.00	1.02
Fricative	6.35	6.78	8.75	5.79	6.45	8.33
Affricate	3.35	3.91	5.31	5.49	4.27	4.88
Voiceless	3.97	4.40	5.52	3.66	4.27	5.34
Voiced	2.71	2.93	4.27	2.25	2.74	3.99

TABLE ES.32

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 5. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 149, Females 71.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	.50	.45	2.91	.70	0.00	1.88
Labiodental	4.36	4.03	6.04	4.23	3.52	2.11
Linguadental	12.08	20.81	26.17	6.34	20.42	14.08
Lingua-alveolar	7.83	7.61	10.18	8.92	7.98	9.86
Linguapalatal	8.46	10.40	13.26	10.99	13.03	15.85
Linguavelar	0.00	.45	4.70	0.00	.47	2.35
Glottal	0.00	-	-	0.00	-	-
Glide	.67	-	-	1.41	-	-
Semi-vowel	5.03	8.72	12.75	7.75	9.86	14.08
Nasal	.34	.45	2.46	1.41	.94	3.29
Stop	0.00	.45	4.36	0.00	0.00	1.88
Fricative	11.83	14.00	16.33	11.62	14.89	12.21
Affricate	8.72	10.07	9.06	9.15	11.27	15.49
Voiceless	7.01	9.65	10.91	7.36	10.56	8.27
Voiced	4.70	5.20	7.99	5.09	5.40	7.94

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.22	.22	.35	0.00	.47
Labiodental	.67	.67	0.00	0.00	.70	0.00
Linguadental	4.03	6.71	8.72	2.11	4.23	5.63
Lingua-alveolar	4.70	3.58	4.14	6.10	5.40	5.40
Linguapalatal	4.56	6.71	8.05	6.48	8.80	8.45
Linguavelar	0.00	0.00	1.34	0.00	.47	1.41
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	2.35	5.03	5.70	6.34	6.34	5.63
Nasal	0.00	.22	1.12	1.41	.94	1.88
Stop	0.00	0.00	.22	0.00	0.00	.23
Fricative	5.70	5.85	7.05	6.16	7.24	7.04
Affricate	5.03	6.04	6.04	4.93	6.34	8.45
Voiceless	3.65	4.53	4.87	4.07	4.40	4.40
Voiced	2.12	2.29	2.87	2.93	3.64	3.84

TABLE ES.33

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 6. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 119, Females 66.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	.84	.56	3.36	.76	0.00	4.04
Labiodental	4.20	1.26	2.52	5.30	2.27	3.79
Linguadental	13.45	20.59	23.53	14.39	18.94	21.21
Lingua-alveolar	8.12	8.40	10.92	9.85	5.56	12.63
Linguapalatal	8.24	7.77	14.08	9.70	11.36	19.32
Linguavelar	0.00	1.12	5.04	.76	.51	7.07
Glottal	0.00	-	-	1.52	-	-
Glide	.84	-	-	.76	-	-
Semi-vowel	4.62	4.62	13.03	6.06	7.58	18.18
Nasal	.84	1.12	3.08	.76	.51	3.54
Stop	.28	.42	4.34	.51	0.00	7.32
Fricative	12.29	13.93	15.27	13.83	11.90	16.41
Affricate	7.98	8.82	11.34	12.12	11.36	12.88
Voiceless	6.82	9.45	10.82	7.24	8.71	13.26
Voiced	5.17	4.55	8.10	6.76	4.42	9.92

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	.42	0.00	0.00	0.00	0.00	.51
Labiodental	.42	0.00	0.00	1.52	0.00	0.00
Linguadental	4.20	4.62	5.04	3.79	4.55	6.06
Lingua-alveolar	5.18	4.62	5.60	4.04	4.04	5.56
Linguapalatal	4.54	5.46	6.93	5.45	7.20	10.23
Linguavelar	0.00	0.00	1.40	0.00	.51	2.02
Glottal	0.00	-	-	0.00	-	-
Glide	.84	-	-	0.00	-	-
Semi-vowel	2.52	2.94	3.36	3.03	4.55	5.30
Nasal	0.00	0.00	1.40	0.00	.51	1.52
Stop	0.00	0.00	.14	0.00	0.00	.76
Fricative	6.09	6.00	7.56	5.11	5.63	8.08
Affricate	4.62	5.46	6.72	7.58	6.82	9.85
Voiceless	3.64	4.31	4.94	3.70	3.98	5.30
Voiced	2.46	2.03	2.83	2.21	2.65	4.13

TABLE ES.34

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 7. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 111, Females 48.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.30	0.00	0.00	2.08
Labiodental	2.25	1.35	.90	5.21	4.17	4.17
Linguadental	12.16	18.47	18.92	9.38	15.63	22.92
Lingua-alveolar	6.01	5.71	6.76	9.72	7.99	8.33
Linguapalatal	5.95	6.31	13.29	7.50	10.94	18.23
Linguavelar	0.00	.90	3.30	0.00	.69	6.25
Glottal	.90	-	-	0.00	-	-
Glide	0.00	-	-	2.08	-	-
Semi-vowel	2.25	4.05	13.96	3.13	6.25	17.71
Nasal	.45	.60	1.80	0.00	.69	2.08
Stop	0.00	.60	1.80	0.00	.35	4.17
Fricative	9.01	10.81	10.66	12.76	13.69	15.63
Affricate	9.01	6.31	8.56	6.25	10.42	9.38
Voiceless	5.21	7.55	8.00	6.25	8.33	9.38
Voiced	3.74	3.45	5.57	5.29	5.56	9.47

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.30	0.00	0.00	.69
Labiodental	.45	0.00	0.00	1.04	1.04	1.04
Linguadental	3.15	7.21	10.81	2.08	5.21	10.42
Lingua-alveolar	3.00	1.80	3.15	5.56	3.82	4.51
Linguapalatal	3.98	3.38	6.31	1.25	4.69	6.77
Linguavelar	0.00	0.00	1.20	0.00	0.00	2.78
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	2.25	2.70	3.60	1.04	2.08	3.13
Nasal	.45	0.00	.90	0.00	0.00	1.39
Stop	0.00	0.00	.45	0.00	0.00	1.39
Fricative	3.72	3.86	6.01	4.95	6.25	8.68
Affricate	4.95	3.15	5.41	2.08	3.13	3.13
Voiceless	2.80	2.93	4.62	2.55	3.65	4.69
Voiced	1.52	1.28	2.05	1.76	2.08	3.60

TABLE ES.35

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 8. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 120, Females 44.

	Test					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.83	.83	.57	0.00	0.00
Labiodental	.42	2.92	2.92	3.41	3.41	2.27
Languadental	10.00	18.33	15.00	10.23	17.05	20.45
Lingua-alveolar	5.97	6.53	7.64	9.09	7.20	7.95
Linguapalatal	5.83	7.08	11.67	8.64	11.93	17.61
Linguavelar	0.00	.83	3.33	0.00	0.00	5.30
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	2.27	-	-
Semi-vowel	6.25	5.00	12.92	3.41	6.82	11.36
Nasal	0.00	.83	1.67	0.00	0.00	3.03
Stop	0.00	.69	1.94	0.00	.38	2.65
Fricative	7.50	12.14	11.53	11.93	12.99	13.26
Affricate	6.67	6.67	7.08	10.23	12.50	15.91
Voiceless	4.63	8.33	7.71	7.07	9.38	10.23
Voiced	3.40	4.03	5.83	4.90	4.73	7.02

	Verbal Stimulation					
	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	0.00	.57	0.00	0.00
Labiodental	.42	.83	0.00	1.14	0.00	0.00
Linguadental	4.17	4.17	7.50	0.00	5.68	4.55
Lingua-alveolar	3.75	2.92	3.89	3.79	4.55	3.41
Linguapalatal	4.00	4.58	6.04	5.45	6.82	6.82
Linguavelar	0.00	0.00	.83	0.00	0.00	2.27
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	1.14	-	-
Semi-vowel	4.17	3.75	5.42	2.27	4.55	2.27
Nasal	0.00	0.00	.56	0.00	0.00	1.52
Stop	0.00	.14	.14	0.00	.38	.76
Fricative	4.48	4.40	6.25	4.26	5.84	5.68
Affricate	3.75	3.33	3.33	6.82	6.82	5.68
Voiceless	2.78	3.23	4.17	3.54	4.55	4.55
Voiced	2.05	1.67	2.20	1.75	2.46	2.07

TABLE ES.36

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 9. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 86, Females 48.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	.29	0.00	1.94	0.00	0.00	0.00
Labiodental	1.74	1.74	3.49	1.04	1.04	4.17
Linguadental	0.47	15.70	12.79	6.25	19.79	18.75
Lingua-alveolar	8.53	8.14	9.30	6.94	6.60	9.72
Linguapalatal	5.81	7.85	13.08	7.08	8.33	15.10
Linguavelar	.58	.39	3.88	0.00	.69	2.78
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	2.91	4.07	13.95	2.08	3.13	11.46
Nasal	0.00	.39	1.16	0.00	.69	2.08
Stop	.39	.19	3.29	0.00	.35	2.43
Fricative	10.47	12.46	12.60	8.07	12.80	14.58
Affricate	7.56	9.30	9.30	11.46	8.43	11.46
Voiceless	5.56	9.59	8.43	6.02	9.11	10.42
Voiced	4.38	3.29	7.08	2.88	3.65	6.44

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.39	0.00	0.00	0.00
Labiodental	.58	.58	1.16	1.04	0.00	1.04
Linguadental	4.65	5.23	4.65	0.00	1.04	4.17
Lingua-alveolar	5.43	4.84	6.01	3.82	3.47	4.17
Linguapalatal	1.63	3.78	5.23	5.42	6.77	8.33
Linguavelar	0.00	.39	.39	0.00	0.00	.69
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	1.74	1.74	5.81	2.08	2.08	5.21
Nasal	0.00	.39	.39	0.00	0.00	0.00
Stop	0.00	0.00	.19	0.00	0.00	.35
Fricative	5.52	6.15	7.56	3.65	4.46	6.60
Affricate	1.74	4.65	3.49	9.38	7.29	7.29
Voiceless	2.84	4.51	3.92	3.24	3.39	4.69
Voiced	1.97	1.74	3.17	1.76	1.91	2.65

TABLE ES.37

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 10. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 55, Females 31.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	1.21	.81	0.00	0.00
Labiodental	0.00	1.82	1.82	1.61	1.61	1.61
Linguadental	4.55	13.64	18.18	1.61	11.29	9.68
Lingua-alveolar	7.88	7.27	10.30	11.83	10.22	14.52
Linguapalatal	3.64	4.55	9.09	5.81	8.06	10.48
Linguavelar	0.00	0.00	3.03	0.00	1.08	4.30
Glottal	0.00	-	-	0.00	-	-
Glide	.91	-	-	1.61	-	-
Semi-vowel	0.00	2.73	8.18	1.61	1.61	12.90
Nasal	0.00	0.00	.61	0.00	1.08	0.00
Stop	0.00	0.00	3.94	.54	0.00	3.76
Fricative	8.18	11.17	13.03	10.48	13.82	15.59
Affricate	3.64	4.55	6.36	8.06	9.68	6.45
Voiceless	5.05	6.82	8.41	5.73	8.87	10.08
Voiced	2.24	3.18	5.95	4.47	4.30	6.74

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	0.00	0.00	0.00	0.00
Labiodental	0.00	.91	0.00	1.61	0.00	0.00
Linguadental	.91	1.82	7.27	0.00	4.84	6.45
Lingua-alveolar	5.45	4.85	6.36	10.75	8.60	10.22
Linguapalatal	1.45	3.18	3.18	1.29	3.23	4.84
Linguavelar	0.00	0.00	0.00	0.00	1.08	2.15
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	0.00	.91	2.73	1.61	1.61	3.23
Nasal	0.00	0.00	0.00	0.00	1.08	0.00
Stop	0.00	0.00	.30	0.00	0.00	1.61
Fricative	5.00	5.45	8.18	8.47	9.22	11.29
Affricate	.91	3.64	.91	1.61	3.23	4.84
Voiceless	2.83	3.41	3.86	4.30	4.84	6.05
Voiced	1.26	1.67	2.48	2.73	3.23	4.11

TABLE ES.38

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 11. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation of the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 45, Females 20.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.74	1.48	0.00	0.00	6.67
Labiodental	1.11	0.00	1.11	5.00	2.50	2.50
Linguadental	0.00	15.56	13.33	2.50	30.00	15.00
Lingua-alveolar	6.30	7.04	7.41	10.00	11.67	12.50
Linguapalatal	5.78	6.67	12.78	4.00	2.50	15.00
Linguavelar	0.00	.74	5.19	0.00	0.00	10.00
Glottal	0.00	-	-	0.00	-	-
Glide	1.11	-	-	0.00	-	-
Semi-vowel	2.22	6.67	13.33	0.00	2.50	12.50
Nasal	0.00	0.00	2.96	0.00	0.00	3.33
Stop	0.00	.74	2.59	0.00	.83	10.00
Fricative	8.06	10.48	11.11	11.25	18.57	15.83
Affricate	8.89	6.67	6.67	2.50	2.50	7.50
Voiceless	4.94	8.89	8.61	6.11	11.87	13.12
Voiced	3.42	2.78	5.66	3.08	4.17	9.09

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	.74	.74	0.00	0.00	1.67
Labiodental	1.11	0.00	0.00	0.00	2.50	0.00
Linguadental	2.22	4.44	4.44	2.50	2.50	5.00
Lingua-alveolar	3.33	2.59	3.70	8.33	6.67	8.33
Linguapalatal	4.00	2.78	7.22	3.00	2.50	6.25
Languavelar	0.00	.74	1.48	0.00	0.00	0.00
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	0.00	-	-
Semi-vowel	1.11	2.22	4.44	0.00	0.00	2.50
Nasal	0.00	0.00	.74	0.00	0.00	0.00
Stop	0.00	.74	.74	0.00	0.00	1.67
Fricative	4.17	3.81	6.30	8.12	7.86	10.83
Affricate	5.56	2.22	4.44	2.50	2.50	2.50
Voiceless	2.72	3.33	4.44	4.44	3.75	5.62
Voiced	1.71	1.11	2.42	2.31	2.50	3.64

TABLE ES.39

Consonants Misarticulated by Class
(Mild Articulation Deviation)

Grade 12. Percent of times each of the classes of consonants was misarticulated in each word position. Percentage figures are the average of the percent of misarticulation on the consonants in each class. Results show stimulability characteristics of each class of consonants for males and females. N = Males 37, Females 30.

