

the immediate postsurgical fitting procedure. Pressures between stump and socket are being measured. The EMG activity of the stump musculature is being studied. Temperature studies are being utilized to chart the course of inflammatory response to trauma.

Under consideration is a revision of the publication "Immediate Postsurgical Prosthetics in the Management of Lower Extremity Amputees," published in April 1967.

VA Hospital, San Francisco, California

Wesley L. Moore, M.D., and Albert D. Hall, M.D.

In the last quarter of 1968 the Veterans Administration Hospital, San Francisco, has initiated a study to evaluate immediate postoperative fitting of prosthesis in patients undergoing below-knee amputation for vascular insufficiency. The purpose of the study is twofold. First of all, we will evaluate the applicability of the immediate fitting technique to a large volume of patients undergoing amputation for vascular insufficiency. The secondary purpose of this study will be to establish quantitative criteria to aid in preoperative determination of level for a successful lower-extremity amputation by evaluating the skin blood flow necessary for successful healing following amputation.

At this time we have performed 25 lower-extremity amputations with immediate postoperative fitting of prosthesis. Twenty-three of these were below knee and two were above knee. The initial results of this study have been summarized in a paper presented at the International Cardiovascular Society in June of 1968 and will be subsequently published in Archives of Surgery in December of 1968.

Work has been started on constructing the various equipment required for performing skin blood flow measurements, including radioisotope techniques utilizing xenon 133 and a capacitance plethysmograph.

SENSORY AIDS

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Fabrication of Obstacle Detectors for the Blind

Bionic Instruments, Inc., Bala Cynwyd, Pennsylvania 19004

**Thomas A. Benham, J. Malvern Benjamin, Jr., D. Ridgeley Bolgiano,
and E. Donnell Meeks, Jr.**

There is no new research activity to report on for this period.

The manufacture of ten C-4 laser canes is nearing completion at this time. Demonstrations of the cane have been made to approximately ten individuals and organizations during the past three months.

A comprehensive article on the development of the C4 cane entitled "A Review of the Veterans Administration Blind Guidance Device Project" appeared in the BPR 10-9 Spring 1968 issue of the Bulletin. The article includes a review of various other guidance devices that have been available.

**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

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, each offering its own advantages (in voice quality, for example) and disadvantages (operating costs, additional development times, etc.). The three methods were described and characterized in the Bulletin of Prosthetics Research, BPR 10-9 Spring 1968.

Additional texts have been prepared, using all three methods. At the present level of development, they can be characterized briefly as follows:

<i>Mode</i>	<i>Characterization</i>
A. Compiled speech	Slow, bumpy prosody, pleasant natural quality, intelligible.
B. Synthetic speech (At several controlled rates)	Fast (if desired), humanoid quality, intelligible, good intonation.
C. Re-formed speech	Fast (if desired), good durational relationships, good intonation, intelligible, voice quality not bad. Procedures for phonetic and prosodic modification of source vocabulary (the "compiled" lexicon) are in primitive condition. Custom tailoring of words into optimal canonical forms is arduous at present.

Further work on *compiled speech* has included comparative tests of speech quality, following digital storage of samples quantized to six, eight, or ten bits per sample, and with both linear and logarithmic amplitude representation. The sampling rate was 8,000 per second in all cases. The results suggest that 8-bit logarithmic quantizing may be the optimal compromise voice quality and memory requirements.

A substantial amount of programing has been done to facilitate the editing of individual words and their incorporation into a recorded dictionary, to be used in generating *compiled speech* for field trials with blind users. This same vocabulary will provide source words for use in preparing the dictionary of parameters needed in generating *re-formed*

speech. A tracing box for use in abstracting the parameters from spectrograms has been designed.

Two research studies have been started:

1. Study of voice quality—A. As a personal idiosyncrasy,
B. As a cultural cue to specific or general emotional state.
2. Study of spontaneous speech, with special reference to stress and intonation patterns—contrasted with subjects' readings of their own spontaneous phrases (and sentences).

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

In the period from March 1968 through June 1968, Miss Reinicke, a blind volunteer subject, read with the older bench model recognition machine, Recognition Prototype II, while the design and construction of a production version, Cognodictor, continued. Although the older machine malfunctioned on several occasions, reading speeds up to 31 words per minute for a line and 23 words per minute for 10 minutes were noted. Miss Reinicke suggested a few potential improvements which may be incorporated in the Cognodictor design.

