

***SPEECH READING:  
A REVIEW OF LITERATURE.***

**Reg No.M9611**

**AN INDEPENDENT PROJECT SUBMITTED AS PART FULFILLMENT OF  
FIRST YEAR M.Sc (SPEECH AND HEARING)  
TO THE UNIVERSITY OF MYSORE.  
MYSORE**

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**MAY 1997**

## **CERTIFICATE**

*This is to certify that this independent project entitled "SPEECH READING:A REVIEW OF LITERATURE." is the bonafide work in partfulfillment for the First year Master of Science (Speech and Hearing) of the student with register number M9611.*

Mysore  
May, 1997



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## **DECLARATION**

This independent project entitled "*SPEECH READING: A REVIEW OF LITERATURE.*" is the result of my own study under the guidance of *Dr. ASHA YATHIRAJ*, Reader in Audiology, Department of Audiology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier at any University for any other Diploma or Degree.

Mysore  
May, 1997

**M9611**

*Dedicated  
With love to  
Mummy, Fapa  
&  
Neethi  
'You mean everything to me''*

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## **ACKNOWLEDGEMENTS**

I express my deep sense of gratitude and heartfelt thanks to my guide, **Dr. ASHA YATHIRAJ**, Reader in Audiology, All India Institute of Speech and Hearing, Mysore, for all her inspiration, encouragement, guidance, comments, patience, listening, and untiring effort in steering me through every aspect of the project.

I extend my gratitude to **Dr. (Miss) S. NIKAM**, Director, All India Institute of Speech and Hearing, Mysore, for permitting me to carry out this project.

I am grateful to all my classmates especially **Veena, Deepa, Rohi, J.P., Shibu, Rajesh** and **Manoj** for assisting me in need throughout this project.

I sincerely thank the Library Staff for their co-operation in providing me with necessary books and journals.

Many thanks to **Spaceage Electronic Typing** for having typed this manuscript of mine.

Last but not the least, I would like to thank my family members; **my beloved parents** who are with me in my good and bad times, my success and failures. I am so indebted to them that I cannot get words to express my feelings; my sister **Neethi**, my loved ones, for providing much needed support, friendship and what not.

Reg. No. M9611

## **INTRODUCTION**

Communication is basic to any living being Human society would not have been possible without communication. In fact, the very ability to communicate through speech has made man unique among all animals. Through speech, man can express his feelings, desires, likes and dislikes and also convey messages to others.

In almost every human society, the primary mode of communication is by speaking and hearing. In ordinary conversation, we employ both sight and hearing. Hearing is so predominant for most of us however, that we seldom appreciate the importance of sight. The information that we get by watching the movements of the speaker's lips, his gestures and the expressions of his face, is realised only when we hear with difficulty and are unable to see the speaker to one's satisfaction. The hearing impaired person on the other hand, is much more dependent on visual cues for communication. The degree to which the hearing impaired need visual information. When conversing with someone, is proportional to the amount of information that is lost due to hearing impairment. In other words, a person with severe hearing loss is likely to be more dependant on visual information to communicate than an individual with a mild auditory impairment (Jeffers & Barley, 1971)

### **Speechreading / Lipreading:**

Lipreading, speechreading or visual hearing are all terms that have been used to describe a particular form of non auditory communication which is used by hearing impaired individuals for speech perception. Here, the



visual shape and movement of a speaker's articulators become the important communicative elements. In this situation, the eye is the primary receptor, with the ear affording some slight assistance. Thus, an additional sensory mode can be used by a person who is aurally handicapped.

Speechreading was defined as "the art of understanding a speaker's thoughts by watching the movements of his mouth and his facial expressions {Nitchie (1912)}. In other words, speechreading means understanding a speaker's thought through a combined look and listen technique. The speechreader observes such visible articulatory movements and at the same time hears the message. Vision is used to supplement an inaccurately or partially received auditory pattern. Again, in 1916, Nitchie expanded his concept of speechreading by including that it requires training of the mind and the eyes.

Ewing (1941) of Manchester University defined speechreading as the "Mental activity by which speech of other people is understood when the words can be seen but not heard".

Both the terms, speechreading and lipreading, are used today to describe the art of gaining about what is being said by watching the lips and facial expression. Lipreading is the better established term and was used almost exclusively from the 1900's upto the 1930's or perhaps even later. Since that time, there has been a continuous effort by a large number of teachers to change the generic term to speechreading. The advantage of the newer term, or the newly rediscovered term, is that it more explicitly connotes

the process. The speechreader is literally reading speech, or atleast speech movements. He observes lip, jaw, and tongue movements that are made by the speaker, as well as his facial expression, whereas the term lipreading implies observation of just the lips.

### **Who needs to speechread?**

All of us, at one time or the other, need to speechread. This is true especially for those who do not receive auditory information which is necessary to comprehend a speaker's message. This could be a result of either environmental or organic deprivation. Speechreading is done not only by the hearing impaired persons but also by normally hearing individuals in adverse listening conditions. All hearing impaired individuals need to speechread and the extent of their need depends on the degree of hearing impairment. Some of them speechread, only part of the time whereas others who do not receive enough information through hearing alone, have to rely mainly on speechreading to receive any message.

### **Who needs speechreading instruction ?**

Any hearing impaired individual whether a child or an adult who finds it difficult to follow a speaker's message even with the use of hearing aids needs speechreading instruction. This need for speechreading instruction will depend and vary with the following factors - the amount of self-teaching, the adequacy of the hearing aid or aids, the extent, configuration, the nature of the hearing loss, individual differences in ability in mastering the skill, knowledge of the language and the nature of instruction.

### **Types of instruction:**

There are essentially three types of speechreading instruction. The basic form is teaching the skill. The pupil learns to use his eyes in conjunction with his ears. He is taught habits of attention and rapid focussing. He must learn to recognise all visible speech movement even when the speech is quite rapid. He must also learn to connect together bits of information into a related whole and mentally to "fill-in" information that is missing. This kind of instruction presupposes the student's knowledge of the basic language structure and a vocabulary upon which the lessons can be based. The student is taught, for the most part, to recognise what he already knows.

The second kind of instruction can be categorised as speechreading vocabulary development. It combines teaching the skill with vocabulary development and tutoring in specific subject matter areas, when the need is eradicated. This is the kind of special instruction provided for hard of - hearing and severely hard - of - hearing children who are enrolled in regular classrooms.

The third type of teaching could be labelled language - speechreading or concurrent instruction. It aims at developing language along with developing speech-reading skill. In this kind of instruction, speechreading can be used as a basic tool, along with other tools, such as visual aids and silent reading, to develop the child's ability to understand language and to permit him to acquire a knowledge of word order.

This is the kind of approach that is used with the profoundly deaf child.

When children are born with a hearing loss, they will often learn to lipread quite spontaneously, and some of them become fixed visual children. Cases are known in which older children who are partially deaf have been passed as having normal hearing because the examiner has failed to cover his or her mouth while testing. Many adults with progressive hearing losses also rely upon watching the speaker's face and are lost in the evening when it is dark. We all rely a great deal on 'natural' lipreading and many people with hearing problems can be trained to develop this faculty as well. It is only within comparatively recent years that speechreading has been recognised as an aid to the adult hearing impaired as well as a method of educating those born hearing impaired. Speechreading is by far the best single aid to the deaf adult, it never gets lost or out of order, and requires no repairs or batteries. As an adjunct to an efficient hearing aid, speechreading plays an important role in the rehabilitation of the deafened. (Jeffers and Barley, 1971)

**Purpose:**

The purpose of this project is to compile and categorise published articles related to speechreading, from the early 1900's to early 1990's.

**Need for this Project:**

A complete knowledge of speechreading would prove beneficial to the students in speech and hearing, trainees and teachers of the deaf and others who are concerned with the area of rehabilitation of the hearing-impaired.

The review of literature has been classified under the following headings.

- \* Historical development of speechreading.
- \* Assessment of speechreading skills
- \* Speechreading training.
- \* Studies on speechreading variables.
  - a) Speechreader variables.
  - b) Speaker variables
  - c) Environmental variables
  - d) Linguistic variables.

## **SPEECHREADING : A REVIEW OF LITERATURE**

### **Historical development:**

Speechreading came under experimentation only in 1914. Kitson in 1914 tried to study experimentally the factors related to speechreading.

Mishra & Palmer (1964) pointed out that speechreading was known in India as early as 500 B.C. It was part of initiation of priests into religious training. Students were required to attend to "silent sermons" where they used speechreading. This practice later died out.

Many became interested in rehabilitating the deaf around the 16<sup>th</sup> century. Because of this interest many methods of teaching speech and language to the deaf developed. An Italian named Jerome Cardon showed that the deaf can be trained to speak. A Spaniard by name Juma Pable Benet (1620) published a book describing a method to teach the deaf to speak. He believed speechreading to be an art that few learned. About 30 years later Bonet John Bulwer wrote a book and suggested lipreading as an important mode by which the deaf could learn to speak. In the 17<sup>th</sup> century experts in Europe became interested in lipreading. Aman, a Swiss Physician wrote a book in 1692 which described methods to teaching speech and lipreading but kept his methods a secret. Samuel Hlinche of Germany (1636) criticised the manual methods and advocated lipreading.

Thomas Braidwood of Scotland (1654) was an important contribution to the development of speechreading instruction. Others did not know much about his methods because he was very secretive. Lipreading was used to

teach the deaf in the USA mainly due to efforts of Alexander Graham Bell (1912).

Till the 19<sup>th</sup> century, lipreading was used only on deaf children but Bilie Warren and her assistant Edward Nitchie used lipreading with deaf adults. Nitchie made the most significant contribution to this subject later. Martha Bruhn (1949), Karl Braukmann (1952), Kinzie, sisters (1931) made notable contributions to this field. Ewing, (1944-1967) from Manchester Britain was the most outstanding contribution from that country.

### **Assessment of Speechreading Skills:**

In contrast to the tests that have been developed to assess auditory skills, available measures of speechreading ability have not been adequately validated nor are they used systematically throughout the professional community. Speechreading performance has been measured for research and clinical purposes using a variety of materials, ranging from nonsense syllables to short paragraph. Some of the materials used, such as the CID Everyday sentences, were designed for use as auditory, rather than visual tests. The procedures used to administer speechreading tests are largely unstandardised. Some tests are presented on film, others, are presented face to face. Frequently, the same materials are presented on film by one professional and live by another. Stimuli may be presented only once or two or more times, depending on the examiner's judgement. These factors probably contribute to the extreme variability in lipreading performance exhibited by both hearing and hearing impaired individuals. They also

complicate interpretation of test results and the exchange of information about a client from one class school, or clinic to another". Davis and Hardick (1981)

### **Review of Formal Lipreading Tests**

Stephons pointed out that tests of lipreading skill can be classified under two types. The first is the face to face test, the second the silent motion picture film test.

#### **Face-to-Face Test:**

#### **Lipreading test developed by Conklin (1917):**

In 1917, Conklin constructed a standardized lipreading test which utilized an objective scoring method. The test was of the face-to-face type, and the materials consisted of eight consonants, fifty, two words, and twenty sentences. Adolescent students at the Oregon State School for the deaf were the subjects. They were provided with a prepared test form and wrote down what they thought had been spoken to them. For each consonant correctly identified, one point was given for each word correctly read, one point was given, and for sentences, five points each were allowed. Analysis of the test scores revealed a high correlation (.90) between test scores and rankings assigned by the teachers. But analysis did not reveal any significant correlation between lipreading ability and chronological age.

Bruhn, (1917) compared Conklin test with fifty syllables and twenty sentences from the Muller-Walle materials, found that students showed a superior performance on the latter.



**Lipreading test developed by Day and Fufeld (1928):**

In 1928, Day and Fufeld constructed two lipreading tests and administered them face-to-face to 8,300 deaf pupils.

Test materials consisted of four sets of ten sentences each. The test sentences were read to the pupils, who in turn were instructed to write down exactly what they read from the lips. One set was read by the teacher and the other by the field agent. Pintner's analysis showed that the speechreading scores achieved when the teacher read the lists were considerably higher than those achieved when the field agent read them.

**Lipreading test developed by Cavender (1949):**

In 1949, Cavender constructed a sentence test, including words which were determined to be within the reading vocabulary of the first three grades. Her list was administered in a face-to-face manner, because she felt it gave a more normal testing situation, once the viewing was three dimensional, the lighting similar to that encountered in the class room and no equipment was required. In addition, she felt that better attention and support could be established with face to face, rather than filmed testing.

**Lipreading test developed by Kelly (1955):**

Kelly (1955) in developing a test of lipreading ability, to be used for either face-to-face or filmed presentation, employed tests of letters, multiple choice word lists, and sentences. Section I of the Keely test consisted of fifteen three letter items that is (1) AIE (2) YBV (3) IGM and so on. Section II labelled, "Words out of context", was composed of less items - such as

- (1) Number one is Whisper shoe.
- (2) Number two is window baseball.
- (3) Number three is picture fish.

After number five, three alternatives were presented for selection. The third test was composed of ten sentences, three of which were questions. There were four word sentences, and two with five words each. The following were examples: (1) Thank you very much (2) What is your name ? (3) We like baseball.

Test - retest correlation on his materials was found to be quite high (.86)

### **Speech Tracking (DeFilippo and Scott, 1978):**

Some radically new approaches have appeared that do not involve just correct and incorrect responses. One of these is the continuous discourse tracking task, which is potentially useful and sensitive index of communication efficiency measured in words transmitted per minute. Tracking has been used both as a training task and as a basis for evaluating speechreading performance, although there are several important methodological problems in using it as a speechreading test (Tyler, 1988).

"Tracking" is a technique originally described by DeFilippo and Scott (1978) for training and evaluating the reception of connected discourse. Tracking requires a verbatim response and it is unique because it is adaptive. It is interactive in that a talker's behaviour depends on the speechreader's performance. When the speechreader is correct, the talker goes on to the next

segment of text, when in error, a correction strategy is selected that is tailored to the error. In tracking, 100% accuracy (or intelligibility) is required. What differentiates levels of performance is rate. A rate measure (word per minute wpm) is derived from the amount of time it takes to attain 100% accuracy in repeating a length of selected text.

Some practical considerations in the use of the tracking procedure in the assessment of lipreading ability was given by Fenn and Smith (1987). They suggested that the introduction of penalty points yielded an additional measure which provided a simple indication of fluency and also a more valid basis for comparison between methods whose wpm presentation rates may be inherently different. The automatic timing and monitoring of the penalty points combined with carefully prepared large point books enabled the talker to concentrate on the task and to build up a good relationship with individual subjects.

**Interview technique (Newell and Holcomb, 1983):**

Apart from the tracking procedure, one of the tools that had been proposed for assessing speechreading was the interview technique for evaluating English as a second language (Newell and Holcomb, 1983). It has been adapted for assessing sign communication competence and categories performance on a continuum from no skill or survival level skill through basic, intermediate, advanced and native-level-skill.

## **Film Tests:**

### **Film test of lipreading developed by Heider and Heider (1940):**

In 1940, Heider and Heider constructed three filmed tests of lipreading ability. Their purpose was to measure achievement among pupils at the Clarke School for the deaf. The first test contained fifteen unrelated nouns, fifteen meaningless phonetic units, fifteen names of animals, fifteen unrelated sentences, and ten related sentences. The second test was comprised of thirty names of animals, thirty correlated nouns, thirty unrelated sentences, and two stories, each containing approximately 150 words. The third test was the same as the second, except that the names of the animals were eliminated. The conclusions reached were that recognition of vowels was superior to consonant recognition and that no correlation existed between the ability to lipread nonsense syllables and general lipreading ability.

### **Film test of lipreading developed by Mason (1942):**

In 1942, Mason constructed a filmed lipreading test for children which could be scored objectively. First she constructed two exploratory tests that were designed to evaluate the lipreading skill of young acoustically handicapped children. Each test had two forms. The materials included:

#### Test I

Form A: flower, cow, top, ball, fish.

Form B: baby, car, cat, cup, shoe

#### Test II

Form A: Woman, boat, fork, man, comb, dog, boy, table, chair, girl.

Form B: Sheep, cap, book, muff, spoon,. coat, knife, glove, glass, horse.

Test I was to determine a pre-school deaf child's ability to recognize the visible kinesthetic speech pattern set up as the words are spoken and to translate into verbal concepts these visible movements. Test II which included ten norms of increasingly visible difficulty, was supposed to measure achievement of a higher level. Not completely satisfied, Mason revised the test for children. Test III included all of the items of Tests I and II. In addition, fifteen new nouns were included. The selection of the test items confirmed to specific criteria.

- (1) Their occurrence in the first three thousand of Thorndike's word frequency list
- (2) Their place in building vocabulary for language comprehension of young deaf children in the early grades of school for the deaf., and in classes for hypacusis.
- (3) Their inclusion of the most frequently occurring consonant and vowel sounds.
- (4) The photogenic qualities of the concrete objects which symbolize the verbal concepts.
- (5) The freedom of the test words from visual ambiguity of meaning.
- (6) The distinct visible speech manifestations of phonetic elements of which the test noise are composed.
- (7) The lack of homophenity in test words, except where deliberately planned, so as to test superior visual discrimination.

- (8) Their place in the life experiences of children, through toys, pictures or actual objects.

The following words were included in Test III, Forms A and B.

**Form A:**

Top, cow, ball, flower, fish, nose, orange, thumb, box, candy, ear, boat, comb, woman, dog, man, chair, fork, boy, table, girl, finger, key, bottle, cracker, bath tub, slipper, hair brush, sweater, birdcage.

**Form B:**

baby, arm, shoe, car, cyc, cup, mouth, cat, flug, soap, sheep, horse, cap, book,, coat, banana, glass, spoon, muff,. pencil, knife, watch, cooker, towel, glove, stocking, basket, toothbrush, umbrella, rabbit.

This test was administered to 138 deaf children whose ages ranged from six to ten. A high correlation was found between the forms of the test.

**Utley Film Test - How Well Can you Read Lips ? (Utley, 1946):-**

Utley (1946) developed, her motion picture achievement test of lipreading ability. This test consisted of three parts. Part I was a sentence test and consisted of two forms, A and B. Part II was a word test and also has two forms, A and B. Part III was a story test and consisted of six short storied or scenes. They were based on interests and experience that were believed to be common to children of intermediate school age. Each story was followed by five questions which were based on the conversation in the story. The words were taken from the Thorndike list of most frequently used words and the sentences were composed of trial statements, common expression and

idiomatic expressions. Utley administered the test, without voice to 200 subjects of different grade levels who had normal hearing.

She revised it, filmed it, and administered it to 100 students in two schools for the deaf. The sentence and word tests were presented by a university coed and were photographed on black and white film, while the story test was filmed in color. Fifteen seconds were allowed for pupils to respond. Utley's conclusions determined that there was interrelation among the skills of word, sentence, and story recognition.

### **Lipreading Achievement Test (Reid, 1947):-**

In 1947, Reid reported preliminary work done on the construction and administration of a test in lipreading. This test was filmed, and had three forms with units, five parts in each form. The parts were comprised of 17 vowels and diphthongs, 11 consonants, 10 unrelated sentences, related sentences which told a story and also a short story. The story was followed by four questions. Three different speakers, differing in educational and speech backgrounds, were photographically reproduced on each of the forms. All three forms were given to 99 girls enrolled in schools for the deaf. Interform correlation was high (.83), thus indicating that there was apparently little relationship between the speaker's speech backgrounds or accents and the ability of the subjects to read his lips.

### **The Keaster Film Test of Lip Reading (Keaster, 1949):-**

This test was constructed by Jacqueline Keaster (1949). Her original test consisted of six forms of test sentences each, available in both black and

white and color. Each form was presented by a different speaker. The film was later made available by the John Tracy Clinic for use in their experimental studies and was administered by them to 408 college students. Analyses of these data proved the test to be reliable and showed that it provided a basis for quantitative discriminations among speechreaders. Since it was deemed desirable to have two forms, the sentences were graded with respect to difficulty, and the original film was cut apart and reassembled into Forms A and B, each consisted of thirty sentences. The equivalence of the two forms was verified by giving them to 173 additional college students. Coefficients of reliability for male subjects (N = 52) were as follows: form A, .90 and form B .92. For female subjects the coefficients of reliability were as follows: form A, .89 and form B, .89.

