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The effects of certain verbal stimuli upon
the autonomic equilibrium of hearing
handicapped, emotionally handicapped,
and non-handicapped adolescents

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Dissertation

THE EFFECTS OF CERTAIN VERBAL STIMULI UPON THE AUTONOMIC
EQUILIBRIUM OF HEARING HANDICAPPED, EMOTIONALLY
HANDICAPPED, AND NON-HANDICAPPED ADOLESCENTS

Submitted by

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(B.S., Boston University, 1949)

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In Partial Fulfillment of Requirements for
the Degree of Doctor of Education

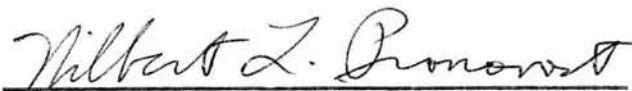
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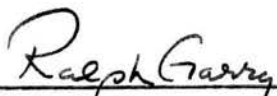
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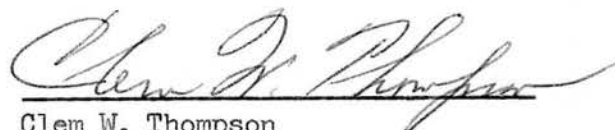

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

For many years educators of the deaf and people in allied fields have felt that acoustically handicapped individuals have more personality problems than normal hearing individuals. In addition, there is a lack of knowledge and considerable differences of opinion concerning the types of personal-social deviations among the hearing handicapped as compared to non-hearing handicapped individuals diagnosed as having a behavior disorder. Finally, during these many years experimentation has been carried out dealing with the relationship between emotional equilibrium and galvanic skin-resistance.

I. THE PROBLEM

Statement of the problem. It first is postulated that the degree and duration of autonomic disequilibrium is related to the disruption of psychophysical equilibrium and that the rate of recovery to a pre-stimulus autonomic state is a reflection of the psychophysical recovery capacity of the individual.

The purpose of this study was to analyze and compare, by psychogalvanometric techniques, differences in response to certain auditory and visual stimuli presented to hearing handicapped, emotionally handicapped, and non-handicapped adolescents.

Justification of the problem. To date, the great majority of statements made in the literature concerning differences in the personality of the hard of hearing and deaf compared to normal individuals appears to be based on subjective thinking. An analysis of the literature has revealed that there are no studies using autonomic nervous system measurements for a comparison of differences in personality equilibrium as a function of visual and/or auditory stimulation. It would be of interest to people working in the field of Audiology as well as allied fields as to whether or not the autonomic equilibrium, as measured by galvanic skin response, will be more or less disrupted in hearing handicapped than in normal hearing or emotionally disturbed adolescents upon presentation of certain emotionally tinged visual and auditory stimuli.

Present study. For this experiment, twenty male adolescents in each of three distinct and separate diagnostic categories were chosen. In selecting the sixty adolescents, distinct criteria were used to establish: (1) the normal or control group, (2) the hearing handicapped group, and (3) the emotionally disturbed group. These criteria are listed under Selection of subjects in Chapter III.

On completion of the experiment, the data obtained from the intergroup and within-group comparisons were analyzed for significance.

II. DEFINITION OF TERMS USED

Major terms used in this study are defined in the following section.

Galvanic skin response (GSR). Techniques utilizing the GSR for audiological procedures are explained in detail by Hardy and Pauls,¹ Hardy and Bordley,² and Sortini.³ Very simply, a child is conditioned to expect a mild faradic shock a few seconds following a standard audiometer's tone, which is presented through ear phones or a loudspeaker. The shock is transmitted through one set of electrodes attached to the calf of one leg, while another set of electrodes, called "pick-up" electrodes, are attached to the fingertips and are used to transmit changes in skin-resistance from the fingertips to the recording apparatus, where it is interpreted by the tester. When the above procedure is repeated several times, increased sweating occurs under the fingertip electrodes. This is the physiological basis for skin-resistance audiometry. Once the patient is conditioned, standard audiometric techniques are employed

¹William G. Hardy and Miriam D. Pauls, "The Test Situation in PGSR Audiometry," Journal of Speech and Hearing Disorders (March, 1952), 17:13-24.

²William G. Hardy and John E. Bordley, "Special Techniques in Testing the Hearing of Children," Journal of Speech and Hearing Disorders (June, 1951), 16:123-131.

³Adam J. Sortini, "Skin-Resistance Audiometry with Young Children," The Hearing Dealer (May, 1955), 5:11-13.

to obtain thresholds, except that the responses or lack of responses are recorded in waves on the milliammeter.

Emotionally disturbed. The criteria for selection of this group were determined after consultation with Dr. J. Roswell Gallagher and Dr. George E. Gardner of the Children's Medical Center in Boston. It was decided to exclude feeble-minded, psychotics, schizophrenics, and those who had psychosomatic ailments which required hospitalization. When a patient with the necessary qualifications of age and sex for the experiment was referred to the Adolescent Unit of the Medical Center and a complete physical examination was negative, he was designated as a candidate for the emotionally disturbed group. It was understood that even with a negative physical examination, structural physiological changes might be overlooked. However, all that was known was that the patient used to do well but was now failing in adjustment, and that the physical examination was negative only as far as medical means of today are able to indicate.

Hearing handicapped. The criteria for selection of this group were a congenital nerve-type hearing loss, with an average loss of 40 to 75 decibels throughout the critical speech range of 500-2000 cycles per second in the better ear, and the other necessary qualifications as explained under Selection of subjects in Chapter III.

Normal. The criteria for selection of this group were an I.Q. of 90 to 110, no referral to the Guidance Service available at the school,

and no significant deviations from the normal range on administration of the Minnesota Multiphasic Personality Inventory, as well as the necessary qualifications explained under Selection of subjects in Chapter III.

Speech-reception threshold. The threshold of intelligibility as defined by Hirsh is "the intensity of the speech at which an observer can repeat fifty per cent of the speech that is presented."⁴

Decibel. Davis⁵ expresses a decibel as having no constant absolute value but expressing a ratio of one sound (or electrical) intensity to another. He feels it is satisfactory for auditory measurement since a difference of one decibel is approximately the smallest difference in intensity that the human ear is able to discern between two sounds, whether loud or faint.

Chapter I has been concerned with the purpose of the study and the definition of some terms to be used. Previous studies related to the present one will be reviewed in Chapter II. Methods used to select subjects and compile data will be discussed in Chapter III. Chapter IV will deal with the analysis of the data. Finally, a summary and conclusions will be presented in Chapter V.

⁴Ira J. Hirsh, The Measurement of Hearing, New York, McGraw-Hill, 1952, p. 128.

⁵Hallowell Davis (ed.), Hearing and Deafness: a Guide for Laymen, New York, Murray Hill, 1947, p. 29.

CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCH

I. HISTORY OF THE GALVANIC SKIN RESPONSE (GSR)

The galvanic skin response has a long history, and since its discovery over sixty years ago, hundreds of papers have been written concerning it. There are three main schools regarding the physiological basis of galvanic skin response.

Vascular theory. The champion of this theory is Féré, who in 1888 first popularized with psychologists the thought that the physiological cause of the galvanic skin response was vasodilation. McDowall¹ suggested two mechanisms for the galvanic skin response: (1) since "whole blood has a higher resistance than extracellular fluid, a fall in skin-resistance is possible through diminished blood content of the layers of skin that comes about through vasoconstriction"; (2) agreeing with Densham and Wells' findings² that any changes in the contour of tension of the skin may cause electrical changes, McDowall felt that "vasodilation might have mechanical effects which would in turn cause a lowering of skin-resistance."

¹R. J. McDowall, "The Physiology of the Psychogalvanic Reflex," Quarterly Journal of Experimental Physiology (1933), 23:271-285.

