THE DEVELOPMENT OF A BROADCAST MASS SCREENING TEST OF HEARING

A DISSERTATION SUBMITTED IN PART FULFILMENT FOR THE DEGREE OF MASTER OF SCIENCE (SPEECH AND HEARING) UNIVERSITY OF MYSORE

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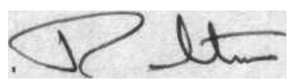

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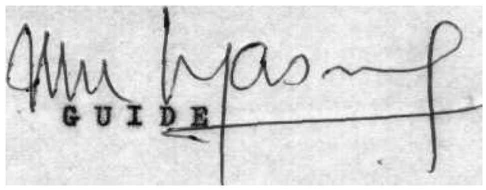

D E C L A R A T I O N

This dissertation is the result of my own study undertaken under the guidance of Mr. M. N. Vyasamurthy, Lecturer in Audiology. All India Institute of Speech and Hearing, Mysore and has not been submitted earlier at any University for any other diploma or degree.

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C O N T E N T S

CHAPTER I

INTRUDCION

"Auditory screening is an attempt to identify persons who have significant hearing defects from & population made up predominantly of people with normal or adequate hearing". (Hedgecock, Miller and Rose,1973). The purpose of the screaning procedures, which generally are an integral part of hearing conservation programs, is to identify these individuals as quickly and as economically as possible (Anderson, 1972). Downs et. al.,(l965) believe that the primary goal of school hearing programs is the detection of active or past ear disease whether accompanied by hearing loss or not. Early identification of hearing loss results, ideally in early diagnosis, treatment, early rehabilitation and education of persons with communication disorders (Downs and Sterrit,1967: Anderson, 1972). In India, many individuals are brought to a speech and hearing center only after it becomes toe late to be able to provide any significant help to these individuals.

There are two aspects of screening - estimating and case finding. "Identification audiometry refers specifically to the case finding aspects of a hearing conservation program" (Melnick et. al.,1964).

There are two stages in an ideal hearing screening program. The first stage eliminates all these persons who have normal hearing and finds those who may have hearing problems. The second stage eliminates those who did not follow instructions in the first stage or those who are poor responders for some other reason - (Anderson,1972;

Measurement of air conduction hearing sensitivity is usually limited number of subjects can be tested at a time. The number of subjects tested at a time is limited by the number of connections available at the audiometer and the number of sets of earphones available.

Although no adequate surveys have ever been done in India (Y.P. Kapur-1965) it is very roughly estimated that acre than 3% of the general population in India suffers from hearing difficulties. Figures from the Ministry of Education, Government of India, indicate that there are 2,23,000 deaf children in the nation (1964), but these figures are also not conclusive as they are not based on any reliable survey (Kapur,1965).

The aim of an ideal hearing screening program should be to locate all the persons with impaired hearing. In order to achieve this, screening programs should be carried out at a number of places and they should be conducted in such a way that they cover the entire population.

Accomplishing this task with the resources available in India is difficult, at least at the present moment, because of the following reasons:

- the non-availability of the required number of trained personnel in India.
- the amount of expenditure involved in undertaking such a program.
- The amount of equipment needed for conducting the survey.
- the amount of time required.
- the reluctance on the part of general public to come to a speech and hearing center to get a check-up of this nature.

the basis for hearing Screening procedures. Hearing screening tests are administered in either individual or group settings, the stimuli used in these tests range from pure tones and speech to noise produced by various noise makers and squeezers and environmental sounds (Anderson,1972; Downs and Doster, 1959; Darley, 1961; Solomon and Fletcher, 1958; Meyersen, 1956 in Anderson, 1972; Bennett,1951- in Anderson,1972; Watson and Tolan - in Andersoa,1972; Nikam and Shyamala, 1971 etc.).

ln 1939 at the World's Fair in New York and San Francisco, the Bell Telephone Company carried out group pure tone testing. (Steinberg et.al. 1940). The Purposes for administering these tests were to determine the incidence of hearing disorders and to determine the effects of age, sex, place of residence, and economic Status on hearing.

Anson (1943) mentions the use of a Similar recorded pure tone group test in a hearing survey conducted in Wisconsin.

A group pure tone test was developed for uae at the U.S. Navy Submarine Base, New London, Connecticut (Donald.1945).

National Physical Laboratory, New Delhi has been planning for a nation - wide survey for hearing problems in India.

There ia one common factor in all these surveys i.e., the presence of the tester and the testee/testees in the testing situation. This means either the tester has to go to the testees or the testees have to come to the tester for taking the test. Also important to note is the fact that even with the group screening tests of hearing, only a

- inaccessability - the people living in the places far away from any speech and hearing center are not accessable; some are not aware of the need for such a screening others do mot have the awareness of where to go.

- It is uneconomical whether all the testees come to the speech and hearing centres or they are approached by the testers.
- In India, where medical facilities have not been available to all the persons it is difficult to provide a service of this nature with the conventional methods of testing.

In such a case, a method is warranted which bypasses all or most of the above mentioned hurdies in carrying out a program of this nature.

PURPOSE OF THE PRESENT STUDY

The purpose of the present study was to develop a hearing screening test, a single administration of which, would screen a large number of people even without the need for their coming to a speech and hearting center. It was intended that the teat be of such a nature that it say be broadcast over the radio and all the persons listening to the radio say be screened out for any hearing impairments. This test would provide for an efficient tool for hearing screening which would not require any special equipment or testing environment and would test a large number of people in one administration of it. It would even be possible to test difficult-to-reach individuals by means of this test. Moreover, no trained personnel would be required for the administration of the screening test.

BRIEF PLAN OF THE STUDY

A pilot study was done in which the test was administered to a group of persons Simultaneously in a free-field condition. The subjects were seated at an equal distance from the speaker of a domestic radio, which was connected to the output of an audiometer and uaed as a free-field speaker. The stimuli used were pure tomes and spondee-words. Each tone was presented several times and for each subsequent presentatien the intensity level was reduced by 5 dB. Similarly, the intensity level was reduced by 5 dB for the presentation of each subsequent spondee-word. The subjects were instruoted to count and note down the number of times they heard each tone and to write down the spondee words they heard. Intra-group comparisons were made to detect a person with impaired hearing. The test, after Making some modifications in it, was broadcast from the Bangalore Station of All India Radio. One hundred and ninty five p e r s o n s responded to a single broadcast of the test. All the persons who responded to the test by sending in their responses, were informed that an individual test of hearing would be given to them at a speech and hearing center. An individual sweep-frequency Screening test was given to the individuals who responded to the request, to cheek the false negative and false poaitive scores.

LIMITS OF THE STUDY

(l) For want of time and money:

- the teSt waS limited to the establishment of the procedure only.
- it was limited to the city population only.
- the test was limited only to the available subjects.
- the test was limited to a trial in English language only, though in order to get a better response the test should

be done in the regional language.

- the test was limited only to the educated population.
- the test was limited to only one broadcast from the AIR.
- the test was limited to the use of pure-tones only as stimuli.

(2) In a free-field type of hearing screening test it may be difficult to catoh a peraon with impaired hearing when one ear is perfectly normal. So the test was limited to screening individuals with bilateral hearing losses only.

IMPLICATION OF THE STUDY

This test will serve as a first stage filter - i.e., it would eliminate a large part of the population from the need for having an individual hearing test.

This test will be an entirely new Technique in the battery of screening tests of hearing with the following advantages:

- no trained personnel are required for the administration of the test. Pre-recorded tapes ean be broadcast from the Radio.
- mp special equipment is needed.
- no special testing environment is needed.
- a single administration of the test can screen out a large number of people, many times more than any other group screening test does.
- can reach people in far-off places too. It can reach all the people who have an access to a radio set .
- eliminates the need for testees going to the tester or vice versa.
- economizes in terms of time and money spent.
- repetition of the screening test can be made without much

expense. The same population can be covered several times reducing the false negatives and the false positives.

- Public education - the screening test broadcast on AIR would serve to awaken awareness and interest on the part of the general public in the prevention and treatment of hearing problems.

DEFINITIONS OF THE TERMS USED:

SCREEING:

"Screening is a mass survey technique which seeks to identify those persons whose hearing is outside normal limits and requires further evaluation" - (Aram Glorig, 1965).

AMPLITUDEMODULATION:

"In amplitude modulation the amplitude of the radio frequency wave is varied in accordance with the pressure of the sound wave being transmitted." (Terman, F.E., 1955).

DYNAMIC RANGE IN A RADIO BROADCAST:

The range between the most intense and the weakest sound capable of being transmitted in radio broadcasting system,

FALSE. NEGATIVE SCORE:

Number of individuals who passed the mass screening test but actually had some hearing loss.

FALSE POSITIVE SCORE:

Number of individuals who failed the screening test but actually had their hearing within normal limits.

CHAPTER II

REVIEW OF LITERATURE

A review into the developmental history of identification audiometry provides an insight into the need for the development of mass screening test. Various testa designed for testing the hearing of infants, children and adults have been developed. The screening tests have been given both in individual as well as in group settings. Modifications in the tests have been made to economize in time and expenditure, however, maintaining or without unduly affecting the efficiency of the tests, a great deal.

FETAL AUDIOMETRY

Peiper (1924.) was the first one to report fetal reactivity to acoustic stimulation. Then on, various attempts have been made to evaluate hearing in fetuses. The techniqae has been of placing a vibrator on the mothers abdominal wall, to deliver auditory stimuli. The responses recorded are the fetal movements, change in the fetal heart-beat and change in the electrical activity of the fetal brain. Although, many researchers have been actively engaged in the research of fetal responses to acoustic stimulation (Bernard et at., 1947; Murphy et al., 1962; Johanson et. al., 1964; Wedenberg,1965; Dwornicka et al., 1964; Smyth et al., 1967), the results are still inconclusive.

Some of the ebjections which may be raised against the fetal audiometric techniques are: the fetus may respond to the tactual stimulation received from the abdominal wall of the mother, due to the replacement of the receiver on it; the reaction of the mother to the sound stimulus may stimulate the fetus; and some investigators hold that myelinization of the auditory nerve does not take place until after birth, which is an important condition for hearing. If this be so, the responses obtained do not represent hearing in the fetuses.

TESTING THE.NEONATES
(from birth to two months.)

Tests used with neonates and infants have essentially been given in individual settings. Whereas from the age of six years onwards, a single screening technique ean generally be made use of, in the case of neonates, infants and children, screening techniques are varied and they require the careful akill of the examiner. The stimuli used are varied. The presentation of the stimuli is done in a controlled fashion and the responses are evaluated carefully (Bergman, 1967).

The main aim for the early detection of hearing loss has been, to provide an oppertanity for early habilitation, at an age at which maximum benefit can be obtained (Downs and Sterritt, 1967).

However, Goodhill (1967) and Kimball (1967) like to take a conservative approach to mass screening programs for neonates and infants. Goodhill argues, the false positives of the test poae problems even for the experianced otologists and andiologists, and also that, corrective middle ear surgery should not be undertaken in neonates. Kimhall suggested that, responses to sound stimuli, in infancy, are mediated at lower brain-stem level, so hearing, in its whole term, is not screened in these screening procedures.

The tests used to evaluate hearing in neonates are not designed to measure the degree of hearing impairment, therefore, these testa are called the screening testa, is contrast to the threshold tests of hearing (Shepherd, 1971).

During the first two months of life, the responses elicited are of all-or-none type. Moreover, fairly intense sounds are required to elicit responses (Spitz, 1963). In normal hearing infants, an average of 77 dB and a range of from 55 to 115 dB S.P.L. of auditory stimuli have been able to evoke behavioral reflex responses (Shepherd, 1971). The responses elicited include the Mere reflex, assumption of listening attitude to sound, cessation of activity, and diminished activity in the presence of bell sounds (Prisina, 1963).

In normal hearing babies, without any impairment of the central nervous system, moderately loud sounds result in Moro reflex, characterized by the cessation of the ongoing activity, pronation of hands and blinking of the eyelids (Darley, 1961). Moro reflex can be used effectively in testing neonates.

A common test of hearing used with the neonates and very young infants is crumpling a sheet of onion-skin paper. The audiologist looks for a change in the child's ongoing, pre-stimulus activity. A change in activity may be considered an auditory response, if it meets the previously set-forth criteria of a response (Shepherd, 1971).

Hardy et al. (1959) suggested the use of short peak of noise made by a clacker at about 55 to 60 dB for testing the hearing of neonates. The response elicited to this type of stimulation is a Moro reflex.

Froeschels and Beebe (l940) used whistle as a stimulus to test infants 10 days or less in age. Wedenberg (1956) used a bell as a stimulus for testing l50 newborns ranging in age from one to seven days. The intensity of the stimulus which peaked at 750 Hz was 125 dB S.P.L. Later, Wedenberg, made use of a pure tone audiometer for presenting pure tone stimuli, of frequencies 500 Hz to 4000 Hz at various intensity levels. He, thus, attempted to quantify the hearing sensitivity in the neonates. Froding (1960) used gong as a stimulus to test 2000 newborn children.

Auro-palpebral response was the response elicited in all these studies.

Aldrich (1928) made use of a conditioning procedure far testing hearing in the neonates. Bell sound and the scratching of foot of the baby were the conditioned and unconditioned stimuli respectively.