Each sentence was presented only once and no voice is used. The examinee wrote down what he thought the speaker said. Each form contains a total of 188 words. One point is given for each correct word.

#### **Cavender Test of Lipreading Ability (Cavender, 1949):-**

Cavender (1949) constructed four sentence type tests, all of which appear to be of equal merit. The tests were designed for use by public school hearing therapists in testing hard - of - hearing children.

The presentation should be live and without voice. Each sentence should be given twice. The testee responds by underlining the one word that occurred in the sentence from a choice of five words on his multiple choice response blank. The criteria for the selection of the answer words for the



multiple choice response were that (a) they must be neither the first nor the last word of the sentence and (c) they must have approximately the same visibility as the rest of the sentence. A score of one point is given for each word underlined correctly.

### **Costello Test of Speechreading (Costello, 1957):-**

The Costello test of speechreading was designed to measure word and sentence recognition skills when the visual perceptual information varied among the various items from words easily identified in speechreading, such as "mouth" to words quite difficult to perceive, such as "yes". Vocabulary used in both the word and sentence tests was selected from Kindergarten lists in order that all words could be familiar to the subjects. With only familiar concepts and vocabulary used, the test proposed to measure the skill of speechreading and not vocabulary or language development. In the final form of the word test, the level of difficulty varied from the first ten words. (Group D), which were recognized 89 percent of the time by college students with normal hearing, to the last ten words (Group V), which were recognised only 18 percent of the time.

The word subtest should be presented without voice and with the testee seated opposite the examiner at a distance of about six feet. The testee responded by repeating each word said by the examiner. Prior to presenting the test words, the examiner should present test items. If necessary, the practice words are repeated and any errors should be pointed out. A score of

one point is given for each word interpreted properly. The maximum score is 50.

There are two parts to the sentence test, each consisting of twenty-five sentences. The test items should be presented without voice and with the examinee seated opposite the examiner at a distance of six feet. A doll house is used which contains the objects and figures mentioned in the sentences. Each sentence should be given only once. The examinee responds by using these materials to act out the meaning of the sentences. For example, "Mother gave the baby a bath". Correct oral responses are also accepted. Before the test, practice should be given in the recognition of a number of words represented in the home scene. The objects should be indicated and named, and the proper names should be presented in writing. The child is asked to point to the object or figure named. A score of one point is given for each sentence that is interpreted correctly. The total possible score for the test is 50.

Lowell and Taafee (1957) developed a film test of lipreading. It consisted of two parallel forms with 60 unrelated short sentences. These forms were tested on 73 normal hearing students. No significant differences were found between the mean test scores between each form.

### **Craig Lipreading Inventory (Craig, 1964):-**

The Craig lipreading inventory consists of a word recognition test and a sentence recognition test. Each test had two forms making it possible to compare scores when the test was given without voice and with voice. The

vocabulary was selected from words presented in Kindergarten and the first grade. The tests were designed to differentiate among speech-readers from the end of the first grade through the tenth grade.

The tests were presented live. Students were to be tested in groups of six, with each child seated exactly eight feet from the speaker. Each item was presented twice permitting each child to have a full view and a three-quarter face view of the speaker. When giving the word test, the speaker precedes each word with the phrase; "Show me". Multiple choice response forms was provided, with four possible responses for each word and for each sentence. The possible responses were pictured as well as written to insure that reading ability would not affect the test score.

The score of one point was given for each word or each sentence correctly identified. The highest possible score for the word recognition test was 33, and for the sentence test was 24.

### **Children's Speechreading Test (Butt, 1968):-**

This test was intended for young children who have not yet learned to read. The child indicates comprehension through motor action. It consists of two portions, Test A, an informal checklist for children under three years, and Test B, for children three years of age and over. Test items were evaluated with respect to developmental age.

All 70 items were found to discriminate satisfactorily between subjects who perform well and subjects who perform poorly on the test as a whole. The reliability of the test was evaluated by means of the Kuder-Richardson

Formula. The coefficient of reliability was level found to be .95, significant at the .001 level method of response:

Responses are elicited by playing with and observing the child.

**Scoring:** Each correct answer receives one point.

#### SUMMARY OF SPEECH READING TESTS.

Author	Test Name	Type of materials	Equivalent Forms	Age or language, competence required.
Utle (1946)	How well do you Read Lips ?	Words sentences.	2 2	Third-grade reading. Eight year olds vocabulary in normative group. Most appropriate for adults.
Barley (1971)	Barley - CID	Sentences	2	Based on CID everyday Speech Sentences. Most appropriate for adults.
Taaffe (1957)	A Film test of lipreading	Sentences	2	Undetermined but all standardization.
Craig (1964)	Craig Lipreading Inventory	Words Sentences	2 2	Children - first through tenth grade.
Costello (1957)	Costello Test of speechreading	Words sentences	1 2	Kindergarten Vocabulary
Cavender (1949)	Cavender Test of Lipreading Ability	Sentences	4	Vocabulary level - grades 1 to 3
Mason (1943)	Visual Hearing Test	Nouns	2	Children
Butt and Chreist	Butt	Questions or Commands	1	Children down to 3 years

Author	Test Name	Type of materials	Equivalent Forms	Age or language, competence required.
(1968)	Children's test			comprehension indicated by motor action.
Myklebust and Neyhus (1970)	Diagnostic Test of Speechreading	Words Phrases Sentences	1 1 2	Vocabulary appropriate for deaf children age 4 to 9
Davis and Silverman (1978)	CIDEveryday speech sentences	Sentences	10	Developed for use with adults.
Hutton, Curry and Armstrong (1959)	Semi-Diagnostic Test	Words	6	Vocabulary level - grades 1 to 4. Multiple - choice format so reading is required.
Binnie, Jackson and Montgomery (1976)	Lipreading Screening Test	C.V.Syllables	1	Meant for adults.

### **Limitation of Speechreading Tests:**

The limitations of speechreading tests have been reported by Berger (1971). Some of the limitations refer to specific tests, while others refer to the tests in general.

(1) The validity of the materials has not been satisfactorily demonstrated. A common method of establishing validity is to compare one test with another that is known or presumed to be a valid measure of the behaviour being tested. Utley's tests, How Well can you Read Lips ? (1946) was developed with considerable care and standardized on a large number of

hearing impaired people. It has been used often as the criterion against which the validity of other tests is evaluated. Unfortunately, the validity of the Utley test has been severely criticized. Heider (1947) suggested that roughly half of the items should be discarded because they are so difficult that they do not discriminate between levels of lipreading ability. Di Carlo and Kataja (1951) used the Utley Test to evaluate performance of normally hearing people and hearing impaired people divided into groups of good and poor lipreaders on the basis of ability to follow conversational speech by speechreading. The Utley test did not discriminate the normally hearing from the hearing - impaired group nor the good from the poor lipreaders. 'O' Neill and Stephens (1959) reported that teacher ratings of speechreading proficiency did not correlate significantly with Utley test results. Many of the other speechreading tests in use correlate with the Utley Test., indicating that the same behaviour is being assessed. The fact that test performance appears to be poorly related to the ability to comprehend conversation by speechreading may be interpreted in several ways. It is possible that these measures are not valid measures of the ability to speechread. Another interpretation is that the ability to speechread sentences is not related to the ability to speechread conversation. The third interpretation is that the tests are not sensitive enough to distinguish among varying degrees of speechreading skill except grossly.

2. Most speechreading tests are sufficiently difficult to discourage many subjects. Few subjects ever achieve a 100 percent correct score while 0 percent scores are not uncommon. It is unlikely that all 0 percent scores

indicate an absence of speechreading ability. The normative data for the Utley sentence test was standardised on 761 hearing-impaired children and adults who used speechreading as an important aspect of speech reception. The range of scores among these hearing impaired subjects was from 0 to 84 with a mean performance of 33.6 items correct. The best speechreader only obtained 67 percent of the possible total.

3. Filmed tests are devoid of facial and gestural cues. Most of them were recorded many years ago and do not reflect contemporary dress or appearance on the other "hand, face-to-face testing introduces variability each time the stimulus materials are spoken.

4. Filmed and live presentations usually involve only one speaker. Because speakers are known to vary in their speaking ability, it may not be possible to generalize test results to other speakers or situations.

5. Most speechreading tests have only one or two forms, rather than several lists equated for difficulty, visibility, familiarity, or other parameters.

6. Test materials are designed for reception by speechreading only. Materials designed to be presented through combined auditory and visual modes have not been developed and standardized, even though this condition is more representative of daily communication than visual reception alone and would allow better assessment of overall receptive proficiency. (Berger 1971).

## **SPEECHREADING TRAINING**

Training in the ability to read lips constituted the earliest form of rehabilitation for hearing-impaired children and adults. As long ago as the 1600s, educational procedure for hearing-impaired children were based on teaching students to recognize speech and to produce it on the basis of visual clues. Because the cues available for speechreading were used as a basis for producing speech, early methods of speechreading instruction tended to stress on analysis of articulatory movements whether or not the speech reader had a good knowledge of language. Although speechreading instruction began as an educational procedure used in classes or schools for deaf children, the most detailed description of instructional methods were published by teachers of adults (Nitehie, 1912; Bruhn, 1915, 1927, 1947, Kinzie and Kinzie, 1931, 1936, Bungier, 1932).

From about 1870 to 1940, speechreading classes were popular in most cities. Several different speechreading ' methods' were developed, based on philosophical issues of the time, such as whether speechreading constituted a visual or a psychological process. These programs either made use of an analytic approach or a synthetic approach.

### **Synthesis and analysis:**

Synthesis seems to be related to, but not the same as closure, which is the ability to perceive an incomplete figure or movement as a whole. The synthetically oriented person presumably lets his mind fill in the portions of the overall message that he does not clearly see. Thus this person is believed

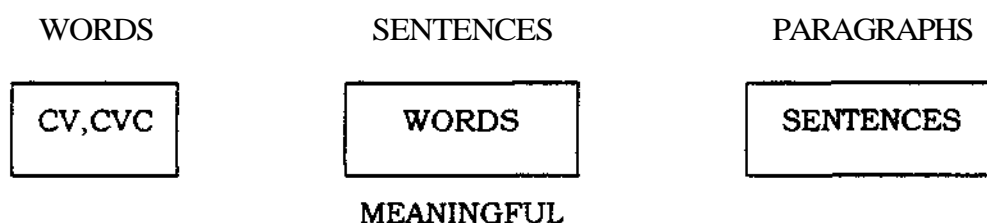


to make greater use of linguistic clues when visual clues are insufficient for meaning. The analytic person on the other hand, presumably tries to see every position or movement of the articulators in detail and therefore does not learn to speechread so readily because conversational speech probably moves too rapidly for this process to be efficient.

The first published study to investigate the matter of analysis and synthesis as it relates to speechreading was by Kitson (1915), who compared the ranking of adult speechreaders with their ranking on a sentence completion task. The resulting correlation was fairly good (0.65). On the basis of a similar test Gopfert (1923) concluded that synthetic ability should be dominant for successful speechreading.

O Neil and Over (1961) have described the synthetic and analytic approach using block diagrams.

(1) Synthetic approach



Representation of the synthetic approach to the teaching of lipreading.

(2) Analytical approach:

ISOLATED PHONETIC UNIT	SYLLABLE	WORD	PHRASES	SENTENCES	PARAGRAPHS.
C or V	C plus V	CV, CVS	Groups of words	Groups of words and phrases	Groups of sentences
Non-meaningful			Meaningful		

## **Speechreading methods and materials for children:**

### **Methods:**

The Muller - Walle Method of speechreading (Bruhn, 1915):

Marther Bruhn wrote a book of lessons for children based completely on the German Muller Walle method. Here the lesson materials were selected and prepared to meet the needs of children. The book was organized so that most visible sounds were presented first and the less visible sounds were presented later. Rather than practice on words, emphasis was upon syllables, because syllable practice required only one mental process, whereas practice on words requires two, one was recognising the movements and the second, determining the word those movements represent.

The basis for the Bruhn method was rapid, rhythmic, syllable drills, Bruhn's aims were not unlike those of Nitchie. She felt that the pupil should learn to (1) feel the sound sensations of speech (2) Observe carefully and (3) be alert and quick to perceive the rapid movements of speech. Bruhn conceived of speechreading as a training of the eye and mind. Grasping the whole rather than parts was stressed. However, she did suggest that analytic fixating was needed for grasping details. The eye, in taking the place of the ear, must be thoroughly trained to distinguish the visible characteristics of the movements of the speech organs.

In the forty lessons, Bruhn moved directly from rapid drill on syllables to sentence practice. She suggested discussing speechreading with the children before beginning the lessons, thus approaching the situation directly.

Vowels, diphthong and consonant were presented separately, then in later lessons combined for syllable practice.

Bruhn's method offered an analytical approach though there was an attempt to get the pupil to see and grasp the whole syllables. They were never to be used alone but always with other cues, unless a particular syllables was described. They must be spoken rapidly and as fluently as running speech. They must not be exaggerated, but always natural. Bruhn advocated that the teacher memorize the syllable to be given and avoid reading from the book. Voice was to be used at all times. The lessons were divided into three parts (1) Review questions, (2) New lesson materials, (3) Sentence practice.

**Description and criticism of Muller —Walle:**

In the Muller-Walle system, speech sounds were categorized with respect to their visible characteristics and lessons were based upon a sound movement or a group of sound movements. Consonants were divided into two classes. Class I includes those consonants with the cavity of the month closed. Class II includes those consdnants with the cavity of the mouth open. Within each category the sounds were described with respect to their appearance, eg. |f| and |v| "the lower lip is placed against the upper teeth;" and for |n|, |b| and |p| ", the lips are closed, vowels are considered to have four principal movements. The lower jaw moves downward and upward. The lips move forward and backward. "All of the class I consonants were introduced in the first lesson. They were f, u, s, z, p, b, m, w, wh, sh and th. These sounds constitute all of the visible consonant movements. Five vowels

were also introduced in the first lesson. They are ah, o, oo, a, e (IPA: a, ou, u, ei, i). Vowels are considered, in general, to be more visible than consonants and hence, the most important part of the word. Syllables are made by combining the consonant and vowel sounds. Only such syllables as can be found in words *in* the English language were included. An additional sounds or groups of sounds were introduced in succeeding lessons, they were combined with sounds previously introduced. Eye training was effected through the use of syllable drill. Each consonant was first practised in combination with each vowel sound, example fa, fo, foo, fa, fe, and sa, so, soo, sa se. Finally, the syllables were put together providing consonant as well as vowel contrast and were given in groups of two or three, eg. fa-ma, se-me, so,ma, se, me etc. Originally mirror practice was recommended, but this was deleted in later editions. Rapid rhythmic syllabic drills formed the basis of the method and was the frame work upon which the sentences were built.

An example of a syllable drill used for eye training and reading to a meaningful sentence is given below:

ma	mo	Show me
ma	so	Show me the way
ma	se	Show me the way to the shop
ma	tha	Show me the way to the sea

The above syllables that were not truly "nonsense" syllables were written as though they were, until put into sentence form. Additional simple sentences were, for the most part, based upon words that can be formed from

the sounds introduced in the lesson and in previous lesson. Some additional sentences from lesson I are as follows.

Show me the way to the sea

Show me the path to the beach

May we bathe in the sea ?

May we see the fish in the sea?

You may pass the beef to Sue

You may pass the beef soup to May

You may pass the fish to me.

Here the stem of the sentence was repeated, and a new phrase or ending was added on each sentence. Bruhn appeared to be the first instructor to use this technique. In this system, the pupil was first told how he speechreads in the visible appearance of each movement. He then was given sufficient practice in actual speechreading to enable him to forget this conscious analysis and recognise sound movements without thinking about what he was doing.

By trying to base the lessons around a limited number of sound movements, the Muller-Walle Method ended up with lesson material that was usually highly visible, but despite this, often difficult to speechread. The difficulty from the fact that sentences that were artificially constructed to meet the criteria were often not functional.

One of the most useful Muller-Walle technique was the exercise story. The "exercise" portion consisted of a series of sentences presented prior to the story which serve to introduce the story and establish a mental set which

would enable the speechreader to anticipate the vocabulary. The Muller-Walle method recognised the importance of the use of voice in teaching speechreading and the help that access to the speechreader through rhythmic and Kinesthetic clues.

**The Kinzie Method (Kinzie, 1936):**

The Kinzies made a unique contribution to the education of hard-of-hearing and deaf children when they constructed three books of graded lessons in lipreading. The grade I book contained the simplest approach and consisted largely of techniques for developing vocabulary through the use of pictures, objects and actions. These were enlarged upon until simple sentences within the grasp of the child were developed. The materials for both grade I and II provide opportunity of self-expression and imagination on the part of the children. The lessons were structured around family life, animals, and other children. They progressed systematically from less difficult to more difficult materials. The materials for both Grades I and II linked movement and idea at all times. In "The Kinzies Snail", the children were first led into spontaneous, unconscious lipreading and then step by step, into the more formal instruction which establishes those mental habits and processes that make for sub-conscious speech reading throughout life.

The lessons in Grade II were more highly developed than in grade I and were referred to as 'Semi - formal' by the Kinzies. Much attention was devoted to "make-believe" and situation". The lessons contain sections with specific movement, words, conversational exercises, sentence drills, story

exercises, rhymes, and finger play activity. Although no formal explanation of movement was provided, the teacher using the method had to draw attention to the formation of sounds as they appear on the lips. In each lesson, different sounds were emphasized and particular words in which these sounds appeared were practiced. The conversational exercises were based upon the movement words which were under study. Sentence drills, built upon the movement words, provided a more formal approach to the task. Each child was given the opportunity to repeat many of the sentences as he read them from the teacher's lips during the lesson. In this area, complete mastery was the goal.

The Kinzies state that the story exercise adds interest to the lesson. Each sentence of the story was given to one pupil at a time, to be repeated by him. The entire story was then retold to the group, followed by questions. The rhyme portion of the lesson was also interesting and profitable. Rhymes were said a number of times by the teacher to familiarize the group with them. The teacher may then repeat the rhyme, purposely making an error. By having the children relate the error, the teacher determined how well they were lipreading. Answering questions on the rhyme or repeating it were additional ways suggested by the Kinzies to ascertain the effectiveness of the youngster's learning.

The finger-play activity in grade II exercised the imagination and held the attention while the child concentrated on the message as it was delivered from the lips of the teacher. The Kinzie's strongly advocated that teachers became thoroughly familiar with the materials before using them so they

could have constant contact with the child. Both Grades I and II were entitled for children. Grade III was entitled "for juniors".

Through Grades I and II the approach was indirect. However, when the pupil entered Grade III instruction, the lessons were formal. He had to realise that he was working for a specific goal and that purpose was to speechread. Proper grading, use of appropriate materials, and the lesson presentation were emphasised on. As far as the lessons themselves were concerned, the movement involved were presented by the teacher who wrote a description of it on the board. The teacher gave the illustrative words to the class. Drills on vocabulary and sentences followed. The story, with its title and important names and words written on the board, was told and the written words were pointed out as they occurred. Nine different techniques for handling the story were suggested by the Kinzies. In all, grade III contained 45 lessons.

### **Braukmann (1927)**

Karl Braukmann established a method which he employed with deaf children and adults in Jena, Germany. It was translated by Rieghard of the University of Michigan (1925) and was used by Whitaker at Ypsilanti in 1927. Later it was published by Bunker (1952) was called the Jena method. This approach, as published by Bunker was for adults, but throughout the series of lessons there was discussion of how materials can be adopted for deaf and hard-of-hearing children.