²H. B. Densham and H. M. Wells, "The Mechanism by Which the Electrical Resistance of the Skin Is Altered," Quarterly Journal of Experimental Physiology (1927), 18:175-184.

Secretary theory. Tarchanoff in 1890 was the first to suggest that the galvanic skin response is the result of secretory activity of the sweat glands. Here, also, two mechanisms are involved -- in this case, alternative mechanisms: (1) Peterson and Jung³ felt that the decreased resistance of the galvanic skin response was brought about because of the presence in and on the skin of sweat -- an electrolyte that would lower skin-resistance; (2) Thouless⁴ suggested that one "secretory mechanism was the more vague possibility that the GSR depends in some way on a change in the sweat-glands that precedes actual secretion -- such, for example, as increased permeability of the cell-membranes whose resistance figures in the GSR circuit."⁵

Muscular theory. Changes in electrical skin-resistance as a matter of involuntary muscular activity was first proposed by Sommer in 1902. He believed that the reflex was simply a change in the contact between the skin and recording electrodes that came about because of involuntary muscular contractions. There have been a number of studies

³Frederic Peterson and C. G. Jung, "Psychological Investigation with the Galvanometer and the Pneumograph in Normal and Insane Individuals," Brain (July, 1907), 30:153-218.

⁴Robert H. Thouless, "The Technique of Experimentation on the Psycho-Galvanic Reflex Phenomenon and the Phenomenon of Tarchanoff," I, British Journal of Psychology (January, 1930), 20:219-240.

⁵Robert A. McCleary, "The Nature of the Galvanic Skin Response," Psychological Bulletin (March, 1950), 47:98.

which agree with the muscular theory,^{6,7} but the consensus of opinion seems to coincide with the feelings of McCleary, who states that "there is little impressive evidence for a muscular theory of the GSR."⁸

II. USE OF GALVANIC SKIN RESPONSE FOR STUDIES DEALING WITH EMOTION

The first use of the psycho-galvanometer for psychological study was in the observation of deflections following presentation of a stimulus like a startling sound and in the observation of galvanic skin response reactions during the answering of simple questions or during verbal responses to specific stimulus words. It was found by Peterson⁹ that when the emotions are touched on, the reaction time is changed and the psycho-galvanometric deflection increased. Peterson first demonstrated the above phenomenon in England and the United States in 1907. He felt that the psycho-galvanometer showed promise as a measurement of conditions where emotions are important.

⁶M. A. Wenger and O. C. Irwin, "Fluctuations in the Skin Resistance of Infants and Adults and Their Relation to Muscular Processes," University of Iowa Studies in Child Welfare (1936), 12:143-179.

⁷M. M. White, "Relation of Bodily Tension to Electrical Resistance," Journal of Experimental Psychology (July, 1930), 13:267-277.

⁸McCleary, op. cit., p. 101.

⁹Frederic Peterson, "The Galvanometer as a Measurer of Emotions," British Medical Journal (May, 1907), 2:804-806.

In testing one hundred college women with twenty-five stimulus words, Hathaway¹⁰ found a definite relationship between the reflex and the emotions. An experiment by McGinnies¹¹ indicated that taboo words required longer tachistoscopic exposures before being reported correctly than did words without any apparent emotional connotation.

The galvanic skin response has been found to be particularly sensitive to sensory and ideational stimuli, especially those associated with alertness, attention, apprehension, and arousal.¹² Darrow¹³ found that there were physiologically as well as psychologically distinguishable processes which had been frequently designated as emotion -- namely, the immediate reflex response to sensory excitation and the response mediated by associated processes or ideas aroused by the stimulus. It is generally felt that there is sufficient evidence of the connection between the galvanic skin response and vegetative-emotional functions.¹⁴

¹⁰Starke Rosecrans Hathaway, "A Comparative Study of Psychogalvanic and Association Time Measures: a New Psychogalvanic Apparatus," Journal of Applied Psychology (December, 1929), 13:632-646.

¹¹Elliott McGinnies, "Emotionality and Perceptual Defense," Psychological Review (September, 1949), 56:244-251.

¹²Donald B. Lindsley, "Emotion," Handbook of Experimental Psychology, S. S. Stevens, editor, New York, J. Wiley and Sons, 1951, p. 474.

¹³Chester W. Darrow, "Electrical and Circulatory Responses to Brief Sensory and Ideational Stimuli," Journal of Experimental Psychology (August, 1929), 12:267-300.

¹⁴Ornolv Odegaard, "The Psychogalvanic Reactivity in Normals and in Various Psychopathic Conditions," Acta Psychiatrica et Neurologica (1930), 5:55-103.

III. PERSONALITY STUDIES OF THE HEARING HANDICAPPED

There is an increasing amount of literature concerning the personality problems of the hard of hearing as opposed to the normal hearing individual. Horne¹⁵ states there is no other disability which causes as much emotional and social maladjustment as deafness. In two groups studied by Rutledge,¹⁶ overt behavioral differences were readily observable and the acoustically handicapped group seemed more unsure of themselves than the normal hearing group. This finding may be related to the viewpoint of Coleman, who states that "absence of noise in the world of the individual with a hearing problem makes it a lifeless world with the lonesome feeling of not being related to the world about him."¹⁷

Individuals handicapped by a hearing loss themselves make statements to the effect that "this hearing loss seems to have thrown a damper over my whole life and personality."¹⁸ Since the effects of a hearing loss are subtle, the actual difficulties experienced with a hearing loss are magnified by the resulting tenseness and apprehension

¹⁵L. Leroy Horne, "Counselling for Adjustment to Hearing Loss," Hearing News (January, 1948), 16:3-5.

¹⁶Louis Rutledge, "Aspiration Levels of Deaf Children as Compared with Those of Hearing Children," Journal of Speech and Hearing Disorders (September, 1954), 19:375-380.

¹⁷Lester C. Coleman, "Psychological Aspects of Loss of Hearing," Hearing News (October, 1953), 21:4-6.

¹⁸Lois Senft et al., "Hard of Hearing Soldiers Discuss Hearing Problems," Hearing News (September, 1953), 21:9-11.

that the individual experiences. This may be brought about by the fact that the problem of a hearing loss tends to shut its victims out from normal human relationships and activities, thereby encouraging introversion.¹⁹ In a study which compared responses to a personality inventory of 225 hearing handicapped persons with those from a group of 148 normal hearing persons, Wells²⁰ found the hearing handicapped group distinctly more emotional, more introverted, and less dominant than the hearing group. Hearing handicapped individuals have been found to show less adequate social adjustment than hearing individuals.²¹ They have been found also to have a higher tendency to neurotic behavior than hearing individuals -- with the mean difference between hearing handicapped and hearing individuals being of a high degree of statistical significance.²² A personality inventory by Lyon²³ revealed that the percentage of deaf pupils doing high school work in the Illinois School

¹⁹Warren M. Smaltz, "The Probability that Deafness Can Affect Personality," American Annals of the Deaf (September, 1945), 90:330-339.

²⁰H. H. Wells, "Measurement of Certain Aspects of Personality among Hard of Hearing Adults," Teachers College Contributions to Education (1932), No. 545, p. 77.

²¹I. Gregory, "A Comparison of Certain Personality Traits and Interests in Deaf and Hearing Children," Child Development (September, 1938), 9:277-280.

²²N. Norton Springer, "A Comparative Study of the Psycho-Neurotic Responses of Deaf and Hearing Children," Journal of Educational Psychology (November, 1938), 29:590-596.

²³Verne W. Lyon, "Personality Tests with the Deaf," American Annals of the Deaf (January, 1934), 79:1-4.

for the Deaf who were designated as emotionally maladjusted and in need of psychiatric advice was twice as great as that of normal hearing freshmen of about the same age at the University of Chicago.