Test

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	.90	.83	0.00	0.00
Labiodental	1.35	0.00	1.35	3.33	0.00	3.33
Linguadental	0.81	18.92	10.81	10.00	8.33	3.33
Lingua-alveolar	8.56	5.41	6.76	14.44	10.56	12.22
Linguapalatal	5.95	6.08	12.16	7.33	14.17	15.83
Linguavelar	0.00	0.00	2.70	0.00	0.00	3.33
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	1.67	-	-
Semi-vowel	4.05	2.70	9.46	3.33	5.00	15.00
Nasal	0.00	0.00	1.80	1.67	0.00	2.22
Stop	0.00	.45	1.80	0.00	0.00	3.33
Fricative	10.81	10.42	10.36	15.42	13.81	12.78
Affricate	5.41	6.76	8.11	8.33	15.00	11.67
Voiceless	6.01	7.43	6.76	8.15	9.58	7.95
Voiced	3.95	2.93	5.41	6.15	5.00	8.48

Verbal Stimulation

	Males			Females		
	I	M	F	I	M	F
Labial	0.00	0.00	0.00	.83	0.00	0.00
Labiodental	0.00	0.00	0.00	0.00	0.00	0.00
Linguadental	5.41	6.76	5.41	0.00	3.33	3.33
Lingua-alveolar	5.41	3.60	4.50	7.78	7.22	6.67
Linguapalatal	2.70	4.05	8.11	7.33	5.83	9.17
Linguavelar	0.00	0.00	2.70	0.00	0.00	1.11
Glottal	0.00	-	-	0.00	-	-
Glide	0.00	-	-	1.67	-	-
Semi-vowel	2.70	1.35	5.41	3.33	3.33	5.00
Nasal	0.00	0.00	1.80	0.00	0.00	1.11
Stop	0.00	0.00	.45	0.00	0.00	.56
Fricative	5.74	5.79	7.21	7.50	8.10	7.78
Affricate	2.70	4.05	5.41	8.33	5.00	10.00
Voiceless	3.30	3.72	4.39	4.44	4.58	5.00
Voiced	2.08	1.80	3.44	3.59	3.06	3.94

APPENDIX F

Total Sample

Number of Consonants Misarticulated
(Detailed Tables)

244

TABLE FS.1

Number of Consonants Misarticulated
(Total Sample)

Total Grades (1-12). Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 19973, Females 18829.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	55.18	55.18	59.87	59.87	80.08	80.08	84.29	84.29
1	13.72	68.90	14.93	74.80	6.57	86.65	6.67	90.96
2	7.50	76.40	7.19	82.00	3.20	89.85	2.45	93.41
3	5.01	81.40	4.56	86.56	2.17	92.02	1.55	94.95
4	3.54	84.94	2.82	89.38	1.47	93.49	.99	95.94
5	2.69	87.63	2.17	91.55	1.18	94.67	.81	96.75
6	1.97	89.60	1.48	93.03	.89	95.56	.60	97.35
7	1.82	91.42	1.36	94.39	.87	96.44	.56	97.91
8	1.39	92.82	1.22	95.61	.70	97.14	.52	98.43
9	1.50	94.31	1.07	96.68	.86	97.99	.56	98.99
10	1.06	95.37	.71	97.39	.40	98.39	.20	99.18
11	.76	96.13	.45	97.83	.27	98.66	.13	99.31
12	.60	96.73	.41	98.25	.26	98.91	.11	99.42
13	.52	97.25	.27	98.51	.16	99.07	.11	99.53
14	.40	97.65	.28	98.79	.17	99.24	.08	99.61
15	.35	98.00	.22	99.01	.10	99.34	.08	99.69
16	.27	98.27	.14	99.15	.08	99.42	.04	99.73
17	.31	98.58	.11	99.26	.11	99.53	.06	99.79
18	.27	98.85	.12	99.38	.08	99.61	.04	99.82
19	.16	99.01	.13	99.51	.04	99.65	.04	99.87
20	.10	99.11	.07	99.58	.01	99.66	.01	99.88
21	.12	99.23	.04	99.62	.03	99.68	.01	99.89
22	.11	99.33	.03	99.65	.04	99.72	.01	99.89
23	.09	99.42	.03	99.68	.04	99.76	.03	99.92
24	.07	99.49	.06	99.74	.03	99.78	.01	99.93
25	.04	99.52	.04	99.78	.04	99.82	.01	99.93
26	.04	99.56	.03	99.81	.02	99.83	.01	99.94
27	.04	99.60	.02	99.83	.04	99.87	.02	99.96
28	.05	99.64	.01	99.84	.02	99.88	.01	99.96
29	.03	99.67	.01	99.85	.03	99.91	.01	99.97
30	.05	99.71	.02	99.86	.02	99.93	.01	99.98
31	.02	99.73	.02	99.88	0.00	99.93	0.00	99.98
32	.03	99.76	.01	99.89	.01	99.93	0.00	99.98
33	.04	99.79	.01	99.90	.01	99.94	0.00	99.98
34	.04	99.83	.02	99.92	.02	99.95	0.00	99.98
35	.02	99.85	.02	99.94	.02	99.97	0.00	99.98
36	.04	99.88	.01	99.94	.01	99.98	0.00	99.98
37	.01	99.89	.01	99.95	0.00	99.98	0.00	99.98
38-45	.06	99.95	.03	99.97	.01	99.99	.01	99.99
46-72	.05	100.00	.03	100.00	.01	100.00	.01	100.00

TABLE FS.2

Number of Consonants Misarticulted
(Total Sample)

Grade 1. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1670, Females 1530.

	Test				Verbal Stimulation			
No.	Males		Females		Males		Females	
Msrt.	%	Cum	%	Cum	%	Cum	%	Cum
0	23.23	23.23	28.37	28.37	51.80	51.80	62.03	62.03
1	11.74	34.97	16.67	45.03	8.56	60.36	10.59	72.61
2	8.98	43.95	10.00	55.03	6.17	66.53	5.29	77.91
3	6.71	50.66	7.78	62.81	4.13	70.66	3.92	81.83
4	5.93	56.59	5.88	68.69	3.89	74.55	3.27	85.10
5	4.91	61.50	3.86	72.55	3.53	78.08	2.42	87.52
6	3.47	64.97	3.86	76.41	2.63	80.72	2.22	89.74
7	3.59	68.56	3.86	80.26	3.05	83.77	1.37	91.11
8	2.87	71.44	3.01	83.27	2.40	86.17	1.31	92.42
9	4.31	75.75	2.75	86.01	3.17	89.34	1.90	94.31
10	3.41	79.16	2.68	88.69	1.62	90.96	.92	95.23
11	2.63	81.80	1.57	90.26	1.14	92.10	.46	95.69
12	1.80	83.59	1.18	91.44	1.20	93.29	.52	96.21
13	1.38	84.97	.65	92.09	.90	94.19	.78	96.99
14	1.74	86.71	1.18	93.27	.90	95.09	.46	97.45
15	1.50	88.20	1.05	94.31	.48	95.57	.46	97.91
16	1.14	89.34	.59	94.90	.66	96.23	.26	98.17
17	1.68	91.02	.46	95.36	.42	96.65	.20	98.37
18	1.56	92.57	.52	95.88	.48	97.13	.20	98.56
19	.66	93.23	.52	96.41	.18	97.31	.26	98.82
20	.60	93.83	.46	96.86	.06	97.37	.13	98.95
21	.66	94.49	.26	97.12	.24	97.60	0.00	98.95
22	.78	95.27	.26	97.39	.42	98.02	.07	99.02
23	.48	95.75	.26	97.65	.30	98.32	.26	99.28
24	.48	96.23	.26	97.91	.24	98.56	0.00	99.28
25	.24	96.47	.13	98.04	.30	98.86	.07	99.35
26	.24	96.71	.13	98.17	.06	98.92	.13	99.48
27	.24	96.95	.13	98.30	.12	99.04	.20	99.67
28	.48	97.43	.13	98.43	.18	99.22	0.00	99.67
29	.18	97.60	.07	98.50	.24	99.46	.07	99.74
30	.30	97.90	.20	98.69	.12	99.58	.07	99.80
31	.18	98.08	.13	98.82	0.00	99.58	0.00	99.80
32	.36	98.44	.07	98.89	.06	99.64	0.00	99.80
33	.30	98.74	.13	99.02	.06	99.70	0.00	99.80
34	.18	98.92	.20	99.22	.06	99.76	0.00	99.80
35	.18	99.10	.20	99.41	.06	99.82	0.00	99.80
36	.30	99.40	0.00	99.41	.06	99.88	0.00	99.80
37	0.00	99.40	.07	99.48	0.00	99.88	0.00	99.80
38-45	.36	99.76	.20	99.67	.06	99.94	.13	99.93
46-72	.24	100.00	.33	100.00	.06	100.00	.07	100.00

TABLE FS.3

Number of Consonants Misarticulated
(Total Sample)

Grade 2. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1645, Females 1573.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	35.81	35.81	41.51	41.51	64.38	64.38	72.03	72.03
1	14.35	50.15	16.66	58.17	9.12	73.50	9.22	81.25
2	8.21	58.36	9.73	67.90	4.74	78.24	5.15	86.40
3	6.08	64.44	5.79	73.68	4.26	82.49	2.67	89.07
4	5.41	69.85	4.45	78.13	3.16	85.65	2.10	91.16
5	4.50	74.35	3.94	82.07	2.31	87.96	1.53	92.69
6	3.16	77.51	2.29	84.36	2.01	89.97	1.14	93.83
7	3.77	81.28	2.86	87.22	2.01	91.98	1.78	95.61
8	3.34	84.62	2.61	89.83	1.34	93.31	.95	96.57
9	2.67	87.29	2.48	92.31	1.82	95.14	1.02	97.58
10	2.01	89.30	1.91	94.21	1.09	96.23	.51	98.09
11	1.40	90.70	1.14	95.36	.73	96.96	.51	98.60
12	1.64	92.34	.89	96.25	.73	97.69	.19	98.79
13	1.03	93.37	.38	96.63	.24	97.93	.13	98.92
14	1.16	94.53	.70	97.33	.43	98.36	.06	98.98
15	.67	95.20	.25	97.58	.12	98.48	.25	99.24
16	.79	95.99	.19	97.77	.12	98.60	.13	99.36
17	.73	96.72	.19	97.97	.43	99.03	.25	99.62
18	.49	97.20	.45	98.41	.36	99.39	.19	99.81
19	.43	97.63	.38	98.79	.12	99.51	.13	99.94
20	.24	97.87	.25	99.05	.06	99.57	0.00	99.94
21	.30	98.18	.06	99.11	0.00	99.57	.06	100.00
22	.24	98.42	.13	99.24	0.00	99.57	0.00	100.00
23	.18	98.60	.06	99.30	0.00	99.57	0.00	100.00
24	.30	98.91	.19	99.49	.06	99.64	0.00	100.00
25	.18	99.09	.13	99.62	.12	99.76	0.00	100.00
26	.12	99.21	.19	99.81	.06	99.82	0.00	100.00
27	.12	99.33	.06	99.87	.06	99.88	0.00	100.00
28	.06	99.39	0.00	99.87	0.00	99.88	0.00	100.00
29	.12	99.51	0.00	99.87	0.00	99.88	0.00	100.00
30	.06	99.57	0.00	99.87	0.00	99.88	0.00	100.00
31	0.00	99.57	.06	99.94	0.00	99.88	0.00	100.00
32	0.00	99.57	0.00	99.94	0.00	99.88	0.00	100.00
33	0.00	99.57	0.00	99.94	0.00	99.88	0.00	100.00
34	.12	99.70	.06	100.00	.06	99.94	0.00	100.00
35	0.00	99.70	0.00	100.00	0.00	99.94	0.00	100.00
36	.06	99.76	0.00	100.00	.06	100.00	0.00	100.00
37	.06	99.82	0.00	100.00	0.00	100.00	0.00	100.00
38-45	.12	99.94	0.00	100.00	0.00	100.00	0.00	100.00

TABLE FS.4

Number of Consonants Misarticulated
(Total Sample)

