

PROGRAMMED SELF-INSTRUCTION IN AUDITORY TRAINING

**Elizabeth M. Moore, M. S.
Supervisor of Audiology Section
NTID Communication Center**

The first attempt in Auditory Training at NTID (National Technical Institute for the Deaf) was undertaken in the Fall Quarter of 1972. The target population at that time was students with poor speech discrimination (i.e., those students who could not score on the CID Everyday Sentence Test*), and with some residual hearing. Initially, training was undertaken in groups, using a synthetic approach which involved training discrimination of supra segmentals as an aid to speechreading.

During the one-year period in which this type of training was attempted, several problems arose which precipitated a change to the programmed self-instruction Auditory Training currently utilized at NTID. The first problem arose from the group training situation. Although students were grouped by discrimination ability, the individuals had different needs and moved at different speeds, thus making it difficult to control the amount of drill necessary for each student to change his perception. Two other problems arose due to the type of materials used. Although the approach was intended to be synthetic, concentration on the individual prosodic elements of speech made the training highly analytic. The students found it difficult to understand the rationale for this seemingly abstract type of training. Also, it was difficult to test whether changes in the discrimination of prosodic elements actually did occur.

These problems led to the present approach to Auditory Training at NTID. After a ten-week pilot program in 1973, an individualized, self-instruction Auditory Training program was devised. To make the training material relevant, motivating, and interesting, "on-the-job" technical types of communication were used. To evaluate improvement of discrimination for the training material, the program included a sequence of tests built into the practice. The scores from these tests not only give important data on the effectiveness of the training but also show the student his own progress as he moves through the training program. A pre- and post-training test of the profile evaluation (the battery of tests given to assess the level of speech discrimination

*At NTID the CID sentences are referred to as CHABA, because they were developed by the Committee on Hearing and Bio-Acoustics.

ability*) are also given each student to determine whether improvement on the material practiced generalizes to improved discrimination of other speech stimuli. It is felt, however, that if the student can make gains on the kind of technical communications he will come in contact with on the job, generalization of that gain is not as critical.

EQUIPMENT. The basic piece of equipment used in this self-instruction Auditory Training program is a multiple/tract, audio flashcard reader (EFI Audio Flashcard Unit, Model AC). The particular instrument utilized at NTID has the capability of recording four separate messages (Tracks 1, 2, 3, and 4) on a strip of magnetic tape across the back of the flashcard.

To amplify the signal from the audio flashcard reader, the students' own hearing aids are used whenever possible. Siemens "Phonoduct" Induction coils are mounted on inexpensive headbands so that students with a telephone switch on their hearing aid can use their own amplification for the Auditory Training without bothering other students working individually on different material in the same room. For students without telephone switches on their hearing aids, Warren Auditory Training units (D-1 S/S) are provided.

MATERIALS. The materials for self-instruction Auditory Training were gathered from the individual technical majors at NTID. In each case, the technical experts provided 100 short, job-related, technical communications with which the student would likely come in contact when pursuing a career in their major area. Sentences were also developed in three non-technical areas: 1) "on-the-job social" communications; example: "Let's go on coffee break."; 2) "RIT social" communications' example: "Let me see your driver's license." In the technical areas, definitions were provided for all of the key technical words to insure understanding of the sentences. The definitions were also provided by the technical experts, and were written at an appropriate language level for NTID students.

Each technical or social area of 100 sentences is divided into ten units of ten sentences each. There is one audio flashcard for each sentence. On the cards, the sentence is recorded in quiet on Tract 1. The Key Word (the most important or technical word in the sentence) is recorded on Track 2. On Track 3, the student can (if he has intelligible speech) record his own voice, listen to his speech, and compare it with the model on Tracks 1 or 2. On Track 4, the sentence is recorded again in job-related background noise; for example, the Data Processing sentences are heard in a +4dB signal to noise ratio of computer noise.

For each unit to be practiced, the student receives ten cards, a list of the ten sentences, and a list of the Key Words with definitions, as shown in Tables 1 and 2.

**This battery includes a 'same-difference' test, 'spondee discrimination,' and CHABA. For a more detailed report on this test battery, refer to the paper by Ms. Karen Snell with the present proceedings.*

TABLE 1: Example of Sentence List for Unit 1 Architectural Drafting.

Auditory Training KEY WORD LIST
<ol style="list-style-type: none"> 1. Dimension your walls from the columns. 2. Please draw darker. 3. What scale is your drawing? 4. Have you established your floor-to-floor height? 5. Make 6 prints of this drawing. 7. Where is the original of this drawing? 8. Put all originals in the Plan File every night. 9. These are presentation drawings. 10. Those are working drawings.

TABLE 2: Example of Key Word List for Unit 1 of Architectural Drafting.

Auditory Training
<ol style="list-style-type: none"> 1. Dimension—locate distance from a given point. 2. Darker—blacker (draw with more pressure or softer lead). 3. Scale—scale as $1/8'' = 1'0''$ or $1/4'' = 1'0''$ or $1/20'' = 1'0''$. 4. Floor-to-floor height—vertical distance from one floor to the floor above. 5. Area—part of a building. 6. Prints—copies of a drawing on tracing paper using either blue or black line print paper. 7. Original—the original drawing, usually done on tracing paper. 8. Plan File—the cabinet with large thin drawers in which drawings can be stored flat. 9. Presentation drawings—drawings used to show the plan and appearance of a building or project. 10. Working drawings—drawings including plans, sections, elevations.