Heider and Heider²⁴ report on several different studies concerning effects of deafness upon personality. They mention that some individuals feel that hearing handicapped persons react to their problem by showing increased aggressiveness and competitiveness in inter-social relations. They suggest that some individuals believe a hearing handicap causes emotional immaturity since words used to express emotional responses in general belong in the category of the more abstract terms which the deaf person has difficulty in mastering; thus, without the word, the feeling itself does not develop fully.

A considerable number of people feel that with hearing problems a psychologic state develops which prevents normal progress and normal relationships in their association with other individuals.²⁵ This would seem to be borne out by Pintner²⁶ in a study which showed neuroticism, introversion, and submissiveness to be more prevalent among the hearing handicapped. Because the deaf child is not able to express his fears,

²⁴Fritz Heider and Grace Heider, "Studies in the Psychology of the Deaf," Psychological Monographs (1941), 53:60.

²⁵James E. Landis, "The Problem of the Hard of Hearing in the Public Schools of Pennsylvania," Volta Review (February, 1950), 52:80-81.

²⁶Rudolph Pintner, "Emotional Stability of the Hard of Hearing," Journal of General Psychology (December, 1933), 43:293-311.

wishes, dreams, hopes, and aspirations, we may witness their effect on him by encountering more emotional problems with him than with the normal hearing child.²⁷ Some individuals believe that deafness places one in a minority group, makes him "different," and this "difference" is a quality difficult for children to cope with.²⁸ This may at least in part be responsible for more behavior problems being found among deaf children than is usual among the hearing.²⁹ Berlinsky³⁰ discusses the results of a personality inventory for deaf children, which indicated that the general adjustment score of hearing handicapped individuals was significantly lower than that of the normal hearing group and that in the sub-scales there was a significant difference between the two groups in social adjustment.

IV. GALVANIC SKIN RESPONSE AND DIAGNOSTIC HEARING TESTING

In recent years the technique of galvanometry has been applied in a special manner in the field of hearing. Bordley, Hardy, and Richter³¹

²⁷Maude H. Knight, "Emotions of the Young Deaf Child," Volta Review (February, 1942), 44:69-72.

²⁸Jean W. Leigh, "Emotional Stability of the Deaf Child," Volta Review (December, 1942), 44:685-688.

²⁹Springer, loc. cit.

³⁰Stanley Berlinsky, "Measurement of the Intelligence and Personality of the Deaf: a Review of the Literature," Journal of Speech and Hearing Disorders (March, 1952), 17:39-54.

³¹John E. Bordley, William G. Hardy, and Curt P. Richter, "Audiometry with Use of Galvanic Skin-Resistance Response: Preliminary Report," Bulletin of the Johns Hopkins Hospital (1948), 82:569.

are usually credited with having developed psycho-galvanic skin-resistance audiometry, for which a standard pure-tone audiometer is used. A specific frequency is transmitted through an ear phone a few seconds before a slight stimulus in the form of a mild faradic shock is given. A response is elicited from the shock sensation in the form of a change in the skin-resistance. The skin-resistance is changed at first only by the unconditioned shock stimulus. When the procedure of shock preceded by tone is repeated a number of times, the patient becomes conditioned to expect a shock following the tone. Even the conditioned tone stimulus then produces a change in the skin-resistance. This then permits determination of when a tone elicits a positive response. Routine pure-tone audiometry then is employed, decreasing the tone intensity until the threshold is reached for the frequency in question. The tester then continues with the other frequencies and completes the test using standard audiometric technique.

Patients with brain damage are more difficult to test, the validity being questionable in some cases.³² However, galvanic skin responses of brain damaged patients have been studied and exhibit characteristic curves that are readily identifiable.³³

There is considerable research going on concerning the application

³²Sortini, op. cit., p. 12.

³³Victor Goodhill, Irving Rehman, and Seymour Brockman, "Objective Skin Resistance Audiometry," Annals of Otology, Rhinology and Laryngology (March, 1954), 63:22-38.

of psycho-galvanometric techniques for use with pure-tone audiometry. Stewart³⁴ has reported new instrumentation which he has used successfully for galvanic skin-resistance audiometry, and also has reported in a recent study that galvanic skin responses to acoustic stimuli were able to be distinguished to a very high degree of significance from other stimuli.³⁵

Related research by Doerfler and McClure³⁶ suggests that by use of improved galvanic skin response instrumentation and proper experimental design it is possible to determine accurate thresholds for adults tested to one specific frequency in an objective manner. Other investigators are searching for factors that influence difficulty of conditioning.^{37,38}

³⁴Kenneth C. Stewart, "A New Instrument for Detecting the Galvanic Skin Response," Journal of Speech and Hearing Disorders (June, 1954), 19:169-173.

³⁵Idem, "Some Basic Considerations in Applying the GSR Technique to the Measurement of Auditory Sensitivity," Journal of Speech and Hearing Disorders (June, 1954), 19:174-183.

³⁶Leo G. Doerfler and Catherine T. McClure, "The Measurement of Hearing Loss in Adults by Galvanic Skin Response," Journal of Speech and Hearing Disorders (June, 1954), 19:184-189.

³⁷Robert Goldstein, H. Ludwig, and R. F. Naunton, "Difficulty in Conditioning Galvanic Skin Responses: Its Possible Significance in Clinical Audiometry," Acta Otolaryngologica (January-February, 1954), 44:66-77.

³⁸Robert Goldstein, Jane T. Daniels, and Sara B. Polito-Castro, "Difficulty in Conditioning Electrodermal Responses to Tone in Normally Hearing Children," Journal of Speech and Hearing Disorders (March, 1955), 20:26-33.

By continued research along the above lines it is hoped that the great potential value of psycho-galvanic skin-resistance audiometry as one of the diagnostic tools of measuring hearing will be fully utilized and eventually refined so that it may be used universally.

It is interesting to note that the galvanic skin response has been used for a considerable number of years in the field of Psychology and allied fields for the measuring of emotion. There have also been a number of studies concerning the personality problems of hearing handicapped individuals. However, there have been no studies reported which would investigate the personality problems of the hearing handicapped by use of the galvanic skin response.

After a comprehensive review of the available literature and research, it was thus decided to formulate the present experiment in order to analyze and compare the responses among three experimental groups to certain visual and auditory stimuli as measured by galvanic skin response.

CHAPTER III

PLAN OF THE EXPERIMENT

I. SELECTION OF THE SUBJECTS

In selecting the sixty male adolescents for this experiment, three distinct and separate diagnostic categories were chosen with twenty subjects in each group. The equated variables used in the experiment consisted of selecting only males between the age limits of 16.0 and 18.0, who had normal vision as determined from school and hospital files, and who were determined to be of average intelligence by standardized tests (verbal and/or non-verbal tests) made available from school and hospital files. Although no specific criteria were used to ascertain any socio-economic level for the subjects, all available evidence supported the assumption that they were essentially of similar socio-economic backgrounds. Since it is generally accepted that the incidence of deafness is greater among males than females, it was felt that an experiment obtaining information concerning the group with the largest incidence of deafness would be of greatest value. Thus, for experimental purposes, the male sex was used for all three groups. There is also voluminous literature in the field of the hearing handicapped concerned with the age levels of adults and young children, but very little investigation has been made concerning the adolescent hearing handicapped; thus, it was felt that the age ranges of 16.0 to 18.0 would be a fruitful area to study.