This method, emphasized the audible, visible, movement, mimetic and gesture forms of communication, including syllable and rhythm. He stated



that the first aim of person who desire to learn lipreading was to develop awareness of the movements of speech and to learn how they felt.

The method included an explanation of the formation and composition of syllables. The consonants were presented and classified under the categories of production, including lips, tongue and tongue - soft palate. The consonants were combined with words for practice. The consonants were said aloud by the clinician, and then the client said them. Clients were asked to concentrate on the manner of articulation.

The rhythmic component of this method included a basic rhythmic pattern that was established to accompany the syllable drills such as hand clapping, tapping, or ball bouncing. The aim of this aspect was to alert the client to the feeling of speech movements as he or she talked and to imitate visible speech movements as another person was speaking. The materials used included the syllable exercises, grammatical forms, stories and conversations.

A number of other professionals who have taught speechreading to children have published books, pamphlets and films on materials they have found to be useful.

**Stowell, Samuelson and Lehman (1928):**

Stowell, Sumuelson and Lehman (1928) have written a book directed to the needs of slightly deafened and hard-of-hearing children. They advocated both the use of words and syllables in practice. For the informal lessons they suggested exercises of speechreading and excercising a command. The

teacher had given answering question based on nursery rhymes, guessing riddles, and so on. They felt that basic lip movements must be taught and that these movements should be compared and contrasted with others previously presented.

**Whildin and Scally: (1939) :**

Whildin and Scally have constructed a set of materials for use in teaching speechreading to hard-of-hearing children of intermediate grades. These are 40 units in all. The first 11 deal with consonant that appear at the beginning of words, the next 24 with vowels, and the remaining 5 with combined consonants as the beginning of words. In general, the units were composed of sentences, stories and questions. The vocabulary is well suited to children.

**Samuelson and Fabregas (1939):**

Samuelson and Fabregus (1939) have written an excellent pamphlet in which they present 60 games built around the usage of vocabulary containing sounds of certain classification. The directions are specific and the games can be readily utilized by the lipreading instructor. In selecting the games best suited to the needs of the children, the authors have set up a classified index with six divisions: I-Games correlated with other subjects in the school curriculum, II-toy Games, III-Games to be used as general drill on movements, IV-Miscellaneous story games for general drill, V-Games for Relaxation and VI-Games similar to "A Grehound Bus" or "Spin the Corter". Within division I there was a subject index (1) Arithmetic (2) English (3)

Geography (4) History (5) Nature (6) Physical training (7) Physiology and (8) Domestic Science.

**New aids and materials for teaching speechreading (Samuelson, 1943):**

A book, *New aids and materials for teaching speechreading* was written by a committee of project teachers and edited by Samuelson (1943). One purpose of the book was to make available to the elementary school teacher, not trained in lipreading methods, a means by which she could help the hearing handicapped child. A second purpose was to create, for the trained teacher of speechreading, a book which clarified, supplemented, and organized various aspects of speechreading theory and practice, and present new and original techniques. The third purpose was to compile practice sentences with their central ideas originating from children. The book contained five chapters, the first a general manual of construction for the elementary teachers not trained in lipreading methods. One of the most valuable portions of the first chapter was in the formal, informal, correlation, and the presentation of the introductory lessons. Chapter two was devoted to a discussion and actual presentation of some new techniques and theory to be utilized by trained teachers of lip reading. Each sound of English was assigned a constant numerical value. For example, the sound | b |, as in ball, is highly visible and thus has a visibility value of 1. The {ng} sound is not visible and thus has a value of 0. With this guide, the teacher could carefully grade each sound, syllable, word or sentence she constructs for practice material. Both chapters 1 and 2 make up Part I of the text which is referred to as the "theory" portion of the book. Part II was labelled "Materials" There

were four chapters in Part II; that is 3,4, 5 and 6. Chapter three dealt with consonants, Chapter four with vowels, Chapter five with diphthongs and Chapter six with picture sentences. In Chapters 3, 4 and 5, descriptions of sounds, word drills, and tested sentences were provided.

Chapter six gives sentences that could be used with pictures to serve as the basis of an informal lesson.

### **Beginning Speechreading (Leavis 1949):**

Leavis published a book of lessons and exercises in speechreading for teachers of children in the first three grades. In the preparation of the lesson, she included teaching of sound movements, exercises for bodily activity, and materials helpful to the child in his regular classroom work. Leavis pointed out that the lessons should close on a happy note so that the youngsters looked forward to returning to their lipreading class.

### **Speechreading Materials for the Public School Grades: Yenrich (1951):**

Yenrich in 1951 discussed material selected from units of study commonly used in the primary grades. He reported that regular class room materials could be adapted for lipreading lessons. After analysing the primary books, he showed how various parts of each could be adapted for speech reading purposes.

In a later publication, Yenrich (1951) presented a variety of lessons correlated with activities of children in grades four through eight. He demonstrated how class room topics could be worked into the speechreading lesson.

### **Hearing with our Byes (Macnutt, 1952):**

Macnutt, (1952) presented not a method, but a set of lessons to be utilized by teachers who were seeking new materials. The early lessons were based upon highly visible movements. Each of the lessons had sufficient materials for 30 to 45 minutes of work and contained 24 sentences, a story, and two games or devices. The lesson becomes progressively more difficult. Macnutt advocated the use of voice. A rather unique aspect of the movements materials was the work book that accompanied the text. Properly employed, the work book was a means by which pupil progress could be followed.

### **Stories and games for Easy Speechreading Practice (Feilbach, 1940) :**

Feilbach (1940), realizing the need for interesting material in lipreading practice, compiled a book of games and stories. Although the material in the book could be used successfully with children in as low as the third grade., the book was prepared for adolescents and adults.

### **Life Situation Films for Children (Morkovin and Moore, 1936):**

Morkovin and Moore (1936) created a new series of life situation films for children. There were five 5-minute black-and-white sound films in the set (1) "Tommy's Table Manners" (2) "A lesson in Magic" (3) "The little cowboy", (4) "Barbara's New Stress" and (5) "Bow Behind". Morkovin pointed out that the films were structured around incidents interesting to children, and advocated the use of hearing aids for success. One objective of showing the films was to reinforce life experiences and activities and to facilitate the aurally handicapped child's language approach to them. Another was to help the

child achieve greater fluency in speech and speechreading. A third was to provide the child, through exercises, the opportunity to make precise discrimination of visual, auditory, kinesthetic, tactile and rhythmic aspects of oral language.

### **Whitehurst (1964):**

Whitehurst (1964) combined, in a manual auditory training, speechreading, and speech. The author viewed her materials as supplementary to those used in basic courses for auditory rehabilitation. The lessons were structured for children 12 to 16 years of age. Whitehurst presented 14 units in which vocabulary building, auditory training, speechreading and speech were presented through a travelogue. The pupil wrote responses to the many varied activities presented by the teacher in a workbook. This approach represented a real attempt to integrate vocabulary building, auditory training, speechreading, and speech which were so important to the aurally handicapped.

Currently, methods that incorporate both auditory and visual input are frequently favoured (Rodel, 1985) even though the auditory input often receives the initial emphasis (Pollack, 1985). Research by Boothyard in 1986 has also demonstrated that speechreading skills can be enhanced through the simultaneous use of vibrotactile aids.

### **Speechreading Methods and Materials for Adults:**

A number of well defined adult methods have been developed by professionals such as Nitchie (1912), Kinzie (1936), Bruhn (1915), and

Braukmann (1927). Many others, however, contributed teaching materials for adults without setting forth a particular set of rules. Still others, in effect, combined aspects of several established methods

## **METHODS:**

### **Nitchie's Method (1912):**

Edward B. Nitchie published several books stating the basic principles that he thought were involved in the lipreading act, as well as methods by which to employ those principles in teaching. His most famous contribution was his last book, published in 1912. Elizabeth H. Nitchie, his widow revised the book on several occasions after his death in 1917. In 1940, Elizabeth H. Nitchie published a series of lessons, on lipreading based upon the fundamentals of the system established by her husband.

At the start, Nitchie advocated an analytical approach to speechreading, but he saw that he was in error and began to instruct his pupils to synthesize what they read. He realized that when they tried to understand the "whole" rather than one part at a time, they were much more successful. He advocated practice, but warned that the wrong kind could do more harm than good. Nitchie (1912) put forth the following principles that he felt were essential to the teaching of speechreading. (1) be natural (2) be thorough, (3) make the work interesting, (4) lose no opportunities, (5) guard against methods that may interfere with the development of any desirable habit, and (6) seek to meet the peculiar needs of each pupil.

In order to apply the principles, certain methods in the training of the eye and the mind were necessary. For the eye training Nitchie suggested that accuracy could be developed through practice with tests of words and sentences in which only one word or more was changed from sentence to sentence. Mirror practice was also recommended. Mouthing and exaggeration were considered of little value. His method for the training for visual memory was built around the "movement words" presented in each lesson. For example, in the lesson for {L}, some of his movement words included {she, then, lee}, (teach, teeth, deal) {shed, then, let} (edge, eth, ell) students were given the opportunity to compare and contrast the other movements with the {L} and, in time subconscious knowledge of the movements involved in speechreading was developed. For mind training, which Nitchie thought extremely important, he emphasized synthesization and not word for word accuracy. He believed that understanding the words from the thought was more important than the thought from the words. Whether the unit be a short sentence, groups of sentences or stories, stress should always be placed upon the whole rather than parts. Development of intuitive power was also emphasized. His technique was to tell the pupil a familiar story and then retell it, adding many details. The pupil was then given questions to answer concerning the story. Still another way to develop intuitiveness was to present the student with a practice word that he underestood and then immediately follow with a sentence containing the word. Another method was to present the student several sentences, one often another, each associated in thought. Homophenoes words, colloquial



forms, conversion practice, and informal lectures were suggested as useful ways to exercise initiative powers for developing quickness of mind. Nitchie suggested that rapid response be made by the pupils. For alertness of mind, he stressed rapid identification of words and sentences. Finally, for securing the pupils concentration, that work should be interesting and voiced. Through his principles, Nitchie emphasized the importance of teachers attending to the motor as well as the visible language form. In his lessons he always introduced the sound or group of sounds he was about to teach.

### **Materials:**

#### **Lipreading for class instruction (Morgenstern, 1916):**

The book by Louise Morgenstern (1916) though old, contains many lessons and exercises that are still used successfully. The book is divided into three parts. Part I consists of 22 lessons. The lessons, in turn, are divided into three sections. The first section is devoted to the study of specific sounds, contains drill and contrast words. The second section includes practice words incorporating the sounds under study. The third section is directed towards sentence practice, and contains the words previously employed in section two. Part II of the book is devoted to consonant combination. The 19 lessons include practice lists of words and sentences and homophenous words, common phrases, conversational sentences, and dictation practice. Practice stories and dialogues appear in Part III Morgenstern advocated the synthetic approach by the way her materials are assembled.

**Visual Hearing Test (Mason, 1943):**

Mason (1943) outlined a course of interaction in visual hearing based upon a series of 30, sixteen millimeter silent color films. Each film is approximately eight minutes long and has a complete instructional unit. The sequence of the 30 films proceeds from the easier to the more difficult aspects of visual hearing. Each film is composed of three parts. The first, functioning as a text, announces the topic and shows several cards in which sentences are printed for the students to read before the filmed speaker utters them. In the second part, the speaker recites the remainder of the script. The third part consists of questions directed toward the student concerning the material concerned in the lesson. Most of the sentences given in the films are unrelated. Mason felt that this develops alertness in making visual discriminations, and provides a background of visual memory of the sounds. In each sentences, there is a specific consonant sound that is frequently repeated. In order to give practice in synthesizing some of the film scripts present related sentences, and others contain discussions of a particular topic.

Mason was not attempting to replace the clinician with her film, but wanted to supplement the work of the teacher and to provide instruction in the areas where skilled assistance was not available. At the time of her death in 1950, she had completed a portion of the manuscript on visual hearing that was to serve as a manual to be used with her films.

**Lipreading Lessons for Adult Beginners (Montague, 1945):**

Montague (1945) constructed a useful book of thirty lessons for the beginning adult speech, but also for the person who is to construct the practice lessons, and for the teacher of speechreading. The lessons presented are based upon Montague's experience in teaching adult speechreaders. The movements employed follow those used in the Muller-Walle method of speech reading. Each lesson contains words phrases, sentences, and stories and each utilizes a set of movements. As the lesson progresses, they become increasingly difficult.

**The Deshon Book of Lipreading Practice Material (Ferguson, 1946):**

The material in the lip reading practice book written at Deshon General Hospital consists of contributions made by the teachers of the lipreading section of the Aural Rehabilitation Service. Subjects of the lesson are biography games, geography, history, humor, personality, general information and miscellaneous.

**Progressive Approach (Alpiner and McCarthy, 1987):**

In describing the general strategies used with the hearing-impaired adult in the remediation process, Alpiner and McCarthy, (1987) stressed the progressive approach. Basically, this was a client centered, individualized approach to rehabilitation which emphasized the use of counselling techniques to deal with specific communication strategies.

### **Speech Tracking (DeFilippo and Scott, 1978):**

Another method which was used in the remediation process was the tracking method proposed by DeFilippo and Scott in 1978. This method was originally designed to be test (which is described earlier) Later it was utilized in speechreading training also.

The main issues put forth in utilizing tracking for speechreading training are described below:

The verbatim response required in tracking had been questioned on the basis of its validity. Owens and Raggio (1987) discussed the advantages of using a nonverbatim response during training. They argued that a nonverbatim response would avoid reinforcing a speechreader's analytic tendencies the way a verbatim response might.

In accounting for missed words, the original tracking task used a viseme based last-resort strategy. All the words were eventually transmitted through speechreading and none were missed. All the words were counted in calculating the word per minute (wpm) score.

Osberger, Johnson and Miller (1987) in their study of tracking to train speech production skills used two independent observers who listened along with the primary clinician during the first and last tracking sessions. They found that their increases in scores were far less than that for the primary clinician, but many factors were cited for minimizing the generalizability of tracking effects. It had also been found that tracking scores were sensitive to

the material being tracked (DeFilippo, 1978). For example, descriptive passages and dialogues appeared to be more difficult than action narrative.

A drawback of tracking was that it provides practice with written language. Also, both young and old speechreaders required special considerations in the tracking task. Lesner and Kricos, (1987) discovered that the task was not compatible with certain of their old subjects. People who were ill or medicated also might not respond well to tracking.

The tracking procedure has been modified further to include communication training and perceptual training. In order to include communication training in speech tracking, two modifications were suggested. First, correction focussed on communication strategies rather than perceptual training. Second, correction became a task of the speechreader rather than the talker. The wpm would then reflect how appropriately the speechreader selected and responded to strategies. Danz and Binnie (1983), modified the tracking procedure by providing a hierarchy of strategies based on proposals by DeFilippo and Scott (1978). The five strategies given to the talker were (a) repeat the phrase, (b) repeat the misidentified word, (c) restructure the word order, (d) use synonyms or antonyms, (e) show the key word in writing to the subject.

For the perceptual training, pre-tracking activities were used. The pre-tracking activities included fail-safe procedure, sound-shape-symbol correspondences, word building and orientation activities.

In the fail-safe procedure, the talker could break down a trouble word to its individual speech elements. This not only ensured success for the speechreader, but it also provided analytic training.

In teaching sound-shape-symbol correspondences, the talker teaches the symbol system to be used and explains why the system was needed.

The word building stage was only to develop a tool for use in tracking word building exercises provided practice in blending sound sequences and engaging the auditory-word-recognition process.

When the speechreader demonstrates confidence and skill in the use of the tool, the talker progresses to orientation activities.

In the orientation activities:

The speechreader is the source of the tracking material; it was tracked immediately after being generated. If necessary, the speechreader is given a copy of the material to refer to during tracking.

The speechreader generates the material, but some time is allowed before it is used for tracking procedure.

Well-known memorized materials such as nursery rhymes are used.

Material not generated by the speechreader is used, but familiarization is done prior to tracking. The key words of the practice material are introduced in writing and through speechreading prior to tracking.

### **Cronin's Computer-based training approaches (1979):**

Other innovative approaches which incorporate speechreading training have utilized computer-based instruction. Gronin (1979) and his colleagues at NTID devised such a system for self instruction in speechreading and auditory training for students of the school. The student makes use of videotaped exercises which provide structured speechreading drill in a variety of material at beginning, intermediate and advanced levels of instruction.

### **Lip-Reader Trainer (University Electric Research Co. 1987):**

Another computerized program, the Lip-Reader Trainer (Universe Electric Research Co., 1987) has been introduced for use with a microcomputer. It incorporates 19 high-resolution, three-color graphic mouth shapes to simulate speech production. The program has an unlimited vocabulary and is capable of animating words or sentences up to 115 character in length (Nerbonne 1989).

### **Use of Video in Speechreading Instruction:**

Kopra, Abrahamson and Dunlop (1986) described the initial use of laser video disc for speechreading training. Boothroyd (1987), Tyler and Gantz (1987) and Bernstein and Eberhardt (1986) have used interactive videotape or disc to investigate the benefits of cochlear implants and tactile sensory aids to speechreading. Using an IBM XT microcomputer interfaced to a Pioneer 6000 videodisc player, Boothroyd (1987) combined interactive video with an observer to simulate a modified DeFilippo and Scott (1978) tracking procedure. In this way the speechreading stimulus is prerecorded and thus is

more reproducible for studying the benefits of a tactile device or cochlear implant as an aid to speechreading (Boothoyd, Hannin and Waltzman, 1987).

Pichora-Fuller and Cichelli (1986) used an interactive videotape (Computer Aided Speechreading Training - CAST) to instruct adventitiously hearing-impaired adults in viseme perception using phrase-length discourse tracking exercises. The CAST system uses an IBM PC-AT and the BCD Videolink 232, Videotape controller for the Sony SLO 325 Beta Cassette Recorder. Each training session focusses on a particular viseme that is practised using viseme-specific texts.



## **STUDIES ON SPEECHREADING VARIABLES**

The studies have been classified under the following headings.

- (a) Speechreader variables
- (b) Speaker variables
- (c) Environmental variables
- (d) Visibility of articulatory movements.

However, there are old articles which are cited in more recent articles, which do not give all the procedural details. It has not been possible to refer to these original articles, due to their non-availability. Hence, these articles are not reported in the above given subheadings.

### **The Speechreader variables:**

The variables studied under the speechreader variables include mental abilities such as intelligence, synthetic or analytic ability, personality and sensory abilities. In addition, hearing loss, training, age, sex and education have also been studied in relation to speechreading ability.

### **Intelligence:**

Kitson (1914) conducted the first study in this field. He suggested that subjects with high scores in visual skills scored high on lipreading tests. A good lipreader had a large visual span and guessed well. Pintner (1929) tested face-to-face lipreading in deaf students and found no correlation between lipreading scores and scores on the Pintner non language mental test. Heider and Heider (1940) developed a film test and tested students of

Clark school. They found no significant relation between school achievements and lipreading proficiency.

Study by O'Neill and Davidson (1956) using the Ohio state Psychological Examination reported no correlation between lipreading skills and intelligence.

Simmons (1959) used the Weschler Scale on 24 hard of hearing subjects and found no significant correlation between IQ and lipreading skill.

Most of the studies indicate no significant correlation between intelligence and lipreading. But Craig (1964) and Evans (1965) found small but significant correlation between intelligence and speechreading scores. This area needs further research.

