Aids for the Visually Handicapped

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Those without vision have obvious problems with reading and mobility. It is less obvious that blindness results in a serious lack of privacy; for instance personal financial information may have to be read to one. The general public tends to assume that blind people are those without sight; however over 85% of the registered blind have some useful vision.

Television reading aids. The main technological development for those with residual vision has been closed-circuit television reading aids (Fig 1). These devices usually provide variable magnification, enhanced contrast and image reversal (white letters on a black background), but the disadvantages include the cost (from £800 to over £3000) and the weight of the machines (typically 25 Kg). Despite these disadvantages they have proved to be very useful aids for those whose needs have not been met by conventional optical aids; there are now thirty-eight models commercially available (ref 1).

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A recent need has been for magnification of visual display units. The simplest solutions are to use conventional low vision aids such as spectacle-mounted telescopes or to substitute alarger screen in the visual display unit. A television reading aid gives higher magnification but severe striation effects can appear if the two images are out of synchronisation. A number of special terminals with large character visual displays have been developed but at prices in excess of £4000.

Tape recorders. For users with no useful residual vision, aids

for access to written information have either audio or tactual output. Probably the most useful technical aid is the cassette tape recorder. The main disadvantages are the user's inability to vary the speed, and the lack of a good indexing system. The variable speed problem can be overcome by using 'compressed speech' modules which correct the pitch changes resulting from increasing the speed. This is done by sampling the signal and discarding some of the samples; the electronic processing links the remaining samples without unpleasant transients. Another application of this technology is audio communication with deep-sea divers who are breathing helium; the helium makes their voices very high pitched and difficult to understand.

The indexing problem is not so easily solved. What is required is an inexpensive system so that the blind user can input a number or keyword, and the machine will then automatically find the information; such systems exist but they are prohibitively expensive. A less satisfactory solution is to record index terms on another track but this is laborious to use.

Synthetic speech. A variety of devices with speech output are now commercially available. The simplest use spelled speech where the output is character by character; the advantage is the very low cost, but the quality is unacceptably low for any application involving prolonged listening. The quality of full vocabulary synthetic speech, where the machine approximates a human speaker, is dependent on the size of the computer program, but high quality synthetic speech systems are still expensive.

The major breakthrough has been in the medium quality systems; there are now a large number of full-vocabulary speech output devices with computer interfaces with prices from about £150. These devices are very useful for blind people wanting a file read out and being prepared to tolerate the Dalek-type speech. However many blind people want to use a microcomputer in a word-processing mode; the available speech terminals, with cursor information, cost in the order of £4000 which is a large increment in cost for a small increment in performance.

A reading machine with optical character recognition and synthetic speech output permits a blind person to have direct access to printed books, but costs in the region of £23,000; costed over five years, it might be cheaper to employ a sighted reader. However the cost of such machines should decrease significantly over the next few years.

Braille. The best known communication medium for the blind is braille where dots are embossed on paper or plastic. The system was developed over 150 years ago by a blind Frenchman Louis Braille. Braille utilises a six dot cell giving sixty-four possible combinations. One of the disadvantages of braille is the considerable bulk which is typically twenty times that of the print version. To reduce this bulk, 190 contractions and abbreviations are used which result in 25% saving in space. There is an acute shortage of people skilled in transcribing braille, so a number of computer-based systems have been developed to translate text to contracted braille. Such systems permit a typist with no knowledge of braille to produce documents in both ink-print and contracted braille from a single typing operation (Fig. 2).

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Computer-based systems are significantly cheaper than manual transcription for information which already exists in digital form. For instance major banks in the UK use an automated system to produce statments of account in braille (Fig 3). Since the system is totally automated it also minimises the risk of an error in the braille version.

(insert Figure 3 here)

Braille has not been superceded by other forms of non-visual media despite numerous predictions to the contrary; braille is still supreme in its use for reference and technical material. Another important aspect is that a blind person can write braille

without having to invest in expensive equipment.

A number of systems have been developed for storing braille digitally on cassette or floppy disc (Fig 4). The braille is output on a transitory display such as an array of pins which can be raised to represent the braille characters. These devices typically cost £5000, so they are beyond the reach of most blind people for use at home.

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Reading machines. Devices have been developed for converting printed characters to some form of tactual output. Most of these devices do not recognise the characters but present a tactual display which has to be recognised by the human reader. The most widely used is the Optacon which gives an enlarged tactual image of the letter being scanned (Fig 5). The advantage of this device is that it can be used on any printed or typewritten material. The disadvantages are the considerable training and practice required to reach speeds of 50 words per minute, and the cost of about £3000.

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A recent development has been the Viewscan which, like the Optacon, has a hand-held camera and has a 7000 pixel orange neon display (Fig 6). The application of this device has been limited by the users having difficulty in learning to track the camera across the page, and the colour of the display being difficult to see for those with certain eye disorders.

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Large print. As mentioned earlier most of the registered blind have residual vision, but it is only very recently that modern technology has been used to produce reading material for this