

Assessment of Grammatical Skills for Speechreading Instruction

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The thesis of this paper is that language competence affects speechreading performance. The speechreader who is competent in English is able to use linguistic context to anticipate what the speaker is saying. This article discusses the development of a speechreading test entitled the Syntax Specific Test for Speechreading (SST) which incorporates grammatical considerations in the scoring procedure and test item selection. The SST assesses speechreading performance of 7 grammatical structures including: infinitives with *to*, infinitives without *to*, *that* complements, relative clauses, adjectives with *-ful*, adjectives with *-less*, and nominals with *-ing*. The SST was administered to 13 prelingually deaf adults enrolled in the remedial English program at the National Technical Institute for the Deaf. Pre- and post-test results show significant improvement in speechreading for each of the structures, following integrated English and speechreading instruction. Error types are presented and explanations proposed. Applications of the SST as a diagnostic test for planning instruction are discussed. Directions for further exploration into the specific contribution grammatical knowledge makes in speechreading are suggested.

Language competence is acknowledged as a crucial factor in speechreading. Recognizing this, A.G. Bell made the following statement before the British Royal Society in 1888: "[Spoken language] is not clear to the eye and requires a knowledge of language to unravel the ambiguities" (Deland, 1923, p. 37). Since this statement was made, a number of authors have pointed out that grammatical ability permits the speechreader to use linguistic context to predict and fill-in what a speaker is saying (Berg, 1976; Berger, 1972; Green, Green, & Holmes, 1980; Jeffers & Barley, 1971; Lowell, 1959; Moores, 1978). Language skill reduces the difficulty of the speechreading task because of linguistic predictability.

Numerous studies report a moderate to high correlation between speech-

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reading ability and measures of linguistic performance such as reading tests, language usage tests, vocabulary measures, and speech measures. Jeffers and Barley (1971) and Berger (1972) provide a comprehensive review of these studies. Few studies, however, have related grammatical competence to speechreading ability. One such study by Albright, Hipskind and Schuckers (1973) employed an artificial language task to evaluate speechreading ability of normal-hearing students. Subjects speechread normal English utterances and also visemically equivalent nonsense utterances composed of English words. As one might predict, speechreading performance was found to be much better for the English utterances. These authors concluded that semantic/syntactic knowledge is essential for processing oral information through speechreading. In another study, Fehr and Trotter (1975) explored the influence of the complexity of grammatical structure on speechreading ability. Their results indicated that for normal-hearing subjects, certain syntactic structures were more difficult to speechread than others.

Prelingually deaf speechreaders may not have a strong mastery of English grammatical structure. Therefore, speechreading becomes a difficult task for them. The language deficits of this population may be comparable to those of nonnative speakers of English in that they also possess only a partial knowledge of English grammar. A measure of speechreading ability for the prelingually deaf needs to account for grammatical competence.

Limitations of Traditional Speechreading Tests

Traditional tests of speechreading fail to provide information regarding students' abilities to speechread complex structures. Most speechreading tests control for vocabulary level but present only simple, single-clause sentence structures. In addition, there are limitations to the types of scoring procedures used in traditional speechreading tests:

1. **Whole-Sentence Scoring.** A common type of scoring procedure used in speechreading testing is whole-sentence scoring. The Utley Sentence Test of Lip Reading Ability (Jeffers & Barley, 1971) utilizes this type of scoring where the entire sentence is scored either right or wrong. This type of scoring penalizes the speechreader with poorer language skills; e.g., stimulus: "What happened" – error response: "What happen?" In this example, the speechreader is penalized, even though he understands the meaning of the utterance.
2. **Key-Word Scoring.** Another type of scoring system is key-word scoring of the type used in the CID Everyday Sentences Speechreading Test (Davis & Silverman, 1970; Johnson, 1976). Here, only key words like nouns, verbs, and adjectives are scored. Function words like prepositions, pronouns, and auxiliaries are not considered in key-word scoring. However, key words alone do not provide enough information to

understand the meaning of the utterance as seen in the following example: The stimulus, "The phone call's for you," containing the key words, *phone*, *call*, and *you*, might elicit one of these four interpretations—"The phone call's (about, for, to, from) you." The speechreader may perceive all of the key words and yet not understand the utterance because the preposition provides important semantic information. Other problems with key-word scoring are that word order is unimportant and there is no penalty for the addition of words. In the example below, the speechreader would receive full credit for the response, even though he clearly has misunderstood the stimulus "I am hungry," by interpreting the same to have been "I am not hungry."