To obtain the subjects for the normal group, the writer of the experiment met with the superintendent of schools for Hingham and after explaining his study, he received permission to contact the principal of the Hingham High School. This was done, and on the same day that the writer of this experiment met with the principal, after explaining his study to the principal he was introduced to the director of the guidance department. Due to the age range being investigated, the freshman and sophomore classes were eliminated and class files for the junior and senior classes were investigated. Files were pulled at random, and if a file was pulled and, after careful scrutiny, did not meet the initial criteria for selection, it was replaced in the files without the subject being contacted. When a student whose file had been pulled met the initial criteria -- that is, he had an I.Q. of 90 to 110, and had no record of ever having been referred to the school Guidance Service -- arrangements were made by the Guidance Director for administration of the Minnesota Multiphasic Personality Inventory to that student. Then each subject was asked to bring home a parent permission form (see Appendix B), and after he returned this form with his parent's signature, arrangements were made with the Guidance Director for transportation of all subjects to the Children's Medical Center for the experiment.

For the hearing handicapped group, the writer went through school files with school officials in the same manner as described above, to screen possible subjects who would be eligible for the experiment. After those boys who met the necessary criteria were contacted, arrangements

were made with school officials for them to be transported to the Children's Medical Center.

For the emotionally disturbed group, incoming patients of the Adolescent Unit of the Children's Medical Center were screened (as stated in Chapter I) in order to select subjects who would be eligible for the experiment.

With distinct criteria used to establish (1) the normal or control group, (2) the hearing handicapped group, and (3) the emotionally disturbed group, the data obtained were then analyzed for significance of intergroup and within-group comparisons after completion of the experiment.

Normal. The subjects in this group came from the Hingham High School in Massachusetts. None of them had any physical defects as determined by periodic school examinations. They were all male, 16.0 to 18.0 years of age, with the mean age being 16.9 years, and were within an I.Q. range of 90 to 110 as determined by school testing. They had never been referred to the guidance service available at the school, and each subject was given the Minnesota Multiphasic Personality Inventory with the results not deviating significantly from the normal range.

Hearing handicapped. The subjects in this group came from public schools and schools for the deaf in Massachusetts. They were all 16.0 to 18.0 years of age, with the mean age of 17.1 years, they were all males, and all had normal intelligence as determined by verbal and/or non-verbal

intelligence tests administered by their schools. Their hearing losses ranged from 40 to 75 decibels throughout the critical speech range of 500-2000 cycles per second in the better ear. It was felt that adventitious losses, occurring after the development of language had begun, might interfere with the validity of the results; thus, the losses selected were all of a nerve-type congenital nature.

Emotionally disturbed. The subjects in this group were patients of the Children's Medical Center, none of whom had any physical defects as determined by Children's Medical Center staff testing. They were all male, 16.0 to 18.0 years of age, with the mean age being 17.2 years; all of them had normal hearing and were within an I.Q. range of 90 to 110 as determined by Medical Center testing. They were diagnosed by the Psychiatric Unit or the Adolescent Unit staff at the Medical Center as being "emotionally disturbed," as defined in Chapter I.

A larger number of subjects for each group would have been more ideal for experimental purposes, but investigation revealed that it was necessary to canvass the entire state to find the number of subjects who had the necessary criteria so as to be classed as "hearing handicapped." It was equally difficult to find the number of emotionally disturbed subjects who had the necessary criteria and could be used for the experiment.

II. EQUIPMENT AND MATERIALS USED FOR THE EXPERIMENT

Maico portable audiometer. The Maico portable audiometer, Model F-1, was used for hearing testing of all subjects. This audiometer, universally used throughout the country, is a standard type which has the acceptance of the American Medical Association Council on Physical Medicine.

Psycho-galvanometer. The psycho-galvanometer at the Hearing Clinic of the Children's Medical Center was used to obtain galvanic skin responses to the visual and auditory stimuli. It consists of the following parts:

1. Standard Maico F-1 pure-tone audiometer.
2. General Electric direct current amplifier, Model 715A, which operates on a 110-volt, 60-cycle alternating current supply.
3. Esterline-Angus, Model AW, 0-5 milliampere ink recorder.
4. Modified Wheatstone bridge, housed in a metal box and supplied by a $4\frac{1}{2}$ -volt dry battery.

5. Harvard inductorium, housed in a metal box, for use as a shock panel with rheostat having gradations for shock up to two milliamperes.

Tachistoscope. For visual presentation of the test items, a tachistoscope was made. On a piece of white cardboard 1/8 inch thick, fourteen inches wide, and sixteen inches long, a slot one inch by three inches was cut to allow visual presentation of a single test item. Then a wheel of white cardboard 1/8 inch thick with a diameter of $13\frac{1}{2}$ inches was cut and the test items to be presented visually were written on the wheel in heavy India ink. The circular wheel then was attached to the fourteen-by-sixteen-inch piece of cardboard, and a rivet was used to fasten the two together. The test items to be presented were numbered and placed on the reverse side of the wheel, with an arrow pointing to the exact location of the opening through which the word was to be presented. By placing the tachistoscope on the psycho-galvanometer so that the experimenter could turn the wheel with one hand, it was possible to listen through the head set and use the recorded test items as time clues while turning the wheel to present the test items. This left the free hand to mark the galvanic skin responses.

Speech audiometer. The speech audiometer at the Hearing Clinic of the Children's Medical Center was used for auditory presentation of the test items to the hearing handicapped subjects in the experiment. It is a console speech audiometer, Model 1160, built by the Grason

Stadler Company of Cambridge, Massachusetts, and constructed in accordance with the Proposed American Standards for Speech Audiometers (Draft of May 1, 1951) with a sound pressure level of 135 decibels at the ear phones and properly calibrated attenuators for threshold measurements. The head set consists of standard PDR permoflex phones, reliable up to 6000 cycles per second. A Western Electric 633-A microphone for live voice testing was used in conjunction with a large broadcast-type meter for monitoring, including a calibration control. Also included was a James Lansing D-130 loudspeaker in matching cabinet, for free field testing up to a sound pressure level of 135 decibels (re .0002 dynes per square centimeter) when desired, and a two-way intercommunication set, the direction of operation being determined at the console. The Maico H-1 pure-tone audiometer, whose output can be fed through the speech audiometer when desired, was used also, enabling all tests to be conducted from a central position.¹

Magnecord standard tape recorder. The Magnecord, Model 33, a standard type tape recorder, was used for auditory presentation of test items. It has a frequency response from below 50 cycles per second to 5 kilocycles plus or minus 2 decibels at 3 3/4 inches per second, and from 50 cycles per second to 10 kilocycles plus or minus 2 decibels at 7 1/2 inches per second.

¹Adam J. Sortini and Carlyle G. Flake, "Speech Audiometry Testing for Pre-School Children," Laryngoscope (October, 1953), 63:991-997.

Word list. A word list of twelve emotionally tinged test items and twelve non-emotionally tinged test items was selected from Rapaport.² These will be discussed in greater detail later in this chapter. The two separate lists selected were:

Emotionally Tinged Words

1. love
2. breast
3. suck
4. party
5. mother
6. intercourse
7. hospital
8. woman
9. doctor
10. hate
11. nipple
12. girlfriend

Non-Emotionally Tinged Words

1. desk
2. teeth
3. clock
4. table
5. snow
6. tobacco
7. shoe
8. arm
9. tree
10. dish
11. dog
12. farm

The test items were presented in the following order:

- | | |
|-----------------|----------------|
| 1. love | 13. hospital |
| 2. desk | 14. shoe |
| 3. breast | 15. woman |
| 4. teeth | 16. arm |
| 5. suck | 17. doctor |
| 6. clock | 18. tree |
| 7. party | 19. hate |
| 8. table | 20. dish |
| 9. mother | 21. nipple |
| 10. snow | 22. dog |
| 11. intercourse | 23. girlfriend |
| 12. tobacco | 24. farm |

²David Rapaport, Diagnostic Psychological Testing, Vol. II, Chicago, Year Book Publishing Company, 1946, pp. 44-50.

