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THE COGNITIVE STRUCTURE OF LIPREADING

by

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Most researchers are indebted to other people, institutions or agencies in the conduct of their research. It would appear that the investigator for this research study is indebted to more people, institutions and agencies than most, however. For example, the investigator is indebted to the Office of Education for financial support of the project. He is indebted to the several schools and colleges that contributed many hours of student time for the purpose of ability and lipreading testing, and he is indebted to the fine work of the project staff who diligently pursued their various duties, and finally, the investigator is indebted to Dr. William Reitz, the Chairman of this dissertation study who contributed many stimulating ideas during the planning and execution phase of the study.

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PREFACE

The investigator first became aware of the problems associated with lipreading in the education of the deaf at the John Tracey Clinic in Los Angeles. The research staff of the Clinic, Edgar Lowell, Mary Woodward, Carl Barber, Alex McEachern, Wilson Wong and the author labored hard and long and often unsuccessfully at the analysis of the lipreading communication process. The difficulty of "coming to grips" with the analysis of lipreading experimentally was frustrating. Many of our most logically related hypotheses failed to be supported in experimental study. Because of the difficulties involved in experimentation with such a complex process as lipreading, much thought was given to the methodological approach that should be used with lipreading. And it was here at the John Tracey Clinic that the present study was formulated. Much thought has gone into the planning and execution of this study, and it is hoped that the study will prove the value of the methodology approach followed in it through the value of the findings that result from it.

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CHAPTER I

INTRODUCTION

The Problem of Lipreading

The problem of lipreading may best be described by
contrasting differences between verbal communication of
the hearing person and lipreading, used typically by the
hearing impaired. Speech, the principal vehicle of com-
munication between hearing people is embedded in oral-
aural sensory processes. Speech is considered to be ex-
pressive (as when a person is talking) and receptive (as
when a person is listening). The two modalities, speech
and hearing, compliment each other in language acquisition
and facilitate easy exchange between hearing people. As
Myklebust[1] has pointed out, speech may be heard over the
telephone, through walls, in the dark, around corners, and
while the listener is engaged in other activities. Speech

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[1]Helmer R. Myklebust, The Psychology of Deafness:
Sensory Deprivation, Learning, and Adjustment (New York:
Grune and Stratton, 1960), p. 247.

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may be heard volitionally and involitionally. Under normal conditions, the listener usually "gets the message" when he listens.

Lipreading, on the other hand, is considered to be a receptive mode of communication dependent entirely upon the visual sense modality. Learning to lipread and learning to speak are two distinct and separate learning problems for the deaf person. Lipreading demands close attention of the lipreader and requires optimal visual conditions between speaker and lipreader. Perhaps the most critical difference between lipreading and speech and hearing is that facial and lip movements of articulation are imperfect correlates of speech. Estimates of the proportion of speech that does not cause visible lip movements range between 50 and 70 percent.[1,2]

Homophenes, or words that sound alike but have different meanings, further complicate lipreading. In contrast

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[1] John H. Muyskens, "The Building and Maintenance of Clear Speech for the Deaf," The Volta Review, 40 (November, 1938), p. 656.

[2] Edward B. Nitchie, The Physiological Basis of the Visible Movements in Lipreading (New York: The Nitchie School of Lipreading, Inc., no date of publication), p. 8.

to the hearing person, the deaf person perceives a set
of ambiguous cues with which to fashion a lipread message.
How this is possible is the problem of this study. Logi-
cally, lipreading is more than the visible movements of
articulation because these cues of lipreading are in them-
selves inadequate for the purpose. What the "more" is
must reside in the lipreader in the form of knowledge of
the language lipread, and in the form of various cognitive
abilities which permit him to reason out what must have
been said from the fleeting cues he perceived. Logical
analysis of lipreading in terms of necessary and sufficient
cognitive abilities suggest that visual abilities are
necessary as are basic competencies in the language lip-
read. Beyond these necessary conditions, it would appear
that the lipreader must have memory abilities to hold in
storage lipread elements while he fits them into various
missing-element slots and compares the appropriateness of
the fit. This latter operation would seemingly require
reasoning powers of both associational and evaluative
attributes. We know that the lipreading act is accomplished
rather quickly, or at least in concert with the normal tem-
po of speaking, a factor suggesting a rapidity-of-thinking

ability. In terms of cognitive abilities, this logical
analysis suggests that visual, verbal, reasoning, memory
and rapidity-of-thinking abilities are important in lip-
reading. The problem and hence the experimental investi-
gation is to obtain verification of this logical analysis
of lipreading.

Background and Importance of the Problem

Human society relies heavily on the free and easy
interchange of ideas among its members and speech has been
found to be the most convenient form of communication.
With respect to the education of the deaf, an "oral" and
a "manual" school of thought has arisen over the conveni-
ence of speech for deaf people. The oralists seek to teach
the deaf both lipreading and speech, teachings which re-
quire consumate skill and which are exceedingly difficult,
whereas the manual school tends to employ finger spelling,
signing, and other purely visual means of communication,
methods which are somewhat easier to learn than speech
and lipreading. The oralists argue that their training
places the deaf person in the hearing society with all of
the advantages of this association, and that purely manual
communication skills tend to force the deaf person to

associate only with the deaf or with a restricted element

of society. The manualists, on the other hand, contend

that lipreading and speech cannot be taught too well if

at all, and that the emphasis in the education of the deaf

should be on traditional academic subjects. Irrespective

of the merits of either approach, the oralists are largely

in control of the education of the deaf in the United

States though some schools tend to combine both methods,

oral and manual, in teaching deaf children. Because of

the importance lipreading has gained in this country for

the education of the deaf, analytical studies of this mode

of communication are of importance from an applied point

of view. From a theoretical point of view, studies of

lipreading may be revealing about communication generally.

For example, there is much about the structure of language

which carries meaning in addition to the meaning of words.

Some of the more obvious language variables which con-

ceivably could carry meaning for the lipreader are:

1. Frequency of usage of language.

2. Semantics.

3. Syntactics.

4. Redundancy (repetition of identical elements in

language).

> 5. Semantic redundancy (repetition of meaning in language).
>
> 6. Sequential relationships, or transitional probabilities, between letter and word elements of the sequence.

These variables may be summarized as familiarity with language, knowledge of meaning and structure of language and repetition of elements in a language sequence. It is possible that the skilled lipreader has an instinctive command of these and other language variables, a factor which may overcome the missing elements of lipread communication. In fact, language structure may be an all important variable in lipreading. Linguists do not usually concern themselves with meaning but tend to devote their attention to the structure of language. Psycholinguists study both meaning and structure. Both disciplines offer insights into the astounding feat of language acquisition which the child accomplishes in a relative short span of time and in a relatively untutored environment. Between birth and five or six years of age and before the advent of formal academic training, the child typically has gained mastery of his language. He has a basic vocabulary,

he knows how to sequence words in appropriate order, he
can ask questions and make demands, and he can converse
sensibly with his parents and peers. And he has done this
on his own in an imitative, trial and error fashion. It
is not until he gets to school that he learns that an
apple is a noun and that blue is an adjective and that
"ain't" is not a proper word to use. The school teacher
adds sophistication to the child's language usage, but the
important point is that the basic learning has been mas-
tered before the child enters school. The deaf child on
the other hand is isolated from the stimuli which make
the miracle of language acquisition possible for the
hearing child. By analogy, imagine a person attempting
to learn a foreign language by observing foreigners con-
verse through a sound proof plate glass window. In addi-
tion to this handicap, the deaf child is further isolated
from his own speech mechanism.

Chomsky[1] makes these points about language generally.
Language is not "merely a collection of words, phrases,

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[1]Noam Chomsky, "Language and the Mind," _Psychology Today_ (1, Feb. 1968), 48-52, 66-68, p. 48.

and sentences and a habit system acquired accidentally
and extrinsically." Language is rather a "latent struc-
ture in the mind."[1] Chomsky[2] makes a distinction between
the "deep structure"[3] of language which is embedded in the
mind probably in the unconscious and "surface structure"[4]
which is the sound-meaning correlate. Deep structure is
syntactical and surface structure phonetic in form. He
speaks of a person's generative grammar and implies that
from a finite set of words, form and structure, the user
of language can generate an infinite number of utterances.
Chomsky[5] seems to think that the deep structure of all
languages are probably quite similar but that the sound-
meaning correlates vary. He feels that it is the sound-
meaning correlate that distinguishes one language from
another, not the syntax. With respect to language acqui-
sition he has this to say:

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[1]Ibid., p. 50.

[2]Ibid., p. 51.

[3]Ibid.

[4]Ibid., p. 68.

[5]Ibid., p. 50.

In formal terms, then, we can describe the
child's acquisition of language as a kind of
theory construction. The child discovers the
theory of his language with only small amounts
of data from that language. Not only does his
"theory of the language" have an enormous pre-
dictive scope, but it also enables the child to
reject a great deal of the very data on which
the theory has been constructed. Normal speech
consists, in large part, of fragments, false
start, blends, and other distortions of the
underlying idealized forms. Nevertheless, as
is evident from a study of the mature use of
language, what the child learns is the under-
lying ideal theory. This is a remarkable fact.
We must also bear in mind that the child con-
structs this ideal theory without explicit
instructions, that he acquires this knowledge
at a time when he is not capable of complex
intellectual achievements in many other domains,
and that this achievement is relatively indepen-
dent of intelligence or the particular course of
experience. These are facts that a theory of
learning must face.[1]

Chomsky[2] cites experimentation in progress which is

directed toward determining the nature of deep structure

and surface structure and relationships between the two.

Conceivably, the approach could be profitably used to gain

a better understanding of the deaf person's use of language.

A person who is born deaf is typically deficient in gram-

matical structure, so much so that his language is often

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[1]_Ibid._, p. 66.

[2]_Ibid._, p. 50.

called "deaf speech" or "deaf language," terms which imply

grammatical errors characteristic of the deaf. On the

other hand, the deaf do communicate with each other in a

more or less satisfactory manner, a factor which suggests

a language code different from the hearing person's. The

point may be made that just as a physicist often goes into

a dark room to study light, so could a linguist turn his

attention to an atypical language structure to gain in-

sights about typical structure. Such research would be

of value both to the linguist and to people concerned with

the education of the deaf. It is a further hypothesis of

the investigator that studies of lipreading could also be

revealing about communication processes generally, aside

from the benefits derived for the education of the deaf

and knowledge about the structure of a particular language.

Definition of Terms

Cognitive Abilities--In Guilford's[1] structure-of-

Intellect Model, mental operations are classified accord-

ing to five categories, only one of which is cognition.

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[1] J. P. Guilford, "Current Summary of Structure-of-
Intellect Factors and Suggested Tests," Reports from the
Psychological Laboratory, No. 30 (December 1963), The
University of Southern California, Los Angeles, California,
p. 2.

Cognition is described as "immediate discovery, awareness,
rediscovery, or recognition of information in various
forms; comprehension or understanding."[1] The remaining
four mental operations in the SI model are Memory, Diver-
gent Productions, Convergent Productions, and Evaluation.
In his recent book on intelligence, "Guilford uses the
term intelligence to cover all types of mental-information
processing."[2] In this investigation, Cognitive Abilities,
are those abilities measured by factor-analytically derived
tests measuring unique abilities such as Visualization,
Numerical Ability, Word Fluency, and the other similar
abilities.

Communality (h^2) of a test is its common-factor
variance.[3] The communality of a test is always smaller
than the reliability except in the limiting case where the

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[1]Ibid.

[2]John B. Carrol, review of The Nature of Human
Intelligence by J. P. Guilford (New York: McGraw-Hill,
1967), cited in American Educational Research Journal
(5, March 1968), p. 249.

[3]Louis Leon Thurstone, Multiple Factor Analysis: A
Development and Expansion of the Mind (Chicago: The
University of Chicago Press, 1947), p. 75.

specific factor is absent, in which case the communality

and the reliability are equal.[1]

Factor Analysis is a method of analyzing a set of

observations from their intercorrelations to determine

whether variations represented in the observations can be

accounted for adequately by a number of basic categories

smaller than that with which the investigation started.

By factor analytic means, data obtained with a large num-

ber of a priori measures may be explained in terms of a

smaller number of reference variables.[2]

Factors.--Each column of the rotated factor matrix

identifies a factorial axis in factor space. The configur-

ation of significant factor loadings on a factor are used

to interpret that space. A factor which is involved in

the variance of two or more tests is called a common fac-

tor. A common factor which is involved in the variance of

only one test is called a unique factor. A common factor

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[1]Ibid., p. 84.

[2]Benjamin Fruchter, Introduction to Factor Analysis
(New York: D. Van Nostrand Co., 1954), p. 1.

which is involved in the variance of all of the tests in the battery is called a <u>general factor</u>.[1] In this investigation, experimental interests is in group factors having three or more significant loadings. Doublets and singlets, or unique factors, will not be interpreted.

<u>Factor loadings</u> are coefficients of factors. They are correlations of test variables with factors. Loadings of .20 or less are usually regarded as insignificant, loadings between .20 and .30 are regarded as being of low significance, loadings between .30 and .50 indicate moderate significance between test variable and factor, loadings between .50 and .70 are regarded as highly significant, and above .70 as very significant.[2] It was planned to use test variables loading .30 or higher on a factor to interpret the factor in this analysis.

<u>Lipreading</u> described by Myklebust as speechreading is the "process of comprehending the words of the speaker by

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[1] Louis Leon Thurstone, <u>Multiple Factor Analysis: A Development and Expansion of Vectors of the Mind</u>. (Chicago: The University of Chicago Press, 1947), p. 182.

[2] Fruchter, <u>op. cit.</u>, p. 151.

associating meaning with the movement of lips. It is a
receptive process used to some extent by everyone but of
critical importance to those who have significant degrees
of deafness."[1] Lipreading is variously known as speech
reading, visual speech reception, and as visual hearing,
terms which recognize that lipreading is more than the
perception of lip movements.

Positive Manifold is a criteria for factor analytic
rotations. Positive manifold is present when axes can be
rotated so that all factor loadings are positive or zero.

Simple Structure, also a criteria for factor analytic
rotations, is present when each test variable has loadings
extending over a few factors. That is to say, the variable
loads on the smallest number of factors.

Varimax Method applies to the rotation of factors by
computer. The method maximizes zero entries in each row
of the rotated matrix. Varimax rotations meet the criteria
of simple structure, positive manifold and factorial

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[1]Myklebust, op. cit., p. 246.

invariance.[1] The method is criticized by Catell[2] for not
"spreading the variance" as much as other rotational pro-
cedures do. It was planned to employ orthogonal varimax
rotations in this study.

Assumptions and Issues

Major assumptions of this investigation are that lip-
reading is inextricably associated with characteristic
structure of language and that conditions under which lan-
guage is acquired, influence basic language structure. It
is assumed for example that basic language structure of
hearing and deaf people is different. It is also assumed
that language structure carries meaning and may be a vital
accessory to visible movements of speech in successful
lipreading. It is further assumed that the insufficient
stimuli of visible movements of articulation present a
problem-solving situation to the lipreader, and finally,
it is assumed that everyone who uses a language can lip-
read with varying degrees of success.

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[1] Harry Harman, _Modern Factor Analysis_ (Chicago: The
University of Chicago Press, 1967), pp. 305, 309, 312.

[2] Raymond B. Cattell, ed., _Handbook of Multivariate
Experimental Psychology_ (Chicago: Rand McNally and
Company, 1966), p. 186.

These assumptions raise certain issues with respect to the most appropriate way in which to investigate lipreading. The assumptions suggest for example that experimental studies conducted with hearing and deaf lipreaders should be designed differently and that such studies would focus on different problems. The assumptions also suggest that the influence of language structure on lipreading is worthy of study as is the study of the reasoning powers of lipreaders. Other issues not directly raised as an assumption but of experimental importance is the medium of presentation of lipreaders. Although face-to-face lipreading is the typical mode of lipreading, it is a difficult mode to control experimentally. Motion picture presentation of speakers on the other hand insures a constancy of presentation from one testing session to another. Motion picture testing has other advantages. Also with respect to speakers, their lipreadability, or differences in the ease and difficulty with which they are lipread, is of experimental importance.

In keeping with the assumptions and issues cited above, experimental conditions incorporated into the experimental design of this study were the use of hearing

lipreaders varying in sex, age and education; the use of
filmed speakers who varied with respect to ease and dif-
ficulty with which they are lipread, and language varying
in structure as lipreading stimuli. One may raise the
question as to whether the findings from this study can
be generalized to deaf lipreaders, and the answer is
"probably not to any great extent." However, it is felt
that this study with hearing lipreaders could serve as a
point of departure for carefully controlled studies of
hearing-impaired lipreaders.

Review of related literature.--The measurement of
lipreading is a critical aspect of lipreading research.
However, no nationally standardized test of lipreading is
available to researchers. There are a variety of instruc-
tional lipreading film reported in the literature which
are used for testing occassionally, as well as lipreading
script that may be administered in face-to-face lipreading
testing sessions. Teacher's ratings of lipreading skill
have also been reported as a means of assessing lipreading
performance. Most lipreading tests can be considered to
be self validating in that they present a work sample of

lipreading. That is to say, the lipreading tests present

a speaker who silently mouths the elements of the lip-

reading test, or filmed or televised speakers are pre-

sented silently. Although motion picture and television

transform the speaker from three dimensions in face-to-

face lipreading to two dimensions, such representation of

the speaker does not appear to invalidate lipreading

testing. Silent motion picture lipreading testing offers

the advantage of constancy of presentation from one test

administration to another. Content of lipreading tests

has been phonemes, vowels, consonants, syllables, words,

phrases, sentences, and stories. Discrimination testing

is required by some tests while others demand the verbatim

reproduction of what was said in the test. Other lip-

reading tests are more interested in content than in ver-

batim reproductions, however. Elements of lipreading

tests vary in lipreading difficulty depending upon the

linguistic environment the element is in and depending on

the phonological characteristics of the element. Because

of this, constant units of lipreading measurement are not

common. Lipreading tests crediting one point for every

word correctly identified by the lipreader are especially

vulnerable to this weakness in lipreading measurement.

Despite the weakness, reported internal consistency and

test-retest reliabilities of lipreading tests are usually

quite high.

One of the first filmed tests of lipreading reported

in the literature is that of Nitchie's in 1913,[1] though

there is no mention of the administration of the test. He

reported the construction of a 16 mm motion picture film

which presented three proverbs: "Tis love that makes the

world go round," "Spare the rod and spoil the child," and

"Fine feathers make fine birds." Kitson in 1915[2] reported

lipreading measurement in face-to-face situations which

was judged by teachers. In 1917 Conklin[3] constructed lip-

reading tests, also in face-to-face situations, which con-

sisted of eight consonants, fifty-two words and twenty

sentences. In 1928 Day and Fusfield[4] constructed two

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[1] Edward B. Nitchie, "Moving Pictures Applied to Lipreading," The Volta Review, 15 (1913), pp. 117-125.

[2] H. D. Kitson, "Psychological Tests for Lip-Reading Abilities," The Volta Review, 17 (1915), pp. 471-476.

[3] Edmund S. Conklin, "A Method for Determining the Relative Skill of Lipreading Ability," The Volta Review, 19 (1917), pp. 216-220.

[4] H. E. Day, Irving S. Fusfield and Rudolph Pitner, A Survey of American Schools for the Deaf: 1924-1925 (Washington, D.C.) National Research Council.

lipreading tests to be administered in face-to-face lip-
reading situations also. In 1940 Heider and Heider[1] con-
structed three filmed tests of lipreading. The first test
contained fifteen nouns, fifteen meaningless phonetic
units, fifteen names of animals, fifteen unrelated sen-
tences, and ten related sentences. The second test was
composed of names of animals, unrelated nouns, and unre-
lated sentences and two stories. The third test was simi-
lar to the second. They concluded that recognition of
vowels was superior to consonant recognition, and that no
correlation existed between ability to lipread nonsense
syllables and general lipreading ability. In 1942 Mason[2]
constructed a film lipreading test that could be used for
children and could be scored objectively. In 1946 Utley[3]

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[1]Fritz K. Heider and Grace More Heider, "Studies in
the Psychology of the Deaf," _Psychological Monographs_, 52
(1940), pp. 124-33.

[2]Marie K. Mason, "A Cinematographic Technique for
Testing More Objectively the Visual Speech Comprehension
of Young Deaf and Hard of Hearing Children," (unpublished
Ph.D. dissertation, The Ohio State University, 1942).

[3]Jean Utley, "Factors Involved in the Teaching and
Testing of Lipreading Ability," _The Volta Review_, 48
(November, 1946), pp. 657-59.

developed a film test of lipreading which consisted of words, sentences and stories. Utley's test, "Let's Lipread," has received extensive use.[1] In 1947 Reid reported construction of a lipreading test presented by motion picture which contained seventeen vowels and dipthongs, eleven consonants, ten unrelated sentences, related sentences which told a story, and also a short story. In 1947 Morkovin[2] brought out a series of ten films designed as training material for the hearing-impaired. Morkovin's films were constructed around everyday experiences. Following each film were questions to be answered by the lipreader. Morkovin's interest was more in training than in testing lipreading, however. DiCarlo and Kataja[3] used The Family Dinner, one of Morkovin's films to establish the validity of the Utley test. They reported a correlation of .77 between Morkovin's Family Dinner and Utley's

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[1]Gladys Reid, "A Preliminary Investigation in the Testing of Lipreading Achievement," _Journal of Speech and Hearing Disorders_, 12 (1947), pp. 77-82.

[2]Boris V. Morkovin, "Rehabilitation of the Aurally Handicapped Through the Study of The Speech Reading in Life Situations," _Journal of Speech and Hearing Disorders_, cited in John J. O'Neill and Herbert J. Oyer, Visual Communication, p. 26.

[3]Louis M. DiCarlo and R. Kataja, "An Analysis of the Utley Lipreading Test," _Journal of Speech and Hearing Disorders_, 16 (1951), pp. 226-40.

lipreading test. In 1957 Taaffe[1] standardized The Film

Test of Lipreading. It originally was part of a training

film developed by Keaster[2] at State University of Iowa.

In its standardization The Film Test of Lipreading was

administered to 408 college students with normal hearing.

Results were statistically analyzed to determine the

reliability and analysis revealed that half of the test,

thirty sentences, was just as reliable as the entire sixty

sentences. Therefore, two forms, Form A and Form B were

constructed. Marshall and Donnelly[3] later modified The

Film Test of Lipreading to form a multiple choice test of

lipreading. Marshall and Donnelly report a correlation

of .88 between Form A and the Utley test of lipreading

and a correlation of .84 between Form B and Utley's test.

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[1]Gordon Taaffe, "A Film Test of Lipreading," John Tracy Clinic Research Papers II (Los Angeles: John Tracy Clinic, 1957).

[2]Jacqueline Keaster, "An Inquiry into Current Concepts of Visual Speech Reception (Lipreading)," Laryngoscope, 65 (1955), pp. 80-84.

[3]William J. A. Marshall and Kenneth G. Donnelly, "Development of a Multiple-Choice Test of Lipreading," Journal of Speech and Hearing Disorders, 10 (September, 1967), pp. 119-36.

Other film tests of lipreading are reported as well as

lipreading testing and training via television.[1,2]

Costello[3] reported a study in which she used visual

Digit Span, Weschler's Picture Arrangement Test, and Pro-

gressive Matrices Test. She also used the Gates Reading

Test as a measure of reading. She reported a significant

correlation between visual Digit Span and the ability to

lipread. The Weschler Picture Arrangement test also cor-

related significantly with lipreading ability for both

deaf and hard of hearing. Picture Arrangement is de-

scribed as the ability to perceive and understand social

situations; it might be considered a test of social intel-

ligence. Costello[4] also reported significant correlations

between scores of lipreading and scores on the Progressive

Matrices Test for the hard-of-hearing subjects only (not

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[1]John J. O'Neill, "A Televised Lipreading Series," Central States Speech Journal, 10 (Winter, 1959), pp. 35-37.

[2]H. J. Oyer, "Teaching Lipreading by Television," The Volta Review (1961), pp. 131-32.

[3]M. R. Costello, "A Study of Speech Reading as a Developing Language Process in Deaf and Hard of Hearing Children," (unpublished Ph.D. dissertation, Northwestern University, 1957), cited by Helmer R. Myklebust, The Psychology of Deafness, p. 248.

[4]Ibid., p. 249.

for the deaf). Myklebust[1] in a comparison of male and
female hearing-impaired subjects reported that more
females than males were considered to have excellent,
good, or average lipreading ability. Myklebust[2] also
reported a significant relationship between teachers'
ratings of lipreading and intelligence scores as measured
by Draw-A-Man Test. The more intelligent were the better
lipreaders. Pintner,[3] however, after extensive work with
the deaf, reported no relationship between intelligence
and lipreading ability. Myklebust[4] also reported a relation-
ship between verbal skills and lipreading. He concludes
that the greater the success in one type of verbal be-
havior, such as lipreading, the greater will be the suc-
cess in other verbal systems. He states that if facility
in lipreading can be developed, facility in read and
written language will be raised. He draws the implication

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[1]Myklebus, op. cit., p. 249.

[2]Ibid., p. 256.

[3]Ibid., p. 261.

[4]Ibid., p. 248.

that the process might be reversed.[1] He feels that the

development of inner language is basic and fundamental to

all other language behavior.

There is considerable agreement among various re-

searchers that lipreading involves a synthesis ability.

Nitchie,[2] Morkovin,[3] and others report that lipreading is

dependent upon a synthesizing ability. Olson[4] reports a

factor analytic study of the relation between speed of

visual perception and language abilities of deaf adoles-

cents. Thirty-nine deaf adolescents from two state resi-

dential schools for the deaf were administered five visual

perceptual tests from which twenty-two scores were ob-

tained and three language measures on which ten scores

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[1]Helmer R. Myklebust, "Toward a New Understanding of the Deaf Child," The American Annals of the Deaf, 98 (September, 1953), p. 255.

[2]Edward B. Nitchie, "Synthesis and Intuition in Lipreading," The Volta Review, 15 (1913), p. 311.

[3]Boris V. Morkovin, "Rehabilitation of the Aurally Handicapped Through the Study of Speechreading in Life Situations," Journal of Speech and Hearing Disorders, 12 pp. 363-68.

[4]Jack R. Olson, "A Factor Analytic Study of the Relation Between the Speed of Visual Perception and the Language Abilities of Deaf Adolescents," Journal of Speech and Hearing Research, 10 (June, 1967), p. 358.

were obtained. He was interested in determining whether
or not the skills of visual perception were related to
language acquisition or not. He isolated five factors.
They were: (1) Detailed Form Perception, (2) Speed of
Visual Perception, (3) Intelligence and Immediate Memory,
(4) General Language Ability, and (5) Memory Span, Open-
Set Skill, and Imagination.

Heider and Heider,[1] Cavender,[2] Reid,[3] and O'Neill and
Davidson[4] examined lipreading ability as a function of

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[1]Fritz K. Heider and Grace Moore Heider, "An Experi-
mental Investigation of Lip Reading," Psychological
Monographs, 52 (1929), pp. 220-25, cited in John Joseph
O'Neill and Herbert J. Oyer, Visual Communication for the
Hard of Hearing (Englewood Cliffs, New Jersey: Prentice-
Hall, Inc., 1961), p. 38.

[2]Betty J. Cavender, "The Construction and Investigation
of a Test of Lip Reading Ability and a Study of Factors
Assumed to Affect the Results," (unpublished Master's thesis,
Indiana University, 1949), cited by John Joseph O'Neill and
Herbert J. Oyer, Visual Communication for the Hard of
Hearing, p. 38.

[3]Gladys Reid, "A Preliminary Investigation in the Test
of Lipreading Achievement," The American Annals of the Deaf,
91 (1946), pp. 403-13, cited in John Joseph O'Neill and
Herbert J. Oyer, Visual Communication for the Hard of
Hearing, p. 38.

[4]John Joseph O'Neill and J. L. Davidson, "Relation-
ships Between Lipreading Ability and Five Psychological
Factors," Journal of Speech and Hearing Disorders, 21 (1956),
pp. 478-81, cited in John Joseph O'Neill and Herbert J. Oyer,
Visual Communication for the Hard of Hearing, p. 39.

various intellectual and personality variables. These
experiments included verbal and non-verbal intelligence,
reading comprehension, speech attitude, concept formation,
and level of aspiration. Only O'Neill[1] and Cavender used
normally hearing lipreaders. A general result of these
studies is that intelligence is not related to lipreading
ability, that language facility and educational achieve-
ment are associated with lipreading proficiency and that
teachers-of-the-deaf ratings of lipreading ability appear
to be valid. Verbal Comprehension and Verbal Fluency did
not relate positively to lipreading performance in these
studies.[2] Pintner[3] concluded that after a certain level
of intelligence has been reached, intelligence per se
ceases to be a determining factor in speech reading, while
educational achievement is a factor.

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[1]John Joseph O'Neill, "An Exploratory Investigation
of Lipreading Ability Among Normal Hearing Students,"
Speech Monographs, 18 (1951), pp. 309-311, cited in John
Joseph O'Neill and Herbert J. Oyer, Visual Communication
for the Hard of Hearing, p. 38.

[2]John Joseph O'Neill and Herbert J. Oyer, Visual Com-
munication for the Hard of Hearing (Englewood Cliffs, New
Jersey: Prentice Hall, Inc., 1961), p. 28.

[3]Rudolf Pintner, Speech and Speech-Reading for the
Deaf," Journal of Applied Psychology, 13 (1929), p. 220,
cited in Helmer R. Myklebust, The Psychology of Deafness,
p. 248.

In view of the fact that much of what is said does not cause lip movements, various writers used the term "speech reading," "visual speech perception," or other expressions that recognize that the lipreader is using more than visible movements of articulation in lipreading. However, Woodward[1] found that only labial articulations are descriminated consistently in her study of phoneme perception in lipreading and concluded that the term "lipreading" was justified from the results.

With respect to psychological abilities important in lipreading, many of the investigations reported are of studies of lipreading ability of hearing-impaired subjects. These studies leave something to be desired in view of the fact that homogeneous groups of hearing impaired subjects with respect to age at onset of deafness, amount of lipreading training, degree of hearing impairment, comparability of academic achievement, possibility of brain damage and many other factors makes a study based on the hearing-impaired difficult of interpretation. Also, the

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[1]Mary F. Woodward, "Linguistic Methodology in Lipreading Research," John Tracy Clinic Research Papers IV, (Los Angeles: John Tracy Clinic, 1957).

possibility of penalizing a deaf lipreader's lipreading protocol for failure to use correct grammar is an ever present hazard.

Differences among speakers make a difference in the efficiency with which a lipreading sequence is interpreted, but the investigator[1] has shown that face-to-face lipreading with different speakers, different sequences of filmed speakers, with and without context, in black and white and in color, are all highly intercorrelated. The average score for the groups varied, showing that one medium was more difficult than another, but the relative rank order with respect to success in lipreading was maintained among the lipreaders with the various media of presentation. Regarding medium of presentation, one study[2] has shown that the more of a speaker that is visible to the lipreader, the better lipreading was. In this study a mask was prepared to obscure all but the speaker's lips for one experimental condition; a second experimental condition presented the speaker with chin to nose exposed; a

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[1]Taaffe, op. cit., p. 10.

[2]Lewis Stone, "Facial Cues of Context in Lipreading," John Tracy Clinic Research Papers V (Los Angeles: John Tracy Clinic, 1957).

third presentation showed the speaker with face from chin to eyebrows exposed, and the final sequence presented the speaker's head, shoulders, and chest. The relationship was not linear, but there were significant increments in lipreading performance as more and more of the speaker was exposed to the lipreader.

Despite the many inadequacies of lipreading as a mode of communication, it would appear that lipreading is a general behavioral phenomena. That is to say, everyone who has command of a language, irrespective of his hearing ability or formal training in lipreading, can lipread with varying degrees of success. The very young and the aged, the intelligent and the mentally retarded, the hearing and the deaf, male and female, those formally trained in lipreading, and those who learned to lipread vicariously all have representation among competent lipreaders. Women are generally better lipreaders than men but the sex difference tends to disappear at younger years. It would appear that skill in lipreading is associated with formal educational progress. College students, on the average, lipread better than high school students, high school students better than elementary school students. Teachers of

the deaf are on the average the best lipreaders. Other
studies about lipreading suggest that while training in
lipreading does aid in developing skills in this area,
increasing one's native skills in lipreading through for-
mal training is a difficult and slow process.[1,2,3]

In conclusion, lipreading has been measured in a
variety of ways and even though units of lipreading measure-
ment are seldom equivalent, measurement appears to be rela-
tively reliable and valid. There is no common agreement
in the literature about the abilities important in lip-
reading other than that many writers feel that synthesizing
ability is important. Much of the contradictory results
reported in the literature may be due to the lack of com-
mon experimental conditions and controls. Comparisons
between experimental studies using deaf and hearing sub-
jects are on tenuous grounds for example.

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[1]Taaffe, op. cit.

[2]Gordon Taaffe and Wilson Wong, "Studies of Variables
in Lipreading," John Tracy Clinic Research Papers, III
(Los Angeles: John Tracy Clinic, 1957).

[3]Edgar L. Lowell, Gordon Taaffe and Mary Frances
Woodward, "Studies in Visual Communication," (paper pre-
sented at the American Speech and Hearing Association,
34th Annual Convention, New York, November, 1958).

Experimental Design

Objectives.--Lipreading is a receptive mode of com-
munication used typically by the hearing-impaired person
in his conversations with others. Success in lipreading
is dependent upon the lipreader's perception of Visual
cues of articulation, his knowledge of the language lip-
read, and upon his reasoning powers. As visual cues of
articulation are imperfect correlates of speech, cognitive
processes play a crucial role in lipreading. It is the
objective of this investigation to isolate and define those
cognitive processes that are important in lipreading and
to specify in what ways they are interrelated.

Research model.--The research model calls for the
presentation of lipreading stimulus material together with
tests of cognitive abilities hypothesized to be important
in lipreading to groups of lipreaders. Measures of lip-
reading will be correlated with measures of cognitive
-abilities and the resulting correlation matrix factor
analyzed. The procedure puts both the dependent and the
independent variables in the same factor matrix. Tests
of cognitive abilities loading significantly on factors
which also contain significant loadings of lipreading

measures will be used to describe lipreading. Preliminary
factor analyses will be conducted on the lipreading cri-
terion measures and final factor analyses will be per-
formed on cognitive and lipreading measures together. A
regression analysis is also planned. The objective of the
regression analysis is to determine the relative contribu-
tion of independent variables to lipreading-ability
variance.

Lipreaders.--It was planned to use four samples of
normally hearing lipreaders. The samples selected were to
reflect age and education differences and sex differences
among adult groups. Previous studies[1] have suggested that
the sex difference favoring female lipreaders tends to
disappear at younger years. Hypotheses under considera-
tion were that lipreading performance would be better for
older and more educated lipreaders and that among adult
lipreaders, females would be better than male lipreaders.
In order to incorporate the hypotheses into operational
specifications, it was planned to obtain samples numbering
100 lipreaders each, of junior high school students, high

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[1]Taaffe, loc. cit., p. 10.

school students and male and female adult college students.
It was planned to perform factor analyses and regression
analyses by group. That is to say, four factor analyses
and four regression analyses were planned.

Criterion measures of lipreading.--It was planned to
use simple language material presented by silent motion
picture as criterion measures of lipreading. Written
reproduction of the languages would be the lipreading task
and correspondence between response and language script,
the scoring key. However, the measures of lipreading were
varied in two ways to accommodate two hypotheses about
lipreading and the kind of structure varied in the lip-
reading measures was the use of "word," "phrase," and
"sentence" for lipreading tests. The second dimension
varied was "lipreadability" of speaker. For example, it
was planned to use an easy-to-lipread speaker, a difficult-
to-lipread speaker, and a speaker of average difficulty-to-
lipread. The hypothesis with respect to lipreadability was
that lipreading would differ in kind for speakers of dif-
fering difficulty to lipread. This is to say, performance
resulting from easy, average and difficult-to-lipread

speakers would not be on the same continuum but would present different continua. It was felt that factor structure would support or refute the hypotheses. For example, lipreading factors containing all lipreading variables would tend to deny the hypotheses while lipreading factors for separate variables would tend to support the hypotheses.

Cognitive abilities.--Cognitive abilities in the areas of reasoning, perceptual, verbal, spatial and visualization will be measured by a variety of "pure" factor tests. Specific hypotheses with respect to cognitive abilities are: (1) Flexibility of Closure, (2) Speed of Closure, (3) Associational Fluency, (4) Expressional Fluency, (5) Ideational Fluency, (6) Word Fluency, (7) Induction, (8) Length Estimation, (9) Associative (Rote) Memory, (1) Memory Span, (11) Perceptual Speed, (12) General Reasoning, (13) Semantic Redefinition, (14) Syllogistic Reasoning, (15) Spatial Orientation, (16) Spatial Scanning, (17) Verbal Comprehension, (18) Visualization, (19) Figural Adaptive Flexibility, and (20) Semantic Spontaneous Flexibility. A twenty-first hypothesis in the form of sex for the two groups containing both boys and girls was included.

Although sex at the younger years might not appear as a lipreading variable, it was felt that the better part of caution would be to include it as a variable. Although sex is not a cognitive ability, the underlying ability which gives female lipreaders an advantage in lipreading was given the name, "Attention to Detail." It was felt that this ability was similar to Perceptual Speed in quality but more comprehensive in observational attributes than Perceptual Speed.

In summary, hypotheses incorporated into the investigation of lipreading are:

Twenty-one cognitive abilities

Lipreadability of speakers

Structure of the language lipread

Age and education of lipreaders

Sex (as a cognitive ability above and as a factor analytic group).

CHAPTER II

METHOD

Test Battery

Tests of Cognitive Abilities.--A description of cog-

nitive abilities selected for this investigation and tests

used to measure them is presented in Table 1. The abili-

ties and tests were selected in large part from a Kit of

Reference Tests for Cognitive Abilities[1] published by

Educational Testing Service. The accompanying manual de-

scribes well identified cognitive abilities isolated by

factor analytic means and lists tests which measure the

abilities. Scoring directions are provided in the manual

and a copy of each test is contained in the Kit. Educa-

tional Testing Service grants permission to reproduce the

tests for experimental purposes.[2] J. P. Guilford granted

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[1]John B. French, Ruth B. Ekstrom and Leighton A. Price, "Manual for Kit of Reference Tests for Cognitive Factors," Educational Testing Service (Princeton, New Jersey: 1963).

[2]Ibid., p. 5.

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permission to reproduce certain Structure-of-Intellect tests also.[1] Four tests were purchased from commercial vendors and the remaining tests were reproduced by offset printing. A description of each test used in this study is presented in Appendix A.

It will be noticed in Table 1 that thirty-four tests are used to measure twenty cognitive abilities. Three tests each are used to measure two cognitive abilities, two tests per ability are used to measure nine cognitive abilities, and a single measure is used to measure ten abilities. More tests were used to measure the more important abilities where tests were available. Fewer tests were used for measures of abilities of lesser importance. For example it was felt that visual and spatial abilities would be crucial to lipreading and three tests were selected to measure Visualization and three tests were selected to measure Length Estimation. A second criterion for the selection of tests was based on their availability and a third criterion for test selection was reliability. Ship Destination for example, a measure of General

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[1]Personal communication.