Eisenberg et al. (l964) used calibrated noise makers for testing the hearing of neonates. The testing situation involved three trained examiners. One of the examiners presented the stimuli. All the three examiners recorded the activity of the baby before and after preseta-tios of the stimuli.

Downs and Sterritt (1967) described two instruments which can be used to screen hearing in the newborns and the infants. The first one is the Vicon Apriton or A-Z signal generator, which produces two types of stimuli: one is a filtered narrow band of white hoise peaking at 3000 Hz and second is the white noise stimulus covering frequencies from 100 Hz to 10,000 Hz. Both these stimuli can be presented at 70 dB, 80 dB, 90 dB, or 100 dB S.P.L. measured at four inches from the source. The second instrument described, is called the Rudmose Warblet 300. It produces a 3000 Hz tone that is warbled with a frequency modulation duration of $\pm$ l50 Hz at a 30 to 40 to Hz rate. This can be presented at a level of 80 dB, 90 dB or 100 dB S.P.L. measured at a distance of ten inches from the source. When the infant is asleep, the Warblet tends to elicit slightly higher intensities of response. The criteria used by Downs and Sterritt was that the infant must respond to 3000 Hz signal in order to pass the test.

Shepherd (1971) makes a mention of another approach to the testing of hearing in neonates. In this approach, the response of the baby in question is compared simultaneously to that of the other babies suspected of having normal hearing, after stimulus is presented.

Nikam and Shyamala (1971) reported on a study conducted to screen infants. The stimuli used were squeaker noise and vocal sounds with frequency characteristics and intensity as 250 Hz to 500 Hz - 65 dB; and 500 Hz to 1000 Hz - 65 dB respectively, presented at a distance of 18 inches from the ear. The response to these stimuli was in the form of reflesive behavior. They suggested the use of acoustically treated environment for testing.

Use of a sound treated crih to screen infants was reported (Rathna 1972). The erih had two speakers on either side and an observation window. Pure tones of frequencies 500 Hz, 1000 Hz, and 3000 Hz at intensities ranging from 30 dB to 100 dB were used as stimuli. Each ear was tested separately and the agreement among the observers, for a response, was taken as criteria for pass and fail.

A modified procedure was suggested (Rathna, 1972) in which the observers plug their ears so that they do not hear the stimuli presented. A light is given to indicate the observation interval. The stimulus may or may not be presented along with the light. Presentation of tones is done in a planned random order.

In a further modification suggested (Rathna, 1973), the observers are required to wear earphones. Bilateral presantation of the same tone which is given to the crib is made to the observers ears. But the tone to the crib is presented only a few times. The tone to the observers ear prevents them from false anticipation of a response.

Glorig (1965) while reviewing the literature on hearing screening, suggested the requirements for an ideal neonate screening program. The suggestions included the use of a stimulus which differentiates between various frequency ranges that are important for identifying hearing losses; stimulus intensity of 90 - to 100 dB S.P.L. measured at a distance of 6-18 inches from the source; 1-2 m. sec. onset time of the stimulus; definition of responses in order to permit duplication of experiments.

Auditory stimuli which have been used effectively to screen neonates are: pure tones at 50 to 60 dB (Murphy, 1966); a clacker with a peak from 55 to 60 dB (Hardy et. al., 1959); pure tones and a cow's moo at 68 dB (Sasuki et. al., 1964) white noise at 93 dB and a 2,500 to 3,500 Hz band at 90 dB (Downs and Sterritt, 1964.); onion-skin paper, a drum, wooden sticks, and a whistle at 64 dB (Eisenberg et al. 1964): and a gong at 126 to 135 dB (Froding, 1960)

TESTING INFANTS
(From 2 months to 24 months)

Infants are more selective in stimuli to which they respond, and they require lower intensity level presentations; neonates require as higher intensity stimuli.

Ewing and Ewing (l944) found percussion sounds more meaningful than voice for children within the first three months; in the next three months of life, voice seemed to be a better stimulus. The response elicited during these periods were of reflexive nature. Then on, there was a progression from reflexive to learned responses such as sound localization. Speech stimuli were found to be successful with children within second and third year of life.

Miller, et. al. (l963) found that stimuli familiar to the environment of the infant were the meat effective stimuli.

Shepherd (1971) dees not agree with Miller et al. (l963) and holds that the stimuli need net be familiar to the infants environment if employed by the audiologist is a proper manner. He gives the example of pure tones which, if property employed, can be used effectively.

Waldon (1963) believes that pure tone stimuli are not appropriate to be used with infants and he suggests the use of baby cry. The method suggested, he calls, audioreflexmetry, in which iavoluntary responses to sound stimulus are observed. Murphy (1966) disagrees width Waldon and says that pure tones can be used effectively, provided they are made meaningful to the infant - they emanate from a visible and meaningful source like a lighted doll.

Gesell and Armatruda (1948) determined that the infant at eight weeks attempts to listen the sounds; at 16 weeks, responds to a bell with varying facial expressions; from 23-28 weeks, local lizes the sounds.

Findings of Chun. et al., (1960) are similar to that of Gesell and Armatruda (l948). They go further in stating that, at 36 weeks the child attempt to imitate sounds; at 40 weeks, he begins to associate sounds with things, people or action; at one year, comprehends simple phrases and; at 18 months carries out instructions given orally.

Euring and Euring (1958) observed that children at 3-6 months begin to respond to mother's voice. From 6-9 months, familiar household sounds are most useful for deriving reaponses at low intensity levels; from 9-15 months, they locate quiet sounds such as their names, voioceless consonants and and certain noise makers; 16-30 month - old child carries out simple commonds spoken quietly.

Eurings (1958) Concentrate their efforts on screening infants beyond the age of seven months. For infants between seven and nine months they employ two high pitched and two low-pitched sounds. To pass the test, the child must localize all the sounds on both sides. With infants from 10-15 months Eurings depend primarily on speech sounds to attract the baby's attention.

Hardy et al. (1959) refined Euring Test (1958) for identification purposes. The stimuli used were a clacker, a doorbell, a tonette, a xylophone, a squeaker, low, middle and high frequency rattles, voiceless consonants, spoon stirring in a cup, and crumpling tissue paper. All the noise makers generated sound that averaged 40 dB S.P.L. except squeaker which produced 50 dB and bell and clacker generated 60 dB.

In contrast to the Eurings (1958) procedure, the stimuli were quantified in the procedure adopted by Hardy, et al. (1959).

Myklebust (1954) presented data, concerning a sound instrument test battery. The sub-tests included a test similar to that used by Euring and Euring (1954.), a sound-toy localization test, and an imitation of verbalization test.

Di Carlo and Bradley (1961) used a sound-field localization test. The stimuli used were white noise ,recorded pure tones of frequencies 250 Hz through 6000 Hz and voice materials presented through four pairs of loudspeakers inside a test chamber.

Suzuki and Ggiba (1961) designed a procedure which they called conditioned Orientation Reflex Audiometry. If property conditioned, the infant localizes the tone. Conditioning was achieved with 44 percent of children below one year of Age; 85 percent of the one-year-old; and 87 percent of the two-year-old, Children three-year and older lost interest in the test and did not respond.

According to the recomendations of the National Conference on Newborn Hearing Screening held in San Francisco in 1971, early identification can be divided into: (1) A High Risk Register,, and (2) Behaviral Auditory Screening Techniques. A Higt Risk Register should be implemented, and, later, if perfected a behavioral screening system could be employed.

The National Joint Committee on Infant Hearing Screening recommended that all babies be claasified in terms of High Risk Register. Downs (1972) calls the register the "A.B.C.D's is the Newborn Nursery".

A. Affected family congenital sensori-neural hearing loss in first cousin or closer.
B. Bilirubin level 20 mg./ml serum.
C. Coagenital Rubella (regardless of the trimester)
D. Defects of ear, nose or throat (any first arch syndrome)
E. Small at birth (1500 grams).

All babies listed on that register should be tested in an audiological center within one month, and followed up for atleast one year.

Meacher (1974) mentions about two procedures which are under consideration for use in screening infants for hearing loss, The first one is Arousal, which is any generalized body movement involving more than one limb and accompanied by eye movement of any form. The second procedure makes use of a device called Crib-O-Gram in which a child's movement in a crib is detected and indicated by a print out on a strip chart recorder. In the procedure suggsted, the movement of the baby should be positively correlated with the onset of an auditory stimulus.

Altman et al.(1973) cell their crib unit as Accelerometer Recording System. Two Testers, one for operating the eqaipment and the other for watching the baby, tested 175 neonates. The stimuli used was 3150 Hz tone at 90 dB S.P.L. of 500 M.Sec. duration presented at least three times with an interstimulus interval of atleast five seconds.

Simmons and Russ (1973) report a similar test unit with good success.

More work is needed before these techniques may be implemented in mass screening programs.

As pointed out by National Conference on Identification Audioimetry (Darley, 1961):

> "Screening of both neonates and infants is desirable and practical. Observation of responses of neonates is much less refined; when a neonate does not respond according to expectations, he ia smiply tabbed for farther observation of development. When infant, seven months or older, does not respond appropriately, he is referred immediately for refined clinical assessment".

The diverse studies on neonates and infant screening indicate the differences of opinion. Some find it beneficial to screen neonates and infants whereas others consider it a waste of time. Considering the amount of time spent on screening, and judging the outcome of the identification program, that we are never sure if a child has a hearing loss, or even, that the test negatives can be given a clear chit from having any hearing impairments, it is felt that atleast for the present moment, we may rely upon building a good High Risk Register and follow-up the babies who fall under this Register. Later, if the testing conditions become refined enough to give a better picture of hearing sensitivity, we may incorporate the tests in identification audiometry.

TESTING YOUNG CHILDREN
(between two and five years of age)

Young children, after the age of two years, no longer give involuntary responses of the neonates and illdefined lateralization responses of infants. Their responses tend to be more adult-like. As the child grows older, he attains control over his responses to the various auditory stimuli. Simple instructions can be followed and carried out. Conditioning can be made use of in testing. Most useful techniques make use of play situations and hence are called play audiometric techniques.

The trend in testing young children is not only screening but also threshold datermining. Most of the tests designed to evaluate the hearing in young children are threshold tests (Bloomer, 1942; Dix and Hallpike 1947; Utley, 1949; Curry and Kurtzrock, 1951; Myklebust, 1954 O'neill and Oyer, 1966; Lesak, 1970; and Shepherd, 1971).

Because the procedures designed to measure the threshold sen-activity of the subjects fall beyond the scope of the present review, only a mention of these tests will be made in this section.

Most of the procedures of play audiometry are based on the operant conditioning principles, for example, Peep-show audiometry and its modifications, (Dix and Hallpike, 1947; Guilford and Hang, ; Denmark, 1950; Green, 1958; Knox, 1960; O'Neill and Oyer, 1961. Other techniques make use of associations of pure tones with specific pictures and involve a task of pointing towards the picture (Bloomer, 1942; Myklebust, 1954; Downs and Doster, 1959); Geyer and Yankauer, 1961; Willeford, 1961).

Geyer and yankauer (1961) and Downs and Doster (1959) used their tests to screen preschool. children. In the Geyer and Yankauer study, each child was instructed to drop a cube in a box when he heard the pure tone corresponding to the picture shown by the examiner. Downs and Doster used 250 te 750 Hz, 1000 - 2000 Hz, and 3000 - 5000 Hz bandwidths of familiar sounds with associated pictures. The testing was sueceasfully carried out ty non-prafessional workers.

Some audiologists prefer to use techniques in which the child is required to perform simple tasks, like placing a peg ia the peg-board, placing & ring on a dowel (Bender, 1964), dropping a bead through a hole in a box (Brown and Knepflar, 1962), and throwing at block into a box as hard as the child wishes (Shepherd, 197l).

Usually earphones are made use of in these approaches but some of the techniques do involve free-field testing.

Speech audiometric techniques - finding of speeeh reeeption threshold and speech discrimination ability, have also been used with children in this age group (Keaster, 1947; Bangs and Bangs, 1952; Sortini and Flake, 1953; Pronovost and Dumbleton, 1953; Siegenthaler, et al., 1954; Meyerson, 1956; Gayer and Yankauer, 1957; Myatt and Laudes, 1963; Shepherd, 1971).

ELECTRO-PHYSIOLOGIC TESTS

In these tests, a change in the eleotrophysiologic activity of the body, as a function of auditory stimulation is measured. These procedures also are mainly employed employed in threshold measurements. The response elicited is called objective as it is not under the voluntary control of the subject. The techniques are most useful with difficult-to-test cases as cases suspected of having functional. hearing loss. Attempts have been made to use these procedures to screen newborns and infants. The results have not been very conclusive.

Santag and Wallace in 1934 and Santag and Richards in 1938 racorded fetal movements and acceleration of the pulse after applying a tone of 120 Hz. Bernard and Santag (1947) delivered auditory stimuli from an audiometer to the child's head and noted acceleration of the heart action.

Johansson, et al. (l964) also noted acceleration of the heartbeat in fetuses on acoustic stimulation, using phonocardiograph.

In testing the fetuses, the problem has been to rule out their responses to the tactual stimulation, received in the form of vibrations from the mother's body as a result of the placement of the reeeiver.