3. **Every-Word Scoring.** Other types of scoring procedures such as every-word scoring have problems similar to key-word and whole-sentence procedures. Every-word scoring [used as an alternative procedure for the Utley Sentence Test of Lipreading Ability (Jeffers & Barley, 1971)] assigns one point for every word. Again, the problem of word order and addition of words is not addressed.

Need for a Language-based Speechreading Test

Scoring procedures for most current speechreading tests fail to yield systematic information concerning the contribution of grammatical knowledge to speechreading skill. This information is essential in evaluating speechreading performance of the prelingually deafened student. A measure of students' abilities to speechread specific grammatical structures could be used diagnostically to plan an effective therapy program integrating speechreading and English instruction. An integrated speechreading/English curriculum is currently in use at the National Technical Institute for the Deaf. This curriculum reinforces the acquisition of grammatical structures in writing and reading with the development of speaking, listening, and speechreading skills for the same structures. In the English class, all grammatical instruction in reading and writing is accompanied by oral/aural practice employing those same structures. Grammatically important elements are reinforced in the students' speech and emphasized in speechreading drills. Speechreading materials were developed to *reinforce* the recognition, identification, and comprehension of the grammatical structures learned in written and read contexts. The multiple modes in which grammatical instruction occurs permit students to incorporate the acquisition of English structures with functional communicative needs. [See Durity, Forman, & Jacobs (1980) for a more detailed discussion of instructional techniques.]

PROCEDURES

Subjects

The subjects were 13 prelingually deaf young adults enrolled at the

Table 1
Communication Characteristics of Subjects (N=13)

Speechreading (best score) ^a ≥		50%
Speech Intelligibility Rating ^b ≥		3.5
Reading ^c	Mean	7.33
	S.D.	.81
Writing ^d	Mean	6.78
	S.D.	.64

a. CID Everyday Sentences Speechreading Test. (Johnson, 1976; Davis & Silverman, 1970)

b. NTID Speech Intelligibility Profile (Johnson, 1976)

c. California Reading Test (Teigs & Clark, 1967)

d. NTID Written Language Test (Crandall, 1977)

National Technical Institute for the Deaf. They exhibited the communication characteristics shown in Table 1. As shown in the Table, Speechreading (Best Score) represents the subjects' best performances in the with or without-sound condition on the CID Everyday Sentences Speechreading Test (Davis & Silverman, 1970; Johnson, 1976). The Speech Intelligibility Rating is on a scale from 1-5 (Johnson, 1976). A profile rating of greater than or equal to 3.5, functionally means that sophisticated listeners understand more than half of what was read using the Rainbow Passage. Reading scores represent the group mean on the California Reading Test: Junior High Level (Tiegs & Clark, 1967). The measure yields a grade-level score based on a 12-point grade scale. The Writing Score represents the group mean on the NTID Written Language Test (Crandall, 1977) and is based on a total of 10 possible points. Table 2 shows the group mean for performance on the CID Everyday Sentences Speechreading Test (Davis & Silverman, 1970; Johnson, 1976) and the Utley Sentence Test of Lipreading Ability (Jeffers & Barley, 1971).

Table 2
Performance on Other Measures of Speechreading Skill (N=13)

	With Sound		Without Sound	
	Mean	S.D.	Mean	S.D.
CID Everyday Sentence Test	60.6%	16.4%	50.4%	11.2%
Utley Sentence Test			56.1%	12.0%

Development of the Syntax Specific Test for Speechreading

Grammatical Structures Tested. To meet the need for a speechreading test of grammatical skill, the Syntax Specific Test for Speechreading (SST) was

developed. This test addressed two areas of linguistic development: (a) complex syntax and (b) complex morphology. Within these two areas, seven grammatical structures were included in this version of the Syntax Specific Test for Speechreading. The seven structures with sample sentences are listed below:

1. Complex Syntax
 - A. That-complements
Example: I forgot that I had an appointment at two o'clock.
 - B. Infinitives which require *to*
Example: He plans to take a short vacation during the break.
 - C. Infinitives without *to* (Bare Infinitives)
Example: I heard my friend scream at his neighbor.
 - D. Relative Clauses
Example: The boy ate all the cookies which were in the kitchen.
2. Complex Morphology
 - A. Nominals with *-ing*
Example: Walking a mile each day is excellent exercise.
 - B. Adjectives with *-ful*
Example: It was thoughtful of you to bring me flowers.
 - C. Adjectives with *-less*
Example: Those shoes with holes in the heels are useless.