TABLE 1

COGNITIVE ABILITIES, TESTS OF COGNITIVE ABILITIES AND
LIPREADING VARIABLES

Cognitive Ability	Description of Ability	Tests Used to Measure Ability
Flexibility of Closure	The ability to keep one or more definite configurations in mind so as to make identification in spite of perceptual distractions.	1. Hidden Patterns 2. Copying Test
Speed of Closure	The ability to unify an apparently disparate perceptual field into a single percept.	3. Gestalt Completion Test 4. Concealed Words Test
Associated Fluency	The ability to produce words from a restricted area of meaning.	5. Associational Fluency
Expressional Fluency	The ability to think rapidly of appropriate wording for ideas.	6. Simile Interpretation 7. Word Arrangements
Ideational Fluency	The facility to call up ideas wherein quantity and not quality of ideas is emphasized.	8. Topics Test 9. Thing Categories Test

TABLE 1 (continued)

Cognitive Ability	Description of Ability	Tests Used to Measure Ability
Word Fluency	Facility in producing isolated words that contain one or more structural, essentially, phonetic, restrictions, without reference to the meaning of the words.	10. Word Beginnings and Endings Test
Induction	Associated abilities involved in the finding of general concepts that will fit sets of data, the forming and trying out of hypotheses.	11. Locations Test 12. Figure Classification
Length Estimation	Ability to judge and compare visually perceived distances on paper.	13. Estimation of Length Test 14. Shortest Road Test 15. Nearer Point Test
Associative (rote) Memory	The ability to remember bits of unrelated material.	16. First and Last Names Test
Memory Span	The ability to recall perfectly for immediate reproduction a series of items after only one presentation of the series.	17. Digit Span - Visual

TABLE 1 (continued)

Cognitive Ability	Description of Ability	Tests Used to Measure Ability
Perceptual Speed	Speed in finding figures, making comparisons, and carrying out other simple tasks involving visual perception.	18. Finding A's 19. Number Comparison
General Reasoning	The ability to solve a broad range of reasoning problems including those of a mathematical nature.	20. Ship Destination Test
Numerical Ability	The ability to manipulate numbers in arithmetical operations rapidly.	21. EAS #2 Numerical ability 22. Arithmetic Operations Test
Semantic Redefinition	The ability to shift a function of an object and use it in a new way.	23. Gestalt Transformation 24. Object Synthesis
Syllogistic Reasoning	Ability to reason from stated premises to their necessary conclusions.	25. Nonsense Syllogisms 26. Logical Reasoning
Spatial Orientation	The ability to perceive spatial patterns or to maintain orientation with respect to objects in space.	27. Cube Comparison Test

TABLE 1 (continued)

Cognitive Ability	Description of Ability	Tests Used to Measure Ability
Spatial Scanning	Speed in exploring a wide or complicated spatial field.	28. Maze Tracing Speed Test
Verbal Comprehension	The ability to understand the English language.	29. Wide Range Vocabulary Test.
Visualization	The ability to manipulate or transform the image of spatial patterns into other visual arrangements.	30. Form Board Test 31. Paper Folding Test 32. Surface Development Test
Figural Adaptive Flexibility	The ability to change set in order to meet new requirements imposed by figural problems.	33. Match Problems V
Semantic Spontaneous Flexibility	The ability to produce a diversity of verbally expressed ideas on a situation that is relatively unrestricted.	34. Utility Test
Word Lipreading	Ability to lipread unrelated words.	35. 1st 10 words, Word Lipreading Test, Easy-to-lipread Speaker

TABLE 1 (continued)

Cognitive Ability	Description of Ability	Tests Used to Measure Ability
Word Lipreading	Ability to lipread unrelated words.	36. 2nd 10 words, Word Lipreading Test, Difficult-to-Lipread Speaker
Word Lipreading	Ability to lipread unrelated words.	37. 3rd 10 words, Word Lipreading Test, Average Difficulty-to-Lipread Speaker
Phrase Lipreading	Ability to lipread unrelated phrases.	38. 1st 10 phrases, Phrase Lipreading Test, Difficult-to-Lipread Speaker
Phrase Lipreading	Ability to lipread unrelated phrases.	39. 2nd 10 phrases, Phrase Lipreading Test, Average Difficulty-to-Lipread Speaker
Phrase Lipreading	Ability to lipread unrelated phrases.	40. 3rd 10 phrases, Phrase Lipreading Test, Easy-to-Lipread Speaker

TABLE 1 (continued)

Cognitive Ability	Description of Ability	Tests Used to Measure Ability
Sentence Lipreading	Ability to lipread unrelated sentences.	41. 1st 10 sentences, Sentence Lipreading Test, Average Difficulty-to-Lipread Speaker
Sentence Lipreading	Ability to lipread unrelated sentences.	42. 2nd 10 sentences, Sentence Lipreading Test, Easy-to-Lipread Speaker.
Sentence Lipreading	Ability to lipread unrelated sentences.	43. 3rd 10 sentences, Difficult-to-Lipread Speaker.

Reasoning, has shown satisfactory reliabilities in pre-
vious studies and this single measure of General Reason-
ing was employed to measure it.

Tests of Lipreading Ability.--As mentioned previously,
it was planned to vary language structure and lipreada-
bility of speakers of the lipreading tests. Language
structure was varied by preparing a word, a phrase and a
sentence test of lipreading. The sentence test of lip-
reading was prepared first. It consists of thirty unre-
lated statements or questions. Thirty phrases taken from
the sentence test were prepared as a phrase test of lip-
reading and thirty words taken from the sentences were
prepared as a word test of lipreading. As lipreading dif-
ficulty due to phonological characteristics of the language
was not evaluated, it was felt that using the same language
would hold this condition constant. The lipreading script
was narrated by speakers, described in the next paragraph,
photographed with 16 mm. black and white, silent, motion
picture film and prepared as The Detroit Lipreading Tests.
The series consists of a Word Test, a Phrase Test, and a
Sentence Test of Lipreading. The script for the series is
presented in Appendix B.

Selection of speakers varied the dimension of ease and difficulty with which the speakers were lipread. Several candidates for speaker roles were evaluated in face-to-face lipreading situations with hearing lipreaders. The speakers spoke silently or mouthed simple language sequences. Average lipreading scores were obtained for the several speakers and the speakers were placed in rank order relative to these average scores. With respect to the average scores, an easy-to-lipread speaker, a difficult-to-lipread speaker and a speaker of median difficulty to lipread were selected to narrate the film. A fourth speaker, also easy to lipread was selected to narrate the instructional parts of the film. The test speakers are male; one is a Negro and two are white. The instructional speaker is a white female. Action pictures of each speaker taken from the lipreading tests are presented in Figure 1. All of the speakers but one are English teachers. One of the speakers, the difficult-to-lipread speaker is a mathematics teacher. All of the speakers, except the mathematics teacher, had had acting experience.

All of the speakers were instructed to speak at normal intensity at a normal rate in "Standard American English." Each speaker narrated a third, or ten words, of
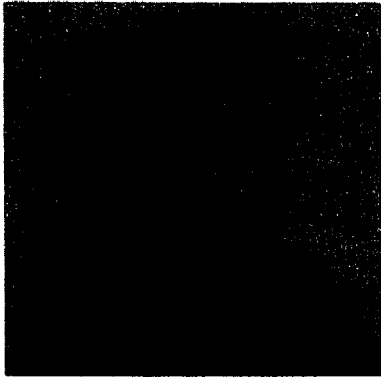
Instructor
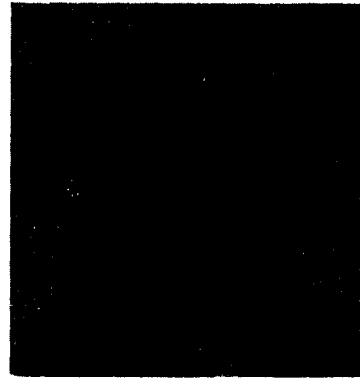
Easy-to-lipread Speaker

Difficult-to-lipread
Speaker
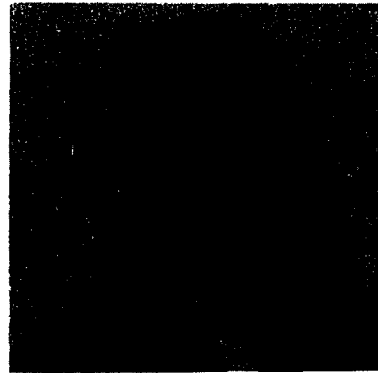
Average difficulty-to-
lipread speaker

Figure 1. Speakers in the Detroit Lipreading Tests

the Word Lipreading Test. In a similar fashion, each speaker narrated a third of the Phrase Test of Lipreading and a third of the Sentence Test of Lipreading. Order of appearance of the speakers in the Word, Phrase and Sentence Tests of Lipreading was varied according to a Latin square design to minimize order-of-appearance effects. Organization of the lipreading tests afforded the investigator nine lipreading scores for each lipreader. The nine variables are presented in Table 1. A score for each speaker in the Word Lipreading Test permits three word lipreading scores. In a similar fashion, three Phrase Lipreading Test scores are available as are three Sentence Lipreading Test Scores. Organization of the Detroit Lipreading Tests is presented in Table 2.

TABLE 2

ORGANIZATION OF THE DETROIT LIPREADING TESTS

Word Test	Phrase Test	Sentence Test
10 words (E)[1]	10 phrases (D)	10 sentences (A)
10 words (D)	10 phrases (A)	10 sentences (E)
10 words (A)	10 phrases (E)	10 sentences (D)
30 words	30 phrases	30 sentences
running time		
8 minutes	12 minutes	16 minutes

[1]E easy-to-lipread speaker
D difficult-to-lipread speaker
A average difficulty-to-lipread speaker

Test Administration and Sample Populations.--Five

hundred copies of each test were assembled as test booklets

requiring an average of forty minutes test administration

time per booklet. Total test administration time was six

hours. Nine booklets, which included the lipreading tests,

were prepared. Composition of each test booklet was diverse

with respect to cognitive-ability coverage. Lined answer

sheets were prepared for the lipreading tests. Cognitive

ability tests were answered, both on IBM answer sheets for

certain tests and in the test booklet itself for other

cognitive ability tests. A biographical information sheet

was attached to the first-to-be-administered test booklet.

The biographical answer sheet elicited information about

hearing and visual acuity as well as previous experience

with lipreading. Age, sex and information about bilingual-

ism and English as a native language was also requested on

the biographical information sheet.

Test administration was conducted by two teaching

fellows over a six month period. Usual testing sessions

were for forty minutes one week apart. Lipreading testing

was conducted via motion picture projector in a semi

darkened room. Enough light was allowed for the examinees

to write their responses, but the room was dark enough to

permit seeing the speakers on the screen. The three lip-

reading tests were presented one week apart and in the

order, Word, Phrase, and Sentence Lipreading Test. It was

felt that this procedure would minimize practice effects.

Cognitive ability testing was conducted under timed con-

ditions.

Testing was conducted at a local junior high school,

a local high school, two colleges for women and one coedu-

cational college. While over 100 subjects were tested for

each sample except the coeducational college, attrition of

subjects due to an examinee missing one or more testing

sessions was quite high in the junior high and high schools,

In the high school sample, fifteen examinees were eliminated

for bilingualism, and another five because English was not

their native language. Composition of the sample popula-

tions included in the investigation is presented below.

Eighth grade sample   49 boys, 40 girls,
                           total 89 subjects

Eleventh grade sample   27 boys, 33 girls,
                           total, 60 subjects

Adult female sample   102 adult females

Adult male sample   43 adult males

Average ages for the samples are presented in Table 3.

TABLE 3

SAMPLE POPULATION

Sample	N	Range	Mean	Standard Deviation
Eighth grade	89	13-15	13.04	0.62
Eleventh grade	60	15-18	16.58	1.23
Adult female	102	17-35	20.23	3.01
Adult male	43	17-26	19.78	1.87

Statistical Treatment

While major interest in this investigation was directed toward factor analysis and regression analysis of cognitive ability and lipreading ability test scores, preliminary analysis of the lipreading data was necessary. Some of the hypotheses could be answered in part from an examination of mean lipreading scores and subsequent statistical treatment of lipreading test scores would depend on the shape of their score distributions. Accordingly, lipreading score distributions and mean scores were prepared for each lipreading variable. For example, Appendix C contains the frequency distribution and mean scores for each of the three factor analytic samples of lipreaders for the Word Test of Lipreading. Appendix D contains the same information for the Phrase Test of Lipreading and Appendix E contains similar information for the Sentence Lipreading Test.

Factor Analyses

Tests were scored and checked. Part I and Part II scores were derived for all tests of cognitive abilities. Three scores each were obtained for the Word, the Phrase

and the Sentence Tests of Lipreading. As was mentioned

before, it was planned to use part and total scores in the

factor analyses. Twenty-two part scores, twenty-four total

scores, sex and nine lipreading scores, or a total of fifty-

six scores were derived as factor analytic variables. It

was felt that three of the samples contained enough exami-

nees for reliable factor analysis. They are the Eighth

Grade sample, the Eleventh Grade sample, and the Adult

Female sample. It was felt that the Adult Male sample was

not large enough for reliable factor analysis, and this

sample was not included in the factor analytic phase of the

investigation. Table 4 presents the variables included in

each analysis. The Eighth Grade sample has fifty-one

variables, the Eleventh Grade sample has fifty-four

variables, and the Adult Female sample has fifty-two

variables. Due to the chance way attrition during test ad-

ministration influenced tests taken, the three samples are

not identical with respect to variables included in the

factor analyses. The samples are quite similar with respect

to cognitive-ability coverage, however. Each analysis con-

tains all nine lipreading variables. Table 4 contains a

variable number which is unique for each variable. The

table also contains a code which is an acronym composed of the first letter of the test's name. The codes are also unique. Variable 3 for example will always indicate Gestalt Completion Test in each of the three analyses. "GCT" is the unique code for this variable. "AF-I" for variable 6, means Associational Fluency, part I. "AF-II" indicates Associational Fluency, part II. Codes having no numerical suffix indicate total scores.

TABLE 4

MASTER LIST OF ALL VARIABLES INCLUDED IN THE
THREE FACTOR ANALYSES

Variable Number	Code	Variable	Factor Analyses		
			8th Grade	11th Grade	Adult Female
1.	HPT	Hidden Patterns Test (Total Score)	x	x	x
2.	CT	Copying Test (Total Score)	x	x	x
3.	GCT	Gestalt Completion Test (Total Score)	x	x	x
4.	CWT	Concealed Words Test (Total Score)	x	x	x
5.	AF-I	Associational Fluency (Part I)	x	x	x
6.	AF-II	Associational Fluency (Part II)	x	x	x
7.	SI	Similie Interpretations (Total Score)	x	x	x
8.	WA	Word Arrangements (Total Score)	x	x	x
9.	TT	Topics Test (Total (Score)	x	x	x
10.	TCT-T	Things Categories Test (Total Score)		x	x

TABLE 4 (continued)

Variable Number	Code	Variable	Factor Analyses		
			8th Grade	11th Grade	Adult Female
11.	TCT-I	Things Categories Test (Part I)	x		
12.	TCT-II	Things Categories Test (Part II)	x		
13.	WBE-I	Word Beginnings and Endings Test (Part I)	x	x	x
14.	WBE-II	Word Beginnings and Endings Test (Part II)	x	x	x
15.	LT	Locations Test (Total Score)	x	x	x
16.	FC	Figure Classification (Total Score)	x	x	x
17.	ELT	Estimation of Length Test (Total Score)		x	x
18.	SRT	Shortest Road Test (Total Score)	x	x	x
19.	NPT	Nearer Point Test (Total Score)	x	x	x
20.	FLNT-I	First and Last Names Test (Part I)	x	x	x
21.	FLNT-II	First and Last Names Test (Part II)	x	x	x
22.	DSV-I	Digit Span - Visual (Part I)	x	x	x
23.	DSV-II	Digit Span - Visual (Part II)	x	x	x
24.	SEX	Sex (1 = male, 2 - female)	x	x	x
25.	FAT	Finding A's Test (Total Score)		x	x
26.	NCT-I	Number Comparison Test (Part I)	x	x	x
27.	NCT-II	Number Comparison Test (Part II)	x	x	x
28.	SD	Ship Destination (Total Score)	x	x	x

TABLE 4 (continued)

Variable Number	Code	Variable	Factor Analyses		
			8th Grade	11th Grade	Adult Female
29.	EAS-2	Employee Aptitude Survey, Test 2, Numerical Ability (Total Score)	x	x	x
30.	AO	Arithmetic Operations (Total Score)	x	x	x
31.	GT	Gestalt Transformation (Total Score)	x	x	x
32.	OS	Object Synthesis (Total Score)	x	x	x
33.	NST	Nonsense Syllogisms Test (Total Score)	x	x	x
34.	LE	Logical Reasoning (Total Score)	x	x	x
35.	CCT-I	Cube Comparison Test (Part I)	x	x	x
36.	CCT-II	Cube Comparison Test (Part II)	x	x	x
37.	MTS-I	Maze Tracing Speed Test (Part I)	x	x	x
38.	MTS-II	Maze Tracing Speed Test (Part II)	x	x	x
39.	WRVT-I	Wide Range Vocabulary Test (Part I)	x	x	x
40.	WRVT-II	Wide Range Vocabulary Test (Part II)	x	x	x
41.	FBT	Form Board Test (Total Score)		x	x
42.	PFT	Paper Folding Test (Total Score)	x	x	x
43.	SDT	Surface Development Test (Total Score)	x	x	x
44.	MP-I	Match Problems V (Part I)	x	x	x
45.	MP-II	Match Problems V (Part II)	x	x	x

TABLE 4 (continued)

Variable Number	Code	Variable	8th Grade	11th Grade	Adult Female
46.	UT-I	Utility Test (Part I)	x	x	x
47.	UT-II	Utility Test (Part II)	x	x	x
48.	WLE-I	Word Lipreading Test, 1st 10 words, easy-to-lipread speaker	x	x	x
49.	WLD-II	Word Lipreading Test, 2nd 10 words, difficult-to-lipread speaker	x	x	x
50.	WLA-III	Word Lipreading Test, 3rd 10 words, average difficulty-to-lipread speaker	x	x	x
51.	PLD-I	Phrase Lipreading Test, 1st 10 phrases, difficult-to-lipread speaker	x	x	x
52.	PLA-II	Phrase Lipreading Test, 2nd 10 phrases, average difficulty-to-lipread speaker	x	x	x
53.	PLE-III	Phrase Lipreading Test, 3rd 10 phrases, easy-to-lipread speaker	x	x	x
54.	SLA-I	Sentence Lipreading Test, 1st 10 sentences, Average difficulty-to-lipread speaker	x	x	x
55.	SLE-II	Sentence Lipreading Test, 2nd 10 sentences, easy-to-lipread speaker	x	x	x
56.	SLD-III	Sentence Lipreading Test, 3rd 10 sentences, difficult-to-lipread speaker	x	x	x

Total Number of Variables, Each Analysis 51   54   52

Cognitive ability test scores were intercorrelated by Pearson product moment coefficients of correlation. Lipreading score distributions were skewed necessitating a dichotomous correlation coefficient. (See Appendixes C, D and E.) Phi coefficients were preferred over tetrachoric coefficients because of the more stable reliability of the phi coefficient.[1] Accordingly, intercorrelation of lipreading variables are phi coefficients. Cognitive ability test scores and lipreading scores were intercorrelated with biserial coefficients of correlation and sex, where this variable is included in an analysis, is a point biserial coefficient of correlation with cognitive ability test scores and a phi coefficient with lipreading scores.

Principal Component factors were extracted from the correlation matrix and rotated to positive manifold and simple structure by varimax procedures.[2] One (1.00) was

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[1] "The tetrachoric r is less reliable than the Pearson r, being at least 50 per cent more variable. . . To attain the same degree of reliability in the tetrachoric r as in a Pearson r, one needs more than twice the number of cases in a sample." p. 330. "Phi is actually a product-moment coefficient of correlation. Its formula is a variation of Pearson's fundamental equation. . ." p. 335. J.P. Guilford, Fundamental Statistics in Psychology and Education, 4th ed., (New York: McGraw-Hill Book Company, 1956).

[2] Data processing was under the direction of Dr. Philip R. Merrifield, Director, Bureau of Educational Research, Kent State University.

placed in the diagonal entry of the correlation matrix and communalities reestimated for each iteration. Factors were extracted until eigenvalues approached .80. This is beyond the customary value of an eigenvalue of 1.00 for signaling the cessation of extractions. However, because communalities were reestimated and because of the desire to extract all relevant variance, the lower limit of .80 was used. Two terminal extracted factors have little to contribute to the solution of the problem, but it was felt that this was an error on the conservative side. Correlation and principal component matrices are appended.

With respect to reliability estimates, it was planned to use communalities as lower bound estimates of reliability of the factor analytic variables. This procedure was followed for two reasons. In the first place they were available as a by product of the factor analyses. In the second place internal consistency estimates of reliability would have been misapplied on the speeded tests and obtaining test-retest reliabilities would have placed a burden of considerable magnitude on the investigation. Most examinees felt that had contributed yomen service to the investigation by taking six hours of tests.

Lipreading variables.--Because of the importance of
the criterion measures of lipreading to the study, the
lipreading variables were factor analyzed separately from
the tests of cognitive abilities. Each sample, the Eighth
Grade, the Eleventh Grade and the Adult Female samples were
factor analyzed. Correlation matrices and unrotated and ro-
tated factor matrices appear in Appendix F for the Eighth Grade
analysis, in Appendix G for the Eleventh Grade analysis,
and Appendix H for the Adult Female sample.

Lipreading and cognitive ability variables.--The prin-
cipal factor analyses, or the factor analysis of lipreading
and cognitive ability test scores were also performed for
the Eighth Grade, the Eleventh Grade and the Adult Female
samples. For the Eighth Grade analysis, the correlation
matrix appears in Appendix J. The unrotated factor matrix
is presented in Appendix K, the rotated factor matrix in
Appendix L, and the Eighth Grade sample factors in Appen-
dix M. Variables included in the Eighth Grade analysis
together with their communalities, means and standard
deviations are presented in Appendix I.

The same kinds of information and data for the Eleventh Grade factor analysis are presented in Appendices N, O, P, Q and R. Similar information about the Adult Female sample is presented in Appendices S, T, U, V and W.

Regression Analysis

A regression analysis was undertaken to evaluate the relative contribution of the independent variables, the tests of cognitive abilities, to total lipreading-ability variance. In this analysis, the three Word Lipreading variables were combined to form a single Word Lipreading score for each subject. In a similar fashion, the Phrase Lipreading variables were combined as were the Sentence Lipreading variables. Total scores formed in this way were C scaled to minimize skewness and the C-scaled lipreading scores were correlated with measures of cognitive abilities using a stepwise multiple regression equation correlation program. Multiple regressions were computed for the three factor analytic samples and for an additional sample, the Adult Male sample. Multiple correlations were discontinued when the addition of a new variable failed to produce a significant increment in the multiple coefficient of correlation.

CHAPTER III

RESULTS

Analysis of the Criteria of Lipreading

Psychometric Analysis.--Appendixes C, D and E present

frequency distributions of each lipreading variable for

each sample of lipreaders. For example, a distribution

of scores obtained from the Eighth Grade, the Eleventh

Grade, and the Adult Female samples of lipreaders for the

three Word, the three Phrase and the three Sentence Lip-

reading variables was prepared. Because of skewness in

the score distribution, medians and semi-interquartile

ranges were computed instead of means and standard devia-

tions. Median scores were converted into proportions

based on the number of words in the variable in order to

form equivalent units for the purposes of comparison. The

Word medians were divided by 10 for example, and the

Phrase medians by 32, 26 and 29, or the number of words

in variables 51, 52 and 53. Sentence medians were divided

by 61, 71 and 68, or the number of words in variables 54,

55 and 56.

Median scores and corresponding proportions are pre-
sented in Table 4 but because relationships between the
several variables are not readily apparent from the Table,
proportions of average lipreading performance are pre-
sented graphically in Figures 2, 3 and 4. Figure 2
shows that average performance resulting from the
Difficult-to-Lipread speaker is consistent for the three
groups of lipreaders. Average performance is quite low
in all cases. The Figure also shows complex relationships
between lipreadability of speaker and language structure.
Figure 3 suggests that there is little difference in
average lipreading performance between the Eighth Grade,
the Eleventh Grade and the Adult Female samples of lip-
readers if lipreadability of speaker is held constant.
Figure 3 also shows that the Easy-to-Lipread and the
Average Difficulty-to-Lipread speakers exchange places
for Words and Phrases. That is to say, the Easy-to-
Lipread speaker is in second position for Words but in
first position, or easiest to lipread, for Phrases and
Sentences. The Difficult-to-Lipread speaker is, however,
consistently difficult to lipread. The Adult Female
sample of lipreaders were the best lipreaders, on the

TABLE 5

SUMMARY TABLE

MEDIAN LIPREADING SCORES AND PROPORTIONS[1] BY
EXPERIMENTAL SAMPLE

	Samples					
	Eighth Grade		Eleventh Grade		Adult Female	
Variable[2]	Median	P	Median	P	Median	P
48. WLE-I	1.26	(.13)	1.18	(.12)	1.38	(.21)
49. WLD-II	0.83	(.08)	0.91	(.09	0.67	(.07)
50. WLA-III	2.94	(.29)	2.43	(.24)	2.46	(.25)
51. PLD-I	2.92	(.09)	3.93	(.12)	3.53	(.11)
52. PLA-II	4.45	(.17)	6.64	(.26)	7.32	(.28)
53. PLE-III	6.00	(.21)	8.61	(.29)	6.50	(.23)
54. SLA-I	3.42	(.06)	10.23	(.17)	13.16	(.21)
55. SLE-II	15.84	(.22)	16.00	(.24)	17.22	(.24)
56. SLD-III	0.43	(.01)	0.75	(.01)	1.71	(.03)

[1]Median scores divided by the total number of words in the variable.

[2]Variable names are presented in Table 3.

p

. Easy-to-Lipread Speaker
x Average Difficulty-to-Lipread Speaker
o Difficult-to-Lipread Speaker

.35
.30
.25
.20
.15
.10
.05
00

W   P   S   W   P   S   W   P   S

8th Grade   11th Grade   Adult Female
Sample   Sample   Sample
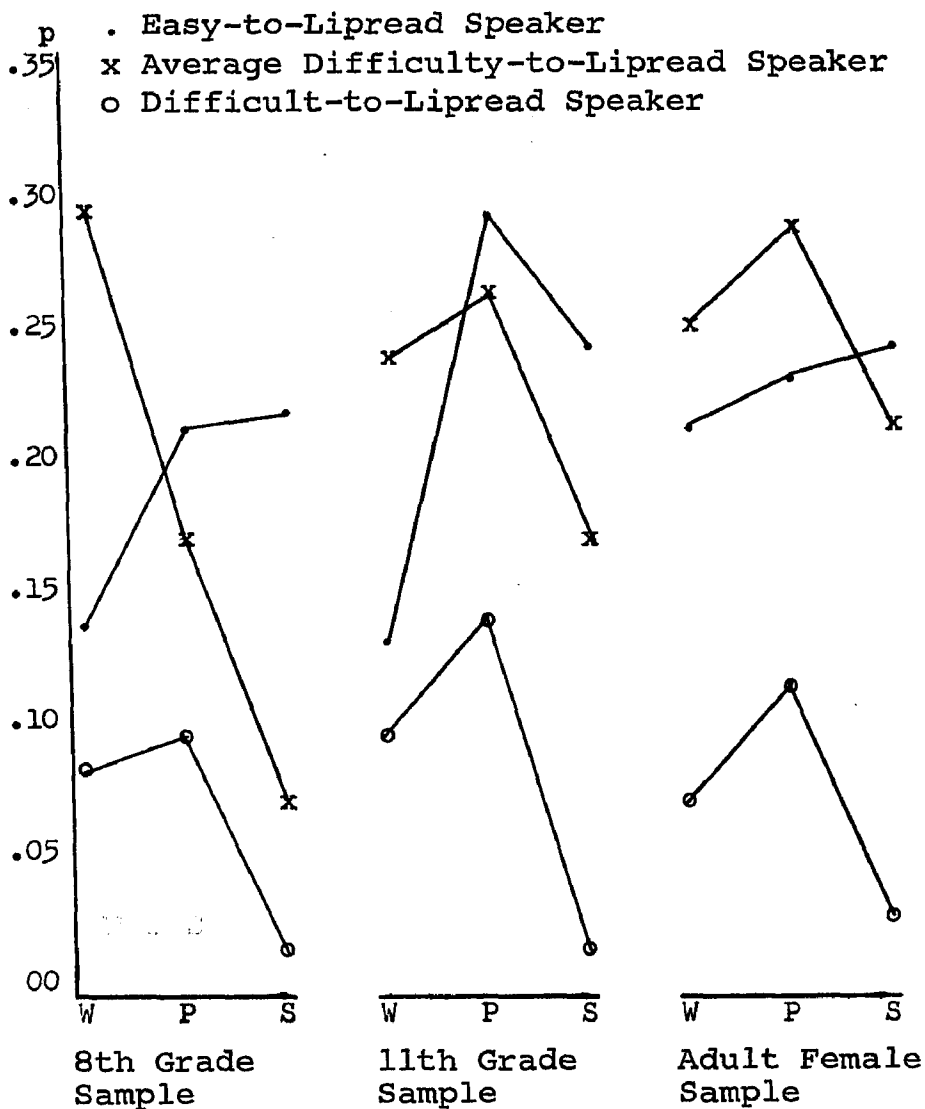
Figure 2.--Median Proportion Lipreading Scores by
Language Structure and Lipreadability Speaker.

W Word Lipreading Test
P Phrase Lipreading Test
S Sentence Lipreading Test
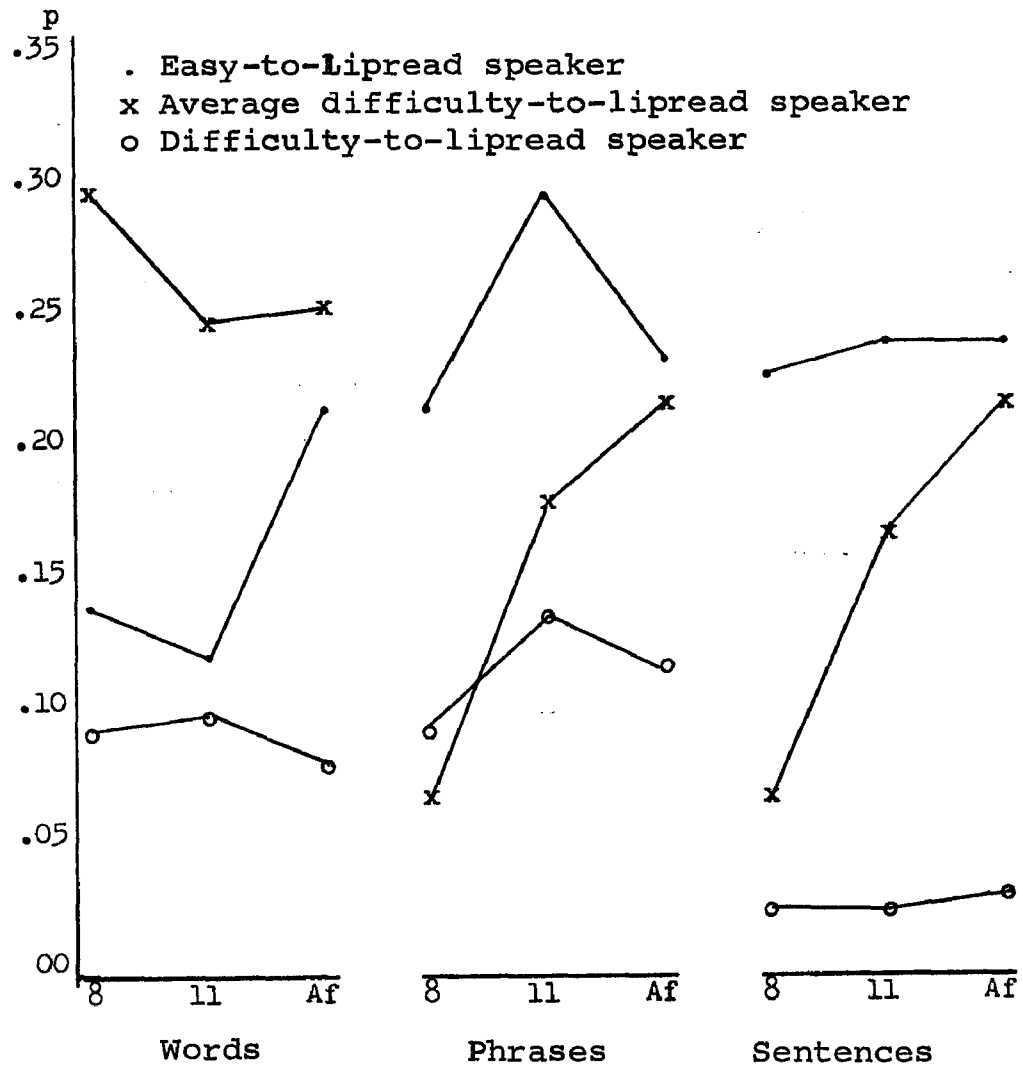
Figure 3.--Median-Proportion Lipreading Scores by
Experimental Group and Lipreadability of Speaker.

  8 Eighth Grade Sample
 11 Eleventh Grade Sample
 Af Adult Female Sample
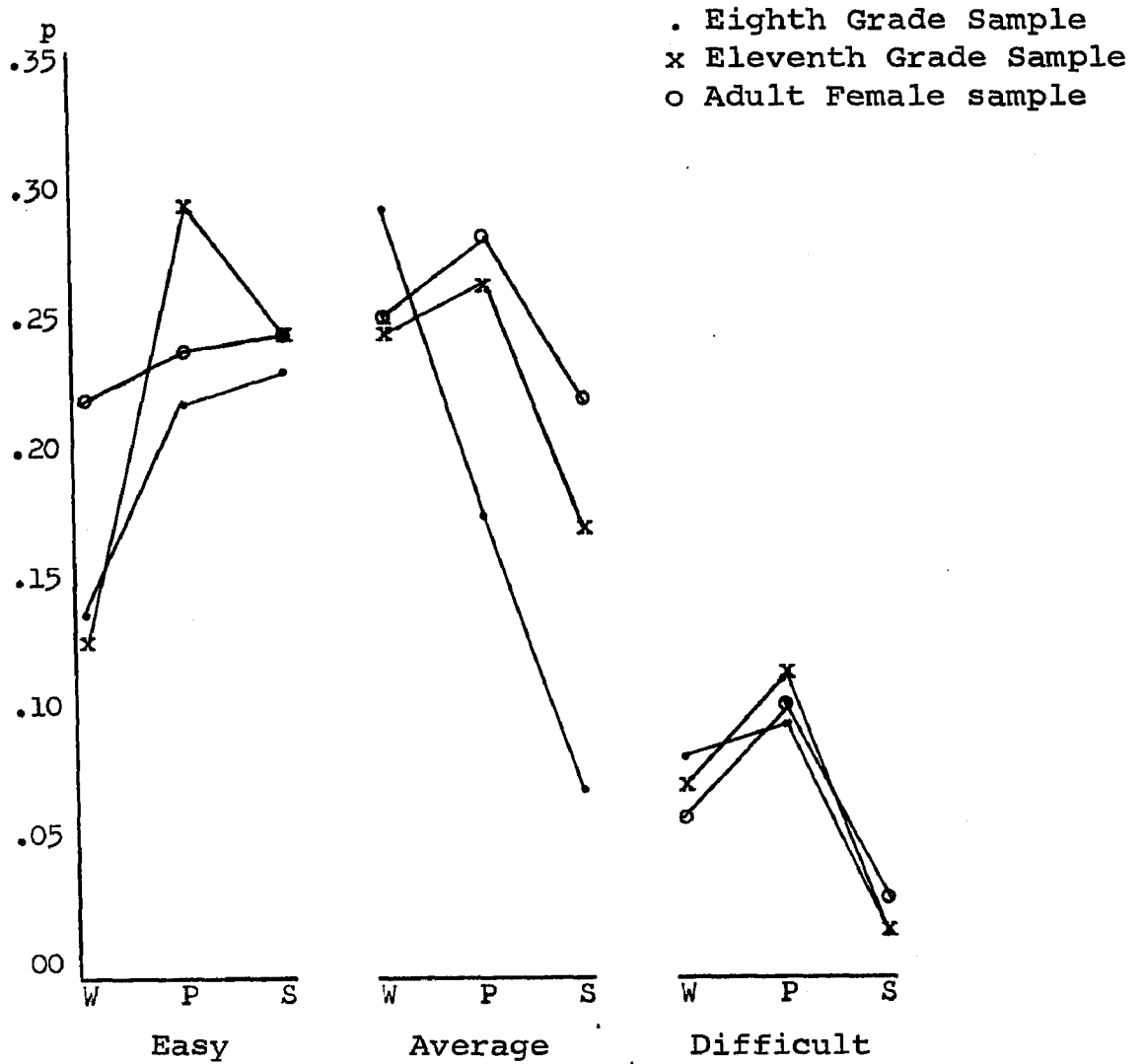
Figure 4.--Median-Proportion Lipreading Scores by
Language Structure and Experimental Group.

  W Word Lipreading Test
  P Phrase Lipreading Test
  S Sentence Lipreading Test

average, for Sentences; the Eleventh Grade lipreaders were generally the best lipreaders for Phrases, there is one exception, and the Eighth Grade was generally the better lipreaders for Words, again there is an exception.

Figure 4 shows, with two exceptions, that average lipreading performance was poorest for Sentences, best for Phrases, with no exception, for the Average and Difficult-to-Lipread speakers. For the Easy-to-Lipread speaker, Phrases are again the easiest to lipread, but Sentences are in second position and Words are the most difficult to lipread.

The psychometric analysis of lipreading criteria suggest that lipreadability of speaker is perhaps the most influential on lipreading of the variables analyzed in this investigation. Language structure is also influential but not in the way hypothesized. It would appear that phrases are the most appropriate unit of language structure for lipreaders and that words and sentences are more difficult than phrases for the lipreader. Finally, it would appear that age and sex differences examined in this study were not differentially influential with respect to average lipreading performance.

Factor Analysis of the Lipreading Variables.--Factor
analysis of the nine lipreading variables revealed what
appear to be a single lipreading factor. Two factors were
extracted in each analysis but the first factor contains
the major proportion of common variance. No meaningful
interpretation could be made with respect to speaker dif-
ficulty or language structure. The results suggest a
general lipreading factor in each analysis. The correla-
tion matrix and the unrotated and rotated factor matrices
for the three analyses are presented in Appendixes F, G
and H.

Analysis of the Cognitive
Structure of Lipreading

Analysis of the Eighth Grade Sample.--Thirteen prin-
cipal component factors were extracted from the fifty-one
cognitive ability and lipreading variable factor matrix.
Twelve of the thirteen extracted factors were rotated to
simple structure and positive manifold by varimax proce-
dures. The thirteenth factor had little common variance
to contribute to the solution and was not included in the
rotations.