### **Behavioral Pattern:**

Strbsehinski (1928) considered lipreading as speech thinking. He suggested 4 types of speechthinking (1) Visual (2) Acoustic (3) Speech motor (4) Script motor. Persons with visual thinking were the best suited for lipreading and those with acoustic type of thought found speechreading more difficult. O' Neill (1951) chose normal hearing college students with varying degrees of lipreading skills. A battery of tests including the Rotter Incomplete sentence test, Rorschach Test, the Knower speech Attitude scale and Knower - Dusenbury test of Ability to judge emotions was given to them. Lipreading skill and performance on the battery had no significant relation. In a similar group, O' Neill and Davidson (1956) found no significant correlation between aspiration level and lipreading-skill, in a population of congenitally deaf

students. Worthington (1956) found no significant correlation between behaviour patterns or degree of adjustment and lipreading ability. Aspiration level and sentence completion tests of Rotter and Mason lipreading test were used.

In contrast with the above studies there are experts who have found a correlation between behavioural abilities and speechreading. Wong and Taaffe (1958) studied normal hearing college students for aptitudes and lipreading ability. He reported that general activity, personal relation and emotional instability were important personality aspirations in lipreading. Aptitudes such as reasoning, identical fluency, spontaneous, flexibility and fluency are important in lipreading. Markides (1977) felt that psychological factors like attention, attitude and motivation definitely influenced learning of speechreading. Kinzie considered motivation as "Will power" and Milesky (1960) considered motivation as the most important factor in lipreading. Myklebust (1960) felt motivation very important and suggested that the therapist should build up motivation in students of speechreading. Getz (1953) stated that good speechreaders had a more positive attitude towards themselves and others than did poor speechreaders. He also felt that speechreading got fatigued due to concentrative visual attention and therefore they should learn to relax during training. Experimental students in this area are not available. Thus, it can be noted that the older studies did not find much correlation between the behaviour or attitude of a person with speechreading ability. However, the later studies did find a correlation.

**Visual Skills:**

Kitson (1915) found that those with high scores on visual tasks scored high in lipreading O' Neill (1951) and O' Neill and Davidson (1956) did not find a significant relation between visual skills and lipreading. Several tests of visual motor coordination were used by O' Neill and O' Neill and Davidson. These included tests of block design, object assembly and digit symbol from the Weschler - Bullevu Adult Intelligence Scale. Results indicated significant correlation between scores for digit symbol and lipreading. But no such correlation was found between block design, object assembly and lipreading. Another study used the Hempmann - Karsnin Test. It's results showed no significant relation between lipreading and test scores. This would seem to indicate that lipreading may involve not the recognition of verbal elements but the recognition of configuration or form patterns.

Studies by O' Neill (1940) and 'O' Neill and Davidson (1956) showed no apparent relationship between lipreading ability and reading rate and reading comprehension. Simmons (1959) sampled first areas in reading using Iowa Reading Test. Only one of the five areas namely ability to extract key words correlated with lipreading performance as measured by mason and Utley test of lipreading ability.

Sharp (1972) found good speech renders significantly superior to poor speechreaders on tests of visual closure, movement closure and short term memory. Evans (1960, 1965) and Berger (1972) agree that anyone with vision sufficient to see differenced in movements and position of the articulators of

the speaker, can learn speechreading. 20/40 vision seems to be sufficient in most conversational situation (Markides (1977) Shepherd et al (1972) found significant, product moment correlation ranging from 0.09 to 0.91 between a selected peak latency in average visual electro encephalic responses and lipreading scores in 20 adults with normal hearing and normal vision with no lipreading training.

### **Age of the Lipreader:**

Evans (1965) reported a rapid increase in speechreading scores between the ages of 6 and 11 years and then a plateau is reached. According to Farrinand (1959) speechreading ability improved from the second to the third decade of life and then it declined. He found that lipreading scores of person over 60 years were about half those achieved by 30 - 35 years old people. But Conklin (1917) did not find deterioration of speechreading scores with age. Similarly Heide's (1940) , Utley (1946) and Reid (1946) reported a very low and insignificant correlation between age and speechreading performance. This point needs further investigation.

### **Sex of the speechreader:**

Females are generally superior to males in linguistic skills. They can be expected to be superior in speechreading also in as much as speechreading can be considered to be a skill. Most of the researchers (McEachun & Aushford, 1958, Brunnan, 1961. Graig 1969, Evans 1965) found that females scored high than males in speechreading but the differences were not

statistically significant. Costello (1963) and Frasin (1961, 1963) reported significant differences in speechreading ability in favour of females.

### **Hearing Loss and Speechreading:**

Lipreading ability and degree of hearing loss and age of onset have been compared. But type of hearing loss, audiometric configuration or the rate and age of development of hearing loss and speechreading have not been compared.

The Heider's (1940) found speechreading and hearing loss correlated favouring the child with better hearing Simmons (1959) found low and non significant correlation between speechreading such hearing loss. Petrovek (1961) in an autobiographical report claimed that a totally deaf person found it easier to learn speechreading than a person with hearing because the latter tend to concentrate on listening at the expense of speechreading. Lowell (1959) conducted a large study and reported that normally hearing persons scored higher in speechreading than did deaf people.

### **Length of training:**

Berger (1972) reported a low and significant correlation between speechreading ability and length of training for the adult hearing impaired. But the length of training given was not reported.

This is a very crucial variable that needs extensive exploration which must also consider the educational background of the speecreader and the therapist's calibre.

Utley (1946) and Reid (1947) found no significant correlation between education and speechreading. The Heider's (1940, 1947) found a correlation at 0.54 and 0.57.

--- Continued in P. 67.

## **THE ENVIRONMENTAL FACTORS AND SPEECHREADING**

The physical environment constitutes an important factor in speechreading. The lighting, voice, distance between the speaker and the speechreader, viewing angle and presence of other stimuli that may or may not be directly connected with speechreading, all tend to influence the process of speechreading.

### **Distance and speechreading:**

Mulligan (1954) found that the slower speed of projection (16 frames/sec as compared to 24 frames/sec) resulted in more correct recognition during speechreading. The distance between the subjects and the screen did not significantly affect the test results. Of the four distances studied 5, 10, 15 & 20 ft., the 10 ft distance was apparently the most favourable.

Most of the research studies on effects of distance on speechreading recommend distances varying from four feet to eighteen feet (O' Neill, 1954; Prall, 1957; Hutton, 1959; Evans, 1960). Berger (1970) compared speechreading performance at 2, 12, 18, & 24 ft and found no significant differences. But from a distance of 24 ft, elderly subjects found difficulty in speechreading. All workers in this agree that speechreading from very close distances i.e., less than 2 ft. is contraindicated [Markides (1977)].

Erber (1971) reported the effects of distance on visual reception of speech in the profoundly deaf. Speechreading at 5 ft. was 75% correct and at



100 ft, it was 11% correct. In another supplementary study he found that the identification of vowels was affected less by distance than that of consonants.

### **S/N ratio and speechreading:**

Background noises have been employed in a number of lipreading experiments with normally hearing subjects. Reports by O'Neill (1954), Sumbay and Pollack (1954) and Erber (1969) have provided data suggesting that the combined auditory-visual recognition of words is more resistant to noise than is the recognition by listening alone. For a given S/N ratio the combined auditory-visual performance is typically better than is the recognition through listening alone. The information could be used to establish S/N criteria for auditory or auditory-visual perception of speech in noisy areas where communication must occur, for example in industrial and educational areas. Leonard (1962) found that speechreading performance was adversely affected when 80 dB SPL background noise (white noise, speech and background music) were presented as auditory distraction in a visual only intelligibility task. Erber (1969) showed that auditory visual intelligibility at approximately 24 dB S/N improved systematically demonstrating the ease by which the spondee vocabulary could be lipread. His results supported the findings of an increased visual component at a poorer speech-to-noise ratio down to approximately 24 dB. Pettit (1963) compared the effects of criterion babble, traffic noise and white noise on lipreading scores to lipreading in quiet. Each type of noise was at 90 dB level and the test materials used were monosyllabic words. Speechreading scores were poorer when observers responded in noise than when in quiet (55 dB background noise). Based on

Miller and Nicely data (1955) it can be predicted that an observer can tolerate a considerable high frequency loss of acoustic speech energy without much decrease in intelligibility on an auditory-visual task because the place of articulation cues compliment the manner of articulation cues that are present in the low frequency acoustic signal Binnie, Montgomery and Jackson (1974) showed that even when broadband masking (-12 dB S/N) eliminated all but voicing and nasality features, normally hearing subjects recognised consonants through auditory visual perception considerably better (83%) than when merely listened (34%). This increase was attributed to speechreading of the place of articulation information that was masked by the noise.

### **Lighting:**

Light on the speaker's face is an important factor in speechreading. Berger (1972) suggested that the deaf or hard of hearing child in the classroom should be seated near the window side of the room so that the natural light is on the teachers face and not shining in the child's eyes. He found that individuals familiar with the message content produced slightly diminishing scores as the intensity of the room illumination decreased from thirty foot candles to one - half foot candle. Erber (1972) found that, with frontal illumination a large reduction in facial illuminance, there was a decrement in visual intelligibility. He also found that conditions of high background brightness produced a reduction in facial luminance from 30 to 3 footlamberts.

**Distractions:**

Markides (1977) suggested that visual distractors influence speechreading. Among the visual distractions reported by speechreaders were movements of the hands in the area of the face and exaggerated lip movements. (Berger, 1972). The effect on speechreading of the visual background behind the speaker was examined in a study conducted by (Keil 1968). A neutral background and three differing pictorial backgrounds were used to determine their possible effect as distractors. They were - a coloured slide of two females projected on each side of the speaker, a coloured background consisting of trees, a car and a building behind the speaker and a black and white moving background of a busy street scene. No significant differences in speechreading scores were found among the four conditions with hearing-impaired or with normal hearing speechreaders. An assortment of moving visual distractors were examined in another study. No significant effect on speechreading scores was found to be caused by the presence of a flashing light. A positive and significant relationship was found between non-purposeful hand movement by the speaker and speechreading scores.

## LINGUISTIC VARIABLES

### Visibility of articulatory movements:-

Speech sounds can be divided into two major groupings, vowels and consonants. Acoustically each speech sound, be it a vowel or a consonant is unique in structure; visually this is not true however. Many speech sounds have identical visual articulatory movements and such sounds are referred to as homophenes. This term must not be confused with the term homophones which refers to speech symbols that have the same sound as others.

VOWELS:- Theoretically each of the vowels is visually distinctive. In practice, that is in running speech, their distinctive visibility is clouded by adjacent sounds. Although this point has been made by Nitchie(1912), Kinzie and Kinzie (1931) and by Ewing (1941), it is often ignored in speechreading instruction. Woodward and Lowell (1964), Berger (1970) produced experimental evidence which showed conclusively that none of the vowels can be visually identified correctly under conditions of pure speechreading Fisher (1968) suggested that the vowels form only four groups of homophenes and not 12 homophenes as has been hitherto accepted in the traditional, classification. Fisher's grouping was as follows:-

Group 1 -- / i̇ , I , ɔI , ʒ /

Group 2 -- / e , ε , ʒ , aI /

Group 3 -- / ae , a , au /

Group 4 -- / ɔ , o , u , u /

O' Neill found that vision alone contributed 29.5% to the recognition of vowels while Woodward and Lowell (1964) and Berger (1972) reported correct visual identification, averaging 49% and 53.1% respectively. These figures are below the acceptable performance (60 - 70% , Ewing 1941) for effective day-to-day communication.

**CONSONANTS** : Consonants can be classified according to their place of production, their manner of production and whether they are voiced, unvoiced or nasalized. This classification however, is modified considerably in rapid conversational speech. Although acoustically voiced/voiceless feature and nasalization of consonants can be easily distinguished, visually it is very difficult to do so (Larr, 1959).

Most of the workers in this field (Bruhn, 1942; Burchett, 1950; Clegg, 1953; Ewing, 1967) accepted that there are the following twelve categories of consonant homophenes.

This classification is mainly based on the point of contact of articulation Woodward and Lowell (1964) challenged the above traditional classification of consonants homophenes and suggested that there are only four consonant homophenous groups

Fisher (1968) provided additional evidence against the traditional classification of the visual distinctiveness of consonants. For the initial position, he classified consonants on five homophenous groupings.

For the final position he found the following consonant homophenes:

Berger (1972) reported that the traditional classification of consonants is essentially correct.

The cumulative writings of these authors show that correct identification of consonants through vision ranges from 30 - 40% for initial consonants and only 20 - 30% for final consonants. According to Ewing (1941) a discrimination of (60 - 70% is necessary for effective understanding of speech. Clearly this cannot be achieved through vision alone.

Walden et al. (1974) have evaluated military personnel whose hearing loss was due primarily to noise exposure. They studied perception of consonants within CV syllables. Visual cues were found to evidence transmission of place of articulation, friction and duration features on an auditory visual task. Lipreading had much less effect on the transmission of sonorant and voicing information. The improvement in transmission resulting from visual input was relatively constant across patients who demonstrated a wide range of auditory word recognition scores. Walden et al. (1974) have reported that most hearing impaired adults with language are very similar in their ability to distinguish visually between the "homophenons" consonant categories of Woodward and Barber (1960). A filmed test indicated that numerous patients categorised the post dental consonants | t, d, n, l, r, s, z, f, z | together. A two week training program consisted of distinguishing between CV syllable pairs as well as identifying spoken syllables containing the key consonants. After training, the patients demonstrated considerable improvement in recognising items from this confusable set of post dental confusions.

Many laboratory studies have used words as stimuli. Studies by Numbers and Hudgins (1954), Prall (1957), Darke (1957), Van Uden (1960, 1970), Evans (1960), Sanders (1968) and Ross et al. (1972) have examined auditory, visual and auditory visual speech perception abilities of hearing impaired children. All of these investigations showed that when the subjects both look and listen, their scores are typically better than when they look alone or listen alone. The mean advantage of auditory - visual perception over lipreading alone usually is greater for the severely deaf children (19 - 28%) than for the profoundly deaf children (1-15%), presumably because of the greater contribution of audition in the severe group. In fact, the scores of the severely hearing-impaired children often reached 100% under combined auditory - visual conditions.

Very few investigators have used sentences as stimuli in auditory-visual research, probably because it is very difficult to construct diagrammatically useful sentences and to score them reliably. Sentence stimuli have been employed in a few studies. However, Craig (1964) compared hearing-impaired children's auditory visual perception of sentences, with their perception of the same sentences through vision alone. Mean auditory visual performance was 5.0 - 8.5% when tested profoundly deaf children on a video-taped paragraph comprehension - test which was presented for visual and auditory perception. He found a relatively small mean increment (3.3%) for auditory visual perception relative to visual alone.

Words: In addition to homophenons phonemes, the English language consists of a high proportion of homophenous words. There are also words which

sound the same (homophonous) which a listener can only differentiate through context. Words such as /bear-bare/, /two-too/, /bad-mat-pat-pan/ are quite common in the English language and they tend to create erratic speechreading difficulties and some times, they can create embarrassing responses.. Several authors have attempted to quantify the frequency distribution of homophonous words in the English language but these calculations are mainly based on experience rather than experimentation.

Nitchie (1915) states that about 50% of the words in the English language are homophonous to one or more other words. Kinzie and Kinzie (1931) and Bruhn (1949) states that 50% of all speech elements are invisible or indistinguishable while Wood and Blakeby (1953) put this down to 11 - 17 % According to Vernon and Mindel (1971) and Berger (1972) 40 - 60% of the words of the English language are homophonous. It can be concluded that whatever the actual proportion of homophonous words in the English language they are basically detrimental to speechreading accuracy.

It has been found by Taaffe and Wong (1957) that word length affects speechreading performance with two - letter words being more difficult to speechread than three - letter words. Similarly Erber (1971) found significant improvement in speechreading of spondee words as compared to monosyllables. On the contrary, Brannon (1961) did not find significant difference in speechreading difficulty between monosyllables and spondee words but reported improvements in speechreading of spondee presented in a sentence. The same results were reported by Sarrait(1951). Franks and Oyer(1967), found that familiar words are easier to speechread than unfamiliar words and



this was supported by Berger (1972) who stated that three - syllable words to speechread. Schwartz and Black in 1967 found phrases to be easier to speechread than sentences. Declarative sentences were found to be more difficult to speechread than interrogative and/or negative sentences.

The relation between nature sentences stimulus material is very important one and needs.

In the following section, studies dealing with speechreading have been classified under the following subheadings:

- Speechreader variables.
- Speaker variables.
- Environmental variables.
- Linguistic variables.
- Correlates of speechreading.
- Teaching and training.

Each of the articles are classified under the headings "author, year, purpose of study, subjects, test materials, procedure and results.

## **SPEECHREADER VARIABLES.**

- Author : Brainerd  
Year : 1969  
Purpose : To determine the influence of analytical perception to determine whether this ability to identify or pickout parts of the overall visual environment might not be related to success in lipreading.  
Subject : 20 normal hearing males.  
Test Materials : Hidden figures test, Utley test.  
Procedure : Analytic ability was measured by the Hidden Figures Test and speechreading ability was measured using form A of the Utley Test.  
Results : The test results shows a moderate positive correlation with lipreading ability based on the Utley Test, form A.

- Author : lowering  
Year : 1969  
Purpose : To study the effect of visual acuity on lipreading performance.  
Subjects : 5 females  
Test Materials : 20 unrelated familiar sentences.  
Procedure : The visual acuity of the subjects were manipulated through the use of optical lenses, providing visual distortions. The experimenter developed 5 experimental lipreading films which differed in level of blurring, corresponding at a distance of 10 feet, to visual acuity conditions of 20/100, 20/60, 20/40 and 20/20. Each experimental film was composed of the same 20 unrelated familiar sentences with 5 different random orders for the 5 female subjects who viewed the films individually.

Results : There was no difference found between the 20/40 and 20/20 condition. But lipreading performance improved with each change in acuity condition from 20/100 to 20/40. Serious deviation in acuity had a deleterious effect on lipreading.

### SPEAKER VARIABLES.

- Author : Stone
- Year : 1957
- Purpose : To study the effect of facial expression, facial exposure and lip mobility on speech reading.
- Subjects : 256 normal hearing college students.
- Test Materials : Coloured motion pictures
- Procedure : Subjects observed coloured motion pictures of trained actors.
- Results : Lipreading performance was better for normal lip movements than tight lip movements. When the speaker had a plain face rather than a smiling face, the lipreading was easier.
- 
- Authors : Greenberg & Bode
- Year : 1968
- Purpose : To determine speechreading of consonants for full-face and lips only exposure
- Subjects : 32 females with normal hearing and vision..
- Test Materials : Modified Rhyme test and materials having monosyllabic structure (CVC form).
- Procedure : Subjects were asked to speechread the consonants which were uttered by speaker with full face exposure and with exposure of lips only.
- Results : Consonant discrimination was more accurate when the entire face of the talker was exposed than when only his lips were exposed.

- Authors : Dicob and Scheffer.  
 Year : 1972  
 Purpose : To examine the effects of over emphasising, under emphasising and normal lip movement on lipreading ability.  
 Subjects : 13 normal hearing in the age range 21-47 years.  
 Test Materials : 30 word from W 22 lists.  
 Procedure : Each word was presented with the carrier phase " write the word ---" Ten of the words were presented in an over emphasized manner, 10 in under emphasized manner and 10 using normal speech movements. The experimenter stood behind a window in a well lighted room and subject in a dimly lit room. An open set was used. Each test item was spoken using soft voice. The talker presented each word with the carrier phrase once, using a predesignated emphasis.  
 Results : The mean errors indicated that under emphasized speech (.8.69) was more difficult to lipread than normal (3.77) or overemphasized (3.85) speech.
- Author : Miller.  
 Year : 1972  
 Purpose : To investigate the effect of facial expression in speech reading performance.  
 Subjects : 4 normal hearing subjects in the age range of 21 - 41 years.  
 Test Materials : 31 tests sentences with one key word each.

Procedure : The subjects were seated in 3 rows near the centre of a partially darkened room and subjects stood in a well lighted room separated by a window which served to limit auditory cues. The speaker spoke each sentence once in soft voice and subjects were instructed to write it as completely as possible. Odd numbered sentences were presented with facial expressions and even numbered sentences with a neutral face. Responses were scored by assigning one point for each word correctly written.