Rationale for Choice of Grammatical Structures. It has been our observation that prelingually deaf students at remedial levels of English have difficulty with these structures. Our findings are supported by the work of Moeller, Osberger, McConkey, and Eccarius (1981) who report that deaf individuals between the ages of 9.5 and 20.0 years demonstrated poorest performance on nominalization, complementation, and relativization as measured by the Test of Syntactic Ability.

Our population of prelingually deaf college students do, for the most part, possess grammatical competence at the single-clause level, but run into difficulties in biclausal and multiclausal constructions. The variety of connectors that are used to join clauses and phrases are not yet clearly understood. Therefore, these students lack knowledge concerning the correct usage of such forms as *that* in that-complements, *to* in infinitives, and relative pronouns such as *that*, *which*, and *who* in relative clauses. Likewise, complex morphology is only vaguely understood. There seems to be a general awareness on the students' parts of the procedures through which new words and different forms of words are generated. In English, the generation of word forms is through the addition of suffixes and prefixes as well as modification of major stress assignment. However, the complex details of deriving morphological forms and how these forms fit into the syntax have not been fully

acquired. Though students demonstrate an awareness that words can have "endings," this sensitivity is largely confined to inflectional morphology (verb tense, plurals, and possessives). Complex or derivational morphology, where prefixes and suffixes are added to root forms to generate more complex word forms [e.g., home (noun) + -less (suffix) = homeless (adjective)], is not used productively. Instead, these students appear to possess one or two forms of a particular word which will be used to function in a variety of semantic and syntactic environments. The errors in the sentences below illustrate the rigid and grammatically inappropriate use of one derived form: (a) I want to *communication*, (b) John *communication* his teacher, and (c) the course *communication* is boring. There is further evidence from student writing samples and performances on comprehension tests that this group of English learners does not have complete control over these structures in either production or comprehension tasks.

Test Development Methodology. Over 200 sentences were generated incorporating the seven grammatical structures. All sentences were controlled for equivalent syllabic length within three syllables. Approximately 20 sentences for each structure were selected from the original 200 for inclusion in the test. One hundred forty-four (144) sentences were selected on the basis of the following criteria: everydayness, spoken naturalness (sentences that would appear in a spoken context), and vocabulary at or below sixth grade level (Dale & O'Rourke, 1976.) The 144 sentences were divided into two lists and randomized.

The sentences were spoken by a female speaker and videotaped in color in a television studio with a visually nondistracting background. The speaker was viewed frontally and spoke at a normal-to-slow rate, using natural facial expression and gesture. VHS video cassette duplicates were made to permit individualized presentation of the SST.

Administration

Subjects viewed the video cassettes on Sony Trinitron color television monitors with Panasonic Model NV 8170 VHS videocassette playback units. The lists were presented in the without-sound condition. The following instructions were given:

1. The speaker will say a sentence once.
2. Watch the speaker's lips very closely.
3. Write in the blank what you think the speaker said.
4. There will be two practice sentences first.
5. Guess if you are not sure.

The subjects wrote their responses on answer sheets. Subjects were allowed sufficient writing time between stimulus presentations and saw each sentence one time only.

Scoring of the SST

Scoring of the Syntax Specific Test for Speechreading involves the seven structures under consideration which are infinitives with *to*, infinitives without *to*, that-complements, relative clauses, nominals with *-ing*, adjectives with *-ful*, and adjectives with *-less*. For each grammatical structure, Syntax Specific Items (SS Items) were determined. SS Items are the words that are considered essential for the proper identification of a particular grammatical structure. In this sense, SS Items represent a set of features which uniquely define a grammatical structure. These sets of features enable us to distinguish and contrast grammatical structures which form natural syntactic minimal pairs. That-complements and infinitives with *to* are one example of a syntactic minimal pair. The following two sentences serve to illustrate the point: (a) John hopes to go and (b) John hopes that he can go. Several observations can be made about these two sentences. They bear semantic equivalence, assuming of course that *John* and *he* are coreferential. They possess some SS Items in common, specifically *John*, *hopes*, and *go*. They differ in syntactic features which are required to define each structure. An infinitive requires a subject (*John*), main verb (*hopes*), infinitive verb (*go*) and *to* which must appear between the main verb and the infinitive verb. That-complements also require a subject (*John*) and main verb (*hopes*) but differ in the occurrence of a subordinate subject (*he*), subordinate verb which is inflected (*go*) and *that* which introduces the subordinate clause. These syntactic features or SS Items are listed below:

1. Infinitive: NOUN VERB TO VERB (uninflected) (4 SS Items)
2. That complements: NOUN VERB THAT NOUN VERB (5 SS Items)

If SS Items are missing from a response, then the meaning as well as the syntactic structure of the sentence becomes difficult to identify. Thus, responses like "John hopes that go" and "John hopes go" are clearly grammatically aberrant. Likewise, if words not present in the original stimulus sentences are inserted, the meaning and syntax can be obscured (e.g., "John hopes to *he* go" and "John hopes to that go"); whereas *he* would be considered an inserted word or intrusive and *that* would be classified as an intrusive item.

A numerical score was calculated for each stimulus sentence by assigning one point for each SS Item present and in the correct word order. One point was deducted for each intrusive. Listed below are sample stimulus sentences from each syntactic structure tested by the SST. The SS Items are italicized.

1. Infinitives with *to*: The *teacher permitted* him *to leave* class early. (4 SS Items)
2. Infinitives without *to*: *We let* the *children go* to school. (4 SS Items)
3. That-complements: The *teacher suspected that* the *boy was cheating*. (5 SS Items)

4. Relative Clauses

Subject/Subject: *The ice cream which melted stained my pants.*
(4 SS Items)

Subject/Object: *The girl who(m) the man robbed lives in my building.*
(5 SS Items)

Object/Object: *The secretary mailed the letter which she had typed.*
(6 SS Items)

Object/Subject: *The boys ate all the cookies that were burnt.*
(5 SS Items)

5. Adjectives with *-ful*: *My grandmother has become very forgetful.*
(3 SS Items)6. Adjectives with *-less*: *The students were careless with the machine.*
(3 SS Items)7. Nominals with *-ing*: *Buying their birthday presents could be fun.*
(3 SS Items)

RESULTS

Figure 1 shows the results of two administrations of the SST in the without-sound condition for each of the seven grammatical structures. Pre-

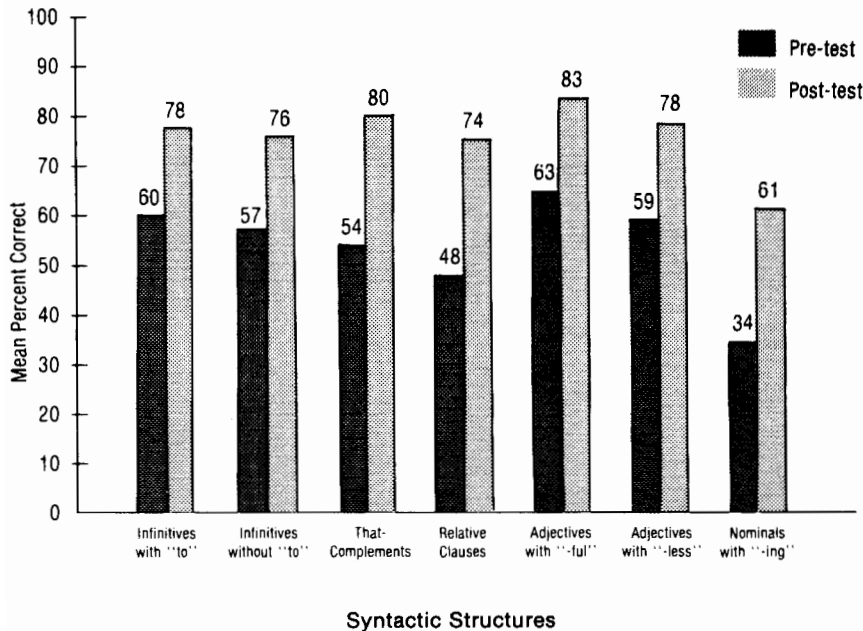


Figure 1. Pre- and post-test results with the Speechreading Syntax Specific Test under the without-sound condition.

test scores represent mean performance of subjects on the SST prior to integrated Speechreading/English instruction. Post-test scores represent mean performance of subjects on the SST following 10 weeks of intensive integrated Speechreading/English instruction. Instruction included: speechreading training in a combined auditory/visual mode, speech training, writing practice, and reading practice with all seven grammatical structures. Students received a total of approximately 90 hours of instruction. Speechreading improvement is shown for all seven grammatical structures. The group means and standard deviations on the SST by structure are shown in Table 3.

