

SENSORY AIDS

Edited by

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Fabrication of Obstacle Detectors for the Blind Bionic Instruments, Inc., Bala Cynwyd, Pa. 19004

Thomas A. Benham, J. Malvern Benjamin, Jr., and D. Ridgeley Belgiano

During the second half of 1969, efforts were spent on supporting the evaluation of the ten C-4 Laser Canes built by this company under another contract. Some time was spent making power measurements on the lasers to supply the basic information required for evaluation of the safety of the cane in terms of its lasers.

Telemetry circuitry has been developed to allow a mobility trainer carrying a small FM radio to hear the signals to which the subject is responding, and canes are being modified to include this extra circuitry.

Some time was spent in conferences with various people involved in the evaluation process and in making minor repairs on individual canes.

Also during this report period, initial exploration was made of techniques for reducing the cost of manufacture of new canes, if produced in sufficient quantity.

**Research on Audible Outputs of Reading Machines for the Blind
Haskins Laboratories, Inc., New York, N.Y. 10017**

**Franklin S. Cooper, Ph. D., Jane Gaitenby, and Ignatius G. Mattingly,
Ph. D.**

The objective of the work at Haskins Laboratories is to find practical methods for generating spoken English from literal text as the output of a reading machine for the blind. Three different types of spoken output are being investigated, as described in preceding issues of the Bulletin. An extended discussion of these and related topics was published under the title, "Reading Aids for the Blind: a Special Case of Machine-to-Man Communication," by F. S. Cooper *et al.*, and appeared in IEEE Transactions on Audio and Electroacoustics, Vol. AU-17, 4, 266-270 (December 1969).

The present status of research on Compiled Speech, Synthetic Speech, and Re-formed Speech is summarized in the paragraphs below. [For some time, the plan has been to run field tests to evaluate these several forms of audible English output. Progress in this direction has been slight in the last quarter, largely because the Speech Section of Haskins Laboratories was being permanently shifted from New York to New Haven during that time.]

Compiled Speech. The original spoken dictionary (recordings of 7200 words, letters, numerals, and punctuation symbols) has been stored on magnetic tape in digital form. It is now possible to compile an audible English word output of any text by using the word retrieval program written by Mr. William Scully.

[As described previously, in this form of output those words which are not included in the dictionary storage are spelled out letter-by-letter from the letter storage, and the prosodic shape (intonation, stress, and timing) of each word is unchangeable.] Arrangements are being made for presenting tests (of scripts, 1 to 10 minutes in length) to selected blind listeners. Only very small groups of blind adults will be exposed to the pilot tests. When anticipated "bugs" have been removed from the testing procedures, larger scale tests will be made.

Synthetic Speech. Recently, a rather long text (a Saroyan story) has been put into Synthetic Speech—using Dr. I. G. Mattingly's synthesis program and table of General American phonemes. Hand simulation methods have allowed us to omit, temporarily, the actual storage of an

extensive pronouncing dictionary and the use of a parsing program. These omissions are for expediency only; the procedure is explicit. The long text will be tested (under various controlled conditions such as at each of several presentation rates) when arrangements have been completed with appropriate blind subjects.

Re-formed Speech. This type of output, a blend of Compiled Speech and Synthetic Speech, has not been worked on as a separate entity lately. Its further development depends on instrumentation that is not yet complete, and on the results of the Compiled and Synthetic listening tests which are forthcoming.

The Development and Evaluation of a Personal Reading Machine for the Blind

Mauch Laboratories, Inc., Dayton, Ohio 45439

Hans A. Mauch and Glendon C. Smith

Preparing Visotactor B-Visotoner Manufacturing Specifications was one of the major activities of Mauch Laboratories personnel during the period from July 1 to December 31, 1969. The Specifications (which were completed on January 30, 1970) consist of about 250 drawings and about 190 typewritten pages which fully describe the parts, special tools, and assembly operations required to build and test Visotactor B's, Visotoners, Colineators, attaché cases, batteries, and battery chargers.

Although the Visotactor B-Visotoner evaluation program continues to suggest changes in these reading aids and some of those changes considered have been tentatively adopted and incorporated in a few prototypes, it was decided that the Specifications should accurately describe the 40 devices actually built during the last production run which ended March 1969. These machines included such significant improvements as the Viscous Damping Unit (pacer), the Stimulator Intensity Control with stop, three Colineator improvements, and the new design for the attaché case. Just prior to the next production run of Visotactor B's and/or Visotoners the Specifications will be revised and updated to reflect those changes which have proven worthwhile.