Results : Mean number of correct responses for facial expression conditions were 7.71 and neutral face conditions were 3.86. There was a significant difference between subjects performance on sentence employing facial expression and those spoken with a neutral face.

Author : Lowell

Year' : 1974

Purpose : To study speechreading performance for various degrees of face exposure.

Subjects : 236 normals hearing college students.

Test Materials : Colour film of 20 unrelated sentences.

Procedure : Four conditions of exposure were studied:

(1) Mouth alone.

(2) Chin to bottom of nose - involving mouth and lines around mouth.

(3) Chin to eyebows - full width of face, and

(4) Full face and body to chest.

Results : Scores of speechreading systematically improved with increasing exposure. The difference between conditions 1 and 2, 1 and 3 and 1 and 4 were statistically significant.

Authors : Byers and Liebermann.

Year : 1959

Purpose : To study the effect of rate of speech of the speaker on lipreading performance.

Subjects : 24 males and 24 females divided into 4 groups of 12 each.

Test Materials : Utley lipreading test.

Procedure : Each group was exposed to a filmed version of a sentence lipreading test (adapted from Utley); the first group viewed the film at normal rate (120 words per minute); the second group saw the film at two-thirds that rate, the third at one-half that rate and the fourth group at one-third that rate.

Results : No significant differences in performance were found at the 4 rates of production for either a group of ' good' or ' poor ' lipreaders.

Authors : Krehonik and Vistor.

Year : 1972

Purpose : To examine the effects of faster than normal rate of speech on lipreading performance.

Subjects : 10 normally hearing individuals.

Test Materials : 2 lists of 15 sentences taken from Utley Film Test of lipreading.

- Procedure : Sentence list AI was used for the normal rate presentation, and sentence list BI for the faster than normal rate presentation (Metronome was used here). Group I received sentence list AI first followed by sentence list BI. Group II received sentence list BI first and then sentence list AI. Sentences were presented live with soft voicing, by a male speaker behind the window and the subjects were asked to write each sentence as it was presented. Each syllable in a sentence was assigned a value of one point, making 60 possible points for each list.
- Results : The mean correct score under the "normal-rate" condition was 26.2 syllables, and under the "faster than normal rate" it was 19.2 syllables. The results of this experiment confirmed the expectation that a faster than average speech rate would reduce lipreading scores.
- Authors : Ackins and Lee
- Year : 1972
- Purpose : To investigate lipreading performance as a function of angle of light on the speaker.
- Subjects : 12 females with the normal hearing and vision.
- Test Materials : List of 60 words (one, two, and three syllable words used) broken down into 4 sublists of 15 words each.
- Procedure : Subjects were divided into four groups of three: individuals each. There were four test conditions; light from a 0° angle, light from 45° angle to the light of the speaker, light from 90° to the right and from 45° angle to the left of the speaker. One sublist of 15 words was



presented under each of the conditions. The speaker was separated from the subjects who were seated ten feet from the speaker. Light used on the speaker was a 100 watt incandescent bulb placed 24 inches from the speaker's mouth, at angle of 14° below the speaker's mouth.

- Results : The findings demonstrated that lipreading performance was better with the light coming from 45° than from 90° or 0°. Light coming from an angle of 90° produced the lowest score of the four conditions.
- Authors : Kricos and Lesner.
- Year : 1985
- Purpose : To determine the effect of a talker's visibility and distinction of speechreading by hearing impaired children.
- Subjects : 2 female talkers and 12 severely hearing impaired lipreaders.
- Test Materials : Craig lipreading inventory (2 forms).  
24 English consonants |p| b, t, d, k, g, f, v, e, r, s, z, , z, ~~z~~, ~~s~~, dz, m, n, n , l, j, w, h.
- Procedure : Form A was presented by Talker 1 and Form B was presented by Talker 2. The children viewed the silent videotapes seated approximately five feet from a 24 inch video monitor (RCA). The presentation of each stimulus was used by a card showing the number of the stimulus item which served to alert the observer of the stimulus item. For the consonant recognition task the children were asked to observe the video portions of the video. Lipreading of the experimental stimuli and to write

down the syllable that they thought were said. A key containing all orthographic symbols for consonants was providential. Several practice syllables were visually presented to ensure understanding

**Results** : Results indicated that the number of consonant visemes was related to the talkers word and sentence intelligibility. It therefore showed that the use of different talkers may significantly affect the performance of hearing impaired teenagers. It was suggested that teachers and clinicians who work with hearing - impaired children considered the visual ambiguities of their own speech and attempted to objectively assess their visual speech intelligibility. These findings, also support the need for selection, training, and use of oral interpreters.

### ENVIRONMENTAL VARIABLES

- Author : Leonard
- Year : 1962
- Purpose of study : To evaluate the effects of selected auditory distraction on lipreading performance.
- Subjectss : 12 normal hearing individuals.
- Procedure : Four test condition were employed:
- (1) Quiet (ambient noise of 55 dBSPL)
  - (2) White noise at 80 dB SPL.
  - (3) Running speech at 80 dB SPL.
  - (4) Background music at 80 dB SPL.
- Results. : Significant variations were found among test conditions and their effects on lipreading performance. The white noise and running speech conditions affected lipreading performance to a greater degree than did background music. All of the auditory distractions led to deterioration of lipreading performance when compared to the quiet condition.
- 
- Authors : Berger and Lewis
- Year - : 1972
- Purpose of study : To determine the effect of noise on lipreading performance,
- Subjects : 12 normally hearing individuals.
- Tes materials. : 20 word pairs in each condition and white noise,

Procedure : White noise was employed at 90 dB SPL, as measured in the centre of the small class room where the subjects sat. Condition I was quiet (55 dBSPL). Condition II had continuous noise and condition III had intermittent noise (.5 Sec on, .5 sec. off). The speaker was in a room separated from the subjects by a large durable window. Subjects identified and circled the words from printed word pairs, eg look, luck, as seen by the speaker saying one of the words from each pair in a redundant phase. Each condition consisted of a list of 20 word pairs and each condition was presented 3 times in a counterbalanced order, using a total 9 equated lists of word pairs. Subjects sat from 8 to 13 feet from the speaker, and had a view of him.

Results. : Scores gradually decreased from the quiet to the continuous noise to the intermittent noise conditions. The predictability of noises permitted the subject to adapt to them. It was speculated that a more random noise background will have a greater negative effect on lipreading performance for the hearing impaired.

## LINGUISTIC VARIABLES

- Authors : Woodward and Barber
- Year : 1960
- Purpose of study : (a) To develop a theoretical model of the structure of perception in lipreading, i.e., a definition of the units of visual perception of oral-aural stimuli and of the relationship among these units in a system of aural visual communication.
- (b) To establish the relationship of the visuallyperceived symbols to the underlying linguistic system.
- Subjects : A total 305 normal-hearing adults subjects out of which 185 formed he experimental group. The two control groups had 65 and 55 subjects respectively.
- Test materials. : Monosyllable/nonsense words, 25 consonants and 229 identical pairs.
- Procedure : The test was administered in the following ways: to the experimental groups, (185 subjects), the film without sound; to one control group (65 subjects), the sound track alone but with item numbers shown on the screen; to the other control group,( 55 subjects), the complete film with sound. All subjects were supplied with numbered answer sheets on which they could indicate whether they thought the members of each syllable pair were ' alike' or ' different'. Subjects were selected on the basis of two main criteria. In as much as the investigation was designed to discover linguistically determined units of visual speech perception, normal hearing English speakers were necessary. The other criterion was that of willingness to

take the test, which was satisfied by using volunteer subjects.

Results. : In place of the 24 initial consonants tested, results indicate that only 4 visually contrastive units are available consistently to the lipreader. Though control group scores were not perfect they were in accord with present knowledge about perceptual confusion among speech sounds under less than optimum conditions of reception.

Author : Brannon

Year : 1961

Purpose of study : To provide clinician with usable information concerning the materials used.

Subjects : 65, 22 males, 43 females in the age range of 17 - 49 years.

Test materials. : Test A; Sentence test - The Utley lipreading test, Form A, which consists of 31 short sentences (125 words).

Test B; Monosyllabic word test. Fifty monosyllabic words selected from PB - 50 series.

Test C; Spondee word test with ten words chosen from a list of spondee words.

Procedure : All three speechreading tests were in the following order - Test A, sentences Test B, PB words, and Test C, spondee words. During the speechreading test, a loud smooth masking noise estimated to be 70 dBSPL was delivered through a loudspeaker into the classroom to rule out the possibility of any other sound reaching the subjects ears. The talker stood before the class to speak the stimulus materials in a faint whisper, being careful not to exaggerate

his lip movements and making every effort to speak naturally at normal speed. To mobilize the viewer's attention, the talker held up a 3" x 5" card displaying the number of the item immediately preceding the presentation. Subjects wrote their responses on mimeographed answer sheets, making a response to each item.

Results. : Test A words in sentence 48.5% of the words were correctly identified by College students and 49.8% were identified by high school students.

Test B - PB words College group obtained a mean percentage of 31.3% while the High school group obtained a mean score of 35.1% .

Test C Spondee word test with ten words chosen from a list of spondee words.

- Author : Roback
- Year : 1961
- Purpose of study : To study the ability of students to identify homophenous words correctly.
- Subjects : 4 speakers (2 men, 2 women).
- Test materials. : Homophenous words.
- Procedure : 4 speakers, 2 men and 2 women presented the stimulus materials via silent film and it was speechread by 4 viewers, 2 men and 2 women.
- Results. Results of a multiple choice test procedure indicated that homophenous words are not produced exactly alike on the lips since subjects were able to select them correctly more frequently than would be expected by chance alone.

Author : Fulton  
 Year : 1964  
 Purpose of study : To compare the production of voiced and unvoiced words,  
 study  
 Subjects : 6 normal hearing individuals.  
 Test materials. : Motion picture films of 4 words with voice and without  
 voice.  
 Procedure : Motion picture films of 6 subjects saying 4 words with  
 voice and without voice were subjected to a frame - by -  
 frame analysis.  
 Results. : Some differences were found with this method in size or  
 amount of lip opening; mouth width, jaw movement, and  
 mouth and bilk areas. Unvoiced words consistently showed  
 greater fluctuation of movements.

Author : Greene  
 Year : 1964  
 Purpose of study : To investigate the ability of lipreaders to identify the  
 accented syllable in 3 syllable words.  
 Subjects : 2 speakers and 4 viewers.  
 Test materials. : Sixty 3 syllable nonsense words,  
 Procedure : Two speakers were filmed while uttering sixty 3 syllable  
 nonsense words.  
 Results. : Viewers were able to determine correctly the accented  
 syllable 40 percent of the time, well above chance level.



- Author : Lloyd
- Year : 1964
- Purpose of study : To evaluate the relationship between sentence familiarity and sentence lipreading difficulty.
- Subjects : 51 normal hearing individuals.
- Test materials. : 60 sentences from the "Filmed test of lipreading". (Taaffe, (1957).
- Procedure : The subjects were presented 60 sentences from a film test of lipreading. Later the subjects rated the sentences on a five point scale of familiarity. The ratings were compared to earlier data of Taffe and Wong (1957) who had ordered the same elements according to the difficulty of lipreading.
- Results. : A correlation of  $r = 0.31$  was found between the difficulty and familiarity of each sentence. This was interpreted as a significant and weak relationship.
- 
- Author : Griggs
- Year : 1972
- Purpose of study : To determine the extent to which keyword identification is dependant upon the familiarity of the sentence.
- Subjects : 14 normal hearing individuals in the age range of 21 - 47 years.
- Test materials. : 15 traditional sayings, 15 declarative sentences.

- Procedure : Key words were placed in the initial, medial, and final position of sentences (in traditional and declarative) Subjects were instructed to write down as much of the sentences as they were able to speechread. The subjects were seated on one side of the observation window and speaker on the other side. Each sentence was presented once and 15 seconds was given for writing their responses.
- Results : The subjects correctly identified 54% of the key words in the traditional sentences, 37% of the key words in the declarative sentences.
- Author : Lloyd
- Year : 1984
- Purpose of study : To investigate the relationship between sentence familiarity and sentence lipreading difficulty.
- Subjects : 52 normal hearing individuals.
- Test materials. : Sixty sentences from the "Filmed Test of Lipreading".
- Procedure : An equal-appearing interval was utilized to obtain quantitative sentence familiarity values for the 60 sentences. Each sentence was individually scaled by 52 judges on a 5 point equal appearing intervals scale, with one standing for least familiar and five for most familiar. The medium values of the 52 judgements of each sentence provided the sentence familiarity value for each of the 60 sentences. All sentences were scaled in a single session with each judge working at his own rate which varied from five minutes to 14 minutes, with a mean scaling time of 9.15 minutes.

- Results : The speechreading different value obtained by Taaffe and Wong (1957) for the six most and six least familiar sentences were compared using the T-test. The obtained t was |6.4| which is significant beyond 0.001 level. This t values indicated that the 10% judged most familiar, differed in obtained speechreading difficulty by more than is likely to occur through chance alone ( $P = 0.001$ ).
- Author : Neilson
- Year : 1966
- Purpose of study : To investigate the effects of word repetition on ease of lipreading.
- Subjects : 20 normally hearing college students.
- Test materials. : List of frequently used words.
- Procedure : Speakers read lists of frequently used words under several conditions: Each word was uttered once on one list, 2 successive utterances of each word' occurred on a second list, and 50 in through 5 successive utterances of each word.
- Results. : This finding suggested that repetition of the stimulus is not an important factor, as a difficult word will not be identified even with additional exposures.

Author : Franks and Oyer

Year : 1967

Purpose of study : To investigate the influence of the perceived stimuli of monosyllabic words on the "identification of the initial consonant by lipreading.

Subjects : 4 speakers presented the material. The viewers comprised of 80 college students, who were divided into 4 groups of 20 each.

Test materials. : 7 Initial consonants

Procedure : Four speakers were filmed speaking the stimulus words. Before viewing each word, the subject heard the word stimulus with the consonant omitted and saw the stimulus on a printed response form.

Results. : The influence of the stimulus on the identification of the initial consonant was so persistent that the acceptance of the basic hypothesis was affirmed. The basic hypothesis was stated as follows: "If the stem of a monosyllabic word is known and the initial consonant is unknown, the correct or incorrect identification of the initial consonant by lipreading is influenced by the linguistic characteristics of the known stem.

Author : Cartwright and Dandridge.

Year : 1971

Purpose of study : To determine how the number of phonemes contained within one syllable words affect the lipreadability of the word.

- Subjects : 18 normally hearing individuals.
- Test materials. : Familiar one syllable word (15 words, 2,3,4 or 5 phoneme words)
- Procedure : Test words were spoken by a female speaker from behind a window. The speaker used soft voice, with no audible clues. The test words were presented once in the carrier phase "Number - is - " In Scoring, all correctly identified words received one point.
- Results. : Adding a phoneme to a syllable altered the relative identification of the syllable.  
Two and three phonemes in a word produced about the same lip reading scores, but lengthier words produced lower scores.
- Author : Moore.
- Year : 1971
- Purpose of study : To examine the difficulty in lipreading vowels and to compare these findings with the characteristics of the vowels, specifically lipreading various lipspread and liprounded vowels.
- Subjects : 10 normal hearing subjects.
- Test materials. : Vowels and diphthongs. The vowels used in this study were | a | | i | | e i | The diphthongs | e i | | o u | were used. The ten vowels were placed into consonant frames to compose ten CVC words.

- Procedure : Words were spoken behind the window without auditory cues and the subjects were asked to write the words. Only the vowel portion of the responses was scored.
- Results : Lip rounded vowels are more easily lipread (69.4% correct) as a whole than the lipspread vowels.
- Author : Erber.
- Year : 1972
- Purpose of study (1) To evaluate auditory and visual reception of voicing inability and place distinction within a set of spoken commands and  
(2) To compare the performance of children with normal hearing, severe hearing impairment and profound deafness on the auditory and visual tasks.
- Subjects : 15 children of which 5 had normal hearing, 5 had severe hearing impairment. and 5 had profound hearing impairment.
- Test materials. : The following eight consonants served as test material: (b,d,g, k, m, r, p, t)
- Procedure : The three groups of children were tested separately. During presentation of each list, auditory, visual and combined auditory, visual reception were evaluated at the same time. While some children listened, others looked or simultaneously looked and listened. A counter balance schedule insured that each subject received all stimuli under all conditions of observation bias due to order effects. During such six second response interval, the

subjects were required to write the consonant that had just been presented and to guess if necessary. At all times, they were allowed to refer to typed lists of the eight consonants included in the response set.

**Results** : Through lipreading alone, all three groups were able to discriminate between the places of articulation (bilabial, alveolar, velar) but not within each place category. The children with normal hearing made few errors in consonant recognition under either auditory or auditory - visual conditions. The normal-hearing, severely hearing-impaired, and profoundly deaf children displayed similar patterns of response in their visual recognition of consonants. The auditory responses of the severely hearing-impaired group indicated that these children were able to categorize the eight consonants accurately into voicing and nasality classes. When the profoundly deaf subjects received only acoustic cues for speech, they were unable to categorize the eight consonants reliably even with regard to voicing or nasality.

**Author** : Franks.

**Year** : 1972

**Purpose of study** : To determine the degree and nature of the confusion among basic language elements in lipreading by examining the areas of confusion encountered in lipreader identification of such consonant clusters.

**Subjects** : 275 normal hearing individuals in the age range of 18 - 35 years.

- Test materials. : 32 cluster - vowel nonsense syllable.
- Procedure : Motion pictures were used for the presentation of the stimulus material. Three speakers were filmed uttering different randomized lists of the 37 nonsense syllables used. Each syllable was repeated by the speakers three times during each presentation. After each presentation the film was stopped and viewers were allowed five seconds in which to write their answer.
- Results : The consonant clusters were highly confused in lipreading, since they were incorrectly perceived 89% of the time. The clusters were seen most frequently as single consonants followed in frequency by identification as other consonant combinations. The confusion found and not attributable to chance, fell into seven visually contrastive groups. Confusion among sounds produced in similar articulatory positions were prominent.
- Authors : Kazanas and Susan.
- Year : 1972
- Purpose of study : To compare the lipreading scores of spondee and monosyllabic words.
- Subjects : 13 normally hearing individuals, who were divided into two groups. Each group contained 6 and 7 subjects respectively.
- Test materials. : CID W1 spondee list and CID W 22 PB and Word list.



- Procedure : For group I, the presentation order was: 18 spondee. 2 PB words, 18 spondees and 25 PB words. For Group II the order was 25 PB words, 18 spondees, 25 PB words, 18 spondees. Subjects were seated 8 feet from the speaker. They were separated by glass partition. Each stimulus word followed the carrier phrase, "Number, - write the word -" Answer sheets were provided Testing was done in a quiet well lighted double room, separated by a window. Visual and auditory cues were minimised lighting illuminated the speaker's face. Subjects were to lipread words of one and two syllables and write them. The speaker presented the words, without voicing and employed natural articulatory movements. Test words were presented twice.
- Results : Mean correct scores were 28% for the spondees and 17% for the PB word.
- Author : Dendiu and Panagotopoulos.
- Year : 1972
- Purpose of study : To examine the differences in word intelligibility in relation to word length stress pattern on lipreading scores.
- Subjects : 8 normal hearing subjects in the age range of 19 - 22 years.
- Test materials. : 30 two syllable words.
- Procedure : The subjects were seated on one side of the observation window and the speaker stood on the

other side. Audibility of test words was prevented by the speaker whispering each word. The subjects were instructed to guess each word and write it down. Each word was presented twice, without the carrier phrase. Numbered cards were held at the window to help subjects maintain the correct item order on the response sheet.