Table 3
Group Mean Scores and Standard Deviations
for the SST (N=13)*

Structures	Pre-Test		Post-Test	
	%		%	
	Mean	S.D.	Mean	S.D.
Infinitives with <i>to</i>	60.2	13.5	78.1	14.2
Infinitives without <i>to</i>	57.7	14.5	76.2	8.7
That-complements	54.4	20.6	80.2	11.6
Relative clauses	48.2	20.0	74.1	11.1
Adjectives with <i>-ful</i>	62.7	22.3	82.7	16.3
Adjectives with <i>-less</i>	59.0	20.3	78.0	14.0
Nominals with <i>-ing</i>	33.7	22.5	61.4	20.5

*Without Sound: List 1

DISCUSSION

Error Types

Errors in written responses to the speechread sentences fell into three general categories: substitutions, reductions, and syntactic additions. Sample error responses from relative clauses (complex syntax) and nominals with *-ing* (complex morphology) are presented in Table 4. The stimulus sentence, "Studying all night has really made me tired," is reported as "Sunday night can really become tired," illustrating a substitution of *Sunday night* for the SS Item, *studying*. The reduction of the nominal *-ing* form *studying* to *study* demonstrates an incorrect usage of a verb form where a nominal is required. The syntactic addition of *I* and *and* in the response, "I study all night and make me tired," is an instance where the nominal phrase *studying all night* has been transformed into an entire clause and joined to the

Table 4
Observed Errors in Response to the Speechreading Syntax Specific Test

	Stimulus Sentence	Substitutions	Reductions	Syntactic Additions
Nominals <i>-ing</i>	Buying their birthday presents could be fun.	Bill is birthday present can be fun.	My birthday present can be fun.	
		Bike is birthday present can be fun.	Buy a birthday present can be fun.	
	Studying all night has really made me tired.	Sunday night can really become tired.	Study all night really make me tired.	I study all night and make me tired. It is thunder all night, it make me tired.
Relative Clauses	We moved into the building that my father built.	Remove the building to my father's building.	Remove the building to my father's building.	We moved into a building that my father built it. When we move to other place when my father is ok.
		We moved into a building when my father built.		
		We will move if my father has building.		
	The husband wore the new tie that his wife bought.	The hospital award that his wife bought. The husband use the car that his wife brought.		The husband wore a tie that his wife bought it.

remainder of the sentence with *and*. These sentences would be scored as shown below:

1. **Stimulus sentence SS Items**

"*Studying all night has really made me tired.*"

+1 +1 +1 = +3

2. **Substitution**

"Sunday *night* can really become tired."

+1 = +1

3. Reduction

“Study all *night* really *make* me tired.”
 +1 +1 = +2

4. Syntactic Addition

“I study all *night and make* me tired.”
 -1 +1 -1 +1 = 0

Application of the SST

The SST can be used diagnostically to determine the specific grammatical structures with which the student is having the greatest difficulty. Speechreading training can then be designed to focus on those structures that the student needs to master. Students may be taught speechreading strategies for particular structures. This type of speechreading training with an emphasis on language structure helps the students become aware that they can use their linguistic knowledge to make predictions about what they are speechreading. In addition, students develop an awareness that it is not necessary to speechread every word but that speechreading requires the processing of information in syntactic units.

For assessment purposes, the SST provides a functional sentence test of speechreading ability which considers the contribution of language competency. The SST reduces the limitations of key-word, whole-sentence, and every-word scoring procedures in that it considers the contributions of grammatical elements in conveying meaning. The development of this type of functional test of speechreading which incorporates sophisticated linguistic analysis requires the collaboration of audiologists and language specialists.

Further Areas of Investigation

Refinement of the SST as a diagnostic tool includes the need for test-item analysis and an investigation of interform reliability. This work is currently underway.

Recognizing the importance of language competence in speechreading ability has a variety of implications. Instructional techniques need to be considered which will enhance the grammatical information available to the speechreader. Techniques may involve focusing instruction on the suprasegmental aspects of the speech signal. Rhythm, stress, intonation, and duration play an important role in signaling grammatical structure. These techniques need to be developed to make the speechreader more aware of this information either auditorily, visually, or tactilely. Some syntactic structures have especially low visibility for speechreading. Referring back to Figure 1, one can see that student performance is relatively low on the Nominal *-ing* structure compared with the other structures tested. The *-ing* suffix is not visible on the lips. In addition, there are very few additional linguistic cues in the Nominal *-ing* structure which could signal the presence of this structure.

