

## TESTING HEARING OF SUBNORMAL CHILDREN

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Experimental psychologists and investigators interested in the communicative process began to develop formal test and precision instruments which gave us the tools for hearing measurements. For a long time, puretones have been used for determining the hearing sensitivity of adults. The same acoustic signal was later used in the testing of children's hearing. In other words, adult standards were imposed upon children for eliciting response and for the determination of hearing thresholds. A review of the literature would indicate that until recently, techniques for measuring sensitivity of hearing of children were almost non-existent. Audiologists used crude methods to estimate hearing levels. Now we do have a few formal techniques available to serve our purpose..

Earlier attempts were made only to do cross evaluation of the hearing sensitivity of children, primarily because the examiners did not have electrical equipment as we have at present, moreover, valid and reliable techniques for testing children were not developed.

It is quite evident that when attempts failed to elicit responses in a child by simply asking him to raise his hands, various investigators started using motivating devices, so that the child would respond when heard the signal. For example, Hallpike and Dix (1947) tried puretones through their Peep Show audiometry; Guilford and Haug (1952) intra Pediacoumeter which had seven dolls. When the child hears the pushes a button and a doll pops up. O'Neill *et al.*, (1961) attempted Paraudiometry, using toys for motivation during the test. They were able to determine hearing thresholds up to the age of 21/2 years. Other investigators made use of slide projectors for motivating not only the normal children but the subnormal as well.

After trying puretones on infants below the age of two years and being dissatisfied with the end results, this author felt the need for a new test stimulus. Therefore, after experimentation with various kinds of signals, this author developed a new audiometric technique, the Baby Cry Text in 1962 (published in 1964). The test was validated by a study of 64 children from the age of one month to three years.

On the basis of a study (reported 1963 b, 73d) of 124 infants from the age of one month to 24 months, this author reported a success of 100 per cent in eliciting responses of infants. The lowest testable age was one month. This study indicated that the hearing sensitivity can be measured at the age of one month,

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and that a reliable threshold can be determined at the age of six months. This was concluded on the basis of high percentage of infants (85 per cent) turning their heads toward the source of the signal.

The research mentioned here encouraged this author to try his new technique, the Baby Cry Test, in testing the hearing of subnormal children. The results of the completed project were very encouraging. For the benefit of those who are interested in the hearing measurements of very young, hard-to test, and multiple handicapped children, an attempt has been made, in this paper, to describe the methodology used in our research, and in our routine clinical testing.

A bibliography of about 300 items can be compiled on studies related to testing of young normal and subnormal children. Traditional audiometry, conditioning in various forms, GSR and EEG have been tried on mentally retarded children and adults. The results have not been very satisfactory or conclusive. With this fact in mind, a research project was initiated at the Catholic University of America, Washington, D.C., in 1964, under the research grant of the National Institute of Child Health and Human Development, to find out the applicability of the Baby Cry Test in testing subnormal children. The main objectives of the project are three:

1. 'To develop a reliable technique to be used in determining the hearing thresholds of mental retardates and brain-damaged children;
2. To demonstrate the usefulness of the Baby Cry Test as a screening technique in programmes with the very young and subnormal children; and
3. To establish, and make available, a simple, economically practical and reliable procedure to be used by audiologists for valid diagnosis of hearing impairments in very young children, and children with mental retardation, and brain-damaged'.

### Testing Procedures

The testing was done in a sound-proof room (IAC 1201-ACT). A battery of tests was given to each child. The battery of tests included puretones, the Baby Cry Test and the Electrodermal Response Test.

The child was brought to the clinic by his mother, a relative or a teacher. The examiner spent some time trying to establish rapport with the child. In many cases the question of establishing rapport did not arise because the child did not realize what was going on in his immediate environment. This was often the case with a child of very low mental age, children with severe mental retardation or multiple handicaps.