Other progress during this period includes completing the assembly of Cognodictors #002 and #003, fabricating and encapsulating five recognition type photocell arrays, and substantial work toward completing the assembly of three Visotactor A's and seven Visotactor B's plus 10 Colineators and other accessories. Several of the Visotactor B's will be used by new students in Dayton. Mrs. Deal and others have started looking for suitable interested blind individuals.

Because the three 6.2 volt regulated power supplies for the Visotactor B-Visotoners have operated well and have been very useful, 12 more

Other VA Research Programs

were built. Ten of these were sent to Mr. Lauer at Hines V. A. Hospital, Hines, Illinois, for his students and two were retained at Mauch Laboratories for local students.

Several possible configurations of the Digitactor, a multicolumn, direct translation, tactile reading aid, were considered in some detail during November-December 1969. Plans were made to develop a breadboard version of the Digitactor as soon as manpower limitations and the needs of higher priority developments permit.

Determination of Performance Attainable with the Battelle Optophone American Center for Research in Blindness and Rehabilitation, Newton, Mass. 02158

Leo H. Riley, M.D., and Mrs. Ruth Morris

Miss Frances Buckley has continued the Battelle lessons with the Optophone in her home. Her progress was slowed down because of her illness and breakdown of equipment. Her test scores for test 17 and 18 were 5.6 and 5.7 words per minute.

Miss Buckley was delighted to receive a Visotoner in November. She had a slight problem adjusting to the Colineator, but is now proceeding well and finishing her Battelle lessons with the Visotoner.

Evaluation of Ultrasonic Aid for the Blind American Center for Research in Blindness and Rehabilitation, Newton, Mass. 02158

Leo H. Riley, M.D., and Mrs. Ruth Morris

Evaluation of the "Manual of Instruction for Use of the Kay Sonic Aid" from St. Dunstan's was interrupted by the hospitalization of the trainee. Mr. Barringham took the aid home during his convalescence, planning to continue his lessons, but resigned from the project in December 1969. A new subject has been selected and training will be continued by Mr. Richard Connors, peripatologist at St. Paul's Rehabilitation Center.

Reading and Mobility Aids for the Blind, Centrally Directed Clinical Application Program

**Central Rehabilitation Section for Visually Impaired and Blinded
Veterans, VA Hospital, Hines, Ill. 60141**

John D. Malamazian and Harvey L. Lauer

Activities, aimed at bringing equipment from the laboratory into personal use, fall into the following four categories:

1. *Testing new equipment*

Sixteen persons other than Mr. Lauer are using and learning to use

Visotoners; twelve are veterans, two are non-veterans in the United States, and two are in England. Two additional Visotoners are at VA facilities and six more are at Hines. Several Visotactors and Battelle instruments are in service. This is twice the equipment previously in service, and the need for servicing has been minimal. Mr. Lauer has been teaching seven persons via telephone, and the extra equipment for this has held up well; however, a better telephone amplifier for future use has been found. Mr. Lauer has also been testing the Visotactor B simulator which produces both the tactile and audible code and incorporates a tape recorder. It works well but has not been extensively used.

All beginners have successfully used the reversible Colineator plate which has removed the need for additional transparent plates.

2. Developing teaching skills and techniques

Three hours of tape recorded instructions were developed and shared with students most of whom were given personal copies with print samples. The instructions include currency identification, reading large print, examining type on checks and envelopes, examining a utility bill, etc. Obviously, much experience was gained in working with beginners.

3. Teaching students

At Hines, six new Visotoner students were added during this period. Two of them are potential teachers. There are now a total of three potential teachers, two of whom have completed the course. Four of our students have taken the Hadley screening course, which is proving of value in screening and as a head start with the code.

Several students are working on projects now, such as reading print card files and making braille card files of information they read from their phonograph record jackets.