- Results : Overall 47% of the words were correctly identified. For spondees, 63% were correctly identified. For trochees 31%, For iambs 47%.
- Author : Schwartz
- Year : 1972
- Purpose of study : To compare the effect of different word stress patterns on lipreading scores.
- Subjects : 15 normal hearing individual (21 -47 years of age).
- Test materials. : 30 two syllabic words.
- Procedure : The subjects were seated on one side of the observation window and the speaker stood on the other side. Audibility of the test words was prevented by the speaker whispering each word. The subjects were instructed to guess each word and write it down. Each word was presented twice, without the carrier phrase. Numbered cards were held at the window to help subjects maintain the correct item order on the response sheet.
- Results : Among the words that were correctly identified, a higher percentage of spondees were correct (63%) followed by iambs (47%) and trochees (31%).

- Author : Goding
- Year : 1972
- Purpose of study : To investigate the value of a specific type of non-verbal contextual cue as an aid to better understanding of the stimulus content.
- Subjects : 12 normally hearing subjects (2 rows of 6 each)
- Test materials. : 20 test sentences, for each sentence a 35 mm slide was prepared that was related directly to the sentence, so as to be used as a visual clue when speechreading a particular sentence.
- Procedure : Group I was presented the odd numbered sentences with slide and even numbered sentences without slide. The procedure was reversed for Group II. The study was conducted in a two room glass partitioned suit. Subjects were positioned 0° horizontal to the speaker and instructed to obtain the jist of the sentences and write them down. Two points were given for each the noun phrases and the verb phrase.
- Results : The mean correct score with the slide clues was 60.50 and for sentences without slides 27.67.

- Authors : Small and Collier.
- Year : 1972
- Purpose of study : To examine the diphthongs | au |, |ɔɪ|, | a i | and their individual components.

- Subjects : 14 normally hearing subjects in the age range of 19 - 25 years.
- Test materials. : Diphthongs | au |, |ɔɪ|, | ai |; consonants /b/, /d/, /g/.
- Procedure : The diphthongs | i |, | ai | and | au | were presented in the initial and final position of syllables. Consonants | b |, | d |, | g | were used in syllables. Answer sheets contained multiple choice item. The speaker spoke the test stimuli at a normal rate at low intensity.
- Results : The diphthongs produced the lowest mean correct score of the stimulus items. Of the diphthongs tested, | ai | produced the largest number of errors, followed by | au | and | i |. The vowels that make up the diphthong | au | were not as visually distinctive as the vowels in the other two diphthongs. There was considerable confusion between | a | and | au |, and between | u | and | au |.
- Authors : Cole and Messal
- Year : 1972
- Purpose of study : To investigate the influence of a known situational context upon identifying key words.
- Subjects : 29 Hearing impaired individuals.
- Test materials. : 20 key words, 10 sentences closed set, 10 sentences - open set, 9 nouns, 5 verbs, 3 adjectives, 1 pronoun, 1 preposition.

- Procedure : Subjectss were seated in three rows. The speaker presented the sentences from behind the window in an adjacent room (at 45° azimuth horizontally). Closed and open sentences were presented and the subjects were instructed to write a response. The speaker spoke the sentence number and then read the sentence.
- Results : Mean correct scores for closed set sentences was 10.55 words (52.75%) and the mean correct scores for the open set sentences was 3.76words (18.80%).
- Authors : Erber and McMahan
- Year : 1976
- Purpose of study : To determine the effect of sentence context on recognition through lipreading.
- Subjects : 15 profoundly deaf children in the age range of 13 - 16 years
- Test materials. : 20 common monosyllabic nouns (10 animate 10 inanimate) and 60 simple sentences.
- Procedure : An experienced teacher who was familiar to the subjects served as the talker. Two 150 Watt floodlights were positioned at mouth level 30° from the midline and at a distance of about five feet. during the sessions. The tester sat before a black cloth screen. The subjects sat within 45° angle relative to talker and 10 feet from her. They did not use their hearing aids. The talker presented each of the words and sentences once without exaggeration and without normal vocal

effort, stress and rhythm. The talker was not told which word in each sentence was the key word. A phrase followed each stimulus. The stimulus materials were presented alternatively: 15 sentences, five words, 15 sentences, 5 words and so on. Sentences containing the same key word were randomly distributed. Seven teachers rated the general lipreading ability on seven point scale from very poor (1) to very good (7). These data were compared with results obtained under abnormal conditions.

Results : Isolated words were more intelligible (80%) than were words in sentences (46%) Animate nouns were more intelligible than inanimate nouns (33%) in initial number of sentences. The results indicated that:

(1) teachers of deaf children could enhanced the intelligibility of important words by isolating them from sentences.

(2) Some speech perception difficulties of deaf children could be diagnosed through lipreading tests.

Authors : Montgomery, Walden and Prosek..

Year : 1987

Purpose of study : To assess the effect of consonantal context on vowel lipreading.

Subjects : 30 hearing impaired adults in the age range of 40 - 45 years.

Test materials. : 55 CVC monosyllables in 11 CVC contexts.

- Procedure : The subjects viewed the videotape on groups of 5 or less seated at a distance of around 17 ft. from the monitor. Each viewer was given prior training in representing the five vowels, until he could pass without error on the 15 item test. The subjects were instructed to lipread a woman saying a vowel on the T.V. monitor and write it on the answer sheet. The tapes were presented without voice and was counter balanced such that 10 viewers saw talker 1 first, then talker 2, and 10 viewers saw talker 2, followed by talker 1. The other subjects saw the tapes in order talker 1, talker 2 on one day and then in same order for 4 days to assess test - retest reliability.
- Results : Analysis of the confusion matrices from each talker indicated that vowel intelligibility was significantly poorer in most contexts involving highly visible consonants, although the utterances of one talker were highly intelligible in the bilabial context. Amongst the visible contexts, the fricative and labiodental contexts in particular produced the lowest vowel intelligibility regardless of talker. Lax vowels were consistently more difficult to perceive than tense vowels.
- Author : Benguerel
- Year : 1982
- Purpose of study : To investigate the ability of lipreaders to use visual information alone to identify phonemes in varying contexts.
- Subjects : 10 normal hearing individuals in the age range of 22 - 31 years.

- Test materials. : 81 (3 x 9 x 3) possible ViCV<sub>2</sub> combinations where V<sub>1</sub> and V<sub>2</sub> were selected from | i |, | e |, | u | and C was selected from | p |, | t |, | k |, | t̥ |, | f |, | θ |, | s |, | ʃ |, | w |.
- Procedure : The test was administered through a monitor which was placed at a distance of 2m from the lipreaders. The T.V. controls and other equipments were blocked from view so that only the speaker on the screen was visible. The subjects were not aware of the number of items in the test until the end. Responses were given in the written form. The items on the response sheet were numbered to conceal the repetitive pattern of the test. Subjects were informed that possible vowels would be | i |, | ae |, and | u | and that possible consonants would be | p |, | b |, | t |, | d |, | k |, | g |, | f |, | v |, | s |, | z |, | θ |, | ʃ | and | w |. Voiced consonants were included to increase the difficulty of the task, but voicing was not considered in scoring the responses. The nature of the ViCV<sub>2</sub> was explained. Subjects were given a practice session, first with the VCN's spoken by the experimenter, then with the six practice items in the tape.
- Results : Lipreading performance was nearly perfect for | p |, | f |, | w |, | θ |, and | u |. Lipreading performance on | t |, | k |, | t̥ |, | e |, | s |, | i | and | ae | depended on the context. The features labial, rounded and alveolar or palatal place of articulation were found to transmit more information to lipreaders than did feature continuant. Variability in articulatory parameters resulting from coarticulatory effects appeared to increase overall lipreading difficulty.



- Author : Spradlin
- Year : 1989
- Purpose of study : To determine the effect of verbal encouragement on lipreading scores.
- Subjects : 32 hearing impaired subjects in the age range of 25 - 32 years.
- Test materials. : Videotaped version of Form A and B of Utley lipreading test, Each list consisted of 30 sentences.
- Procedure : Subjectss were tested individually and viewed the test stimuli while seated in a quiet well lit room, approximately 6 feet. from an 18 inch colour TV. Subjects rated their lipreading ability on a 4 point scale, poor as (1), fair (2), good (3), excellent (4). The experimenter than told the subject to view the taped speaker saying each sentence with the sound turned off and to write down on the response sheet what the speaker said. Subjects received the first test with no feedback about their performance. In the second test, special encouragement was given. Verbal commands differed based on the response of the individual. The test was scored by counting the numbers of correct words. Subjects rated their own lipreading performance, both pre, post test without knowing the actual performance score.
- Results : Both groups gave initial ratings that did not correlate significantly with their performance scores on test I. After the lipreading experience, both groups had self ratings correlating with performance scores on Test 2.

- Authors : Demolest and Bernstein.
- Year : 1992
- Purpose of study : To examine the importance of two stimulus factors that can affect speechreading performance, the talker and the test materials, in relation to the magnitude of individual differences among subjects with normal hearing.
- Subjects : 104 young normal hearing adults in the age range of 16-37 years.
- Test materials. : 100 CID everyday sentences.
- Procedure : The subject was seated approximately 8 feet from a monitor. Stimulus presentation on the first trial was initiated by the subject passing a key on the terminal. After a brief pause, the initial frame of a sentence was presented for 2 sec. Then the sentence was played. Subjectss were instructed to type whatever they thought the talker had said. Testing was conducted in two 50 sentences blocks, one for each talker, and within each block the order of the five lists was randomised for each subject. The subjects typed response was scored by the computer and responses were edited for spelling errors. Numerals were converted to spelled form and punctuations of contractions was checked for consistency. An automatic scoring program then counted the number of words correct in each sentence.
- Results : For performance on individual sentences, the most important sources of variability were the sentence (26.3) The speechreader (10.5%), the talker (4.4%) and

the interaction of the talker and sentence (5.1%). Residual error accounted for 51.2% of the variance. Generalization functions were presented, as a function of test length, for five models of test administration and interpretation.

### VARIABLES THAT CORRELATE WITH SPEECHREADING

Author	:	Reid
Year	:	1946.
Purpose of study	:	To determine the relation between school achievement and lipreading proficiency.
Subjects	:	99 deaf girls.
Test materials.	:	Mason's filmed test and Stanford Achievement test.
Procedure	:	The relation between the school achievement and lipreading proficiency of subjects was determined using a filmed test.
Results	:	There was no significant relation between school achievement and lipreading profile.
Author	:	'O' Neill.
Year	:	1951.
Purpose of study	:	To determine the relation between intelligence and speechreading proficiency.
Subjects	:	20 normal hearing college students.
Test materials.	:	Mason filmed tests and Weschler's Bellevue-Adult intelligence scale.
Procedure	:	Using Mason's filmer tests, twenty seven cases were evaluated in relation to speechreading.  One of these two skills was performed in the Weshle's Bellevue adult intelligence scale.
Results	:	Only two skills out of 27 correlated significantly with lipreading differently.

- Authors : O' Neill and Davidson.
- Year : 1956.
- Purpose of study : To study the relationship between lipreading ability and
- (a) Concept formation
  - (b) Intelligence
  - (c) Reading comprehension
  - (d) Visual perception
  - (e) Level of aspiration.
- Subjects : 30 normal hearing individuals.
- Test materials. : Silient motion picture
- (1) Hanfmann-Kasamin test (21 blocks)
  - (2) Welchler-Bellevue Adult intelligence tests (11 sublists with 12 pairs of nouns)
  - (3) Rotter Level of Aspiration test.
- Procedure : A silent motion picture test was used to ascertain the relative capacity of the subjects. The subjects were also administered the different psychological tests.
- In the Hanfmann test, the subjects was required to sort the blocks into 4 categories.
- In Weschler-Belevue Intelligence Test, the subject was required to explain in what way the pairs were similar.
- In the Rotter Level of Aspiration Test, the subject made predictions as to the future performance on the test on the basis of previous performance.
- Results : Better lipreaders required less time than poor lipreaders to complete the sortings on the first test.

There was no significant relationship between Spreading ability and intelligence.

There was no significant difference in level of aspiration behaviour between good and poor lipreaders.

There was no significant relationship between lipreading and five psychological factors. However, there was relationship between lipreading ability and non verbal concept formation.

- Author : Simmons.
- Year : 1959.
- Purpose of study : To compare performance on the Weschler's scale with the scores obtained in lipreading tests.
- Subjects : 24 hearing impaired individuals.
- Test materials. : Weschler's scale, Hanfmann-Kasanin Test and 2 lipreading tests i.e., Utley's test (How Well Can You Read Lips?) and Mason's test (Visual Hearing Test).
- Procedure : The untrained subjects were were evaluated on different items of Weschler's scale such as digit symbol, block design, picture arrangement.
- The subjects were also evaluated using the Hanfmann-Kasanin test.
- Results : Significant correlations were reported between the scores in digit symbol, block design, picture arrangement of Waschler's scale and the scores on the two tests of lipreading. Results on the Hanfmann - Kasamin test did not correlate with lipreading performance.

- Authors : Corrine and Davidson.
- Year : 1961.
- Purpose of study : To determine whether relatively good lipreaders, as measured by scores on a lipreading film test, were significantly better than poor lipreaders with respect to synthetic ability as measured by scores on a letter prediction test.
- Subjects : 100 normal hearing college students (50 males, 50 females).
- Test materials. : 30 unrelated sentences.
- Procedure : The test of lipreading was administered. The film was projected, the subjects were seated in 3 rows of chairs. The distance from the screen to the 1<sup>st</sup> row of chairs was 11 feet, to the 2<sup>nd</sup> row, 13 feet, and to the 3<sup>rd</sup> row, 15 ft. Distance from the screen to the projector was 19.5 ft. Subjects wrote their responses on a form numbered 1 to 30. The 50 subjects were alternated and then given the vision and hearing screening tests. The subjects were given instructions after the individual appointment. For scoring, the examiner used a form with 20 sentences.
- Results : Results of test showed that the good lipreaders were not significantly better letter predictors than poor lipreaders.

- Authors : Dodds and.Marford.
- Year : 1968
- Purpose of study : To utilize a lipreading test in hearing evaluation.
- Test materials : Utley lipreading test.
- Subjects : 1 hearing impaired individual.
- Procedure : A hearing aid was selected for a patient, utilizing conventional or modified speech audiometric procedures. Following this, the Utley lipreading test was utilized, if further information about the patient's communicative efficiency with a hearing aid was needed. During the test, the tester and patient were seated face-to-face in the same room at a conversational distance of approximately 4 feet, so that the patient made use of all visual and auditory cues.
- In scoring the test, if the patient missed any part of the sentence, it was scored incorrect. The above procedure was done for cases with poor discrimination.
- Results : Cases obtained a score of 100% with hearing and visual clues and obtained lesser scores without visual clues.
- The lipreading test, therefore helped in making a decision to recommend a hearing and for a trial period.

- Author : Kitchen.
- Year : 1971.
- Purpose of study : To explore the relationship between different variables or correlates of lipreading.



- Subjects : 32 normal hearing individuals.
- Test materials. : Letters, digits, geometric forms, Utley's test.
- Procedure : Nine facts of visual perception suggested for visual synthesis were recognition speed for geometric forms, speed of organising geometric form patterns, recognition speed of common words, speed of organizing words from scattered letters, speed of organising sentences from scattered words, providing missing cues in sentences containing detected letters, speed of perceiving letters and digits from their dotted outlines, supplying missing cues in nonverbal context and delivering wholes on the basis of partial clues.
- Results : Recognizing letters and digits from their dotted outline and speed of journey words from scattered letters were significantly related to depending scores from the Utley sublists and for total score. The total synthesis score was also positively related to lipreading.
- Authors : Binnie, Montogomey and Jackson.
- Year : 1976.
- Purpose of study : To determine the visual intelligibility of consonants for vaural rehabilitation.
- Subjects : 36 normal hearing females.
- Test materials. : 20 English consonant | p |, | t |, | k | , | f |, | θ |, | s |, | |, | b | | g |, | v | , | d |, | z |, | r |, | ʃ |, | l |, | m |, | n |, | w |, | j |, | z | combined with a vowel /a/ to form 20 CV syllables.

- Procedure : Each syllable was recorded in videotape 5 times in order of a total of 100 items. A female speaker was used and the recording was done such that a front view of her face appeared on the TV monitor. The observers viewed the stimulus items in small groups with each observer situated approximately 6 ft. from the 18 inch TV monitor. The subjects recorded their responses on computer viewed in answer sheets.
- Results : The correct responses revealed an overall percentage of correct lipreading score of 41.2 %. Majority of the errors were confusion in voicing, nasality and place of articulation. The percentage score for the homophenos category of |p, b, m| was 95% and was a more accurate account of lipreading ability for these consonants.

### **TEACHING AND TRAINING.**

- Author : Black et .al.
- Year : 1963
- Purpose of study : To study lipreading training through self- instruction.
- Subjects : :60 normal hearing individuals.
- Test materials. : The Black Multiple Choice Intelligibility Test.
- Procedure : Six male speakers read in rotation, the Black Multiple Choice Intelligibility Test, forms A, B, C and D. Subjectss responded to the filmed stimuli after having seen a list of correct responses. A record was made for each subject of the sequence of forward and reverse operations of the projector until he obtained a perfect score. Following training, the subjects were asked to respond to a different list read by the same speaker and by a different speaker as well, to list for transfer. Gains were made for both the same speaker and a different speaker.
- Results : The training led to improved lipreading responses to a given speaker and the benifit transfered to a different speaker as well.
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- Authors : Bode, Nerbonne and Sahlstrom.
- Year : 1970.
- Purpose of study : To determine the relationship between subjects performance on a speechreading task and on a task requiring synthesis of distorted orthographic material.

- Subjects : 50 normally hearing individuals.
- Test materials. : Filmed speechreading test, list of distorted orthographic sentences.
- Procedure : The subjects were seated in an average size classroom with no viewing angle greater than 30 degrees from a direct frontal view. Room lighting was reduced and the film was projected at a standard film speed of 16 frames per sec. on a 40 x 40 in screen of glass beaded fabric. On the speechreading task, subjects were instructed to write their responses after the appropriate number on their answer sheet and when not sure, to guess. On the orthographic task, they were informed that they would be given 31 sentences in which certain letters had been omitted and their task was to fill in the blank spaces with appropriate letters. Number of correct words was tabulated on the 31 sentences included in the speechreading task and on the identical number of different sentences on distorted orthographic sentences.
- Results : On the distorted orthographic sentences, mean performance was 167 out of 226 points for an average correct performance score of 73%. On the speechreading task, the mean score was 34.8 out of 125 points for an average of 28% correct.
- Therefore, skill of subjects performing at low level was positively related to performance on filmed speechreading task.

- Author : Binnie
- Year : 1977
- Purpose of study : To determine the attitude changes following speechreading training.
- Subjects : 12 hearing impaired adults in the age range of 35 - 79 years.
- Test materials. : Video tape test questionnaire.
- Procedure : An experimental questionnaire was designed stimulus items were of multiple choice. Students had to select the one most nearly matching his opinion. If his opinion did not fit any of the response alternative, he was allowed to write in his comments. A videotaped test of speech reading ability consisting of common monosyllabic words and sentences were also administered to determine if improvement in speechreading skill could be verified by objective means.
- Results : The mean scores for the list of monosyllabic words did not show a significant difference between pre and post treatment test conditions. The mean scores of 17.66 (pretreatment) and 17.50 (post treatment) indicated that these individuals did not improve in their identification of monosyllabic words after speech training.

- Authors : Warren, Dancer, Monfils and Pittenger.
- Year : 1989.
- Purpose of study : To determine the practice effect in speechreading (same versus different CID lists).
- Subjects : 20 normal hearing individuals in the age range of 18 - 30 years.
- Test materials. : Harris Revised Central Institute for the (CID) everyday sentence list.
- Procedure : Subjects were tested individually on the visual presentation of the everyday sentence lists. Those in the same list group received the same sentence list on each of the five successive days. A different list was used for each subject in the group and the other group received randomly selected list subjects were instructed to view the talker saying the sentences and to write down what the talker said.
- Results : Mean ranged from a low of 18.6% on trial 1 to a high of 32.2% on trial 4. Thus subjects improved by 13.6% . For different list group, averages ranged from a low of 12.0% on trial 1 to a high of 21.2% on trials 4 and 5, showing maximum improvement of 9.2 percentage points.