Two lipreading factors were isolated in the Eighth Grade analysis. Factor A contained two lipreading variables and measures of fluency and flexibility abilities. For example, measures of the cognitive abilities, Ideational Fluency, Associational Fluency, Word Fluency, Expressional Fluency and Semantic Spontaneous Flexibility load significantly on this factor. The several cognitive abilities suggest the rapid, fluent, flexible generation and use of language to underly this factor. Factor A was tentatively identified as Ideational Fluency.

Factor F contains seven of the nine lipreading variables and measures of Associative (Rote) Memory, Syllogistic Reasoning, Ideational Fluency and sex. The positive loading of sex favors female lipreaders due to the way this variable was scored. Sex was interpreted as Attention to Detail, an ability similar to Perceptual Speed but more comprehensive in nature. Factor F has been identified as a General Lipreading Ability. It contains word, phrase and sentence lipreading variables and easy, average and difficult to lipread speakers.

Of the remaining ten factors, one is a doublet and the remaining nine, were identified as General Reasoning,

Spatial Scanning, Perceptual Speed, Associative (Rote)

Memory, Memory Span, Verbal Comprehension, Syllogistic

Reasoning, Semantic Redefinition and Speed of Closure.

Communalities, Means, and Standard Deviations of

variables included in the Eighth Grade analysis are pre-

sented in Appendix I. The correlation matrix of the fifty-

one cognitive and lipreading variables appears in Appendix

J. The unrotated factor matrix is presented in Appendix K

and the rotated factor matrix in Appendix L. The Eighth

Grade factors appear in Appendix M.

 Analysis of the Eleventh Grade Sample.--Fifty-four

cognitive and lipreading variables were factor analyzed in

the Eleventh Grade analysis. Seventeen factors were ex-

tracted and sixteen of them rotated to positive manifold

and simple structure. The seventeenth factor had little

to contribute and was omitted from the solution of the

problem.

Five lipreading factors were isolated in the Eleventh

Grade analysis. They have been identified as General Lip-

reading, Factor B; Numerical Ability, Factor I; Word Lip-

reading, Factor J; Perceptual Speed, Factor N and Sentence

Lipreading, Factor O.

Of the remaining eleven factors, three are doublets and one is a singlet. Of the remaining seven factors, not doublets or singlets or lipreading factors, tentative identifications are offered. For example, Factor A has been identified as Verbal Comprehension; Factor C as Associative (Rote) Memory; Factor D as Semantic Spontaneous Flexibility; Factor E as Spatial Orientation; Factor F as Length Estimation; Factor G as Memory Span, and Factor H as Spatial Scanning.

Appendicized tables and matrices are as follows: Communalities, means and standard deviations of variables included in the Eleventh Grade analysis, Appendix N; correlation matrix of fifty-four cognitive and lipreading variables, Appendix O; unrotated factor matrix, Appendix P; rotated factor matrix, Appendix Q and Eleventh Grade factors, Appendix R.

Analysis of the Adult Female Sample.--Fifty-two cognitive and lipreading variables were factor analyzed in the Adult Female analysis. Thirteen factors were extracted from the correlation matrix and the thirteen were rotated to positive manifold and simple structure by varimax method. Four lipreading factors were isolated. The Four

factors have been identified as General Lipreading, Factor

B; Word Lipreading, Factor J; Word Fluency, Factor K and

Syllogistic Reasoning, Factor L.

The remaining nine factors have been identified as

Perceptual Speed, Semantic Spontaneous Flexibility, Visuali-

zation, Spatial Scanning, Verbal Comprehension, Memory

Span, Associative (Rote) Memory, Numerical Ability, and

Speed of Closure.

The appendicized tables and matrices associated with

the Adult Female analysis are: Appendix S, communalities,

means and standard deviations of variables included in the

analysis; Appendix T, the correlation matrix of the fifty-

two cognitive and lipreading variables; Appendix U, un-

rotated factor matrix; Appendix V, rotated factor matrix

and Appendix W, Adult Female sample factors.

Summary of the results.--Thirty-five interpertable

factors were isolated in the three analyses. The factors

are presented in Table 5. Eleven of the thirty-five are

described as lipreading factors in that they have one or

more lipreading variables loading significantly on the

factor. One of the factors was isolated in the three

analyses and one was isolated in two analyses. The re-
maining six lipreading factors were isolated in just one
analysis.

Regression Analysis

Multiple coefficients of correlation and beta weights
for the Word Lipreading Test are presented in Appendix X;
for the Phrase Lipreading Test, the coefficient and beta
weights are presented in Appendix Y and similar information
for the Sentence Lipreading Test appear in Appendix Z. In
addition to the Eighth Grade, the Elventh Grade and the
Adult Female samples of lipreaders, an Adult Male sample
has been added. The results of these twelve regression
analyses are summarized in Table 6.

Measures of fourteen cognitive abilities, including
sex or Attention to Detail appear thirty-five times in the
twelve analyses. Sex favoring female lipreaders, has the
most frequently appearing beta weight. Perceptual Speed
and Speed of Closure are the next most frequently appear-
ing beta weights, appearing five times each for these two
independent variables. Beta weights of measures for
Associational (Rote) Memory and Figural Adaptive Flexi-
bility appear three times each; Number Ability, Flexibility

TABLE 6

SUMMARY TABLE

FACTORS ISOLATED IN THREE FACTOR ANALYSES

8th Grade Analysis	11th Grade Analysis	Adult Female Analysis
A. Ideational Fluency	A. Verbal Comprehension	A. Perceptual Speed
B. General Reasoning	*B. General Lipreading	*B. General Lipreading
C. Spatial Scanning	C. Associative (Rote) Memory	C. Semantic Spontaneous Flexibility
D. Perceptual Speec	D. Semantic Spontaneous Flexibility	D. Visualization
E. Associative (Rote) Memory	E. Spatial Orientation	E. Spatial Scanning
*F. General Lipreading	F. Length Estimation	F. Verbal Comprehension
G. Memory Span	G. Memory Span	G. Memory Span
H. Verbal Comprehension	H. Spatial Scanning	H. Associative (Rote)Memory
I. Syllogistic Reasoning	*I. Numerical Ability	I. Numerical Ability
J. Doublet	*J. Word Lipreading	*J. Word Lipreading
K. Semantic Redefinition	K. Doublet	*K. Word Fluency
L. Speed of Closure	L. Singlet	*L. Syllogistic Reasoning
	M. Doublet	M. Speed of Closure
	*N. Perceptual Speed	
	*O. Sentence Lipreading	
	P. Doublet	

*Lipreading Factors

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TABLE 7

SUMMARY TABLE

BETA WEIGHTS[1] BY COGNITIVE ABILITIES FOR LIPREADING TESTS

Lipreading Tests and Sample Populations[2]

Cognitive Abilities	Words				Phrases				Sentences				Total
	8	11	Af	Am	8	11	Af	Am	8	11	Af	Am	
Attention to Detail	51	63			59	37			66	47			6
Perceptual Speed						25			16	27	18	27	5
Number Ability	19				16								2
Figural Adaptive Flexibility		26		28					-23				3
Flexibility of Closure		-25				-26							2
Expressional Fluency			25										1
Ideational Fluency							36						1
Visualization						37				22			2
Length Estimation			20					-25					2
Spatial Scanning				-33									1
General Reasoning		31											1
Speed of Closure	21	30						40	19	29			5
Associational (Rote) Memory								28		21		24	3
Verbal Comprehension											20		1
Total	3	5	2	2	2	4	1	3	4	5	2	2	35
R1	60	67	34	35	70	60	36	53	72	71	30	37	

[1]Decimal points omitted

[2]8 Eighth Grade sample   11 Eleventh Gr sample

Af Adult Female Sample   Am Adult male sample

of Closure, Visualization, and Length Estimation, have

two beta weights for their independent measures and

Expressional Fluency, Ideational Fluency, Spatial Scan-

ning, General Reasoning Verbal Comprehension have one

beta weight each for their measures.

With respect to the four samples, the Eleventh Grade

sample has five independent variables each for Sentence

Test of Lipreading and Word Test of Lipreading. Samples

having four independent variables contributing to lip-

reading variance is the Eighth Grade sample for Sentences

and the Eleventh Grade sample for Phrases. The Eighth

Grade sample has three independent variables which contri-

bute to Word Test of Lipreading variance and the Adult

Male sample has three independent variables which contri-

bute to the Phrase Test of Lipreading variance. Two

independent-variable contributors are the Adult Female

sample for Words, the Adult Male sample for Words, the

Eighth Grade sample for Phrases, the Adult Female sample

and the Adult Male sample for Sentences. The Adult Female

sample has one independent variable as a contributor to

the Phrase test of lipreading variance.

Coefficients of multiple correlation range in value from .72 to .30. Coefficients for the Word Test of Lipreading are slightly lower than for the Phrase and Sentence Test of Lipreading. The Adult Male and the Adult Female samples have the lowest coefficients ranging in value from .30 to .37. The Eighth Grade and Eleventh Grade samples have multiple coefficients of correlation in the .60's and .70's.

CHAPTER IV

DISCUSSION

The Cognitive Structure of Lipreading

Lipreading Factors.--Among the thirty-five interpertable

factors isolated in the three factor analyses, eleven are

described as lipreading factors in that one of more lip-

reading variables loaded on the factor in a significant way.

One lipreading factor was isolated in three analyses and

one was isolated in two analyses. The remaining five fac-

tors were isolated in a single analysis. The lipreading

factors are:

1. General Lipreading Ability (isolated in three
    analyses)

2. Word Lipreading Ability (isolated in two analyses)

3. Ideational Fluency (isolated in a single analysis)

4. Numerical Ability (isolated in a single analysis)

5. Perceptual Speed (isolated in a single analysis)

6. Sentence Lipreading Ability (isolated in a single
    analysis)

7. Syllogistic Reasoning (isolated in a single
    analysis).

The General Lipreading Ability factor suggests a generalized ability to lipread for differing kinds of language material and for speakers of differing difficulty to lipread. That is to say, words, phrases and sentences and easy, average and difficult-to-lipread speakers are all contained in this ability. The factor is supported by the preliminary factor analyses of lipreading variables in which a general lipreading factor was derived from each analysis. General Lipreading Ability is also supported by research[1] in which it was found that the relative rank order with respect to lipreading ability was maintained under diverse lipreading conditions. The ability does not imply that a lipreader will lipread all speakers with equal ease and all language stimuli with equal facility. It does suggest however that relative rank order of lip-readers in a group will be constant for differing conditions of lipreading. Credibility of General Lipreading Ability is enhanced by the fact that it was isolated three times.

---

[1]Gordon Taaffe, op. cit., p. 10.

In contrast to the generality of lipreading suggested
by General Lipreading Ability, Word Lipreading Ability
indicates some specificity of lipreading ability. Word
Lipreading Ability contains word and phrase lipreading
variables in Factor J of the Adult Female sample analysis
and Concealed Words Test, Associational Fluency, Gestalt
Transformation in addition to word lipreading variables
in Factor J in the Eleventh Grade analysis. The implica-
tion is that language units shorter than sentences are the
important underlying dimension. Word Lipreading Ability
was isolated in two analyses suggesting a stable finding.

Ideational Fluency contains only sentence lipreading
variables. Variables 54 and 56, or the variables contain-
ing the average and difficult-to-lipread speakers for the
first ten and last ten sentences load significantly on this
factor. The remaining variables loading significantly are
measures of Fluency and Flexibility abilities. For example,
in addition to Ideational Fluency which is the lead varia-
ble, measures of Associational Fluency, Expressional Fluency
and Semantic Spontaneous Flexibility appear in this factor.
The structure for Ideational Fluency stresses the rapid,
fluent and flexible generation and use of language as the
important underlying dimension in lipreading sentences.

Numerical Ability, Factor I in the Eleventh Grade

analysis, contains two measures of numerical ability and

measures of Visualization, Perceptual Speed and Attention

to Detail. Phrase and word lipreading variables load sig-

nificantly on this factor. It would appear that the unifying

underlying dimension for Numerical Ability is Perceptual

ability. The two numerical tests treat rapid computations

of simple arithmetic problems. The other measures are also

concerned with the rapid perception of detail.

Perceptual Speed, Factor N in the Eleventh Grade analy-

sis, contains Perceptual Speed as the lead variable and

measures of Length Estimation, Attention to Detail, and

word, phrase and sentence lipreading variables. Whereas

Perceptual Speed measured by Part I and Part II of Number

Comparison Test had the lowest loadings on Factor I above,

Number Comparisons Part II is the leading variable on

Factor N. Factor I and N are similar with respect to their

cognitive structure and it would appear that the underly-

ing ability for Factor N is also Perceptual Speed.

Sentence Lipreading Ability contains measures of Flexi-

bility of Closure, Syllogistic Reasoning and Length Estima-

tion. The cognitive-ability variables are spatial and

reasoning in type. While Fluency and Flexibility abilities were found to be important in lipreading sentences in the Ideational Fluency factor, the sentence lipreading factor suggests that space and reasoning are also elements in lipreading sentences. These abilities might be generalized as "facility with language," for Ideational Fluency and "Visual Reasoning" for Sentence Lipreading Ability.

Syllogistic Reasoning, Factor L in the Adult Female analysis contains in addition to Syllogistic Reasoning, measures of General Reasoning, Associational Fluency and variable 56, Sentence Lipreading Test, Difficult-to-Lipread speaker. Both this factor and the previous one emphasize the importance of reasoning in lipreading sentences. Apparently lipreading units of language shorter than sentences demands more perceptual than reasoning abilities.

The Cognitive Structure of Lipreading.--The factorial structure of lipreading suggested by the seven lipreading factors is both specific and general. Lipreading is apparently both a general ability for diverse stimuli and specific for words, for phrases and for sentences. The

cognitive structure reflected through factorial structure

implies that verbal skills, perceptual abilities, reason-

ing and visualization are important in lipreading. Cogni-

tive abilities loading significantly on lipreading factors

have been tabulated in Table 8.. The Table shows that

measures of 12 fluency abilities, 11 visual abilities, 4

reasoning abilities, 4 flexibility abilities, 2 numerical

abilities, 1 memory ability, and 1 redefinition ability had

significant loadings on the lipreading factors.

With respect to the fluency abilities, measures of

Association Fluency and Word Fluency appeared four times

in the factor analyses. Measures of Ideational Fluency

appeared three times and Expressional Fluency appeared a

single time. The factor loadings range in value from .70

to .30, or from very significant to low significance.

Associational Fluency, measured by the rapid generation of

synoyms, is described as "the ability to produce words

from a restricted area of meaning and involving an aware-

ness of the similarity of meanings of words."[1] Word Fluency

is described as "facility in producing isolated words that

contain one or more structural, essentially phonetic,

---

[1] French, Ekstrom, and Price, op. cit., p. 12.

TABLE 8

SUMMARY TABLE

COGNITIVE ABILITIES LOADING SIGNIFICANTLY ON
LIPREADING FACTORS

Fluency Abilities · Location and Loading[1]		Total
1. Associational Fluency (8-A .59, .36; 11-J .32; A-L .31)		4
2. Word Fluency (8-A .46; 8-F .47; 11-K .46, .42)		4
3. Ideational Fluency (8-A .70, .30; 8-F .30)		3
4. Expressional Fluency (8-A .39)		1
	Total	12

Visual Abilities
1. Perceptual Speec (11-B .40; 11-I .36; .34; 11-N .58)		4
2. Attention to Detail (Sex) (8-F .77; 11-I .48; 11-N .39)		3
3. Length Estimation (11-N .43; 11-O .31)		2
4. Visualization (11-I .37)		1
5. Speed of Closure (11-J .39)		1
	Total	11

Reasoning Abilities
1. Syllogistic Reasoning (8-F .31; 11-O .35; A-L .53)		3
2. General Reasoning (A-L .40)		1
	Total	4

Flexibility Abilities
1. Flexibility of Closure (11-O .39, .39)		2
2. Semantic Spontaneous Flexibility (8-A .37)		1
3. Figural Adaptive Flexibility (A-K .39)		1
	Total	4

TABLE 8 (continued)

	Location and Loading	Total
Number Ability		
1. Number Ability (11-I .62, .57)		2
Memory Ability		
1. Associative (Rote) Memory (8-F .33)		1
Semantic Redefinition		
1. Semantic Redefinition (11-J .30)		1
	Grand Total	35

[1] 8 Eighth Grade Analysis, factors A and F
11 Eleventh Grade Analysis, factors B, I, J, N, O
A Adult Female Sample, factors B, J, K, L

restrictions without reference to the meaning of thw
words."[1] Ideational Fluency is described as "a facility
to call up ideas wherein quantity and not quality of ideas
is emphasized."[2] Expressional Fluency is described as
"the ability to think rapidly of appropriate wording for
ideas."[3] These four fluency abilities emphasize the rapid,
fluent generation and use of verbal materials.

Among the visual abilities, measures of Perceptual
Speed appeared four times in the lipreading factors. Atten-
tion to Detail, or sex favoring the female lipreader,
appeared three times. Measures of Length Estimation
appeared twice and measures of Visualization and Speed of
Closure appeared a single time each. Factor loadings
varied between .77 for Attention to Detail to .31 for
Length Estimation. Perceptual Speed is described as
"speed in finding figures, making comparisons, and carry-
ing out other very simple tasks involving visual percep-
tion."[4] Attention to Detail or the sex variable in

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[1] Ibid., p. 17.

[2] Ibid., p. 15.

[3] Ibid., p. 14.

[4] Ibid., p. 31.

lipreading favoring female lipreaders is described by this
investigator as an ability similar to Perceptual Speed but
more comprehensive for perceptual stimuli than Perceptual
Speed. The intended meaning is somewhat contradictory, in
that the attention for detail is for a broad visual field,
and not a narrow task such as comparing numbers on a test.
Length Estimation is a spatial ability described as "the
ability to judge and compare visually perceived distances
on paper."[1] Visualization on the other hand is described
as "the ability to manipulate or transform the image or
spatial patterns into other visual arrangements."[2] Tests
of Visualization require the examinee to mentally manipu-
late two dimensional objects in a three dimensional space.
Speed is usually not a critical factor for success in
Visualization. Speed of Closure is described as "the
ability to unify a disparit perceptual field into a single
percept."[3] Speed of Closure tests present ambiguous images
that require the examinee to fill in detail mentally. The

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[1] Ibid., p. 21.

[2] Ibid., p. 47.

[3] Ibid., p. 11.

visual abilities demand observation, comparison, evalua-

tion, mental manipulation and the filling in of missing

stimuli mentally by the examinees. In some of the tasks,

speed is a factor and in others it is not.

With respect to the reasoning abilities, Syllogistic

Reasoning appeared three times and General Reasoning

appeared a single time. The factor loadings are from low

to moderate. The highest loading is .53 and the lowest

loading .31. Syllogistic Reasoning is described as "the

ability to reason from stated premises to their necessary

conclusions."[1] General Reasoning is described "as the

ability to solve a broad range of reasoning problems

including those of a mathematical nature."[2] Both abstract

and problem solving reasoning appear to be important in

lipreading.

Flexibility of Closure appearing twice in the factor

analyses, is described "as the ability to keep one or more

definite configurations in mind so as to make identifica-

tion in spite of perceptual distractions."[3] Flexibility of

Closure was measured in this investigation by tests

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[1] _Ibid._, p. 37.

[2] _Ibid._, p. 33.

[3] _Ibid._, p. 9.

containing visual stimuli. To be successful on the test,
the examinee had to overcome the influence of visual dis-
tractions presented to him. Semantic Spontaneous Flexi-
bility on the other hand is a verbal type of flexibility.
It is described as the "ability to produce a diversity of
verbally expressed ideas in a situation that is relatively
unrestricted."[1] Figural Adaptive Flexibility is similar
to Flexibility of Closure in that the stimuli are visual.
No distracting materials are presented in the test situa-
tion but rather a visual problem is presented to the
examinee. Figural Adaptive Flexibility is described as
"the ability to change set in order to meet new require-
ments imposed by figural problems."[2]

Numerical Ability, measured by Arithmetic Operations
and Employee Aptitude Survey Test Number 2, Numerical
Ability, appeared twice, once for each measure, on a lip-
reading factor. Numerical ability is described as the
ability to make rapid and accurate arithmetic computations.
Although Numerical Ability is often a predictor of mathe-
matical aptitude, the loadings in this investigation were
interpreted in the light of perceptual abilities.

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[1]Ibid., p. 50.

[2]Ibid., p. 49.

Associative (Rote) Memory is described as "the ability
to remember bits of unrelated material."[1] The test used
to measure Associative (Rote) Memory required the examinee
to associate first and last names from memory. It is
interesting to note that Memory Span, measured by the pre-
sentation of digits did not load significantly on lip-
reading factors in this investigation.

Semantic Redefinition is described as "the ability to
shift the function of an object or part of an object and
use it in a new way."[2] Semantic redefinition requires
creativity, originality and problem solving.

The five cognitive abilities not represented by sig-
nificant factor loadings on the lipreading factors are
Induction, Memory Span, Spatial Orientation, Spatial
Scanning and Verbal Comprehension.

Induction is a reasoning ability described as "abili-
ties involved in the finding of general concepts that will
fit sets of data; the forming and trying out of hypotheses."[3]
Memory Span is described as "the ability to recall perfectly

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[1] _Ibid._, p. 22.

[2] _Ibid._, p. 35.

[3] _Ibid._, p. 19.

for immediate reproduction a series of items after only

one presentation of the series."[1] Spatial Orientation is

described as "the ability to perceive spatial patterns or

to maintain orientation with respect to objects in space."[2]

Spatial Scanning is described as "speed in exploring a

wide or complicated spatial field."[3] Verbal Comprehension

is described as "the ability to understand the English

language."[4] The five abilities were of course hypothesized

to be important in lipreading and they still appear to this

investigator to be logically important in lipreading. Ver-

bal comprehension may not have loaded significantly on any

of the lipreading factors in this study because the lan-

guage of the lipreading tests was quite simple and the

language of the vocabulary test used in this investigation

was sufficiently difficult to gain discrimination among

college students.

In summary it would appear that fluency cognitive

abilities are important in lipreading and that visual

abilities, especially those related to perception of detail

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[1]Ibid., p. 26.

[2]Ibid., p. 40.

[3]Ibid., p. 42.

[4]French, et al, op. cit.,

are also quite important in lipreading. Both abstract and
general reasoning appear to be necessary for success in
lipreading with abstract reasoning perhaps more important
than general reasoning. Reasoning abilities appear to be a
special requirement for lipreading sentences whereas per-
ceptual abilities appear to be more important for words and
phrases. Verbal, visual and flexibility cognitive abilities
appear to be important in lipreading as well. Memory by
association is important in lipreading whereas memory by
perfect recall does not appear to be influential. Finally,
a creative thinking ability, Semantic Redefinition is also
of some importance in lipreading.

Regression Analysis.--Results of the regression analy-
sis support generally the results of the factor analysis.
Measures of the same cognitive abilities with the exception
of Verbal Comprehension appear in both analyses. Verbal
Comprehension did not appear in the Factor Analyses.

Among the thirty-five independent variables appearing
in the twelve regression analyses, Attention to Detail, or
sex favoring female lipreaders, appeared most frequently
even though sex was only included in six of the twelve

analyses. Sex of course could not be a variable in the adult male and the adult female analyses. Attention to Detail beta weights ranged in value .37 to .66. Sex, where it was a variable was the largest contributor to lipreading variance. Non sex or non Attention to Detail beta weights range in value from .19 to .40. Negative beta weights for Figural Adaptive Flexibility, Flexibility of Closure, Length Estimation and Spatial Scanning suggest the need for further analysis of these variables to isolate suppressor variables or to define different scoring procedures.

Methodological Considerations

Reliability.--While the general objectives of the study were met in isolating seven lipreading factors and defining them in terms of mental processes influential in lipreading, it is also important that the methodological approach of this investigation be examined. For example, part scores of measures of cognitive abilities were used in order that the possibility of defining a factor with them would be maximized. Use of part scores was in turn a result of using as wide a range of measures of cognitive abilities as the constraints of time and money would permit. Also test administration time was arbitrarily reduced on a number of

tests for the above stated reason. It was known at the out set that these procedures would influence reliability adversely but the position was taken that should positive findings result from the investigation, reliability could be increased in future studies by increasing test administration time, thereby increasing length of test, and by adding additional tests of similar cognitive abilities. Reliability estimates in the form of communalities are presented in Table 9. The table shows that the reliability appear to be a function of the experimental group tested more than the test itself. For example the communality of variable 29, Numerical Ability varies between .58 and .89 depending upon the experimental group. Also, part scores do not necessarily have lower reliability estimates than total scores. Variables 37 and 38, Maze Tracing Speed Tests, Part I and II have reliability estimates of .86, .85, .77 and .73 for example. In fact the lowest communality for these variables is .73. Generally speaking, reliability estimates of lipreading variables included in the factor analyses are moderate or low, Gestalt Transformation, variable 31, has a low reliability estimate for all analyses as does Match Problems V, or variable 44. On the

TABLE 9

RELIABILITY ESTIMATES OF VARIABLES INCLUDED IN
THE FACTOR ANALYSIS[1]

Variable Number	Code	Variable	Factor Analyses		
			8th Grade	11th Grade	Adult Female
1.	HPT	Hidden Patterns Test (Total Score)	45	55	48
2.	CT	Copying Test (Total Score)	63	73	66
3.	GCT	Gestalt Completion Test (Total Score)	52	52	52
4.	CWT	Concealed Words Test (Total Score)	44	54	63
5.	AF-I	Associational Fluency (Part I)	45	65	53
6.	AF-II	Associational Fluency (Part II)	47	54	52
7.	SI	Similie Interpretations (Total Score)	36	67	
8.	WA	Word Arrangements (Total Score)	41	51	50
9.	TT	Topics Test (Total Score)		65	53
10.	TCT-T	Things Categories Test (Total Score)		57	64
11.	TCT-I	Things Categories Test (Part I)	36		
12.	TCT-II	Things Categories Test (Part II)	61		
13.	WBE-I	Word Beginnings and Endings Test (Part I)	66	54	56
14.	WBE-II	Word Beginnings and Endings Test (Part II)	66	45	46
15.	LT	Locations Test (Total Score)	44	66	53
16.	FC	Figure Classification (Total Score)	45	54	41
17.	ELT	Estimation of Length Test (Total Score)		66	36

TABLE 9 (continued)

Variable Number	Code	Variable	Factor Analyses 8th Grade	11th Grade	Adult Female
18.	SRT	Shortest Road Test (Total Score)	42	56	59
19.	NPT	Nearer Point Test (Total Score)	42	57	49
20.	FLNT-I	First and Last Names Test (Part I)	64	77	67
21.	FLNT-II	First and Last Names Test (Part II)	65	94	49
22.	DSV-I	Digit Span - Visual (Part I)	53	71	69
23.	DSV-II	Digit Span - Visual (Part II)	53	60	64
24.	SEX	Sex (1 = male, 2 = female)	72	83	
25.	FAT	Finding A's Test (Total Score)		54	57
26.	NCT-I	Number Comparison Test (Part I)	69	52	43
27.	NCT-II	Number Comparison Test (Part II)	71	62	58
28.	SD	Ship Destination (Total Score)	55	56	73
29.	EAS-2	Employee Aptitude Survey, Test 2, Numerical Ability (Total Score)	58	89	73
30.	AO	Arithmetic Operations (Total Score)	64	43	84
31.	GT	Gestalt Transformation (Total Score)	25	58	43
32.	OS	Object Synthesis (Total Score)	46	65	59
33.	NST	Nonsense Syllogisms Test (Total Score)	30	30	41
34.	LR	Logical Reasoning (Total Score)	44	60	64
35.	CCT-I	Cube Comparison Test (Part I)	37	74	50

TABLE 9 (continued)

Variable Number	Code	Variable	Factor Analyses 8th Grade	11th Grade	Adult Female
36.	CCT-II	Cube Comparison Test (Part II)	43	87	67
37.	MTS-I	Maze Tracing Speed Test (Part I)	79	85	84
38.	MTS-II	Maze Tracing Speed Test (Part II)	80	86	77
39.	WRVT-I	Wide Range Vocabulary Test (Part I)	52	61	73
40.	WRVT-II	Wide Range Vocabulary Test (Part II)	40	77	56
41.	FBT	Form Board Test (Total Score)		60	63
42.	PFT	Paper Folding Test (Total Score)	54	78	71
43.	SDT	Surface Development Test (Total Score)	62	71	71
44.	MP-I	Match Problems V (Part I)	38	49	58
45.	MP-II	Match Problems V (Part II)	52	74	51
46.	UT-I	Utility Test (Part I)	40	60	57
47.	UT-II	Utility Test (Part II)	34	77	73
48.	WLE-I	Word Lipreading Test, 1st 10 words, easy-to-lipread speaker	40	55	42
49.	WLD-II	Word Lipreading Test, 2nd 10 words, difficult-to-lipread speaker	33	57	44
50.	WLA-III	Word Lipreading Test, 3rd 10 words, average difficulty-to-lipread speaker	48	69	43
51.	PLD-I	Phrase Lipreading Test, 1st 10 phrases, difficult-to-lipread speaker	59	71	42

TABLE 9 (continued)

Variable Number	Code	Variable	Factor Analyses		
			8th Grade	11th Grade	Adult Female
52.	PLA-II	Phrase Lipreading Test, 2nd 10 phrases, average difficulty-to-lipread speaker	57	65	30
53.	PLE-III	Phrase Lipreading Test, 3rd 10 phrases, easy-to-lipread speaker	50	74	64
54.	SLA-I	Sentence Lipreading Test, 1st 10 sentences, average difficulty-to-lipread speaker	44—	78	61
55.	SLE-II	Sentence Lipreading Test, 2nd 10 sentences, Easy-to-lipread speaker	65	75	63
56.	SLD-III	Sentence Lipreading Test, 3rd 10 sentences, difficult-to-lipread speaker	34	65	44
	TOTAL NUMBER OF VARIABLES, EACH ANALYSIS		51	54	52

[1] Communalities obtained in each analysis. Decimal points omitted.

other hand, sex has a substantial communality in two analyses and Numerical Ability, variable 29, Maze Tracing Speed Test, Parts I and II, variables 37 and 38, generally have communalities that suggest adequate reliabilities. Other variables have high, low and moderate communalities depending on the experimental group of lipreaders.

Lipreading Variables.--In order to evaluate the methodological effects imposed on the nine lipreading variables, the variables were tabulated in two ways. Table 10 for example presents all of the lipreading variable factor loadings appearing in the lipreading factors. The table shows that the nine variables appeared thirty-six times in the three analyses. Two lipreading factors contain seven of the nine lipreading variables, one factor contains six variables, one factor contains 4 variables, one factor contains 3 variables, three factors contain 2 variables, and three lipreading factors contain 1 of the 9 lipreading variables each.

TABLE 10

SUMMARY TABLE

LIPREADING VARIABLE FACTOR LOADINGS BY EXPERIMENTAL GROUP

Lipreading Variables	Analyses and Factors[1]											
	8 A	8 F	11 B	11 I	11 J	11 N	11 O	Af B	Af J	Af K	Af L	Total
48. WLE-I		.46			.38	.37		.52				4
49. WLD-II				.49					.53			2
50. WLA-III		.59	.33		.62			.42		.30		5
51. PLD-I		.62	.74						.46			3
52. PLA-II		.58	.62			.31		.41				4
53. PLE-III		.58	.36	.54		.35		.58	.42			6
54. SLA-I	.40	.33	.53			.57		.72				5
55. SLE-II		.63	.69					.74				3
56. SLD-III	.31						.63	.39			.36	4
TOTAL	2	7	6	2	2	4	1	7	3	1	1	36

[1] 8 Eighth Grade Analysis, Factors A and F
11 Eleventh Grade Analysis, Factors, B, I, J, N and O
Af Adult Female Analysis, Factors B, J, K and L

Table 9 summarizes the results of the language struc-
ture and lipreadability variables incorporated into the
experimental design. Both dimensions were hypothesized as
being important in lipreading. While the two dimensions
do make a difference with respect to average lipreading
performance as was pointed out previously, factorial struc-
ture of these variables does not reveal the same results
as the average-performance analysis. For example, Table 11
shows that word, phrase and sentence dimensions appeared
about equally often in lipreading factors. On the other
hand, Average and Easty-to-lipread speakers showed little
difference in frequency of occurrence in the lipreading
factors, whereas the difficult-to-lipread speaker appeared
infrequently. The difficult-to-lipread speaker for words
was the most infrequently appearing lipreading variable and
the easy-to-lipread speaker for phrases appeared most fre-
quently in lipreading factors.

TABLE 11

SUMMARY TABLE

LANGUAGE STRUCTURE AND LIPREADABILITY INFLUENCES
ON LIPREADING FACTORS

Lipreadability	Language Structure			Total
	Words	Phrases	Sentences	
Difficult	2	3	4	9
Average	5	4	5	14
Easy	4	6	3	13
Total	11	13	12	36

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary.--In an attempt to isolate and define constituent lipreading abilities, factor analytic and regression analyses were performed with data obtained from hearing lipreaders. Experimental variables hypothesized to be important in lipreading were twenty-one cognitive abilities, lipreadability of speaker, structure of the language lipread, age and education of lipreaders and sex of lipreaders.

Three samples of lipreaders varying in age and education and sex were included in the factor analyses and four samples of lipreaders were included in the regression analyses.

Lipreading stimulus material varied lipreadability of speaker and language structure. Lipreaders were administered lipreading and cognitive-ability tests. Correlation matrices generated from test scores were factor analyzed. Measures of cognitive abilities loading significantly on factors containing significant lipreading variable were

used to identify the cognitive structure of lipreading.
Lipreading was described in terms of the mental processes
defined by the cognitive abilities. Regression analyses
were used to supplement information gained through factor
analysis.

Seven lipreading factors were isolated. The results
suggest both a general ability to lipread for diverse
stimulus material and specific lipreading abilities for
specific kinds of lipreading stimulus material. Seventeen
of the twenty-one cognitive abilities hypothesized as being
important in lipreading were supported. The cognitive
structure of lipreading defined by this study shows that
Fluency, Flexibility, Spatial, Visualization, Reasoning,
Memory and Perceptual cognitive abilities are important in
lipreading.

Conclusions.--This study suggests that a necessary
condition but perhaps not sufficient for success in lipread-
ing is facility with the language lipread. The investiga-
tion tends to support the oral school of thought for the
education of the deaf in this respect. Other conditions
important in lipreading are development in the lipreader of

perceptual, reasoning and visual skills. It is probable

that the results of this study pertaining to verbal skills

will not be generalizable to deaf populations while the

findings with respect to non verbal skills may be general-

izable to deaf lipreaders.

Recommendations.--It is recommended that factor

analytic studies seek to extend cognitive ability coverage

in future studies. For studies involving hearing impaired

lipreaders, Q factor analysis may be more appropriate than

R analysis. Other dimension of lipreading need also to be

experimentally varied. The speaker, the lipreader and the

lipreading stimulus material all offer variables for

experimental study.

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APPENDIX A

DESCRIPTION OF THE TESTS OF

COGNITIVE ABILITIES

APPENDIX A

DESCRIPTION OF THE TESTS OF COGNITIVE ABILITIES

Hidden Patterns Test consists of items of a given geometrical pattern in which a single given configuration is imbedded. The task is to mark each pattern in which the configuration occurs. There are 200 patterns in each of two parts of the test. The test is copyrighted by Educational Testing Service.

Copying Test contains items consisting of four-line geometrical figures in a square matrix of dots. The task is to copy the figures onto the dots. Each of two parts contains 32 figures. The test is copyrighted by Educational Testing Service.

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[1] Descriptions are taken from Manual for Kit of Cognitive Tests by John W. French, Ruth B. Ekstrom and Leighton A. Price. Princeton, New Jersey: Educational Testing Service, 1963.

Gestalt Completion Test contains drawings which are composed of black blotches representing parts of objects being portrayed. The subject writes down the name of the objects being as specific about them as he can. Each of two parts contains 10 pictures. The test is copyrighted by Educational Testing Service.

Concealed Words Test contains words with parts of each letter missing. The subject writes down the full word in an adjacent space. Each of two parts of the test contain 25 words. The test is copyrighted by Educational Testing Service.

In Associational Fluency the subject is asked to write as many synonyms as possible for each of two words given in each part. The score is the number of words written that are reasonably similar in meaning to the stimulus word. The test is copyrighted by Sheridan Supply Company.

In Simile Interpretation, incomplete sentences of the form "a woman's beauty is like the autumn because"

are presented. The task is to complete the sentence in as many ways as possible by giving different explanations for each simile. The test contains two similies, one similie for each part. It is copyrighted by J. P. Guilford.

In Word Arrangements the task is to write as many sentences as possible containing a set of four specified words. Each part contains four words. Word Arrangements is copyrighted by J. P. Guilford.

In Topics Test the task is to write as many ideas as possible about a given topic. The score is the number of separate ideas written. Each of two parts contains one topic. Topics Test is an adaptation from Calvin Taylor's version of a test by R. B. Cattell.

In Things Categories Test the subject is asked to list the names of things that are alike in some specified way. The score is the number of things listed. Each of two parts contains one category. Things Category Test is an adaptation from Taylor's Things Round, a version of a test by R. B. Cattell.

Word Beginnings and Endings Test is a test requiring the subject to write as many words as possible beginning with one given letter and ending with another. The score is the number of words written. Each of two parts contains one pair of letters. The test is copyrighted by Educational Testing Service.

In Location Test five rows of places and gaps are given for each item. In each of the first four rows, one place in each row is marked according to a rule. The task is to discover the rule and to mark the fifth numbered place in the fifth row accordingly. Each part contains 14 items, the test contains 2 parts. Locations test is copyrighted by Educational Testing Service.

In Figure Classification each item presents two or three groups each containing three geometrical figures that are alike in accordance with some rule. The second rule of each item contains 8 test figures. The task is to discover the rules and assign each test figure to one of the groups. The test contains 14 items in each part with

8 test figures. It is copyrighted by Educational Testing
Service.

Estimation of Length Test contains items which
consist of lines one-half to one and one-half inches in
length oriented at different angles. These lines are
compared with a set of five pairs of companion lines at
the center of the page. The test lines may be as long or
twice as long as the companion lines. Each of two parts
contains 40 items. The test is copyrighted by Educational
Testing Service.

Shortest Road Test contains items which consist of
two points. Three curved or angular lines are drawn be-
tween these two points. The task of the examinee is to
select the shortest of these lines. Each of two parts
contains 28 items. The test is copyrighted by Educational
TEsting Service.

Nearer Point Test contains items of two dots, a
reference point, and some distracting lines and figures.
The task is to select the dot that is nearer to the

reference point. Each of two parts contains 30 items.
Nearer Point Test is copyrighted by Educational Testing
Service.

First and Last Names Test contains full names
including first and last. The examinee studies this list
of 20 full names and later when the last names are pre-
sented to him in different order, he writes the appropriate
first names in front of each last name. The study page
contains 20 items and each test part contains 15 items.
The test is copyrighted by Educational Testing Service.

Digit Span-Visual is a test consisting of numbers
printed on cards which are presented to the examinee by
flipping over one card per second. Twelve items or twelve
numbers varying between 4 and 7 digits were used in this
investigation. The test is copyrighted by Educational
Testing Service.

Finding A's Test contains columns of 41 words,
and the task is to check the five words having the letter
A in them. The score is the number of words correctly

checked. Each of two parts contains one thousand and twenty five words. The test is copyrighted by Educational Testing Service.