During June 1968, a new photocell input conditioning circuit was designed for the Cognodictor. In addition to a stable Schmitt trigger circuit which uses an integrated circuit, this design includes an improved version of the automatic white level compensation used successfully in the older Recognition Prototype II.

The speed dependent viscous damping device was tested on several Visotactor B and Visotoner direct translation reading aids at Hines VA Hospital, Hines, Illinois, and at The Hadley School for the Blind, Winnetka, Illinois, in addition to tests by Miss Reinicke on a Visotactor B and on the Visotactor A. Several changes were made in the design for this device, including a slip clutch which begins to slip at about 35 words per minute to facilitate higher speed recognition reading or fast forward and reverse travel of the probe.

The new tactile stimulator intensity control was added to several Visotactor B's in the field, and it was well received by the users of these devices. This design will be included in future Visotactor (A and B) prototypes.

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

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

Our newest subject made little progress with the Optophone and returned the equipment in April 1968.

Our other subject, who started in January 1968, has made excellent progress. On May 15, 1968, she achieved 6.5 words per minute in Test No. 2; and on June 18, 1968, 5.7 words per minute on Test No. 3. She is interested and enthusiastic.

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

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

A rough draft of the results of the recent field trial was prepared for submission to the Veterans Administration. Conclusions were:

1. All subjects had more confidence using the ultrasonic aid alone in familiar than in unfamiliar surroundings.
2. All subjects were more relaxed using the ultrasonic aid alone in familiar than in unfamiliar surroundings.
3. All subjects had difficulty in detecting down curbs almost always or always.
4. All subjects used the aid at least part of the time enriching their contact with the environment.
5. No subject expressed a desire for permanent possession of the aid.
6. The subjects disagreed among themselves in all other aspects of using the ultrasonic aid.

· Professor Kay visited ACRIBAR in May 1968, and expressed the need to study the stresses experienced by users of the ultrasonic aid. With the collaboration of Gunther Weil, Ph.D., and Estelle Singer, Ph.D., Dr. Riley prepared and did a brief study in June 1968, of the stress effects, using telemetered electrocardiograms to show changes in heart rate. Supplementary information was provided by experimental psychologists' rating of the behavior of the subjects and by the subjects' own ratings of anxiety they may have experienced.

Dr. Singer prepared a rough draft of the study in July 1968. Her conclusions were: "The best kind of evaluation of the Kay Device appears to be to consider it separately on each type of stress. The present study is quite favorable for it on physiological stress, moderately favorable on experienced comfort, and unfavorable on manifest anxiety. More data must be collected."

The Center is still awaiting receipt of the instructional text and tape recorded materials from Palo Alto. When they arrive, the Center plans to make use of these materials with selected subjects.

The Center had to abandon plans to present tape recordings of the outputs of the ultrasonic aids to Professor Kay. On the day planned for the presentation, both Professor Kay and Dr. Riley went to VA Headquarters in Washington, D.C., to consult on the question of making the Kay Device available to blinded veterans in its present form as marketed by Beltone.

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

Central Rehabilitation Section for Visually Impaired and Blinded Veterans, VA Hospital, Hines, Illinois 60141

John D. Malamazian and Harvey L. Lauer

The Central Rehabilitation Section is currently working largely with the Mauch Visotoners and Visotactors which are reading machines for the blind about which further information can be supplied on request. The means employed here to move the equipment from the laboratory stages into use by blind veterans are divided into four categories:

Testing New Equipment Designs

In preparation for building the 40 machines on order, the manufacturer made several design improvements. These changes were incorporated in some of the existing prototypes for updating and testing purposes. Some changes such as bolted-in lamps are welcome but have little effect on the use of the machine. A stimulator intensity control has been added to the Visotactor design. Work was completed on the testing of earphones and the modified output of a Visotoner with resultant improvements in reading and recording qualities. The currently improved design of the Mauch pacing mechanism has been found satisfactory thus far. Though it adds nothing to the size of the instrument, this pacer tends to steady the reading pace thus adding to legibility and ease of handling.