Grade 3. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1651, Females 1557.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	47.00	47.00	51.70	51.70	73.53	73.53	78.36	78.36
1	15.08	62.08	16.63	68.34	8.42	81.95	9.25	87.60
2	8.42	70.50	7.51	75.85	4.72	86.67	3.47	91.07
3	5.09	75.59	5.52	81.37	2.18	88.86	1.86	92.94
4	3.82	79.41	3.60	84.97	1.94	90.79	1.28	94.22
5	3.94	83.34	2.83	87.80	1.27	92.07	1.28	95.50
6	2.85	86.19	1.73	89.53	1.45	93.52	.77	96.27
7	1.82	88.01	1.61	91.14	1.70	95.22	1.16	97.43
8	1.94	89.95	2.31	93.45	1.09	96.31	.83	98.27
9	1.82	91.76	1.61	95.05	1.21	97.52	.90	99.17
10	1.88	93.64	.90	95.95	.67	98.18	.06	99.23
11	1.27	94.91	.83	96.79	.36	98.55	.19	99.42
12	1.21	96.12	.96	97.75	.30	98.85	.13	99.55
13	.91	97.03	.64	98.39	.24	99.09	.13	99.68
14	.42	97.46	.32	98.72	.18	99.27	.13	99.81
15	.30	97.76	.26	98.97	.24	99.52	.13	99.94
16	.18	97.94	.26	99.23	0.00	99.52	.06	100.00
17	.42	98.36	.06	99.29	.12	99.64	0.00	100.00
18	.36	98.73	.26	99.55	0.00	99.64	0.00	100.00
19	.42	99.15	.32	99.87	0.00	99.64	0.00	100.00
20	0.00	99.15	.06	99.94	0.00	99.64	0.00	100.00
21	.06	99.21	0.00	99.94	0.00	99.64	0.00	100.00
22	.12	99.33	0.00	99.94	.06	99.70	0.00	100.00
23	.30	99.64	0.00	99.94	0.00	99.70	0.00	100.00
24	0.00	99.64	.06	100.00	0.00	99.70	0.00	100.00
25	0.00	99.64	0.00	100.00	0.00	99.70	0.00	100.00
26	0.00	99.64	0.00	100.00	.06	99.76	0.00	100.00
27	0.00	99.64	0.00	100.00	.06	99.82	0.00	100.00
28	0.00	99.64	0.00	100.00	0.00	99.82	0.00	100.00
29	0.00	99.64	0.00	100.00	.06	99.88	0.00	100.00
30	.18	99.82	0.00	100.00	0.00	99.88	0.00	100.00
31	0.00	99.82	0.00	100.00	0.00	99.88	0.00	100.00
32	0.00	99.82	0.00	100.00	0.00	99.88	0.00	100.00
33	0.00	99.82	0.00	100.00	0.00	99.88	0.00	100.00
34	0.00	99.82	0.00	100.00	.06	99.94	0.00	100.00
35	0.00	99.82	0.00	100.00	.06	100.00	0.00	100.00
36	.06	99.88	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	99.88	0.00	100.00	0.00	100.00	0.00	100.00
38-45	.06	99.94	0.00	100.00	0.00	100.00	0.00	100.00
46-72	.06	100.00	0.00	100.00				

TABLE FS.5

Number of Consonants Misarticulated
(Total Sample)

Grade 4. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1708, Females 1530.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	50.06	50.06	58.50	58.50	76.35	76.35	83.14	83.14
1	16.10	66.16	15.10	73.59	8.61	84.95	7.32	90.46
2	8.84	75.00	7.58	81.18	3.16	88.11	2.94	93.40
3	5.33	80.33	4.51	85.69	3.28	91.39	2.29	95.69
4	3.86	84.19	3.07	88.76	2.05	93.44	1.11	96.80
5	2.40	86.59	2.75	91.50	.94	94.38	.72	97.52
6	2.11	88.70	1.83	93.33	.88	95.26	.46	97.97
7	2.28	90.98	1.90	95.23	.82	96.08	.65	98.63
8	1.41	92.39	1.76	96.99	.82	96.90	.46	99.08
9	2.34	94.73	.85	97.84	1.17	98.07	.26	99.35
10	1.00	95.73	.59	98.43	.41	98.48	.20	99.54
11	.94	96.66	.07	98.50	.29	98.77	.07	99.61
12	.47	97.13	.39	98.89	.23	99.00	.07	99.67
13	.64	97.78	.52	99.41	.29	99.30	.13	99.80
14	.35	98.13	.20	99.61	.18	99.47	.07	99.87
15	.53	98.65	0.00	99.61	.06	99.53	0.00	99.87
16	.29	98.95	.07	99.67	0.00	99.53	0.00	99.87
17	.18	99.12	0.00	99.67	.18	99.71	.13	100.00
18	.18	99.30	.07	99.74	0.00	99.71	0.00	100.00
19	0.00	99.30	.07	99.80	0.00	99.71	0.00	100.00
20	.18	99.47	0.00	99.80	0.00	99.71	0.00	100.00
21	.12	99.59	.07	99.87	0.00	99.71	0.00	100.00
22	.06	99.65	0.00	99.87	0.00	99.71	0.00	100.00
23	0.00	99.65	0.00	99.87	.06	99.77	0.00	100.00
24	0.00	99.65	.13	100.00	0.00	99.77	0.00	100.00
25	0.00	99.65	0.00	100.00	0.00	99.77	0.00	100.00
26	0.00	99.65	0.00	100.00	0.00	99.77	0.00	100.00
27	.06	99.71	0.00	100.00	.06	99.82	0.00	100.00
28	0.00	99.71	0.00	100.00	0.00	99.82	0.00	100.00
29	0.00	99.71	0.00	100.00	.06	99.88	0.00	100.00
30	0.00	99.71	0.00	100.00	.06	99.94	0.00	100.00
31	0.00	99.71	0.00	100.00	0.00	99.94	0.00	100.00
32	0.00	99.71	0.00	100.00	0.00	99.94	0.00	100.00
33	0.00	99.71	0.00	100.00	0.00	99.94	0.00	100.00
34	.06	99.77	0.00	100.00	0.00	99.94	0.00	100.00
35	0.00	99.77	0.00	100.00	0.00	99.94	0.00	100.00
36	0.00	99.77	0.00	100.00	0.00	99.94	0.00	100.00
37	0.00	99.77	0.00	100.00	0.00	99.94	0.00	100.00
38-45	.18	99.94	0.00	100.00	.06	100.00	0.00	100.00
46-72								

TABLE FS.6

Number of Consonants Misarticulated
(Total Sample)

Grade 5. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1693, Females 1504.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	53.10	53.10	59.18	59.18	80.57	80.57	84.64	84.64
1	15.00	68.10	16.62	75.80	6.79	87.36	6.85	91.49
2	7.86	75.96	6.05	81.85	3.72	91.08	2.13	93.62
3	5.67	81.63	4.39	86.24	2.36	93.44	1.40	95.01
4	3.31	84.94	2.26	88.50	1.71	95.16	1.20	96.21
5	2.48	87.42	2.93	91.42	1.24	96.40	1.20	97.41
6	2.84	90.25	1.73	93.15	1.06	97.46	.73	98.14
7	2.30	92.56	2.19	95.35	.59	98.05	.40	98.54
8	1.65	94.21	1.26	96.61	.59	98.64	.53	99.07
9	1.42	95.63	1.13	97.74	.59	99.23	.33	99.40
10	1.12	96.75	.20	97.94	.18	99.41	.07	99.47
11	.53	97.28	.27	98.20	.06	99.47	.13	99.60
12	.47	97.76	.20	98.40	.06	99.53	.13	99.73
13	.47	98.23	.27	98.67	.12	99.65	0.00	99.73
14	.35	98.58	.27	98.94	.12	99.76	0.00	99.73
15	.41	99.00	.40	99.34	.06	99.82	0.00	99.73
16	.24	99.23	.27	99.60	.06	99.88	.07	99.80
17	.24	99.47	.07	99.67	0.00	99.88	0.00	99.80
18	.06	99.53	.07	99.73	.06	99.94	.07	99.87
19	.12	99.65	.07	99.80	0.00	99.94	.07	99.93
20	.06	99.70	0.00	99.80	0.00	99.94	0.00	99.93
21	.06	99.76	0.00	99.80	0.00	99.94	0.00	99.93
22	.06	99.82	0.00	99.80	0.00	99.94	0.00	99.93
23	0.00	99.82	0.00	99.80	.06	100.00	0.00	99.93
24	.06	99.88	.07	99.87	0.00	100.00	.07	100.00
25	0.00	99.88	.07	99.93	0.00	100.00	0.00	100.00
26	.06	99.94	.07	100.00	0.00	100.00	0.00	100.00
27	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
46-72	.06	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE FS.7

Number of Consonants Misarticulated
(Total Sample)

Grade 6. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males, 1585, Females 1633.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	57.54	57.54	63.38	63.38	83.66	83.66	86.83	86.83
1	14.38	71.92	15.80	79.18	6.31	89.97	6.67	93.51
2	8.14	80.06	6.43	85.61	3.03	93.00	1.84	95.35
3	4.16	84.23	3.55	89.16	1.58	94.57	1.41	96.75
4	3.34	87.57	2.82	91.98	.88	95.46	.37	97.12
5	2.46	90.03	1.41	93.39	1.39	96.85	.37	97.49
6	1.77	91.80	1.59	94.98	.57	97.41	.61	98.10
7	1.96	93.75	1.10	96.08	.76	98.17	.24	98.35
8	1.45	95.21	.61	96.69	.44	98.61	.49	98.84
9	1.01	96.21	1.10	97.80	.50	99.12	.80	99.63
10	1.01	97.22	.43	98.22	.13	99.24	.18	99.82
11	.63	97.85	.18	98.41	.13	99.37	.12	99.94
12	.32	98.17	.37	98.78	.25	99.62	0.00	99.94
13	.57	98.74	.31	99.08	0.00	99.62	0.00	99.94
14	.19	98.93	.24	99.33	.06	99.68	.06	100.00
15	.19	99.12	.18	99.51	0.00	99.68	0.00	100.00
16	.06	99.18	.12	99.63	.13	99.81	0.00	100.00
17	.25	99.43	.18	99.82	.13	99.94	0.00	100.00
18	.19	99.62	0.00	99.82	0.00	99.94	0.00	100.00
19	.19	99.81	.12	99.94	.06	100.00	0.00	100.00
20	.06	99.87	.06	100.00	0.00	100.00	0.00	100.00
21	0.00	99.87	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	99.87	0.00	100.00	0.00	100.00	0.00	100.00
23	.06	99.94	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
34	.06	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE FS.8

Number of Consonants Misarticulated
(Total Sample)

Grade 7. Percent of subjects who mi .rticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between mlaes and females. N = Males 1673, Females 1589.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	59.35	59.35	64.95	64.95	84.16	84.16	88.61	88.61
1	15.06	74.42	13.47	78.41	6.69	90.85	5.54	94.15
2	6.87	81.29	7.99	86.41	2.45	93.31	2.14	96.29
3	5.26	86.55	4.41	90.81	2.09	95.40	1.26	97.55
4	3.23	89.78	2.52	93.33	1.55	96.95	.57	98.11
5	2.63	92.41	2.01	95.34	.78	97.73	.63	98.74
6	1.85	94.26	1.07	96.41	.60	98.33	.25	98.99
7	1.79	96.05	.69	97.11	.42	98.74	.31	99.31
8	1.08	97.13	.76	97.86	.36	99.10	.38	99.69
9	.66	97.79	.63	98.49	.30	99.40	.19	99.87
10	.72	98.51	.50	98.99	.24	99.64	.06	99.94
11	.18	98.68	.25	99.24	0.00	99.64	0.00	99.94
12	.54	99.22	.31	99.56	.12	99.76	0.00	99.94
13	.18	99.40	.13	99.69	0.00	99.76	0.00	99.94
14	.18	99.58	0.00	99.69	.06	99.82	0.00	99.94
15	.12	99.70	.13	99.81	.12	99.94	0.00	99.94
16	0.00	99.70	.06	99.87	0.00	99.94	0.00	99.94
17	.06	99.76	.06	99.94	0.00	99.94	0.00	99.94
18	.06	99.82	0.00	99.94	0.00	99.94	0.00	99.94
19	0.00	99.82	0.00	99.94	0.00	99.94	0.00	99.94
20	0.00	99.82	0.00	99.94	0.00	99.94	0.00	99.94
21	.06	99.88	0.00	99.94	0.00	99.94	0.00	99.94
22	0.00	99.88	0.00	99.94	0.00	99.94	0.00	99.94
23	0.00	99.88	0.00	99.94	0.00	99.94	0.00	99.94
24	0.00	99.88	0.00	99.94	0.00	99.94	0.00	99.94
25	0.00	99.88	0.00	99.94	0.00	99.94	0.00	99.94
26	0.00	99.88	0.00	99.94	0.00	99.94	0.00	99.94
27	0.00	99.88	0.00	99.94	0.00	99.94	0.00	99.94
28	0.00	99.88	0.00	99.94	0.00	99.94	0.00	99.94
29	0.00	99.88	0.00	99.94	0.00	99.94	.06	100.00
30	0.00	99.88	0.00	99.94	0.00	99.94	0.00	100.00
31	0.00	99.88	0.00	99.94	0.00	99.94	0.00	100.00
32	0.00	99.88	0.00	99.94	0.00	99.94	0.00	100.00
33	.06	99.94	0.00	99.94	0.00	99.94	0.00	100.00
34	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
35	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
36	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
37	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
38-45	0.00	99.94	.06	100.00	0.00	99.94	0.00	100.00
46-72	.06	100.00	0.00	100.00	.06	100.00	0.00	100.00

TABLE FS.9

Number of Consonants Misarticulated
(Total Sample)