In Number Comparison Test the subject inspects pairs of multi-digit numbers and indicates whether two numbers in each pair are the same or different. Each of two parts contains 48 items. The test is copyrighted by Educational Testing Service.

In Ship Destination Test the task is to use knowledge of the position of a ship with respect to a port, wind direction, ocean current, and direction of heading to compute effective distance to a port following given rules. The test contains 48 items. It is copyrighted by Sheridan Supply Co.

EAS-2, Numerical Ability, or Employee Aptitude Survey, Test 2, is a test of arithmatic ability containing three parts. Items are simple arithmatic operations in common and decimal fractions. The test is copyrighted by Psychological Services Inc.

Arithmatic Operations Test is a test of addition, multiplication and subtraction. It is copyrighted by Educational Testing Service.

In Gestalt Transformation the task is to indicate which of five listed objects has a part that will serve a specified purpose. Each of two parts contains 10 items. The test is copyrighted by Sheridan Supply Co.

In Object Synthesis the task is to name an object that could be made by combining two specified objects. Each of two parts contains twelve items. Object Synthesis is copyrighted by J. P. Guilford.

In Nonsense Syllogisms Test the subjects are presented with formal syllogisms having nonsense words so that they cannot be solved by reference to past learning. Some of the stated conclusions follow correctly from the premises and some do not. The task is to indicate which conclusions are logically correct. Each of two parts contains 15 items. The test is copyrighted by Educational Testing Service.

In Logical Reasoning the test consists of formal syllogisms for which the task is to choose the correct conclusion that can be drawn from the two given statements. Each of two parts contains 20 items. The test is copyrighted by Sheridan Supply Co.

Each item in Cube Comparison Test presents two drawings of a cube. Assuming no cube can have two faces alike, the subject is to indicate which items present drawings that can be of the same cube and which ones present drawings that cannot be of the same cube. Each of two parts contains 21 items. The test is copyrighted by Educational Testing Service.

In Maze Tracing Speed Test the task is to find and mark an open path through a moderately complex series of paper mazes. Each of two parts contains four scorable units. The test is copyrighted by Educational Testing Service.

Wide Range Vocabulary test is a five choice synonym test having items ranging from very easy to very difficult.

Each of two parts contains 24 items. The test is copyrighted by Educational Testing Service.

Each item in Form Board Test presents five shaded drawings of pieces, some or all of which can be put together to form a figure presented in outline form. The task is to indicate which of the pieces when fitted together would form an outline. Each of two parts contains 24 items. The test is copyrighted by Educational Testing Service.

In Paper Folding Test for each item successive drawings illustrate two or three folds made in a square sheet of paper. The drawing of the folded paper shows where a hole is punched in it. The subject selects one of five drawings to show how the sheet would appear when fully opened. Each of two parts contains ten items. The test is copyrighted by Educational Testing Service.

In Surface Development Test drawings are presented of solid forms that could be made with paper or sheet metal. With each drawing there is a diagram showing how a piece of paper might be cut and folded so as to make

the solid form. Dotted lines show where the paper is folded. One part of the diagram is marked to correspond to a marked surface in the drawing. The subject is to indicate which lettered edges in the drawing fit together or fit the dotted lines in the diagram. Each of two parts contains five items each, of six drawings. The test is copyrighted by Educational Testing Service.

In Match Problems V the task is to indicate several different patterns of matches that can be removed to leave a specified number of squares. Many set-breaking solutions are needed. Each of two parts contains three items. The test is copyrighted by Sheridan Supply Co.

In Utility Test the score is the number of times the classes of uses is changed as the subject lists different uses for a given object. Each of two parts contain one stimulus object. The test is copyrighted by Sheridan Supply Company.

APPENDIX B

THE DETROIT LIPREADING TESTS (SCRIPT)

APPENDIX B

FRAME	DETROIT LIPREADING TESTS
1	**Word Test** Prepared by Gordon Taaffe Prepared in connection with an Investigation of the Cognitive Domain of Lipreading and supported by the U.S. Department of Health, Education and Welfare and the University of Detroit.
2	In the following sequence, you will see people speaking but there will be no sound. The film is a silent film of people talking.
3	In the next picture you will see a person saying, DOOR.
4 INSTRUCTOR	DOOR

FRAME

5	You just saw a person saying, DOOR.

6	In the next picture, you will see the same person saying, SCHOOL

7 INSTRUCTOR	SCHOOL

8	You have just seen a speaker saying, DOOR and SCHOOL

9	Now try lipreading the next sequence.

10 INSTRUCTOR	HOUSE

11	You have just seen the speaker saying HOUSE. How many of you got it? If you did, you were lipreading!

12	This is a test of lipreading. You will see three people speaking. They will be saying

FRAME	words. You are to write down the word you think the lipreader has said. If you are not sure, guess.

13	Thirty words will be presented by the three speakers. Write each word the speaker says on the numbered answer sheet you have. If you have a question, raise your hand.

14 EASY-TO-LIP READ SPEAKER	1.	April	6.	Feet
	2.	City	7.	Lights
	3.	Ear	8.	Book
	4.	Cold	9.	Music
	5.	Sugar	10.	Coffee

15 DIFFICULT- TO-LIPREAD SPEAKER	11.	Work	16.	New Mexico
	12.	High School	17.	Basketball
	13.	Moon	18.	Face
	14.	Post cards	19.	Clouds
	15.	Party	20.	State

FRAME

16
AVERAGE
DIFFICULT¥
TO-LIPREAD
SPEAKER

21.	What	26.	Dog
22.	Drive	27.	Bottle
23.	Window	28.	Toledo
24.	Ice Cream	29.	Aspirin
25.	Movies	30.	Lights

END

FRAME	DETROIT LIPREADING TESTS
1	<u>Phrase</u> <u>Tests</u>
	Prepared by
	Gordon Taaffe
	Prepared in connection with an Investigation of the Cognitive Domain of Lipreading and supported by the U. S. Department of Health, Education and Welfare and the University of Detroit.
2	In the following sequence, you will see people speaking but there will be no sound. The film is a silent film of people talking.
3	In the next picture, you will see a person saying, THE SHOPPING CENTER
4 INSTRUCTOR	THE SHOPPING CENTER

FRAME

5	You just saw a person saying, THE SHOPPING CENTER.

6	In the next picture, you will see the same person saying, WASHINGTON'S BIRTHDAY IS

7 INSTRUCTOR	WASHINGTON'S BIRTHDAY IS

8	You have just seen a speaker saying, THE SHOPPING CENTER and WASHINGTON'S BIRTHDAY IS

9	Now try lipreading the next sequence.

10 INSTRUCTOR	DO YOU HAVE?

11	You have just seen the speaker saying DO YOU HAVE? How many of you got it? If you did, you were lipreading!

12	This is a test of lipreading. You will see

FRAME	three people speaking. They will be saying phrases. You are to write down what you think the speaker has said. If you are not sure, guess.

13	Thirty phrases will be presented by three speakers. Write each phrase the speaker says on the numbered answer sheet you have. If you have a question, raise your hand.

14 DIFFICULT- TO-LIPREAD SPEAKER	1. Leave for work 2. Are you ready 3. How many people 4. My hobby is 5. For a trip 6. The boy has 7. Where is the 8. What time did you 9. There are five players 10. There are many

FRAME

15
AVERAGE
DIFFICULTY
TO-LIPREAD
SPEAKER

11. What is your

12. Do you like

13. Where did you

14. The window

15. Wants to know

16. Did you drive

17. Turn off the

18. Would you like

19. Bring me a

20. My dog is

16
EASY-TO-
LIPREAD
SPEAKER

21. Cream and sugar

22. The city of

23. You are ready

24. At one o'clock

25. Wrist watch

26. April Fool's Day

27. I like my

28. What is the

29. You are reading

30. My feet are

END

FRAME	DETROIT LIPREADING TESTS

1   <u>Sentence Test</u>

Prepared by

Gordon Taaffe

Prepared in connection with An Investigation
of the Cognitive Domain of Lipreading and
supported by the Department of Health, Educa-
tion and Welfare, U.S. Federal Government
and the University of Detroit.

---

2   In the following sequence, you will see

people speaking but there will be no sound.

The film is a silent film of people talking.

---

3   In the next picture you will see a person

saying, WHAT TIME IS IT?

4
INSTRUCTOR   WHAT TIME IS IT?

FRAME

5	You just saw a speaker saying, WHAT TIME IS IT?
6	In the next picture, you will see the same person saying, HOW ARE YOU TODAY?
7 INSTRUCTOR	HOW ARE YOU TODAY?
8	You have just seen a speaker saying, WHAT TIME IS IT? and HOW ARE YOU TODAY?
9	Now try lipreading the next sequence.
10 INSTRUCTOR	PLEASE OPEN THE DOOR.
11	You just saw, PLEASE OPEN THE DOOR. How many of you got it? If you did, you were lipreading!

FRAME

12   This is a test of lipreading. You will see

three speakers talking. They will be saying

complete sentences. Some of the sentences

will be questions. Others will be statements.

You are to write down what the speakers say.

You are not supposed to answer a question or

do what the statement says. Just write what

the speakers say. Write the complete

sentence or any part of it you get. Do not

hesitate to guess or to fill in parts of the

sentence that you did not get. If you have

any questions, hold up your hand.

---

13   Thirty sentences will be presented. Write

each sentence on the numbered answer sheet.

14
AVERAGE
DIFFICULTY   1. What is your favorite season?
TO-LIPREAD
SPEAKER   2. Did you drive from Toledo, Ohio?

3. Please close the window.

4. Turn off the lights.

FRAME

5. Bill wants to know what time it is.

6. My dog is a Great Dane.

7. Would you like to go to the movies?

8. Bring me a bottle of aspirin.

9. Do you like chocolate ice cream?

10. Where did you put the ball of twine?

15
EASY-TO-
LIPREAD
SPEAKER

11. April Fool's Day falls on April first.

12. What is the name of the book you are

reading?

13. The City of Pittsburgh is famous for

its steel mills.

14. Do you have a pair of ear muffs?

15. Where did you put my wrist watch?

16. I like my coffee with cream and sugar.

17. My feet are cold.

18. Turn off the lights.

19. Do you like rock and roll music?

20. My appointment is at one o'clock.

16
DIFFICULT-
TO-LIPREAD
SPEAKER

21. Are you ready for a trip to the moon?

FRAME

22. How many people came to the party?

23. What time did you leave for work?

24. Hawaii was our fiftieth state.

25. My hobby is collecting post cards.

26. There are five players on a basketball team.

27. Where is the capitol of New Mexico?

28. There are many clouds in the sky.

29. The boy has a clean face.

30. Are you going to high school

END

APPENDIX C

FREQUENCY DISTRIBUTION OF THE

WORD LIPREADING TESTS

Number of Words	WLE-I First 10 Words[1]			WLD-II Second 10 Words			WLA-III Third 10 Words		
	8	11	A	8	11	A	8	11	A
7							1		
6							4	2	4
5	1		1				16	4	13
4	6	2	8	1	1	1	14	11	18
3	11	5	17	2	2	3	17	12	15
2	20	15	21	10	11	9	19	14	25
1	27	25	33	41	27	46	10	7	17
0	24	13	22	35	19	43	8	10	10
N	89	60	102	89	60	102	89	60	102
Mdn	1.26	1.18	1.38	0.83	0.91	0.67	2.94	2.43	2.46
Q	1.14	0.70	1.35	0.63	0.73	0.62	1.34	1.16	1.31
Range	0-5	0-4	0-5	0-4	0-4	0-4	0-7	0-6	0-6

[1] 8 = Eighth grade sample, 11 = Eleventh grade sample, A = Adult female sample.

APPENDIX D

FREQUENCY DISTRIBUTION OF THE

PHRASE LIPREADING TESTS

Number of Phrases	PID-I First 10 Phrases[1]			PLA-II Second 10 Phrases			PLE-III Third 10 Phrases		
	8	11	A	8	11	A	8	11	A
20								1	1
19						1			2
18								1	1
17						1			
16				1		1		3	2
15					1			1	1
14				1		4	1	3	3
13					2	3	3	2	1
12	1			2	2	3	4	4	8
11		1			3	13	3	7	4
10	1	2	2	1	4	14	1	1	5
9	2			8	7	5	5	8	8
8	2	5	3	3	5	4	13	2	6
7	4	5	8	8	7	11	10	3	9

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Number of Phrases	PLD-I First 10 Phrases[1]			PLA-II Second 10 Phrases			PLE-III Third 10 Phrases		
	8	11	A	8	11	A	8	11	A
6	4	9	12	9	5	13	9	3	13
5	9	4	13	11	3	9	8	3	7
4	14	7	19	10	9	3	5	6	7
3	13	7	18	11	4	8	12	1	8
2	8	11	11	13	4	5	6	4	7
1	18	4	11	7	3	1	5	5	6
0	13	5	6	4	1	3	4	2	3
N	89	60	102	89	60	102	89	60	102
Mdn	2.92	3.93	3.53	4.45	6.64	7.32	6.00	8.61	6.50
Q	1.78	2.12	1.56	2.14	3.21	2.71	2.50	4.00	2.60
Range	0-12	0-10	0-11	0-16	0-15	0-19	0-14	0-20	0-20

[1] 8 = Eighth grade sample, 11 = Eleventh grade sample, A = Adult female sample.

APPENDIX E

FREQUENCY DISTRIBUTION OF THE

SENTENCE LIPREADING TESTS

Number of Words	SLA-I First 10 Sentences[1]			SLE-II Second 10 Sentences			SLD-III Third 10 Sentences		
	8	11	A	8	11	A	8	11	A
50-51					1				
48-49				1	2				
46-47					1	1			
44-45				1					
42-43						2			
40-41			1						
38-39				2					
36-37				2	1	1			
34-35			2	3		2			
32-33			2	4		4			
30-31		4	5	6	5	4			
28-29	1	2	1		1	5			
26-27		1	3	4	4	6			
24-25		3	2	2	3	3			
22-23	1	6	6	5	4	7			

Number of Words	SLA-I First 10 Sentences[1]			SLE-II Second 10 Sentences			SLD-III Third 10 Sentences		
	8	11	A	8	11	A	8	11	A
20-21	2	2	6	9	5	5			
18-19	3	2	7	3	2	10			
16-17	1	5	6	3	2	7			
14-15	1	1	9	6	5	7			
12-13	1	1	6	6	3	4			
10-11	3	11	9	2	7	9		1	
8-9	12	5	10	7	1	19		2	6
6-7	5	7	6	5	2	2	1	5	4
4-5	13	3	10	6	3	2	3	5	16
2-3	17	3	5	7	5	1	21	11	28
0-1	29	4	6	5	3	1	64	36	48
N	89	60	102	89	60	102	89	60	102
Mdn	3.42	10.23	13.16	15.84	16.00	17.22	0.43	0.75	1.71
Q	3.05	7.81	6.67	9.30	7.93	7.78	0.88	1.58	1.78
Range	0-29	0-31	0-41	0-49	0-51	0-47	0-7	0-11	0-9

[1] 8 = Eighth grade sample, 11 = Eleventh grade sample, A = Adult female sample.

APPENDIX F

CORRELATION MATRIX AND UNROTATED AND ROTATED

FACTOR MATRICES OF THE NINE LIPREADING

TESTS, EIGHTH GRADE SAMPLE

Correlation Matrix[a]

		1	2	3	4	5	6	7	8	9
WLE–I	1	39	33	37	37	39	30	12	33	21
WLD–II	2	33	33	19	04	16	20	02	13	−03
WLA–III	3	37	19	37	33	30	35	08	33	05
PLD–I	4	37	04	33	57	57	52	21	27	22
PLA–II	5	39	16	30	57	57	41	14	30	28
PLE–III	6	30	20	35	52	41	52	27	43	20
SLA–I	7	12	02	08	21	14	27	27	25	23
SLE–II	8	33	13	33	27	30	43	25	43	32
SLD–III	9	21	−03	05	22	28	20	23	32	32

[a]Based on phi coefficients

Factor Matrices

			Unrotated Factor Matrix			Rotated Factor Matrix		
			Factors			Factors		
Variable		Roots	I	II	h^2	I	II	h^2
WLE-I	1.	2.7657	.576	-.087	.339	.385	-.436	.339
WLD-II	2.	.6978	.272	-.226	.125	.063	-.348	.125
WLA-III	3.	.6212	.486	-.060	.240	.334	-.359	.240
PLD-I	4.	.2584	.788	.557	.931	.958	-.076	.923
PLA-II	5.	.1671	.647	.170	.448	.605	-.286	.448
PLE-III	6.	.0581	.650	.003	.422	.500	-.415	.422
SLA-I	7.	.0342	.311	-.072	.102	.192	-.255	.102
SLE-II	8.	-.0790	.660	-.531	.718	.165	-.831	.718
SLD-III	9.	-.1238	.370	-.093	.146	.224	-.309	.146

APPENDIX G

CORRELATION MATRIX AND UNROTATED AND ROTATED

FACTOR MATRICES OF THE NINE LIPREADING

TESTS, ELEVENTH GRADE SAMPLE

Correlation Matrix[a]

		1	2	3	4	5	6	7	8	9
WLE-I	1	.42	23	42	18	23	35	42	39	20
WLD-II	2	23	.39	24	16	36	39	37	14	-07
WLA-III	3	42	24	.47	27	20	47	37	30	17
PLD-I	4	18	16	27	.43	40	40	32	43	26
PLA-II	5	23	36	20	40	.50	27	44	50	05
PLE-III	6	35	39	47	40	27	.47	44	23	17
SLA-I	7	42	37	37	32	44	44	.54	54	19
SLE-II	8	39	14	30	43	50	23	54	.54	28
SLD-III	9	20	-07	17	26	05	17	19	28	.28

[a]Based on phi coefficients

Factor Matrices

Variable		Roots	Unrotated Factor Matrix			Rotated Factor Matrix		
			Factors			Factors		
			I	II	h^2	I	II	h^2
WLE-I	1.	3.0053	.543	−.069	.300	.391	−.384	.300
WLD-II	2.	.7186	.482	.544	.539	.719	.149	.539
WLA-III	3.	.6439	.568	−.020	.323	.440	−.359	.323
PLD-I	4.	.2758	.538	−.145	.310	.341	−.440	.310
PLA-II	5.	.1704	.646	.176	.448	.621	−.250	.449
PLE-III	6.	.0587	.620	.136	.403	.567	−.267	.403
SLA-I	7.	−.0110	.712	.023	.507	.581	−.412	.507
SLE-II	8.	−.0585	.684	−.303	.560	.362	−.654	.559
SLD-III	9.	−.1623	.299	−.494	.333	−.061	−.574	.334

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APPENDIX H

CORRELATION MATRIX AND UNROTATED AND ROTATED

FACTOR MATRICES OF THE NINE LIPREADING

TESTS, ADULT FEMALE SAMPLE

Correlation Matrix[1]

	1	2	3	4	5	6	7	8	9
WLE-I	36	23	20	-05	12	36	36	32	19
WLD-II	23	35	16	24	-00	35	11	23	04
WLA-III	20	16	34	00	10	29	30	34	08
PLD-I	-05	24	00	27	-04	27	03	11	08
PLA-II	12	-00	10	-04	33	33	21	29	20
PLE-III	36	35	29	27	33	53	37	53	16
SLA-I	36	11	30	03	21	37	61	61	31
SLE-II	32	23	34	10	29	53	61	61	26
SLD-III	19	04	08	08	20	16	31	26	31

[1]Based on phi coefficients.

Factor Matrices

	Variable	Roots	Unrotated Factor Matrix			Rotated Factor Matrix		
			I	II	h^2	I	II	h^2
1	WLE-I	2.5064	.461	-.087	.220	.454	-.115	.219
2	WLD-II	.8877	.338	-.324	.219	.318	-.344	.219
3	WLA-III	.6564	.390	-.087	.160	.384	-.110	.160
4	PLD-I	.2890	.177	-.313	.129	.158	-.324	.130
5	PLA-II	.1127	.504	.799	.892	.551	.768	.893
6	PLE-III	.0526	.737	-.148	.565	.727	-.192	.566
7	SLA-I	.0027	.718	-.039	.517	.715	-.082	.518
8	SLE-II	-.0415	.758	-.060	.578	.753	-.106	.578
9	SLD-III	-.1376	.329	.056	.111	.332	.036	.112

APPENDIX I

COMMUNALITIES, MEANS AND STANDARD DEVIATIONS

OF VARIABLES IN THE EIGHTH GRADE ANALYSIS

Variable	#	h^2	Mean	Standard Deviation	Variable
HPT	1.	.45	55.14	14.21	Hidden Patterns Test (Total Score)
CT	2.	.63	28.78	8.94	Copying Test (Total Score)
GCT	3.	.52	14.31	3.61	Gestalt Completion Test (Total Score)
CWT	4.	.44	16.51	4.79	Concealed Words Test (Total Score)
AF-I	5.	.45	2.26	2.33	Associational Fluency (Part I)
AF-II	6.	.47	14.63	2.33	Associational Fluency (Part II)
SI	7.	.36	3.83	2.01	Simile Interpretation (Total Score)
WA	8.	.41	18.39	6.77	Word Arrangements (Total Score)
TCT-I	11.	.36	9.00	2.82	Thing Categories Test (Part I)
TCT-II	12.	.61	2.60	1.32	Thing Categories Test (Part II)
WBE-I	13.	.66	10.48	3.93	Word Beginnings and Endings Test (Part I)
WBE-II	14.	.66	6.09	2.11	Word Beginnings and Endings Test (Part II)
LT	15.	.44	7.21	4.10	Locations Test (Total Score)
FC	16.	.45	100.21	23.30	Figure Classification (Total Score)

Variable	#	h^2	Mean	Standard Deviation	Variable
SRT	18.	.42	27.73	7.69	Shortest Road Test (Total Score)
NPT	19.	.42	22.91	10.83	Nearer Point Test (Total Score)
FLNT-I	20.	.64	7.54	3.42	First and Last Names Test (Part I)
FLNT-II	21.	.65	9.48	3.33	First and Last Names Test (Part II)
DSV-I	22.	.53	33.58	4.34	Digit Span-Visual (Part I)
DSV-II	23.	.53	35.55	4.94	Digit Span-Visual (Part II)
SEX	24.	.72	1.40	0.50	Sex (1 = male, 2 = female)
NCT-I	26.	.69	9.33	2.63	Number Comparison Test (Part I)
NCT-II	27.	.71	8.50	2.93	Number Comparison Test (Part II)
SD	28.	.55	14.11	3.63	Ship Destination (Total Score)
EAS-2	29.	.58	30.25	11.42	EAS #2, Numerical Ability (Total Score)
AO	30.	.64	20.80	9.84	Arithmetic Operations (Total Score)
GT	31.	.25	4.57	2.55	Gestalt Transformation (Total Score)
OS	32.	.46	4.30	2.14	Object Synthesis (Total Score)

Variable #		h^2	Mean	Standard Deviation	Variable
NST	33.	.30	4.81	3.96	Nonsense Syllogisms Test (Total Score)
LR	34.	.44	16.61	5.76	Logical Reasoning (Total Score)
CCT-I	35.	.37	3.89	3.65	Cube Comparison Test (Part I)
CCT-II	36.	.43	2.24	2.57	Cube Comparison Test (Part II)
MTS-I	37.	.79	8.55	2.84	Maze Tracing Speed Test (Part I)
MTS-II	38.	.80	10.82	2.85	Maze Tracing Speed Test (Part II)
WRVT-I	39.	.52	4.80	2.61	Wide Range Vocabulary Test (Part I)
WRVT-II	40.	.40	3.94	1.84	Wide Range Vocabulary Test (Part II)
PFT	42.	.54	6.64	3.78	Paper Folding Test (Total Score)
SDT	43.	.62	14.09	2.62	Surface Development Test (Total Score)
MP-I	44.	.38	4.09	2.62	Match Problems V (Part I)
MP-II	45.	.52	1.53	1.35	Match Problems V (Part II)
UT-I	46.	.40	1.22	1.77	Utility Test (Part I)

Variable #		h^2	Mean	Standard Deviation	Variable
UT-II	47.	.34	2.52	2.36	Utility Test (Part II)
WLE	*48.	.40	1.26	1.18	Word Lipreading Test, 1st 10 Words
WLD-II	*49.	.33	0.83	0.83	Word Lipreading Test, 2nd 10 Words
WLA-III	*50.	.48	2.94	1.34	Word Lipreading Test, 3rd 10 Words
PLD-I	*51.	.59	2.92	1.78	Phrase Lipreading Test, 1st 10 Phrases
PLA-II	*52.	.57	4.45	2.14	Phrase Lipreading Test, 2nd 10 Phrases
PLE-III	*53.	.50	6.00	2.50	Phrase Lipreading Test, 3rd 10 Phrases
SLA-I	*54.	.44	3.42	3.05	Sentence Lipreading Test, 1st 10 Sentences
SLE-II	*55.	.65	15.84	9.30	Sentence Lipreading Test, 2nd 10 Sentences
SLD-III	*56.	.34	0.43	0.88	Sentence Lipreading Test, 3rd 10 Sentences

*Medians and Semi-interquartile ranges reported for variables 48 through 56.

APPENDIX J

CORRELATION MATRIX OF 51 COGNITIVE AND

LIPREADING VARIABLES IN THE

EIGHTH GRADE ANALYSIS

		1	2	3	4	5	6	7	8	9	10
HPT-1	1.	1.000	.501	.289	.168	.187	.144	.058	.185	.021	.135
CT	2.	.501	1.000	.515	.371	.074	.155	.023	.185	.068	.135
GCT	3.	.289	.515	1.000	.401	-.040	.146	-.084	.061	.182	.250
CWT	4.	.168	.371	.401	1.000	-.002	-.026	.048	.068	-.022	.109
AF-I	5.	.087	.074	-.040	-.002	1.000	.350	.232	.050	.227	.472
AF-II	6.	.144	.155	.146	-.026	.350	1.000	.012	.017	.195	.437
SI	7.	.058	.023	-.084	.048	.232	.012	1.000	.148	-.051	.261
WA	8.	.185	.185	.061	.068	.050	.017	.148	1.000	.148	.020
TCT-I	11.	-.051	.148	1.000	.307	.119	.021	.068	.182	-.022	.227
TCT-II	12.	.261	.020	.307	1.000	.377	.135	.135	.250	.109	.472
WBE-I	13.	.267	.014	.119	.377	1.000	.190	.233	.073	.074	.369
WBE-II	14.	.069	-.026	.168	.182	.609	.216	.169	.105	.130	.310

		1	2	3	4	5	6	7	8	9	10
LT	15.	.174	−.050	.019	.142	.359	.114	.370	.183	.137	.113
FC	16.	.038	−.028	−.066	.144	.270	.217	.311	.176	.218	.116
SRT	18.	.022	−.068	−.107	.174	.082	.355	.502	.390	.212	.228
NPT	19.	.085	−.063	−.019	.205	.221	.325	.346	.249	.302	.142
FLNT-I	20.	.136	.061	−.021	.156	.040	.150	.113	−.161	−.009	.001
FLNT-II	21.	.182	.194	.193	.194	.100	.265	.156	−.138	.027	.113
DSV-I	22.	.121	.059	.135	.098	.105	.256	.237	.027	.095	.229
DSV-II	23.	−.020	−.017	.093	−.007	.087	.083	.081	.043	.036	.046
SEX	24.	.033	−.131	−.091	−.034	.326	.131	.031	−.273	.224	.259
NCT-I	26.	.237	.306	.211	.141	.242	.212	−.208	.084	.164	.155
NCT-II	27.	.146	.266	.183	.110	.133	.197	−.175	.015	.244	.134
SD	28.	.217	.405	.235	.110	.068	.234	.116	.007	−.035	.291

		1	2	3	4	5	6	7	8	9	10
EAS-2	29.	.325	.416	.293	.177	.164	.236	.091	.125	-.016	.228
AO	30.	.336	.312	.192	.032	.180	.190	-.007	.250	.174	.083
GT	31.	.138	.207	.068	.080	-.046	.028	.128	.160	-.206	-.118
OS	32	.133	.103	.256	-.083	.151	.407	.009	-.029	.343	.277
NST	33.	-.178	-.146	.037	-.005	-.108	-.159	-.128	-.017	-.051	-.017
LR	34.	.232	.240	.156	.077	.143	.208	.116	-.067	.111	.366
CCT-I	35.	.237	.171	.190	.022	.125	.208	.042	.031	.207	.079
CCT-II	36.	.261	.353	.232	.293	-.038	.053	-.099	.214	.006	.018
MTS-I	37.	.408	.375	.218	.076	.007	.063	.175	.381	.041	.029
MTS-II	38.	.461	.278	.084	.019	.032	.043	.083	.358	.018	.067
WRVT-I	39.	.062	.120	.056	.071	.175	.147	.168	-.038	-.026	.107
WRVT-II	40.	.021	.160	.047	.072	.124	.196	.052	-.163	.065	-.019
PFT	42.	.256	.486	.326	.317	.139	.215	.104	.027	.068	.203
SDT	43.	.239	.421	.340	.224	.069	.105	.175	.023	.000	.228

		1	2	3	4	5	6	7	8	9	10
MP-I	44.	.220	.317	.258	.193	.040	-.042	-.091	.054	-.006	.033
MP-II	45.	.329	.313	.280	.082	.096	.178	-.079	-.071	.080	.107
UT-I	46.	.066	.281	.116	.145	.204	.242	.086	.008	-.020	.073
UT-II	47.	-.026	-.040	.072	-.012	.199	.202	.099	.280	.020	.269
WLE-I	48.	.179	.108	.236	.179	.254	.250	.007	-.099	.111	.259
WLD-II	49.	-.077	-.141	.037	.020	.086	.021	-.063	-.027	.161	.045
WLA-III	50.	.106	-.070	.130	-.022	-.054	.019	-.127	-.072	.016	-.082
PLD-I	51.	.198	.061	.216	.133	.217	.113	.036	-.081	.280	.390
PLA-II	52.	.253	.100	.162	.225	.315	.308	.135	-.096	.327	.331
PLE-III	53.	.101	.051	.108	.122	.263	.262	.162	-.173	.273	.192
SLA-I	54.	.001	.015	-.057	.145	.286	.097	.213	.064	.136	.246
SLE-II	55.	-.044	-.159	-.021	-.046	.100	.213	-.064	-.235	.256	.151
SLD-III	56.	-.037	.017	.035	-.124	.345	.177	.072	-.043	.181	.267

		11	12	13	14	15	16	17	18	19	20
HPT-I	1.	.190	.216	.114	.217	.355	.325	.136	.182	.121	-.020
CT	2.	.233	.169	.370	.311	.502	.346	.061	.194	.059	-.017
GCT	3.	.073	.105	.183	.176	.390	.249	-.021	.193	.135	.093
CWT	4.	.074	.130	.137	.218	.212	.302	.156	.194	.098	-.007
AF-I	5.	.369	.310	.113	.116	.228	.142	.040	.100	.105	.087
AF-II	6.	.424	.300	.086	.084	.216	.160	.150	.265	.256	.083
SI	7.	.267	.069	.174	.038	.022	.085	.113	.156	.237	.081
WA	8.	.014	-.026	-.050	-.028	-.068	-.063	-.161	-.138	.027	.043
TCT-I	11.	.195	.027	.095	.036	.224	.164	.168	.019	-.066	-.107
TCT-II	12.	.437	.113	.229	.046	.259	.155	.182	.142	.144	.174
WBE-I	13.	.424	.363	.298	.185	.371	.227	.609	.359	.270	.082
WBE-II	14.	.300	.420	.294	.254	.528	.390	1.000	.222	.284	.154

		11	12	13	14	15	16	17	18	19	20
LT	15.	.086	.256	.094	−.092	.102	.185	.222	1.000	.239	.208
FC	16.	.084	.107	.002	.093	.165	.171	.284	.239	1.000	.241
SRT	18.	.216	.218	.097	−.097	−.103	.140	.154	.208	.241	1.000
NPT	19.	.160	.284	−.019	−.126	.024	.218	.188	.212	.169	.301
FLNT-I	20.	.103	.177	.135	.060	.107	.144	1.000	.000	.259	.069
FLNT-II	21.	.363	.420	.256	.107	.218	.284	.590	1.000	.186	.001
DSV-I	22.	.298	.294	.094	.002	.097	−.019	.259	.186	1.000	.447
DSV-II	23.	.185	.254	−.092	.093	−.097	−.126	.069	.001	.447	1.000
SEX	24.	.371	.528	.102	.165	−.103	.024	.102	.330	.123	.219
NCT-I	26.	.227	.390	.185	.171	.140	.218	.057	.269	.103	.111
NCT-II	27.	.219	.316	.081	.149	.048	.347	.065	.330	−.016	−.027
SD	28.	.102	.145	1.000	.178	.304	.199	.123	.202	.050	−.124

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		11	12	13	14	15	16	17	18	19	20
EAS-2	29.	.336	.319	.278	.225	.302	.478	.270	.443	.155	-.037
AO	30.	.291	.329	.177	.059	.135	.358	.277	.466	.092	-.086
GT	31.	-.043	.007	.080	.148	.154	.065	.096	-.011	-.048	.093
OS	32.	.191	.195	.060	.170	.105	.085	-.117	-.025	.064	.070
NST	33.	-.115	-.182	-.039	.129	.019	-.164	-.041	-.056	.000	-.042
LR	34.	.248	.206	.322	.040	.202	.264	.316	.365	.233	.119
CCT-I	35.	.207	.383	.089	.160	.167	.125	.089	.239	-.060	.043
CCT-II	36.	-.119	.093	.048	.029	.318	.244	.089	.073	-.168	-.073
MTS-I	37.	.035	.029	.203	.037	.241	.111	-.016	.022	.031	-.178
MTS-II	38.	.016	.070	.016	.055	.171	.186	-.021	-.038	-.021	-.146
WRVT-I	39.	.227	.189	.058	.304	.146	.111	.231	.181	-.171	-.038
WRVT-II	40.	.237	.305	.149	.021	.144	.092	.150	.144	.052	.147
PFT	42.	.074	.217	.275	.182	.312	.253	.007	.072	.065	.026

		11	12	13	14	15	16	17	18	19	20
SDT	43.	.208	.239	.339	.357	.402	.336	.160	.136	.037	.040
MP-I	44.	-.130	.210	.222	.160	.269	.197	.086	.158	-.006	-.107
MP-II	45.	.168	.287	.187	-.067	.212	.244	.026	.186	.150	.037
UT-I	46.	.232	.109	.138	.164	.211	.076	-.167	.136	-.070	.077
UT-II	47.	.196	.004	-.092	-.021	-.021	-.118	-.043	-.082	.058	.141
WLE-I	48.	.156	.287	.139	.206	.170	.251	.274	.380	.097	.046
WLD-II	49.	.135	.187	.034	.027	-.010	.106	-.037	.159	.090	.055
WLA-III	50.	.007	.180	.123	.221	-.023	-.106	.097	.252	.117	.010
PLD-I	51.	.232	.348	.174	.003	.036	.124	.281	.328	.194	.096
PLA-II	52.	.268	.445	.103	.272	.082	.180	.218	.276	.223	.203
PLE-III	53.	.385	.402	.217	-.005	-.057	.108	.278	.353	.187	.112
SLA-I	54.	.097	.195	-.016	.012	.382	.012	.231	.164	.148	-.000
SLE-II	55.	.213	.233	.002	.215	.598	.207	.370	-.041	.206	-.146
SLD-III	56.	.177	.124	.039	-.060	.271	.159	.359	.025	.104	.082

		21	22	23	24	25	26	27	28	29	30
HPT-I	1.	.033	.237	.146	.217	.325	.336	.138	.133	-.178	.232
CT	2.	-.131	.306	.266	.405	.416	.312	.207	.103	-.146	.240
GCT	3.	-.091	.211	.183	.235	.293	.192	.068	.256	.037	.156
CWT	4.	-.034	.141	.110	.110	.177	.032	.080	-.083	-.005	.077
AF-I	5.	.326	.242	.133	.068	.164	.180	-.046	.151	-.108	.143
AF-II	6.	.131	.212	.197	.234	.236	.190	.028	.407	-.159	.208
SI	7.	.031	-.208	-.175	.116	.091	-.007	.128	.009	-.128	.116
WA	8.	-.273	.084	.015	.007	.125	.250	.160	-.029	-.017	-.067
TCT-I	11.	-.019	-.009	-.051	.111	.207	.006	.041	.244	-.035	-.016
TCT-II	12.	.205	.001	-.017	.366	.079	.018	.029	.134	.291	.228
WBE-I	13.	.221	.103	-.115	.248	.207	-.119	.035	.219	.102	.336
WBE-II	14.	.188	.177	-.182	.206	.383	.093	.029	.316	.145	.319

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		21	22	23	24	25	26	27	28	29	30
LT	15.	.212	.135	-.039	.322	.089	.048	.203	.081	.434	.278
FC	16.	.169	.060	.129	.040	.160	.029	.037	.149	.178	.225
SRT	18.	.301	.107	.019	.202	.167	.318	.241	.048	.304	.302
NPT	19.	1.000	.144	-.164	.264	.125	.244	.111	.347	.199	.478
FLNT-I	20.	.102	.057	.065	.123	.270	.277	.096	-.117	-.041	.316
FLNT-II	21.	.330	.269	.330	.202	.443	.466	-.011	-.025	-.056	.365
DSV-I	22.	.123	.103	-.016	.050	.155	.092	-.048	.064	.000	.233
DSV-II	23.	.219	.111	-.027	-.124	-.037	-.086	.093	.070	-.042	.119
SEX	24.	1.000	.146	.254	-.065	.111	.126	-.185	.115	.072	.274
NCT-I	26.	.146	1.000	.699	.137	.254	.481	-.036	-.034	-.116	.153
NCT-II	27.	.254	.699	1.000	.078	.280	.479	-.146	.032	-.138	.130
SD	28.	-.065	.137	.078	.498	.368	.121	.106	.176	-.084	.409
EAS-2	29.	.111	.254	.280	.368	1.000	.616	.214	.146	-.078	.364

		21	22	23	24	25	26	27	28	29	30
AO	30.	.126	.481	.479	.121	.616	1.000	-.050	.066	-.046	.163
GT	31.	-.185	-.036	-.146	.106	.214	-.050	1.000	.122	-.144	-.011
OS	32.	.115	-.034	.032	.176	.146	.066	.122	1.000	-.030	.010
NST	33.	.072	-.116	-.138	-.084	-.078	-.046	-.144	-.030	1.000	-.078
LR	34.	.274	.153	.130	.409	.364	.163	-.011	.010	-.078	1.000
CCT-I	35.	.244	.086	.082	.143	.237	.145	.009	.139	-.261	.167
CCT-II	36.	-.021	.227	.193	.124	.269	.149	.160	-.099	-.143	.217
MTS-I	37.	-.239	.145	.115	.132	.219	.223	.207	.015	-.157	.101
MTS-II	38.	-.157	.147	.097	.020	.223	.271	.175	.048	-.107	.068
WRVT-I	39.	.105	.034	-.063	.176	.202	.148	.099	.105	.011	.033
WRVT-II	40.	.273	.148	.128	.210	.110	.096	-.039	.116	-.156	.115
PFT	42.	.080	.000	.022	.389	.336	.025	.228	.181	-.100	.362
SDT	43.	.011	-.046	-.055	.498	.416	.057	.194	.110	.012	.378