The speechreading and language instructor needs to consider ways of making this type of grammatical information more available to the speechreader. Methods need to be developed for increasing the redundancy of low-redundancy structures.

Another area for investigation is the manner in which linguistic competence affects performance on the SST. It would be interesting to compare the performance of students with more diverse English language skills than demonstrated by the group investigated in the present study. One would expect students with greater or less English proficiency to make different types of errors and show different overall performance because of their difference in language competence.

Summary

This paper has addressed the need for the development of a speechreading measure which considers the contributions of grammatical competence. Theoretical grounding for this approach can be found throughout the literature on assessing language skill which finds correlations between linguistic ability and speechreading skill. Traditional methods for scoring speechreading tests were shown to be inadequate because they do not take into account, in any systematic way, the linguistic structure of the stimuli.

The Syntax Specific Test for Speechreading was developed to satisfy the need for a test that measures the contribution of grammatical knowledge to speechreading performance. It evaluates seven grammatical structures under the categories of complex syntax and complex morphology. The test was administered to 13 prelingually deafened college students enrolled in remedial English classes. Pre- and Post-test scores were compared. Significant improvement was noted on all seven structures following intensive integrated English/Speechreading instruction.

These findings suggest that it is possible to evaluate the contribution of grammatical knowledge to speechreading ability. The representation of essential grammatical information in speechread as well as acoustic signals needs to be systematically investigated. The results of such an investigation would provide insight into how language input can be optimized by those involved in communication training for the deaf. It would also further our understanding of what is really being measured when speechreading skill is assessed.

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REFERENCES

- Albright, P., Hipskind, N., & Schuckers, G. A comparison of visibility and speechreading performance on English and Slurvian. *Journal of Communication Disorders*, 1973, 6, 44-52.
- Berg, F.S. *Educational audiology: hearing and speech management*. New York, N.Y.: Grune & Stratton, 1976, 158-160.
- Berger, K.W. *Speechreading: principles and methods*. Baltimore, Md.: National Educational Press, Inc., 1972, 73-140.
- Crandall, K. *Written language scoring procedures for grammatical corrections: directions*. Working paper, Rochester, N.Y.: National Technical Institute for the Deaf, 1977.
- Dale, E., & O'Rourke, J. *The living word vocabulary*. Elgin, Il.: Field Enterprises, Educational Corporation, 1976.
- Davis, H., & Silverman, S. *Hearing and deafness* (3rd ed.). New York, N.Y.: Holt, Rinehart & Winston, 1970, 492-495.
- Deland, F. An ever continuing memorial. *The Volta Review*, 1923, 25, 34-39.
- Durity, R., Forman, J., & Jacobs, M. *The integration of speechreading and English Level-2 instruction*. Paper presented to the Division of Communication Programs, NTID, Rochester, N.Y.: National Technical Institute for the Deaf, 1980.
- Fehr, J., & Trotter, W. Visual perception by speechreaders of selected syntactic structures. *Journal of Perceptual and Motor Skills*, 1975, 41, 31-34.
- Green, K., Green, W., & Holmes, D. Speechreading abilities of young deaf children. *American Annals of the Deaf*, 1980, 125, 906-908.
- Jeffers, J., & Barley, M. *Speechreading*. Springfield, Il.: Charles C. Thomas, 1971.
- Johnson, D. Communication characteristics of a young deaf adult population: techniques for evaluating their communication skills. *American Annals of the Deaf*, 1976, 121, 409-424.
- Lowell, E. Research in speechreading: some relationships to language development and implications for the classroom. *Proceedings of the 39th Convention of the American Instructors of the Deaf*, 1959, 68-72.
- Moeller, M.P., Osberger, M.J., McConkey, A.J., & Eccarius, M. Some language skills of the students in a residential school for the deaf. *Journal of the Academy of Rehabilitative Audiology*, 1981, 14, 84-111.
- Moores, D.F. *Educating the Deaf: psychology, principles and practices*. Boston, Ma.: Houghton & Mifflin, Co., 1978, 16-17.
- Tiegs, E., & Clark, W. *California Reading Test: Junior High Level, WXYZ series, 1963 norms*. Monterey, Ca.: McGraw-Hill, Inc., 1967.