Grade 8. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1662, Females 1596.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	61.37	61.37	68.17	68.17	86.46	86.46	90.48	90.48
1	13.48	74.85	12.72	80.89	6.20	92.66	5.14	95.61
2	7.34	82.19	7.46	88.35	2.35	95.01	1.19	96.80
3	5.72	87.91	4.14	92.48	1.68	96.69	1.07	97.87
4	3.55	91.46	2.07	94.55	.54	97.23	.38	98.25
5	2.17	93.62	1.50	96.05	.84	98.07	.38	98.62
6	1.20	94.83	.88	96.93	.48	98.56	.19	98.81
7	1.08	95.91	.50	97.43	.54	99.10	.13	98.93
8	1.20	97.11	.31	97.74	.30	99.40	.31	99.25
9	.90	98.01	.56	98.31	.30	99.70	.25	99.50
10	.54	98.56	.56	98.87	.06	99.76	.06	99.56
11	.60	99.16	.38	99.25	.12	99.88	.06	99.62
12	.24	99.40	.13	99.37	0.00	99.88	0.00	99.62
13	.18	99.58	.13	99.50	0.00	99.88	.06	99.69
14	0.00	99.58	.06	99.56	0.00	99.88	.13	99.81
15	.12	99.70	.19	99.75	.12	100.00	.06	99.87
16	.12	99.82	0.00	99.75	0.00	100.00	0.00	99.87
17	0.00	99.82	.13	99.87	0.00	100.00	0.00	99.87
18	.12	99.94	0.00	99.87	0.00	100.00	0.00	99.87
19	0.00	99.94	0.00	99.87	0.00	100.00	0.00	99.87
20	0.00	99.94	0.00	99.87	0.00	100.00	0.00	99.87
21	.06	100.00	0.00	99.87	0.00	100.00	.06	99.94
22	0.00	100.00	0.00	99.87	0.00	100.00	0.00	99.94
23	0.00	100.00	.06	99.94	0.00	100.00	.06	100.00
24	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
38-45	0.00	100.00	.06	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE FS.10

Number of Consonants Misarticulated
(Total Sample)

Grade 9. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1668, Females 1577.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	64.15	64.15	64.55	64.55	87.23	87.23	89.47	89.47
1	12.23	76.38	15.85	80.41	5.46	92.69	6.02	95.50
2	7.79	84.17	7.74	88.14	2.34	95.02	1.40	96.89
3	4.44	88.61	5.01	93.15	1.62	96.64	.89	97.78
4	3.24	91.85	1.59	94.74	.78	97.42	.44	98.22
5	2.28	94.12	1.40	96.13	.78	98.20	.51	98.73
6	1.44	95.56	.95	97.08	.24	98.44	.25	98.99
7	1.26	96.82	.63	97.72	.12	98.56	.19	99.18
8	.48	97.30	.89	98.60	.36	98.92	.25	99.43
9	.72	98.02	.51	99.11	.42	99.34	.25	99.68
10	.18	98.20	.06	99.18	.18	99.52	.06	99.75
11	.18	98.38	.19	99.37	.12	99.64	0.00	99.75
12	.24	98.62	.13	99.49	.12	99.76	0.00	99.75
13	.24	98.86	.13	99.62	.06	99.82	.06	99.81
14	.30	99.16	.06	99.68	.12	99.94	0.00	99.81
15	.18	99.34	0.00	99.68	0.00	99.94	0.00	99.81
16	.24	99.58	.06	99.75	0.00	99.94	0.00	99.81
17	.06	99.64	0.00	99.75	0.00	99.94	.06	99.87
18	.24	99.88	0.00	99.75	0.00	99.94	0.00	99.87
19	0.00	99.88	.06	99.81	0.00	99.94	.06	99.94
20	.06	99.94	0.00	99.81	0.00	99.94	0.00	99.94
21	0.00	99.94	0.00	99.81	0.00	99.94	0.00	99.94
22	0.00	99.94	0.00	99.81	0.00	99.94	0.00	99.94
23	0.00	99.94	0.00	99.81	0.00	99.94	0.00	99.94
24	0.00	99.94	0.00	99.81	0.00	99.94	0.00	99.94
25	0.00	99.94	.13	99.94	0.00	99.94	0.00	99.94
26	0.00	99.94	0.00	99.94	0.00	99.94	0.00	99.94
27	0.00	99.94	0.00	99.94	.06	100.00	0.00	99.94
28	0.00	99.94	0.00	99.94	0.00	100.00	0.00	99.94
29	0.00	99.94	0.00	99.94	0.00	100.00	0.00	99.94
30	0.00	99.94	0.00	99.94	0.00	100.00	.06	100.00
31	0.00	99.94	0.00	99.94	0.00	100.00	0.00	100.00
32	0.00	99.94	0.00	99.94	0.00	100.00	0.00	100.00
33	0.00	99.94	0.00	99.94	0.00	100.00	0.00	100.00
34	.06	100.00	0.00	99.94	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
36	0.00	100.00	.06	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE FS.11

Number of Consonants Misarticulated
(Total Sample)

Grade 10. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1658, Females 1614.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	67.37	67.37	70.69	70.69	89.99	89.99	91.33	91.33
1	13.45	80.82	12.70	83.40	4.52	94.51	4.46	95.79
2	6.21	87.03	6.07	89.47	2.17	96.68	1.30	97.09
3	4.40	91.44	3.84	93.31	1.27	97.95	1.05	98.14
4	2.17	93.61	2.11	95.42	.48	98.43	.37	98.51
5	2.05	95.66	1.55	96.96	.42	98.85	.25	98.76
6	1.27	96.92	.81	97.77	.24	99.10	.19	98.95
7	.72	97.65	.62	98.39	.18	99.28	.12	99.07
8	.54	98.19	.19	98.57	.12	99.40	.25	99.32
9	.54	98.73	.43	99.01	.24	99.64	.37	99.69
10	.42	99.16	.06	99.07	0.00	99.64	.12	99.81
11	.24	99.40	.31	99.38	.24	99.88	0.00	99.81
12	.06	99.46	.19	99.57	0.00	99.88	.12	99.94
13	.18	99.64	0.00	99.57	0.00	99.88	.06	100.00
14	.06	99.70	.19	99.75	0.00	99.88	0.00	100.00
15	.12	99.82	.12	99.88	0.00	99.88	0.00	100.00
16	0.00	99.82	0.00	99.88	0.00	99.88	0.00	100.00
17	0.00	99.82	.12	100.00	0.00	99.88	0.00	100.00
18	0.00	99.82	0.00	100.00	0.00	99.88	0.00	100.00
19	.12	99.94	0.00	100.00	.06	99.94	0.00	100.00
20	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
21	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
22	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
23	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
24	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
25	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
26	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
27	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
28	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
29	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
30	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
31	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
32	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
33	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
34	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
35	0.00	99.94	0.00	100.00	.06	100.00	0.00	100.00
36	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
37	.06	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00				

TABLE FS.12

Number of Consonants Misarticulated
(Total Sample)

Grade 11. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1691, Females 1561.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	71.50	71.50	72.20	72.20	90.42	90.42	90.52	90.52
1	11.77	83.26	13.90	86.10	5.20	95.62	5.77	96.28
2	5.62	88.88	4.74	90.84	1.71	97.34	1.60	97.89
3	3.84	92.73	3.40	94.23	.65	97.99	.32	98.21
4	2.31	95.03	1.54	95.77	.35	98.34	.51	98.72
5	1.42	96.45	1.22	96.99	.35	98.70	.19	98.91
6	.59	97.04	.58	97.57	.30	98.99	.19	99.10
7	.77	97.81	.32	97.89	.18	99.17	.19	99.30
8	.41	98.23	.45	98.33	.30	99.47	.13	99.42
9	.53	98.76	.58	98.91	.24	99.70	.32	99.74
10	.24	98.99	.45	99.36	0.00	99.70	.06	99.81
11	.30	99.29	.13	99.49	.06	99.76	0.00	99.81
12	.06	99.35	.13	99.62	.06	99.82	.06	99.87
13	.30	99.65	0.00	99.62	0.00	99.82	0.00	99.87
14	0.00	99.65	.13	99.74	0.00	99.82	0.00	99.87
15	.06	99.70	.06	99.81	0.00	99.82	0.00	99.87
16	.06	99.76	0.00	99.81	0.00	99.82	0.00	99.87
17	.06	99.82	0.00	99.81	0.00	99.82	.06	99.94
18	0.00	99.82	0.00	99.81	.06	99.88	0.00	99.94
19	0.00	99.82	.06	99.87	.06	99.94	0.00	99.94
20	0.00	99.82	0.00	99.87	0.00	99.94	0.00	99.94
21	.12	99.94	.06	99.94	.06	100.00	0.00	99.94
22	0.00	99.94	0.00	99.94	0.00	100.00	0.00	99.94
23	0.00	99.94	0.00	99.94	0.00	100.00	0.00	99.94
24	0.00	99.94	0.00	99.94	0.00	100.00	0.00	99.94
25	0.00	99.94	0.00	99.94	0.00	100.00	0.00	99.94
26	.06	100.00	0.00	99.94	0.00	100.00	0.00	99.94
27	0.00	100.00	0.00	99.94	0.00	100.00	0.00	99.94
28	0.00	100.00	0.00	99.94	0.00	100.00	.06	100.00
29	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	99.94	0.00	100.00	0.00	100.00
32	0.00	100.00	.06	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE FS.13

Number of Consonants Misarticulated
(Total Sample)

Grade 12. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1669, Females1565.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	71.48	71.48	73.80	73.80	92.39	92.39	93.04	93.04
1	11.98	83.46	13.29	87.09	2.94	95.33	3.45	96.49
2	5.75	89.22	5.05	92.14	1.86	97.18	1.09	97.57
3	3.36	92.57	2.56	94.70	.90	98.08	.51	98.08
4	2.34	94.91	2.04	96.74	.30	98.38	.38	98.47
5	1.08	95.99	.83	97.57	.36	98.74	.32	98.79
6	1.08	97.06	.51	98.08	.24	98.98	.26	99.04
7	.54	97.60	.26	98.34	.12	99.10	.26	99.30
8	.36	97.96	.58	98.91	.30	99.40	.32	99.62
9	1.02	98.98	.32	99.23	.30	99.70	.13	99.74
10	.24	99.22	.19	99.42	.18	99.88	.06	99.81
11	.24	99.46	.06	99.49	0.00	99.88	0.00	99.81
12	.12	99.58	.13	99.62	0.00	99.88	.06	99.87
13	.18	99.76	.06	99.68	0.00	99.88	0.00	99.87
14	.06	99.82	.06	99.74	0.00	99.88	.06	99.94
15	0.00	99.82	0.00	99.74	0.00	99.88	.06	100.00
16	.06	99.88	.06	99.81	0.00	99.88	0.00	100.00
17	.06	99.94	.06	99.87	.06	99.94	0.00	100.00
18	0.00	99.94	.06	99.94	0.00	99.94	0.00	100.00
19	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
20	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
21	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
22	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
23	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
24	0.00	99.94	0.00	99.94	0.00	99.94	0.00	100.00
25	0.00	99.94	.06	100.00	0.00	99.94	0.00	100.00
26	0.00	99.94	0.00	100.00	0.00	99.94	0.00	100.00
27	0.00	99.94	0.00	100.00	.06	100.00	0.00	100.00
28	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	99.94	0.00	100.00	0.00	100.00	0.00	100.00
33	.06	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

APPENDIX G

Acceptable Articulation (AA)

Number of Consonants Misarticulated
(Detailed Tables)

TABLE GS.1

Number of Consonants Misarticulated
(Acceptable Articulation)

Total Grades (1-12). Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 17689, Females 17584.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	61.08	61.08	63.63	63.63	86.76	86.76	88.58	88.58
1	14.59	75.67	15.54	79.16	6.06	92.82	6.20	94.79
2	7.57	83.24	7.25	86.41	2.58	95.40	2.09	96.87
3	4.87	88.11	4.45	90.86	1.49	96.89	1.07	97.94
4	3.30	91.40	2.55	93.41	.90	97.80	.56	98.50
5	2.25	93.65	1.89	95.30	.67	98.47	.43	98.94
6	1.57	95.22	1.16	96.46	.41	98.88	.31	99.25
7	1.25	96.47	.98	97.45	.38	99.26	.18	99.43
8	.95	97.42	.81	98.25	.28	99.54	.20	99.63
9	.81	98.23	.62	98.87	.26	99.80	.23	99.86
10	.50	98.73	.39	99.27	.07	99.87	.09	99.94
11	.38	99.11	.21	99.48	.03	99.90	.03	99.97
12	.25	99.37	.20	99.68	.03	99.94	.01	99.98
13	.22	99.59	.10	99.77	.03	99.97	.01	99.99
14	.09	99.68	.10	99.87	.01	99.98	0.00	99.99
15	.11	99.79	.05	99.93	.01	99.99	0.00	99.99
16	.05	99.84	.03	99.95	.01	99.99	0.00	99.99
17	.06	99.89	.01	99.96	.01	100.00	.01	99.99
18	.04	99.93	.02	99.98	0.00	100.00	0.00	99.99
19	.02	99.95	.01	99.99	0.00	100.00	0.00	99.99
20	.02	99.97	0.00	99.99	0.00	100.00	0.00	99.99
21	0.00	99.97	0.00	99.99	0.00	100.00	0.00	99.99
22	.01	99.98	0.00	99.99	0.00	100.00	0.00	99.99
23	.01	99.99	0.00	99.99	0.00	100.00	0.00	99.99
24	0.00	99.99	0.00	99.99	0.00	100.00	0.00	99.99
25	.01	99.99	.01	99.99	0.00	100.00	0.00	99.99
26	0.00	99.99	0.00	99.99	0.00	100.00	.01	100.00
27	0.00	99.99	0.00	99.99	0.00	100.00	0.00	100.00
28	0.00	99.99	.01	100.00	0.00	100.00	0.00	100.00
29	0.00	99.99	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	99.99	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	99.99	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	99.99	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	99.99	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	99.99	0.00	100.00	0.00	100.00	0.00	100.00
35	.01	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE GS.2

