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 Bolgiano

A conference on September 3 at Hines, Illinois, gathered representatives from all of the agencies that had been working with the cane for the last few months for the purpose of interchanging information and developing recommendations for future work. Canes have been under study at the following activities:

Western Blind Rehabilitation Center
Veterans Administration Hospital
3801 Miranda Avenue
Palo Alto, California 94304

Central Rehab. Sect. for Visually Impaired and Blinded Veterans
Veterans Administration Hospital
Hines, Illinois 60141

Cincinnati Association for the Blind
2045 Gilbert Avenue
Cincinnati, Ohio 45202

Missouri School for the Blind
3815 Magnolia Avenue
St. Louis, Missouri 63110

Institute of Blind Rehabilitation
Western Michigan University
Kalamazoo, Michigan 49001

The Seeing Eye, Inc.
Morristown, New Jersey 07960

The group at Hines Veterans Administration Hospital kindly hosted the meeting, while the Committee on Prosthetics Research and Development of the National Research Council sponsored the conference. The participants expressed appreciation to both organizations.

The group addressed itself to three questions: 1. Does experience to date indicate sufficient promise in the laser cane to be worth continuing work with it? 2. What mechanical changes should be made to overcome difficulties which have shown up thus far? 3. What direction should cane development and testing take in the remainder of this fiscal year?

The general attitude toward the cane seemed to be cautiously optimistic. All found the forward channel to be useful. Most found the upward channel to be either currently useful or potentially useful if its range were moved forward 2 ft., and one group (Hines) found the lower channel to be useful in its present form. It was generally considered that even a laser cane with only a forward channel would be a significant improvement over a simple cane. The usefulness of the other two channels would vary with the individual, the geographical location and patterns of travel, and the extent to which problems (primarily in the downward channel) could be corrected.

It was recognized that some mechanical problems would be much more difficult and time-consuming to correct than others; so it was decided to make some modifications as rapidly as possible on existing canes while proceeding more slowly, on a laboratory basis, on other changes. Bionic Instruments has proceeded on modifications to determine feasibility as well as labor and materials involved. Canes are being sent back to Bionic Instruments for modification, and then returned to the activities using them to develop training techniques.

Research on Audible Outputs of Reading Machines for the Blind
Haskins Laboratories, Inc., New Haven, Conn. 06510
Franklin S. Cooper, Ph. D., Jane Gaitenby, and
Ignatius G. Mattingly, Ph. D.

Generating spoken English from printed text to serve as the output of a reading machine for the blind is the objective of the research at Haskins Laboratories. The three approaches thus far investigated have been discussed previously in the Bulletin.

Current work on 1. Compiled Speech and 2. Synthetic Speech is described below; further work on 3. Reformed Speech (a blend of the first two methods) is being deferred for the present. Haskins' working plans are to conduct informal field trials with blind volunteers from the Veterans Administration Hospital in West Haven. First, compiled speech will be tried as there are now a substantial number of recordings that can be used to assess some of the factors that may affect the acceptability of either compiled or synthetic speech. However, most of the field trials will be done with synthetic speech, mainly because it is believed to be the more promising method, but also because it allows much greater flexibility in manipulating the variables that seem likely to be important to the blind user.

Compiled Speech. Field trials have begun of the type indicated above, using compiled speech recordings of a collection of short stories by William Saroyan. In these stories, the text has been paraphrased somewhat to eliminate the requirement for spelling those words that were not in the 7200-item dictionary of spoken word recordings. The initial focus is on the acceptability of various speech rates in the compiled speech medium. The original, uncompressed rate of 114 words per minute seems rather slow to most listeners. Some passages have been time compressed at the Center for Rate Controlled Recording of the University of Louisville using four different compression rates at each of three discard durations. Thus, the sample contains 12 versions of the same text at rates ranging from 114 to 190 words per minute. Longer texts are being time compressed at a few chosen rates and discard durations.