4. Public information and conferences

Mr. Lauer attended two Sensory Aids conferences in Washington and demonstrated the reading machine to the staff members of the Texas School for the Blind and Texas Commission for the Blind. He also demonstrated the reading machine at the AAWB meeting in Chicago during July 1969. Mr. Lauer's article, "Reading Machines for the Blind," was published in the November issue of *The New Outlook for the Blind*.

Development of Correspondence Courses for Personal Reading Aids for the Blind

The Hadley School for the Blind, Winnetka, Ill. 60093

Donald W. Hathaway and Margaret Butow

From July 19-23, 1969, the Visotoner was featured at the exhibit of

the Hadley School during the convention of the American Association of Workers for the Blind held at the Sherman House in Chicago. Harvey Lauer and Margaret Butow manned the exhibit, and there were many interested people from all parts of the country who heard the demonstration tape and examined the equipment. On July 16, Miss Butow spoke and demonstrated the Visotoner at the convention of the American Council of the Blind in Charlotte, North Carolina.

In September 1969, the Veterans Administration loaned two research models of the Visotoner and one Battelle Optophone to St. Dunstan's Rehabilitation Center for War Blinded in London, England. Miss Mary Jameson, who has been reading with the British Optophone for almost 50 years, and Mr. Michael Lloyd, who had been reading with the British Optophone for almost 10 years, were given the two Visotoners. Miss Butow was in England for 2 weeks teaching these two people the use of the Visotoner. She also taught Philip Rodgers, who had completed the screening course, to use the Battelle Optophone. The Visotoner and Battelle Optophone use a nine-tone code as opposed to the six-tone code of the British Optophone. Both machines are much smaller and have a clearer output. The British Optophone has an oil-driven pacer which moves the probe across the line of print at the speed desired once it is lined up. With the Visotoner and Battelle Optophone, the reader does the pacing, and a good steady hand is needed to get a clear definition of the code. Both Miss Jameson and Mr. Lloyd found this difficult at first, but they are continuing to read, and are finding hand pacing easier according to the last correspondence Miss Butow received from them. Mr. Rodgers hears the code very well, and is even attempting to read simple music. He has made three tapes explaining how he reads music, finds the lines, spaces on the staff, etc. He has sent print samples along with his tapes which Miss Butow shared with Mr. Lauer. This involves freehand tracking vertically with the Battelle probe, and it is a slow process.

In August 1969, Mr. E. G. Brown, Chief Librarian of the Canadian National Institute for the Blind, enrolled in the Visotoner screening course. In October, he came to visit the Hadley School and Hines Hospital to look at the Visotoner and Visotactor. He has completed 15 lessons in the screening course thus far. He has also been given a Lexiphone reading machine developed by Dr. Michael Beddoes of Vancouver, B.C., which he is trying to learn to use on his own. He played for the Hadley staff one of the Lexiphone tapes which Dr. Beddoes has made. The output has a number of tones which appear to be closer together and may make letters and symbols slightly more difficult to recognize—in Miss Butow's opinion. Mr. Brown says he will show the Hadley staff the Lexiphone when he next visits the United States.

During the months of August, September, and October 1969, two veterans and one civilian teacher who had completed the screening course took further training at Hines, and now are reading with their own Visotoners.

Inquiries about the screening course have increased considerably since Harvey Lauer's article appeared in the November 1969 issue of *The New Outlook for the Blind*. There are seven new students in the course, and one who enrolled in January 1969 is nearing completion. She is a blind civilian and a graduate student in rehabilitation.

In October 1969, Miss Butow demonstrated the Visotoner for two groups of people at the Division for the Blind and Physically Handicapped at the Library of Congress in Washington, D.C. In November 1969, Miss Butow spoke and demonstrated the Visotoner at the Chicago Lighthouse for the Blind.

In December 1969, Miss Butow started working on preliminary ideas for the Visotactor screening course, and she hopes to have some lessons prepared soon.

Development of Test Procedures for Evaluation of Binaural Hearing Aids

Northwestern University, Evanston, Ill. 60201

Raymond Carhart, Ph. D., and Wayne O. Olsen, Ph. D.