Number of Consonants Misarticulated
(Acceptable Articulation)

Grade 1. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 1098, Females 1198.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	33.97	33.97	35.56	35.56	70.67	70.67	75.54	75.54
1	16.12	50.09	20.70	56.26	10.20	80.87	10.77	86.31
2	12.11	62.20	11.77	68.03	5.65	86.52	5.01	91.32
3	8.74	70.95	8.76	76.79	2.55	89.07	2.67	93.99
4	6.47	77.41	5.59	82.39	2.00	91.07	1.34	95.33
5	4.83	82.24	3.51	85.89	2.00	93.08	1.34	96.66
6	2.91	85.15	3.17	89.07	1.64	94.72	1.09	97.75
7	2.82	87.98	3.34	92.40	1.55	96.27	.42	98.16
8	2.46	90.44	2.00	94.41	1.00	97.27	.33	98.50
9	3.19	93.62	1.84	96.24	1.28	98.54	.75	99.25
10	1.46	95.08	1.59	97.83	.46	99.00	.42	99.67
11	1.28	96.36	.58	98.41	.09	99.09	.17	99.83
12	.82	97.18	.67	99.08	.18	99.27	0.00	99.83
13	.36	97.54	.08	99.17	.36	99.64	.08	99.92
14	.55	98.09	.33	99.50	.09	99.73	0.00	99.92
15	.46	98.54	.25	99.75	.18	99.91	0.00	99.92
16	.09	98.63	0.00	99.75	.09	100.00	0.00	99.92
17	.55	99.18	0.00	99.75	0.00	100.00	0.00	99.92
18	.36	99.54	.17	99.92	0.00	100.00	0.00	99.92
19	0.00	99.54	0.00	99.92	0.00	100.00	0.00	99.92
20	.27	99.82	0.00	99.92	0.00	100.00	0.00	99.92
21	0.00	99.82	0.00	99.92	0.00	100.00	0.00	99.92
22	.09	99.91	0.00	99.92	0.00	100.00	0.00	99.92
23	0.00	99.91	0.00	99.92	0.00	100.00	0.00	99.92
24	0.00	99.91	0.00	99.92	0.00	100.00	0.00	99.92
25	0.00	99.91	0.00	99.92	0.00	100.00	0.00	99.92
26	0.00	99.91	0.00	99.92	0.00	100.00	0.00	99.92
27	0.00	99.91	0.00	99.92	0.00	100.00	.08	100.00
28	0.00	99.91	.08	100.00	0.00	100.00	0.00	100.00
29	0.00	99.91	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	99.91	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	99.91	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	99.91	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	99.91	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	99.91	0.00	100.00	0.00	100.00	0.00	100.00
35	.09	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.2

Number of Consonants Misarticulted
(Mild Articulation Deviation)

Grade 1. Percent of subjects who misarticulted a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 375, Females 220.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	4.00	4.00	3.64	3.64	23.20	23.20	18.64	18.64
1	5.07	9.07	2.73	6.36	8.00	31.20	14.09	32.73
2	4.00	13.07	5.00	11.36	9.60	40.80	7.27	40.00
3	4.27	17.33	5.00	16.36	7.73	48.53	9.09	49.09
4	7.20	24.53	10.45	26.82	7.73	56.27	11.82	60.91
5	6.67	31.20	7.27	34.09	7.73	64.00	7.27	68.18
6	6.93	38.13	9.09	43.18	4.53	68.53	4.09	72.27
7	6.40	44.53	6.82	50.00	5.87	74.40	5.00	77.27
8	4.53	49.07	6.82	56.82	4.53	78.93	5.00	82.27
9	8.27	57.33	7.27	64.09	8.00	86.93	6.82	89.09
10	7.47	64.80	7.73	71.82	2.67	89.60	2.27	91.36
1	5.87	70.67	5.45	77.27	1.60	91.20	.91	92.27
12	3.47	74.13	4.09	81.36	2.40	93.60	1.36	93.64
13	3.20	77.33	2.73	84.09	1.33	94.93	2.27	95.91
14	4.00	81.33	4.55	88.64	2.13	97.07	.91	96.82
15	3.20	84.53	.91	89.55	.53	97.60	.45	97.27
16	3.47	88.00	1.82	91.36	.53	98.13	.91	98.18
17	2.93	90.93	1.82	93.18	0.00	98.13	.91	99.09
18	2.67	93.60	1.82	95.00	.80	98.93	.91	100.00
19	1.60	95.20	.91	95.91	0.00	98.93	0.00	100.00
20	.53	95.73	.45	96.36	0.00	98.93	0.00	100.00
21	.81	96.53	.45	96.82	.27	99.20	0.00	100.00
22	1.07	97.60	1.36	98.18	0.00	99.20	0.00	100.00
23	.27	97.87	.91	99.09	.53	99.73	0.00	100.00
24	.80	98.67	.91	100.00	.27	100.00	0.00	100.00
25	.27	98.93	0.00	100.00	0.00	100.00	0.00	100.00
26	.27	99.20	0.00	100.00	0.00	100.00	0.00	100.00
27	.27	99.47	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	99.47	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	99.47	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	99.47	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	99.47	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	99.47	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.2
(continued)

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
33	.27	99.73	0.00	100.00	0.00	100.00	0.00	100.00
34	.27	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.3

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 2. Percent of subjects who misarticulted a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 301, Females 179.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	7.97	7.97	6.15	6.15	28.24	28.24	29.05	29.05
1	4.65	12.62	7.26	13.41	12.96	41.20	11.73	40.78
2	6.98	19.60	8.94	22.35	7.97	49.17	10.06	50.84
3	8.97	28.57	3.91	26.26	9.63	58.80	7.82	58.66
4	6.98	35.55	7.26	33.52	5.65	64.45	6.70	65.36
5	7.31	42.86	6.15	39.66	5.32	69.77	2.79	68.16
6	5.32	48.17	3.91	43.58	5.65	75.42	5.03	73.18
7	8.31	56.48	7.82	51.40	4.65	80.07	9.50	82.68
8	7.31	63.79	8.94	60.34	3.99	84.05	5.59	88.27
9	8.31	72.09	8.94	69.27	4.98	89.04	2.23	90.50
10	3.32	75.42	6.15	75.42	3.32	92.36	1.68	92.18
11	4.32	79.73	6.15	81.56	2.33	94.68	2.23	94.41
12	4.65	84.39	3.35	84.92	1.99	96.68	0.00	94.41
13	2.99	87.38	2.23	87.15	.66	97.34	1.12	95.53
14	3.32	90.70	2.23	89.39	.33	97.67	.56	96.09
15	1.99	92.69	1.12	90.50	.33	98.01	.56	96.65
16	1.66	94.35	.56	91.06	.33	98.34	.56	97.21
17	1.00	95.35	.56	91.62	1.00	99.34	1.12	98.32
18	.66	96.01	2.23	93.85	.33	99.67	1.12	99.44
19	.66	96.68	2.23	96.09	.33	100.00	.56	100.00
20	1.33	98.01	.56	96.65	0.00	100.00	0.00	100.00
21	.33	98.34	0.00	96.65	0.00	100.00	0.00	100.00
22	.33	98.67	.56	97.21	0.00	100.00	0.00	100.00
23	0.00	98.67	.56	97.77	0.00	100.00	0.00	100.00
24	.33	99.00	1.12	98.88	0.00	100.00	0.00	100.00
25	.33	99.34	0.00	98.88	0.00	100.00	0.00	100.00
26	.33	99.67	.56	99.44	0.00	100.00	0.00	100.00
27	0.00	99.67	.56	100.00	0.00	100.00	0.00	100.00
28	0.00	99.67	0.00	100.00	0.00	100.00	0.00	100.00
29	.33	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.3
(continued)

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.4

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 3. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 219, Females 130.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	11.87	11.87	3.08	3.08	35.16	35.16	20.77	20.77
1.	9.59	21.46	10.00	13.08	12.33	47.49	25.38	46.15
2	7.76	29.22	6.92	20.00	9.59	57.08	7.69	53.85
[illegible]	5.48	34.70	8.46	28.46	5.48	62.56	7.69	61.54
[illegible]	6.39	41.10	7.69	36.15	4.57	67.12	6.15	67.69
[illegible]	9.59	50.68	6.92	43.08	4.57	71.69	5.38	73.08
[illegible]	7.76	58.45	5.38	48.46	4.11	75.80	3.08	76.15
7	4.11	62.56	7.69	56.15	5.94	81.74	7.69	83.85
8	5.02	67.58	6.15	62.31	4.57	86.30	6.92	90.77
9	7.76	75.34	7.69	70.00	5.94	92.24	6.15	96.92
10	6.85	82.19	6.92	76.92	2.28	94.52	0.00	96.92
11	3.65	85.84	5.38	82.31	.91	95.43	.77	97.69
12	4.11	89.95	4.62	86.92	2.28	97.72	.77	98.46
13	.91	90.87	4.62	91.54	.91	98.63	.77	99.23
14	.91	91.78	3.08	94.62	0.00	98.63	.77	100.00
15	1.37	93.15	.77	95.38	1.37	100.00	0.00	100.00
16	.46	93.61	.77	96.15	0.00	100.00	0.00	100.00
17	2.28	95.89	.77	96.92	0.00	100.00	0.00	100.00
18	1.83	97.72	.77	97.69	0.00	100.00	0.00	100.00
19	1.37	99.09	1.54	99.23	0.00	100.00	0.00	100.00
20	.00	99.09	.77	100.00	0.00	100.00	0.00	100.00
21	.00	99.09	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	99.09	0.00	100.00	0.00	100.00	0.00	100.00
23	.91	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.4
(continued)

	Tes				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.5

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 4. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 179, Females 82.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	10.61	10.41	13.41	13.41	29.61	29.61	34.15	34.15
1	7.26	17.88	9.76	23.17	16.76	46.37	14.63	48.78
2	10.06	27.93	9.76	32.93	5.59	51.96	8.54	57.32
3	7.82	35.75	7.32	40.24	8.38	60.34	14.63	71.95
4	4.47	40.22	7.32	47.56	8.94	69.27	6.10	78.05
5	4.47	44.69	8.54	56.10	4.47	73.74	3.66	81.71
6	6.70	51.40	8.54	64.63	6.70	80.45	3.66	85.37
7	10.06	61.45	4.88	69.51	3.91	84.36	7.32	92.68
8	3.91	65.36	8.54	78.05	1.68	86.03	3.66	96.34
9	8.94	74.30	7.32	85.37	5.03	91.06	0.00	95.34
10	4.47	78.77	3.66	89.02	2.23	93.30	0.00	96.34
11	4.47	83.24	0.00	89.02	1.12	94.41	1.22	97.56
12	2.79	86.03	3.66	92.68	2.23	96.65	0.00	97.56
13	4.47	90.50	6.10	98.78	1.68	98.32	1.22	98.78
14	2.79	93.30	0.00	98.78	1.12	99.44	0.00	98.78
15	1.68	94.97	0.00	98.78	0.00	99.44	0.00	98.78
16	1.12	96.09	0.00	98.78	0.00	99.44	0.00	98.78
17	1.68	97.77	0.00	98.78	.56	100.00	1.22	100.00
18	0.00	97.77	0.00	98.78	0.00	100.00	0.00	100.00
19	0.00	97.77	0.00	98.78	0.00	100.00	0.00	100.00
20	1.12	98.89	0.00	98.78	0.00	100.00	0.00	100.00
21	0.00	98.88	1.22	100.00	0.00	100.00	0.00	100.00
22	.56	99.44	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	99.44	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	99.44	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	99.44	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	99.44	0.00	100.00	0.00	100.00	0.00	100.00
27	.56	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00				

TABLE HS.6

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 5. Percent of subjects who misarticulated a specified number of the 72 consonants(/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 149, Females 71.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	15.44	15.44	12.68	12.68	38.93	38.93	32.39	32.39
1	11.41	26.85	14.08	26.76	12.08	51.01	16.90	49.30
2	6.71	33.56	4.23	30.99	12.08	63.09	5.63	54.93
3	9.40	42.95	5.63	36.62	10.07	73.15	7.04	61.97
4	6.71	49.66	2.82	39.44	6.04	79.19	4.23	66.20
5	6.04	55.70	9.86	49.30	5.37	84.56	9.86	76.06
6	11.41	67.11	8.45	57.75	3.36	87.92	5.63	81.69
7	6.71	73.83	11.27	69.01	1.34	89.26	4.23	85.92
8	5.37	79.19	9.86	78.87	2.01	91.28	5.63	91.55
9	3.36	82.55	8.45	87.32	4.03	95.30	4.23	95.77
10	3.36	85.91	0.00	87.32	.67	95.97	0.00	95.77
11	.67	86.58	1.41	88.73	.67	96.64	1.41	97.18
12	2.68	89.26	1.41	90.14	.67	97.32	1.41	98.59
13	.67	89.93	0.00	90.14	1.34	98.66	0.00	98.59
14	2.01	91.95	0.00	90.14	0.00	98.66	0.00	98.59
15	2.01	93.96	5.63	95.77	0.00	98.66	0.00	98.59
16	1.34	95.30	4.23	100.00	.67	99.33	1.41	100.00
17	1.34	96.64	0.00	100.00	0.00	99.33	0.00	100.00
18	.67	97.32	0.00	100.00	.67	100.00	0.00	100.00
19	.67	97.99	0.00	100.00	0.00	100.00	0.00	100.00
20	.67	98.66	0.00	100.00	0.00	100.00	0.00	100.00
21	.67	99.33	0.00	100.00	0.00	100.00	0.00	100.00
22	.67	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.7