## SUMMARY

Speechreading is one of the methods of comprehending speech which is used by all individuals in one instance or the other. It is used not only by the hearing impaired persons but also by normal hearing individuals in adverse listening conditions. All hearing impaired individuals need to speechread and the extent of their need depends on the degree of hearing impairment.

This project summarizes the literature on speechreading. Articles published from the early 1900's to the early 1990's have been summarized. The major concentration of articles lie in the early 60's.

The studies have been classified with respect to those dealing with assessment of speechreading skills, speechreading training and studies on speechreading variables. The studies have been conducted on hearing impaired or normal hearing subjects with the auditory cues out off.

This project would prove beneficial to the students in speech and hearing, trainees and teachers of the deaf and those who are concerned with the rehabilitation of the hearing impaired.

## BIBLIOGRAPHY

- Alexander Graham Bell (1912). Cited in Historical aspects. In *J.J. O'Neill and H.J. Oyer* p(9-19). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Alpiner, J and McCarthy.P. (1987). *Rehabilitative Audiology: Children and Adults (3<sup>rd</sup> Ed)*. Baltimore: Williams and Wilkins.
- Benguerel, A. (1982). Coarticulation effects in lipreading. *J.Speech. Hear. Res. Vol.25*, p 600-607.
- Berger, K.W. (1971). Lipreading. *Teacher of the Deaf. Vol. 29* p 30-32.
- Berger, K.W., and Lewis, M.A. (1972). The effect of noise on lipreading performance. *Sound. Vol.6*.p.7.
- Berger, K.W., (1972). Relationship between word length and word frequency in speechreading performance. *J.Commun. Dis. Vol.1* p.22 - 26.
- Berger,K.W., (1970). Vowel confusions in speechreading. *J.Speech. Hear. Res. Vol.34* p. 106 - 109.
- Berger, K.W.,(1970). The effect of distance on speechreading. *J.Speech. Hear. Res. Vol.35*, p 123-128.
- Berger, K.W., and Popelka, G.R., (1971). Extra facial gestures in relation to speechreading *J.Commun. Dis. Vol.3*.p 302-308.
- Bernstein, B.M., and Eberhardt L. (1986). Cited in Visual stimuli in communication. In *S.Nerbonne (2<sup>nd</sup> Ed)* p (125 - 164). *Introduction to Aural Rehabilitation*. United States of America: Simon and Schuster, Inc.
- Binnie,.C.A.(1977). Attitude changes following speechreading training. *Scandinavian Audiology. Vol.6*, p. 13-16.
- Binnie, C.A., Jackson, P.L., and Montgomery, P.A. (1976). Visual intelligibility of consonants. A lipreading screening test with implications for aural rehabilitation *J.Speech Hear. Dis. Vol.41*, p. 530-539.
- Binnie, C.A., Montgomery, A.A., and Jackson, P.L. (1974) Auditory and visual contributions to the perception of selected English consonants. *J.speech. Hear. Res. Vol. 17*, p.619-630.
- Black,J.W., Reilly, P.P.O., and Peck (1963). Self administered training in lipreading *J.Speech Hear Dis. Vol. 28*, p. 183-186.
- Bode, D.L.,Nerbonne, G.P., and Sahlstrom, L.J., (1970). Speechreading and the synthesis of distorted printed sentences. *J.Speech Hear Res. Vol.13*.p.115-121.
- Boothroyd, A. (1987). Speechreading and the hearing impaired. *Volta Rev. Vol. 77*, p 27-34.



- Boothroyd, A., Hannin, M., and Watzmann. B (1987). Computer assisted speech perception evaluation and training in proceedings of the 10<sup>th</sup> Annual Conference of the Society of North America, Washington, D.C: Association for advancement of rehabilitation technology, p 134-136.
- BrackettD. (1983). Group communication strategies for the hearing impaired learning to communicate. Implications for the hearing impaired *Volta Rev.* Vol.85, p. 116-127.
- Brainerd, L.A. (1969). Analytical perception and lipreading. *J.Speech. Hear. Res.* Vol. 30 p, 120-124.
- Braukmann,K (1927). Cited in *Speechreading methods and materials for children.* In J.J. O'Neill and H.J. Oyer. p (84-92) *Visual communication for the hard of hearing.* New Jersey : Prentice-Hall.
- Braukmann, K, (1952). Cited in *Lipreading methods and materials for Children .* In J.J. O'Neill and H.J. Oyer. p (84-92) *Visual communication for the hard of hearing.* New Jersey : Prentice-Hall.
- Brannon, J.B., (1961). *Speechreading of various speech materials* *J.Speech. Hear.Dis.* Vol.26. p 348 - 353.
- Brehman, G.E., (1965). Programmed discrimination training for lipreaders. *Amer. Ann. Deaf.* Vol.110.p.553-562.
- Bruhn, M.E. (1915). Cited in *Tests of Lipreading.* In J.J. O'Neill, and H.J. Oyer. p (20-34). *Visual communication for the hard of hearing.* New Jersey: Prentice-Hall.
- Bruhn, M.E. (1917). Cited in *Tests of Lipreading.* In J.J. O'Neill, and H.J. Oyer. p (20-34). *Visual communication for the hard of hearing.* New Jersey: Prentice-Hall.
- Bruhn, M.E. (1929). Cited in *Lipreading methods and materials for adults.* In J.J. O'Neill and H.J. Oyer p (93-105). *Visual communication for the hard of hearing.* New Jersey: Prentice-Hall.
- Bruhn, M.E. (1942). Cited in *Lipreading methods and materials for children.* In J.J. O'Neill and H.J.Oyer, p (84-93). *Visual communication for the hard of hearing.* New Jersey : Prentice-Hall.
- Bruhn, M.E. (1949). Cited in *Lipreading methods and materials for children.* In J.J. O'Neill and H.J.Oyer, p (84-93). *Visual communication for the hard of hearing.* New Jersey : Prentice-Hall.
- Bunger.,A.M., (1924). Cited in *Improving communication through aural rehabilitation treatment.* In Hull (Ed) p (109-113). *Aural rehabilitation in Rehabilitative Audiology.* New York: Grune and Stratton.
- Bunger, A.M., (1961); Cited in *Improving communication through aural rehabilitation treatment.* In Hull (Ed) p (109-113). *Aural rehabilitation in Rehabilitative Audiology.* New York: Grune and Stratton.

- Bunger, A.M., (1952). Cited in Lipreading methods and materials. In K.W. Berger.(2<sup>nd</sup> Ed) p (84-92). Speechreading principles and methods. United States of America: National Educational Press, Inc.
- Burchett, J.H. (1950). Cited in Philosophy of Lipreading. In J.J. O'Neill and H.J. Oyer. p. (1-8). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Butt,D., and Chreist, F.M. (1968). A speechreading test for young children Volta Rev. Vol.70 p.225 - 239.
- Byers, V.W., and Liebermann, L. (1959). Lipreading performance and the rate of the speaker. J.Speech Hear.Res. Vol.2, p.271-276.
- Carr,J (1954). A limited or limitless vocabulary through speechreading Volta Rev. Vol.56 p. 109-113.
- Cartwright,.N.M., and Dandridge, L. (1971). Cited in The effect of phoneme per syllable in lipreading performance. In K.W. Berger (Ed) p (87-89).Research Studies in Speechreading. Kent: OH.
- Cavender, B.J., (1949). Cited in The construction and investigation of a test of - lipreading ability and a study of factors assumed to affect the results. In J. Jeffers and M.Barley. p (392- 395) Speechreading. Springfield, Illinois; Charles. C. Thomas. Publisher 1971.
- Clegg, D.G. (1953). Cited in Philosophy of Lipreading. In J.J. O'Neill and H.J. Oyer. p (1-8). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Clouser, R.A. (1973). The effect of vowel consonant ratio and sentence length on lipreading ability. Amer. Ann.Deaf Vol.121 p.513-518.
- Cole,S.S. and Messal. S.L. (1972). Cited in The effect of context on Speechreading accuracy. In K.W.Berger, (Ed) p (22-24) Research studies in speechreading. United States of America: National Educational Press, Inc.
- Conklin,E.S. (1917). Cited in Tests of Lipreading. In J.J. O'Neill, and H.J. Oyer. p (20-34). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Corraine, M.D., and Davidson (1961); Lipreading and Letter predictions J.Speech Hear Res. Vol.4.p 178-181.
- Costello, M.R., (1957). Cited in Speechreading tests. In J. Jeffers and M.Barely. p (105-109). Speechreading Spacingfield Illinois: Charles L.C. Thomas Publisher, 1971.
- Costello, M.R.,(1963). Individual differences in speechreading. J.Speech Hear. Res. Vol.24 p (90-94).
- Craig, W.N., (1964). Effects of Preschool training on the development of reaching and lipreading skills of deaf children. Amer, Ann. Deaf.Vol.108, p 280 - 296.

- Craig, W.N. (1969). Cited in *The Speechreader*. In K.W. Berger. (Ed) p (109-138). *Speechreading principles and methods*. United States of America: National Educational press, Inc.
- Crawford, C, Dancer, J.J. and Pittenger, J. (1986). Initial performance level on a speechreading task as related to subsequent improvement after short term training, *Volta Rev.* Vol.88, p 101-105.
- Cronin, A.W., (1979). The development of an interactive video system at the National Institute for the Deaf. *Amer. Ann. Deaf.* Vol.124, p 615-618.
- Cypreasen. L.E. and J.C. Mc. bridge (1956); Lipreading lessons on television *Volta Rev.* Vol.58, p.346-348.
- Dans, A.D. and Binnie, C.A. (1983). Quantification of the effects of training the auditory visual reception of connected speech. *Ear and hearing* Vol. 4 p (146-159).
- Darke, M. (1957). Lipreading *J.Speech. Hear. Res.* Vol.2 p (99-102).
- Davis, H., and Silverman. S.R. (1978). *Hearing and deafness* (4<sup>th</sup> Ed), New York: Holt, Rinehart and Wintson.
- Davis, H., and Hardick, M. (1981). Cited in *Tests of Lipreading*. In J.J. O'Neill and H.J. Oyer. p (20-34). *Visual communication for the hard of hearing*. New Jersey: Prentice-Hall.
- Day, H.E., and Pusefeld, I.S. (1928). Cited in *Tests of lipreading*. In J.J. O'Neill and H.J. Oyer. p( 20-34). *Visual communication for the hard of hearing* New Jersey: Prentice-Hall.
- DeFilippo, C.L., (1990). *Speechreading training: Believe it or not*. *Amer. Speech. Hear. Association* Vol.32.p.46-48.
- DeFilippo, C.L., (1983). Laboratory projects in tactile aids to lipreading. *Ear and Hearing.* Vol.5 p.211-227.
- DeFilippo, C.L., (1982). Memory for articulated sequences and lipreading performance of hearing - impaired observers. *Volta Rev.* Vol.84 p. 134 - 146.
- DeFillippo, C.L., Scott, B., (1978). A Method for training and evaluating the reception of ongoing speech. *J.Ac. Soc. Amer.* Vol. 63, p. 1186-92.
- Demorest, M.E., Bernstein, L.E. (1992). Sources of variability in speechreading sentences *J.Speech. Hear Res.* Vol.35 p 4 - 6.
- Dendiu, P.D., and Panagotopulos, K.S. (1972). Cited in *A comparison of Lipreading difficulty of monosyllables, spondees and bisyllabic non-spondees*. In K.W. Berger. (Ed), p (39-42). *Research studies in Speechreading*. Kent: OH.
- DiCarlo, L.M., and Kataja, R. (1951). An analysis of the Utley lipreading test. *J.Speech Hear Dis.* Vol.16 p. 226-240.

- Dicob, C.M., and Scheffar, S.L., (1972). Cited in The effect of articulatory overperformance; underperformance, overemphasis, underemphasis and normal emphasis. In K.W. Berger (Ed) p (30-33). Research studies in speechreading. Kent: : OH.
- Dodds, E., and Harford, E. (1968). Applications of a lipreading test in a hearing aid evaluation. J.speech Hear Dis. Vol.33, p. 167-173.
- Dodd, B., and Gregory, M. (1989). Teaching lipreading: The efficacy of lessons on video. Br. J.Audiol Vol.23, p. 229 - 38.
- Erber, N. P. (1972). Speech - envelope was as an acoustic aid to lipreading for profoundly hearing - impaired children J.Ac. Soc. Amer. Vol.51 p. 1224-27.
- Erber, N.P. (1971). Effect of distance on the visual reception of speech J.Speech. Hear Res. Vol.14, p. 848- 859.
- Erber, N.P. (1969). Interaction of audition and vision in the recognition of oral speech stimuli J.Speech Hear. Res. Vol.12 p.423 - 425.
- Erber, N.P. (1972). Auditory, visual and auditory - visual recognition of consonants by children with normal and impaired hearing. J.Speech. Hear. Res. Vol.15, p. 413 - 422.
- Erber, N.P., and McMahan, D.A. (1976). Effect of sentence context on recognition of words through lipreading by deaf children J.speech. Hear. Res. Vol.19 p. 112-119.
- Evans, L.. (1960). Factors related to listening and lipreading. Journals of Acoustic Society of America. Vol. 58, p. (417 - 423).
- Evans, L. (1965). Psychological factors related to lipreading;. Journals of Acoustic Society of America.Vol.63 p. (131 - 136).
- Ewing, I.R. (1944). Cited in The Speechreader. In K.W. Berger (2nd Ed) p (109-138). Speechreading: Principles and Methods. United States of America: National Educational Press, Inc.
- Ewing, I.R. (1967). Lipreading and Hearing aids (3<sup>rd</sup> Ed). Macheenster : Manchester University Press.
- Ewing, I.R. (1941). Cited in The Speechreader. In K.W. Berger, (Ed) p (20-34). Speechreading principles and methods. United States of America: National Educational Press, Inc.
- Farrinand, T. (1959). Cited in The Speechreader. In K.W. Berger (2<sup>nd</sup> Ed) p 109-138) Speechreading: principles and methods, United States of America: National Educational Press, Inc.
- Feilbach, R.V. (1940). Cited in Speechreading methods and materials for children. In J.J. O'Neill and H.J.Oyer. p (84-93). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Fenn, S.S. (1987). The assessment of lipreading ability. Some practical considerations in the area of the teaching procedure. Br. J.Audiol Vol.21, p.253 - 258.

- Ferguson, M.(1946). Cited in Speechreading methods and materials for adults. In J.J.O' Neill and H.J. Oyer. p (93-108). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Ferreri, G. (1910). Cited in Lipreading, Auditory training and hearing aids. In J.J. O'Neill, and H.J. Oyer, p (70-83). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Fisher, C.G. (1968). Confusion among visually perceived consonants. J.Speech Hear Res. Vol. 11, p 796 - 804.
- Franks, J (1922). Cited in Lipreading, Auditory training and hearing aids. In J.J. O'Neill, and H.J. Oyer, p (70-83) In Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Franks, J.R. (1972). The confusion of English consonants in lipreading. J.Speech Hear. Res. Vol.15.
- Franks, J., and Oyer. H.J. (1967); Identification of critical consonant by lipreading. J.Speech. Hear. Res. Vol.16, p (630-634).
- Frisina, D.R. (1961). Comparison of the performance of deaf students and residential students in residential schools for the deaf. Proceedings 40<sup>th</sup> Convention American Instructions Deaf. p (149-165).
- Frisina, D.R. (1963). Speechreading proceedings International Congress Education Deaf. p (191-207).
- Fulton, R.M. (1964). Comparitive assessment of visible' differences between voiced and unvoiced words. J.Speech. Hear. Res. Vol. 12 p (105-109).
- Garstecki, D.C. and O'Neill, J.J. (1983). Situational cue and strategy influence on speechreading. Scand. Audiol Vol. 9 p. 147 - 151.
- Gault,R.H. (1927). The interpretation of speech by tactual and visual impression. Archieves Otolaryngology Vol.4 p. 228-239.
- Goding, R.L. (1972). Cited in A study of the value of visual aids as contextual cues in a speechreading task. In K.W. Berger (Ed) p (31-33). Research Studies in Speechreading, Kent: OH. Herald Publishing.
- Gopfert, M (1923). Factors related to lipreading. In J. Speech. Hear. Res. Vol.2. p 340-342.
- Greene, W.B.(1964). Identification of accented syllables by lipreading. J.Speech. Hear. Res. Vol. 65 p (97-100).
- Greene, W.B. and Holmes (1981). An investigation on growth of speech reading proficiency in young hearing impaired children. Volta Rev. Vol.83.
- Greenberg, H.J., and Bode, D.L. (1968). Visual discrimination of consonants. J.Speech Hear. Res. Vol. 11.p.869-874.
- Griffths, C, (1964). The auditory approach for pre-school deaf children. Volta Rev. Vol.66. p.387.

- Griggs, V.A (1972). Visual recognition of key words as a function of sentence familiarity and sentence context.
- Hardick, E.J., Oyer, H.J., and Irion. (1970). Lipreading performance as related to measurements of vision. *J.Speech. Hear. Res.* Vol.13. p.92-100.
- Haas, W.M., (1982). Stimulus predictability and speechreading performance *Volta Rev.* Vol.84, p 156-162.
- Haspiel,G. (1964). Cited in *Asynthetic approach to lipreading.* In J.Katz (Ed); *Handbook of Clinical Audiology* (3<sup>rd</sup> ed). p.(1004-1016). Baltimore: Williams and Wilkins.
- Heider, F., and Heider, G.M. (1940). Cited in *An experimental investigation of lipreading.* In J.J. O'Neill and H.J. Oyer p (35-49). *Visual communication for the hard of hearing Ner Jersey:* Prentice - Hall.
- Heider, G.M. (1947). Cited in *Tests of lipreading.* In J.J. O'Neill and H.J. Oyer. p[ (20-34). *Visual communication for the hard of hearing.* New Jersey: Prentice-Hall.
- Huizing, H. (1952). Auditory training. *Acta otalaryngology* (suppl. 10) p 158 - 163.
- Hutton, C. (1959). Cited in *The Speechreader.* In K.W Berger, (2<sup>nd</sup> Ed) p (109-138). *Speechreading principles and methods.* United states of American: National Educational press, Inc.
- Hudgins, C.V. and Numbers, M.E. (1948). *Speechreading in present day education for deaf children.* *Ear and Hearing.* Vol. 10 p (449-450).
- Hutton,C.E. T., and. Armstrong, M.B (1959). *Semi diagnostic test materials for aural rehabilitation* *J.Speech Hear. Dis.* Vol.24 p.318-329.
- Jackson, P.L., Montgomery, A.A., and Binnie, C.A. (1976). *Perceptual dimensions underlying vowel lipreading performance* *J.Speech. Hear. Res.* Vol. 19 p. 796- 812.
- Jacobs, S.M., and Sims,M.A., (1982). Cited in *Visual communication for the severely and profoundly hearing impaired young adult* In D.Sims and Whithead. (Eds.), *Deafness and communication: Assessment and training.* Baltimore: Williams and Wilkins.
- Jeffers, J and Barley. M. (1971). *Speechreading.* Springfield, II: Charles. C. Thomas Publisher.
- Kazanas, M. and Susan, S.M. (1972). Cited in *comparison of spondee and monosyllabic word identification by lipreading.* In K.W. Berger (Ed) p (25-30). *Research studies in Speechreading.* Kent: OH. Herald Publishing.
- Keaster, J. (1949). Cited in *Tests of Lipreading.* In J.J. O'Neill and H.J. Oyer. p (20-34). *Visual communication for the hard of hearing.* New Jersey: Prentice-Hall.

