Communication aid for nonvocal handicapped people

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Abstract—A communication aid of the scanning type has been developed for nonvocal handicapped people. The aid is portable and battery operated, with an electronic memory for short-term message storage and a coded output for hard-copy messages. Control of the aid is achieved by presenting a logic 1 or 0 at the appropriate input terminal. The aid may be therefore controlled by a variety of control transducers.

1 Introduction

In today's society, the ability to communicate properly and effectively is of paramount importance. Thus there has been increasing emphasis on providing communication aids for severely handicapped people. An excellent bibliography of the institutions working in this field and of the aids developed has been provided by the University of Wisconsin*. Although the aids vary from each other in specific detail, they may be placed into three broad classes.

(a) Direct-selection type: The communication symbols are presented on a board and the user indicates the desired output directly. Aids of this type may range from a simple Blissboard† to a sophisticated system such as the Auto-Com (VANDERHEIDEN et al., 1974). For this class of aids it is implied that the user has sufficient motor control to point to the desired symbol location.

(b) Coding type: The user indicates the desired symbol, alphabet, word etc., by means of a code, e.g. Morse code, ASCII code etc. Since it is necessary to learn a code, these devices are usually specific to persons who know the particular code.

(c) Scanning type: As in the direct-selection type, the symbols are arranged in a matrix. The user, however, is able to move an indicator or cursor to the proper matrix element. The indicator is usually moved by activating a switch and, therefore, patients with limited motor control are able to control the aid.

This paper describes a lightweight, portable communication system, which is of the scanning type. The unit was designed for use by a 19-year-old person who was injured in an automobile accident at the age of 12. The person has no speech and is totally immobile save for gross motor control of one arm. Intellectually, the person is able to function fairly well, limited primarily by an inability to communicate effectively. At present, the person communicates by having people, such as the therapist and teacher, scan the desired English alphabet on a 5 x 5 matrix and stopping, on a visual cue, when the desired alphabet is reached.

Although the system was designed for this person, the general design specifications were such as to make the system applicable to other nonvocal handicapped persons, e.g. cerebral-palsy victims, adult stroke patients etc. These general specifications were:

(i) The system should be portable and relatively inexpensive, so that it may be used in a home setting as well as in an institution.
(ii) There should be a capability to change the communication symbols so that the system could be operable in any language or any symbol system.
(iii) The number of symbols presented on the display should be variable to accommodate users with different sizes of vocabulary.
(iv) The system should interface readily with standard output devices, such as an electric typewriter, teletypewriter, television etc.
(v) The user should be able to store messages in an electronic memory. This, along with feature (iv), provides the user with the capability to write messages without the need for constant attention.

General features and operation of such a system are described in the next Section. This is followed by a description of the circuitry.

2. General features and operation

A prototype of the device is shown in Figs. 1, 2 and 3. Primary emphasis in the design was on portability and, therefore, the unit was constructed in an attaché-case arrangement.

Fig. 1 Front view of the communication aid

The display board is divided into two parts, each consisting of a 16 x 8 matrix with 20 mm square elements. Each element has an i.e.d. in the upper left-hand corner, which serves as an indicator. The i.e.d. matrix is overlaid by a transparent Ozalid sheet, which has the desired communication symbols. The sheet is held in place by two metal strips and thus may be easily changed. This facilitates the matching of the symbols to a particular user.

Fig. 2 Rear view of the communication aid

Fig. 1 shows a particular set and arrangement of symbols. The symbols in the 16 x 8 matrix on the left were chosen for a specific patient while the right matrix contains the symbols found on a standard teletypewriter keyboard. These symbols have an ASCII coded output at the rear, and therefore can be used to communicate with any device that accepts an ASCII code. The code is stored in a programmable read-only memory (p.r.o.m.), which may be reprogrammed to other codes.

The total number of matrix elements is 256.

However, especially when a patient first starts to use the aid, it may be desirable to work with a smaller set of symbols. The matrix size that a patient works with is controlled by means of two hexadecimal switches at the rear. These switches set the matrix dimensions, e.g. 1 x 4, 5 x 3, 9 x 9 etc., and, therefore, as a user's vocabulary is expanded the matrix size may be increased accordingly.

Patient control of the unit is achieved via an interface plug at the rear. By presenting at logic 1 to one of five inputs, the unit may scan in the UP, DOWN, LEFT, RIGHT directions or WRITE a chosen matrix element into an electronic memory. The WRITE command may also present an ASCII coded output of the matrix element. A logic 0 at the inputs puts the unit in a standby mode. Since all that is required is to present a logic level of 1 or 0, the inputs may come from a number of transducers such as a joystick and head control unit.

When a user has scanned to a desired location,