During this period, testing was completed of subjects listening to sound field generated signals which were amplified and delivered to them via systems consisting of hearing-aid microphones in behind-the-ear hearing-aid shells, specially designed amplifiers with adjustable peak clipping provisions, and insert receivers. Two different microphone orientations were provided in the shells, and two different hearing-aid receivers were employed. Further, various degrees of symmetric and asymmetric peak clipping and consequent distortion were introduced as adjusted on the peak clipping amplifier. Persons with bilaterally symmetrical sensorineural hearing losses were tested in monaural and binaural listening conditions. Unaided and aided sound field thresholds were established using narrow bands of noise as test signals. Speech reception thresholds and speech discrimination scores in quiet and in competition were also established in unaided and aided listening conditions. In the aided conditions, the microphone in use and the insert receiver in use were systematically interchanged, and the type and amount of peak clipping were adjusted for each subject in the various test situations. Test results are now being analyzed with particular interest directed to the influences of distortion, bandwidth, and aided thresholds on speech intelligibility.

Other work underway is directed to setting up the necessary instrumentation for the comparison of binaural release from masking for

pure tones and for speech when test signals and maskers are delivered via earphones to release from masking attained in sound field listening situations with various loudspeaker locations to the front and side of the listener. The necessary tape recordings have been made, the equipment array has been assembled and checked and pilot investigations are underway.

Normal hearers and persons with bilateral sensorineural hearing losses will be tested under earphones and in sound field conditions to ascertain the magnitude of release from masking that normal hearers attain, and the extent to which hearing-impaired listeners derive release from masking in like listening situations.

The Development of Improved Techniques for the Analysis of Hearing-Aid Performance

BioCommunications Laboratory, University of Maryland, College Park, Md. 20742

G. Donald Causey, Ph. D., Earleen Elkins, Ph. D., Rosalind Green, and Eleanor Wintercorn

A study investigating the effectiveness of a group hearing-aid evaluation procedure has been completed. Three types of verbal material approximating everyday listening tasks were developed and recorded along with synthetic sentences and music to provide stimuli for 29 hearing-aid users. Listening to these materials, each subject evaluated four different hearing aids selected on the basis of a performance score derived from electroacoustic measurements of the instruments by the National Bureau of Standards. On the basis of this evaluation, two aids were chosen for each subject to be taken home for successive 2-week trial periods. One aid was the one with which he made the best scores, and the other was one arbitrarily chosen among the remaining three aids. Following each trial period, the subject reevaluated the trial aid with five more listening situations. Finally, a questionnaire was used to gain subjective opinions of the trial aids. The subject was then issued the aid with which he made the highest test-retest scores. One month later, another questionnaire was completed by each subject whereby he essentially rated the aid which had been issued.

The results of this study indicated that the listening situations did not differentiate hearing aids relative to the electroacoustic performance scores. However, hearing aids which had performance scores above the mean were preferred by more subjects than aids which had performance scores one or two standard deviations below the mean. Other results showed that subjects' experience with trial aids was not reflected in higher retest scores with those aids. Subjective evaluation of the group hearing-aid selection procedure by the veterans was favorable, particularly with respect to the use of everyday listening situations.

Another study investigating the effects of signal intensity and auditory acuity upon the ability to perceive consonant speech sounds by subjects with normal hearing and sensorineural impairments has been completed. The analysis of responses to the stimuli was performed with regard to the linguistic features of nasality, voicing, placement, affrication, and duration. Subsequent analyses were made of consonants which differed from one another by two or three features.

The results of the study indicated that both groups had more correct responses through sensation levels of 2–26 dB than error responses. Neither the severity nor audiometric configuration of the hearing impairments was related to the linguistic features studied. For the normal hearing group, the linguistic features and number of contrasting features were ranked in the following order by increasing number of error responses: 1. nasality and three contrasting features, 2. voicing and duration, 3. affrication and two contrasting features, and 4. placement. Also relative to an increasing number of errors by subjects with sensorineural impairments, the linguistic features were ranked in the following order: 1. nasality, 2. voicing, 3. two and three contrasting features, 4. affrication, 5. duration, and 6. placement. These results indicate that both normal and impaired listeners have the most difficulty perceiving sounds which differ only with relation to where they are formed in the oral cavity and the least amount of difficulty perceiving sounds which vary only in regard to resonance in the oral versus the nasal cavities. The results also show that the voicing feature received similar ranking for both groups but duration and affrication were reversed. These results do not support the hypothesis that there are no differences in the way subjects with normal hearing and subjects with sensorineural impairments perceive the various linguistic features of consonants.