		21	22	23	24	25	26	27	28	29	30
MP-I	44.	.124	.089	.059	.362	.381	.160	.166	-.035	-.029	.220
MP-II	45	.149	.069	.093	.321	.335	.090	.115	.232	-.196	.302
UT-I	46.	.039	.033	.074	.073	.209	-.046	.004	.104	.058	.107
UT-II	47.	-.035	-.107	-.147	-.044	.051	.005	-.001	.129	.012	-.036
WLE-I	48.	.351	.183	.228	.204	.230	.308	-.025	.182	-.082	.346
WLD-II	49.	.369	.159	.241	.071	.029	.167	-.118	-.005	-.088	.067
WLA-III	50.	.351	.200	.144	-.050	.014	.124	-.025	.025	.185	.163
PID-I	51.	.408	.164	.239	.059	.069	.188	-.063	.181	.036	.346
PIA-II	52.	.473	.209	.234	.178	.150	.130	.102	.183	-.113	.391
PLE-III	53.	.525	.170	.243	.021	.176	.263	-.059	.178	.089	.203
SLA-I	54.	.382	.012	.011	-.127	.069	.166	-.075	-.016	.007	.121
SLE-II	55.	.598	.207	.254	-.196	.016	.121	-.258	.254	.093	.111
SLD-III	56.	.271	.159	.156	.072	.043	.161	-.121	.125	-.083	-.019

		31	32	33	34	35	36	37	38	39	40
HPT-I	1.	.237	.261	.408	.461	.062	.021	.256	.239	.220	.329
CT	2.	.171	.353	.375	.278	.120	.160	.486	.421	.317	.313
GCT	3.	.190	.232	.218	.084	.056	.047	.326	.340	.258	.280
CWT	4.	.022	.293	.076	.019	.071	.072	.317	.224	.193	.082
AF-I	5.	.125	-.038	.007	.032	.175	.124	.139	.069	.040	.096
AF-II	6.	.208	.053	.063	.043	.147	.196	.215	.105	-.042	.178
SI	7.	.042	-.099	.175	.083	.168	.052	.104	.175	-.091	-.079
WA	8.	.031	.214	.381	.358	-.038	-.163	.027	.023	.054	-.071
TCT-I	11.	.174	-.206	.343	.080	-.020	.020	.111	.161	.018	-.026
TCT-II	12.	.083	-.118	.277	.107	.073	.269	.259	.045	.067	.107
WBE-I	13.	.291	-.043	.191	.168	.232	.196	.156	.135	.016	.227
WBE-II	14.	.329	.007	.195	.287	.109	.004	.287	.187	.070	.189

		31	32	33	34	35	36	37	38	39	40
LT	15	.177	.080	.060	.187	.138	-.092	.139	.034	.016	.058
FC	16.	.059	.148	.170	-.067	.164	-.021	.206	.027	.055	.304
SRT	18.	.135	.154	.105	.212	.211	-.021	.170	-.010	.171	.146
NPT	19.	.358	.065	.085	.244	.076	-.118	.251	.106	.186	.111
FLNT-I	20.	.089	.089	-.016	-.021	.231	.150	.007	.160	.086	.026
FLNT-II	21.	.239	.073	.022	-.038	.181	.144	.072	.136	.158	.186
DSV-I	22.	-.060	-.168	.031	-.021	-.171	.052	.065	.037	-.006	.150
DSV-II	23.	.043	-.073	-.178	-.146	-.038	.147	.026	.040	-.107	.037
SEX	24.	.244	-.021	-.239	-.157	.105	.273	.080	.011	.124	.149
NCT-I	26.	.086	.227	.145	.147	.034	.148	.000	-.046	.089	.069
NCT-II	27.	.082	.193	.115	.097	-.063	.128	.022	-.055	.059	.093
SD	28.	.143	.124	.132	.020	.176	.210	.389	.498	.362	.321
EAS-2	29.	.237	.269	.219	.223	.202	.110	.336	.416	.381	.335

		31	32	33	34	35	36	37	38	39	40
AO	30.	.145	.149	.223	.271	.148	.096	.025	.057	.160	.090
GT	31.	.009	.160	.207	.175	.099	-.039	.228	.194	.166	.115
OS	32.	.139	-.099	.015	.048	.105	.116	.181	.110	-.035	.232
NST	33.	-.261	-.143	-.157	-.107	.011	-.156	-.100	.012	-.029	-.196
LR	34.	.167	.217	.101	.068	.033	.115	.362	.378	.220	.032
CCT-I	35.	1.000	.323	.069	.055	.232	.178	.163	.292	.192	.258
CCT-II	36.	.323	1.000	.240	.247	.131	.153	.249	.272	.204	.126
MTS-I	37.	.069	.240	1.000	.804	-.164	-.184	.164	.077	.163	.106
MTS-II	38.	.055	.247	.804	1.000	-.109	-.240	.092	-.024	.071	.074
WRVT-I	39.	.232	.131	-.164	-.109	1.000	.414	.144	.370	.111	-.072
WRVT-II	40.	.178	.153	-.184	-.240	.414	1.000	.178	.324	.153	.139
PFT	42.	.163	.249	.164	.092	.144	.178	1.000	.513	.336	.427
SDT	43.	.292	.272	.077	-.024	.370	.324	.514	1.000	.416	.297

		31	32	33	34	35	36	37	38	39	40
MP-I	44.	.192	.204	.163	.071	.111	.153	.336	.416	1.000	.317
MP-II	45.	.258	.126	.106	.074	-.072	.139	.427	.297	.317	1.000
UT-I	46.	.068	.040	.166	.097	-.041	-.024	.236	.123	.066	.139
UT-II	47.	-.014	-.085	.230	.271	-.049	-.126	.054	.053	-.137	-.015
WLE-I	48.	.179	.108	-.109	-.407	.212	.116	.239	.200	.077	.220
WLD-II	49.	.166	.044	-.081	-.214	.064	.184	-.016	.045	.108	.102
WLA-III	50.	.080	-.023	.010	.009	.001	.043	.049	.018	.086	-.079
PLD-I	51.	.139	.021	.016	-.011	.248	.254	.252	.222	.204	.216
PLA-II	52.	.200	.067	-.027	-.011	.248	.254	.252	.222	.204	.128
PLE-III	53.	.109	-.086	-.116	-.111	.088	.343	.066	.070	-.030	.245
SLA-I	54.	.212	.015	.076	.021	.067	-.053	.008	.045	.109	-.123
SLE-II	55.	.158	-.040	-.191	-.057	.034	.169	-.140	-.095	-.133	-.065
SLD-III	56.	.105	.003	-.048	.072	.207	.163	-.170	.060	.023	.029

		41	42	43	44	45	46	47	48	49	50
HPT-I	1.	.066	-.026	-.077	.106	.106	.198	.253	.101	.001	-.044
CT	2.	.281	-.040	.121	-.141	-.070	.061	.100	.051	.015	-.159
GCT	3.	.116	.072	.236	.037	.130	.216	.162	.108	-.057	-.021
CWT	4.	.145	-.012	.179	.020	-.022	.135	.225	.122	.145	-.046
AF-I	5.	.204	.199	.254	.086	-.054	.217	.315	.263	.286	.100
AF-II	6.	.242	.202	.250	.021	.019	.113	.308	.262	.097	.213
SI	7.	.086	.099	.007	.063	-.127	.036	.135	.162	.213	-.064
WA	8.	.008	.280	-.099	-.027	-.072	-.081	-.096	-.173	.064	-.235
TCT-I	11.	-.026	.065	.068	.000	-.006	.181	.076	.241	.223	-.116
TCT-II	12.	.107	-.019	.203	.228	.033	.267	.007	.111	.207	.007
WBE-I	13.	.227	.237	.074	.208	-.013	.317	.063	-.016	.015	.163
WBE-II	14.	.189	.305	.217	.239	.210	.359	.175	.022	-.157	.106

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		41	42	43	44	45	46	47	48	49	50
LT	15.	.058	.149	.275	.339	.222	.025	.381	.031	.101	.166
FC	16.	.304	.021	.182	.357	.160	.104	.041	-.178	.069	.230
SRT	18.	.146	.144	.312	.402	.269	.082	.029	-.239	.244	-.109
NPT	19.	.111	.092	.253	.336	.197	-.020	.035	.145	-.081	.043
FLNT-I	20.	-.167	-.043	.274	-.037	.097	.281	.218	.278	.159	-.016
FLNT-II	21.	.136	-.082	.380	.159	.252	.328	.276	.353	.195	.233
DSV-I	22.	-.070	.058	.097	.090	.117	.194	.223	.187	-.016	.002
DSV-II	23.	.077	.141	.046	.055	.010	.096	.203	.112	.012	.215
SEX	24.	.039	-.035	.351	.369	.351	.408	.473	.525	.382	.589
NCT-I	26.	.033	-.107	.183	.159	.200	.164	.209	.170	.012	.207
NCT-II	27.	.074	-.147	.228	.241	.144	.239	.234	.243	.011	.254
SD	28.	.073	-.044	.204	.071	-.050	.059	.178	.021	-.127	-.196
EAS-2	29.	.209	.051	.230	.029	.014	.069	.150	.176	.069	.016

		41	42	43	44	45	46	47	48	49	50
AO	30.	-.046	.005	.380	.167	.124	.188	.130	.263	.166	.121
GT	31.	.004	-.001	-.025	-.118	-.025	-.063	.102	-.059	-.075	-.258
OS	32.	.104	.129	.249	.204	.025	.181	.183	.178	-.016	.254
NST	33.	-.058	.012	-.082	-.088	.185	.036	-.113	.089	.007	.093
LR	34.	.107	-.036	-.036	.346	.163	.346	.391	.203	.121	.111
CCT-I	35.	.068	-.014	.179	.166	.080	.139	.200	.109	.212	.158
CCT-II	36.	.040	-.085	.108	.044	-.023	.021	.067	-.086	.015	-.040
MTS-I	37.	.166	.230	-.109	-.081	.010	.016	-.027	-.116	.076	-.191
MTS-II	38.	.097	.271	-.047	-.214	.009	-.017	-.011	-.111	.021	-.057
WRVT-I	39.	-.041	-.049	.121	.064	.001	.034	.248	.088	.067	.034
WRVT-II	40.	-.024	-.126	.116	.184	.043	.120	.254	.343	-.053	.169
PFT	42.	.236	-.054	.239	-.016	.049	.135	.252	.066	.008	-.141
SDT	43.	.123	.053	.200	.045	.018	.101	.222	.070	.045	-.095

		41	42	43	44	45	46	47	48	49	50
MP-I	44.	.066	-.137	.077	.108	.086	.022	.204	-.030	.109	-.133
MP-II	45.	.139	-.015	.220	.102	-.079	.287	.128	.245	-.123	-.065
UT-I	46.	1.000	.221	-.065	-.225	-.091	-.128	.041	-.016	.130	.102
UT-II	47.	.221	1.000	.045	-.206	-.098	-.032	-.113	-.027	.212	-.022
WLE-I	48.	-.065	.045	1.000	.328	.371	.372	.394	.304	.123	.326
WLD-II	49.	-.225	-.206	.328	1.000	.191	.042	.159	.199	.023	.133
WLA-III	50.	-.091	-.098	.371	.191	1.000	.326	.303	.350	.078	.326
PLD-I	51.	-.128	-.032	.372	.042	.326	1.000	.570	.522	.207	.273
PLA-II	52.	.041	-.113	.394	.159	.303	.570	1.000	.410	.141	.298
PLE-III	53.	.245	-.016	-.027	.304	.199	.350	.522	.410	1.000	.274
SLA-I	54.	.130	.212	.123	.023	.078	.207	.141	.274	1.000	.253
SLE-II	55.	.102	-.022	.326	.133	.326	.273	.298	.431	.253	1.000
SLD-III	56.	.008	.179	.209	-.025	.048	.216	.282	.204	.228	.324

APPENDIX K

UNROTATED FACTOR MATRIX, EIGHTH GRADE ANALYSIS

		Roots	Commu-nality	1	2	3	4	5
HPT	1.	8.0683	.4473	.469	−.346	.178	.073	.012
CT	2.	4.2901	.6299	.538	−.554	.006	.042	−.129
GCT	3.	2.4213	.5170	.436	−.298	−.044	.046	−.273
CWT	4.	2.1910	.4378	.309	−.227	−.140	.084	.020
AF-I	5.	1.5555	.4504	.411	.191	.206	−.318	−.021
AF-II	6.	1.4884	.4716	.465	.104	.154	−.272	−.114
SI	7.	1.3037	.3566	.159	−.013	.025	−.391	.387
WA	8.	1.1418	.4082	.009	−.322	.410	−.072	.050
TCT-I	11.	1.1068	.3609	.256	.244	.232	−.053	−.286
TCT-II	12.	.9597	.6065	.471	.118	.159	−.424	−.091
WBE-I	13.	.8967	.6646	.572	.242	.168	−.291	.132
WBE-II	14.	.8175	.6550	.659	.273	.072	−.014	−.006
LT	15.	.7170	.4388	.427	−.150	−.144	−.039	.135
FC	16.	.6510	.4535	.362	−.058	−.099	−.063	−.070

		Roots	Commu-nality	1	2	3	4	5
SRT	18.	.5759	.4185	.411	-.399	-.120	-.045	-.055
NPT	19.	.5158	.4185	.467	-.252	-.039	.157	.033
FLNT-I	20.	.4674	.6389	.337	.089	-.184	.172	.598
FLNT-II	21.	.3985	.6473	.581	.154	-.068	.260	.398
DSV-I	22.	.3747	.5247	.266	.147	.050	-.182	.248
DSV-II	23.	.3200	.4983	.115	.246	-.016	-.209	.003
SEX	24.	.2675	.7177	.452	.645	-.047	.022	-.045
NCT-I	26.	.1991	.6892	.452	.047	.309	.449	-.179
NCT-II	27.	.1775	.7092	.441	.121	.296	.517	-.229
SD	28.	.1483	.5505	.440	-.337	-.293	-.103	-.040
EAS-2	29.	.1194	.5815	.618	-.296	.014	.090	.165
AO	30.	.0863	.6463	.513	-.039	.332	.387	.190
GT	31.	.0611	.2527	.083	-.348	-.093	-.091	.104
OS	32.	.0346	.4570	.285	.077	.073	-.310	-.362

		Roots	Communality	1	2	3	4	5
NST	33.	.0048	.2970	-.160	.117	-.090	.023	.029
LR	34.	-.0095	.4390	.534	-.030	-.151	-.028	.147
CCT-I	35.	-.0380	.3692	.403	-.006	-.045	-.008	-.113
CCT-II	36.	-.0756	.4264	.282	-.363	-.015	.243	-.118
MTS-I	37.	-.0936	.7864	.206	-.558	.538	.002	.131
MTS-II	38.	-.1264	.7951	.168	-.464	.636	.019	.104
WRVT-I	39.	-.1476	.5197	.290	.026	-.296	-.109	.071
WRVT-II	40.	-.1840	.4017	.341	.161	-.329	.009	-.100
PFT	42.	-.2031	.5423	.465	-.361	-.285	-.174	-.172
SDT	43.	-.2118	.6173	.510	-.338	-.428	-.217	-.016
MP-I	44.	-.2434	.3785	.356	-.299	-.239	.116	-.041
MP-II	45.	-.2588	.5223	.431	-.184	-.148	-.043	-.191
UT-I	46.	-.2876	.3840	.198	-.166	.115	-.267	-.121
UT-II	47.	-.3025	.3360	.020	-.042	.366	-.430	.073

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		Roots	Commu- nality	1	2	3	4	5
WLE-I	48.	-.3045	.4015	.516	.214	-.098	.115	-.018
WLD-II	49.	-.3268	.3255	.199	.260	-.119	.220	-.080
WLA-III	50.	-.3415	.4752	.229	.290	-.035	.294	.021
PLD-I	51.	-.3687	.5870	.489	.338	.020	.041	.035
PLA-II	52.	-.3802	.5741	.587	.294	-.085	-.054	-.054
PLE-III	53.	-.3954	.5005	.482	.468	-.012	.031	.085
SLA-I	54.	-.4103	.4450	.261	.227	.181	-.161	.225
SLE-II	55.	-.4373	.6470	.277	.623	.151	.063	-.197
SLD-III	56.	-.4541	.3393	.278	.290	.191	-.143	-.062

		6	7	8	9	10	11	12	13
HPT	1.	.126	-.082	.027	-.137	-.043	.090	-.038	.134
CT	2.	-.030	.016	-.196	.042	-.011	-.047	-.021	.046
GCT	3.	.230	-.051	-.185	.162	-.185	.028	-.076	-.209
CWT	4.	.081	-.142	-.238	.115	-.150	-.342	-.198	-.029
AF-I	5.	-.166	.072	.124	.081	-.046	-.164	.013	.142
AF-II	6.	-.052	.252	.004	.051	-.084	.212	-.148	.053
SI	7.	-.046	.002	.064	-.053	-.028	-.165	.140	.034
WA	8.	.001	-.056	.029	-.150	-.222	-.141	.179	.273
TCT-I	11.	.147	.038	.212	.029	-.134	-.087	.036	-.150
TCT-II	12.	.095	.082	.144	.368	-.140	-.167	.051	.031
WBE-I	13.	-.240	.178	-.203	-.048	.145	.009	.102	-.016
WBE-II	14.	-.133	.013	-.122	-.326	.103	.007	.039	.019
LT	15.	-.012	.008	-.074	.154	.274	-.026	.286	.060
FC	16.	-.237	-.352	-.354	.066	-.072	.085	.149	.090

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		6	7	8	9	10	11	12	13
SRT	18.	-.067	-.031	-.076	.122	-.045	.066	-.104	.122
NPT	19.	-.105	..128	.066	.150	.025	-.106	-.124	.028
FLNT-I	20.	.068	.059	.057	.014	-.203	.132	-.225	.065
FLNT-II	21.	-.038	.089	-.053	.098	.096	.114	-.1196	-.057
DSV-I	22.	.391	.292	-.297	-.129	-.127	-.014	.127	-.036
DSV-II	23.	.193	.121	-.415	-.373	-.167	-.098	-.044	-.078
SEX	24.	.003	-.209	.051	-.123	.254	-.121	.013	-.036
NCT-I	26.	-.126	.196	-.214	.015	-.113	-.108	.143	.168
NCT-II	27.	-.115	.212	-.080	.113	.007	-.126	.029	.095
SD	28.	.004	.168	.139	.150	.058	.107	.274	.067
EAS-2	29.	-.134	.123	-.020	.041	.089	.132	-.026	-.244
AO	30.	-.169	.146	.071	.076	-.083	.132	.081	-.263
GT	31.	.028	-.092	-.053	-.239	-.101	.119	.005	.080
OS	32.	.075	.036	.051	.026	-.070	.379	-.015	-.090

		6	7	8	9	10	11	12	13
NST	33.	.085	−.257	−.205	.324	−.032	.113	.118	−.168
LR	34.	.262	.050	.111	.073	.127	−.082	.001	.058
CCT-I	35.	−.151	−.117	.201	−.289	.039	−.005	−.142	−.151
CCT-II	36.	−.088	−.144	.140	−.156	−.134	−.189	−.210	−.022
MTS-I	37.	.157	−.189	.081	−.115	.122	.029	.131	.085
MTS-II	38.	.092	−.250	.120	−.134	.048	.151	.004	.143
WRVT-I	39.	−.469	−.146	.114	−.055	−.327	.124	.036	.021
WRVT-II	40.	−.219	.128	.053	−.238	−.097	.022	.037	.056
PFT	42.	.180	−.063	.008	−.054	.094	−.095	−.024	−.003
SDT	43.	−.089	−.139	.023	−.014	−.048	−.006	.006	−.126
MP-I	44.	−.009	−.137	.085	−.077	.139	−.078	.126	−.111
MP-II	45.	.276	.230	.158	−.173	.282	.091	−.112	−.074
UT-I	46.	−.146	−.022	−.272	.067	.323	−.049	−.243	.038
UT-II	47.	−.013	−.056	−.042	.066	−.045	.047	−.109	−.190

		6	7	8	9	10	11	12	13
WLE-I	48.	.124	-.087	.101	.123	-.100	.070	-.053	-.051
WLD-II	49.	-.014	.081	.132	-.121	-.005	-.168	.245	-.184
WLA-III	50.	.239	-.388	-.120	.000	.018	.201	.183	.002
PLD-I	51.	.405	-.123	.170	.096	-.092	-.027	-.041	.110
PLA-II	52.	.178	-.170	.072	-.102	-.202	-.077	.031	.250
PLE-III	53.	.147	-.022	.033	.013	.063	.047	-.012	-.039
SLA-I	54.	-.149	-.316	.059	.104	.124	-.272	-.110	-.138
SLE-II	55.	-.069	-.241	-.128	-.009	.115	.140	-.132	-.028
SLD-III	56.	-.247	-.065	.142	.056	-.072	.081	.037	.103

APPENDIX L

ROTATED FACTOR MATRIX, EIGHTH GRADE ANALYSIS

		A	B	C	D	E	F	G	H	I	J	K	L	h_1^2	h_2^2
HPT	1.	-03	34	44	14	14	12	05	04	15	03	14	15	.43	.45
CT	2.	-01	60	26	27	04	-10	06	11	05	19	10	30	.67	.63
GCT	3.	-04	41	12	18	-03	09	09	00	-11	03	30	42	.51	.52
CWT	4.	01	27	00	08	09	04	10	04	-05	11	-16	55	.44	.44
AF-I	5.	59	08	02	11	01	17	06	09	14	08	06	-01	.44	.45
AF-II	6.	36	13	00	15	16	10	15	05	14	14	45	-03	.47	.47
SI	7.	39	13	13	-24	14	-03	21	10	03	-03	-22	-11	.38	.36
WA	8.	14	-02	52	08	-14	-20	11	07	04	-13	-08	09	.41	.41
TCT-I	11.	30	-05	05	18	-17	30	01	-11	11	-17	22	08	.35	.36
TCT-II	12.	70	24	01	04	-02	18	06	-09	-10	-04	21	14	.67	.61
WBE-I	13.	46	19	-01	23	16	22	32	20	10	31	03	-25	.69	.66
WBE-II	14.	16	19	03	28	10	47	29	25	32	19	02	-12	.67	.61
LT	15.	11	55	02	11	09	12	04	02	13	10	-15	-16	.43	.44

		A	B	C	D	E	F	G	H	I	J	K	L	h^2_1	h^2_2
FC	16.	02	27	05	10	-06	18	06	51	-23	23	01	11	.50	.45
SRT	18.	03	47	11	07	13	-08	-05	14	01	15	16	24	.39	.42
NPT	19.	12	40	04	28	25	-01	-12	-01	13	07	-01	20	.39	.42
FLNT-I	20.	-00	07	-02	-05	76	17	11	08	03	-14	-07	10	.67	.64
FLNT-II	21.	05	21	-06	26	65	33	04	03	04	14	-05	00	.68	.65
DSV-I	22.	12	10	04	03	18	12	67	-15	-08	-08	06	04	.56	.53
DSV-II	23.	-00	-12	-09	-04	-06	14	66	08	11	09	05	10	.52	.53
SEX	24.	19	-02	-22	10	-01	77	05	06	16	14	-12	-12	.77	.72
NCT-I	26.	03	08	11	78	02	14	12	08	03	-01	01	10	.68	.69
NCT-II	27.	05	05	02	80	05	21	-05	-06	08	02	02	10	.72	.71
SD	28.	11	70	-03	05	06	-06	-04	06	-00	-14	13	-10	.56	.55
EAS-2	29.	09	50	19	27	38	03	-00	11	12	15	07	-01	.57	.58
AO	30.	12	13	29	57	40	13	-07	10	05	-08	03	-07	.65	.64

		A	B	C	D	E	F	G	H	I	J	K	L	h_1^2	h_2^2
GT	31.	-16	22	24	-18	07	-13	13	18	10	-01	04	06	.25	.25
OS	32.	17	14	03	-02	-13	17	05	08	03	06	60	-08	.48	.46
NST	33.	-08	-07	-09	-09	-04	10	-06	06	-50	02	-01	02	.30	.30
LR	34.	15	46	01	01	24	31	10	-18	07	-04	-02	07	.44	.44
CCT-I	35.	05	18	07	03	03	26	-09	20	44	07	06	06	.36	.37
CCT-II	36.	-11	22	21	15	04	-00	-18	12	33	-03	-06	41	.46	.43
MTS-I	37.	02	23	83	07	-02	-06	-04	-12	02	08	-05	-01	.78	.79
MTS-II	38.	02	05	86	06	03	-01	-11	-05	05	12	07	00	.78	.80
WRVT-I	39.	17	16	-14	-06	18	02	-12	64	13	-12	06	04	.57	.52
WRVT-II	40.	03	20	-29	10	06	15	10	31	33	-10	07	-04	.39	.40
PFT	42.	01	64	04	-11	-08	10	07	-01	16	08	09	24	.54	.54
SDT	43.	08	69	-03	-15	05	05	02	33	09	-00	03	15	.67	.62
MP-I	44.	-12	52	08	04	-02	12	-11	10	13	-02	-13	07	.37	.38

		A	B	C	D	E	F	G	H	I	J	K	L	h_1^2	h_2^2
MP-II	45.	-07	49	00	02	03	16	07	-29	36	07	25	-03	.56	.52
UT-I	46.	15	18	05	01	-07	-06	03	-02	94	60	06	07	.44	.40
UT-II	47.	37	-13	29	-17	-01	-08	10	-00	-07	22	16	00	.36	.34
WLE-I	48.	12	21	-07	14	22	46	-02	05	-00	-10	16	14	.40	.40
WLD-II	49.	02	08	-18	24	-08	27	04	04	15	-26	-15	-09	.30	.33
WLA-III	50.	-25	02	07	09	05	59	03	11	-27	-08	00	-03	.52	.48
PLD-I	51.	20	11	02	03	18	62	09	-17	-02	-18	13	16	.58	.59
PLA-II	52.	22	19	-02	95	06	58	19	16	12	-15	10	19	.57	.57
PLE-III	53.	19	05	-13	13	22	58	14	-02	03	00	07	-07	.45	.50
SLA-I	54.	41	-06	10	-06	11	33	-10	09	00	24	-29	08	.47	.44
SLE-II	55.	09	-27	-15	19	-03	63	-00	14	-01	27	17	-06	.66	.65
SLD-III	56.	37	-08	01	13	02	24	-09	23	06	03	15	-12	.32	.34

APPENDIX M

EIGHTH GRADE SAMPLE FACTORS

Variable		Test	Cognitive Abilities	Factor Loading
		FACTOR A (Ideational Fluency)		
TCT-II	12.	Things Categories Test (Part II)	Ideational Fluency	.70
AF-I	5.	Associational Fluency (Part I)	Associational Fluency	.59
WBE-I	13.	Word Beginnings and Endings Test (Part I)	Word Fluency	.46
SLA-I	54.	Sentence Lipreading Test -- 1st 10 Sentences	Lipreading (A)*	.41
SI	7.	Simile Interpretation (Total Score)	Expressional Fluency	.39
UT-II	47.	Utility Test (Part II)	Semantic Spontaneous Flexibility	.37
SLD-III	56.	Sentence Lipreading Test -- 3rd 10 Sentences	Lipreading (D)	.37
AF-II	6.	Associational Fluency (Part II)	Associational Fluency	.36
TCT-I	11.	Things Categories Test (Part I)	Ideational Fluency	.30

Variables		Test	Cognitive Abilities	Factor Loading
		FACTOR B (General Reasoning)		
SD	28.	Ship Destination (Total Score)	General Reasoning	.70
SDT	43.	Surface Development (Total Score)	Visualization	.69
PFT	42.	Paper Folding Test (Total Score)	Visualization	.64
CT	2.	Copying Test (Total Score)	Flexibility of Closure	.60
LT	15.	Locations Test (Total Score)	Induction	.55
MP-I	44.	Match Problems V (Part I)	Figural Adaptive Flexibility	.52
EAS-2	29.	EAS #2, Numerical Ability (Total Score)	Numerical Ability	.50
MP-II	45.	Match Problems V (Part II)	Figural Adaptive Flexibility	.49
SRT	18.	Shortest Road Test (Total Score)	Length Estimation	.47
LR	34.	Logical Reasoning (Total Score)	Syllogistic Reasoning	.46

Variable		Test	Cognitive Abilities	Factor Loading
GCT	3.	Gestalt Completion Test (Total Score)	Speed of Closure	.41
NPT	19.	Nearer Point Test (Total Score)	Length Estimation	.40
HPT	1.	Hidden Patterns Test (Total Score)	Flexibility of Closure	.34

FACTOR C (Spatial Scanning)

Variable		Test	Cognitive Abilities	Factor Loading
MTS-II	38.	Maze Tracing Speed (Part II)	Spatial Scanning	.86
MTS-I	37.	Maze Tracing Speed (Part I)	Spatial Scanning	.83
WA	8.	Word Arrangements (Total Score)	Expressional Fluency	.52
HPT	1.	Hidden Patterns Test (Total Score)	Flexibility of Closure	.44

FACTOR D (Perceptual Speed)

Variable		Test	Cognitive Abilities	Factor Loading
NCT-II	27.	Number Comparison Test (Part II)	Perceptual Speed	.80
NCT-I	26.	Number Comparison Test (Part I)	Perceptual Speed	.78
AO	30.	Airhtmetic Operations (Total Score)	Number Ability	.57

Variable		Test	Cognitive Abilities	Factor Loading
		FACTOR E (Associative (Rote) Memory)		
FLNT-I	20.	First and Last Names Test (Part I)	Associative (Rote) Memory	.76
FLNT-II	21.	First and Last Names Test (Part II)	Associative (Rote) Memory	.65
AO	30.	Arithmetic Operations (Total Score)	Number Ability	.40
EAS-2	29.	EAS #2, Numerical Ability (Total Score)	Number Ability	.38
		FACTOR F (General Lipreading)		
SEX	24.	Sex	Attention to Detail	.77
SLE-II	55.	Sentence Lipreading Test -- 2nd 10 Sentences	Lipreading (E)*	.63
PLD-I	51.	Phrase Lipreading Test -- 1st 10 Phrases	Lipreading (D)	.62
WLA-III	50.	Word Lipreading Test -- 3rd 10 Words	Lipreading (A)	.59

Variable		Test	Cognitive Abilities	Factor Loading
PLE-III	53.	Phrase Lipreading Test -- 2nd 10 Phrases	Lipreading (A)	.58
PLA-II	52.	Phrase Lipreading Test -- 3rd 10 Phrases	Lipreading (E)	.58
WBE-II	14.	Word Beginnings and Endings Test (Part II)	Word Fluency	.47
WLE-I	48.	Word Lipreading Test -- 1st 10 Words	Lipreading (E)	.46
FLNT-II	21.	First and Last Names Test (Part II)	Associative (Rote) Memory	.33
SLA-I	54.	Sentence Lipreading Test -- 1st 10 Sentences	Lipreading (A)	.33
LR	34.	Logical Reasoning (Total Score)	Syllogistic Reasoning	.31
TCT-I	11.	Things Categories Test (Part I)	Ideational Fluency	.30

Variable		Test	Cognitive Abilities	Factor Loading
		FACTOR G (Memory Span)		
DSV-I	22.	Digit Span-Visual (Part I)	Memory Span	.67
DSV-II	23.	Digit Span-Visual (Part II)	Memory Span	.66
WBE	13.	Word Beginnings and Endings Test (Part I)	Word Fluency	.32
		FACTOR H (Verbal Comprehension)		
WRVT-I	39.	Wide Range Vocabulary Test (Part I)	Verbal Comprehension	.64
FC	16.	Figure Classification (Total Score)	Induction	.51
SDT	43.	Surface Development Test (Total Score)	Visualization	.33
WRVT-II	40.	Wide Range Vocabulary Test (Part II)	Verbal Comprehension	.31

Variable		Test	Cognitive Abilities	Factor Loading

FACTOR I (Syllogistic Reasoning)

Variable		Test	Cognitive Abilities	Factor Loading
LR	34.	Logical Reasoning (Total Score)	Syllogistic Reasoning	.50
CCT-I	35.	Cube Comparison Test (Part I)	Spatial Orientation	.44
MP-II	45.	Match Problems V (Part II)	Figural Adaptive Flexibility	.36
CCT-II	36.	Cube Comparison Test (Part II)	Spatial Orientation	.33
WRVT-II	40.	Wide Range Vocabulary Test (Part II)	Verbal Comprehension	.33
WBE-II	14.	Word Beginnings and Endings Test (Part II)	Word Fluency	.32

FACTOR J (Doublet)

Variable		Test	Cognitive Abilities	Factor Loading
UT-I	46.	Utility Test (Part I)	Semantic Spontaneous Flexibility	.60
WBE-I	13.	Word Beginnings and Endings Test (Part I)	Word Fluency	.31

Variable		Test	Cognitive Abilities	Factor Loading
FACTOR K (Semantic Redefinition)				
OS	32.	Object Synthesis (Total Score)	Semantic Redefinition	.60
AF-II	6.	Association Fluency (Part II)	Associational Fluency	.45
GCT	3.	Gestalt Completion Test (Total Score)	Speed of Closure	.30
FACTOR L (Speed of Closure)				
CWT	4.	Concealed Words Test (Total Score)	Speed of Closure	.55
GCT	3.	Gestalt Completion Test (Total Score)	Speed of Closure	.42
CCT-II	36.	Cube Comparison Test (Part II)	Spatial Orientation	.41
CT	2.	Copying Test (Total Score)	Flexibility of Closure	.30

*(A) Average difficulty to lipread speaker
 (D) Difficult to lipread speaker
 (E) Easy to lipread speaker

APPENDIX N

COMMUNALITIES, MEANS AND STANDARD DEVIATIONS

OF VARIABLES IN THE ELEVENTH GRADE ANALYSIS

Variable	#	h^2	Mean	Standard Deviation	Variable
HPT-I	1.	.55	59.35	26.04	Hidden Patterns Test (Total Score)
CT	2.	.73	22.38	7.74	Copying Test (Total Score)
GCT	3.	.52	16.82	3.15	Gestalt Completion Test (Total Score)
CWT	4.	.54	21.92	4.76	Concealed Words Test (Total Score)
AF-I	5.	.65	7.88	3.00	Associational Fluency (Part I)
AF-II	6.	.54	7.68	2.97	Associational Fluency (Part II)
SI	7.	.67	5.72	2.09	Similie Interpretation (Total Score)
WA	8.	.51	26.83	8.27	Word Arrangements (Total Score)
TT	9.	.65	16.22	6.06	Topics Test (Total Score)
TCT-T	10.	.57	14.58	4.27	Things Categories Test (Total Score)
WBE-I	13.	.54	9.87	2.98	Word Beginnings and Endings Test (Part I)
WBE-II	14.	.43	6.63	2.00	Word Beginnings and Endings Test (Part II)
LT	15.	.66	7.17	4.34	Locations Test (Total Score)
FC	16.	.54	93.50	27.35	Figure Classification Test (Total Score)
ELT	17.	.66	17.57	8.12	Estimation of Length (Total Score)

Variable	#	h^2	Mean	Standard Deviation	Variable
SRT	18.	.56	29.73	8.05	Shortest Road Test (Total Score)
NPT	19.	.57	32.93	10.16	Nearer Point Test (Total Score)
FLNT-I	20.	.77	9.63	3.53	First and Last Names Test (Part I)
FLNT-II	21.	.94	11.08	2.74	First and Last Names Test (Part II)
DSV-I	22.	.71	33.47	3.16	Digit Span-Visual (Part I)
DSV-II	23.	.60	33.27	4.47	Digit Span-Visual (Part II)
SEX	24.	.83	1.50	0.50	Sex (1 = male, 2 = female)
FAT	25.	.54	62.10	13.81	Finding A's Test (Total Score)
NCT-I	26.	.52	12.17	4.31	Number Comparison Test (Part I)
NCT-II	27.	.62	10.58	4.16	Number Comparison Test (Part II)
SD	28.	.56	17.33	5.50	Ship Destination (Total Score)
EAS-2	29.	.79	38.98	11.34	EAS #2, Numerical Ability (Total Score)
AO	30.	.43	29.33	9.43	Arithmetic Operations (Total Score)
GT	31.	.58	6.78	3.33	Gestalt Transformation (Total Score)

Variable	#	h^2	Mean	Standard Deviation	Variable
OS	32.	.65	6.33	2.72	Object Synthesis (Total Score)
NST	33.	.50	14.43	5.85	Nonsense Syllogisms Test (Total Score)
LR	34.	.60	22.75	5.57	Logical Reasoning (Total Score)
CCT-I	35.	.74	5.12	4.69	Cube Comparison Test (Part I)
CCT-II	36.	.81	5.88	4.51	Cube Comparison Test (Part II)
MTS-I	37.	.85	8.88	3.34	Maze Tracing Speed Test (Part I)
MTS-II	38.	.96	11.52	3.49	Maze Tracing Speed Test (Part II)
WRVT-I	39.	.61	8.12	3.73	Wide Range Vocabulary Test (Part I)
WRVT-II	40.	.77	7.08	2.86	Wide Range Vocabulary Test (Part II)
FBT	41.	.60	83.17	32.28	Form Board Test (Total Score)
PFT	42.	.79	8.73	4.25	Paper Folding Test (Total Score)
SDT	43.	.71	23.73	11.72	Surface Development Test (Total Score)
MP-I	44.	.49	5.93	2.68	Match Problems V (Part I)
MP-II	45.	.74	2.48	1.54	Match Problems V (Part II)

Variable	#	h^2	Mean	Standard Deviation	Variable
UT-I	46.	.80	4.77	3.71	Utility Test (Part I)
UT-II	47.	.77	5.40	3.81	Utility Test (Part II)
WLE-I	*48.	.55	1.18	0.70	Word Lipreading Test, 1st 10 words
WLD-II	*49.	.57	0.91	0.73	Word Lipreading Test, 2nd 10 words
WLA-III	*50.	.69	2.43	1.16	Word Lipreading Test, 3rd 10 words
PLD-I	*51.	.71	3.93	2.12	Phrase Lipreading Test, 1st 10 Phrases
PLA-II	*52.	.65	6.64	3.21	Phrase Lipreading Test, 2nd 10 Phrases
PLE-III	*53.	.74	8.61	4.00	Phrase Lipreading Test, 3rd 10 Phrases
SLA-I	*54.	.78	10.23	7.81	Sentence Lipreading Test, 1st 10 Sentences
SLE-II	*55.	.75	16.00	7.93	Sentence Lipreading Test, 2nd 10 Sentences
SLD-III	*56.	.65	0.75	1.58	Sentence Lipreading Test, 3rd 10 Sentences

*Medians and Semi-interquartile ranges are presented for variables 48 through 56.