Rate is, however, only one of a variety of factors that are likely to affect user acceptance. The length and kind of text will certainly be important. It is suspected that dialogue, as in the Saroyan stories, will not seem as good as straightforward exposition, largely because the rapid shifts in speaker, signalled visually by paragraph breaks, are not conveyed to the listener. Non-fiction that is not so technical as to make spelling a severe problem is also a promising kind of text. Other relevant factors are the type of test (i.e., whether formal or informal), the role of the subject in it (as volunteer or student or "draftee"), and whether or not the subject reads braille.

We are grateful to Mr. Gillispie and Mr. Kingsley of the Rehabilitation (Adjustment) Section of the West Haven Veterans Administration Hospital for their cooperation and initiative in finding test subjects for us, and we are of course deeply indebted to the subjects themselves.

Synthetic Speech. Most of the work on synthetic speech during the past few months has been on the hardware and software needed to generate substantial quantities of speech for field trials. Text input is the core of this problem. Eventually this is to be done by optical character recognition from the printed page, but this step was excluded from the original research plans in order that efforts could be focused on the more specialized—and in many ways more difficult—problem of providing suitable audible outputs. Haskins Laboratories expects, therefore, to simulate the OCR operation by typing the input text directly into the computer. Initially, it will be typed in phonetic form—the input required by the synthesis-by-rule programs—but later in normal English spelling.

Phonetic input with a conventional typewriter requires many compromises that make the typing and proofreading slow and laborious. Ways, therefore, have been sought to simplify the input of phonetic text with equipment that is on hand or relatively inexpensive. This has been accomplished by using a Rand-type tablet (Computer Sciences

Corporation "Graph Pen") and a Tektronix Type 611 storage oscilloscope. A phonetic keyboard is laid out on the tablet and activated by touching the pen to successive symbols. The symbols then appear on the storage oscilloscope, where they can be checked for accuracy just as if they had been typed on paper in a conventional typewriter. Moreover, each completed sentence (or a whole "page" of text) can be listened to as soon as it has been typed. When it is in exactly the desired form, a single pen stroke sends it to disk storage, from which it can be retrieved as part of a long continuous text in preparing the test recordings. Since the storage is in the form of the phonemic text *before synthesis,* many characteristics such as speech rate can be chosen at the time the recording is made.

The same computer programs and interface equipment can also be used with an inexpensive typewriter keyboard (instead of the tablet), as soon as the keyboard has been wired. Thus far, the system using the XY tablet works extremely well and promises an easy, rapid method for generating extensive texts in synthetic speech form. Hence, Haskins expects very soon to be testing synthetic speech in parallel with compiled speech.

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

An abstract of an annual report, which covers the progress during this report period, appears elsewhere in this issue.

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 completed the 200 Battelle lessons with the Visotoner. Her test scores for test 19 and 20 were 5.8 and 6.7 words per minute.

Since completing her training she has been using the Visotoner to increase her reading skills. Miss Buckley has read newspaper and popular magazine articles. She is presently learning to identify money and read her household bills.

Mr. Harvey Lauer from the Central Rehabilitation Section for Visually Impaired and Blinded Veterans, VA Hospital, Hines, Illinois, came to visit the Center in June 1970. Miss Buckley enjoyed meeting and talking with Mr. Lauer and received valuable advice and instruction for the short time he was here. It would be most profitable and helpful to have

a closer liaison with Mr. Lauer and other instructors of the Visotoner to share information and experiences which would help improve teaching techniques.

(The contract for the above project was terminated approximately 1 year ago. However, the contractor has continued to forward followup information for our records. Beginning with BPR 10–15, this information will no longer be published in the Bulletin, but instead will be kept, along with similar followup material, in our files.—Editor)

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 Sonic Aid" from St. Dunstan's has been continued using staff and trainees of St. Paul's and St. Raphael's Rehabilitation Centers.

Progress has been slow because of the tight schedules of the peripatologists and of the trainees and no reports are as yet available.