- Keil, J.M., (1968). The effects of peripheral visual stimuli on lipreading performance. *J.Speech Hear. Res.* Vol.36 p (120-124).
- Keith, J., (1943). Has lipreading missed the bus ? Yes! *Volta Rev.* Vol.45 p.(286-288).
- Kopra, L.L. Abrahmson, J.E. and Dunlop R.J. (1986). Development of sentences graded in difficulty for lipreading practice. *J. Academy Rehabilitation Audiology*, Vol.19, p (71-76).
- Kricos, M. and Lesner, H., (1985). Effect of Talker differences on the speechreading of hearing impaired teenagers *Volta Rev.* Vol.80. p 216 - 218.
- Kitson (1915) . Cited in *The Speechreader*. In K.W. Berger. (2<sup>nd</sup> Ed). p (109-138). *Speechreading principles and methods*, United States of America: National Educational Press, Inc.
- Kiznie, C.E., and Kinzie. R (1931). Cited in *Lipreading methods*. In K.W. Berger. (2<sup>nd</sup> Ed). p (117-120). *Speechreading principles and methods*. United States of America: National Educational Press, Inc.
- Kinzie, C.E. (1936). Cited in *Lipreading methods and materials for children*. In K.W. Berger, (2<sup>nd</sup> Ed). p (84-93) *Speechreading principles and methods*. United States of America.: National Educational Press. Inc.
- Kitson, M. (1971). *Speechreading*. *Volta Rev.* Vol.72 . p (93-97).
- Kelly, J.C., (1955). Cited in *Lipreading, auditory training and hearing aids*. In J.J. O'Neill and H.J. p (70-83). *Visual communication for the hard of hearing*. New Jersey.: Prentice Hall.
- Larr,A.L. (1959). Cited in *The Speechreader*. In K.W. Berger, (2<sup>nd</sup>) p (109-138). *Speechreading principles and methods*. United states of America: National Educational Press, Inc.
- Leavis, (1949). Cited in *Speechreading methods and material for children*. In J.J. O'Neill and H.J. Oyer. p (70-83). *Visual communication for the hard of hearing*. New Jersey: Prentice-Hall.
- Leonard, R., (1962). The effects of continuous auditory distractions on lip reading performance. *J.Speech Hear. Res.* Vol. 17 p (102-105).
- Lloyd, L.L. (1964). Sentence familiarity as a factor in visual speech recetpion. *J. Speech. Hear. Dis.* Vo.29. p (409-413)
- Lloyd, L.L. (1984). Sentence familiarity as a factor in visual speech reception of deaf students. *J.Speech Hear Res.* Vol.32 p.303-307.
- Lonka, .E., (1995). *Speechreading instruction for hard of hearing adults, effects of training face to face and with a video programme*. *Scand. Audiol.*Vol.24, p. 193-198.
- Lovering, L.J., (1968). Cited in *The Speechreader*. In K.W. Berger, (2<sup>nd</sup>) p (109- 138). *Speechreading principles and methods*. United states of America: National Educational Press, Inc.

- Lowell, E.L., and Taaffe, G., (1957). Cited in Tests of Lipreading. In J.J O'Neill and H.J Oyer p[20-34]. Visual Communication for the hearing. New Jersey: Prentice Hall.
- Lowell,E.L, (1959). Research in speechreading: some relationship to language development and implications for the class room teacher. Proceedings of 39<sup>th</sup> Convention American Instructor Deaf p. 68-75.
- Lowell, G. ((1974). Speechreading performance under various degrees of face exposure. J.Speech. Hear. Res. Vol.73 p (103-106).
- Lyxell, B., and Ronnberg, J. (1991).Visual speech processing: word decoding and word discrimination related to sentence based speechreading and hearing impairment. Scand Audiol Vol. 32 p 9 - 17.
- Lyxell, B.,and Ronnberg, J. (1996).Facial expressions and speechreading performance. Scand Audiol Vol. 25, No. 2 p: 97-102.
- Lyxell, B., and Ronnberg, J.( 1996). Lipreading with auditory low frequency information: contextual constraints Scand Audiol Vol.25, No: 2 p 127 - 132.
- Macnutt, E.G. (1952). Cited in Speechreading methods and materials for children. In J.J. O'Neill and H.J.Oyer. p (84-93). Visual communication for the hard of hearing. New Jersey : Prentice-Hall.
- Markides, J.R., (1977). Speechreading and the hearing impaired. Volta Rev. Vol. 73 p 35-38.
- Martin, L.F.A. and Clark, G.M. (1970). Lipreading assessment for profoundly deaf patients. J.Laryngology Otology Vol. 97 p. 343 - 350.
- Mary, K., and Sally, M.S. (1952). Cited in A comparison of spondee and monosyllabic word identification by lipreading. In K.W. Berger (Ed) p (37-39). Research studies in speechreading. Kent: OH.
- Mason, KM. (1961). Cited in Tests of Lipreading. In J.J. O'Neill and H.J.Oyer, p (20-34). Visual communication for hard of hearing. New Jersey: Prentice-Hall.
- Mathies, M.L. and Carney, A.E. (1988). A modified speechtracking procedure as a communicative performance measure. J.Speech Hear.Res. Vol.31, p.394 - 404.
- Mason, M.K. (1993). A Cinematographic technique for testing visual speech comprehension. J.Speech Hear Dis. Vol. 8 p. 271-278.
- Mason, M.K., (1942). Cited in Tests of speechreading. In J.J. O'Neill and H.J. Oyer. p (20-34). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- McEachern. A.W., and Aushford, G., (1958). Lipreading performance as a function of unknown communications. John Tracy Research Papers VIII.



- Montague, H., (1949). Cited in Speechreading methods and materials for adults. In J.J. O'Neill and H.J. Oyer, p(93-105). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Morgenstern. (1916). Cited in Speechreading methods and materials for adults. In J.J. O'Neill and H.J.Oyer. p (93-105) Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Mc.Dearman, J.R., (1967). A method of teaching lipreading using programmed learning principles J.Speech Hear. Res. Vol.69 p(120-122).
- Mc.Null,E. (1952). Cited in visual stimuli in communication. In Nerbonne 2<sup>nd</sup> Ed, p. (125 - 167). Int. to Aural rehabilitation Simmon and Schuster, Inc. Gould street.
- Krehanik,M.A., and victor,H.P. (1972). Cited in the Speechreader. In K.W. Berger, (2<sup>nd</sup> Ed) p (58-to), speechreading: principles and methods. United States of America: National Educational Press. Inc.
- Milesky, S.D. (1960). Testing lipreading potential. Volta review Vol.62, p.373-375.
- Miller, G., and Nicely, P. (1955). An analysis of perceptual confusions among some English consonants. Journals of Acoustic Society of America, Vol.27, p (338-352).
- Miller. J, and Rousey, C.L. (1968). An exploratory investigation of a method of improving speechreading. Arner. Arn. Deaf.Vol. 103, p.473-478.
- Miller, L.M. (1974). Cited in The effect of facial expression on speechreading performance. In K.W.Berger, (Ed) p (14-18). Research studies in speechreading. Kent: OH Herald Publishing.
- Mishra, S.K., and Palmer, M.F. (1964). A comparison of speechreading in Hindi and English in a School for the deaf. Volta Review Vol.66.p .615 -617.
- Montague,H. (1949) Lipreading Lessons for adult beginners. Volta Rev. Vol.65 p.226 - 228.
- Montgomery, A.A. and Jackson, P.L. (1974). Lipreading. Ear and Hearing Vol.5, p (30 - 36).
- Montgomery, A.A., and Jackson, P.L. (1983). Physical Characteristics of the lips underlying vowel lipreading performance. J.Ac. Soc. Amer. Vol. 13, p 2134-2144.
- Montgomery A.A., and Prosek, R.A. (1987). Effects of consonantal context on vowel lipreading. J. speech Hear Res. Vol.3, p. 50-59.
- Moore, V.J. (1971). Cited in Comparison of lipreading difficulty between lip spread and liprounded vowels. In K.W. Berger, (Ed) p (26-29) Research studies in speechreading. Kent: OH.
- Morkowin, B.W., and Moore, L.M. (1936). Cited in lipreading methods and materials. In J.J. O'Neill, and H.J. Overy. p (84-93). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.

- Mulligan, M. (1954) Cited in The Environment. In K.W. Berger. (2<sup>nd</sup> Ed.) p (151 - 154). Speechreading principles and methods. United States of America. National Educational Press, Inc.
- Myklebust, H.R. (1960). The psychology of deafness. New York: Grune and Stratton Inc. p (393).
- Myklebust, H.R. and Neyhus, A.I., (1970). Cited in Tests of Speechreading.. In K.W. Berger, (2<sup>nd</sup> Ed) p (159-169) Speechreading: Principles and methods. United States of America: National Educational Press, Inc.
- Nerbonne, S. (1989). Introduction to aural rehabilitation (2<sup>nd</sup> Ed.) Simon and Schuster, Inc.
- Neilson, K.M. (1966). The effect of redundancy on visual recognition of frequently employed spoken words. J. Speech. Hear. Res. Vol. 16 p (93-98).
- Newell, C.H., and Holcomb, L.A., (1983). The assessment of lipreading ability. Br. J. Audiol. Vol. 21, p 253-258.
- Nitchie, E.J. (1912). Cited in Speechreading methods and materials for adults. In J.J. O'Neill and H.J. Oyer, (2<sup>nd</sup> Ed). p (93-105). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Nitchie, E.J. (1913). Cited in Lipreading methods and materials for adults. In J.J. O'Neill and H.J. Oyer. p (93-105). Visual communication for the hard of hearing, New Jersey: Prentice-Hall.
- Numbers, M.E. and Hudgins C.V. (1954). Speechreading in present day education for deaf children. J. Speech Hear. Res. Vol.10 p (449 - 450).
- O'Neill J.J. (1940). Cited in Philosophy of lipreading. In J.J. O'Neill and H.J. Oyer, p (1-8). Visual communication for hard of hearing. New Jersey, Prentice House.
- O'Neill, J.J. and Davidson, J. (1956). Relationship between lipreading ability and five psychological factors. J. speech Hear. Dis. Vol. 21. p.478-481.
- O'Neill, J.J., and Stephens, M.C., (1959). Relationship among three filmed lipreading tests. J. Speech Hear. Res. Vol.2, p 61-65.
- O'Neill, J.J. (1951). An exploratory investigation of lipreading ability among normal hearing students. J. Speech. Hear. Res. Vol.18 p (400-403).
- O'Neill, J.J. (1954). Contributions of the visual components of oral symbols to speech comprehension. J. Speech. Hear. Res. Vol.19, p.429 - 439.
- O'Neill, J.J. and Oyer, H.J. (1961). Visual communication for the hard of hearing. New Jersey, Prentice-Hall.
- Osberger, Johnson and Miller. (1987). Cited in Speechreading and the hearing impaired. In Nerbonne (2<sup>nd</sup> Ed). p (63-68) Introduction to Aural Rehabilitation. Simon and Schuster, Inc.
- Owens, E and Raggio, M. (1987). The UCSF Tracking procedure for evaluation and training of speech reception by hearing impaired adults. J. Speech. Hear. Des. Vol. 52 p (120-128).

- Oyer, H.J. (1961). Teaching lipreading by television. *Ear and Hearing*. Vol.6 p.(131 - 132).
- Petrovek, M. (1961). The eyes have it. *Ear and Hearing* Vol.29 p (5-9).
- Pettit, B.C. (1963). The effect of acoustical environment on speechreading performance. M.A. thesis, Ohio State University.
- Pichora-Fullet, S., and Cichelli, M., (1986). The design of CAST computer aided Speechreading Training . *J Speech. Hear. Res.* Vol.34 p (202-212).
- Pickett, J.M. (1963). Tactual communication of speech sounds to the deaf: comparison with lipreading. *J.Speech Hear Dis.* Vol.28, p.315-330.
- Pollack, D. (1954). "Visual contribution to speech intelligibility in Noise" *J.Ac. Soc. Amer*, Vol. 26.p.212-215.
- Pollack, D. (1964.). *Acoupedics*. *Ear and hearing*, Vol.6 p.400.
- Pollack.D. (1985). Cited in *Visual stimuli in communication*. In Nerbonne, A.M. (Ed) p (125-170). *Introduction to Aural Rehabilitation*. United States of America: Simon and Schuster, Inc.
- Prall, J. (1957). Lipreading with Hearing aids combine for better information *J.Speech. Hear. Res.* Vol.59, p (64 - 65).
- Raggio, M.L., (1987). Cited in *Speechreading and the hearing impaired*. In Nerbonne, (2nd Ed). p (63-68). *Introduction to Aural rehabilitation*. Simon and Schuster, Inc.
- Reid,G. (1947). A Preliminary investigation in the testing of lipreading achievement *J.speech Hear Res.* Vol.12, p. 77-82.
- Richardson,J.A. (1968). A review of four methods of lipreading *Volta Review*, Vol.70.
- Roback, I.M. (1961). Homophenons words. M.A.Thesis, Michigan State University.
- Rodel, M.,. (1978,). Children with hearing impairment In J.Katz (Ed); *Hand book of Clinical Audiology* (3<sup>rd</sup> Ed) p 1004 - 10167: Baltimore: Williams and Wilkins.
- Rodel, M. (1985). Cited in *Children with hearing impairment*. In Katz. J. (Ed), (3rd Ed) p (1004-1006). *Hand Book of Clinical Audiology*. Baltimore: Williams and Wilkins.
- Samuel Hlinche, R. (1636). Cited in *Historical aspects*. In J.J. O'Neill and H.J. Oyer, p (9-19). *Visual communication for the hard of hearing*. In New Jersey: Prentice-Hall.
- Samuelson, E.E., and Fabregas, M.B. (1939). Speechreading methods and materials for children. In J.J. O'Neill and H.J. Oyer, p (84-92). In *Visual communication for the hard of hearing*. New Jersey: Prentice-Hall.

- Samuelson, E.E. (1943). Methods and materials for children. In J.J. O'Neill and H.J. Oyer, p (84-92). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Sanders, D.A. (1968). Aural Rehabilitation. Englewood Cliffs: Prentice-Hall, Inc.
- Sarrail, S. (1951). Basic percentage of error in lipreading Otolaryngology Vol.2, p. 271 - 277.
- Schienberg, J.S. (1980). "Analysis of speechreading cues using an interleaved technique. J.Commun. Dis. Vol.13, p. 489 - 492.
- Schwartz, J.R. and Black, J.W. (1967). Some effects of sentence structures on speechreading. Central States Speech J. Vol.18 p (86-90).
- Schwartz, N.B. (1972). Cited in The effect of different word stress patterns on lipreading scores. In K.W.Berger, (Ed) p (42-46). Research studies in Speechreading, Kent: OH.
- Sharp, E.Y. (1972). The relationship of Visual closure to speechreading. Exceptional children. Vol. 38 p 729-734.
- Shepherd, R. and Markides, S (1972). Cited in the Speechreader. In K.W.Berger, (2<sup>nd</sup> Ed) 109-137). In speechreading: Principles and methods. United States of America: National Educational Press, Inc.
- Shepherd.D.C. (1982). Visual Neural correlate of speechreading ability in normal hearing adults. J.Speech Hear Res. Vol.2, p 340 - 352.
- Simmons,A.A. (1959). Factors related to lipreading J.speech Hear Res. Vol.2 p 340 - 352.
- Spradlin, A., and Monfils, M. (1989). Effects of verbal encouragement on self reatings of lipreading performance. Volta Rev. Vol.91.
- Stepp,E. (1964). A new approach to teaching lipreading - demonstration films Volta Rev. Vol. 66.
- Stobsehinki,R. (1928). Lipreading: It's Psychological aspects and its adaptation to individual needs of the hard of hearing Amer Anu. Deaf Vol.73, p.234 - 242.
- Stone, M.E. (1957). Cited in Lipreading methods and materials. In J.J.O'Neill and H.J. Oyer, p (84-92). Visual communication for the hard of hearing, New Jersey: Prentice-Hall.
- Stowell, A. E., Samuelson, E.E., and Lehman, A. (1928). Cited in Lipreading Methods and Materials for children. In J.J. O'Neill, and H.J. Oyer, p (84-92). Visual communication for the hard of Hearing. New Jersey, Prentice Hall.
- Stroker, R.J. (1988). Speechreading: An Historical perspective: In DeFilippo D.G. eds. New reflections in speechreading Volta Rev. Vol.90, p. 17-29.
- Sumby, W.H., and Pollack. (1954). Visual contribution to Speech Intelligibility in Noise. J.Ac.Soc. Amer. Vol.26, p 212-215.

- Thomas Braidwood (1654). Cited in Historical aspects. In J.J.O'Neill and H.J.Oyer, p (9 - 19). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Tyler, R.M. (1988). Cited in Visual stimuli in communication. In Nerbonne, S.(2<sup>nd</sup> Ed) p (124-164). United States of America. Simon and Schuster, Inc.
- Tyler, R.M. and Gantz.S (1987). Cited in Visual Stimuli in Communication in Nerbonne. S. (2<sup>nd</sup> Ed) p (125-164). United States of Amerca: Simon and Schuster, Inc.
- Utley, J., (1946). Cited in Tests of Lipreading. In J.J. O'Neill and H.J. Oyer, p (20-34). Visual communication for the hard of hearing. New Jersey: Prentice-Hall.
- Valerie Ann Giggs. (1972). Cited in Visual recognition of keywords as a function of sentence familiarity and sentence context. In K.W.Berger (Ed). p(25-30). Research Studies in Speechreading. Kent: OH.
- Vernon, M and Mindel, E.D. (1971). Psychological and Psychiatric aspects of profound hearing loss. In Audiological assessment, edited by D.E. Rose, Engiewood Cliffs: Prentice-Hall.
- Van Uden, A. (1960). Observations on the education of the deaf in Netherlands and the U.S.A. Volta Rev. Vol.62, p 10-14.
- Walden, B.E., and Montgomery, A.A. (1974). Dimensions of Consonant perception in normal and hearing impapired listernes. J. Speech. Hear. Res. Vol.18, p (444-455).
- Warren, L.A., Dancer, C, Monfils, J., and Pittenger, J.J. (1989). Practice effect in speechreading Volta Review Vol.89 p (130 - 133).
- Welenberg, E. (1951). Auditory training of deaf and hard of hearing children. Acta Otolaryngology (suppl 94) 39, 1 - 39.
- Whilden, O.A., and Scally, M.A. (1939). Cited in Speechreading methods and materials for children. In J.J. O'Neill and H.J. Oyer. p (84-92). Visual communication for the hard of hearing. New Jersey : Prentice-Hall.
- Whitchurst, M.W. (1964). Cited in visual stimuli in communication. In Nerbonne (2nd Ed) p (125-164). Introduction to Aural rehabilitation. Simon and Schuster.Inc.
- Wong, W., and Taaffe,G. (1958). Relationships between selected aptitude and personality tests of lipreading ability. Volt. Rev. Vol. 80 p 100 - 105.
- Woodward, M.F. (1960). Phoneme perception in lipreading. J.speech Hear.Res. Vol.3, p 212 - 222.
- Woodward, M.F., and Lowell, E.E. (1964). A linguistic approach to the education of the aurally - handicapped children. United States Department of health, Education and Welfare Project No.907.

- Woodward, K.S. and Blakely, R.W. (1953). Cited in Receptive speech by vision. In K.W.Berger(Ed) p (49-71). Speechreading principles and methods. United States of America: National Educational Press, Inc.
- Worthington, A.M. (1956). Cited in Experimental study of lipreading. In J.J. O'Neill, and H.J. Oyer, p (35-49). Visual communication for hard of hearing. New Jersey: Prentice-Hall.
- Yenrich, D.E. (1951). Cited in Speechreading methods and materials for children. J.J. O'Neill and H.J.Oyer p( 84-92). In Visual communication for the hard of hearing. New Jersey: Prentice-Hall.