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 6. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 119, Females 66.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	13.45	13.45	12.12	12.12	47.90	47.90	37.88	37.88
1	15.13	28.57	7.58	19.70	9.24	57.14	16.67	54.55
2	13.45	42.02	7.58	27.27	9.24	66.39	9.09	63.64
3	5.04	47.06	12.12	39.39	4.20	70.59	9.09	72.73
4	2.52	49.58	13.64	53.03	3.36	73.95	3.03	75.76
5	8.40	57.98	4.55	57.58	5.04	78.99	4.55	80.30
6	2.52	60.50	3.03	60.61	3.36	82.35	1.52	81.82
7	5.88	66.39	7.58	68.18	4.20	86.55	0.00	81.82
8	5.88	72.27	1.52	69.70	4.20	90.76	3.03	84.85
9	6.72	78.99	9.09	78.79	2.52	93.28	10.61	95.45
10	5.88	84.87	4.55	83.33	1.68	94.96	3.03	98.48
11	1.68	86.55	1.52	84.85	0.00	94.96	1.52	100.00
12	1.68	88.24	1.52	86.36	1.68	96.64	0.00	100.00
13	1.68	89.92	1.52	87.88	0.00	96.64	0.00	100.00
14	1.68	91.60	1.52	89.39	0.00	96.64	0.00	100.00
15	.84	92.44	3.03	92.42	0.00	96.64	0.00	100.00
16	.84	93.28	3.03	95.45	1.68	98.32	0.00	100.00
17	3.36	96.64	3.03	98.48	1.68	100.00	0.00	100.00
18	1.68	98.32	0.00	98.48	0.00	100.00	0.00	100.00
19	.84	99.16	1.52	100.00	0.00	100.00	0.00	100.00
20	.84	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.8

Number of Consonants Misarticulted
(Mild Articulation Deviation)

Grade 7. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 111, Females 48.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	17.12	17.12	14.58	14.58	46.85	46.85	39.58	39.58
1	11.71	28.83	8.33	22.92	14.41	61.26	10.42	50.00
2	15.32	44.14	6.25	29.17	9.91	71.17	16.67	66.67
3	9.91	54.05	12.50	41.67	8.11	79.28	8.33	75.00
4	8.11	62.16	6.25	47.92	6.31	85.59	6.25	81.25
5	7.21	69.37	10.42	58.33	1.80	87.39	2.08	83.33
6	3.60	72.97	4.17	62.50	2.70	90.09	2.08	85.42
7	7.21	80.18	4.17	66.67	3.60	93.69	6.25	91.67
8	5.41	85.59	10.42	77.08	2.70	96.40	2.08	93.75
9	5.41	90.99	6.25	83.33	1.80	98.20	4.17	97.92
10	3.60	94.59	4.17	87.50	.90	99.10	2.08	100.00
11	.90	95.50	2.08	89.58	0.00	99.10	0.00	100.00
12	.90	96.40	4.17	93.75	.90	100.00	0.00	100.00
13	1.80	98.20	0.00	93.75	0.00	100.00	0.00	100.00
14	.90	99.10	0.00	93.75	0.00	100.00	0.00	100.00
15	0.00	99.10	2.08	95.83	0.00	100.00	0.00	100.00
16	0.00	99.10	2.08	97.92	0.00	100.00	0.00	100.00
17	.90	100.00	2.08	100.00	0.00	100.00	0.00	100.00
18	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
19	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
20	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.0	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.9

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 8. Percent of subjects who misarticulated a specified number of the 72 consoants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 120, Females 44.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	21.67	21.67	18.18	18.18	43.33	43.33	52.27	52.27
1	8.33	30.00	13.64	31.82	15.83	59.17	4.55	56.82
2	12.50	42.50	9.09	40.91	10.00	69.17	9.09	65.91
3	10.83	53.33	6.82	47.73	8.33	77.50	9.09	75.00
4	6.67	60.00	4.55	52.27	4.17	81.67	6.82	81.82
5	6.67	66.67	4.55	56.82	2.50	84.17	4.55	86.36
6	6.67	73.33	9.09	65.91	3.33	87.50	2.27	88.64
7	5.83	79.17	2.27	68.18	4.17	91.67	2.27	90.91
8	5.00	84.17	4.55	72.73	1.67	93.33	2.27	93.18
9	5.83	90.00	6.82	79.55	3.33	96.67	2.27	95.45
10	.83	90.83	6.82	86.36	.83	97.50	0.00	95.45
11	3.33	94.17	4.55	90.91	.83	98.33	0.00	95.45
12	1.67	95.83	4.55	95.45	0.00	98.33	0.00	95.45
13	.83	96.67	0.00	95.45	0.00	98.33	2.27	97.73
14	0.00	96.67	0.00	95.45	0.00	98.33	2.27	100.00
15	.83	97.50	4.55	100.00	1.67	100.00	0.00	100.00
16	.83	98.33	0.00	100.00	0.00	100.00	0.00	100.00
17	0.00	98.33	0.00	100.00	0.00	100.00	0.00	100.00
18	.83	99.17	0.00	100.00	0.00	100.00	0.00	100.00
19	0.00	99.17	0.00	100.00	0.00	100.00	0.00	100.00
20	0.00	99.17	0.00	100.00	0.00	100.00	0.00	100.00
21	.83	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.10

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 9. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 86, Females 48.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	19.77	19.77	20.83	20.83	46.51	46.51	47.92	47.92
1	11.63	31.40	10.42	31.25	19.77	66.28	18.75	66.67
2	13.95	45.35	14.58	45.83	6.98	73.26	4.17	70.83
3	8.14	53.49	14.58	60.42	2.33	75.58	6.25	77.08
4	4.65	58.14	2.08	62.50	3.49	79.07	4.17	81.25
5	6.98	65.12	4.17	66.67	3.49	82.56	2.08	83.33
6	5.81	70.93	6.25	72.92	3.49	86.05	6.25	89.58
7	8.14	79.07	8.33	81.25	1.16	87.21	4.17	93.75
8	2.33	81.40	4.17	85.42	2.33	89.53	0.00	93.75
9	6.98	88.37	2.08	87.50	4.65	94.19	4.17	97.92
10	2.33	90.70	0.00	87.50	1.16	95.35	0.00	97.92
11	1.16	91.86	2.08	89.58	2.33	97.67	0.00	97.92
12	0.00	91.86	4.17	93.75	1.16	98.84	0.00	97.92
13	0.00	91.86	0.00	93.75	1.16	100.00	2.08	100.00
14	1.16	93.02	2.08	95.83	0.00	100.00	0.00	100.00
15	1.16	94.19	0.00	95.83	0.00	100.00	0.00	100.00
16	3.49	97.67	2.08	97.92	0.00	100.00	0.00	100.00
17	0.00	97.67	0.00	97.92	0.00	100.00	0.00	100.00
18	2.33	100.00	0.00	97.92	0.00	100.00	0.00	100.00
19	0.00	100.00	2.08	100.00	0.00	100.00	0.00	100.00
20	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE HS.11

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 10. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 55, Females 31.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	23.64	23.64	9.68	9.68	52.73	52.73	32.26	32.26
1	16.36	40.00	9.68	19.35	14.55	67.27	12.90	45.16
2	9.09	49.09	12.90	32.26	9.09	76.36	6.45	51.61
3	9.09	58.18	6.45	38.71	3.64	80.00	16.13	67.74
4	9.09	67.27	16.13	54.84	1.82	81.82	3.23	70.97
5	7.27	74.55	16.13	70.97	1.82	83.64	6.45	77.42
6	0.00	74.55	6.45	77.42	1.82	85.45	3.23	80.65
7	5.45	80.00	0.00	77.42	3.64	89.09	0.00	80.65
8	3.64	83.64	0.00	77.42	1.82	90.91	3.23	83.87
9	7.27	90.91	12.90	90.32	5.45	96.36	9.68	93.55
10	3.64	94.55	0.00	90.32	0.00	96.36	0.00	93.55
11	1.82	96.36	3.23	93.55	3.64	100.00	0.00	93.55
12	0.00	96.36	0.00	93.55	0.00	100.00	6.45	100.00
13	1.82	98.18	0.00	93.55	0.00	100.00	0.00	100.00
14	1.82	100.00	3.23	96.77	0.00	100.00	0.00	100.00
15	0.00	100.00	0.00	96.77	0.00	100.00	0.00	100.00
16	0.00	100.00	0.00	96.77	0.00	100.00	0.00	100.00
17	0.00	100.00	3.23	100.00	0.00	100.00	0.00	100.00
18	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
19	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
20	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00				

TABLE HS.12

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 11. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 45, Females 20.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	17.78	17.78	5.00	5.00	44.44	44.44	20.00	20.00
1	11.11	28.89	15.00	20.00	20.00	64.44	40.00	60.00
2	8.89	37.78	15.00	35.00	11.11	75.56	10.00	70.00
3	15.56	53.33	10.00	45.00	2.22	77.78	0.00	70.00
4	13.33	66.67	10.00	55.00	2.22	80.00	5.00	75.00
5	4.44	71.11	0.00	55.00	4.44	84.44	0.00	75.00
6	0.00	71.11	15.00	70.00	2.22	86.67	0.00	75.00
7	11.11	82.22	5.00	75.00	2.22	88.89	10.00	85.00
8	2.22	84.44	5.00	80.00	4.44	93.33	0.00	85.00
9	4.44	88.89	5.00	85.00	6.67	100.00	15.00	100.00
10	4.44	93.33	5.00	90.00	0.00	100.00	0.00	100.00
11	4.44	97.78	0.00	90.00	0.00	100.00	0.00	100.00
12	2.22	100.00	5.00	95.00	0.00	100.00	0.00	100.00
13	0.00	100.00	0.00	95.00	0.00	100.00	0.00	100.00
14	0.00	100.00	0.00	95.00	0.00	100.00	0.00	100.00
15	0.00	100.00	0.00	95.00	0.00	100.00	0.00	100.00
16	0.00	100.00	0.00	95.00	0.00	100.00	0.00	100.00
17	0.00	100.00	0.00	95.00	0.00	100.00	0.00	100.00
18	0.00	100.00	0.00	95.00	0.00	100.00	0.00	100.00
19	0.00	100.00	0.00	95.00	0.00	100.00	0.00	100.00
20	0.00	100.00	0.00	95.00	0.00	100.00	0.00	100.00
21	0.00	100.00	5.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00				

TABLE HS.13

Number of Consonants Misarticulated
(Mild Articulation Deviation)

Grade 12. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 37, Females 30.

	Test				Verbal Stimulation			
	Males		Females		Males		Females	
No.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.	Pct.	Cum.
0	24.32	24.32	13.33	13.33	51.35	51.35	33.33	33.33
1	21.62	45.95	3.33	16.67	13.51	64.86	16.67	50.00
2	8.11	54.05	10.00	26.67	5.41	70.27	3.33	53.33
3	8.11	62.16	10.00	36.67	8.11	78.38	3.33	56.67
4	5.41	67.57	6.67	43.33	0.00	78.38	3.33	60.00
5	2.70	70.27	6.67	50.00	0.00	78.38	6.67	66.67
6	2.70	72.97	6.67	56.67	5.41	83.78	10.00	76.67
7	2.70	75.68	10.00	66.67	0.00	83.78	10.00	86.67
8	2.70	78.38	13.33	80.00	2.70	86.49	6.67	93.33
9	5.41	83.78	6.67	86.67	5.41	91.89	3.33	96.67
10	2.70	86.49	3.33	90.00	5.41	97.30	0.00	96.67
11	5.41	91.89	0.00	90.00	0.00	97.30	0.00	96.67
12	0.00	91.89	3.33	93.33	0.00	97.30	0.00	96.67
13	5.41	97.30	0.00	93.33	0.00	97.30	0.00	96.67
14	0.00	97.30	0.00	93.33	0.00	97.30	3.33	100.00
15	0.00	97.30	0.00	93.33	0.00	97.30	0.00	100.00
16	0.00	97.30	3.33	96.67	0.00	97.30	0.00	100.00
17	2.70	100.00	3.33	100.00	2.70	100.00	0.00	100.00
18	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
19	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
20	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

APPENDIX I

Moderate Articulation Deviation (MAD)

Number of Consonants Misarticulated
(Detailed Tables)