PROCEDURES. Two different instructional procedures were developed, each of which tells the student step by step how to manipulate the training materials. One procedure is for students who have poor speech discrimination skills (0% on CHABA), and the other more difficult procedure, is for students who can score on the CHABA sentence test. Auditory Training is currently offered to students at all levels of discrimination ability who are deemed to have good potential for improvement. For more information on how students are selected for the Auditory Training program see the paper on "Hearing Characteristics" by Ms. Moore, within the present proceedings. Both procedures follow the same order of training and utilize the same materials; however, the method of testing is different for the two.

Regardless of which procedure is used, the first step is to determine the student's pre-training unit. To accomplish this, the student shuffles the cards, listens to Track 1, and writes down what he hears for each card. After this pre-test, the student begins training by listening to the Key Words on Track 2. When he feels that he can understand the words, he tests himself on them by shuffling the cards

again, listening to Track 2, and writing the word he thinks he hears for each card. If the student obtains a score of 50% or better (5 or more words correct), he may proceed. Otherwise, he must repeat the Key Word practice and testing until he can achieve a 50% score. He then proceeds to practice and test on the sentences in quiet (Track 1). When he achieves a 70% or better score on the test of sentences (7 or more sentences correct), he practices and tests on the sentences in noise (Track 4). The cards are numbered on the back so that for each test in the training unit, the student can shuffle the cards and listen to them in a new random order.

In the easier procedure, the student is allowed to look at the list of ten sentences during the practice and during all of the tests. Thus, each test is a forced choice of ten in which the student may be cueing on prosodic elements rather than actually discriminating individual words. In the more difficult procedure, the student does not look at the list of sentences before or during the pre-test, thus making it a true sentence-type discrimination task. He also may not look at the sentence or word lists during all subsequent tests in this training procedure; however, because the student becomes familiar with the sentences during the practice, these subsequent tests yield inflated scores. To reduce this short term memory effect, a test of all cards practiced during the ten week training period is given at the end of the quarter without review. The score on this comprehensive post-test is, therefore, a better indicator of long-term discrimination learning of the sentences.

Two alternative methods are being considered for reducing the memory factor in individual unit post-tests. One would be to give the students an alternate set of cards for the post-test, on which some of the sentences would be the same as those practiced, and some different but similar. Another possibility would be to retest the students one or two quarters after they have completed the Auditory Training program.

SCORING. For each test within the training unit, the students score themselves. On the easier procedure, scoring consists of checking the response correct or incorrect based on comparison with the list of ten choices (sentences or words). For the more difficult procedure, sentences are scored correct or incorrect based on the "general meaning" (to check the accuracy of the student's scoring), for the number of Key Words correct. Each time the student completes a test in the training unit and must determine whether to repeat the practice or go on, he bases his decision on his own scoring.

PROBLEMS. One problem which has arisen is the time included for the instructor to rescore each test for the three parameters cited above. Recent statistical analysis has shown a high correlation between the student's scoring and the instructor's scoring for "general meaning". A high correlation also exists between scoring for Key Word and "general meaning". Therefore, in the future, students will score them-

selves for "general meaning" with a periodic check by the instructor for accuracy on their scoring and all other scoring will be eliminated.

Another difficulty with this training program is that the procedures outline, which gives the students step-by-step instructions for manipulating the materials, is 13 pages long and is therefore difficult to follow. Initial steps are being taken now to pilot a program utilizing Computer Assisted Instruction (CIA) to handle the procedures, and also aid in scoring and analysis and storage of the data. A CAI approach to programmed Auditory Training would be invaluable for research on student performance and for flexibility of the training program.

Recording and audio flashcards has also proven to be a problem area. Experience with recording the first set of cards has pointed out the necessity for making high quality master recordings on reel-to-reel tape rather than recording directly onto the cards. Making master recordings would eliminate the mechanical noise of the flashcard reader, and allow easy production of duplicate cards through dubbing.

RESULTS OF TRAINING. Data has been collected on all students who have been through the Auditory Training program. Test scores from all tests on all units were compiled and analyzed in terms of individual students and the population as a whole. Thus, any given student's progress can be followed; trends can be established; and the program itself can be modified for those students who do not benefit from this approach to Auditory Training.

The results of one year's experience with this method of training have been quite encouraging. Although it is beyond the scope of this paper to give a complete report and analysis of all results, some evidence can be given. The average improvement in discrimination of the sentences practiced (calculated on all students using the more difficult procedure; N 55) was 30%, with a range of -13% to 83%. These figures were calculated by averaging the scores on all pre-tests, and subtracting that figure from the scores on the comprehensive post-test administered at the culmination of the ten-week training period.

PLANS FOR THE FUTURE. Ideas for expanding the self-instruction Auditory Training program are currently being explored. Some plans for the future are: 1) to double the number of technical sentences by gathering another 100 sentences in each area which are no longer and more complex; 2) to program phoneme drills on the audio flashcards for students with good discrimination skills but some phoneme confusions; 3) to develop and program gross sound and gross phoneme discrimination tasks for students with very poor discrimination skills and new hearing aid users; 4) to program audio-cassettes with stories or paragraph-length material to help the students follow a longer train of conversation; and 5) as mentioned earlier, to utilize CAI techniques.