Developing Instructional Aids and Teaching Skills

Technical help continues to be given for the development of The Hadley School Home Study Course for screening candidates interested in training with the Visotoner.

Mr. Lauer drafted a rating table which was needed as a tool in the systematic selection of candidates for training in the use of reading machines. Based on experience to date, it is a 21-factor scale which should form the basis for later policies and for several chapters in a teaching manual.

The new Visotoner recorded letter, word, and sentence studies have proven helpful to students, and they shall continue to be used.

Direct Teaching of Students

Since the last report in late March 1968, a new student was accepted for the entire course. Reading with the Visotoner, he has reached Lesson 100 of the 200-lesson course. The other two students have almost completed the course and are able to sample their mail and read items of personal interest. They still need deliberate practice in order to maintain and improve their skill, and part of their text is now specially selected material which may incorporate several type sizes and styles. All students live in this area, practice at home, and come to Hines for lessons.

Three other persons received between 10 and 35 lessons each for the purpose of determining their potential candidacy. One veteran was in poor health and the other two showed average ability to learn the skill. They could profit from the course if they and the equipment can be made available at a future time.

The Visotactor student is doing well and reading at Lesson 130. Progress is slowed due to his other activities during the summer months. Reading speeds for all students are at speeds of 12 words per minute or less.

Public Information

Mr. Lauer demonstrated the Visotoner on NBC TV's "Today Show" on April 18, 1968. This also afforded an opportunity to discuss the project with a number of VA personnel in Washington, D. C. Mr. Lauer also attended the Alumni Meeting of the Wisconsin School for the Visually Handicapped in Janesville, Wisconsin, where he demonstrated the reading machines to about 35 interested persons. Working with groups of several persons each, much interest developed. His article about the use of the Visotoner appeared in "Dialogue Magazine," a talking book magazine widely circulated in the Midwest.

Response to the occasional inquiries about reading machines and correspondence with several persons who are interested in the project continues.

Development of Correspondence Courses for Personal Reading Aids for the Blind

The Hadley School for the Blind, Winnetka, Illinois 60093

Donald W. Hathaway and Margaret Butow

During March, April, and May 1968 the braille text was written and the reading material was typed for a 25-lesson tape-recorded home-study screening course to determine students' ability with the code of the Visotoner print reading machine developed by Mauch Laboratories of Dayton, Ohio. A short description of the course contents follows:

The first tape includes a demonstration of the sounds of the reading device, and an introductory lesson to which the students must respond. This lesson includes a capital and small "v" read six times each with the

Visotoner. Questions are asked about these letters, for example: "On what kind of tone does the V start, high, low, or medium?" Several series of letters are given and the student is asked to count the number of symbols he hears in each series. In the third part of the introductory lesson, the student is told that all capital letters sound the highest tones in the range of the Visotoner. A series of letters are then read by the instructor using no small letters with ascending lines, and the student is asked to say which have the high tones and which do not. After the student has completed the introductory lesson, and if it is determined that he can hear the difference between tone patterns of letters, he will be sent the 25-lesson screening course.

Lessons in the screening course are set up as follows: No more than five, and no fewer than two letters are taught in each lesson. Questions are asked about each letter read to which the student must respond. A list of words is then read. The instructor reads each word once, says it and spells it, then reads it two more times. No fewer than five and no more than twelve words are given in each lesson. After this, each word is read again once. The student is asked to consider this a self-check test, and to write any words he recognizes in typing or braille. The instructor reads the list of words and asks the student to check the list. Then the instructor reads the words again, asking the student to write any he recognizes, but this time he must send the second list to The Hadley School. After Lesson Four, short sentences are given. From one to four sentences are given in each lesson. After Lesson Six, common letter combinations are stressed like *th*, *ea*, and *ed*. If the student completes Lesson Ten, he is sent a tape describing capital and small letters and numbers. Lessons 15 through 18 contain sentences and paragraphs partly spoken and partly read with the Visotoner. The student must pick out the words read with the Visotoner from the context of the material. Lessons 19 and 20 describe briefly the kind of work encountered in the 200-lesson Battelle Memorial Institute's course which the Battelle Institute developed for their Optophone. The last lessons of the course deal with the adjustment of the lights, type-size knob, and proper alignment of the reading probe, on a line of print.