III. PHYSICAL ARRANGEMENTS FOR THE EXPERIMENT

I. Testing room.

A. Sound treatment.

1. Sound treated doors set in rubber.
2. Padded floor.
3. Johns-Manville Perma-Acoustic tile on ceiling and down to four feet from the floor.
4. From four feet down to floor, transite panels (three feet by three feet), backed by three inches of ground glass acoustical treatment, and set on furring strips two inches by two inches.

B. Size of room.

1. Seven feet wide, fifteen feet long, and eight feet six inches high.

C. Articles of furniture.

1. Subject's chair.
2. Examiner's chair.
3. Table for tachistoscope and tape recorder.
4. Psycho-galvanometer.
5. Audiometer.
6. Loudspeaker.

II. All articles were in the same place for each subject.

IV. PRELIMINARY PROCEDURES

Contacts with administrative officials. Necessary administrative officials were contacted for each group and visits made so that the experimental plan could be explained in detail. Since the Adolescent and Psychiatric Units are part of the Children's Medical Center, the subjects in the emotionally disturbed group had only to come to a different part of the same building for the test. The subjects in the hearing handicapped group and normal group were transported by school officials or representatives directly to the Hearing Clinic of the Children's Medical Center.

Scoring form. A form was devised which could be used for all three groups in the scoring of galvanic skin responses to the auditory and visual stimuli (see Appendix A).

Parents' permission form. In cooperation with the Guidance Director of the Hingham High School, a form was designed for the parents of the test subjects, asking permission for the use of their children for the normal group of the study (see Appendix B).

Personality test administration. The Minnesota Multiphasic Personality Inventory was administered to the normal group in the high school by the Guidance Director, and then scored by staff psychologists at the Children's Medical Center.

Hearing test. Each subject of each group was given a hearing

test from 500 through 4000 cycles per second and a speech-reception threshold test. All audiologic or "hearing" thresholds were determined in the manner suggested by Pauls and Hardy.³

Tape recording. The test items were recorded at twenty-second intervals and for a duration of one second.

Word list. Word lists of the nature used in this experiment have been used in studying emotional disturbance through the use of the galvanic skin response for many years.⁴ It thus was felt that if a pretest were conducted to establish reliability and validity of the test items used for the actual experiment, the validity of the experimental results would be increased.

V. PRE-EXPERIMENTAL PROCEDURES

Pretest. In order to establish the reliability and validity of the test items, a pretest was conducted. Fifteen male college students 19 to 20 years of age were used as test subjects. Every subject tested had normal vision and normal hearing as determined by school records.

The subjects were brought into the testing room and given preliminary instructions, after which the psycho-galvanometer electrodes were

³Miriam D. Pauls and William G. Hardy, "Hearing Impairment in Preschool Children," Laryngoscope (June, 1953), 63:534-544.

⁴J. McV. Hunt, Personality and the Behavior Disorders, Vol. I, New York, Ronald Press Company, 1944, pp. 389-412.

applied. The test items were then presented visually by means of a tachistoscope at twenty-second intervals and of one second duration. The galvanic skin response reactions were interpreted from the ink writer as positive or negative responses. Table I gives the list of emotionally tinged and non-emotionally tinged items⁵ used for the pretest experiment. Table II shows the validity check of the emotionally tinged and non-emotionally tinged test items. A "t" test was used to obtain the significance of the difference between two correlated means.⁶ With a "t" of 9.3 and a "p" of $\leq .001$, one may conclude that the emotionally tinged test items evoke positive responses more often than the non-emotionally tinged test items.

Table III shows the results of a reliability check on the emotionally tinged test items using even-numbered words as half the sample and odd-numbered words as the other half. The reliability of .596 found in this check was not very high. However, by basing the reliability on random assignments of the items to the two half-samples⁷ (as shown in Table IV), the reliability of .846 found was high enough to be of statistical significance.

As a result of the above experiment, the following emotionally tinged word list was selected from the original twenty-four test items

⁵Rapaport, loc. cit.

⁶Allen L. Edwards, Experimental Design in Psychological Research, New York, Rinehart and Company, 1950, p. 18, formula 3.

⁷Harold Gulliksen, Theory of Mental Tests, New York, John Wiley and Sons, 1950, p. 216.

TABLE I
LIST OF ITEMS USED FOR PRETEST EXPERIMENT

Emotionally Tinged Test Items	Non-Emotionally Tinged Test Items
1. man	1. desk
2. love	2. teeth
3. bite	3. clock
4. breast	4. table
5. chair	5. snow
6. drink	6. tobacco
7. suck	7. shoe
8. party	8. arm
9. masturbate	9. tree
10. mother	10. dish
11. intercourse	11. dog
12. hospital	12. farm
13. house	13. hair
14. woman	14. flower
15. penis	15. brush
16. doctor	16. cat
17. water	17. ruler
18. hate	18. eyes
19. world	19. horse
20. dark	20. pencil
21. son	21. watch
22. nipple	22. card
23. homosexual	23. paper
24. girlfriend	24. belt

TABLE II
 VALIDITY CHECK OF NON-EMOTIONALLY AND
 EMOTIONALLY TINGED TEST ITEMS

Subject	Total Number of Positive Responses		D ($x_1 - x_2$)	D ²
	Emotionally Tinged (x_1)	Non-Emotionally Tinged (x_2)		
1	13	6	7	49
2	16	3	13	169
3	18	4	14	196
4	16	7	9	81
5	22	4	18	324
6	21	7	14	196
7	14	9	5	25
8	12	3	9	81
9	18	6	12	144
10	14	5	9	81
11	11	4	7	49
12	20	3	17	289
13	11	5	6	36
14	22	3	19	361
15	11	4	7	49
N=15 Totals	239	73	166	2130

$$\frac{\bar{D}}{S_D} = t = 9.3$$

$$p < .001$$

TABLE III

RELIABILITY CHECK OF POSITIVE RESPONSES TO EMOTIONALLY
TINGED WORDS BY THE ODD-EVEN METHOD

Subject	Total Positive Responses		X ($x_1 + x_2$)	D ($x_1 - x_2$)	
	Odd-Numbered Words (x_1)	Even-Numbered Words (x_2)			
1	3	10	13	-7	
2	4	12	16	-8	
3	7	11	18	-4	
4	6	10	16	-4	
5	11	11	22	0	
6	9	12	21	-3	
7	6	8	14	-2	
8	6	6	12	0	
9	6	12	18	-6	
10	4	10	14	-6	
11	5	6	11	-1	
12	8	12	20	-4	
13	4	7	11	-3	
14	10	12	22	-2	
15	2	9	11	-7	
N=15	Totals	91	148	239	-57

$$r''_{XX} = 1 - \frac{S_d^2}{S_x^2} = r' = .596$$

TABLE IV

RELIABILITY CHECK OF POSITIVE RESPONSES TO EMOTIONALLY
TINGED WORDS BY THE RANDOM SAMPLING METHOD

Subject	Total Positive Responses		X ($x_1 + x_2$)	D ($x_1 - x_2$)
	Words in Sample A (x_1)	Words in Sample B (x_2)		
1	7	6	13	1
2	8	8	16	0
3	9	9	18	0
4	7	9	16	-2
5	12	10	22	2
6	10	11	21	-1
7	6	8	14	-2
8	7	5	12	2
9	9	9	18	0
10	8	6	14	2
11	7	4	11	3
12	9	11	20	-2
13	6	5	11	1
14	11	11	22	0
15	6	5	11	1
N=15 Totals	122	117	239	5

$$r''_{xx} = 1 - \frac{s_d^2}{s_{x^2}} = r' = .846$$

and was used in the major experiment:

- | | |
|----------------|----------------|
| 1. love | 7. hospital |
| 2. breast | 8. woman |
| 3. suck | 9. doctor |
| 4. party | 10. hate |
| 5. mother | 11. nipple |
| 6. intercourse | 12. girlfriend |

The first twelve items from the non-emotionally tinged word list in Table I, page 27, were selected for use in the experiment. The final order in which the test items were presented in the experiment consisted of an emotionally tinged word and then a non-emotionally tinged word:

- | | |
|-----------------|----------------|
| 1. love | 13. hospital |
| 2. desk | 14. shoe |
| 3. breast | 15. woman |
| 4. teeth | 16. arm |
| 5. suck | 17. doctor |
| 6. clock | 18. tree |
| 7. party | 19. hate |
| 8. table | 20. dish |
| 9. mother | 21. nipple |
| 10. snow | 22. dog |
| 11. intercourse | 23. girlfriend |
| 12. tobacco | 24. farm |

VI. EXPERIMENTAL PROCEDURE

Each subject of each group was placed in the testing chair. A pair of electrodes, rectangular and curved to fit the fingertips, were used as pick-up electrodes. After Redux electrode paste had been applied to the electrodes to facilitate adequate contact, gauze and/or adhesive tape was used to fasten the electrodes onto the fingertips of the subject's hand.

The test items on both the visual and the auditory portions of the test were presented at twenty-second intervals of one second duration to each subject of each group. The order of presenting the visual and auditory portions was alternated for each subject in turn; that is, one subject would receive the visual portion before the auditory, and the next subject would receive the auditory portion first. There was a rest period of approximately ten minutes between the visual and auditory phases of the test. The words presented to each subject of each group for the auditory portion of the test were calibrated at 30 decibels above the free field unaided speech-reception threshold. For the visual presentation of the test items, the experimenter plugged in a head set to the tape recorder and thus was insured of flashing the test items at the proper twenty-second intervals by utilizing the tape recording of the test items, audible only to the experimenter through the head set.

For the visual presentation of the test items to each subject of each group, the subject was told the following: "You will see a word appear in the opening. Do not repeat it, but continue looking at the opening for more words. Lean back and relax, and don't move your fingers with the electrodes."

For the auditory presentation of the test items to the normal and emotionally disturbed groups, each subject was told the following: "You will hear a word from the loudspeaker. Do not repeat it. Lean back and relax, and don't move your fingers with the electrodes."

For the auditory presentation of the test items to the hearing handicapped group, the tape recorder was placed beside the microphone of

the speech audiometer and the test items presented by monitored means through the speech phones, at a level of 30 decibels above the free field speech-reception threshold of the individual subject. Each hearing handicapped subject was told: "You will hear a word through your ear phones. Do not repeat it. Lean back and relax, and don't move your fingers with the electrodes."

After each subject in each group had completed both the visual and the auditory phases of the test, he was sent to a waiting room apart from the subjects waiting to be tested. This was done in order to prevent subjects already tested explaining to the subjects waiting to be tested the experimental procedures that had taken place.

For each subject the galvanic skin response record was analyzed for the number of galvanic skin responses to each visual and auditory test item. By "response" is meant that, using the center of the millimeter graph paper as a base line, the recording needle of the millimeter either moved in a positive direction to the left of the base line (indicating a positive response) or remained stationary (indicating a negative response) upon presentation of a test item. These responses were interpreted as "scores" for each subject. Both the visual and the auditory responses observable on the millimeter were recorded by the experimenter on the scoring form (see Appendix A). For a negative response, the test item space was left blank; for a positive response, a check mark was recorded.

The breakdowns of the total sums of squares into the various components for the visual and auditory test items are shown in Tables VIII and IX. Also shown in Tables VIII and IX are the F-ratios used for testing the significance of the variation contributed by the condition of the subject (that is, whether he is normal, hearing handicapped, or emotionally disturbed) against the between-subject error-variance, as well as the F-ratios for testing the significance of the contributions of the type of stimulus word (emotionally tinged and non-emotionally tinged) and the interaction between condition of subject and type of stimulus against the within-subject error-variance. The F-ratios in Tables VIII and IX give the fifth and first per cent points of F for appropriate degrees of freedom.¹ The resulting P-values provide statistical meaning (using a five per cent level of significance) for the various results shown in Tables V through VII. These P-values are shown also in Tables VIII and IX.

Since the analysis of variance indicated that the overall effect of the condition of the subject was significant beyond the five per cent level for both the auditory and the visual portions of the experiment, separate t-tests were made between the pairs of group means for the number of positive responses to the emotionally tinged test items. These results are shown in Tables X and XI. No t-tests were made for the non-emotionally tinged test items since the number of positive responses were of such a small number.

¹Edwards, op. cit., pp. 410-411.

Table V shows the number of positive galvanic skin responses to the emotionally tinged and non-emotionally tinged experimental stimuli for the three groups. The results of t-tests indicate that the responses of the hearing handicapped group to the visual stimuli were significantly greater than those of the normal group at the two per cent level of significance. The number of responses of the hearing handicapped group and that of the emotionally disturbed group, as shown in Table VI, were so close together for the visual stimuli (135 and 136 respectively) that no test of statistical significance was necessary. The responses of the emotionally disturbed group to the visual stimuli were significantly greater than those of the normal group at the one per cent level.

The difference between the positive responses to auditory stimuli of the emotionally disturbed group and those of the normal group was barely significant at the five per cent level, the normal group showing more responses. The degree of difference between the responses of the hearing handicapped group and those of the normal group to the auditory stimuli was significant at the one per cent level, the hearing handicapped group showing significantly fewer responses. The degree of difference between the responses of the hearing handicapped group and the emotionally disturbed group to the auditory stimuli was not great enough to be of statistical significance.

The within-group comparisons, as shown in Table XII, indicate that the responses of the normal group to the emotionally tinged visual stimuli were significantly fewer than their responses to the emotionally

tinged auditory stimuli, well beyond the one per cent level. The responses of the hearing handicapped group to the emotionally tinged visual stimuli were greater than those to the emotionally tinged auditory stimuli, although the difference did not attain statistical significance. The responses of the emotionally disturbed group to the emotionally tinged visual stimuli were fewer than those to the emotionally tinged auditory stimuli, although the difference was not great enough to be of statistical significance. Corresponding t-tests for the non-emotionally tinged test items were not done because of the small number of positive responses from all three groups.

The twenty scores in each quadrangle of Tables VI and VII represent the frequency of positive responses shown by each of the twenty subjects of each particular group to the emotionally tinged and the non-emotionally tinged auditory and visual stimuli. The within-group comparisons shown in Table VI indicate that there were significantly fewer responses to the non-emotionally tinged visual stimuli than to the emotionally tinged visual stimuli for all three groups. There also were significantly fewer responses to the non-emotionally tinged auditory stimuli than to the emotionally tinged auditory stimuli for all three groups, as shown in Table VII. The respective differences were so large as to make it unnecessary to perform any statistical tests for significance.