Jesienska et al. (1967) examined 35 newborns and registered aurocardial reflex. They hold that this method requires experienced personnel and auitable apparatus.

Cody and Klaus (1968) pointed to the use of cortical audiometry in testing the hearing of infants, children, mentally retarded persons, patients with central nervous system disorders and the patients with functional hearing loss.

Lowell (1971) described the use of evoked response audiometry with infants.

Bradford and Rousey (l972) suggested the use of respiration audiometry, to obtain measures of hearing sensitivity in difficult-to test" patients.

Mc Spaden and Weber (1973) suggested the use of averaged electroocular reaponse to acoustic stimuli for differential diagnosis in hearing impairments.

Other names frequently mentioned in electrophysiologic tests for auditory functioning are Electrodermal or Psycho-galvanic skin response audiometry and Electroencephalic audiometry (Goldstein & Derbyshire, 1967).

The electrophysiologic tests for screening purposes are not desirable because of the need for the specially trained personnel, use of complicated equipment and the time consuming nature of the tests, in addition to the fact that these techniques are still in & developing stage.

INDIVIDUAL SCREENING TESTS

There have been various approaches to the identification of hearing impaired individuals. These include, the subjective judgements made by the persons, in immediate contact with the hearing impaired child - parents, family members and teachers, or the use of special hearing screening tests.

Geyer and Yankauer (1956) quote Curry (1950) in emphasizing that the identification of children with hearing loss should be done by audiological techniques and not by the teacher referrals. Kodman (1967) compared the identification of children with hearing loss made ^ papsata aad teachers, with that of the results of pure tone audiometry, and concluded that, parents and teachers are inefficient in recognizing hearing loss. The general trend is that the claas-room teacher may supplement the hearing screening but she cannot substitute for an Audiometrick evaluation (Darley, 1961).

Most of the audiometric procedures used in sereening the hearing make use of pure tones usually delivered through the headsets. Each ear is tested separately. The frequencies used in screening vary from, all the frequencies tested in a threshold test of hearing, to a single frequency screening.

National conference on identification audiometry Darley (l96l) recommended that the testing should be done in sound treated rooms. The frequencies used in such a screening test are 500, 1000, 2000, 4000 and 6000 Hz. The intensity level at which these frequencies are presented is 10 dB (ASA 1951) for 500, 1000, 2000 and 6000 Hz tones and 20 dB for 4000 Hz tone. Criteria for fail is no response at any of these frequencies at the levels they are presented. Using these criteria 860 children were tested successfully for hearing problems. These procedures, however, did not identify active or past ear pathology (Melnick et. al., 1964).

Newhart (1938) discussed the individual pure tone sweep frequency test. in this test the frequencies are swept from low to high frequencies at a predetermined intensity level. The procedure la much less time consuming than the conventional method. Peterson (l944) also reported on the technique of sweep-frequency testing. Van Dishoeck (1956) described the objectives of sweep frequency audiometry. He reported on a specially built built Peekel continuous audiometer which can be used in sweep frequency testing. Newhard (1943) states that individual sweep check method is more accurate than the group screening methods.

Hirsh (1957) suggested that the pure tone should be presented at a level of 15 dB (ISO 1964), and that the pulsed tone is a more suitable stimulus than the continuous tone stimulus. Both automatic as well as manual techniques can be employed. Darley (l961) also saggests 15 dB screening level to be used in quiet rooms. Anderson (l965) and Lloyd suggest a 20 dB (ISO 1964) level for a11 the test frequencies.

Discussing the follow-up program, Newby (1964) suggests that the highest priority should be given to those children failing to meet the criteria for hearing in normal limits at 500, 1000, and 2000 Hz. The second highest priority should be given to those who fail at any one of these frequencies and the least priority is to be given to these failing at 4000 Hz or 6000 Hz.

Population of a hospital for mentally ill was screened using sweep check method at 20dB HL (ASA 195l) for 250 - 8000 Hz range (Mc Coy and Plotkin, 1967).

Ballantyne (1970) reports the use of a sweep frequency teat described by Eurings in which the frequencies were swept from 500 to 4000 Hz in one octave or half octave steps at 15 or 20 dB level.

Fay et al. (1970) tested 461 extremely disadvantaged, inner city children, at 500, 1000, 2000 and 3000 Hz at 15 dB level. Istra and Barbacoia (1970) made use of four automatic - Bekesy type audiometers to screen four subjects at a time. The total testing tiaa taken was 10 minutes per test. The test was given at 500, 1000, 2000, 4000 and 6000 Hz. The results were given by computerized read-out sheets.

Hildyard et al. (1963) suggest the use of tuning fork tests to increase the validity of current techniques. Jordan and Eagles (1961) stated that the audiometric test does not identify all children with physical abnormalities of the ear who may need medical treatment. The presence of air-bone gap demonstrates the abnormality which may have to be inferred from tuning fork testa or from examination of the ear. Crowley and Kaufman (l966) suggested the use of Rinne tuning fork test for identification purposes.

Limited frequency testing procedures have been adopted by various workers mainly to speed up the screening programs. In these teats a selected number of frequencies are included which give an overall. idea about the hearing sensitivity of the subject.

Lawrence and Rubin (1959) suggested that a limited fraquency test using 500 and 4000 Hz tones would best meet reasonable criteria for agreement with the standard sweep check test.

Lawrence and Rubin (1958) found 4000 and 1000 Hz frequencies adequate for locating hearing losses with medical significance.

The two frequency test ia simpler, faster to administer, less fatiguing to the tester and is the one which requires leas preparations and cheaper instruments (Siegenthaler, B.M, 1961; Norton and Lux 1960) Norton & Lux (1960) used double frequency screening with 1046 subjects. They found it to be less reliable than 5 frequency screening procedures.

Glorig and House (1957) House and Glorig, 1957-I, 1957-II) proposed 4000 Hz single frequency screening.

Davis et al (1958) state that hearing is rarely poor far speech frequencies than it is for 4000 Hz. Ventry and Newby (1959) tested 1517 first, second and third grade children and found single frequency screening at 4 Hz is useful. Sataloff and Meduke (1959) pointed out that 4000 Hz test would have missed only five out of one hundred children with hypertrophied adenoids. Merklein and Fox (1957) found that single frequency screening at 4000 Hz correctly classified 97.3% of the 220 industrial workers. Hanky and Gaddie (l962) conclude in favour of single frequency screening by saying that as long as major hearing losses are not ignored, time is one of the major criteria to be applied. It took under 30 secs per pupil on the average for screening with single frequency technique..

lightfoot, et al. (1959); Miller and Bella (1959); Siegenthaler and Sommers (1959); and Stevens and Davidson (1959) reject the single frequency screening technique.

Stevens and Davidson (1959) conclude that a hearing screening method using 4000 Hz single frequency or this combined with any one, two or even three of ether speech frequencies is not effective as the standard sweep-check method.

Miller and Bella (1959) state that Oto-check, a one or two frequency instrument can be used in industrial situations to find out which workers are in danger of suffering handicapping losses of hearing from the effects of continued exposure to intense noise.

Frequencies 3000, 4000 and 6000 Hz are a sensitive indicator of the onset and progress of noise induced hearing loss (Glorig, A. 1967). These can be used in industrial settings for identification

Mc Murry and Rudmose (1957) proposed the use of an automatic technique for large scale testing of personnel.

Mobile hearing units have been made use of to control the testing environment in crowded places or where the ambient noise levels are high (Osborn, C.D. 1951; Chase, R. 1949; Cox, J.R. et. al.,1957) Smaltz J.M. 1949).

Computerized audiometry can be used in the evaluation of the hearing impairments (Weiss 1961; Wood, et al., 1971, 1972; Sparks, D.W, 1973). This would save the audiologists' time needed in the administration of the test. The test can be administered by any staff of the center and the audiologist may use all his time only for the interpretation of the audiograms, This approach is most useful for clinical use, in which threshold audiometry is, what is needed. In all the approaches dismussed pure tone have been used as stimuli. The tones were presented to each ear separately using earphones in all audiometric approaches to individual hearing screening. One subject is tested at a time and the testing is done by the trained professionals. Testing situation consists essentially of a tester and a testee. Normally testees are brought to the canters giving the test, but sometimes the testees are approached in their places by a mobile hearing unit. The trend has been to economize in time and expenditure by trying out sweep-frequency tests, limited frequency tests and double and single frequency tests.

GROUP SCREENING TESTS OF HEARING

Group screening tests came into existence mainly to economize in the time and money spent on identification programs.

One of the earliest group tests used on a large scale was Fading Numbers Test. The test consisted of presentation of paired one-digit numbers decreasing in intensity in 3-dB steps from 33 to 0 dB, The subjects were required to write down the numbers heard, in the score shaets. (Alpiner Jerome G. 1971; Anderson 1972). A modification of the test which uses fading words with the R.S.Maico Aadiometric test employs pictures rather than number. One word at a time is presented and the subjects mark on the scoring sheet the picture which represents the word they hear (O'Neill amd Oyer, 1966).

Any child who eeuld hear at 9 dB level or lower was considered to have passed the test (Newhart and Reger, 1956). Newby (1958) indicated that children with losses as high as 30 to 50 dB at 1000 & 2OOO hz have been able to pass the Fading Numbers Test at 9 dB level. Also a child who passed the Fading Numbers Test may not be able to function adequately in converasational situations because digits are not representative of running speech.

Many children with high frequency losaes of hearing sensitivity above 1000 Hz were able to identify the digits correctly as the baais of the acoustic information contained in the vowels and therefore their hearing losses were not identified in this procedure.

Johnston (1948) developed the Massachusetts Hearing Test, a group pure tone test. With this method, as with Fading Number Test, forty children can be screened simultaneously. Three frequencies are uti -lized in the Massachusetts test; 500, 4000 and 8000 Hz. These are presented at hearing levels of 20, 25 and. 30 dB respectively. The tester calls Out A series of numbers ranging from 1-6. The children are informed that after each number is called they may hear A faint tone or they may act. If the tone is heard, the 'yes', opposite the Number, is circled; if no tone is heard, they circle 'no'. Following a pre-arranged plan, the audiometrist will occasionally not present a tone after giving the signal for observation. If the number of 'no' responses at any frequency differs by more than two from the way in which the test was presented, the subject fails the test.

Because of the difficulty in matching the phones at 8000 Hz, later instructions for the Massachusetts test have specified that the highest frequency tested should be 6000 Hz.

In a comparison of the Massachusetts and the Fading Numbers Tests, as measured against the standard of an individual sweep test, (Johnson 1952, 1954) discovered that the massachusetts was far more superior to the Fading Numbers Test in revealing cases of hearing impairment.

In Pulse Tone Group Test also as many as 40 children can be tested, simultaneously. The frequencies tested are 500, 1000, 2000, 4000 and 6000 Hz. (Reger and Newby 1947). The pure tones are presented, in descending order at levels of 50, 40, 30, 25, 20 and 15 dB above the normal threshold. A loss of 20 dB at any of the test frequencies in either ear is considered to be a failure of the test. The response given by the subjects is the number of times they hear the tone each time they get a signal to listen for the tones. Individual testing is indicated for those who fail the teat so that appropriate referral, if necessary, may be made for the children.

Watson and Tolan (1949) played disc recordings of individual monosyllables which could be represented by pictures which the child identified. The presentation level of each subsequent word was reduced by 3 dB. It overcame the problem of a written response and the failure to identify children with high frequency hearing losses. Consonant identification was necessary in order to rocognize words in their lists.

Bennett (1951) presented a closed response set of four phonetically similar words for each trial. He found a strong positive relationship between this procedure and pure tone screening in identifying six-year-old children with hearing losses.

In 1939 at the World's Fair in New York and San Franeiaco, the Bell Telephone Company carried out tests with musical tones and speech (Steinberg, J.C. et al., 1940).

In 1952 Johnston described a pure tone test that could be administered to 10 children at a time and did not demand a written response. When a sound was presented to the child, he was to raise his hand. Sometimes, some of the ten children, heard the sounds in their earphones while the children sitting next to them did not. The children were asked not to pay any attention to the responses of their neighbours. the greatest single advantage of this test is that it can be administered by nurses, teachers or other available personnel who need only a brief orientation before administering it.

Anderson (1952) constructed a group pure tone test of hearing using 500, 1000, 2000 and 4000 Hz tones. The tones were given at a level of 15 dB. The subjects were required to count the number of times they heard these tones in eaeh ear. Anderson found that the pulse, tone test was a good screening device. He also determined that bursts of white noise could be utilized as test stimuli.

Webster in 1952 reported that development of a warble tone group screening test. The test was presented through loudspeakers in A reverberant room. The tones were presented with decreasing intensity from 40 dB above normal threshold. The greatest barrier to obtaining satisfactory results in such a test is the unpredictable ambient noise levels.

In 1953 Glorig described an instrument he designed to test 50 persons simultaneously for screening with pure tone frequencies ranging from 500 to 8000 Hz. The instrument was started by pressing a button and then continued through the entire cycle automatically. The stimuli were delivered in different number in left and right ears. The subjects had to listen and count the tones they heard and then record the number on the answer sheets.