APPENDIX O

CORRELATION MATRIX OF 54 COGNITIVE AND

LIPREADING VARIABLES IN THE

ELEVENTH GRADE ANALYSIS

LIP DATA GROUP B SET ONE CORRELATION MATRIX

		1	2	3	4	5	6	7	8	9	10
HPT	1.	1.000	.396	.131	.150	.222	.183	.181	.101	.326	.217
CT	2.	.396	1.000	.020	.237	.214	.048	.151	.168	.233	.110
GCT	3.	.131	.020	1.000	.260	.282	.136	.200	.135	.075	.220
CWT	4.	.150	.237	.260	1.000	.190	−.016	−.083	.081	−.161	.123
AF-I	5.	.222	.214	.282	.190	1.000	.325	.247	.274	.186	.255
AF-II	6.	.183	.048	.136	−.016	.325	1.000	.225	.171	.182	.178
SI	7.	.181	.151	.200	−.083	.247	.225	1.000	.289	.361	.312
WA	8.	.191	.168	.135	.081	.274	.171	.289	1.000	.358	.299
TT	9.	.326	.233	.075	−.161	.186	.182	.361	.358	1.000	.346
TCT-T	10.	.217	.110	.220	.123	.255	.178	.312	.299	.346	1.000
WBE-I	13.	.074	.423	.088	.161	.162	.125	.018	.185	.215	.260
WBE-II	14.	.361	.192	.217	.256	.407	.225	.107	.312	.089	.240
LT	15.	.352	.281	.326	.191	.496	.187	.171	.348	.359	.388
FC	16.	.087	.348	.173	.175	.324	−.015	.179	.300	.181	.155

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LIP DATA GROUP B SET ONE CORRELATION MATRIX--CONTINUED

		1	2	3	4	5	6	7	8	9	10
ELT	17.	.178	.262	.010	.071	.227	-.020	.056	.241	.144	.088
SRT	18.	.240	.403	.258	.104	.306	.038	.185	.191	.105	.239
NPT	19.	.170	.334	-.116	-.057	.043	.096	.151	.167	.035	.055
FLNT-I	20.	.047	.054	-.021	.023	.117	.011	-.061	.060	-.013	.056
FLNT-II	21.	.249	.112	.054	.117	.242	.009	-.077	.139	-.020	.073
DSV-I	22.	-.028	.088	-.065	.069	.037	-.080	.128	.028	.019	.245
DSV-II	23.	-.068	-.053	.271	.300	.144	.054	.028	.123	-.080	.187
SEX	24.	.119	.235	-.297	-.051	-.035	-.074	.118	.111	.132	-.049
FAT	25.	.279	.344	-.020	.184	-.104	.115	.039	.047	.120	.126
NCT-I	26.	-.029	.116	.028	-.111	.151	.065	.185	.280	.228	.081
NCT-II	27.	.279	.204	-.081	-.029	.085	.103	.053	.127	.153	.049
SD	28.	.369	.314	.282	.109	.321	.185	.134	.188	.384	.393
EAS-2	29.	.248	.287	-.046	.008	.407	.143	.010	.372	.366	.219
AO	30.	.095	.071	.059	.058	.120	.008	.007	.137	.088	.044

LIP DATA GROUP B SET ONE CORRELATION MATRIX—CONTINUED

		1	2	3	4	5	6	7	8	9	10
GT	31.	.227	.127	.146	.279	.426	.222	.046	.190	.110	.310
OS	32.	173	.118	.287	.164	.256	.147	.005	.082	.105	.433
NST	33.	.233	.101	.278	-.011	.204	.102	.048	-.046	-.011	.214
LR	34.	.161	.248	.061	.229	.441	.054	.163	.332	.063	.212
CCT-I	35.	.132	-.002	-.014	.101	.180	-.180	-.019	.098	.238	.040
CCT-II	36.	.297	.297	.091	.259	.273	.021	.223	.113	.264	.196
MTS-I	37.	.122	.219	.323	.331	.201	.074	.200	.209	.264	.290
MTS-II	38.	.213	.270	.352	.357	.234	.095	.272	.346	.330	.336
WRVT-I	39.	.158	.131	.301	.067	.381	.247	.210	.264	.120	.221
WRVT-II	40.	.260	.216	.198	.131	.372	.127	.035	.260	.165	.167
FBT	41.	.101	.112	.215	.190	.326	.227	-.078	-.040	-.081	.104
PFT	42.	.289	.421	.115	.207	.380	.071	.160	.218	.237	.260
SDT	43.	.206	.327	.229	.296	.180	-.034	-.040	.010	.188	.383
MP-I	44.	.160	.267	.174	.086	.370	.280	.059	.134	.124	.207

LIP DATA GROUP B SET ONE CORRELATION MATRIX--CONTINUED

		1	2	3	4	5	6	7	8	9	10
MP-II	45.	.090	.230	.049	.060	.242	.259	.099	.220	-.011	.208
UT-I	46.	.133	.054	.256	.034	.229	.403	.245	.246	.324	.482
UT-II	47.	.081	-.081	.202	-.051	.022	.185	.186	.369	.385	.517
WLE-I	48.	.022	-.066	.022	.246	.283	-.082	-.079	.066	.001	.006
WLD-II	49.	.004	-.068	.057	.183	.087	-.061	-.151	.040	.110	-.029
WLA-III	50.	.060	.131	.026	.150	.183	-.051	-.088	-.020	-.030	.051
PLD-I	51.	.134	.087	.184	-.100	.179	-.003	.058	-.054	-.085	-.101
PLA-II	52.	.047	.016	.094	.040	-.070	.047	-.079	.005	.006	-.037
PLE-III	53.	.090	-.015	-.101	-.115	.128	-.129	.024	-.016	-.085	-.105
SLA-I	54.	.112	-.014	.159	.016	.180	-.084	-.006	-.051	.128	.120
SLE-II	55.	.008	.233	.272	.039	.185	.032	-.051	.166	.095	.140
SLD-III	56.	.266	.373	.232	-.021	.281	.147	.373	.046	.115	.170

LIP DATA GROUP B SET ONE CORRELATION MATRIX—CONTINUED

		13	14	15	16	17	18	19	20	21	22
HPT	1.	.074	.361	.352	.087	.178	.240	.170	.047	.249	-.028
CT	2.	.423	.192	.281	.348	.262	.403	.334	.054	.112	.088
GCT	3.	.088	.217	.326	.173	.010	.258	-.116	-.021	.054	-.065
CWT	4.	.161	.256	.191	.175	.071	.104	-.057	.023	.117	.069
AF-I	5.	.162	.407	.496	.324	.227	.306	.043	.117	.242	.037
AF-II	6.	.125	.225	.187	-.015	-.020	.038	.096	.011	.009	-.080
SI	7.	.018	.107	.171	.179	.056	.185	.151	-.061	-.077	.128
WA	8.	.185	.312	.348	.300	.241	.191	.167	.060	.139	.028
TT	9.	.215	.089	.359	.181	.144	.105	.035	-.013	-.020	.019
TCT-T	10.	.260	.240	.388	.155	.088	.239	.055	.056	.073	.245
WBE-I	13.	1.000	.223	.132	.250	.159	.123	.184	-.014	-.001	.171
WBE-II	14.	.223	1.000	.366	.423	.259	.146	.023	.019	.255	-.076
LT	15.	.132	.366	1.000	.368	.175	.188	.186	.338	.491	.066
FC	16.	.250	.423	.368	1.000	.272	.162	.135	.088	.253	-.028

LIP DATA GROUP B SET ONE CORRELATION MATRIX--CONTINUED

		13	14	15	16	17	18	19	20	21	22
ELT	17.	.159	.259	.175	.272	1.000	.098	-.037	.092	.220	-.204
SRT	18.	.123	.146	.188	.162	.098	1.000	.009	-.104	-.064	.095
NPT	19.	.184	.023	.186	.135	-.037	.009	1.000	.110	.030	.257
FLNT-I	20.	-.014	.019	.338	.088	.092	-.104	.110	1.000	.785	.235
FLNT-II	21.	-.001	.255	.491	.253	.220	-.064	.030	.785	1.000	.099
DSV-I	22.	.171	-.076	.066	-.028	-.204	.095	.257	.235	.099	1.000
DSV-II	23.	.245	.074	.277	.005	-.055	.056	-.054	.163	.157	.363
SEX	24.	.162	-.049	-.004	.149	.294	-.063	.050	.210	.235	-.057
FAT	25.	.057	.071	.117	.143	.148	.240	.003	.134	.160	.101
NCT-I	26.	.078	.065	.069	.180	.028	.102	.191	.096	.047	.029
NCT-II	27.	.174	.102	.055	-.032	.240	.164	.152	.105	.130	.249
SD	28.	.224	.144	.337	.204	.074	.248	.142	.023	-.015	.257
EAS-2	29.	.241	.286	.386	.415	.133	.204	.067	.181	.287	.068
AO	30.	.167	.154	.026	.148	.093	.080	.104	.132	.094	-.066

LIP DATA GROUP B SET ONE CORRELATION MATRIX—CONTINUED

		13	14	15	16	17	18	19	20	21	22
GT	31.	.039	.358	.376	.102	.056	.183	-.072	.221	.256	.055
OS	32.	.155	.322	.244	.076	.334	.293	.057	-.039	.007	-.132
NST	33.	.066	.279	.301	.131	.024	.278	.044	-.167	.013	.001
LR	34.	.109	.207	.378	.348	.106	.324	.281	.032	.083	.162
CCT-I	35.	.014	.095	.113	.174	.122	.174	-.261	-.161	-.028	.093
CCT-II	36.	.261	.260	.276	.461	.295	-.010	-.096	.049	.197	.164
MTS-I	37.	.155	.368	.359	.167	.109	.396	.007	-.203	-.114	.131
MTS-II	38.	.231	.381	.356	.253	.202	.409	-.125	-.218	-.093	.017
WRVT-I	39.	.135	.292	.300	.289	.099	.305	.178	.164	.113	.059
WRVT-II	40.	.216	.317	.344	.305	.167	.456	.116	.005	.080	.036
FBT	41.	.198	.210	.179	.147	.395	.154	-.085	-.088	.030	-.209
PFT	42.	.020	.235	.264	.237	.194	.374	.025	-.045	-.020	.118
SDT	43.	.152	.206	.310	.246	.037	.205	-.039	-.150	-.020	.110
MP-I	44.	.070	.222	.298	.111	.033	.306	.133	-.047	-.031	.255

LIP DATA GROUP B SET ONE CORRELATION MATRIX--CONTINUED

		13	14	15	16	17	18	19	20	21	22
MP-II	45.	.130	.257	.112	.145	.271	.433	.039	.078	-.013	.131
UT-I	46.	.054	.188	.274	-.075	-.082	.183	-.048	-.040	-.164	.123
UT-II	47.	-.019	.083	.233	.026	-.071	.148	-.238	-.108	-.182	-.032
WLE-I	48.	.092	.191	.003	.138	.322	.120	-.107	.265	.179	.095
WLD-II	49.	.104	.042	.024	.053	.054	-.045	-.167	.057	.084	.006
WLA-III	50.	-.011	.000	-.008	-.123	.222	.075	-.092	.066	.030	.147
PLD-I	51.	.107	.142	-.090	.010	-.067	.034	.077	-.062	-.133	-.041
PLA-II	52.	.081	.163	.098	.045	.308	-.035	-.115	.045	.126	-.052
PLE-III	53.	-.056	.050	-.085	-.027	.070	.021	-.007	.104	.018	.032
SLA-I	54.	.197	.032	.012	-.004	.296	-.028	-.096	.122	.083	.057
SLE-II	55.	.325	.123	.191	.235	.261	.138	-.049	.192	.236	-.079
SLD-III	56.	.151	.172	.287	.118	.120	.343	.115	-.018	.048	.142

		23	24	25	26	27	28	29	30	31	32
HPT	1.	-.068	.119	.279	-.029	.279	.369	.248	.095	.227	.173
CT	2.	-.053	.235	.344	.116	.204	.314	.287	.071	.127	.118
GCT	3.	.271	-.297	-.020	.028	-.071	.282	-.046	.059	.146	.287
CWT	4.	.300	-.051	.184	-.111	-.029	.109	.008	.058	.279	.164
AF-I	5.	.144	-.035	-.104	.151	.085	.321	.407	.120	.426	.256
AF-II	6.	.054	-.074	.115	.065	.103	.185	.143	.008	.222	.147
SI	7.	.028	.118	.039	.185	.053	.134	.010	.007	.046	.005
WA	8.	.123	.111	.047	.280	.127	.188	.372	.137	.190	.082
TT	9.	-.080	.132	.120	.228	.153	.384	.366	.088	.110	.105
TCT-T	10.	.187	-.049	.126	.081	.049	.393	.219	.044	.310	.433
WBE-I	13.	.245	.162	.057	.078	.174	.224	.241	.167	.039	.155
WBE-II	14.	.074	-.049	.071	.065	.102	.144	.286	.154	.358	.322
LT	15.	.277	-.004	.117	.069	.055	.337	.386	.026	.376	.244
FC	16.	.005	.149	.143	.180	-.032	.204	.415	.148	.102	.076

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		23	24	25	26	27	28	29	30	31	32
ELT	17.	-.055	.294	.148	.028	.240	.074	.133	.093	.056	.334
SRT	18.	.056	-.063	.240	.102	.164	.248	.204	.080	.183	.293
NPT	19.	-.054	.050	.003	.191	.152	.142	.067	.104	-.072	.057
FINT-I	20.	.163	.210	.134	.096	.105	.023	.181	.132	.221	-.039
FINT-II	21.	.157	.235	.160	.047	.130	-.015	.287	.094	.256	.007
DSV-I	22.	.363	-.057	.101	.029	.249	.257	.068	-.066	.055	-.132
DSV-II	23.	1.000	.076	.188	.084	.165	.194	.261	.223	.125	.036
SEX	24.	.076	1.000	.184	.330	.352	-.189	.309	.394	-.240	-.123
FAT	25.	.188	.184	1.000	.137	.253	.385	.277	.153	.035	.085
NCT-I	26.	.084	.330	.137	1.000	.315	.055	.370	.315	-.147	-.152
NCT-II	27.	.165	.352	.253	.315	1.000	.224	.363	.286	.099	-.017
SD	28.	.194	-.189	.385	.055	.224	1.000	.410	.023	.411	.114
EAS-2	29.	.261	.309	.277	.370	.363	.410	1.000	.431	.320	.045
AO	30.	.223	.394	.153	.315	.286	.023	.431	1.000	-.041	.061

		23	24	25	26	27	28	29	30	31	32
GT	31.	.125	-.240	.035	-.147	.099	.411	.320	-.041	1.000	.208
OS	32.	.036	-.123	.085	-.152	-.017	.114	.045	.061	.208	1.000
NST	33.	.048	-.483	-.027	-.183	-.162	.130	.018	-.181	.155	.339
LR	34.	-.009	-.059	.112	.204	.129	.280	.396	.141	.372	.081
CCT-I	35.	.013	.001	-.092	-.038	.143	.232	.294	-.024	.192	-.071
CCT-II	36.	.045	.051	.180	.032	.179	.382	.343	.026	.279	-.120
MTS-I	37.	.273	-.402	.162	-.029	.110	.426	.149	-.068	.375	.218
MTS-II	38.	.296	-.279	.277	-.025	.096	.424	.194	-.010	.357	.293
WRVT-I	39.	.117	-.062	-.046	.096	.234	.161	.278	.038	.382	.339
WRVT-II	40.	.144	-.185	.083	-.032	.232	.248	.368	.029	.353	.403
FBT	41.	.104	-.120	.013	-.164	-.103	.180	.030	-.118	.311	.468
PFT	42.	.156	.006	.235	.096	.188	.502	.564	.102	.484	.179
SDT	43.	.021	-.238	.095	-.024	-.001	.331	.206	-.156	.326	.305
MP-I	44.	.049	-.185	-.014	-.204	.224	.313	.262	.106	.295	.090

		23	24	25	26	27	28	29	30	31	32
MP-II	45.	.206	.023	.167	.025	.073	.201	.214	.054	.283	.219
UT-I	46.	.055	-.409	-.024	.007	-.011	.389	.113	.027	.356	.177
UT-II	47.	.064	-.177	.045	.068	-.028	.273	.094	.137	.222	.117
WLE-I	48.	.163	.202	.245	.211	.317	.193	.163	.259	.226	.224
WLD-II	49.	.126	.341	.199	.061	.188	.117	.338	.340	-.059	-.082
WLA-III	50.	.253	.302	.147	.155	.324	.218	.166	.269	.175	.110
PLD-I	51.	.105	.155	-.108	.307	.106	.047	.180	.209	.004	-.041
PLA-II	52.	.190	.228	.227	.230	.308	-.047	.113	.072	-.021	.053
PLE-III	53.	.171	.502	-.005	.302	.524	.085	.319	.332	-.095	-.171
SLA-I	54.	.223	.279	.049	.307	.436	.061	.164	.213	-.022	.197
SLE-II	55.	.237	.332	.147	.440	.224	.137	.290	.353	.037	.131
SLD-III	56.	.192	.221	.048	.101	.190	.152	.091	.114	.146	.318

		33	34	35	36	37	38	39	40	41	42
HPT	1.	.233	.161	.132	.297	.122	.213	.158	.260	.101	.289
CT	2.	.101	.248	-.002	.297	.219	.270	.131	.216	.112	.421
GCT	3.	.278	.061	-.014	.091	.323	.352	.301	.198	.215	.115
CWT	4.	-.011	.229	.010	.259	.331	.357	.067	.131	.190	.207
AF-I	5.	.204	.441	.180	.273	.201	.234	.381	.372	.326	.380
AF-II	6.	.102	.054	-.180	.021	.074	.095	.247	.127	.227	.071
SI	7.	.048	.163	-.019	.223	.200	.272	.210	.035	-.078	.160
WA	8.	-.046	.332	.098	.113	.209	.346	.264	.260	-.040	.218
TT	9.	-.011	.063	.238	.264	.264	.330	.120	.165	-.081	.237
TCT-T	10.	.214	.212	.040	.196	.290	.336	.221	.167	.104	.260
WBE-I	13.	.066	.109	.014	.261	.155	.231	.135	.216	.198	.020
WBE-II	14.	.279	.207	.095	.260	.368	.381	.292	.317	.210	.235
LT	15.	.301	.378	.113	.276	.359	.356	.300	.344	.179	.264
FC	16.	.131	.348	.174	.461	.167	.253	.289	.305	.147	.237

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		33	34	35	36	37	38	39	40	41	42
ELT	17.	.024	.106	.122	.295	.109	.202	.099	.167	.395	.194
SRT	18.	.278	.324	.174	-.010	.396	.409	.305	.456	.154	.374
NPT	19.	.044	.281	-.261	-.096	.007	-.125	.178	.116	-.085	.025
FLNT-I	20.	-.167	.032	-.161	.049	-.203	-.218	.164	.005	-.088	-.045
FLNT-II	21.	.013	.083	-.028	.197	-.114	-.093	.113	.080	.030	-.020
DSV-I	22.	.001	.162	.093	.164	.131	.017	.059	.036	-.209	.118
DSV-II	23.	.048	-.009	.013	.045	.273	.296	.117	.144	.104	.156
SEX	24.	-.483	-.059	.001	.051	-.402	-.279	-.062	-.185	-.120	.006
FAT	25.	-.027	.112	-.092	.180	.162	.277	-.046	.083	.013	.235
NCT-I	26.	-.183	.204	-.038	.032	-.029	-.025	.096	-.032	-.164	.096
NCT-II	27.	-.162	.129	.143	.179	.110	.096	.234	.232	-.103	.188
SD	28.	.130	.280	.232	.382	.426	.424	.161	.248	.180	.502
EAS-2	29.	.018	.396	.294	.343	.149	.194	.278	.368	.030	.564
AO	30.	-.181	.141	-.024	.026	-.068	-.010	.038	.029	-.118	.102

		33	34	35	36	37	38	39	40	41	42
GT	31.	.155	.372	.192	.279	.375	.357	.382	.353	.311	.484
OS	32.	.339	.081	-.071	-.120	.218	.293	.339	.403	.468	.179
NST	33.	1.000	.128	.056	.167	.236	.163	.025	.268	.195	.193
LR	34.	.128	1.000	.323	.409	.248	.143	.261	.370	.055	.424
CCT-I	35.	.056	.323	1.000	.513	.282	.248	.061	.285	.023	.492
CCT-II	36.	.167	.409	.513	1.000	.243	.199	.129	.214	.225	.464
MTS-I	37.	.236	.248	.282	.243	1.000	.868	.150	.278	.157	.392
MTS-II	38.	.163	.143	.248	.199	.868	1.000	.175	.367	.198	.350
WRVT-I	39.	.025	.261	.061	.129	.150	.175	1.000	.626	.224	.359
WRVT-II	40.	.268	.370	.285	.214	.278	.367	.626	1.000	.259	.336
FBT	41.	.195	.055	.0234	.225	.157	.198	.224	.259	1.000	.223
PFT	42.	.193	.424	.492	.464	.392	.350	.359	.336	.223	1.000
SDT	43.	.393	.405	.406	.441	.287	.214	.265	.404	.253	.541
MP-I	44.	.305	.238	.175	.290	.272	.109	.214	.348	.087	.323

		33	34	35	36	37	38	39	40	41	42
MP-II	45.	.259	.206	.374	.205	.315	.285	.202	.282	.238	.540
UT-I	46.	.230	.204	.022	.153	.383	.330	.184	.071	.194	.319
UT-II	47.	.001	-.028	.051	-.008	.176	.329	.099	.017	.009	.094
WLE-I	48.	-.139	.202	.151	.235	.016	.026	.199	.280	.110	.178
WLD-II	49.	.203	.060	.062	.162	-.122	-.127	.036	-.002	-.163	.174
WLA-III	50.	.222	.057	-.011	.033	.035	-.043	-.094	-.169	-.022	.196
PLD-I	51.	.108	.039	.065	-.030	-.111	-.170	.145	-.069	.122	.301
PLA-II	52.	-.119	-.066	.173	.206	.147	.052	.164	-.019	.180	.287
PLE-III	53.	-.331	.027	.139	.033	-.105	-.206	.085	-.087	-.263	.180
SLA-I	54.	-.233	-.140	.035	.142	-.009	.010	.304	.149	.100	.072
SLE-II	55.	-.156	-.031	.095	.182	-.064	.038	.209	.156	.278	.190
SLD-III	56.	.203	.074	-.028	.022	-.011	.117	.273	.306	.153	.228

		43	44	45	46	47	48	49	50	51	52
HPT	1.	.206	.160	.090	.133	.081	.022	.004	−.060	−.134	−.047
CT	2.	.327	.267	.230	.054	−.081	−.006	−.068	.131	.087	.016
GCT	3.	.229	.174	.049	.256	.202	.022	.057	.026	.184	.094
CWT	4.	.296	.086	.060	.034	−.051	.246	.183	.150	−.100	.040
AF–I	5.	.180	.370	.242	.229	.022	.283	.087	.183	.179	−.070
AF–II	6.	.034	.280	.259	.403	.185	−.082	−.061	−.051	−.003	.047
SI	7.	−.040	.059	.099	.245	.186	−.079	−.151	−.088	.058	−.079
WA	8.	.010	.134	.220	.246	.369	.066	.040	−.020	−.054	.005
TT	9.	.188	.124	−.011	.324	.385	.001	.110	−.030	−.085	.066
TCT–T	10.	.383	.207	.208	.482	.517	.066	−.029	.051	−.101	−.037
WBE–I	13.	.152	.070	.130	.054	−.019	.092	.104	−.011	.107	.081
WBE–II	14.	.206	.222	.257	.188	.083	.191	.042	.000	.142	.163
LT	15.	.310	.298	.112	.274	.233	.003	.024	−.008	−.090	.298
FC	16.	.246	.111	.145	−.075	.026	.138	.053	−.123	.010	.045

		43	44	45	46	47	48	49	50	51	52
ELT	17.	.037	.033	.271	−.082	−.071	.322	.054	.222	−.067	.308
SRT	18.	.205	.306	.433	.183	.148	.120	−.045	.075	.034	−.035
NPT	19.	−.039	.133	.039	−.048	−.238	−.107	−.167	−.092	.077	−.115
FLNT-I	20.	−.150	−.047	.078	−.040	−.108	.265	.057	.066	−.062	.045
FLNT-II	21.	−.020	−.031	−.013	−.164	−.182	.179	.084	.030	−.133	.126
DSV-I	22.	.110	.255	.131	.123	−.032	.095	.006	.147	−.041	−.052
DSV-II	23.	.021	.049	.206	.055	.064	.163	.126	.253	.105	.190
SEX	24.	−.238	−.185	.023	−.409	−.177	.202	.341	.302	.155	.228
FAT	25.	.095	−.014	.167	−.024	.045	.245	.199	.147	−.108	.227
NCT-I	26.	−.024	−.204	.025	.007	.068	.211	.061	.155	.307	.230
NCT-II	27.	−.001	.224	.073	−.011	−.028	.317	.188	.324	.106	.308
SD	28.	.331	.313	.201	.389	.273	.193	.117	.218	.047	−.047
EAS-2	29.	.206	.262	.214	.113	.094	.163	.338	.166	.180	.113
AO	30.	−.156	.106	.054	.027	.137	.259	.340	.269	.209	.072

		43	44	45	46	47	48	49	50	51	52
GT	31.	.326	.295	.283	.356	.222	.226	-.059	.175	.004	-.021
OS	32.	.305	.090	.219	.177	.117	.224	-.082	-.110	-.041	.053
NST	33.	.393	.305	.259	.230	.001	-.139	-.203	-.222	-.108	-.119
LR	34.	.405	.238	.206	.204	-.028	.202	.060	.057	.039	-.066
CCT-I	35.	.406	.175	.374	.022	.051	.151	.062	-.011	.065	.173
CCT-II	36.	.441	.290	.205	.153	-.008	.235	.163	.033	-.030	.206
MTS-I	37.	.287	.272	.315	.383	.176	.016	-.122	.035	-.111	.147
MTS-II	38.	.214	.109	.285	.330	.329	.026	-.127	-.043	-.170	.052
WRVT-I	39.	.265	.214	.202	.184	.099	.199	.036	-.094	.145	.164
WRVT-II	40.	.404	.348	.282	.071	.017	.280	-.002	-.169	-.069	-.019
FBT	41.	.253	.087	.238	.194	.009	.110	-.163	-.022	.122	.180
PFT	42.	.541	.323	.540	.319	.094	.178	.174	.196	.301	.287
SDT	43.	1.000	.279	.241	.254	.079	.147	-.055	-.065	.017	.107
MP-I	44.	.219	1.000	.257	.311	.170	.122	.117	.236	.091	.014

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		43	44	45	46	47	48	49	50	51	52
MP-II	45.	.241	.257	1.000	.145	-.022	.165	-.147	-.032	.034	.076
UT-I	46.	.254	.311	.145	1.000	.637	-.027	-.263	.081	.199	-.032
UT-II	47.	.019	.170	-.022	.637	1.000	-.007	-.089	.079	.048	-.016
WLE-I	48.	.147	.122	.165	-.027	-.007	1.000	.234	.415	.177	.226
WLD-II	49.	-.055	.117	-.147	-.263	-.089	.234	1.000	.236	.164	.358
WLA-III	50.	-.065	.236	-.032	.081	.079	.415	.236	1.000	.269	.200
PID-I	51.	.017	.091	.034	.199	.048	.177	.164	.269	1.000	.396
PIA-II	52.	.107	.014	.076	-.032	-.016	.226	.358	.200	.396	1.000
PLE-III	53.	-.213	.124	.054	-.198	-.149	.346	.394	.467	.404	.267
SLA-I	54.	-.017	-.040	-.110	-.069	-.007	.424	.372	.369	.318	.443
SLE-II	55.	.112	.013	.087	.047	.180	.390	.139	.300	.433	.499
SLD-III	56.	.187	.235	.086	.062	.098	.199	-.067	.169	.262	.045

		53	54	55	56			53	54	55	56
HPT	1.	−.090	−.112	.008	.266	ELT	17.	.070	.296	.261	.120
CT	2.	−.015	−.014	.233	.373	SRT	18.	.021	−.028	.138	.343
GCT	3.	−.101	.159	.272	.232	NPT	19.	−.007	−.096	−.049	.115
CWT	4.	−.115	.016	.039	−.021	FLNT-I	20.	.104	.122	.192	−.108
AF-I	5.	.128	.180	.185	.281	FLNT-II	21.	.018	.083	.236	.048
AF-II	6.	−.129	−.084	.032	.147	DSV-I	22.	.032	.057	−.079	.142
SI	7.	.024	−.006	−.051	.373	DSV-II	23.	.171	.223	.237	.192
WA	8.	−.016	−.051	.166	.046	SEX	24.	.503	.279	.332	.221
TT	9.	−.085	.128	.095	.115	FAT	25.	−.005	.049	.147	.048
TCT-T	10.	−.105	.120	.140	.170	NCT-I	26.	.302	.307	.440	.101
WBE-I	13.	−.056	.196	.325	.151	NCT-II	27.	.524	.436	.224	.190
WBE-II	14.	.050	.032	.123	.172	SD	28.	.085	.061	.137	.152
LT	15.	−.085	.012	.191	.287	EAS-2	29.	.319	.164	.290	.091
FC	16.	−.027	−.004	.235	.118	AO	30.	.332	.213	.353	.114

		53	54	55	56			53	54	55	56
GT	31.	-.095	-.022	.037	.146	MP-I	44.	.124	-.040	.013	.235
OS	32.	-.171	.197	.131	.318	MP-II	45.	.054	-.110	.087	.086
NST	33.	-.331	-.233	-.156	.203	UT-I	46.	-.198	-.069	.047	.062
LR	34.	.027	-.140	-.031	.074	WLE-I	47.	-.149	-.007	.180	.098
CCT-I	35.	.139	.035	.095	-.028	WLE-I	48.	.346	.424	.390	.199
CCT-II	36.	.033	.142	.182	.022	WLD-II	49.	.394	.372	.139	-.067
MTS-I	37.	-.105	-.009	-.064	-.011	WLA-III	50.	.467	.369	.300	.169
MTS-II	38.	-.206	.010	.038	.117	PLD-I	51.	.404	.318	.433	.262
WRVT-I	39.	.085	.304	.209	.273	PLA-II	52.	.267	.443	.499	.045
WRVT-II	40.	-.087	.149	.156	.306	PLE-III	53.	1.000	.436	.233	.169
FBT	41.	-.263	.100	.278	.153	SLA-I	54.	.436	1.000	.540	.187
PFT	42.	.180	.072	.190	.228	SLE-II	55.	.233	.540	1.000	.276
SDT	43.	-.213	-.017	.112	.187	SLD-III	56.	.169	.187	.276	1.000

APPENDIX P

UNROTATED FACTOR MATRIX, ELEVENTH GRADE ANALYSIS

		Roots	Commu- nality	1	2	3	4	5	6	7
HPT	1.	9.0449	.5245	.429	−.080	.264	.154	.003	−.094	−.115
CT	2.	4.9647	.7339	.491	.065	.261	.121	.102	−.348	−.130
GCT	3.	2.5532	.5209	.378	−.169	−.225	−.146	−.314	.098	.025
CWT	4.	2.4076	.5400	.311	−.061	.092	−.293	.058	.282	−.088
AF-I	5.	2.2914	.6512	.615	.026	.095	−.041	−.151	−.040	.256
AF-II	6.	1.9372	.5395	.262	−.150	−.057	.203	−.295	−.050	.117
SI	7.	1.8506	.6676	.285	−.099	−.084	.455	−.109	−.212	−.062
WA	8.	1.6608	.5070	.438	.008	.044	.349	−.104	.012	−.171
TT	9.	1.3254	.6523	.411	−.023	−.100	.454	.020	−.026	−.349
TCT-T	10.	1.2708	.5683	.520	−.185	−.134	.239	−.181	.162	−.037
WBE-I	13.	1.1725	.5417	.354	.110	.041	.018	−.093	−.130	−.170
WBE-II	14.	1.0897	.4291	.525	−.047	.115	−.115	−.153	−.012	−.071
LT	15.	1.0172	.6590	.623	−.097	.277	.138	−.226	.212	.001
FC	16.	9.353	.5397	.461	.060	.325	−.003	.011	−.123	−.222

		Roots	Commu- nality	1	2	3	4	5	6	7
ELT	17.	.9255	.6559	.346	.235	.151	−.280	−.119	−.137	−.376
SRT	18.	.8121	.5586	.501	−.133	−.080	−.004	.039	−.261	.075
NPT	19.	.6816	.5697	.104	.023	.307	.337	−.070	−.312	.233
FLNT-I	20.	.6317	.7701	.099	.333	.483	.097	−.274	.448	.209
FLNT-II	21.	.5687	.9337	.221	.293	.662	−.038	−.283	.446	.032
DSV-I	22.	.5270	.7085	.169	.043	.045	.253	.238	.247	.377
DSV-II	23.	.4705	.5999	.300	.185	−.154	−.055	−.089	.365	.112
SEX	24.	.3993	.8302	−.005	.765	.185	.183	−.012	−.198	−.243
FAT	25.	.3328	.5406	.290	.174	.088	.076	.113	.132	−.270
NCT-I	26.	.2880	.5236	.183	.453	−.107	.312	−.068	−.145	−.076
NCT-II	27.	.2372	.6229	.329	.493	−.065	.137	.134	−.045	.065
SD	28.	.2179	.5555	.604	−.081	−.122	.174	.191	.154	.036
EAS-2	29.	.1860	.7901	.603	.353	.135	.215	.194	.027	.007
AO	30.	.1568	.4310	.201	.460	−.072	.161	−.068	−.010	−.021

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		Roots	Commu-nality	1	2	3	4	5	6	7
GT	31.	.0827	.5837	.557	−.193	.052	−.112	.004	.280	.232
OS	32.	.0638	.6490	.404	−.206	−.306	−.309	−.430	−.174	−.047
NST	33.	.0258	.4984	.282	−.491	.106	−.160	−.045	−.125	.141
LR	34.	.0052	.6010	.513	−.050	.230	.085	.278	−.075	.199
CCT-I	35.	−.0252	.7370	.353	−.003	−.067	−.191	.582	−.007	−.075
CCT-II	36.	−.0400	.8099	.535	.065	.183	−.109	.402	.106	−.171
MTS-I	37.	−.0815	.8502	.564	−.376	−.236	−.045	.201	.188	−.195
MTS-II	38.	−.0932	.9618	.604	−.365	−.227	−.000	.046	.154	−.436
WRVT-I	39.	−.1151	.6054	.516	.028	.028	−.078	−.249	−.154	.241
WRVT-II	40.	−.1346	.7707	.601	−.135	.160	−.208	−.044	−.208	.136
FBT	41.	−.1541	.6066	.344	−.170	−.025	−.493	−.282	−.111	−.066
PFT	42.	−.1770	.7894	.699	.034	−.107	−.099	.392	−.102	.113
SDT	43.	−.1807	.7103	.524	−.270	.028	−.264	.242	−.066	.053
MP-I	44.	−.2093	.4781	.456	−.106	−.063	.033	.144	−.029	.365

		Roots	Commu- nality	1	2	3	4	5	6	7
MP-II	45.	-.2173	.7397	.463	-.099	.037	-.142	.176	-.153	.093
UT-I	46.	-.2346	.8038	.427	-.384	-.430	.282	-.140	.176	.159
UT-II	47.	-.2596	.7662	.276	-.216	-.492	.365	-.212	.229	-.145
WLE-I	48.	-.2773	.5482	.338	.437	-.052	-.277	-.010	.127	.095
WLD-II	49.	-.2792	.5712	.097	.497	-.062	-.084	.169	.167	-.060
WLA-III	50.	-.2942	.6938	.173	.487	-.308	-.033	.090	.210	.181
PLD-I	51.	-.3165	.7104	.139	.393	-.410	-.093	-.073	-.252	.291
PLA-II	52.	-.3173	.6502	.211	.441	-.240	-.302	-.018	.046	-.196
PLT-III	53.	-.3435	.7334	.068	.707	-.204	.043	.195	-.067	.232
SLA-I	54.	-.3721	.7781	.216	.597	-.314	-.229	-.215	.043	-.042
SLE-II	55.	-.3930	.7496	.371	.531	-.195	-.164	-.309	-.040	-.131
SLD-III	56.	-.4019	.6463	.394	.119	-.060	.042	-.274	-.345	.208

		8	9	10	11	12	13	14	15	16	17
HPT	1.	-.059	.267	-.202	.097	.193	-.087	.195	-.101	-.052	-.039
CT	2.	-.325	.308	.097	-.171	.035	.016	-.023	-.028	-.134	.152
GCT	3.	-.026	-.083	.239	-.063	.151	-.174	.098	-.187	-.024	-.053
CWT	4.	-.270	-.038	.122	-.230	.245	-.033	-.163	.060	-.064	-.215
AF-I	5.	.199	-.119	-.068	-.142	.140	-.226	-.112	.100	.072	.040
AF-II	6.	.075	.099	-.213	-.155	-.035	.035	.278	.282	.157	-.191
SI	7.	.003	-.060	.057	.033	-.149	-.472	-.067	-.026	-.003	-.307
WA	8.	.144	-.295	-.046	-.094	-.066	.065	-.137	.075	.016	.018
TT	9.	.211	.112	-.002	.280	.053	-.021	.070	.032	.015	.070
TCT-T	10.	-.009	.133	.050	.172	-.034	.093	-.221	-.018	.143	-.112
WBE-I	13.	-.206	.044	.329	-.009	.027	.158	-.055	.281	.294	.136
WBE-II	14.	.082	-.128	-.060	-.177	.100	-.104	.097	.074	.045	.026
LT	15.	.099	.002	.103	-.008	.063	-.115	.111	-.137	.002	.137
FC	16.	.169	-.158	.255	-.143	.057	-.029	-.115	-.021	.019	.000

		8	9	10	11	12	13	14	15	16	17
ELT	17.	.016	.094	−.280	.027	−.138	−.161	−.167	.192	.005	.117
SRT	18	−.256	−.134	−.162	.001	−.023	.067	−.078	−.288	−.060	.054
NPT	19.	−.241	−.022	.185	−.051	−.029	.098	.059	.250	−.157	.059
FLNT-I	20.	.027	.050	−.043	.046	−.258	.051	−.008	−.062	−.104	.009
FLNT-II	21.	.104	.054	−.023	.000	−.123	−.103	.112	−.175	−.055	.115
DSV-I	22.	−.370	.048	.276	.237	−.232	−.029	−.103	.086	.136	−.023
DSV-II	23.	−.341	−.188	.189	−.087	−.112	.017	.078	−.101	.303	−.060
SEX	24.	−.035	.085	−.128	−.042	−.036	−.064	−.123	−.095	.191	−.118
FAT	25.	−.363	.193	−.137	−.047	.004	.224	.132	−.113	−.125	−.240
NCT-I	26.	.083	−.156	.181	−.107	−.139	.109	−.030	−.041	−.209	−.028
NCT-II	27.	−.211	−.018	−.191	.272	−.015	−.019	.179	.177	−.085	.092
SD	28.	−.100	.206	.002	.036	.098	.065	.050	.066	−.063	.024
EAS-2	29.	.211	−.123	−.058	−.091	.123	.288	.143	−.052	.131	.081
AO	30.	−.014	−.119	−.073	−.170	.204	.175	−.064	−.068	.132	.015