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Reading and Mobility Aids for the Blind, Centrally Directed Clinic Application Program
Central Rehabilitation Section for Visually Impaired and Blinded Veterans, VA Hospital, Hines, Ill. 60141
John D. Malamazian and Harvey L. Lauer

The goal of this effort is to evaluate reading machines for the blind and to move them from the laboratory into use. Testing, teaching, and demonstrating the electronic reading devices sponsored by the Research and Development Division of the Prosthetic and Sensory Aids Service are performed at Hines VAH. There are four areas of functioning:

1. *Testing Devices:* This project has used, tested, and distributed to students improved ancillary hardware—power supplies, batteries, cables, etc. A few minor modifications to the basic equipment were made. A teaching aid called the Visotactor Simulator is used for making recordings and for converting the audible code to the tactile code.

Tests began on one of three existing prototypes of the Mauch Cognodictor—an optical character reader with spelled-speech output in addition to the direct translation output of the Visotactor. This instrument opens a vast new area for study, development, and eventual utility.

2. *Developing Learning Aids:* Nothing was added during this period though print lessons and instructional tape recordings were shared with students. Some "raw material" was collected for the critically-needed teacher's manual and rating scale for prospective candidates.

3. *Teaching Students:* There are 13 Visotoner students, four of whom are new during this report period. (As of September 1970 there are 15 such students.) Five of these students are potential teachers, one of whom conducted in the summer of 1970 a course for several college students. All students completed the basic training at Hines and are using the instruments in their homes. Work progressed with four students from the previous year for periods ranging from 3 days to 2 weeks each. All students remain in touch with their instructor for several months on a regular basis by phone and/or tape recording. Seven persons were given evaluation lessons averaging 10 hours each. Miss Butow, who teaches The Hadley School's Visotoner Screening Course, conferred with Mr. Lauer, and conferences were held with teachers and students in Washington, D.C., and Boston.

At least eight students are making use of the reading aids for meeting some reading needs other than reading practice. Organized documentation needs to be prepared in order to establish confidence for building new equipment. The existing supply of Visotoners is low.

4. *Conferences and Demonstrations:* There were three visitors to the project from three foreign countries. Mr. Lauer spent 2 weeks at Stanford Research Institute with Dr. J. C. Bliss, his staff and students. They are developing and evaluating a reading device with a tactile output called the Optacon.

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

Enrollment has increased in the Visotoner Screening course during the time period covered in this report. There are 24 active students. Eleven students have completed the course, and eight of these have gone to Hines Hospital for further training with their Visotoners, and are now using them in their own homes.

Miss Mary Jameson, London, England, long-time user of the original and updated British optophones, and Mr. Michael Lloyd, Birmingham, England, have sent tape recordings of their reading to The Hadley School. Miss Jameson especially has made good progress with the Visotoner. She uses it to check her own typing as well as for small quantities of reading. The mechanics of reading have become less difficult for her, she is tracking well, and recognizing the code with much

facility. Mr. Philip Rodgers, Sheffield, England, the user of the Battelle Optophone, has dropped out of the project for personal reasons, not because he was discouraged with the Optophone. He has loaned the Optophone to Dr. and Mrs. Ronald Gorton, Hertfordshire, England. Dr. Gorton has submitted six lessons in the screening course and is doing well.

Little progress has been made with the Visotactor Screening course. Five lessons have been brailled, and the braille text has been tape recorded. Diagrams made on a braille writer representing the eight channels of the Visotactor were made, and the student would be asked to tell which lines are missing in each diagram. He would be asked "Which channel is not vibrating?" The student is told to use the four fingers of his right hand to trace the diagrams. It was felt that no further progress could be made unless tactile letter shapes similar to those produced by the Visotactor were obtained. Work will continue on this project the rest of this year and early next year.

Preparation was started on an article about the development and 2 years' progress of the Visotoner Screening Course. It is hoped that this article will be published in magazines dealing with the field of work for the visually handicapped.

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.

Work is continuing on the development of test procedures for evaluation of binaural hearing aids by testing normal hearers and persons with bilaterally symmetrical hearing losses in various monaural and binaural listening conditions. Specifically, subjects are being tested in earphone listening conditions monaurally and binaurally with pure tone and speech signals in quiet and in the presence of noise. Various binaural conditions are being employed: 1. noise in phase and test signal in phase at the two ears; 2. noise in phase, test signal 180 deg. out of phase at the ears; 3. noise 180 deg. out of phase, signal in phase at the two ears.