Nielsen (1952) administered a pure-tone group test to 2,500 school children. Frequencies used were 256 and 4096 Hz at intensity levels 45, 35, 25, 15, 5 and 0 dB above normal threshold. The children were instructed to make a dot when they heard a short tone and dash when they heard a long tone.

Hoesema and Huizing (1956) described a multiple audiometer for group testing and its use in school audiometry.

Cox et al. (1957) pointed to the utilization of a mobile lab. for group hearing screening tests. Solomon and Fleteher (1958) used group audiometry in conducting a survey of hearing losaes among armour personnel. They tested 18 persons at a time. Stimuli used were warble tones of frequencies 500, 1000, 2000, 4000 and 7000 Hz.

Hegdecook, et al., (1973) used automatic screening audiometric technique testing four persons at a time. Bekesy audiometers were used to screen groups of people.

Griffing et. al., (1967) developed a procedure called Verbal Auditory screening for children. At a time two children are tested. The first word is presented at a leval of 51 dB and each subsequent word is attenuated by 4 dB to the lowest 15 dB level where the last three words are presented. An observer records the responses of each child as he points to the pictures. A lions roar and a birds whistle have been added to the signals to be identified in the pictures. Group procedures of screening offered more by way of economizing in time, expenditure and the staff needed for conducting the testing program. The tests, most often were given in sound treated rooms, making use of the multiple headset audiometers, except in one study where the test was given using loudspeakers in a reverberant room. The maximum number of subjects tested at a time has been limited to 50 subjects only even by the use of these methods. In addition, there are problems of having large sound treated rooms, costly equipment, difficulties in calibration and ensuring against cheating in group testing.

GROUP HEARING TEST PROCEDURES VS. INDIVIDUAL PROCEDURES

Some audiologists prefer to use the individual sweep frequency cheek rather than the group-test. The National Conference on Identification Audiometry specified that for school-age children the frequencies tested should be 500, 1000, 2000, 4000 and 6000 Hz. (Darley, 1961).

O'Neill and Oyer (l966) feel that if two frequencies at 15 dB (ASA 1951) are failed in either one or both ears the person being tested should be rechecked.

The biggest advantage in giving a group test of hearing is that many persons can be tested in a relatively short period of time. A group test can be administered by an audiometrist who has a minimum of training (Newby, 1964). The National Conference of Identification Audiometry stated that there aye two stages in identification audiometry The first stage involves, testing of a large number of children resulting in the ready identification of those, who have no hearing problems and the tentative identification of those who may have hearing problems. The second stage involves, a more detailed test by more highly trained personnel with store elaborate equipment (Darley, 1961). This leads to the final identificatien of those who should be referred for a complete diagaostic cheek up. In such a program a group screening test for the first stage and an individual test for the second stage of identification can be employed most beneficially.

The disadvantages of group hearing tests include: special, costly equipment, its maintenance and calibration, the necessity of insuing against cheating and higher false positive identification rate (Anderson 1972).

Sweep-checks of hearing properly administered in relatively quiet surronndings are found to be very accurate. But, it must be borne in mind that an acceptable group test will not result in failure of those whose hearing is normal. Nor will it pass those whose hearing is outside the normal range. One cannot, however, hope to achieve a hundred percent accuracy with group testing because there will be a few subjects who will not follow the test instructions. (O'Neill, and Oyer, 1966).

Procedures have been described to evaluate the efficiency of group-

Screening tests. (Reger and Newby, 1947); Newby, 1948, Dicarlo and Gardner, 1958).

individually and by group testing procedures. Uae of tetrachorio table is suggested upon which comparisons are made of percent of subjects showing significant or non-significant losses for both individual and group tests.

HEARING SCREEING IN INDIA

No reliable figure iS available about the number of hard of hearing individuals in India (Kapur 1965). According to the 1931 census report the no. of deaf persons in the country was approximately 200,000 (Lal Advani, 1966). According to the National Sample Survey of India the country has 124. deaf persons per 100,000 people. On this basis the country should have 600 - 700 thousand deaf persons. According to a very rough estimate the country may have a million to a Million and a half deaf persons (Lal Advani, 1966). According to a more recant communication from National Sample Survey Organization (l973), All India level estimate of deaf persons per thousand population is 0.70 in rural areas, 0.53 in urban areas and 0.67 in the areas in general.

Most of the attempts made to identify persons with hearing loss in India have made use of crude tests of hearing. The stimuli used were arbitrary and the intensity levels not specified. The studies were done in uncontrolled environment. This involved a lot of subjectivity in the criteria employed. A few examples of the studies conducted in India are: Misara et al. (l961) in a sample survey of 50,000 school children found that one in every 30 children required attention for hearing problem. Kapur (l965) tested school children from three schools in and around Vellore and concluded that prevalence of hearing loss in these children was between 16.3 and 18.6%. The test given was individual pure tone type. Any child who failed to respond at 23 dB for any of the frequencies from 500 through 6000 Hz was considered to have failed the test.

Jain (1967) tested 5000 children and Gupta (l966) tested 3504 children using tuning fork, conventional and whisper voice tests. The children with wax in the ears were also included in the study which reported 39.13% and 35.4% of the population as the test failures respectively.

Other studies are reported where fall details regarding the test procedure and the criteria used are not specified. Abrol et al. (l97l) reported the use of group and individual screening procedures in testing 210 subjects from a rural area. The results indicated that 94 persons had a loss af 30 dB or More in one or both the ears. 28 subjects in the study had wax in the ear. It appears from the report, that a threshold test of hearing might have been given to all the subjects of the study. The classification of all the individuals in the study has been done in terms of their hearing sensitivity.

Bhatia B.P.R. (l966) examined 1390 school children and found 31.61% had slight deafness and 2.9% had moderate deafness. It was also found that one in every 30 school childred required special attention.

Kameswaran.S (l967) has reported on the results of three studies. First study was done on 1,886 school children. 460 children failed the testing leading to 3.5% of children with hearing difficulties. The second study was done in an exhibition where 221 subjects were tested, 38 failed lead to 11.7% of the individuals with hearing loss. The third study was done in a village where 194 persons were tested, 69 of them failed leading to 23.7 % as the prevalence of hearing loss. Testing methods, the environment and the criteria have not been mentioned in the report.

Another study is reported by Shah at el. (1971). School children in Bombay were given individual tests in a comparatively quieter area of the school. The frequencies tested were; 4,000, 2,000 and 500 (in the order of presentation) at 15 and 25 dB levels. Any child who failed to respond at 15 dB for 2000 and 4000 Hz and at 25 dB for 500 Hz tone was considered to have failed the test. The total number of the subjects screened were 7.100 in the age range of 5-9 years.

Viswanath, et al., (1971) used individual pure tone screening test to screen 410 school going children in a rural area. The testing was done in a quiet area of the school. The frequencies tested. were 1000, 2000 and 4000 Hz at 20 dB and 500 Hz at 30 dB HL (ISO, 1964): (in the order of presentation). The test was considered positive if the child failed to respond at two or more frequencies in one ear or at the same frequency in both theears. However, if the subject failed only for 2000 or 4000 Hz in one ear only then the test was extended to frequencies 6000 and 8000 Hz at 20 d8. 18.9 percent of the subjects failed the test.

Nikam (1970) reported on a school screening programs being conducted at the All India Institute of speeeh & Hearing. Children were bought to the center and ware tested in a more controlled environment. The frequencies tested were 500, 1000, 2000 and 4000 Hz at levels 30 dB, 20 dB, 20 dB, 20 dB and 20 dB respeetively. The levels were decided upon after a validating threshold study on 50 children with normal Ear, Nose, Throat and hearing findings. In all 2048 children were given the test. Out of these 247 children failed the screening test but out of these only 82 were found to have hearing less. The false-positive score, as seen, is quite high in this study.

Of all the studies reported only a few have reported the use of standard procedures and defined the criteria for fail or pass in the test. (Shah Vijay et al., 1971; Nikam Shailaja, 1970; Vishwanath N., et al., 1971).

National Physical Laboratory, New Delhi has been planning to conduct a National Survey of hearing problems in the country. (Pancholy, M. 1967). This will be the first survey of its kind in the country. Well defined procedures will be used to test the subjects, using calibrated, sophisticated equipment, in appropriate acoustical environment. Pancholy (1967) discussed the aims and objectives of the proposed survey and outlined the operations involved. The whole work will be divided into (a) basic physical measurements (b) measurements of free-field thresholds (e) standardization of equipment (d) measurementof audiometric thresholds and (e) statistical analysis of the results (Pancholy, M 1967).

The Hearing and Speech Center, Vellore presented a draft outline of the methodology and the protocols to be used in the National Survey. Six regional centers are to participate in this survey. The objectives of the proposed survey are: to determine the normal threshold of hearing in Indian population, to find out the prevalence and type of hearing loss, and to determine the major causes of hearing loss (Kapur, Y.P. 1970). Very limited studies have been reported about hearing screening in India. This mainly, has been due to the lack of facilities available in the country. A very limited number of trained personnel are available in India. Moreover, most often, funds available do not permit any expenses made towards work of this nature. There is a lack of audiometers in the country. The number of hearing centers functioning in the country is very small and it is almost impossible to screen all the persons in India with the existing methods and the available re-sources.

MASS COMMUNICATION

According to the Reference Annual of Ministry of Information & Broadcasting, Government of India (1973), "the term mass communication stands for extensive dissemination of information, ideas, and entertain ment by the use of media which science and technology have made available to modern man".

The Mass media include the radio, the television, the film, the newspapers, the books, the magazines and the pamhlets (Emery Edwin et. al(1965) Chatterjee, R.K., 1973).

Mass communication is highly effective in creating attitudes on newly arisen or newly evoked issues. The point of view first expressed prevails over later persuasive communications to the country (Klapper, joseph T., 1960). As Joseph Goebbels stated, "whoever says the first word to the world is always right" (Doob, Leonard, W., 1950).

The mass media has a positive role in a complex society of today. Great significance of man has been the growth of mass media by the app-lication of which millions of people have oome to know new ideas, phi-losophies, approaches and attitudes to life. Mass media can provide the motivation for social change, create the climate for development & influence attitudes and traditional practices.

Broadcasting constitutes a most powerful medium of mass communica-tion. It is of special importance as a medium of information, education and entertainment in accessible readily. The electronics media such as radio, television and films affect the minds of the people so intimately that through them people almost sense & feeling of actual participation in national affairs. (Chatterjiee, R.K. 1973).

The radio and television are of special value as they can reach millions of people in India overcoming the barriers of illiteracy. Because of the introduction of these media, urbanization is no longer an essential condition for wider mass communication. Radio & television being capable of providing an immediate step constitute some sort of a compelling medium for the generation of reactions and responses.

The number of radio licenses by the end of 1972 was 1,28,94,535. The All India Radio, medium wave service covers about 78 percent of the population, Under the Fourth Five Year Plan within a few years, this is expected to go upto 86 percent. To enable All India Radio to reach rural areas, listening is arranged by means of community listening sets, installed for public use in a large number of villages, as also over a network of rural listening clubs.

The number of transmitters in use, (as on 1st December 1972) was 138, made up of 106 medium wave and 32 short wave transmitters.

All india Radio's programme in the home service are broadcast in 20 principal languages, 22 dialects and as many as 91 tribal languages.

Telivision in India was started on an experimental basis on 15th September, 1959 in Delhi. The television service broadcast from Delhi centre is available to viewers within a range of 60 kilometers around Delhi. There are about 37,600 television sets in Delhi. There is a regular program for Sohools on selected subjects supplementing the regular school classes. More than two lakh students in 11 schools benefit from these programs. Another television station has been started recently in Bombay.

Bombay TV started functioning on 2nd October 1972. A relay transmitter at Poona was commissioned on 2nd October, 1973. TV center started experimental telecast.on 26th January 1973. Amritsar TV Center was commissioned on 29th September, 1973. In the Fourth Five Year Plan TV stations will be established at Calcutta, Madras, Jullundur and Lucknow and relay centeres at Bhatinda, Kanpur, Ksauli and Mussorie.

The number of TV licences by the end of year 1972 was 84,144. The Committee on Broadcasting & Information has strongly recommended for the expansion of television in India. Television is of great help in mass education and in information and education of people on National programs and development efforts.

Radio & Television can be used effectively in the field of education, agriculture and industrial production, health, hygiene and family planning, adult literacy, vocational and technical trainiag.

The use of satellites in broadcasting and television will make intercontinental and trans-world hook-ups possible.

All the studies conducted on screening hearing have been in either individual or group settings. Studies involving individual screening tests, are no doubt, more accurate ones than the ones utilizing group tests. But the time and money, equipment and the trained personnel required for individual screening testing is much more than it is ia group screening tests. Moreover, screening tests are always a compromise between efficiency and economy. Even with the group testing procedures ef hearing screening, it would have taken many years time, to screen all the individuals in India, even if, for one moment, the problems of equipment, finance and trained personnel are igaored.

The present study, by making use of mass media, attempts to circumvent the main problems which are faced with, is conducting the hearing screening of the individuals in india. The broadcast test can, at one time, be administered to a very large number of people. The number of subjects is limited only by the number ef listeners to the radio programmes. there is no special equipment needed for the administration of the test. The tape prepared at one station can be broadcast from any numbers of stations. A very limited number of trained personnel are required for the analysis and follow up of the cases. The speed of the test seems to be the biggest advantage. in addition to other important advantages like economy in cost, equipment and trained personnel.