TABLE V
 NUMBER OF POSITIVE GALVANIC SKIN RESPONSES
 TO EXPERIMENTAL STIMULI

Test Items	Groups					
	Normal (r=1)		Hearing Handicapped (r=2)		Emotionally Disturbed (r=3)	
	Visual	Auditory	Visual	Auditory	Visual	Auditory
1. love	9	10	19	17	18	16
2. desk	0	0	0	0	0	0
3. breast	11	16	9	8	10	8
4. teeth	0	0	0	0	0	0
5. suck	14	19	15	13	5	15
6. clock	0	0	0	0	1	0
7. party	7	12	1	1	2	3
8. table	0	0	0	0	0	1
9. mother	5	12	17	18	15	17
10. snow	0	0	0	0	0	1
11. intercourse	18	20	9	9	10	11
12. tobacco	0	0	0	0	3	2
13. hospital	13	8	12	8	14	10
14. shoe	0	0	2	1	0	0
15. woman	13	16	15	16	14	18
16. arm	0	0	2	1	0	1
17. doctor	3	9	13	13	12	13
18. tree	1	0	0	0	1	1
19. hate	4	8	1	1	1	2
20. dish	1	0	0	0	0	0
21. nipple	7	17	6	8	8	9
22. dog	1	1	3	0	2	1
23. girlfriend	15	18	18	17	17	18
24. farm	1	0	0	0	1	2
N = 24 Totals:	113	166	142	131	144	149

TABLE VI

RESPONSES TO EMOTIONALLY TINGED AND NON-EMOTIONALLY
TINGED VISUAL TEST ITEMS FOR THE
THREE EXPERIMENTAL GROUPS

Group	Emotionally Tinged	Non-Emotionally Tinged
Normal	8 6 5 4	0 0 0 0
	7 6 5 6	1 0 0 0
	7 6 4 6	0 0 0 0
	5 6 5 4 $T_{11.}=109$	0 0 0 0 $T_{12.}=4$
	5 3 6 5	1 1 0 1 $T_{1..}=113$
Hearing Handicapped	6 9 6 7	2 0 0 1
	10 6 11 5	0 0 1 0
	7 8 5 7	1 1 0 0
	7 4 6 4 $T_{21.}=135$	0 1 0 0 $T_{22.}=7$
	9 6 5 7	0 0 0 0 $T_{2..}=142$
Emotionally Disturbed	10 5 6 7	2 3 0 0
	9 7 6 6	2 1 0 0
	9 7 5 6	0 0 0 0
	11 4 7 8 $T_{31.}=136$	0 0 0 0 $T_{32.}=8$
	7 5 7 4	0 0 0 0 $T_{3..}=144$

$T = 380$
"
 $T_{.1.}$

19 $T = 399$
"
 $T_{.2.}$

TABLE VII

RESPONSES TO EMOTIONALLY TINGED AND NON-EMOTIONALLY
TINGED AUDITORY TEST ITEMS FOR THE
THREE EXPERIMENTAL GROUPS

Group	Emotionally Tinged	Non-Emotionally Tinged
Normal	9 10 7 7	0 0 0 0
	8 9 8 8	1 0 0 0
	10 10 6 9	0 0 0 0
	10 8 9 4	0 0 0 0
	8 7 10 8	0 0 0 0
	$T_{11.}=165$	$T_{12.}=1$
		$T_{1..}=166$
Hearing Handicapped	7 7 8 9	2 0 0 0
	7 6 4 5	0 0 0 0
	4 3 7 7	0 0 0 0
	7 5 7 4	0 0 0 0
	10 8 5 9	0 0 0 0
	$T_{21.}=129$	$T_{22.}=2$
		$T_{2..}=131$
Emotionally Disturbed	10 9 6 10	1 1 0 0
	7 7 5 5	2 0 0 0
	9 10 8 7	1 2 0 0
	10 5 6 6	0 0 0 0
	7 3 4 8	0 0 0 0
	$T_{31.}=142$	$T_{32.}=7$
		$T_{3..}=149$

$$T = 436$$

$$"$$

$$T_{.1.}$$

$$10 \quad T = 446$$

$$"$$

$$T_{.2.}$$

TABLE VIII

COMPLETE ANALYSIS OF VARIANCE FOR THE EMOTIONALLY TINGED
AND NON-EMOTIONALLY TINGED VISUAL TEST ITEMS

Source	ndf	Sum of Squares	Mean Squares	F-Ratios	P-Value
Between Subjects	59	113.825			
Condition (Normal, Hearing Handicapped, Emotionally Disturbed)	2	15.050	7.525	4.342	.02
Error (b)	57	98.775	1.733		
Within Subjects	60	1182.500			
Type of Stimulus (Emotional and Non-Emotional)	1	1086.008	1086.008	706.117	.00
Interaction (Condition x Type)	2	8.817	4.408	2.866	.10
Error (w)	57	87.675	1.538		
Totals	119	1296.325			

TABLE IX

COMPLETE ANALYSIS OF VARIANCE FOR THE EMOTIONALLY TINGED
AND NON-EMOTIONALLY TINGED AUDITORY TEST ITEMS

Source	ndf	Sum of Squares	Mean Squares	F-Ratios	P-Value
Between Subjects	59	135.366			
{ Condition (Normal, Hearing Handicapped, Emotionally Disturbed)	2	15.316	7.658	3.636	.03
{ Error (b)	57	120.050	2.106		
Within Subjects	60	1625.000			
{ Type of Stimulus (Emotional and Non- Emotional)	1	1512.300	1512.300	919.331	.00
{ Interaction (Condition x Type)	2	18.950	9.475	5.759	.005
{ Error (w)	57	93.750	1.645		
Totals	119	1760.366			

TABLE X

MEANS, STANDARD DEVIATIONS, T-VALUES, AND P-VALUES
FOR THE POSITIVE RESPONSES TO EMOTIONALLY
TINGED AUDITORY TEST ITEMS FOR THE
THREE EXPERIMENTAL GROUPS

	Normal Group	Hearing Handicapped Group	Emotionally Disturbed Group
Mean	8.25	6.45	7.10
Standard Deviation	1.51	1.86	2.07
	Normal versus Hearing Handicapped	Normal versus Emotionally Disturbed	Emotionally Disturbed versus Hearing Handicapped
t	3.28	1.96	1.02
ndf	38	38	38
P	< .01	≈ .05	> .10

TABLE XI
 MEANS, STANDARD DEVIATIONS, T-VALUES, AND P-VALUES
 FOR THE POSITIVE RESPONSES TO EMOTIONALLY
 TINGED VISUAL TEST ITEMS FOR THE
 THREE EXPERIMENTAL GROUPS

	Normal Group	Hearing Handicapped Group	Emotionally Disturbed Group
Mean	5.45	6.75	6.80
Standard Deviation	1.16	1.84	1.83
	Normal versus Hearing Handicapped	Normal versus Emotionally Disturbed	Emotionally Disturbed versus Hearing Handicapped*
t	2.61	2.71	----
ndf	38	38	----
P	\approx .015	.01	----

*No test was performed for this pair, since the two means were almost identical.

TABLE XII

DIFFERENCE BETWEEN NUMBER OF RESPONSES MADE TO EMOTIONALLY
TINGED AND NON-EMOTIONALLY TINGED AUDITORY AND VISUAL
STIMULI FOR THE THREE EXPERIMENTAL GROUPS

Subject	Normal Difference Score	Hearing Handicapped Difference Score	Emotionally Disturbed Difference Score
1	1	1	0
2	1	-3	-2
3	3	-3	0
4	5	0	-1
5	3	1	0
6	4	-2	4
7	3	0	0
8	4	-5	3
9	2	1	1
10	4	2	-2
11	2	2	0
12	3	-7	-1
13	2	2	3
14	4	1	-1
15	4	0	-3
16	3	2	3
17	2	0	-1
18	3	0	1
19	0	0	-2
20	3	2	4
Mean	2.80	-.30	-.30
t	10.11	-.54	.64
ndf	19	19	19
P	$\ll .01$	$\approx .70$	$\approx .55$

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this experimental investigation was to analyze and compare differences in response to certain visual and auditory stimuli presented to hearing handicapped, emotionally disturbed, and non-handicapped adolescents, as measured by psycho-galvanometric means.