The same speech test materials (spondees and monosyllables in noise) are also being presented in sound field listening conditions. Two loudspeakers are positioned so that the noise and/or speech are generated directly in front of the listeners approximating in phase signals at the ears or with one of the loudspeakers moved 90 deg. to one side to produce out-of-phase signals and head-shadow effects at the two ears. In this way it is hoped to learn more about binaural listening in sound field conditions. Of course the prime interest is to assess the extent to which persons with bilaterally symmetrical hearing losses can attain

benefit from two-eared listening as compared to normal hearers. This, of course, has implications for monaural and binaural hearing-aid use.

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, Ph. D., and Eleanor Wintercorn, Ph. D.

In a study designed to evaluate the Modified Rhyme Test (MRT) as a possible tool for testing aided speech discrimination, 50 impaired and nine normal hearing subjects were administered four lists of the MRT spoken by talker #1 at signal-to-noise ratios determined by the MRT developers to yield 96, 83, 75, and 96 percent correct responses with normal listeners. All subjects received the stimuli monaurally at 40 dB re the SRT of the better ear. The normal listeners performed within normal limits. The impaired hearing subjects performed below normal levels and were regrouped by audiometric configuration into three groups for further analyses. The MRT did not differentiate among groups consisting of subjects with flat or gradually sloping losses, subjects with steep losses between 500–2000 Hz, and subjects with steep losses from 2000 Hz. Subjects with sensorineural impairments did not maintain the expected relationship between lists presented at the P83 and P75 levels. Subjects with steep losses between 500–2000 Hz and normal listeners did not show the same rank order when ranked by their scores on each of the four MRT lists. Comparison of W–22 scores and MRT scores yielded one significant coefficient of correlation.

Investigations are in progress to determine the loudness and integration time of frequency glides. This information will then be used to study speech perception ability of hearing-impaired subjects by their identification of consonant-vowel and vowel-consonant syllables varied with regard to glide duration and frequency.

Another study in progress is measuring the dynamic response of a group of hearing aids with compression characteristics. Instantaneous changes in input sound pressure levels are effected to determine how rapidly the amplifying system responds to these changes. Subsequently, the intelligibility of vowel-consonant-vowel syllables will be investigated with hearing-aid users.

The effects of sensation level on open and closed response intelligibility tests with normal and impaired listeners is the subject of another study. Presentation levels of 26 and 40 dB above the subject's SRT in his better ear will be employed with lists of consonant-vowel syllables. The number of correct responses will be evaluated to determine the

source of variance among the main effects and interactions of groups of subjects, sensation levels, and response modes.

In March, 1970, a study was undertaken to investigate the effect of extended storage of hearing aids on the electroacoustic characteristics of the hearing aids. The hearing-aid characteristics are being monitored for a 12-month period to determine if acoustical changes do occur when hearing aids are stored in the continuously air-conditioned environment of the BioCommunications Laboratory.

At the onset of the study, the electroacoustic characteristics of 32 hearing aids were measured and recorded. Following the completion of this initial evaluation, batteries were removed and all hearing aids were replaced in their boxes and divided into four groups.

Groups I and II were to be opened and retested at 3, 6, and 12 month intervals. Group III will be tested 6 and 12 months after the initial evaluation. Group IV will be reevaluated at the end of the 12-month period. The hearing aids in groups II, III and IV remained in their boxes between test sessions. The hearing aids in Group I have batteries temporarily installed and are being turned on 1 hour weekly throughout the year. The purpose of turning these aids on for 1 hour weekly is to create a situation similar to the use of the aids in a clinical evaluation.

The results of the study will provide pertinent technical information, particularly if changes occur and the causes are identified. Should significant findings result, they may provide information regarding the maximum storage period before a hearing aid becomes unacceptable due to changes in acoustical properties which occur. Finally, the need for periodic monitoring or reevaluation of the hearing-aid characteristics during the storage period may be revealed.

If the results of the investigation demonstrate that no significant electroacoustical changes occur in the hearing aids during the storage period, the study will still be valuable. It will provide documentation to support the assumption upon which clinical facilities now rely.