3HSSSSSS

CHAPTER III

M E T H O D O L O G Y

Maas hearing screening through radio broadcasting appears to be a new venture in hearing screening attempts. As no literature is available regarding the present study, the final procedure for conducting this study was arrived at, by conducting some expirements and a pilot study.

TEST CONSTRUCTION:

The problems which needed attention in constructing the test were:

1) Accounting for the volume control settings of the different radio receivers.
2) Determination of the intensity level of the stimuli presented over the radio.
3) Accounting for the environmental noise, and the distortion in the signal both due to the transmission and the reception process.
4) Accounting for the frequency characteristics and the quality of reception of the radio signals in different receiver sets.
5) Fixing-up of one reference against which the responses of the subjects may be evaluated.

As the usual domestic radio sets are not provided with any sound intensity indicating meter, some indirect way of arriving at a suitable reference intensity level was indicated. Also, it may be appreciated, that, a control could not have been gained over variables, like environmental noises and the differences in the characteristics of signals received and reproduced by different radio receivers.

The test had to be one which was suitable for Administration in a free-field condition because of the obvious reasons that no domestic radio is normally provided with headphones which has provision to switch on the signal to either ear.

These problems indicated that each tasting situation would be different from every other in terms of the nature and the strength of the stimuli received. This called for an individual evaluation of each testing condition and made it impossible to have one fixed reference for normal hearing, against which the responses of the subjects may be compared.

To eliminate the above mentioned problems, to the extent it was possible to do, it was decided that the test be given to a group of persons simultaneously, who should sit in front of the speaker of a domestic radio receiver in the form of a semi-circle. The distance from each one ef them to the speaker of the radio should be same. This situation permitted intra-group comparisons of the test performances and anyone who heard less than the best hearing person in his group was considered to have failed the test. So it eliminated the problem of determining the intensity levels at the receiving end and also overcame the problems ef environmental factors and receiver characteristics, these being the common factors for one particular group of subjects.

The stimuli used were pure tones of frequencies 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz.

PILOT STUDY

The conditions, thus arrived at, were made use of in conducting a pilot study. Tomake the comparisons within the group more meaningful, one more step was included in the test.

Fifteen presentations of 1000 Hz tone were made. One of the subjects (arbitrarily specified as the one sitting on the extream left) was instructed to adjust the volume control of the radio in such a manner that he was just able to hear the tone. *

The test consisted of presentation of tones from frequency 250 Hz to 8000 Hz. The initial presentation of each tone was made at a level of 20 dB above the presentation level of 1000 Hz reference tone. For each subsequent presentation the intensity level was reduced by 5 dB till it became 25 dB less than that of the 1000 Hz reference tone. Spondee words were also used as stimuli for the pilot study and the presentation of these spondee words was done in a manner similar to that of pure tones.

The subjects were instructed to count and write down on a sheet of paper, the number of times they heard each tone. The spondee words also were to be witten down immediately after the presentation of each word. The subjects were cautioned not to adjust the volume of the radio receiver under any circumstances once the test had started.

Figure 1 and photos A and B shows the testing situation, as it was, during the pilot study. The output of a tape recorder was given to an audiometer, the output of which was connected to a common domestic radio receiver. The subjects were seated in front of the radios, in the form of a semicircle. The tape recorder was used to give instructions to the subjects and to present the spondee words. The audiometer provided the pure tones of different frequencies at different intensity levels and also acted as an attenuator for the presentation of spondee-words. The domestic radio was used as a free-

A. PHOTOGRAPH SHOWING THE EQUIPMENT USED IN THE PILOT STUDY

5. PHOTOGRAPH SHOWING THE TESTING SESSION IN PROGRESS

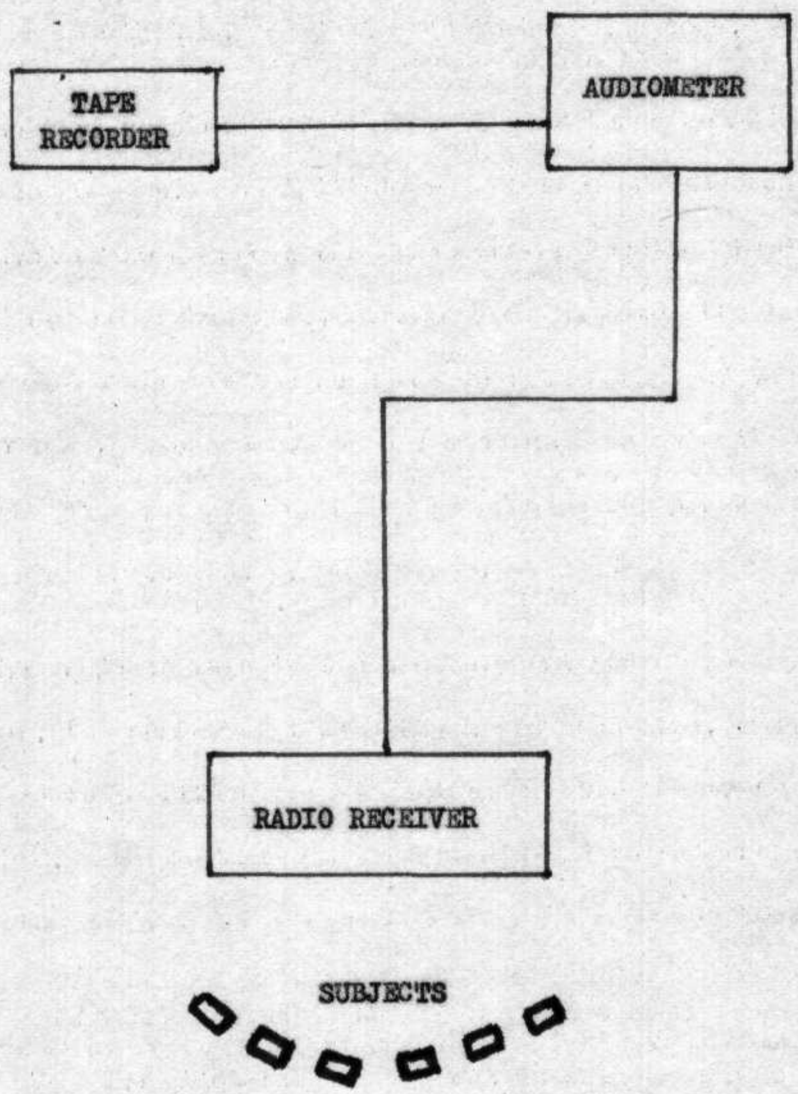


FIGURE 1

SHOWING:
BLOCK DIAGRAM OF THE TESTING SITUATION IN THE PILOT STUDY

field speaker. This situation simulated the situation of presenting the test ever radio more closely than it would have been if a free-field speaker was used instead of a radio receiver.

Intra-group.comparison of the responses was made to decide about the test negatives and the test positives. The subjects who heard say of the tones, more than two times less, than the member of times heard by the best hearing subject, for that tone, in that particular group, were considered to have failed the test.

The results of the pilot study were encouraging in terms of identification of persons with impaired hearing. But it was observed that even seas of the sophisticated subjects found it difficult to follow the instructions of the test for making the initial adjustment of the volume control of the radio. It was, therefore, decided to eliminate that part of the test. The Modified procedure consisted of presentation of different frequency tones in a decreasing order of intensity where the last presentation of each tone was made at a level 50 dB lower than that of the initial presentation.

The modification of the test in this way did not affect its utility and it was still possible to identify a person with a loss of hearing where given this test.

Altogether, three hundred and forty eight subjects were tested in the pilot study. These included some general college going students, students of Speech Pathology & Audiology, and some confirmed patient with hearing loss. The test, in the pilot study, identified one hundred and six patients with hearing less, correctly. Three patients with unilateral hearing loss could not be identified. Sixteen patients could not follow the instructions to the test and hence they did not take part in the test.

TRIAL BROADCAST

All India Radio, Banglore was approached for making a broadcast of the test. It was desired to have a trial broadcast of the different frequency tones before the test was finally broadcast in a program for listeners.

In India, the radio transmission is amplitude modulated. The dynamic range in a radio broadcast is 40 dB. Even though the signal-to-noise ratio is better than 60 dB (with respect to full output), modulated signals below one percent are not readily audible. However, very close to the transmitter, within about one mile area, even one-half percent modulated signals may be heard. So the dynamic range can be taken to be about 45 dB. The transmitted signal has a distortian of 1.1 percent at 1OO percent Modulation over the range of 30 Hz to 10 KHz. There is a volume compressor or limiter in the transmitter to compress the high intensity sounds. It comes into operation at 83 percent modulation. Fidelity of reproduction is very good in broadcasting. Under ideal conditions 45 dB or even SO dB variation in intensity can be detected in a broadcast but it is not certain if it can be heard in a domestic receiver. In commercial receivers automatic gain control (A.G.C) acts on local signals (radio frequency above 10 microvolts per metre). This will however not affect the fidelity of the Modulated signal (Venkata Raman, 1973). A characteristic curve of the action of automatic gain control is shown in figure 2.

A trial broadcast was made in which pure tones were given and the modulation was varied to different percentages. It was observed that the frequancies above 4000 Hz, viz., 6000 Hz and 8000 Hz could not be heard ever a radio clearly. There was a lot of distortion at these frequecies and the signal-to-noice ratio:: was very low. This

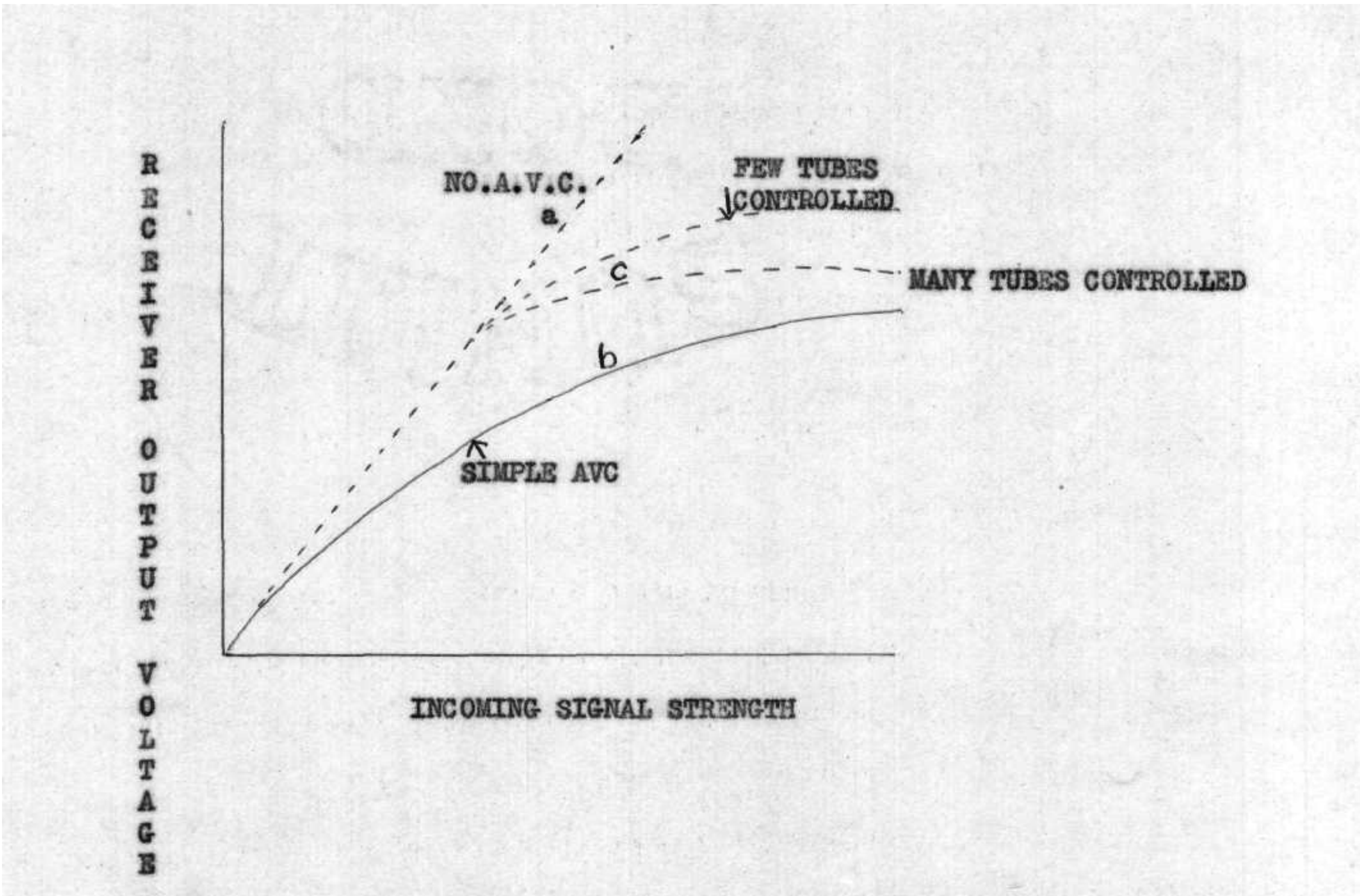


FIGURE 2

Characteristics of Different automatic-volume-control arrangements (Adapted from Electronic & Radio Engineering by F.E. Terman, 1955).