For this experiment, twenty male adolescents in each of three separate categories were chosen. In selecting the sixty adolescents, distinct criteria were used to establish: (1) the normal or control group, (2) the hearing handicapped group, and (3) the emotionally disturbed group. The equated variables used in the experiment consisted of selecting only males between the ages of 16.0 and 18.0, who were all determined to be of average intelligence by standardized tests (verbal and/or non-verbal tests) made available from school and hospital files, and who all had normal vision as determined from school and hospital files.

The subjects for the normal group came from the Hingham High School in Massachusetts. None of them had any physical defects as determined by periodic school examinations. They had never been referred to the Guidance Service available at the school, and each subject was given the Minnesota Multiphasic Personality Inventory with the results not deviating significantly from the normal range.

The subjects for the hearing handicapped group came from public schools and schools for the deaf in Massachusetts.

Their hearing losses ranged from 40 to 75 decibels throughout the critical speech range of 500-2000 cycles per second in the better ear. It was felt that adventitious losses, occurring after the development of language, might interfere with the validity of the results; thus, the losses selected were all of a nerve-type congenital nature.

The subjects for the emotionally disturbed group were patients of the Children's Medical Center, none of whom had any physical defects as determined by Medical Center staff testing. They were diagnosed by the Psychiatric Unit or the Adolescent Unit staff at the Medical Center as being "emotionally disturbed"; feeble-minded, psychotics, schizophrenics, and those who had psychosomatic ailments which required hospitalization were excluded. When a patient with the necessary qualifications of age and sex was referred to the Adolescent Unit and a complete physical examination was negative, he was designated as a candidate for the emotionally disturbed group.

A pretest was conducted to establish reliability and validity of the emotionally tinged test items and a list was selected for use in the final experiment. The test items were presented visually to all three groups by means of a tachistoscope, at twenty-second intervals and of one second duration. For the auditory stimuli, the test items were presented through a standard tape recorder at twenty-second intervals and of one second duration to the three groups, at 30 decibels above the free field unaided speech reception threshold of each individual subject. For the normal and emotionally disturbed groups, the tape

recorder itself was used for the auditory presentation of the test items; for the hearing handicapped group, the tape recorder was placed beside the microphone of a standard speech audiometer and the auditory test items presented by monitored means through the speech phones at a level of 30 decibels above the free field speech-reception threshold of the individual subject.

For each subject, the galvanic skin responses, obtained through psycho-galvanometric means, were observed and recorded by the experimenter. The data then were analyzed upon completion of the experiment for intergroup and within-group comparisons.

Findings.

1. The responses of the hearing handicapped group to the visual stimuli were significantly greater than those of the normal group.
2. The degree of difference between the responses of the hearing handicapped group and those of the emotionally disturbed group to the visual stimuli was not great enough to be of statistical significance.
3. The responses of the emotionally disturbed group to the visual stimuli were significantly greater than those of the normal group.
4. The responses of the hearing handicapped group to the auditory stimuli were significantly less than those of the normal group.

5. The degree of difference between the responses of the hearing handicapped group to the auditory stimuli and those of the emotionally disturbed group was not great enough to be of statistical significance.
6. The responses of the normal group to the auditory stimuli were enough greater than those of the emotionally disturbed group to be of slight statistical significance.
7. The responses of the normal group to the emotionally tinged visual stimuli were significantly fewer than the responses to the emotionally tinged auditory stimuli.
8. The responses of the hearing handicapped group to the emotionally tinged visual stimuli were greater than those to the emotionally tinged auditory stimuli, although the difference was not great enough to be of statistical significance.
9. The responses of the emotionally disturbed group to the emotionally tinged visual stimuli were fewer than those to the emotionally tinged auditory stimuli, although the difference was not great enough to be of statistical significance.
10. There was a significant interaction between condition of subject and type of stimulus word only in the auditory part of the experiment. That is, for the auditory presentation of the emotionally tinged test items, the normal group showed the largest number of responses, the emotionally disturbed the next largest, and the hearing handicapped group the smallest number of responses.

Conclusions.

1. On the basis of this experiment, the autonomic equilibrium of hearing handicapped individuals is more disrupted, to a degree significant at the two per cent level, than is that of normal hearing individuals upon presentation of emotionally and non-emotionally tinged visual stimuli, as measured by psychogalvanometric means.
2. On the basis of this experiment, the autonomic equilibrium of hearing handicapped individuals is disrupted to a degree comparable to that of emotionally disturbed individuals upon presentation of emotionally and non-emotionally tinged visual stimuli, as measured by psychogalvanometric means.
3. On the basis of this experiment, the autonomic equilibrium of hearing handicapped individuals is less disrupted, to a degree significant at the one per cent level, than that of normal hearing individuals upon presentation of emotionally and non-emotionally tinged auditory stimuli, as measured by psychogalvanometric means.
4. On the basis of this experiment, the autonomic equilibrium of hearing handicapped individuals is less disrupted, but not to a significant degree, than is that of emotionally disturbed individuals upon presentation of emotionally and non-emotionally tinged auditory stimuli, as measured by psychogalvanometric means.

Discussion. In summary, on the basis of the present experimentation, it appears that galvanic skin responses of hearing handicapped

individuals more closely approximate the responses of emotionally disturbed individuals to auditory and visual emotionally tinged stimuli than the responses of non-handicapped individuals, as measured by psychogalvanometric means. This supports the subjectively motivated statements in the literature concerning the presence of personality problems in hearing handicapped individuals. The finding of this study that the autonomic variability of the hearing handicapped individuals more closely approximates that of the emotionally disturbed than that of the normal individuals would seem to further substantiate this hypothesis.

Limitations of the study. Certain factors may have directly or indirectly exerted an influence on the outcome of the experiment. They are as follows:

1. The number of subjects for each group ideally might have been larger to increase the validity of the results obtained.
2. The experimental procedures might have been repeated for each subject of each group so that comparisons between galvanic skin responses elicited on two separate testing occasions might have been obtained.

Suggestions for further research. It is suggested that future research, which could be similar in design to the present experiment, be designed to investigate the following areas:

1. The use of female subjects.
2. The use of both sexes as subjects with comparisons.

3. The use of pictures of objects for the visual presentation of test items instead of a word list.
4. The use of different age ranges for subjects.
5. The utilization of other areas of the physically handicapped for the handicapped group.
6. The investigation of possible personality differences caused among the hearing handicapped as a function of the time of onset of the disorder.
7. The use of two hearing handicapped groups with the same extent of hearing loss: one group with an air conduction loss, the other group with a bone conduction loss; this would investigate the possible personality differences between the two different groups.
8. The investigation of possible personality differences between hearing handicapped individuals in schools for the deaf and those in public schools.

APPENDIX A

SCORING FORM

SCORING FORM

NAME: _____ AGE: _____ GROUP: N ED HH SUB.NO: _____

Hearing (250-4000 cps, 15 db bil.): Pass Fail Ave.loss, HH Gr.:

VISUAL STIMULI

AUDITORY STIMULI

No.	Positive Responses	Negative Responses	No.	Positive Responses	Negative Responses
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
0			0		
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
0			0		
1			1		
2			2		
3			3		
4			4		

APPENDIX B

PARENTS' PERMISSION FORM

PARENTS' PERMISSION FORM

May 2, 1955

Dear Parent:

Your son has signified his willingness to cooperate in a study to be undertaken at the Children's Medical Center. They hope to try a certain hearing test on twenty boys of the ages sixteen to eighteen. This will necessitate his being taken to the Center some morning in the near future by either a member of their staff or the Hingham High School staff. He will be excused from his school work on that morning.

If you are willing for him to take part in this activity please sign this sheet and return it to us.

Sincerely,

Burditt W. Collins
Director of Guidance.

Pupil's Name _____

Parent's Signature _____

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