

## **ABSTRACT OF SUMMARY REPORT ON THE DEVELOPMENT OF A READING MACHINE FOR THE BLIND\***

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This report describes the progress from July 1, 1970, through June 30, 1971, on the development of personal-type reading machines for the blind sponsored by the Veterans Administration, Prosthetic and Sensory Aids Service.

The most advanced personal-type reading machine being developed by Mauch Laboratories (the Cognodictor) provides the blind user with the "spelled speech" equivalent for each upper and lower case letter or ligature scanned by a hand-held optical probe. The first Cognodictor design used the "multiple snapshot" character recognition technique which recognizes most popular type fonts with moderate accuracy (90-95 percent) and speed (80-90 words per minute) by using a special arrangement of CdSe photoconductors to sense letter features. The development of the hand-held probe for this machine also resulted in a family of direct translation reading aids which are pocket-sized and battery-operated and may be used independently for low-speed reading. These are the Visotactor A and proposed Digitactor (which may be used for recognition also) and the Visotactor B which are "tactile optophones" with one or more columns of photocells and associated stimulators, and the Visotoner which is a nine-tone self-contained optophone. (See the Bulletin of Prosthetics Research, BPR 10-12 Fall 1969, pp. 243-271.)

During this report period, the first three Cognodictor prototypes and associated Visotactor A's were loaned to users in Dayton, Ohio; Hines, Illinois; and Winnetka, Illinois; in addition to being tested at Mauch Laboratories. Many improvements were made. For several months, Mr.

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\* Based on work performed under VA Contract V1005M-1943. For a copy of the complete report, write to: Editor, Bulletin of Prosthetics Research, Research and Development Division, Prosthetic and Sensory Aids Service, VA, 252 Seventh Avenue, New York, N.Y. 10001.

Lauer at Hines used a *Visotoner* with one of the *Cognodictors* and reported reading at a 50 word-per-minute rate. For most users, the factors which limited reading speed were the requirement for accurate tracking of the line of print, recognition errors for upper case letters and for poor quality print, and the 75 wpm limitation imposed by the current "spelled speech" recordings. At times, excessively rapid line scan caused both recognition errors due to the slow response of the photoconductive cells and loss of letters due to the limited storage capacity (eight letters) of the Word Storage Unit.

After careful study of possible ways to eliminate these shortcomings, the "two dimensional multiple snapshot" recognition technique was devised. At the end of June 1970, a breadboard model of a *Cognodictor* using this system was about 25 percent completed and a photocell array containing 52 small cells had been fabricated. The report describes this recognition technique and its benefits. Methods of speeding the output code including the development of a Contracted Spelled Speech (CSS) are also discussed. Improvements in the photocells and input circuits will make line scan rates of 200-300 words per minute practical.

Several improvements in *Visotactor/Visotoner* designs were made. Ten additional power supplies were built and shipped to the Hines VA Hospital for distribution.

Miss Jameson in London and other participants in St. Dunstan's research program continued to use *Visotoners* and *Colineators* satisfactorily. Mrs. Deal in Dayton started teaching Mr. Ron Abrams to read with the *Visotactor B* and he had completed one-half of the Battelle course at the end of June 1970.

The *Digitactor* is a direct translation reading aid which contains one or more columns of tactile stimulators which will fit and stimulate the underside of one or more fingers on either hand, the same hand which scans the page. In addition, the *Digitactor* will produce electrical signals suitable for being fed into either a personally owned recognition machine with a spelled-speech output (*Cognodictor*) or a central library computer with a machine-speech output. Several designs for the *Digitactor* were considered during the report period and a *Digitactor* breadboard prototype will be built in the near future.