This was found to be due to limitations in the common domestic receivers. It was then decided to drop out frequencies 6000 Hz and 8000 Hz along with 250 Hz which could have been unduly affected by low frequency environmental noises.

RECORDING OF THE TEST

The test was pre-recorded on A magnetic tape. The recoding was done by the expireanced staff of the All India Radio, Banglore.

The tape recording heads of the tape recorders at All India Radio (Ampe) normally operate on audio-inputs of - 5V.U.(1 M.W. across 600 Ohns). They can take a 12 dB increase (resultant distortion will be 2.5 percent). By adjusting the input to give distortion-free output at peak reeording level, it may be possible to achieve a range of 50 dB of the input by suitable attenuators. The signal-to-noise ratio of the record/replay ohain however is only 50 dB, which must be considered (Venkata Raman, 1973).

The teat reeording consisted of:

1. an introduction about the importance of hearing and hearing impairments.
2. instructions to the tastees regarding the test.
3. the test proper.
4. instructions about sending the response sheets*

The complete broadcast script is given in the Appendix.

PROCEDURE

Figure 3 shows the block diagram of the total set up, as used in this study.

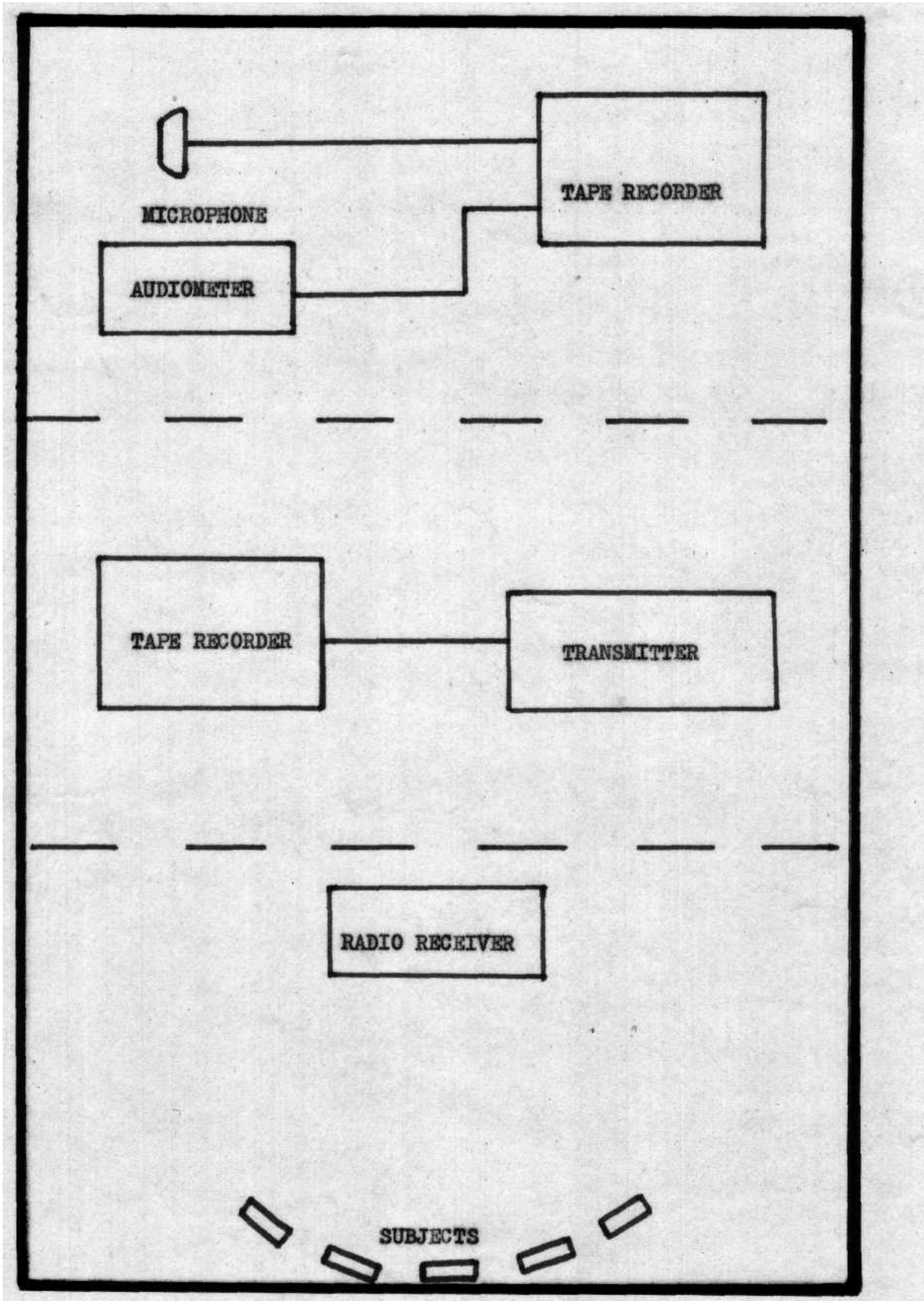

MICROPHONE
TAPE RECORDER
AUDIOMETER
TAPE RECORDER
TRANSMITTER
RADIO RECEIVER
SUBJECTS

FIGURE 3

After giving an introduction to the test, the listeners were given instructions About the nature of the test, and the necessary requirements for participating in the test, i.e,, a minimum of two persons should take the test At & time, from each radio receiver; and all the persons taking the test should have a sheet of paper and a pen ready with them before the actual test begins. They were also instructed to keep their distance from the radio sets, same and con-stand till the test was over. And that they should let the volume control of the radio in the position in which it was when they heard these instructions. A two-minutes time was given to the subjects to carry out the instructions.

The test proper consisted of presentation of tones of, in the order of presentation, 1000 Hz, 2000 Hz, 4000 Hz, and 500 Hz. The first presentation of the tone was made at the Maximum broadcasting level. The subsequent presentations of the tone were made at lower and lower levels till the last presentation was 45 dB below the ini-tial presentation of the tone. The intensity of the tone was radu-ced in decibel steps of the signal and the modulation percentage was kept undisturbed. The person at the transmitter was given spe-cial instructions to, not to boost up the weak stimuli.

The presentation of the first tone - 1000 Hz tone was repeated so that if some people failed to follow the instructions in the first attempt, they might try again. Other three tones were presented in the similar fashion. All through the test, it was insisted that the lis-teners do not change their position or alter the volume of the radios

It was desired that the last presntation of all the tones should be too weak to be heard over domestic radio sets.

6, 9, 9, and 9 (six, nine, nine and nine) presentations of 1000 Hz, 2000 Hz, 4000 Hz and 500 Hz tone were made respectively. The subjects were instructed to count and write down the number of times they heard each tone.

0nly pure tones were used as stimuli in the final test and spondee-words were not used.

The transmission of the test was done under the supervision of the Engineers of All India Radio, Bangalere.

SUBJECTS

Announcement regarding the test was made in newspapers and also in the preview of the programs ever the radio.

To make certain that a good number of people respond to the test some individual letters giving information about the test were sent to some of the co-operative families (so designated by listener Research Programs data). Personally known families were informed about the broadcast of the test. Some persons who were known to have some hearing impairments were also informed regarding the test.

All these people constituted the subjects for the study.

COLLECTION OF RESPONSES

The subjects were instructed to send the responses of the whole group collectively to the All India Institute of Speach and Hearing, Mysore-6, by post or by hand.

DETERMINATION OF OUTPUT LEVELS OF STIMULI OVER RADIO

It was attempted to determine the radio output levels for different tones at bangalore as well as at Mysore. A sound-pressure level meter with an Ootave band, filter was used fornoting down the levels of the tones heard over the radio. Since the microphone of the sound pressure level meter was kept in front of the speaker of the radio in a free field condition, the difficulty in recording the low intensity signal is apparent.

Table I shows the sound pressure level valves for different frequencies recorded in Bangalore.

Sound Pressure Level of Speech = 74 dB during instructions.

Sound Pressure level of Pure tones in the test:

FREQUENCIES		500 Hz	1000 HZ	2000 Hz	4000 Hz
Sound Pressure Levels (in dBs)	MAXIMUM	80	70	75	65
	MINIMUM	50	40	40	30
	RANGE	30	30	35	35

TABLE I

Showing SPL's of Speech during instructions to the testees and that of the pure tones used in the test (Measured using B.& K. SPL meter with Octave Bank Filter).

Criteria for fail: If a person heard any tone less than any other person in the group by two or more number of times.

If a person heard two or more tones less than any other person in the group by one time.

All the subjects who responded to the test by sending in their score sheets were informed that an individual hearing test would be given to them to check the results of the test which was broadcast over the radio. Those who responded to the follow-up were given an individual sweep-frequency screening test. The individual screening test was given at frequencies 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz and 6000 Hz at a level of 28 dB H.L.(I.S.O., 1964) in acoustically treated rooms.

Agreement and disagreement frequencies for the two tests, chi-zquare valves, critical radio valves and the significance levels were computed with the data obtained.

CHAPTER IV

ANALYSIS, DISCUSSION & RESULTS

ANALYSIS:

One hundred and ninety five responses were received to the broadcast from AIR Bangalore. These included 113 responses from Mysore, 72 responses from Banalore, and 10 responses from places other than Mysore and Bangalore.

The responses obtained were put into two categories:

(i) Those obtained from groups of persons, who took the test at the same time as was indicated in the test broadcast; and

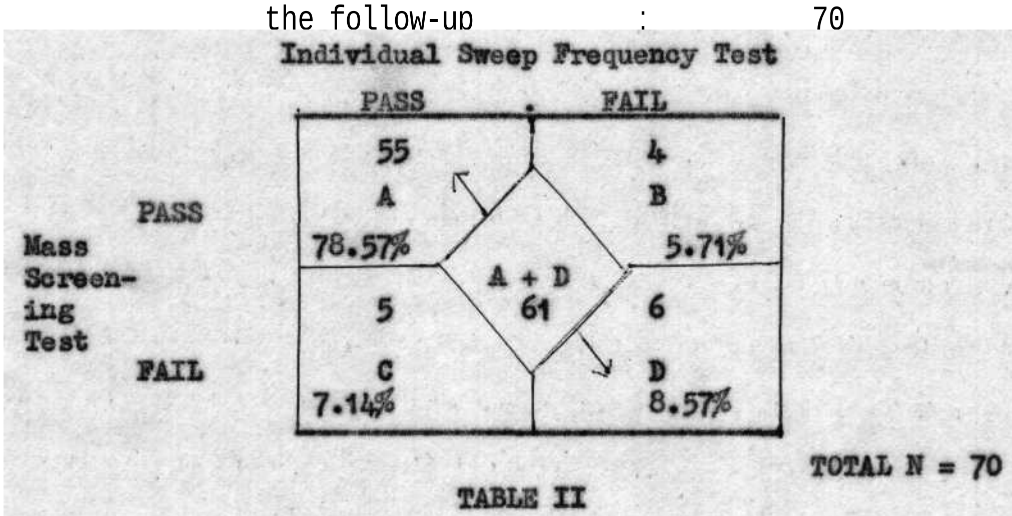
(ii) those who responded individually to the test, either because when the test was broadcast, no other persons were available who could take the test along with them or that they failed to understand the instructions to the test completely.

For the analysis of responses of the subjects who fell in the first category, intra-group comparisons were made. The reaponses of each subject in a group were compared to the best responses in that group for the various frequencies. If, at any frequency, any subject responded two or more number of times less than the beat response for that frequency in that group, he was considered to have failed ihe test. Also, if any subject responded one time less than the best responses of the group for two or more number of frequencies, he was considered to have failed the test.

The individual responses to the teat were analyzed by considering the person having failed the test if, the response at any one or more number of frequencies was leas than the actual number of presentations by more than twotimes.

This analysis led to 168 subjests passing the test and 27 subjects, as the test failures. To validate the obtained results, all the subjects of the study were infromed they were required to report personally for a further check-up. Seventy, out of a total of one hundred and ninety-five subjects, reported for the follow-up. They were given individual, pure-tone, sweep-frequency type screening test as used by Bishoeck (1956), Gardner et al. (1953) etc. Frequencies were swept frow 500 Hz, to 6000 Hz at a level of 20 dB HL (I.S.O. 1964,). The individual screening test was done ia an acoustioally-treated room both at Bangalore and at Mysore. The subjects who failed to give a response at any frequency in either ear were considered to have failed the individual screening test.

No. of subjects who responded to
the mass screening test : 195
No. of subjects passed : 168
No. of subjects failed : 27
No. of subjects who responded to
the follow-up : 70



Slowing the Comparison of Mass Screening Test
with the Individual Sweep Frequency Test

The results of the Maas Screening Test and the Individual Screening Test were compared for these 70 subjects. The data obtainad is put in the form of a tetrachoric table in table 2. The table shows that 59 subjects passed and 11 subjects failed the mass screening test.