290

TABLE IS.1

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Total Grades (1-12). Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 246, Females 149.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	.41	.41	.67	.67	4.88	4.88	4.70	4.70
1	.81	1.22	0.00	.67	2.44	7.32	4.03	8.72
2	1.63	2.85	2.68	3.36	4.47	11.79	6.71	15.44
3	1.63	4.47	4.03	7.38	10.57	22.36	8.05	23.49
4	2.03	6.50	1.34	8.72	8.54	30.89	7.38	30.87
5	5.69	12.20	4.70	13.42	9.35	40.24	14.77	45.64
6	1.22	13.41	3.36	16.78	5.69	45.93	6.71	52.35
7	5.28	18.70	8.05	24.83	10.57	56.50	6.71	59.06
8	6.10	24.80	9.40	34.23	3.66	60.16	9.40	68.46
9	6.50	31.30	10.74	44.97	8.54	68.70	6.71	75.17
10	10.16	41.46	7.38	52.35	6.10	74.80	6.04	81.21
11	6.10	47.56	3.36	55.70	6.10	80.89	1.34	82.55
12	5.69	53.25	4.70	60.40	2.85	83.74	3.36	85.91
13	6.50	59.76	5.37	65.77	2.03	85.77	2.01	87.92
14	5.69	65.45	6.04	71.81	4.88	90.65	3.36	91.28
15	3.66	69.11	7.38	79.19	1.63	92.28	2.01	93.29
16	3.66	72.76	2.01	81.21	2.03	94.31	.67	93.96
17	5.28	78.05	3.36	84.56	1.22	95.53	1.34	95.30
18	4.88	82.93	4.70	89.26	.81	96.34	.67	95.97
19	3.25	86.18	2.68	91.95	.81	97.15	2.68	98.66
20	1.22	87.40	2.01	93.96	.41	97.56	0.00	98.66
21	2.44	89.84	1.34	95.30	.41	97.97	0.00	98.66
22	2.44	92.28	0.00	95.30	1.22	99.19	0.00	98.66
23	2.03	94.31	0.00	95.30	0.00	99.19	.67	99.33
24	1.63	95.93	1.34	96.64	0.00	99.19	.67	100.00
25	.41	96.34	1.34	97.99	0.00	99.19	0.00	100.00
26	.41	96.75	0.00	97.99	0.00	99.19	0.00	100.00
27	.41	97.15	.67	98.66	0.00	99.19	0.00	100.00
28	0.00	97.15	0.00	98.66	.41	99.59	0.00	100.00
29	0.00	97.15	0.00	98.66	0.00	99.59	0.00	100.00
30	1.22	98.37	0.00	98.66	.41	100.00	0.00	100.00
31	0.00	98.37	.67	99.33	0.00	100.00	0.00	100.00
32	0.00	98.37	0.00	99.33	0.00	100.00	0.00	100.00
33	.81	99.19	0.00	99.33	0.00	100.00	0.00	100.00
34	0.00	99.19	.67	100.00	0.00	100.00	0.00	100.00
35	0.00	99.19	0.00	100.00	0.00	100.00	0.00	100.00
36	.41	99.59	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	99.59	0.00	100.00	0.00	100.00	0.00	100.00
38-45	.41	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.2

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 1. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 81, Females 43.

No.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
Msrt.	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	2.47	2.47	2.33	2.33
1	0.00	0.00	0.00	0.00	1.23	3.70	4.65	6.98
2	2.47	2.47	2.33	2.33	1.23	4.94	6.98	13.95
3	0.00	2.47	4.65	6.98	8.64	13.58	6.98	20.93
4	1.23	3.70	0.00	6.98	9.88	23.46	9.30	30.23
5	3.70	7.41	2.33	9.30	8.64	32.10	9.30	39.53
6	0.00	7.41	2.33	11.63	6.17	38.27	11.63	51.16
7	4.94	12.35	4.65	16.28	11.11	49.38	2.33	53.49
8	3.70	16.05	9.30	25.58	3.70	53.09	6.98	60.47
9	2.47	18.52	6.98	32.56	6.17	59.26	4.65	65.12
10	13.58	32.10	6.98	39.53	6.17	65.43	9.30	74.42
11	4.94	37.04	4.65	44.19	7.41	72.84	0.00	74.42
12	6.17	43.21	0.00	44.19	3.70	76.54	2.33	76.74
13	7.41	50.62	2.33	46.51	2.47	79.01	6.98	83.72
14	2.47	53.09	4.65	51.16	2.47	81.48	4.65	88.37
15	4.94	58.02	13.95	65.12	3.70	85.19	4.65	93.02
16	3.70	61.73	6.98	72.09	4.94	90.12	0.00	93.02
17	9.88	71.60	4.65	76.74	2.47	92.59	0.00	93.02
18	3.70	75.31	2.33	79.07	0.00	92.59	0.00	93.02
19	1.23	76.54	4.65	83.72	0.00	92.59	4.65	97.67
20	2.47	79.01	6.98	90.70	1.23	93.83	0.00	97.67
21	3.70	82.72	2.33	93.02	1.23	95.06	0.00	97.67
22	3.70	86.42	0.00	93.02	2.47	97.53	0.00	97.67
23	3.70	90.12	0.00	93.02	0.00	97.53	2.33	100.00
24	1.23	91.36	2.33	95.35	0.00	97.53	0.00	100.00
25	1.23	92.59	0.00	95.35	0.00	97.53	0.00	100.00
26	1.23	93.83	0.00	95.35	0.00	97.53	0.00	100.00
27	0.00	93.83	2.33	97.67	0.00	97.53	0.00	100.00
28	0.00	93.83	0.00	97.67	1.23	98.77	0.00	100.00
29	0.00	93.83	0.00	97.67	0.00	98.77	0.00	100.00
30	2.47	96.30	0.00	97.67	1.23	100.00	0.00	100.00
31	0.00	96.30	2.33	100.00	0.00	100.00	0.00	100.00
32	0.00	96.30	0.00	100.00	0.00	100.00	0.00	100.00
33	1.23	97.53	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	97.53	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	97.53	0.00	100.00	0.00	100.00	0.00	100.00
36	1.23	98.77	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	98.77	0.00	100.00	0.00	100.00	0.00	100.00
38-45	1.23	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.3

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 2. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 59, Females 26.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	3.39	3.39	7.69	7.69
1	0.00	0.00	0.00	0.00	1.69	5.08	0.00	7.69
2	0.00	0.00	0.00	0.00	11.86	16.95	7.69	15.38
3	1.69	1.69	0.00	0.00	8.47	25.42	0.00	15.38
4	1.69	3.39	3.85	3.85	6.78	32.20	7.69	23.08
5	6.78	10.17	0.00	3.85	6.78	38.98	23.08	46.15
6	3.39	13.56	0.00	3.85	3.39	42.37	0.00	46.15
7	5.08	18.64	26.92	30.77	18.64	61.02	19.23	65.38
8	5.08	23.73	11.54	42.31	1.69	62.71	3.85	69.23
9	6.78	30.51	0.00	42.31	5.08	67.80	7.69	76.92
10	3.39	33.90	11.54	53.85	6.78	74.58	3.85	80.77
11	3.39	37.29	0.00	53.85	5.08	79.66	3.85	84.62
12	3.39	40.68	3.85	57.69	5.08	84.75	3.85	88.46
13	8.47	49.15	7.69	65.38	0.00	84.75	0.00	88.46
14	11.86	61.02	7.69	73.08	6.78	91.53	0.00	88.46
15	1.69	62.71	7.69	80.77	0.00	91.53	0.00	88.46
16	5.08	67.80	0.00	80.77	1.69	93.22	0.00	88.46
17	5.08	72.88	3.85	84.62	1.69	94.92	3.85	92.31
18	5.08	77.97	3.85	88.46	3.39	98.31	3.85	96.15
19	5.08	83.05	0.00	88.46	1.69	100.00	3.85	100.00
20	0.00	83.05	0.00	88.46	0.00	100.00	0.00	100.00
21	5.08	88.14	3.85	92.31	0.00	100.00	0.00	100.00
22	5.08	93.22	0.00	92.31	0.00	100.00	0.00	100.00
23	1.69	94.92	0.00	92.31	0.00	100.00	0.00	100.00
24	3.39	98.31	0.00	92.31	0.00	100.00	0.00	100.00
25	0.00	98.31	3.85	96.15	0.00	100.00	0.00	100.00
26	0.00	98.31	0.00	96.15	0.00	100.00	0.00	100.00
27	1.69	100.00	0.00	96.15	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	96.15	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	96.15	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	96.15	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	96.15	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	96.15	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	96.15	0.00	100.00	0.00	100.00
34	0.00	100.00	3.85	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.4

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 3. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 23, Females 15.

	Test				Verbal Stimulation			
No.	Males		Females		Males		Females	
Msrt.	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	8.70	8.70	6.67	6.67
1	0.00	0.00	0.00	0.00	0.00	8.70	0.00	6.67
2	0.00	0.00	0.00	0.00	4.35	13.04	13.33	20.00
3	0.00	0.00	6.67	6.67	13.04	26.09	0.00	20.00
4	4.35	4.35	0.00	6.67	0.00	26.09	6.67	26.67
5	0.00	4.35	0.00	6.67	8.70	34.78	13.33	40.00
6	0.00	4.35	13.33	20.00	4.35	39.13	26.67	66.67
7	0.00	4.35	0.00	20.00	8.70	47.83	13.33	80.00
8	13.04	17.39	6.67	26.67	4.35	52.17	6.67	86.67
9	4.35	21.74	20.00	46.67	13.04	65.22	0.00	86.67
10	13.04	34.78	6.67	53.33	4.35	69.57	0.00	86.67
11	8.70	43.48	6.67	60.00	13.04	82.61	0.00	86.67
12	13.04	56.52	13.33	73.33	0.00	82.61	0.00	86.67
13	8.70	65.22	6.67	80.00	4.35	86.96	0.00	86.67
14	8.70	73.91	0.00	80.00	8.70	95.65	0.00	86.67
15	0.00	73.91	0.00	80.00	0.00	95.65	6.67	93.33
16	4.35	78.26	0.00	80.00	0.00	95.65	6.67	100.00
17	0.00	78.26	0.00	80.00	0.00	95.65	0.00	100.00
18	4.35	82.61	20.00	100.00	0.00	95.65	0.00	100.00
19	8.70	91.30	0.00	100.00	0.00	95.65	0.00	100.00
20	0.00	91.30	0.00	100.00	0.00	95.65	0.00	100.00
21	0.00	91.30	0.00	100.00	0.00	95.65	0.00	100.00
22	0.00	91.30	0.00	100.00	4.35	100.00	0.00	100.00
23	4.35	95.65	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	95.65	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	95.65	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	95.65	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	95.65	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	95.65	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	95.65	0.00	100.00	0.00	100.00	0.00	100.00
30	4.35	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.5

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 4. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 18, Females 11.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	5.56	5.56	0.00	0.00
1	0.00	0.00	0.00	0.00	11.11	16.67	0.00	0.00
2	5.56	5.56	0.00	0.00	0.00	16.67	0.00	0.00
3	0.00	5.56	9.09	9.09	0.00	16.67	9.09	9.09
4	5.56	11.11	0.00	9.09	11.11	27.78	0.00	9.09
5	5.56	16.67	0.00	9.09	11.11	38.89	36.36	45.45
6	0.00	16.67	0.00	9.09	0.00	38.89	0.00	45.45
7	11.11	27.78	0.00	9.09	5.56	44.44	9.09	54.55
8	5.56	33.33	0.00	9.09	5.56	50.00	9.09	63.64
9	11.11	44.44	18.18	27.27	16.67	66.67	9.09	72.73
10	16.67	61.11	27.27	54.55	11.11	77.78	18.18	90.91
11	11.11	72.22	0.00	54.55	5.56	83.33	0.00	90.91
12	0.00	72.22	9.09	63.64	0.00	83.33	0.00	90.91
13	0.00	72.22	9.09	72.73	11.11	94.44	0.00	90.91
14	5.56	77.78	18.18	90.91	5.56	100.00	9.09	100.00
15	5.56	83.33	0.00	90.91	0.00	100.00	0.00	100.00
16	5.56	88.89	0.00	90.91	0.00	100.00	0.00	100.00
17	0.00	88.89	0.00	90.91	0.00	100.00	0.00	100.00
18	11.11	100.00	9.09	100.00	0.00	100.00	0.00	100.00
19	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
20	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.6

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 5. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 20, Females 17.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	15.00	15.00	0.00	0.00
1	5.00	5.00	0.00	0.00	10.00	25.00	5.88	5.88
2	5.00	10.00	0.00	0.00	0.00	25.00	5.88	11.76
3	10.00	20.00	5.88	5.88	10.00	35.00	29.41	41.18
4	0.00	20.00	5.88	11.76	20.00	55.00	11.76	52.94
5	5.00	25.00	17.65	29.41	10.00	65.00	5.88	58.82
6	5.00	30.00	0.00	29.41	5.00	70.00	0.00	58.82
7	0.00	30.00	11.76	41.18	10.00	80.00	0.00	58.82
8	10.00	40.00	5.88	47.06	10.00	90.00	11.76	70.59
9	10.00	50.00	11.76	58.82	0.00	90.00	0.00	70.59
10	15.00	65.00	0.00	58.82	10.00	100.00	5.88	76.47
11	5.00	70.00	0.00	58.82	0.00	100.00	5.88	82.35
12	10.00	80.00	5.88	64.71	0.00	100.00	5.88	88.24
13	5.00	85.00	5.88	70.59	0.00	100.00	0.00	88.24
14	0.00	85.00	0.00	70.59	0.00	100.00	0.00	88.24
15	5.00	90.00	5.88	76.47	0.00	100.00	0.00	88.24
16	0.00	90.00	0.00	76.47	0.00	100.00	0.00	88.24
17	5.00	95.00	5.88	82.35	0.00	100.00	0.00	88.24
18	0.00	95.00	0.00	82.35	0.00	100.00	0.00	88.24
19	0.00	95.00	5.88	88.24	0.00	100.00	5.88	94.12
20	0.00	95.00	0.00	88.24	0.00	100.00	0.00	94.12
21	0.00	95.00	0.00	88.24	0.00	100.00	0.00	94.12
22	0.00	95.00	0.00	88.24	0.00	100.00	0.00	94.12
23	0.00	95.00	0.00	88.24	0.00	100.00	0.00	94.12
24	5.00	100.00	5.88	94.12	0.00	100.00	5.88	100.00
25	0.00	100.00	5.88	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.7

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 6. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 8, Females 9.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	0.00	0.00	11.11	11.11
1	0.00	0.00	0.00	0.00	0.00	0.00	11.11	22.22
2	0.00	0.00	11.11	11.11	12.50	12.50	11.11	33.33
3	12.50	12.50	0.00	11.11	25.00	37.50	11.11	44.44
4	0.00	12.50	0.00	11.11	12.50	50.00	0.00	44.44
5	0.00	12.50	11.11	22.22	0.00	50.00	0.00	44.44
6	0.00	12.50	11.11	33.33	12.50	62.50	11.11	55.56
7	12.50	25.00	0.00	33.33	0.00	62.50	0.00	55.56
8	0.00	25.00	11.11	44.44	0.00	62.50	22.22	77.78
9	25.00	50.00	22.22	66.67	25.00	87.50	11.11	88.89
10	12.50	62.50	11.11	77.78	0.00	87.50	0.00	88.89
11	12.50	75.00	0.00	77.78	0.00	87.50	0.00	88.89
12	0.00	75.00	0.00	77.78	0.00	87.50	0.00	88.89
13	12.50	87.50	0.00	77.78	0.00	87.50	0.00	88.89
14	0.00	87.50	11.11	88.89	12.50	100.00	11.11	100.00
15	0.00	87.50	0.00	88.89	0.00	100.00	0.00	100.00
16	0.00	87.50	0.00	88.89	0.00	100.00	0.00	100.00
17	0.00	87.50	11.11	100.00	0.00	100.00	0.00	100.00
18	12.50	100.00	0.00	100.00	0.00	100.00	0.00	100.00
19	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
20	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.8

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 7. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 10, Females 4.