Lesson 25 is a five-part final examination covering the material just learned. In several lessons students are asked to count the number of symbols heard in a series.

Recording of the course started on May 28, and finished June 16, 1968. At present, our recording engineer, Charles Shipley is editing the tapes. After the master tapes have been edited, they will be listened to, and anything that needs re-doing will be re-recorded. The introductory lesson must still be recorded.

It is hoped that the screening course will be available to both veterans and certain non-veterans in the fall.

**Development of Test Procedures for Evaluation of Binaural Hearing Aids
Northwestern University, Evanston, Illinois 60201**

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

At the April 18-20, 1968, Centennial Meeting of the American Otological Society, Dr. Olsen and Dr. Tillman presented a paper, "Hearing Aids and Sensorineural Hearing Loss." This paper suggested that in some professional circles, the role of a hearing aid in the communicative rehabilitation of individuals with sensorineural hearing impairments is misunderstood due to a number of misconceptions. Four of these misconceptions were singled out and contrary to the views held by some professional workers in the field of hearing, it was emphasized that: 1. persons with sensorineural hearing impairments can benefit from hearing-aid amplification in quiet or relatively quiet environment; 2. differences in hearing aids do have an effect on the ability of individuals with sensorineural hearing loss to hear and understand the speech they wish to hear, particularly when other speech or environmental noises are present; 3. the head shadow effect can have a marked influence on speech understanding for the person with a unilateral hearing loss and for a monaural hearing-aid user; and 4. the CROS hearing-aid arrangement can be of significant communicative assistance for some unilateral hearing loss cases.

A paper entitled "Physical Performance Characteristics of Hearing Aids" was presented by Dr. Olsen at the April 11, 1968, Midwest Acoustics Conference. This paper described the use of a system consisting of active microphones in dummy hearing-aid shells, external laboratory amplifiers, and various insert receivers to systematically vary distortion and bandwidth characteristics. Tape recordings of speech reproduced by this system were presented to demonstrate the effects of different types and degrees of distortion introduced by peak clippings and the influence of bandwidths on speech intelligibility. These demonstrations suggested that speech remained intelligible in spite of marked peak clipping and consequent distortion, but that speech in noise was more intelligible when the system had the wider bandwidth. It was pointed out that these observations with regard to peak clipping and distortion are in agreement with those of Licklider, Licklider and Pollack, and Martin. Insofar as bandwidth is concerned it was pointed out that the above observations are in agreement with the work of Egan and Wiener, Pollack, and the concept of articulation index of French and Steinberg, Beranek, and Kryter.

Current efforts are concerned with determination of the interference function provided by modulated white noise (noise alternately increased and decreased by 10 dB during 250 msec. periods) for monosyllabic words.

Normal hearing listeners are being tested at present in sound field monaural direct, monaural indirect, and binaural listening conditions. Other work involves speech reception threshold and speech discrimination testing for hearing-impaired persons when receiving speech as received, amplified, and reproduced by the system consisting of the active microphones in the dummy hearing-aid shells, laboratory amplifiers, and insert receivers mentioned above.

Electroacoustic Characteristics of Hearing Aids

Houston Speech and Hearing Center, Houston, Texas 77025

Jack L. Bangs, Ph. D.

Published elsewhere in this issue is a report by Dr. James Jerger entitled "Effects of Electroacoustic Characteristics of Hearing Aids on Speech Understanding." This article discusses the relationship between speech understanding and the electroacoustic parameters of frequency response, effective bandwidth, and harmonic distortion in a sample of 21 commercially available hearing aids.

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

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

G. Donald Causey, Ph. D., Earleen Elkins, Ph. D., Ronald Rayburn, and Eleanor Wintercorn

For the portion of this study related to discrimination ability with hearing aids, preliminary steps have been taken regarding the recording of new speech discrimination materials. The selection of Peterson and Lehiste's CNC monosyllables was made after exhaustive search and comparison of available intelligibility word lists.

Trial recordings of potential speakers led to the selection of a 30-year-old male with general American dialect and adequate vocal flexibility to perform the recording task. This speaker is currently undergoing practice in vocal monitoring.

The necessary electroacoustic instrumentation which includes microphones, preamplifiers, and tape recorders, is being assembled and calibrated according to the standards of the recording industry outlined by the National Association of Broadcasters.