60 subjects passed the individual screening test and 10 subjects failed it. Out of 60 subjects who passed the individual screening test, 53 subjects passed the mass screaning test sad 5 subjects failed it. These five subjects constituted the false positives in - the study. Out of 10 subjects who failed the individual screening test 6 subjects failed tha mass screening test also and the remaining four subjects constitited the false negative score.

Cells A and D in the table two show agreement between the mass screeing test and the individual screening test. and the Calls B and C show the disagreement between the two tests. The total agreement figure (A + D) is 61 and the disagreement in terms of false negative and false positive scores is 4 and 5 respectively.

While giving the criteria for the evaluation of the efficiency of group screening tests of hearing, Newby (1948) says that a minimum number of fifty subjects must be tasted individually. And if there is 75-80% agreement between the two tests (A + B) and the cell B contains less than 5% of the total ears the group test may be considered reasonably efficient.

In the data presented in table 2, A + D valve is 87.14 parcent and the value in the call B is 5,71 percent. The total agreement value obtained is fairly satisfactory when evaluated against the criteria proposed by Newby (1948) but the false negative score is slightly higher than the criteria valve suggested.

Di. Carlo and Gardner (1953) utilised the following criteria for evaluating the efficiency of a group screening tests of hearing. Percentages in cells A + D should be more than 85 percent and in cells B and C it should be less than 3 and 10 percent respectively. Beeker (1951) also felt that a 15 to 20 percent limit for errors seems to be a realistic limit.

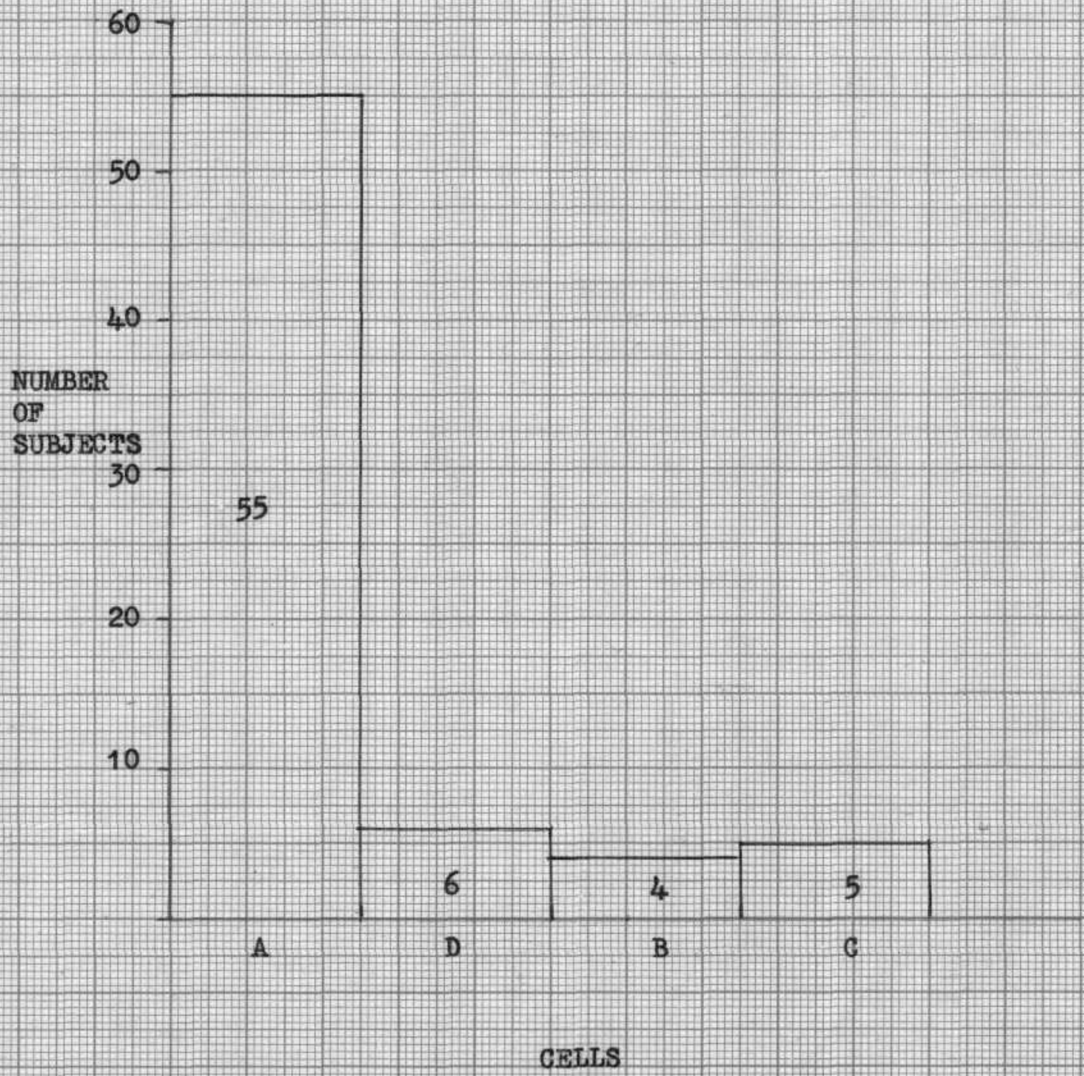
The data of table 2 is represented graphically in Graph 1. On the 'X' axis are the four cells, A, D, B and C and on the 'Y' axis are plotted the frequencies (No. of individuals) falling under each cell.

Graph 2 shows a cosparison between the agreement valves of the two tests and the false negative and false positive scores at different frequencies.

Further analysis of the data is done in the way similar to the one used by Di. Carlo and Gardner (1953).

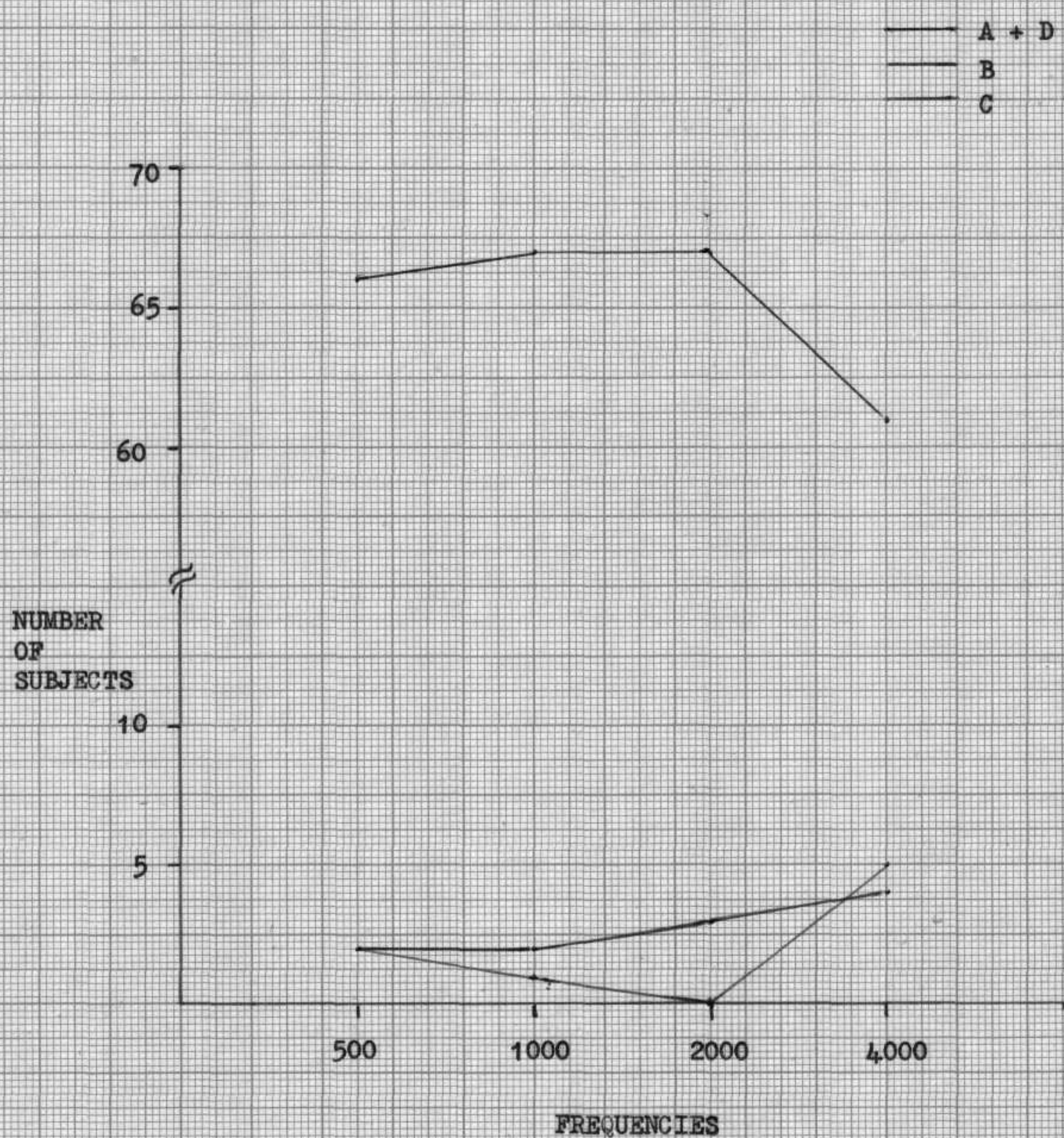
Table 3 shows the distribution of 15 subjects, who failed in either or both of the mass screening test and the individual screening test, into various cells.

Tables 4 and five show the agreements, and disagreements between the two tests at the various frequencies tested. The valves obtained satisfy the criteria suggested very well at all the frequencies except at 4000 Hz.



GRAPH - I

SHOWING THE DISTRIBUTION OF SUBJECTS IN THE FOUR CELLS



GRAPH 2

SHOWING THE COMPARISON BETWEEN THE AGREEMENT VALUES OF TWO TESTS AND THE FALSE NEGATIVE AND FALSE POSITIVE SCORES AT DIFFERENT FREQUENCIES

Sl.No.	Subject	500 Hz	1000 Hz	2000 Hz	4800 Hz	Total
1	1	A	A	A	C	C
2	8	A	A	A	C	C
3	11	A	A	A	C	C
4	15	A	A	A	C	C
5	22	A	A	A	D	D
6	23	A	A	A	B	B
7	40	C	C	D	D	D
8	41	C	A	D	D	D
9	42	A	A	A	C	C
10	43	B	B	B	D	D
11	51	A	B	B	B	B
12	64	A	A	A	B	B
13	67	B	A	B	B	B
14	69	D	D	D	D	D
15	70	D	D	D	D	D
	A	9	10	8	-	-
	B	2	2	3	4	4
	C	2	1	-	5	5
	D	2	2	4	6	6

TABLE III

Showing the Distribution of Individuals who failed the Mass Screening Test into various cells.

FREQUENCY	CELLS			
	A	B	C	D
N 500 Hz %	64	2	2	2
N 1000 Hz %	65	2	1	2
N 2000 Hz %	63	3	-	4
N 4000 Hz %	55	4	5	6

TABLE IV

SHOWING THE DISTRIBUTION OF INDIVIDUALS INTO VARIOUS CELLS

FREQUENCY	CELL		
	A + D	B	C
500 Hz	66	2	2
1000 Hz	67	2	1
2000 Hz	67	3	-
4000 Hz	61	4	5

TABLE V

Showing the Agreement between the mass Screening Test & Individual. Sweep Fre-Quency Test & False negitve and False Positive score.

FREQUENCY	CELL	OBSERVED FREQUENCY	THEORETICAL FREQUENCY	CHI-SQUARE	DEGREE OF FREEDOM.	P VALUE
500 Hz	AD	66	59	5.40	2	Between 0.10 and 0.05
	B	2	4			
	C	2	7			
1000 Hz	AD	67	59	8.22	2	between 0.02 & 0.01
	B	2	4			
	C	1	7			
2000 Hz	AD	67	59	9.33	2	more tha[n] 0.01
	B	3	4			
	C	0	7			
4000 Hz	AD	61	59	0.64	2	between 0.80 and 0.70
	B	4	4			
	C	5	7			
TOTAL	AD	61	59	0.64	2	between 0.80 & 0.70
	B	4	4			
	C	5	7			

Table VI

Showing the Chi-Square Analysis of the Data

FREQUENCY	CELL	OBSERVED PERCENTAGE	THEORETICAL PERCENTAGE	CRITICAL RATIO	P Value
500 Hz	AD	94.2%	85%	2.09	More than 0.05
1000 Hz	AD	95.71%	85%	2.56	More than .02
2000 Hz	AD	95.71%	85%	2.56	More than .02
4000 Hz	AD	87.14%	85%	0.47	Less than .10
TOTAL	AD	87.14%	85%	0.47	Less than .10

TABLE VII

Showing Critical Ratio Analysis of the Agreement between the Mass Screening Test and the Individual Sweep-Frequency Test.

the mass screening tests seems to be very effective at the frequencies tAgwxwunMt 500 Hz, 1000 Hz, and 2000 Hz. At these frequencies agreement between the mass screening test and the individual screening test ia very high and the false negative and the false positive scores are very low.