	Test				Verbal Stimulation			
No.	Males		Females		Males		Females	
Msrt.	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	10.00	10.00	0.00	0.00
3	0.00	0.00	0.00	0.00	10.00	20.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00
5	20.00	20.00	0.00	0.00	20.00	40.00	25.00	25.00
6	0.00	20.00	0.00	0.00	10.00	50.00	0.00	25.00
7	0.00	20.00	0.00	0.00	0.00	50.00	25.00	50.00
8	0.00	20.00	0.00	0.00	0.00	50.00	50.00	100.00
9	10.00	30.00	0.00	0.00	10.00	60.00	0.00	100.00
10	10.00	40.00	0.00	0.00	10.00	70.00	0.00	100.00
11	0.00	40.00	25.00	25.00	0.00	70.00	0.00	100.00
12	20.00	60.00	50.00	75.00	10.00	80.00	0.00	100.00
13	0.00	60.00	0.00	75.00	0.00	80.00	0.00	100.00
14	10.00	70.00	0.00	75.00	10.00	90.00	0.00	100.00
15	10.00	80.00	25.00	100.00	10.00	100.00	0.00	100.00
16	0.00	80.00	0.00	100.00	0.00	100.00	0.00	100.00
17	0.00	80.00	0.00	100.00	0.00	100.00	0.00	100.00
18	10.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
19	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
20	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
33	10.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.9

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 8. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 7, Females 3.

No. Msrt.	Test Males %	Test Males Cum	Test Females %	Test Females Cum	Verbal Stimulation Males %	Verbal Stimulation Males Cum	Verbal Stimulation Females %	Verbal Stimulation Females Cum
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	33.33	33.33	42.86	42.86	33.33	33.33
4	14.29	14.29	0.00	33.33	14.29	57.14	0.00	33.33
5	0.00	14.29	0.00	33.33	0.00	57.14	0.00	33.33
6	0.00	14.29	0.00	33.33	14.29	71.43	0.00	33.33
7	14.29	28.57	0.00	33.33	14.29	85.71	0.00	33.33
8	28.57	57.14	0.00	33.33	0.00	85.71	33.33	66.67
9	0.00	57.14	0.00	33.33	0.00	85.71	0.00	66.67
10	14.29	71.43	0.00	33.33	0.00	85.71	0.00	66.67
11	14.29	85.71	0.00	33.33	14.29	100.00	0.00	66.67
12	0.00	85.71	0.00	33.33	0.00	100.00	0.00	66.67
13	0.00	85.71	33.33	66.67	0.00	100.00	0.00	66.67
14	0.00	85.71	33.33	100.00	0.00	100.00	33.33	100.00
15	0.00	85.71	0.00	100.00	0.00	100.00	0.00	100.00
16	14.29	100.00	0.00	100.00	0.00	100.00	0.00	100.00
17	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
18	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
19	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
20	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE IS.10

Number of Consonants Misarticulated
(Moderate Articulation Deviation)

Grade 9. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 10, Females 6.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	10.00	10.00	0.00	0.00
1	10.00	10.00	0.00	0.00	0.00	10.00	16.67	16.67
2	0.00	10.00	0.00	0.00	0.00	10.00	0.00	16.67
3	0.00	10.00	0.00	0.00	30.00	40.00	0.00	16.67
4	0.00	10.00	0.00	0.00	0.00	40.00	0.00	16.67
5	20.00	30.00	16.67	16.67	20.00	60.00	50.00	66.67
6	0.00	30.00	0.00	16.67	0.00	60.00	0.00	66.67
7	10.00	40.00	0.00	16.67	0.00	60.00	0.00	66.67
8	0.00	40.00	66.67	83.33	10.00	70.00	16.67	83.33
9	0.00	40.00	16.67	100.00	20.00	90.00	16.67	100.00
10	0.00	40.00	0.00	100.00	0.00	90.00	0.00	100.00
11	10.00	50.00	0.00	100.00	0.00	90.00	0.00	100.00
12	0.00	50.00	0.00	100.00	0.00	90.00	0.00	100.00
13	10.00	60.00	0.00	100.00	0.00	90.00	0.00	100.00
14	10.00	70.00	0.00	100.00	10.00	100.00	0.00	100.00
15	10.00	80.00	0.00	100.00	0.00	100.00	0.00	100.00
16	0.00	80.00	0.00	100.00	0.00	100.00	0.00	100.00
17	0.00	80.00	0.00	100.00	0.00	100.00	0.00	100.00
18	10.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
19	0.00	90.00	0.00	100.00	0.00	100.00	0.00	100.00
20	10.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
21	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
22	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
23	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
24	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
25	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
26	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
27	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
28	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE JS.11

Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 10. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 4, Females 3.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	33.33	33.33
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.33
6	0.00	0.00	33.33	33.33	50.00	50.00	0.00	33.33
7	0.00	0.00	0.00	33.33	0.00	50.00	0.00	33.33
8	0.00	0.00	0.00	33.33	0.00	50.00	0.00	33.33
9	0.00	0.00	0.00	33.33	0.00	50.00	0.00	33.33
10	50.00	50.00	0.00	33.33	0.00	50.00	33.33	66.67
11	0.00	50.00	0.00	33.33	25.00	75.00	0.00	66.67
12	0.00	50.00	0.00	33.33	0.00	75.00	0.00	66.67
13	0.00	50.00	0.00	33.33	0.00	75.00	33.33	100.00
14	0.00	50.00	0.00	33.33	0.00	75.00	0.00	100.00
15	25.00	75.00	33.33	66.67	0.00	75.00	0.00	100.00
16	0.00	75.00	0.00	66.67	0.00	75.00	0.00	100.00
17	0.00	75.00	33.33	100.00	0.00	75.00	0.00	100.00
18	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
19	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
20	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
21	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
22	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
23	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
24	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
25	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
26	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
27	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
28	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
29	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
30	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
31	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
32	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
33	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
34	0.00	75.00	0.00	100.00	0.00	75.00	0.00	100.00
35	0.00	75.00	0.00	100.00	25.00	100.00	0.00	100.00
36	0.00	75.00	0.00	100.00	0.00	100.00	0.00	100.00
37	25.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE JS.12

Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 11. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 6, Females 1.

	Test				Verbal Stimulation			
No.	Males		Females		Males		Females	
Msrt.	%	Cum	%	Cum	%	Cum	%	Cum
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	16.67	16.67	0.00	0.00	16.67	16.67	0.00	0.00
3	0.00	16.67	0.00	0.00	0.00	16.67	0.00	0.00
4	0.00	16.67	0.00	0.00	0.00	16.67	0.00	0.00
5	0.00	16.67	0.00	0.00	0.00	16.67	0.00	0.00
6	0.00	16.67	0.00	0.00	0.00	16.67	0.00	0.00
7	0.00	16.67	0.00	0.00	0.00	16.67	0.00	0.00
8	0.00	16.67	0.00	0.00	16.67	33.33	0.00	0.00
9	0.00	16.67	0.00	0.00	0.00	33.33	0.00	0.00
10	0.00	16.67	0.00	0.00	0.00	33.33	0.00	0.00
11	0.00	16.67	0.00	0.00	0.00	33.33	0.00	0.00
12	0.00	16.67	0.00	0.00	16.67	50.00	0.00	0.00
13	16.67	33.33	0.00	0.00	0.00	50.00	0.00	0.00
14	0.00	33.33	0.00	0.00	0.00	50.00	0.00	0.00
15	16.67	50.00	0.00	0.00	0.00	50.00	0.00	0.00
16	0.00	50.00	0.00	0.00	0.00	50.00	0.00	0.00
17	0.00	50.00	0.00	0.00	0.00	50.00	0.00	0.00
18	0.00	50.00	0.00	0.00	16.67	66.67	0.00	0.00
19	0.00	50.00	0.00	0.00	16.67	83.33	0.00	0.00
20	0.00	50.00	0.00	0.00	0.00	83.33	0.00	0.00
21	33.33	83.33	0.00	0.00	16.67	100.00	0.00	0.00
22	0.00	83.33	0.00	0.00	0.00	100.00	0.00	0.00
23	0.00	83.33	0.00	0.00	0.00	100.00	0.00	0.00
24	0.00	83.33	0.00	0.00	0.00	100.00	0.00	0.00
25	0.00	83.33	0.00	0.00	0.00	100.00	0.00	0.00
26	16.67	100.00	0.00	0.00	0.00	100.00	0.00	0.00
27	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00
28	0.00	100.00	0.00	0.00	0.00	100.00	100.00	100.00
29	0.00	100.00	0.00	0.00	0.00	100.00	0.00	100.00
30	0.00	100.00	0.00	0.00	0.00	100.00	0.00	100.00
31	0.00	100.00	0.00	0.00	0.00	100.00	0.00	100.00
32	0.00	100.00	100.00	100.00	0.00	100.00	0.00	100.00
33	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00

TABLE JS.13

Number of Consonants Misarticulated
(Extreme Articulation Deviation)

Grade 12. Percent of subjects who misarticulated a specified number of the 72 consonants (/hw/ excluded). Results show performance differences between initial test and verbal stimulation conditions; and between males and females. N = Males 8, Females 2.

No. Msrt.	Test				Verbal Stimulation			
	Males		Females		Males		Females	
	%	Cum	%	Cum	%	Cum	%	Cum
0	12.50	12.50	0.00	0.00	25.00	25.00	0.00	0.00
1	0.00	12.50	0.00	0.00	12.50	37.50	0.00	0.00
2	0.00	12.50	0.00	0.00	12.50	50.00	0.00	0.00
3	0.00	12.50	0.00	0.00	0.00	50.00	0.00	0.00
4	0.00	12.50	50.00	50.00	0.00	50.00	50.00	50.00
5	0.00	12.50	0.00	50.00	0.00	50.00	0.00	50.00
6	0.00	12.50	0.00	50.00	0.00	50.00	0.00	50.00
7	0.00	12.50	0.00	50.00	12.50	62.50	0.00	50.00
8	0.00	12.50	0.00	50.00	0.00	62.50	0.00	50.00
9	37.50	50.00	0.00	50.00	12.50	75.00	0.00	50.00
10	12.50	62.50	0.00	50.00	12.50	87.50	0.00	50.00
11	0.00	62.50	0.00	50.00	0.00	87.50	0.00	50.00
12	0.00	62.50	0.00	50.00	0.00	87.50	0.00	50.00
13	12.50	75.00	0.00	50.00	0.00	87.50	0.00	50.00
14	12.50	87.50	0.00	50.00	0.00	87.50	0.00	50.00
15	0.00	87.50	0.00	50.00	0.00	87.50	50.00	100.00
16	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
17	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
18	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
19	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
20	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
21	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
22	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
23	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
24	0.00	87.50	0.00	50.00	0.00	87.50	0.00	100.00
25	0.00	87.50	50.00	100.00	0.00	87.50	0.00	100.00
26	0.00	87.50	0.00	100.00	0.00	87.50	0.00	100.00
27	0.00	87.50	0.00	100.00	12.50	100.00	0.00	100.00
28	0.00	87.50	0.00	100.00	0.00	100.00	0.00	100.00
29	0.00	87.50	0.00	100.00	0.00	100.00	0.00	100.00
30	0.00	87.50	0.00	100.00	0.00	100.00	0.00	100.00
31	0.00	87.50	0.00	100.00	0.00	100.00	0.00	100.00
32	0.00	87.50	0.00	100.00	0.00	100.00	0.00	100.00
33	12.50	100.00	0.00	100.00	0.00	100.00	0.00	100.00
34	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
35	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
36	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
37	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
38-45	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
46-72	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00