The child was then brought to the examination room by his companion-mother, teacher, relative, or a therapist. First of all the traditional Puretone Test was given, in a single room situation. A portable audiometer was used and the child was asked to raise his hand to indicate his responses. First the child was

conditioned by leaving the earphone open on the table and introducing a 1000 Hz or 2000 Hz tone at a high intensity level (90-100 db). The child raised his hand or nodded his head to indicate his response. When the child was conditioned to the tone the routine test began, following the standard procedure. If the child failed to respond or refused to cooperate, the play audiometry and other motivational devices were introduced. Devices like putting a ring on a peg, taking milk bottles out of a cart or putting them back in the cart, building blocks, putting marbles in a box, putting blocks in a box, or any other toy which may be attractive or interesting to the child were used.

Subnormal children were very much attracted by coloured cartoons. If a child showed some interest in cartoons, a 2x2 slide projector was used to project the cartoons in a small screen in front of the child. A foot switch was used to control the noise of the projector, and to eliminate interference with the testing. When the child indicated that he heard the signal, the examiner pushed the foot switch and the projector was turned on and the cartoon was projected on the screen.

It has been found useful to condition a mentally retarded child with a bone oscillator. The oscillator was held on the hard surface of a table by the examiner # 1. The examiner # 2 controlled the instruments in the control room. He introduced a tone of 60-65 db in the oscillator. The examiner # 1 held the child's hand on top of the oscillator, and with the other hand the examiner held the child's other hand with a ring in the hand. The hand with the ring was placed close to the vibrating bone oscillator. The examiner then demonstrated how to put the ring on a peg. This was all done holding the child's hand. Then the child was conditioned to do the same independently. As soon as the child heard the tone, he puts a ring on the peg. After the ring fell on the peg, the tone was withdrawn, giving an impression to the child that he made the tone go away. When the child was conditioned with this technique, the bone oscillator was withdrawn and the earphones were placed on the table. A tone was introduced of 90-100 db in the earphones, as described earlier. If the child began to respond, the examiner put the earphones on the ears and proceeded to complete the test, following the standard procedure. If one motivating device did not work another one was tried until the child began to respond.

If this effort failed, then, the Baby Cry signal was introduced in the earphones and the thresholds determined. When no response was elicited through the earphones, the signal was introduced in the sound field situation. Four speakers were fitted on the four walls of the examinations room. The Baby Cry Test signals were presented from a tape recorded which was connected to a speech audiometer. The intensity of the signal was controlled by a Speech Audiometer. A custom-built four-way switch was used for switching signals from one speaker to another to determine a true response. Audio-reflexometry—a method of measuring the levels of hearing through the observations of involuntary responses resulting from acoustic stimulation, was used to determine a child's response to the test signal. After this, GSR testing was attempted.

## Experiment

Following the above mentioned procedures, a group of forty (40) subnormal children, (mentally retarded) from the age of four to fifteen years, was tested. The children were taken from the Kennedy Institute for Mentally Retarded Children, and St. Gertrude School, Washington, DC. Children went through the whole battery of tests, as described earlier. The results of this study indicate that puretones were not very effective signals for testing children with mental retardation. Fifteen per cent did not respond to puretones, but the responses to the Baby Cry Test were clear-cut and consistent at the 100 per cent level. The hearing thresholds determined with the baby cry test were significantly lower than the thresholds determined with puretones.

## Summary and Conclusions

The results of this study, which was a part of a larger study, indicated the following:

1. The subnormal children can be tested at all ages.
2. Motivational devices such as the slide projector, bone oscillator, and all sorts of toys, can be used in testing such children.
3. It is very important for the examiner to follow the methodology, stage by stage, and to understand the behaviour of the subnormal child.
4. The Baby Cry Test proved to be very reliable and valid tool for testing subnormal children.
5. The testing procedure and the meaningfulness of the test signal may be of great importance in determining hearing levels of children who are hard-to-test.
6. The imposition of adult standards in the audiologic evaluation of the normal or subnormal children may lead to confounded and unrealistic test results.
7. For determining hearing levels through the earphones, the cooperativeness and the ability of the child to respond to the test stimulus may determine the reliability of the test results.
8. If hearing thresholds cannot be determined through the earphones, sound field situation should be used, employing audio-reflexometry, for evaluating the levels of hearing of normal young children, hard to test children, the mentally retarded and the multiple handicapped.

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