For finding out whether the results obtained are statistically significant or not, chi-squre and critical ratio analysis were done to arrive at the level at whieh theresults are significant (p value)

Table 6 showsthe chi-square analysis of the data. Theoretical frequencies were computed on the basis of the criteria aa used by Di Carlo and Gardner (1953). Chi-square values and P values were obtained for different frequencies and for the total test. The chi-square value for 500 Hz is found to be significant at 0.05 level. For the frequencies 1000 Hz and 2000 Hz, the chi-saquare values obtained are found to be significant at even higher level (O.Ol level) But the significance level is low for 4000 Hz and the total test.

Table 7 shows the observed and theoretical percentages of cells A + D. This refers to, the total agreement between mass screening test and the individual screening test, value. 'p'valve for the critical ratios obtained ia 0.05, 0.01, and 0.01 for frequencies 500 Hz, 1000 Hz, and 2000 Hz and less than 0.10 for 4000 Hz and the test on the whole.

DISCUSSION

The results of the mass screening teat and the individual SCreeniag when put in the from of a tetrachoric table shew an agreement with the criteria suggested by Becker (l95l) and Newby (l948).

When the statistical tests of significance are applied, it is observed that the values obtained for the frequencies 500 Hz, 1000 Hz are highly significant statistically. But this is not true in case of 4OOOHz.

The test which was broadcast over the radio was pre-reoorded on a magnetic tape. Due to some unknown reasons, the final tape recording which was used for the broadcast was distorted. this was realised only when the test was already on AIR. The speech sounded quite unclear when received over a radio receiver.

It was found in the trial broadcast of the pare tones, that the signal to noise ratio for the transmission-reeeption process of high frequencies, was very low. Frequencies above 4000 Hz when transmitted and heard over a radio sounded very unclear with lot of noise.

For a medium wave-broadcast, the areas receiving the broadcast are classified under primary and secondary zones. The reception of ground radio waves is better in the primary zone and it is affected in the secondary zone. Mysore seems to fall into the secondary zone for the broadcasts made from the All India Radio, Bangalore.

There are other factors which might have affected the raception of the Bangalore broadcast in Mysore. These include the fading of signals, because Mysore is near the skip-zone distance of the Bangalore broadcast and the increased numbers of transmitters operating at night time (Krishnamurthy, 1974).

It is important to note that the disagreement between the mass screening test and the individual screening test at 4000 Hz was more ia the responses received from Mysore than in the responses received from Bangalore. It may be hypothesized that if the broadcast in Mysore is bolstered up by a relaying station such descripeneies in responses would not arise. Inspite of the distortions present in the test during its broadcast, it ia likely that it was heard acceptably in Bangalore. But the reception was very adversely affected in Mysore. And, as the signal-to-noise ratio at high frequencies ia less, 4000 Hz tone might have been affected more than ether frequencies.

Another factor which might have affected the results at 4000 Hz in Mysore, may be a wrong response by one individual in the group, For example, if in a group of eight subjects, one subject reported te have heard the 4000 Hz tone nine times. Out of the remaining seven subjects, five subjects heard the tone eight times and two heard it seven times. According to the criteria used in the test, these two subjects who responded seven times responded two times less than nine, the best response in the group.

But it is probable that the subject who responded nine times responded wrongly, by guessing the last presentation of the tone. The fact Right have been that the tome was heard only seven or eight times in that situation. But because the tones of 1000 Hz were heard nine times, this subject expected to hear the 4000 Hz tone also nine times and gave a wrong response. This Night have led to an increase in the false positive score and hence would have affected the results at 4000 Hz.

It was then realized that it was a mistake to have presented 1000 Hz, 3000 Hz, and 4000 Hz tones, all for nine times each. The better thing would have been to present different tones unequal number of times,it would have prevented any guessing cn the part of the subjects while counting the number of times they heard each tone.

As pointed out earlier, the mass hearing screening test developed in such & way so as to screen out persons with impaired hearing when their one ear functioned perfectly normally. THis ia exactly what happened in the case of two subjects who had unilateral hearing losses at 4000 Hz. These two individuals passed the screening test, at all the frequencies but failed the individual screening test at 4000 Hz in one ear. They were labelled as false negatives. But, bacause this is an inherent limitation in the test to be unable to find out individuals with unilateral hearing less, these cases may be excluded from the analysis to evaluate the efficieney of the mass screening test. When these two cases are excluded from the analysis, the false negative score comes down to two from four. This makes the teat to be highly efficient even at 4000 Hz.

It is interesting to note, however, that mass screening test identified one subject with hearing loss when, in one ear, his hearing was perfectly within normal limits. It ia difficult to explain, how this could have happened in a free-field type of test situation like the one made uae of in this study.

When the test was broadcast, it was desired and indicated to the broadcasting authorities that the last presentation of each tone should be so weak that it might not be detected by the common domestic receivers. But, in the actual observation, it was found that even the weakest stimuli in the test were heard clearly, at least in Bangalore. This might have lead to missing the cases with mild hearing losses. Even though this is not the limitation of the test it might have contributed in the evaluation of the efficiency of the mass screeninig test. It is felt that a few more decrements could be profitably added to the test.

RESULTS:

Mass screening test satisfies the criteria for the effectiveness opf a group test of hearing as suggested by Newby (1948), and Di Carlo and Gardner(l953).

Chi-square and the cretical ratio analysis, of the data points to the high significance of the observed results of comparision of mass screening testing with individual screening test. this indicates that the mass screening test is a fairly valid technique for conducting hearing screening .

Mass screening test appears to be an efficient group screening test. In one administration of the test it screened one hundred and ninety five subjected which seems to be the largest number ever reported to have been screened in one administration of the test. It is evident that, there really is no limit to the number of subjects to such a test. It is easily envisaged that a greater number of response can be obtained if such tests are routinely administrated. It is also apparent that many more people would have listened but for some reason or the other did not respond.

The total time taken for the admimistration of the test, including the instruction to the subjects and a two-minute -gap given for fetching a pen and a sheet of paper, is twelve minutes.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

SUMMARY:

It was felt that no suitable hearing screening test was available, which could be made use of in screening the whole population of India, with the available personnel, equipment and the other resources at hand.

The individual screening tests were not feasible because of their time consuming nature, and the large number of trained personnel, and equipment needed for the test. Even with the group screening tests, the condition was only slightly better in terms of the time and the number of personnel required. Moreover, the group testing required special audiometers and large audiometric rooms.

Mass communication media have been used very effectively in various fields of life, in India as well as abroad. The purpose of this study was, to develop and try out it mass screening test, which could be broadcast or telecast, and thus, administered to all the people listening to the broadcast. The intension was that if such a test of hearing is broadcast ,in one administration of it, it would test a very large number of people. Such a test was developed by conducting some experiments and a pilot study. The test was finally broadcast from the All India Radio, Bangalore. One hundred and ninty five persons responded to the test by sending la their score sheets. For the validation part of the study, seventy of the 195 subjects wort gives individual screening tests. The results obtained for the two tests were ooapared for the same subjects. Statistical analysis of the data was done to find out the significance of the obtained results. It was found that the broadcast mass screening test is ft valid and efficient test.

Ihe mass screening test can be used to test an almost infinite number of groups of subjects at a time. It does not make use of any special equipment for administration. The test environment need not be controlled for the administration of this test, as it relies on intra-group comparison of the responses, for interpretation; where these variables are common for all toe subjects in one particular group. The test is administered in a sound-field condition. In brief, the method consists of presentation of tones of frequencies 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz. Each tone is presented several times and for each subsequent presentation, the intensity of the stimuli is reduced till the tone becomes too weak to be heard. The subjects sit in a group in front of the speaker of a radio receiver, in the form of a semicircle. Thus the distance of the speaker, from each subject is kept same for a particular group. The subjects are asked to count and write down the number of times they hear each tone.

There is no need for a trained personnel for the administration of the test. Only a few professionals may be required to analyse the responses of the whole population in India. Moreover, the test will serve as a very useful means for public education regarding the communication disorders.

RECOMMENDATIONS:

1. a few more decrements can be added to the test- tones as used in this study.

2. The number of presentations of each tone should be made different from that of the other tones. However, the last presentation

of all the test tones should be made equally intense.

3. The test may be adapted for regular hearing screening. A high official, from the social welfare Department, Government of India, has shown interest in the test. It may be decided to broadcast the test from the various stations of the All India Radio and Television, every week or at least, once a month, on a fixed day and time.

4. If the test is taken for routine administration, a considerably larger number of response* oan bo expected to each broadcast of it.

5. When that happens the test cant be standardised on larger population.

6. The test should be administered is different regional languages, is order to reach more number of people.

However, the broadcast mass screening test, so developed, is a valid screening test. The test can be usefully employed in conducting hearing screening in India. The program can be undertaken rightaway, without incurring any appreciable expenses.

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Appendix

SCRIPT OF THE MASS SCREENING TEST BROADCAST FROM THE ALL INDIA RADIO BANGALORE.

So casually we sit and listen to the radio. But how often we think about how we hear? Do we, at any time, realize what would happen of our sense of hearing gets impaired?. Or that, there are people who are deprived of this sort of entertainment ever radio. Or still, that many persons turn out to be speechless because they did not hear since birth, and this was not detected and something done about it, before it was too late to develop normal speech. Some hearing defects are of such a nature, as make the condition worse with the passage of time, unless the rehabilitative measures are undertaken, and these person can be helped sometimes, only when the necessary help is sought at an early stage. But sometimes, a person dees not realise that he has some difficulty in hearing at all. Again if he does realize that he is suffering from a defect in hearing, he might not seek medical help until he is no longer able to manage without it. Although, the best ccurse would be for everyone to go and get a hearing checkup at a speech and hearing center, the way one gets a routine medical check up, it appears almost impracticable considering the number of speech and hearing centers in India as also the time required for getting this check-up. Here, we have a short game by playing it, with your co-operation, we hope to help you ia identifying your hearing defects.

(Name of the Candidate) of the All India Institute of Speech and Hearing will now tell you about the test and what you are required to do.

Good Evening, Listeners.

Shortly, a hearing test will be given over the radio. This is a sort of game in which everybody can participate. So it does not matter whether you have any difficulty in hearing or you hear perfectly normally, We are sure that all of you will have fun par-tioipatiag in it, in addition to the advantage of knowing, if you have any hearing problem, of which you were not aware earlier.

This is a game, like most ether games, which you do not play alone. So, you must be accompanied by atleaat one more person. You will have to do a bit of writing work, and for this all of you should have a pen and a sheet of paper ready with you. All of you please hurry up, and fetch a pen and a sheet of paper. Of course, it is not essential that you must have an ink pen only with you. You may have a ball point pen, or dot pen, or even an ordinary lead pencil. Anything to write with, as long as it does not give you trouble in the middle of the test, would be alright. While using a lead pensil, make sure that it is sharpened well and you do not have to leave your place in the middle of the teat to sharpen it. There is absolutely nothing special about the paper too. It may be ruled, plain, foolscape, a page from a regular exercise notebook, or even a sheet from a letter pad. Please get both these things ready with you before the actual test begins. In the meantime I will play some music for you.

- (Music for two minutes) .

Hay I proceed further? How please adjust your positions in such a way that all of you sit at equal distance from your radio set. For doing this, just make sure that you ait in the form of a semioircle in front of your radio. Second, and & very important point to note is that: Pleaseleave the volume control of your radio, in the position where it is kept at this moment, while you are listening to this broadcast. And please, let the volume control remain in this position till the entire test is completed. Please note again that you do net change year positions or the volume control setting of year radio even if you find some difficulty in hearing, when once the test has begun.

So, shall we assume that you now have a pen and a sheat of paper with you and have seated yourselves in the manner suggested? We now start with the test proper.

You will hear four different kinds of sounds. Each sound will be presented several times. All of you, please count the number of times you hear each sound and write it down on the paper. Please be very attentive while counting because the sounds will gradually become weaker and weaker. Also please be careful not to count loudly. This will disturb other persons' attention and may provide them a clue. So please make sure that all of you count and note down inde-pendently.

Here is the first sound.

(Presentation of 1000 Hz tone)

Bid you all count the number of times you heard the first sound? Oh! you seem to have forgotten counting it. Shall we present it once again? But please be very careful this time and see to it that you don't forget to count the nua&er of times you hear and also remember that you don't meddle with the volume control of your radio. Please get set and count the number of times you hear the first sound.

(Presentation of 1000 Hz tone)

Please write down the number of time a you heard the first sound and be ready for counting the second, sound. Please count the number of times you hear the second sound.

(Presentation of 2000 Hz tone)

Please note down the number of times you heard the second sound, and here is the third sound, see how many times you hear it.

We hope that you are counting these sounds independently and are not copying down from your neighbour while writing down the number of times you hear these.

(presentation of 4000 Hz tone)

Finally, here is the fourth sound, please count the number of times you hear it.

(Presentation of 500 Hz tone)

Please make a note of the number of times you heard the fourth sound.

That finishes the test. Please write down your name, age and address on the sheets of paper on whieb you have written your responses. Put these sheets together in one cover and send them to:

She director
All India Institute Of Speech & Hearing
MYS0RE.6

I repeat:

The Direetor
All India Institute of Speech & Hearing
MYS0RE.6

Those suspected of having any hearing problems shall be informed by post.

Thank you, Good night.

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