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		8	9	10	11	12	13	14	15	16	17
GT	31.	.127	.034	−.212	−.055	−.001	.002	−.044	.079	−.132	−.020
OS	32.	−.122	.016	−.165	.189	.073	.160	−.107	−.022	.045	−.073
NST	33.	−.017	.112	.065	.009	.042	−.038	.137	−.169	.179	.103
LR	34.	.131	−.147	.075	−.127	.089	.061	−.230	.078	−.182	−.098
CCT-I	35.	.335	−.099	−.002	.186	−.184	−.080	−.041	−.147	.117	.131
CCT-II	36.	.250	.242	.231	.048	−.029	−.227	−.034	.191	.093	−.109
MTS-I	37.	−.276	−.254	.015	−.081	−.077	−.148	.143	.091	−.144	.149
MTS-II	38.	−.294	−.302	−.054	−.047	−.033	−.110	.047	−.024	−.078	.083
WRVT-I	39.	.123	−.255	.030	.234	−.034	.057	.099	.097	−.152	−.182
WRVT-II	40.	−.003	−.306	−.041	.348	.096	.189	.039	.001	−.022	.037
FBT	41.	.061	.207	−.046	−.137	−.104	.040	−.020	.190	.060	−.009
PFT	42.	.110	.117	−.083	−.122	−.125	.066	.091	−.138	−.089	−.155
SDT	43.	.107	.247	.270	.163	.033	.162	−.087	−.135	−.079	−.086
MP-I	44.	−.011	.114	−.104	.010	.174	−.072	.077	.089	.171	.165

		8	9	10	11	12	13	14	15	16	17
MP-II	45.	-.090	-.092	-.269	-.177	-.497	.118	-.016	-.044	.261	-.088
UT-I	46.	.184	.233	-.040	-.112	-.098	.076	-.025	.130	-.079	.029
UT-II	47.	.232	.099	-.096	.052	.030	.155	-.170	-.150	.021	.046
WLE-I	48.	-.042	-.019	-.137	.121	.019	..035	-.302	.058	-.115	-.083
WLD-II	49.	.067	-.055	.022	.038	.407	.054	.170	-.004	.160	-.200
WLA-III	50.	-.189	.213	-.193	-.167	.129	-.144	-.230	.034	-.071	.167
PLD-I	51.	.176	.081	.233	-.299	-.061	-.020	.123	-.059	-.098	.031
PLA-II	52.	.071	.090	.108	-.001	-.218	-.011	.359	.037	-.097	-.075
PLT-III	53.	-.004	-.155	-.160	-.004	.056	-.188	.053	-.042	.025	.044
SLA-I	54.	-.023	-.030	.129	.359	.016	-.981	.004	.157	-.062	.018
SLE-II	55.	.091	.122	.236	-.066	-.151	.163	-.048	-.116	-.037	.150
SLD-III	56.	-.201	.161	.022	.125	.039	-.255	-.057	-.290	.073	-.015

APPENDIX Q

ROTATED FACTOR MATRIX, ELEVENTH GRADE ANALYSIS

		A	B	C	D	E	F	G	H	I
HPT	1.	10	-23	22	22	19	19	-21	19	08
CT	2.	01	02	05	13	26	55	-18	32	07
GCT	3.	39	26	06	19	-04	-19	04	27	-05
CWT	4.	16	-02	11	-07	10	-05	-00	45	-01
AF-I	5.	57	05	24	15	18	07	-07	-04	17
AF-II	6.	23	01	05	32	-14	20	-11	-05	02
SI	7.	06	-00	04	39	-01	15	03	07	01
WA	8.	24	-07	17	43	05	12	-06	09	29
TT	9.	01	-08	09	63	22	03	-06	06	15
TCT-T	10.	24	-04	11	61	04	-04	21	10	-02
WBE-I	13.	14	14	-00	17	06	23	06	17	07
WBE-II	14.	43	03	20	12	13	04	-23	22	11
LT	15.	33	-03	53	33	17	05	01	21	07
FC	16.	24	01	27	10	34	14	-20	13	15
ELT	17.	22	04	18	03	03	03	-47	17	-08

		A	B	C	D	E	F	G	H	I
SRT	18.	39	-06	-16	12	09	13	03	30	18
NPT	19.	06	-07	05	-01	-05	71	15	-05	07
FLNT-I	20.	-01	06	79	-05	-15	13	16	-09	02
FLNT-II	21.	04	00	95	-11	-02	02	-06	04	03
DSV-I	22.	-08	-02	14	03	10	20	75	11	-02
DSV-II	23.	12	29	18	00	-13	-16	40	37	21
SEX	24.	-30	20	24	-08	-09	11	-27	-12	48
FAT	25.	-16	00	14	12	05	18	-08	47	19
NCT-I	26.	-03	40	09	20	02	28	-01	-03	36
NCT-II	27.	11	14	09	-00	04	25	13	15	34
SD	28.	15	00	04	41	33	14	17	30	10
EAS-2	29.	21	08	27	21	41	13	-03	04	62
AO	30.	03	19	07	10	-07	03	-07	-02	57
GT	31.	44	-09	25	21	24	-01	05	13	-06
OS	32.	59	-05	-05	17	-19	-03	-17	12	-15

		A	B	C	D	E	F	G	H	I
NST	33.	30	-17	-04	05	19	-04	02	10	-23
LR	34.	33	-14	11	10	47	29	08	03	-19
CCT-I	35.	14	-02	-04	-01	70	-30	06	06	05
CCT-II	36.	05	05	27	14	71	-01	-04	14	-10
MTS-I	37.	31	-06	-12	24	21	-02	12	74	-06
MTS-II	38.	32	-12	-09	38	08	-12	-04	80	02
WRVT-I	39.	68	12	15	09	06	19	08	-02	06
WRVT-II	40.	75	-18	05	01	21	11	08	12	11
FBT	41.	42	18	-00	05	04	-00	-32	09	-37
PFT	42.	29	18	-02	16	62	10	-02	23	15
SDT	43.	31	02	-03	16	60	01	10	13	-23
MP-I	44.	32	-06	-04	12	26	07	18	01	13
MP-II	45.	30	-01	-03	01	22	09	-00	20	03
UT-I	46.	21	11	-10	71	09	03	14	01	-17
UT-II	47.	07	05	-09	79	-06	-28	06	-02	07

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		A	B	C	D	E	F	G	H	I
WLE-I	48.	29	21	16	-07	04	-05	03	05	15
WLD-II	49.	-04	18	10	-14	15	-20	-02	03	49
WLA-III	50.	-09	33	00	02	-05	-04	08	09	26
PLD-I	51.	11	74	-17	-03	11	12	-03	-18	17
PLA-II	52.	04	62	11	-07	14	-07	-16	22	00
PLE-III	53.	-01	36	01	-25	03	-01	08	-09	54
SLA-I	54.	25	53	09	-01	-12	-10	08	03	10
SLE-II	55.	17	69	20	17	01	02	-13	03	13
SLD-III	56.	29	20	03	11	-09	13	04	02	08

		J	K	L	M	N	O	P	h_1^2	h_2^2
HPT	1.	00	18	−05	−02	11	39	−11	.53	.55
CT	2.	17	−06	07	01	02	39	14	.74	.73
GCT	3.	01	05	−19	−10	−27	19	02	.53	.52
CWT	4.	39	−03	−17	16	−15	−04	17	.52	.54
AF-I	5.	32	11	01	−24	−09	04	04	.66	.65
AF-II	6.	−01	50	13	−07	−05	−05	−04	.51	.54
SI	7.	−04	−09	05	−64	01	14	01	.63	.67
WA	8.	−04	−14	12	−14	−04	−21	12	.50	.51
TT	9.	−21	02	−10	−14	27	09	04	.65	.65
TCT-T	10.	11	−01	09	06	04	15	13	.57	.57
WBE-I	13.	03	10	02	08	10	06	59	.54	.54
WBE-II	14.	08	15	02	−10	−09	−01	10	.43	.43
LT	15.	−00	09	−05	−08	−17	18	03	.66	.66
FC	16.	−01	−20	−02	−10	−13	01	34	.54	.54
ELT	17.	20	−10	18	−06	43	00	18	.64	.66

		J	K	L	M	N	O	P	h_1^2	h_2^2
SRT	18.	05	-17	26	-02	-05	31	-13	.56	.56
NPT	19.	-06	01	-04	-08	-07	05	10	.58	.57
FLNT-I	20.	07	-06	13	15	05	-06	-11	.77	.77
FLNT-II	21.	02	-00	04	-08	-02	07	-03	.94	.94
DSV-I	22.	14	04	13	-07	12	07	09	.74	.71
DSV-II	23.	10	14	17	04	-07	01	19	.62	.60
SEX	24.	09	-18	18	-10	39	16	23	.84	.83
FAT	25.	04	02	09	30	18	15	-07	.52	.54
NCT-I	26.	-12	-29	01	-08	07	-11	00	.54	.52
NCT-II	27.	03	10	00	-05	58	04	-13	.63	.62
SD	28.	19	18	-03	08	10	11	-10	.56	.56
EAS-2	29.	-03	11	12	14	08	-02	05	.80	.79
AO	30.	14	-03	02	10	06	01	11	.43	.43
GT	31.	30	15	07	09	-05	-09	-25	.59	.58
OS	32.	04	-02	08	23	08	28	11	.64	.65

		J	K	L	M	N	O	P	h_1^2	h_2^2
NST	33.	-06	22	11	-01	29	-35	05	.50	.50
LR	34.	24	-17	00	-04	-13	-09	-01	.61	.60
CCT-I	35.	-06	-11	24	-12	21	-05	-04	.75	.74
CCT-II	36.	19	10	-04	-14	22	-01	25	.81	.81
MTS-I	37.	02	08	03	-16	-06	-17	-08	.85	.85
MTS-II	38.	-04	05	06	-14	-03	-09	03	.97	.96
WRVT-I	39.	-14	02	-04	-04	10	02	-06	.59	.61
WRVT-II	40.	-16	06	02	12	13	15	06	.77	.77
FBT	41.	18	17	15	16	00	05	17	.60	.60
PFT	42.	14	06	28	03	05	12	-23	.78	.79
SDT	43.	05	-08	-02	24	-05	28	05	.71	.71
MP-I	44.	26	36	04	-08	01	19	-08	.49	.49
MP-II	45.	07	08	75	-02	01	-01	01	.76	.74
UT-I	46.	16	23	07	00	-17	-09	-24	.81	.80
UT-II	47.	02	-04	02	08	-06	-01	-15	.77	.77

		J	K	L	M	N	O	P	h_1^2	h_2^2
WLE	48.	38	-22	02	17	37	-03	-03	.55	.55
WLD-II	49.	07	16	-27	14	23	00	10	.55	.57
WLA-III	50.	62	01	-02	01	25	03	-19	.69	.69
PLD-I	51.	09	04	00	-09	-10	05	-12	.72	.71
PLA-II	52.	-15	11	02	07	31	-06	-04	.64	.65
PLE-III	53.	18	-01	03	-22	35	-01	-18	.74	.74
SLA-I	54.	03	-09	-22	01	57	02	10	.79	.78
SLE-II	55.	03	-18	07	19	16	11	17	.75	.75
SLD-III	56.	12	-06	08	-24	06	63	-00	.65	.65

*Decimal points ommitted

h_1^2 Rotated communalities

h_2^2 Unrotated communalities

APPENDIX R

ELEVENTH GRADE SAMPLE FACTORS

Variable		Test	Cognitive Abilities	h^2
		FACTOR A (Verbal Comprehension)		
WRVT-II	40.	Wide Range Vocabulary Test (Part II)	Verbal Comprehension	.75
WRVT-I	39.	Wide Range Vocabulary Test (Part I)	Verbal Comprehension	.68
OS	32.	Object Synthesis (Total Score)	Semantic Redefinition	.59
AF-I	5.	Associational Fluency (Part I)	Associational Fluency	.57
GT	31.	Gestalt Transformation (Total Score)	Semantic Redefinition	.44
WBE-II	14.	Word Beginnings and Endings Test (Part II)	Word Fluency	.43
FBT	41.	Form Board Test (Total Score)	Visualization	.42
GCT	3.	Gestalt Completion Test	Speed of Closure	.39
SRT	18.	Shortest Road Test (Total Score)	Length Estimation	.39
LT	15.	Locations Test (Total Score)	Induction	.33
LR	34.	Logical Reasoning (Total Score)	Syllogistic Reasoning	.33
MTS-II	38.	Maze Tracing Speed Test (Part II)	Spatial Scanning	.32

Variable		Test	Cognitive Abilities	h^2
MP-I	44.	Match Problems V (Part I)	Figural Adaptive Flexibility	.32
MTS-I	37.	Maze Tracing Speed Test (Part I)	Spatial Scanning	.31
SDT	43.	Surface Development Test (Total Score)	Visualization	.31
SEX	24.	Sex	Attention to Detail	.30
NST	33.	Nonsense Syllogisms Test (Total Score)	Syllogistic Reasoning	.30
MP-II	45.	Match Problems V (Part II)	Figural Adaptive Flexibility	.30

FACTOR B (General Lipreading)

Variable		Test	Cognitive Abilities	h^2
PLD-I	51.	Phrase Lipreading Test -- 1st 10 Phrases	Lipreading (D)*	.74
SLE-II	55.	Sentence Lipreading Test -- 2nd 10 Sentences	Lipreading (A)	.69
PLA-II	52.	Phrase Lipreading Test -- 2nd 10 Phrases	Lipreading (A)	.62
SLA-I	54.	Sentence Lipreading Test -- 1st 10 Sentences	Lipreading (A)	.53

Variable		Test	Cognitive Abilities	h^2
NCT-I	26.	Number Comparison Test (Part I)	Perceptual Speed	.40
PLE-III	53.	Phrase Lipreading Test -- 3rd 10 Phrases	Lipreading (E)	.36
WLA-III	50.	Word Lipreading Test -- 3rd 10 Words	Lipreading (A)	.33

FACTOR C (Associative (Rote) Memory)

Variable		Test	Cognitive Abilities	h^2
FLNT-I	20.	First and Last Names Test (Part I)	Associative (Rote) Memory	.95
FLNT-II	21.	First and Last Names Test (Part II)	Associative (Rote) Memory	.79
LT	15.	Locations Test (Total Score)	Induction	.53

FACTOR D (Semantic Spontaneous Flexibility)

Variable		Test	Cognitive Abilities	h^2
UT-II	47.	Utility Test (Part II)	Semantic Spontaneous Flexibility	.79
UT-I	46.	Utility Test (Part I)	Semantic Spontaneous Flexibility	.71

Variable		Test	Cognitive Abilities	h^2
TT	9.	Topics Test (Total Score)	Ideational Fluency	.63
TCT	10.	Things Categories Test (Total Score)	Ideational Fluency	.61
WA	8.	Word Arrangements (Total Score)	Expressional Fluency	.43
SD	28.	Ship Destination (Total Score)	General Reasoning	.41
SI	7.	Simile Interpretations (Total Score)	Expressional Fluency	.39
MTS-II	38.	Maze Tracing Speed Test (Part II)	Spatial Scanning	.38
LT	15.	Locations Test (Total Score)	Induction	.33
AF-II	6.	Associational Fluency (Part II)	Associational Fluency	.32

FACTOR E (Spatial Orientation)

CCT-II	36.	Cube Comparison Test (Part II)	Spatial Orientation	.71
CCT-I	35.	Cube Comparison Test (Part I)	Spatial Orientation	.70
PFT	42.	Paper Folding Test (Total Score)	Visualization	.62
SDT	43.	Surface Development Test (Total Score)	Visualization	.60
LR	34.	Logical Reasoning (Total Score)	Syllogistic Reasoning	.47

Variable		Test	Cognitive Abilities	h^2
EAS-2	29.	EAS #2, Numerical Ability (Total Score)	Number Ability	.41
FC	16.	Figure Classification (Total Score)	Induction	.34
SD	28.	Ship Destination (Total Score)	General Reasoning	.33

FACTOR F (Length Estimation)

Variable		Test	Cognitive Abilities	h^2
NPT	19.	Nearer Point Test (Total Score)	Length Estimation	.71
CT	2.	Copying Test (Total Score)	Flexibility of Closure	.55
CCT-I	35.	Cube Comparison Test (Part I)	Spatial Orientation	.30

FACTOR G (Memory Span)

Variable		Test	Cognitive Abilities	h^2
DSV-I	22.	Digit Span-Visual (Part I)	Memory Span	.75
ELT	17.	Estimation of Length (Total Score)	Length Estimation	.47
DSV-II	23.	Digit Span-Visual (Part II)	Memory Span	.40
FBT	41.	Form Board Test (Total Score)	Visualization	.32

Variable		Test	Cognitive Abilities	h^2
		FACTOR H (Spatial Scanning)		
MTS-II	38.	Maze Tracing Speed Test (Part II)	Spatial Scanning	.80
MTS-I	37.	Maze Tracing Speed Test (Part I)	Spatial Scanning	.74
FAT	25.	Findings A's Test (Total Score)	Perceptual Speed	.47
CWT	4.	Concealed Word's Test (Total Score)	Speed of Closure	.45
DSV-II	23.	Digit Span-Visual (Part II)	Memory Span	.37
CT	2.	Copying Test (Total Score)	Flexibility of Closure	.32
SRT	18.	Shortest Road Test (Total Score)	Length Estimation	.30
SD	28.	Ship Destination (Total Score)	General Reasoning	.30
		FACTOR I (Numerical Ability)		
EAS-2	29.	EAS #2, Numerical Ability (Total Score)	Number Ability	.62
AO	30.	Arithmetic Operations (Total Score)	Number Ability	.57
PLE-III	53.	Phrase Lipreading Test -- 3rd 10 Phrases	Lipreading (E)	.54

Variable		Test	Cognitive Abilities	h^2
WLD-II	49.	Word Lipreading Test -- 2nd 10 Words	Lipreading (D)	.49
SEX	24.	Sex	Attention to Detail	.48
FBT	41.	Form Board Test (Total Score)	Visualization	.37
NCT-I	26.	Number Comparison Test (Part I)	Perceptual Speed	.36
NCT-II	27.	Number Comparison Test (Part II)	Perceptual Speed	.34

FACTOR J (Word Lipreading)

Variable		Test	Cognitive Abilities	h^2
WLA-III	50.	Word Lipreading Test -- 3rd 10 Words	Lipreading (A)	.62
CWT	4.	Concealed Words Test (Total Score)	Speed of Closure	.39
WLE-I	48.	Word Lipreading Test -- 1st 10 Words	Lipreading (E)	.38
AF-I	5.	Associational Fluency (Part I)	Associational Fluency	.32
GT	31.	Gestalt Transformation (Total Score)	Semantic Redefinition	.30

Variable		Test	Cognitive Abilities	h^2
		FACTOR K (Doublet)		
AF-II	6.	Associational Fluence (Part II)	Associational Fluency	.50
MP-I	44.	Match Problems V (Part I)	Figural Adaptive Flexibility	.36
		FACTOR L (Singlet)		
MP-II	45.	Match Problems V (Part II)	Figural Adaptive Flexibility	.75
		FACTOR M (Doublet)		
SI	7.	Similie Interpretations (Total Score)	Expressional Fluency	.64
FAT	25.	Finding A's Test (Total Score)	Perceptual Speed	.30
		FACTOR N (Perceptual Speed)		
NCT-II	27.	Number Comparison Test (Part II)	Perceptual Speed	.58
SLA-I	54.	Sentence Lipreading Test -- 1st 10 Sentences	Lipreading (A)	.57

Variable		Test	Cognitive Abilities	h^2
ELT	17.	Estimation of Length (Total Score)	Length Estimation	.43
SEX	24.	Sex	Attention to Detail	.39
WLE-I	48.	Word Lipreading Test -- 1st 10 Words	Lipreading (E)	.37
PLE-III	53.	Phrase Lipreading Test -- 3rd 10 Phrases	Lipreading (E)	.35
PLA-II	52.	Phrase Lipreading Test -- 2nd 10 Phrases	Lipreading (A)	.31

FACTOR O (Sentence Lipreading)

Variable		Test	Cognitive Abilities	h^2
SLD-III	56.	Sentence Lipreading Test -- 3rd 10 Sentences	Lipreading (D)	.63
HPT	1.	Hidden Patterns Test (Total Score)	Flexibility of Closure	.39
CT	2.	Copying Test (Total Score)	Flexibility of Closure	.39
NST	33.	Nonsense Syllogisms Test (Total Score)	Syllogistic Reasoning	.35
SRT	18.	Shortest Road Test (Total Score)	Length Estimation	.31

Variable		Test	Cognitive Abilities	h^2
		FACTOR P (Doublet)		
WBE-I	13.	Word Beginnings and Endings Test (Part I)	Word Fluency	.59
FC	16.	Figure Classification (Total Score)	Induction	.34

*(A) Average difficulty to lipread speaker

 (D) Difficult to lipread speaker

 (E) Easy to lipread speaker

APPENDIX S

COMMUNALITIES, MEANS AND STANDARD DEVIATIONS

OF VARIABLES IN THE ADULT FEMALE ANALYSIS

Variable	#	h^2	Mean	Standard Deviation	Variable
HPT	1.	.48	66.43	23.40	Hidden Patterns Test (Total Score)
CT	2.	.66	30.36	11.22	Copying Test (Total Score)
GCT	3.	.52	14.35	3.97	Gestalt Completion Test (Total Score)
CWT	4.	.63	22.55	6.42	Concealed Words Test (Total Score)
AF-I	5.	.53	9.67	3.27	Associational Fluency (Part I)
AF-II	6.	.52	7.50	2.72	Associational Fluency (Part II)
WA	8.	.50	26.82	8.51	Word Arrangements (Total Score)
TT	9.	.53	20.61	8.75	Topics Test (Total Score)
TCT-T	10.	.64	18.08	5.59	Things Categories Test (Total Score)
WBE-I	13.	.56	12.60	4.55	Word Beginnings and Endings Test (Part I)
WBE-II	14.	.44	8.04	2.70	Word Beginnings and Endings Test (Part II)
LT	15.	.53	5.55	3.58	Locations Test (Total Score)
FC	16.	.41	59.36	21.67	Figure Classification (Total Score)
ELT	17.	.36	20.78	12.01	Estimation of Length Test (Total Score)

Variable	#	h^2	Mean	Standard Deviation	Variable
SRT	18.	.57	26.92	8.17	Shortest Road Test (Total Score)
NPT	19.	.49	29.09	11.19	Nearer Point Test (Total Score)
FLNT-I	20.	.67	9.58	3.61	First and Last Names Test (Part I)
FLNT-II	21.	.49	10.98	3.17	First and Last Names Test (Part II)
DSV-I	22.	.69	33.60	4.78	Digit Span-Visual (Part I)
DSV-II	23.	.64	34.66	6.12	Digit Span-Visual (Part II)
FAT	25.	.57	72.17	17.91	Finding A's Test (Total Score)
NCT-I	26.	.43	13.47	4.02	Number Comparison Test (Part I)
NCT-II	27.	.58	13.15	3.89	Number Comparison Test (Part II)
SD	28.	.73	20.10	6.36	Ship Destination (Total Score)
EAS-2	29.	.73	39.15	13.72	EAS #2, Numerical Ability (Total Score)
AO	30.	.84	26.32	10.44	Arithmetic Operations (Total Score)
GT	31.	.43	7.79	3.33	Gestalt Transformation (Total Score)
OS	32.	.59	6.64	3.24	Object Synthesis (Total Score)

Variable	#	h^2	Mean	Standard Deviation	Variable
NST	33.	.41	6.34	4.99	Nonsense Syllogisms Test (Total Score)
LR	34.	.64	20.70	7.80	Logical Reasoning (Total Score)
CCT-I	35.	.50	6.94	5.20	Cube Comparison Test (Part I)
CCT-II	36.	.67	6.81	5.45	Cube Comparison Test (Part II)
MTS-I	37.	.84	9.62	3.58	Maze Tracing Speed Test (Part I)
MTS-II	38.	.77	11.74	3.90	Maze Tracing Speed Test (Part II)
WRVT-I	39.	.73	12.09	4.70	Wide Range Vocabulary Test (Part I)
WRVT-II	40.	.56	10.26	4.56	Wide Range Vocabulary Test (Part II)
FBT	41.	.63	52.76	27.13	Form Board Test (Total Score)
PFT	42.	.71	9.65	4.35	Paper Folding Test (Total Score)
SDT	43.	.71	16.20	11.37	Surface Development Test (Total Score)
MP-I	44.	.58	3.14	2.41	Match Problems V (Part I)
MP-II	45.	.51	1.97	1.47	Match Problems V (Part II)
UT-I	46.	.57	5.87	3.30	Utility Test (Part I)

Variable	#	h^2	Mean	Standard Deviation	Variable
UT-II	47.	.73	4.41	2.95	Utility Test (Part II)
WLE	*48.	.42	1.38	1.35	Word Lipreading Test, 1st 10 Words
WLD-II	*49.	.44	0.67	0.62	Word Lipreading Test, 2nd 10 Words
WLA-III	*50.	.43	2.46	1.31	Word Lipreading Test, 3rd 10 Words
PLD-I	*51.	.42	3.53	1.56	Phrase Lipreading Test, 1st 10 Phrases
PLA-II	*52.	.30	7.32	2.71	Phrase Lipreading Test, 2nd 10 Phrases
PLE-III	*53.	.64	6.50	2.60	Phrase Lipreading Test, 3rd 10 Phrases
SLA-I	*54.	.61	13.16	6.67	Sentence Lipreading Test, 1st 10 Sentences
SLE-II	*55.	.63	17.22	7.78	Sentence Lipreading Test, 2nd 10 Sentences
SLD-III	*56.	.44	1.71	1.78	Sentence Lipreading Test, 3rd 10 Sentences

*Medians and Semi-interquartile ranges reported for variables 48 through 56.

APPENDIX T

CORRELATION MATRIX OF 52 COGNITIVE AND

LIPREADING VARIABLES IN THE

ADULT FEMALE ANALYSIS

		1	2	3	4	5	6	7	8	9	10
HPT-I	1.	1.000	.536	.172	.223	.167	.183	.304	.289	.205	.395
CT	2.	.536	1.000	.207	.265	.295	.240	.338	.341	.362	.451
GCT	3.	.172	.207	1.000	.399	.080	.105	.084	.144	.324	.254
CWT	4.	.223	.265	.399	1.000	.108	.205	.143	.229	.267	.263
AF-I	5.	.167	.295	.080	.108	1.000	.457	.299	.332	.429	.244
AF-II	6.	.183	.240	.105	.205	.457	1.000	.344	.347	.407	.379
SI	7.	.304	.338	.084	.143	.299	.344	1.000	.446	.356	.320
WA	8.	.289	.341	.144	.229	.332	.347	.446	1.000	.324	.445
TT	9.	.205	.362	.324	.267	.429	.407	.365	.324	1.000	.398
TCT-T	10.	.395	.451	.254	.263	.244	.379	.320	.445	.398	1.000
TCT-I	11.	.186	.235	.120	.075	.224	.229	.312	.124	.348	.449
TCT-II	12.	.363	.408	.121	.085	.231	.264	.269	.456	.226	.369

		1	2	3	4	5	6	7	8	9	10
WBE-I	13.	.188	.312	.299	.192	.050	.140	.142	.257	.277	.167
WBE-II	14.	.280	.463	.071	.189	.132	.098	.171	.223	.075	.229
LT	15.	.419	.521	.176	.255	.094	.169	.318	.244	.170	.221
FC	16.	.419	.521	.176	.255	.094	.169	.318	.244	.170	.221
ELT	17.	.232	.294	.098	.120	.058	.244	.048	.172	.130	.255
SRT	18.	.256	.262	.102	.221	-.048	.217	.069	.218	.052	.312
NPT	19.	.383	.380	.383	.285	.301	.273	.121	.235	.225	.396
FLNT-I	20.	.345	.424	.317	.243	.320	.289	.183	.237	.197	.230
FLNT-II	21.	.331	.459	.161	.309	.087	.156	.299	.214	.122	.219
DSV-I	22.	.295	.291	.037	.076	.109	.102	.131	.035	.021	.207
DSV-II	23.	.329	.336	.016	.154	.071	.039	.215	.208	.021	.217
SEX	24.	.396	.471	.223	.298	.462	.372	.305	.424	.465	.336
FAT	25.	.381	.523	.162	.264	.294	.409	.228	.370	.283	.384

		1	2	3	4	5	6	7	8	9	10
NCT-I	26.	.179	.334	.067	.256	.137	.207	.114	.151	.094	.241
NCT-II	27.	.278	.283	.231	.109	.178	.386	.175	.157	.214	.157
SD	28.	.342	.312	.276	.203	.408	.363	.312	.280	.302	.278
EAS-2	29.	.236	.179	.058	.166	.188	.470	.293	.226	.378	.202
AO	30.	.275	.393	.087	.160	.296	.384	.338	.276	.316	.182
GT	31.	.331	.469	.227	.046	.126	.258	.325	.293	.194	.378
OS	32.	.306	.488	.367	.207	.183	.307	.236	.340	.262	.358
NST	33.	.510	.593	.254	.125	.166	.179	.445	.198	.346	.277
LR	34.	.455	.500	.223	.240	.215	.259	.421	.132	.378	.200
CCT-I	35.	.238	.372	.043	.061	.502	.374	.311	.330	.303	.306
CCT-II	36.	.248	.326	.081	.123	.408	.315	.212	.286	.290	.322
MTS-I	37.	.295	.533	.219	.279	.073	.146	.169	.263	-.000	.133
MTS-II	38.	.489	.581	.264	.312	.273	.186	.318	.335	.267	.332

		1	2	3	4	5	6	7	8	9	10
WRVT-I	39.	.408	.493	.385	.272	.135	.155	.210	.194	.149	.224
WRVT-II	40.	.456	.157	.239	.242	.348	.268	.321	.364	.297	.326
FBT	41.	.375	.333	.177	.151	.227	.097	.197	.294	.085	.241
PFT	42.	.198	.394	.091	.012	.437	.343	.220	.345	.478	.232
SDT	43.	.268	.349	.085	.060	.404	.401	.382	.375	.407	.351
MP-I	44.	-.026	.045	.017	-.122	.034	.004	.273	.284	.029	.172
MP-II	45.	-.019	.034	.034	.042	.006	-.054	.009	.102	.097	.057
UT-I	46.	.036	.166	-.082	.072	-.086	-.043	.230	.033	.067	.009
UT-II	47.	.017	-.198	-.204	-.059	-.048	-.047	-.100	.028	-.161	-.122
WLE-I	48.	.166	.154	.146	.044	.086	.029	.086	.328	.101	.245
WLD-II	49.	.066	.102	.013	.178	.104	.101	.139	.292	.165	.125
WLA-III	50.	-.151	-.029	-.109	-.081	.042	.036	-.006	.095	-.032	.038
PLD-I	51.	-.017	.159	.017	.145	.058	.080	.120	.275	.111	.175
PLA-II	52.	.123	.105	.021	-.044	.107	.201	.136	.218	.111	.099

		11	12	13	14	15	16	17	18	19	20
HPT-I	1.	.187	.363	.189	.288	.335	.419	.232	.256	.383	.345
CT	2.	.235	.408	.312	.463	.428	.521	.294	.262	.380	.424
GCT	3.	.120	.121	.299	.071	.138	.176	.098	.102	.383	.317
CWT	4.	.075	.085	.192	.189	.120	.255	.120	.221	.285	.243
AF-I	5.	.224	.230	.050	.132	.264	.094	.058	-.048	.301	.320
AF-II	6.	.229	.264	.140	.098	.225	.169	.244	.217	.273	.289
SI	7.	.312	.269	.142	.171	.116	.318	.048	.069	.121	.183
WA	8.	.124	.246	.257	.223	.069	.244	.172	.218	.235	.237
TT	9.	.348	.226	.277	.075	.154	.170	.130	.051	.225	.197
TCT-T	10.	.449	.369	.167	.229	.128	.221	.226	.312	.296	.230
TCT-I	11.	1.000	.196	-.024	.054	.097	.059	.066	.072	.254	.117
TCT-II	12.	.197	1.000	.346	.219	.328	.247	.244	.261	.204	.339

		11	12	13	14	15	16	17	18	19	20
WBE-I	13.	-.024	.346	1.000	.148	.373	.114	.089	.190	.063	.155
WBE-II	14.1	.054	.219	.148	1.000	.329	.386	.215	.211	.224	.340
LT	15.	.097	.328	.373	.329	1.000	.242	.169	.132	.335	.420
FC	16.	.059	.247	.114	.386	.242	1.000	.190	.313	.238	.366
ELT	17.	.066	.244	.088	.215	.169	.190	1.000	.595	.217	.335
SRT	18.	.072	.261	.190	.211	.132	.313	.595	1.000	.277	.313
NPT	19.	.254	.204	.063	.224	.335	.238	.217	.279	1.000	.650
FLNT-I	20.	.117	.339	.155	.340	.420	.366	.335	.313	.650	1.000
FLNT-II	21.	.205	.190	.138	.273	.222	.419	.227	.257	.247	.367
DSV-I	22.	.055	.257	.058	.095	.276	.346	.103	.276	.122	.218
DSV-II	23.	.030	.188	.038	.209	.107	.317	.191	.271	.138	.284
SEX	24.	.213	.525	.493	.152	.382	.290	.396	.255	.339	.349
FAT	25.	.245	.521	.319	.248	.331	.340	.369	.291	.262	.325

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		11	12	13	14	15	16	17	18	19	20
NCT-I	26.	.135	.223	.056	.276	.177	.293	.234	.179	.148	.310
NCT-II	27.	.160	.228	.230	.201	.394	.168	.060	.035	.252	.324
SD	28.	.050	.272	.300	.112	.419	.168	.079	.027	.336	.383
EAS-2	29.	.171	.240	.150	.022	.107	.130	.117	.187	.198	.209
AO	30.	.056	.494	.276	.294	.288	.333	.247	.298	.222	.344
GT	31.	.214	.355	.291	.208	.256	.292	.266	.224	.207	.296
OS	32.	.145	.453	.312	.146	.252	.109	.198	.197	.213	.277
NST	33.	.245	.375	.321	.373	.367	.447	.221	.192	.202	.315
LR	34.	.151	.341	.281	.315	.448	.319	.262	.134	.254	.351
CCT-I	35.	.161	.301	.051	.160	.287	.185	.094	.142	.193	.269
CCT-II	36.	.178	.288	.097	.219	.300	.173	.123	.194	.287	.339
MTS-I	37.	-.022	.432	.448	.246	.376	.295	.133	.103	.116	.319
MTS-II	38.	.105	.501	.458	.208	.443	.370	.199	.295	.288	.326

		11	12	13	14	15	16	17	18	19	20
WRVT-I	39.	.121	.491	.447	.212	.414	.208	.243	.241	.235	.336
WRVT-II	40.	.209	.413	.307	.316	.416	.216	.130	.135	.226	.357
FBT	41.	.216	.426	.252	.197	.243	.157	.051	.149	.341	.207
PFT	42.	.234	.300	.097	-.022	.155	.113	.133	.116	.134	.186
SDT	43.	.359	.161	.151	.073	.141	.119	.088	.179	.223	.346
MP-I	44.	.103	.078	.061	.225	.069	.116	-.094	-.050	-.013	.039
MP-II	45.	.028	-.013	-.017	.088	-.023	.065	-.257	-.086	.004	.118
UT-I	46.	-.152	.096	.042	.096	-.027	.024	.136	-.099	-.102	.113
UT-II	47.	-.170	.070	.066	.000	.086	.021	-.109	.063	-.075	-.014
WLE-I	48.	-.048	.238	-.026	.188	.012	.108	.124	.080	.123	.115
WLD-II	49.	-.088	.046	.136	.105	.187	.088	-.055	-.018	-.009	.176
WLA-III	50.	-.198	-.080	-.075	-.007	-.009	-.003	-.028	-.148	-.063	-.021
PLD-I	51.	-.074	.062	-.022	.251	.052	.194	.047	-.037	.080	.196
PLA-II	52.	.079	-.019	.028	.064	.016	.218	-.089	.007	.069	.043

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		21	22	231	24	25	26	27	28	29	30
HPT-I	1.	.331	.295	.329	.396	.381	.179	.278	.343	.236	.275
CT	2.	.459	.291	.336	.471	.523	.334	.283	.313	.179	.393
GCT	3.	.161	.037	.016	.223	.162	.067	.231	.276	.058	.087
CWT	4.	.309	.076	.154	.298	.269	.256	.109	.203	.166	.156
AF-I	5.	.087	.108	.071	.462	.294	.137	.178	.408	.188	.296
AF-II	6.	.156	.102	.038	.372	.409	.207	.386	.363	.470	.384
SI	7.	.299	.131	.215	.305	.228	.114	.175	.312	.293	.338
WA	8.	.214	.034	.208	.424	.370	.151	.157	.280	.226	.276
TT	9.	.122	.021	.022	.465	.282	.094	.214	.302	.378	.316
TCT-T	10.	.219	.207	.216	.336	.384	.241	.157	.278	.202	.182
TCT-I	11.	.205	.055	.030	.212	.245	.135	.160	.050	.171	.056
TCT-II	12.	.190	.257	.189	.525	.521	.222	.228	.272	.240	.494

		21	22	23	24	25	26	27	28	29	30
WBE-I	13.	.138	.058	.038	.493	.319	.056	.230	.300	.150	.276
WBE-II	14.	.273	.095	.209	.152	.248	.276	.201	.112	.022	.294
LT	15.	.222	.275	.107	.382	.331	.177	.394	.419	.107	.288
FC	16.	.419	.346	.317	.290	.249	.292	.168	.168	.130	.333
ELT	17.	.227	.103	.191	.296	.368	.234	.050	.079	.117	.247
SRT	18.	.257	.276	.271	.255	.291	.178	.035	.027	.187	.298
NPT	19.	.247	.122	.138	.339	.262	.148	.252	.336	.198	.222
FLNT-I	20.	.367	.218	.284	.349	.325	.310	.324	.383	.209	.344
FLNT-II	21.	1.000	.447	.358	.171	.428	.538	.176	.147	.238	.282
DSV-I	22.	.447	1.000	.491	.136	.248	.360	.190	.222	.080	.383
DSV-II	23.	.358	.491	1.000	-.004	.152	.286	.129	.312	-.039	.225
SEX	24.	.170	.136	-.004	1.000	.593	.208	.302	.293	.325	546
FAT	25.	.482	.248	.153	.593	1.000	.676	.315	.196	.274	.507

		21	22	23	24	25	26	27	28	29	30
NCT-I	26.	.538	.360	.286	.207	.676	1.000	.236	.121	.123	.331
NCT-II	27.	.177	.189	.128	.301	.315	.236	1.000	.447	.272	.268
SD	28.	.147	.222	.311	.293	.196	.121	.447	1.000	.157	.219
EAS-2	29.	.237	.079	-.040	.324	.274	.123	.272	.157	1.000	.365
AO	30.	.282	.383	.225	.547	.506	.331	.268	.219	.364	1.000
GT	31.	.251	.159	.078	.393	.357	.131	.238	.151	.198	.309
OS	32.	.322	.177	.071	.438	.459	.138	.281	.265	.435	.330
NST	33.	.329	.257	.186	.414	.401	.166	.269	.293	.184	.249
LR	34.	.318	.303	.180	.444	.416	.200	.293	.351	.208	.276
CCT-I	35.	.183	.154	.144	.391	.322	.116	.301	.325	.188	.357
CCT-II	36.	.206	.124	.192	.282	.243	.116	.292	.317	.183	.300
MTS-I	37.	.307	.136	.149	.441	.387	.189	.338	.275	.147	.319
MTS-II	38.	.288	.210	.167	.602	.465	.085	.293	.358	.243	.404

		21	22	23	24	25	26	27	28	29	30
WRVT-I	39.	.289	.205	.195	.472	.428	.112	.262	.303	.168	.373
WRVT-II	40.	.385	.234	.243	.459	.493	.353	.371	.404	.287	.332
FBT	41.	.278	.191	.091	.358	.316	.179	.248	.178	.243	.296
PFT	42.	.154	−.003	.081	.451	.323	.086	.245	.286	.373	.257
SDT	43.	.284	.100	.124	.358	.303	.132	.349	.409	.418	.246
MP-I	44.	.083	.073	.066	.020	−.003	−.055	.110	.183	.047	−.057
MP-II	45.	−.039	−.063	−.048	−.020	−.054	−.069	.117	−.130	−.018	−.100
UT-I	46.	.039	−.027	.144	.034	−.006	.030	.031	.055	−.012	.081
UT-II	47.	−.174	−.034	−.073	.026	−.048	−.173	−.031	−.069	−.089	.051
WLE-I	48.	.050	.208	.208	.074	.053	.053	.134	.066	.134	.150
WLD-II	49.	.046	.042	.087	.−86	.021	−.002	.145	.175	.087	−.003
WLA-III	50.	−.113	.022	−.015	−.057	−.179	−.097	−.046	.052	−.128	−.095
PLD-I	51.	.087	.057	.136	.073	−.010	−.006	.133	.130	−.013	.121
PLA-II	52.	−.026	.100	.206	.151	.034	.080	.233	.131	.095	.290

		31	32	33	34	35	36	37	38	39	40
HPT-I	1.	.331	.306	.510	.455	.238	.248	.295	.489	.408	.456
CT	2.	.469	.488	.593	.500	.372	.326	.532	.581	.493	.517
GCT	3.	.227	.367	.254	.223	.042	.080	.219	.263	.384	.239
CWT	4.	.046	.207	.125	.240	.061	.123	.280	.312	.272	.242
AF-I	5.	.126	.183	.165	.215	.520	.408	.073	.272	.134	.348
AF-II	6.	.258	.307	.179	.259	.374	.315	.146	.186	.155	.268
SI	7.	.236	.444	.421	.311	.213	.169	.318	.210	.321	.197
WA	8.	.340	.198	.132	.330	.286	.263	.335	.194	.364	.294
TT	9.	.196	.262	.345	.378	.302	.290	-.000	.267	.149	.296
TCT-T	10.	.378	.358	.277	.200	.306	.322	.133	.332	.224	.326
TCT-I	11.	.214	.144	.244	.151	.161	.178	-.022	.105	.121	.209
TCT-II	12.	.355	.453	.374	.341	.301	.288	.432	.501	.491	.413

		31	32	33	34	35	36	37	38	39	40
WBE-I	13.	.291	.312	.321	.281	.051	.097	.448	.458	.447	.306
WBE-II	14.	.208	.146	.373	.315	.160	.219	.246	.208	.212	.316
LT	15.	.256	.251	.367	.448	.286	.300	.376	.443	.414	.416
FC	16.	.291	.108	.446	.319	.184	.173	.295	.370	.208	.216
ELT	17.	.266	.198	.221	.262	.094	.123	.133	.199	.243	.130
SRT	18.	.223	.197	.192	.134	.142	.194	.103	.295	.241	.135
NPT	19.	.207	.213	.202	.254	.193	.287	.116	.288	.235	.226
FLNT-I	20.	.296	.277	.315	.351	.269	.339	.319	.326	.336	.375
FLNT-II	21.	.251	.322	.330	.318	.182	.206	.307	.288	.289	.385
DSV-I	22.	.159	.177	.258	.303	.154	.124	.136	.210	.205	.234
DSV-II	23.	.078	.061	.187	.180	.144	.192	.149	.169	.195	.243
SEX	24.	.393	.438	.415	.444	.391	.282	.441	.602	.472	.459
FAT	25.	.357	.459	.402	.416	.322	.243	.388	.465	.428	.493

		31	32	33	34	35	36	37	38	39	40
NCT-I	26.	.131	.138	.167	.200	.116	.116	.189	.085	.112	.353
NCT-II	27.	.238	.281	.269	.293	.301	.292	.338	.293	.262	.371
SD	28.	.151	.265	.293	.351	.325	.317	.275	.358	.303	.404
EAS-2	29.	.198	.436	.184	.208	.188	.183	.147	.243	.168	.287
AO	30.	.309	.330	.249	.276	.357	.300	.319	.404	.373	.332
GT	31.	1.000	.631	.326	.315	.136	.111	.415	.525	.528	.291
OS	32.	.631	1.000	.319	.329	.241	.112	.480	.599	.604	.404
NST	33.	.327	.319	1.000	.818	.123	.091	.376	.422	.443	.409
LR	34.	.315	.329	.818	1.000	.162	.160	.326	.421	.419	.342
CCT-I	35.	.136	.241	.123	.162	1.000	.741	.217	.307	.199	.463
CCT-II	36.	.111	.112	.091	.160	.741	1.000	.089	.238	.131	.280
MTS-I	37.	.415	.480	.376	.326	.217	.089	1.000	.545	.651	.444
MTS-II	38.	.525		.599	.422	.421	.307	.238	.545	1.000	.656

		31	32	33	34	35	36	37	38	39	40
WRVT-I	39.	.528	.604	.443	.419	.199	.131	.651	.676	1.000	.469
WRVT-II	40.	.291	.404	.409	.342	.463	.280	.444	.472	.469	1.000
FBT	41.	.323	.275	.240	.182	.156	.180	.333	.449	.450	1.000
PFT	42.	.225	.341	.136	.103	.384	.266	.232	.355	.252	.368
SDT	43.	.316	.400	.234	.214	.392	.316	.168	.363	.235	.412
MP-I	44.	.094	.104	.165	.093	.050	.104	-.027	.088	.008	.159
MP-II	45.	-.037	-.038	.015	-.076	.042	.058	-.060	.028	-.075	.059
UT-I	46.	-.008	-.024	.149	.198	-.102	.018	.011	-.038	-.019	-.056
UT-II	47.	-.025	-.117	-.128	-.111	.013	-.002	.030	.019	-.049	-.023
WLE-I	48.	.200	.087	.125	.081	.119	.124	.114	.131	.072	.195
WLD-II	49.	.253	.230	.356	.177	.317	.071	.114	.008	.145	-.045
WLA-III	50.	-.147	-.151	-.034	.051	.126	-.187	-.189	-.188	-.003	-.095
PLD-I	51.	-.027	.002	.045	.055	.189	.009	.040	-.047	.060	.055
PLA-II	52.	.093	.033	-.047	-.073	.143	.204	.022	-.042	.011	.057

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		41	42	43	44	45	46	47	48	49	50
HPT-I	1.	.375	.198	.268	−.026	−.019	.036	.017	.166	.151	−.017
CT	2.	.333	.394	.349	.045	.034	.116	−.198	.154	.102	.029
GCT	3.	.177	.091	.085	.017	.032	−.082	−.204	.146	.013	.109
CWT	4.	.151	.012	.070	−.122	.042	.072	−.059	.044	.178	.081
AF-I	5.	.227	.437	.404	.034	.006	−.086	−.048	.086	.104	.042
AF-II	6.	.097	.343	.401	.004	−.054	−.043	−.047	.029	.101	.036
SI	7.	.197	.220	.382	.273	.009	.230	−.100	.086	.139	−.008
WA	8.	.294	.345	.375	.284	.033	.028	.328	.292	.095	.275
TT	9.	.085	.479	.407	.029	.097	.067	−.111	.101	.165	.032
TCT-T	10.	.241	.231	.351	.172	.056	.009	−.122	.245	.125	.038
TCT-I	11.	.216	.234	.359	.103	.028	−.152	−.170	−.058	−.088	.198
TCT-II	12.	.425	.300	.160	.078	−.013	.096	.070	.238	.046	−.080

		41	42	43	44	45	46	47	48	49	50
WBE-I	13.	.252	.097	.150	.061	-.017	.042	.066	-.026	.136	.075
WBE-II	14.	.197	-.023	.073	.225	.088	.096	.000	.188	.195	-.007
LT	15.	.243	.155	.140	.069	-.023	-.027	.086	.012	.187	-.009
FC	16.	.157	.113	.118	.116	.065	.024	.021	.108	.088	-.003
ELT	17.	.051	.133	.088	-.094	-.257	.136	-.109	.124	-.055	-.028
SRT	18.	.140	.116	.179	-.050	.086	-.099	.063	.080	-.018	-.148
NPT	19.	.341	.134	.223	-.013	.004	-.102	-.075	.123	-.009	-.063
FLNT-I	20.	.207	.186	.346	.039	.118	.113	-.014	.115	.176	-.021
FLNT-II	21.	.278	.154	.284	.083	-.039	.039	-.174	.050	.046	-.113
DSV-I	22.	.191	-.003	.100	.073	-.036	-.027	-.034	.208	.042	.022
DSV-II	23.	.091	.081	.124	.066	-.048	.144	-.073	.208	.087	-.015
SEX	24.	.358	.451	.358	.020	-.020	.034	.026	.074	.086	-.057
FAT	25.	.316	.323	.303	-.003	-.054	-.006	-.048	.053	.021	-.179

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		41	42	43	44	45	46	47	48	49	50
NCT-I	26.	.179	.086	.132	-.055	-.069	.030	-.173	.053	-.002	-.097
NCT-II	27.	.248	.245	.349	.110	.117	.031	-.031	.134	.145	-.046
SD	28.	.178	.286	.409	.183	-.130	.055	-.069	.066	.175	.052
EAS-2	29.	.243	.373	.418	.043	-.018	-.012	-.089	.134	.087	-.128
AO	30.	.296	.257	.246	-.057	-.100	.081	.051	.150	-.003	-.095
GT	31.	.323	.225	.316	.094	-.037	-.008	-.025	.185	.023	-.147
OS	32.	.275	.341	.400	.104	-.038	-.024	-.117	.200	.031	-.151
NST	33.	.240	.136	.234	.165	.015	.149	-.128	.087	-.006	-.156
LR	34.	.182	.103	.214	.093	-.076	.198	-.111	.125	.069	-.034
CCT-I	35.	.156	.384	.392	.050	.042	-.102	.013	.018	.177	.051
CCT-II	36.	.180	.266	.316	.104	.058	.018	-.002	.119	.317	.126
MTS-I	37.	.333	.232	.168	-.027	-.060	.011	.030	.124	.071	-.187
MTS-II	38.	.449	.355	.363	.088	.028	-.038	.019	.114	.114	-.189

		41	42	43	44	45	46	47	48	49	50
WRVT-I	39.	.450	.252	.235	.008	-.075	-.019	-.049	.131	.008	-.188
WRVT-II	40.	.496	.368	.412	.159	.059	-.056	-.023	.072	.145	-.003
FBT	41.	1.000	.184	.161	.147	.030	-.221	-.023	.195	-.045	-.095
PFT	42.	.184	1.000	.649	.071	.151	.103	-.100	.158	.253	-.019
SDT	43.	.161	.649	1.000	.191	.064	.036	-.117	.124	.230	-.095
MP-I	44.	.147	.071	.191	1.000	.227	.195	-.050	.120	.356	.359
MP-II	45.	.030	.151	.064	.227	1.000	.160	.244	-.002	.353	.112
UT-I	46.	-.221	.103	.036	.195	.60	1.000	.002	.098	.295	.296
UT-II	47.	-.023	-.100	-.117	-.050	.244	.002	1.000	-.042	.274	.033
WLE-I	48.	.195	.158	.124	.120	-.002	.098	-.042	1.000	.333	.215
WLD-II	49.	-.045	.253	.230	.356	.353	.295	.274	.333	1.000	.372
WLA-III	50.	-.095	-.019	-.095	.359	.112	.296	.033	.215	.372	1.000
PLD-I	51.	.055	.144	.040	.324	.226	.337	.107	.294	.530	.606
PLA-II	52.	.128	.220	.119	.192	.041	.083	.081	.195	.156	.156

APPENDIX U

UNROTATED FACTOR MATRIX, ADULT FEMALE ANALYSIS

		Roots	Commu-nality	1	2	3	4	5
HPT	1.	12.2891	.4800	.607	-.124	.128	-.029	-.064
CT	2.	3.1308	.6589	.761	-.066	.172	-.004	-.111
GCT	3.	2.4106	.5308	.359 1	-.124	-.021	.140	-.196
CWT	4.	1.9882	.6437	.375	-.073	.124	-.047	-.068
AF-I	5.	1.5398	.5325	.460	.275	-.359	-.131	.043
AF-II	6.	1.4164	.5253	.502	.193	-.314	-.211	.027
WA	8.	1.3502	.5117	.499	.194	-.049	-.016	-.322
TT	9.	1.2125	.5398	.537	.311	-.048	.037	.066
TCT-T	10.	1.0875	.6329	.499	.232	-.348	-.043	-.321
WBE-I	13.	.9798	.5586	.553	.144	-.067	-.174	-.143
WBE-II	14.	.8837	.4470	.315	.003	-.307	-.218	-.292
LT	15.	.7999	.5328	.620	-.085	.006	.130	.194
FC	16.	.7669	.4157	.435	-.154	.002	.381	.073
ELT	17.	.6272	.3714	.409	.039	.367	-.036	-.014

		Roots	Commu- nality	1	2	3	4	5
SRT	18.	.5418	.5738	.529	-.075	.118	.154	.134
NPT	19.	.4977	.4953	.486	-.015	.363	-.136	-.050
FLNT-I	20.	.4811	.6680	.365	-.202	.147	-.288	.074
FLNT-II	21.	.4370	.6394	.382	-.207	.145	-.298	.216
DSV-I	22.	.3844	.6783	.491	-.018	-.018	-.217	-.016
DSV-II	23.	.3572	.6424	.594	.037	.174	-.150	.060
FAT	25.	.3196	.5711	.514	-.147	.250	-.291	-.090
NCT-I	26.	.2461	.4513	.368	-.085	.322	-.251	.078
NCT-II	27.	.2038	.5723	.338	.040	.402	-.297	.029
SD	28.	.1886	.7261	.716	-.032	-.216	.159	.130
EAS-2	29.	.1495	.7786	.692	-.199	-.054	-.167	.139
AO	30.	.1272	.8231	.409	-.154	.216	-.498	.083
GT	31.	.0957	.4413	.485	.110	-.047	.062	.043
OS	32.	.0642	.6011	.528	.176	-.057	.055	-.058

		Roots	Commu-nality	1	2	3	4	5
NST	33.	.0428	.4246	.422	.058	-.302	-.058	-.035
LR	34.	.0192	.6286	.596	-.027	.005	-.121	..290
CCT-I	35.	.0012	.5042	.555	-.177	-.036	.191	-.014
CCT-II	36.	-.0550	.6603	.623	-.179	-.172	.253	.001
MTS-I	37.	-.0606	.8365	.619	-.216	.200	.140	-.489
MTS-II	38.	-.0726	.7576	.605	-.158	.191	.102	-.409
WRVT-I	39.	-.0966	.7152	.508	.294	-.279	-.159	.265
WRVT-II	40.	-.1139	.5557	.458	.367	-.102	-.191	.213
FBT	41.	-.1365	.6254	.560	-.275	.119	.367	.191
PFT	42.	-.1510	.7086	.715	-.191	-.033	.332	.101
SDT	43.	-.1706	.7051	.641	-.346	.036	.361	.097
MP-I	44.	-.1890	.5758	.676	.011	-.043	.070	.062
MP-II	45.	-.1973	.5133	.486	-.118	-.030	.125	.154
UT-I	46.	-.2114	.5864	.485	.297	-.379	.041	.027

		Roots	Commu- nality	1	2	3	4	5
UT-II	47.	-.2296	.7236	.548	.264	-.384	-.069	-.136
WLE-I	48.	-.2437	.4504	.148	.422	.186	.189	-.194
WLD-II	49.	-.2618	.4554	.011	.0344	.082	.201	-.036
WLA-III	50.	-.2915	.4527	.061	.293	.332	.117	-.212
PLD-I	51.	-.3045	.4585	-.086	.127	.112	.229	.389
PLA-II	52.	-.3198	.3329	.237	.236	.205	.050	.043
PLE-III	53.	-.3416	.6396	.200	.622	.240	.233	.078
SLA-I	54.	-.3520	.6077	-.090	.613	.302	.081	.034
SLE-II	55.	-.3819	.6132	.160	.609	.397	.097	.021
SLA-III	56.	-.3870	.4967	.168	.394	.058	-.059	.155

		6	7	8	9	10	11	12	13
HPT	1.	.075	-.009	-.088	-.197	-.076	.004	.129	.080
CT	2.	.004	-.060	-.022	-.034	-.070	.069	-.089	.204
GCT	3.	.066	.478	-.133	.157	.162	-.099	.048	.061
CWT	4.	.008	.421	.032	.383	-.062	-.001	.261	-.008
AF-I	5.	.238	-.038	.073	-.026	-.007	-.102	-.065	-.008
AF-II	6.	-.022	.030	.202	.053	.117	-.072	.062	.072
WA	8.	-.092	-.229	.002	-.101	-.041	-.061	.172	.099
TT	9.	-.294	.056	-.088	-.032	-.085	-.102	.023	.117
TCT-T	10.	-.037	.107	.211	.098	-.039	-.093	.151	.080
WBE-I	13.	-.218	.198	-.162	-.122	-.110	-.118	-.099	-.064
WBE-II	14.	-.043	.000	-.211	-.077	-.209	-.099	-.078	.082
LT	15.	-.147	-.107	.058	-.104	-.070	-.143	-.097	.076
FC	16.	-.001	.038	.134	.106	.023	-.065	.075	-.050
ELT	17.	.063	.015	.002	-.024	-.198	-.035	-.113	.046

		6	7	8	9	10	11	12	13
SRT	18.	.426	-.020	.116	-.036	-.000	.010	-.134	.016
NPT	19.	.004	-.026	-.020	-.086	-.133	-.027	.265	.096
FLNT-I	20.	-.278	.200	.390	-.187	.095	.129	-.250	.006
FLNT-II	21.	-.280	.239	.138	-.271	-.093	.181	.088	-.002
DSV-I	22.	.229	.510	-.111	-.132	-.015	-.102	-.048	-.180
DSV-II	23.	.230	.294	.044	-.009	.016	.169	-.073	-.017
FAT	25.	-.035	-.107	-.203	.207	-.027	.170	.014	-.073
NCT-I	26.	.064	-.220	-.141	-.068	.158	-.016	.131	.088
NCT-II	27.	.024	-.126	-.182	-.133	.197	.147	.181	.082
SD	28.	-.060	.019	.275	.047	-.089	-.194	.039	.008
EAS-2	29.	-.139	-.148	.126	.302	-.141	-.104	-.194	.014
AO	30.	-.038	-.194	-.062	.517	-.033	-.074	-.147	-.088
GT	31.	.239	-.044	-.065	.128	.161	.018	.017	-.077
OS	32.	.364	.034	-.010	-.034	.356	.043	.043	.054

		6	7	8	9	10	11	12	13
NST	33.	-.178	-.030	.045	.090	.077	.059	.167	-.076
LR	34.	-.094	-.182	.198	.021	.086	-.184	.223	.097
CCT-I	35.	-.258	-.007	-.109	-.146	.045	.023	-.073	-.037
CCT-II	36.	-.266	.035	-.125	.051	.189	.112	-.098	-.070
MTS-I	37.	.110	-.193	.158	-.151	-.140	-.062	.013	-.003
MTS-II	38.	.191	-.128	.306	-.060	.020	-.061	-.020	-.013
WRVT-I	39.	.259	-.147	.019	-.137	-.107	.084	-.079	.021
WRVT-II	40.	.235	.031	.028	-.143	-.085	.050	-.073	.048
FBT	41.	.020	-.077	-.059	.141	.081	.093	-.001	.053
PFT	42.	-.032	.029	-.050	-.087	-.058	.099	.062	.015
SDT	43.	-.027	.038	-.089	-.028	.139	.047	-.047	.077
MP-I	44.	.143	-.131	-.179	.127	-.068	.016	-.112	-.013
MP-II	45.	-.009	.000	-.365	-.049	-.084	-.262	-.049	-.061
UT-I	46.	-.154	-.097	.010	.057	.052	.249	-.011	-.003

		6	7	8	9	10	11	12	13
UT-II	47.	-.073	-.095	-.123	-.007	.071	.383	.015	.059
WLE-I	48.	-.090	-.123	-.210	-.078	-.034	-.049	-.173	-.093
WLD-II	49.	.019	.074	-.137	.141	-.414	..144	.081	-.028
WLA-III	50.	-.145	-.104	.312	.100	.080	.147	-.026	-.099
PLD-I	51.	.051	-.010	.119	-.081	-.304	.037	.221	.026
PLA-II	52.	-.250	.086	-.124	-.094	.190	-.073	-.035	-.067
PLE-III	53.	-.022	.086	.048	.145	-.109	.234	.012	.012
SLA-I	54.	-.040	.021	.099	-.011	.178	-.198	-.218	.012
SLE-II	55.	-.110	.153	.046	.090	.041	-.092	-.066	.043
SLA-III	56.	-.082	-.102	-.121	-.046	.203	-.257	.235	.083

APPENDIX V

ROTATED FACTOR MATRIX, ADULT FEMALE ANALYSIS

		A	B	C	D	E	F	G	H	I	J	K	L	M	h_1^2	h_2^2
HPT	1.	48	04	11	31	24	17	13	13	-01	07	10	02	08	.48	.48
CT	2.	37	08	17	43	32	29	03	24	17	07	08	-09	10	.66	.66
GCT	3.	02	02	13	28	12	04	27	-02	01	-16	01	-07	55	.52	.53
CWT	4.	13	06	06	15	06	09	05	07	24	18	-11	04	68	.63	.64
AF-I	5.	03	00	30	02	09	62	10	-00	02	-01	10	15	02	.53	.53
AF-II	6.	08	00	48	-01	10	32	16	17	12	-08	01	31	05	.52	.52
WA	8.	31	12	35	08	41	19	-17	-03	-02	05	13	08	05	.50	.51
TT	9.	18	28	35	22	-02	25	-13	16	-01	13	27	11	21	.53	.54
TCT-T	10.	-02	02	51	-01	37	32	-01	05	00	05	06	19	31	.64	.63
WBE-I	13.	22	12	30	11	13	24	04	25	03	-01	42	-06	28	.56	.56
WBE-II	14.	08	17	31	-03	24	14	11	-01	07	-02	46	-07	02	.44	.45
LT	15.	18	07	13	50	09	24	-04	28	04	03	18	20	-03	.53	.53
FC	16.	-00	-00	09	54	14	.0	-00	06	-02	05	-13	18	17	.41	.42
ELT	17.	25	23	-10	20	22	11	16	20	16	19	10	-04	02	.36	.37

		A	B	C	D	E	F	G	H	I	J	K	L	M	h_1^2	h_2^2
SRT	18.	14	05	−06	42	21	37	37	08	06	05	−16	06	−11	.57	.57
NPT	19.	54	11	01	14	23	02	09	13	11	20	04	12	13	.49	.50
FLNT-I	20.	13	−03	08	06	07	04	07	78	09	−12	−05	00	04	.67	.67
FLNT-II	21.	40	−14	11	08	−11	−05	12	61	−02	12	06	06	10	.62	.64
DSV-I	22.	22	−02	11	08	08	23	63	20	−01	−06	19	00	30	.69	.68
DSV-II	23.	29	10	16	18	11	23	54	28	15	08	−11	−05	11	.64	.64
FAT	25.	46	−02	13	19	14	05	04	11	48	05	05	−16	09	.57	.57
NCT-I	26.	57	08	−05	11	05	08	03	05	23	−11	−02	07	−07	.43	.45
NCT-II	27.	68	15	−03	00	−02	13	−10	09	14	−06	−10	−12	08	.58	.57
SD	28.	02	−04	30	47	20	35	04	25	03	09	07	40	13	.73	.73
EAS-2	29.	09	−09	21	41	15	26	01	33	53	05	17	21	−00	.78	.78
AO	30.	23	−01	01	07	05	11	05	15	85	−02	10	08	02	.84	.82
GT	31.	16	12	27	26	11	22	34	−12	16	−06	−11	11	−06	.43	.44

		A	B	C	D	E	F	G	H	I	J	K	L	M	h^2_1	h^2_2
OS	32.	25	13	22	20	15	48	19	-10	-03	-21	-24	-01	13	.59	.60
NST	33.	10	-07	55	12	07	03	09	05	10	-02	02	22	00	.41	.42
LR	34.	35	02	21	27	03	20	01	21	19	-00	-02	53	-04	.64	.63
CCT-I	35.	20	02	31	51	12	-04	06	22	-04	-08	17	00	-02	.50	.50
CCT-II	36.	10	-02	46	61	04	03	02	16	06	-17	06	-05	09	.67	.66
MTS-I	37.	30	-03	06	36	77	08	04	12	01	04	04	-01	-01	.84	.84
MTS-II	38.	22	02	06	31	72	18	09	17	06	-05	-14	06	04	.77	.76
WRVT-I	39.	19	-01	23	08	-08	76	-01	07	-00	15	07	04	-11	.73	.72
WVRT-II	40.	21	14	17	-01	-07	63	13	13	-02	15	06	03	00	.56	.56
FBT	41.	18	-02	06	73	03	11	01	05	13	03	-16	02	06	.63	.62
PFT	42.	26	-07	23	68	11	22	02	15	-09	12	01	02	13	.71	.71
SDT	43.	21	-07	12	76	09	11	06	14	-01	-11	-05	-02	12	.71	.71

		A	B	C	D	E	F	G	H	I	J	K	L	M	h^2_1	h^2_2
MP-I	44.	22	04	21	47	-12	41	08	-03	24	07	12	-04	02	.58	.58
MP-II	45.	22	03	06	49	-03	14	16	-07	05	-04	39	10	05	.51	.51
UT-I	46.	03	06	66	16	-02	39	-05	06	04	07	-01	00	-06	.57	.59
UT-II	47.	19	-01	75	10	07	27	08	00	05	04	01	-16	-09	.73	.72
WLE-I	48.	04	52	14	07	17	02	-01	-12	-06	05	19	-16	-10	.42	.45
WLD-II	49.	-08	24	13	01	02	-07	14	-20	-01	53	08	-10	01	.44	.46
WLA-III	50.	-02	42	08	-06	27	-08	-18	15	06	11	30	-04	00	.43	.46'
PLD-I	51.	-01	09	-12	09	-20	-06	09	-02	-19	46	-10	26	-15	.42	.46
PLA-II	52.	19	41	14	12	-07	-03	-02	13	-04	-11	09	01	12	.30	.33
PLE-III	53	-01	58	-22	05	-05	15	03	-01	-01	42	-19	-09	08	.64	.64
SLA-I	54	-13	72	-09	-18	-03	14	-05	03	-06	-06	-04	04	01	.61	.60
SLE-II	55.	02	74	05	-05	01	07	05	07	03	16	-04	04	18	.63	.61
SLD-III	56.	25	39	19	-06	-12	05	05	-16	-02	-09	08	36	-02	.44	.42

APPENDIX W

ADULT FEMALE SAMPLE FACTORS

Variable		Test	Cognitive Abilities	h^2
FACTOR A (Perceptual Speed)				
NCT-II	27.	Number Comparison Test (Part II)	Perceptual Speed	.68
NCT-I	26.	Number Comparison Test (Part I)	Perceptual Speed	.57
NPT	19.	Nearer Point Test (Total Score)	Length Estimation	.54
HPT	1.	Hidden Patterns Test (Total Score)	Flexibility of Closure	.48
FAT	25.	Finding A's Test (Total Score)	Perceptual Speed	.46
FLNT-II	21.	First and Last Names Test (Part II)	Associative (Rote) Memory	.40
CT	2.	Copying Test (Total Score)	Flexibility of Closure	.37
LR	34.	Logical Reasoning (Total Score)	Syllogistic Reasoning	.35
MTS-I	37.	Maze Tracing Speed Test (Part I)	Spatial Scanning	.30
FACTOR B (General Lipreading)				
SLE-II	55.	Sentence Lipreading Test -- 2nd 10 Sentences	Lipreading (E)*	.74
SLA-I	54.	Sentence Lipreading Test -- 1st 10 Sentences	Lipreading (A)	.72

Variable		Test	Cognitive Abilities	h^2
PLE-III	53.	Phrase Lipreading Test -- 3rd 10 Phrases	Lipreading (E)	.58
WLE-I	48.	Word Lipreading Test -- 1st 10 Words	Lipreading (E)	.52
WLA-III	50.	Word Lipreading Test -- 3rd 10 Words	Lipreading (A)	.42
PLA-II	52.	Phrase Lipreading Test -- 2nd 10 Phrases	Lipreading (A)	.41
SLD-III	56.	Sentence Lipreading Test -- 3rd 10 Sentences	Lipreading (D)	.39

FACTOR C (Semantic Spontaneous Flexibility)

Variable		Test	Cognitive Abilities	h^2
UT-II	47.	Utility Test (Part II)	Semantic Spontaneous Flexibility	.75
UT-I	46.	Utility Test (Part I)	Semantic Spontaneous Flexibility	.66
NST	33.	Nonsense Syllogisms Test (Total Score)	Syllogistic Reasoning	.55
TCT-T	10.	Things Categories Test (Total Score)	Ideational Fluency	.51

Variable		Test	Cognitive Abilities	h^2
AF-II	6.	Associational Fluence (Part II)	Associational Fluency	.48
CCT-II	36.	Cube Comparison Test (Part II)	Spatial Orientation	.46
WA	8.	Word Arrangements (Total Score)	Expressional Fluency	.35
TT	9.	Topics Test (Total Score)	Ideational Fluency	.35
WBE-II	14.	Word Beginnings and Endings Test (Part II)	Word Fluency	.31
CCT-II	36.	Cube Comparison Test (Part II)	Spatial Scanning	.31
AF-I	5.	Associational Fluency (Total Score)	Associational Fluency	.30
WBE-I	13.	Word Beginnings and Endings Test (Part I)	Word Fluency	.30
SD	28.	Ship Destination (Total Score)	General Reasoning	.30

FACTOR D (Visualization)

Variable		Test	Cognitive Abilities	h^2
SDT	43.	Surface Development Test (Total Score)	Visualization	.76
FBT	41.	Form Board Test (Total Score)	Visualization	.73
PFT	42.	Paper Folding Test (Total Score)	Visualization	.68
CCT-II	36.	Cube Comparison Test (Part II)	Spatial Orientation	.61

Variable		Test	Cognitive Abilities	h^2
FC	16.	Figure Classification (Total Score)	Induction	.54
CCT-I	35.	Cube Comparison Test (Part I)	Spatial Orientation	.51
LT	15.	Locations Test (Total Score)	Induction	.50
MP-II	45.	Match Problems V (Part II)	Figural Adaptive Flexibility	.49
MP-I	44.	Match Problems V (Part I)	Figural Adaptive Flexibility	.47
SD	28.	Ship Destination (Total Score)	General Reasoning	.47
CT	2.	Copying Test (Total Score)	Flexibility of Closure	.43
SRT	18.	Shortest Road Test (Total Score)	Length Estimation	.42
MTS-I	37.	Maze Tracing Speed Test (Part I)	Spatial Scanning	.36
MTS-II	38.	Maze Tracing Speed Test (Part II)	Spatial Scanning	.31
HPT	1.	Hidden Patterns Test (Total Score)	Flexibility of Closure	.31

Variable		Test	Cognitive Abilities	h^2
		FACTOR E (Spatial Scanning)		
MTS-I	37.	Maze Tracing Speed Test (Part I)	Spatial Scanning	.77
MTS-II	38.	Maze Tracing Speed Test (Part II)	Spatial Scanning	.72
WA	8.	Word Arrangements (Total Score)	Expressional Fluency	.41
TCT-T	10.	Thing Categories Test (Total Score)	Ideational Fluency	.37
CT	2.	Copying Test (Total Score)	Flexibility of Closure	.32
		FACTOR F (Verbal Comprehension)		
WRVT-I	39.	Wide Range Vocabulary Test (Part I)	Verbal Comprehension	.76
WRVT-II	40.	Wide Range Vocabulary Test (Part II)	Verbal Comprehension	.63
AF-I	5.	Associational Fluency (Part I)	Associational Fluency	.62
OS	32.	Object Synthesis (Total Score)	Semantic Redefinition	.48
MP-I	44.	Match Problems V (Part I)	Figural Adaptive Flexibility	.41

Variable		Test	Cognitive Abilities	h^2
SRT	18.	Shortest Road Test (Total Score)	Length Estimation	.37
SD	28.	Ship Destination (Total Score)	General Reasoning	.35
TCT-T	10.	Thing Categories Test (Total Score)	Ideational Fluency	.32
AF-II	6.	Associational Fluency (Part II)	Associational Fluency	.32
UT-I	46.	Utility Test (Part I)	Semantic Spontaneous Flexibility	.30

FACTOR G (Memory Span)

Variable		Test	Cognitive Abilities	h^2
DVS-I	22.	Digit Span-Visual (Part I)	Memory Span	.63
DVS-II	23.	Digit Span-Visual (Part II)	Memory Span	.54
SRT	18.	Shortest Road Test (Total Score)	Length Estimation	.37
GT	31.	Gestalt Transformation (Total Score)	Semantic Redefinition	.34

Variable		Test	Cognitive Abilities	h^2
		FACTOR H (Associative (Rote) Memory)		
FLNT-I	20.	First and Last Names Test (Part I)	Associative (Rote) Memory	.78
FLNT-II	21.	First and Last Names Test (Part II)	Associative (Rote) Memory	.61
EAS-2	29.	EAS #2, Numerical Ability (Total Score)	Number Ability	.33
		FACTOR I (Numerical Ability)		
AO	30.	Arithmetic Operations (Total Score)	Number Ability	.85
EAS-2	29.	EAS #2, Numerical Ability (Total Score)	Number Ability	.53
FAT	25.	Finding A's Test (Total Score)	Perceptual Speed	.48

Variable		Test	Cognitive Abilities	h^2
FACTOR J (Word Lipreading)				
WLD-II	49.	Word Lipreading Test -- 2nd 10 Words	Lipreading (D)	.53
PLD-I	51.	Phrase Lipreading Test -- 1st 10 Phrases	Lipreading (D)	.46
PLE-III	53.	Phrase Lipreading Test -- 3rd 10 Phrases	Lipreading (E)	.42
FACTOR K (Word Fluency)				
WBE-II	14.	Word Beginnings and Endings Test (Part II)	Word Fluency	.46
WBE-I	13.	Word Beginnings and Endings Test (Part I)	Word Fluency	.42
MP-II	45.	Match Problems V (Part II)	Figural Adaptive Flexibility	.39
WLA-III	50.	Word Lipreading Test -- 3rd 10 Words	Lipreading (A)	.30

Variable		Test	Cognitive Abilities	h^2
FACTOR L (Syllogistic Reasoning)				
LR	34.	Logical Reasoning (Total Score)	Syllogistic Reasoning	.53
SD	28.	Ship Destination (Total Score)	General Reasoning	.40
SLD-III	56.	Sentence Lipreading Test -- 3rd 10 Sentences	Lipreading (D)	.36
AF-II	6.	Associational Fluency (Part II)	Associational Fluency	.31
FACTOR M (Speed of Closure)				
CWT	4.	Concealed Words Test (Total Score)	Speed of Closure	.68
GCT	3.	Gestalt Completion Test (Total Score)	Speed of Closure	.55
TCT-T	10.	Things Categories Test (Total Score)	Ideational Fluency	.31
DSV-I	22.	Digit Span-Visual (Part I)	Memory Span	.30

*(A) Average difficulty to lipread speaker

(D) Difficult to lipread speaker

(E) Easy to lipread speaker

APPENDIX X

MULTIPLE COEFFICIENTS OF CORRELATION AND BETA WEIGHTS,

WORD LIPREADING TEST

R = .60 (Eighth Grade Sample, N = 89)

		Test	Cognitive Ability
Beta	.51	Sex	Attention to Detail
	.21	Gestalt Completion	Speed of Closure
	.19	Arithmetic Operation	Numerical Ability

R = .67 (Eleventh Grade Sample, N = 60)

		Test	Cognitive Ability
Beta	.63	Sex	Attention to Detail
	.31	Ship Destination	General Reasoning
	.30	Concealed Words Test	Speed of Closure
	.26	Math Problems V	Figural Adaptive Flexibility
	-.25	Copying Test	Flexibility of Closure

R = .34 (Adult Female Sample, N = 102)

		Test	Cognitive Ability
Beta	.25	Word Arrangements	Expressional Fluency
	.20	Estimation of Length Test	Length Estimation

R = .35 (Adult Male Sample, N = 43)

		Test	Cognitive Ability
Beta	.28	Copying Test	Flexibility of Closure
	-.33	Maze Tracing Speed Test	Spatial Scanning

APPENDIX Y

MULTIPLE COEFFICIENTS OF CORRELATION AND BETA WEIGHTS,

PHRASE LIPREADING TEST

R = .70 (Eighth Grade Sample, N = 89)

		Test	Cognitive Ability
Beta	.59	Sex	Attention to Detail
	.19	Logical Reasoning	Syllogistic Reasoning
	.16	Arithmetic Operations	Numerical Ability

R = .60 (Eleventh Grade Sample, N = 60)

		Test	Cognitive Ability
Beta	.37	Sex	Attention to Detail
	.37	Paper Folding Test	Visualization
	-.26	Copying Test	Flexibility of Closure
	.25	Number Comparison	Perceptual Speed

R = .36 (Adult Female Sample, N = 102)

		Test	Cognitive Ability
Beta	.36	Topics Test	Ideational Fluency

R = .53 (Adult Male Sample, N = 43)

		Test	Cognitive Ability
Beta	.40	Gestalt Completion	Speed of Closure
	-.25	Shorter Road Test	Length Estimation
	.28	First and Last Names Test	Associative (Rote) Memory

APPENDIX Z

MULTIPLE COEFFICIENTS OF CORRELATION AND BETA WEIGHTS,

SENTENCE LIPREADING TEST

R = .72 (Eighth Grade Sample, N = 89)

		Test	Cognitive Ability
Beta	.66	Sex	Attention to Detail
	.16	Number Comparison	Perceptual Speed
	-.23	Math Problems V	Figural Adaptive Flexibility
	.19	Gestalt Completion	Speed of Closure

R = .71 (Eleventh Grade Sample, N = 60)

		Test	Cognitive Ability
Beta	.47	Sex	Attention to Detail
	.29	Gestalt Completion Test	Speed of Closure
	.27	Number Comparison	Perceptual Speed
	.22	Form Board Test	Visualization
	.21	First and Last Names Test	Associative (Rote) Memory

R = .30 (Adult Female Sample, N = 102)

		Test	Cognitive Ability
Beta	.20	Wide Range Vocabulary Test	Verbal Comprehension
	.18	Number Comparison	Perceptual Speed

R = .37 (Adult Male Sample, N = 43)

		Test	Cognitive Ability
Beta	.24	First and Last Names Test	Associative (Rote) Memory
	.27	Number Comparison	Perceptual Speed

AUTOBIOGRAPHICAL STATEMENT

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Memberships: American Psychological Association,
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