Displays for Network Terminals for Use by Visually Disabled Persons

J M Gill
Royal National Institute for the Blind, England

At present few visually handicapped persons find it essential to use a network terminal in a public place. For instance, there is not usually a financial penalty in withdrawing money via a bank cashier instead of using a cash dispenser (automatic telling machine). However it is anticipated that within five years in many cases there will be no viable alternative to using a network terminal. Another factor affecting the urgency of the situation is that the rate of progress in developing special adaptations for the visually handicapped is considerably less than the general rate of introduction of high technology for use by the general public.

1. Tactual displays

Estimates for the number of people who read braille vary but are usually in the range 10,000 to 15,000 in the UK; the number of *registered blind* is 145,000 and the estimated number of visually disabled persons is 300,000. A significant factor is that in many developed countries the largest single cause of blindness among those of working age is diabetic retinopathy which often results in a poor sense of touch.

Another tactual system is Moon which was invented by Dr William Moon in 1847. This system is based on embossed characters similar to Roman capital letters. It is claimed that this is easier to learn, but it is typically four times the volume of the equivalent text in braille. The only significant use of Moon is in the UK where there are about 1000 regular users.

Hardcopy output of braille (ie braille embossed on paper) is little used for interactive communication with network terminals although systems have been developed for outputting textual data from teletext and viewdata systems; as yet, there has been no satisfactory solution to the problem of embossed versions of the graphical representations used on these systems. Softcopy (transitory) braille displays have been connected to a range of terminals; this is not technically difficult if the terminal has a standard interface such as RS232.

However the increasing use of icons and pull-down menus creates serious problems for those relying on non-visual displays. No solutions have been found to overcome this problem and, more seriously, there does not appear to be any ongoing research likely to lead to a solution in the forseeable future.

2. Audio displays

The simplest form of synthetic speech device outputs in *spelled speech* where each character is pronounced separately. A slightly more sophisticated variant is *compiled speech* where the device stores digitally a limited vocabulary of words and phrases, and spells out words not in this vocabulary. Full vocabulary synthetic speech is easier to implement in phonetic languages (eg Serbocroat) than in the romance languages (English, French, Italian). One problem is homographs where words are spelt the same but pronounced differently (eg *resting* could be *rest-ing* or *re-sting*). The more powerful speech synthesisers have larger exception tables and more sophisticated algorithms which incorporate some rules of context.

Many older visually disabled persons have a hearing loss; the most common is in the two to five kilohertz range. This means that for this group it is easier to hear a male voice than a female one. However many of the existing synthetic speech output network terminals for use by the older visually disabled person (eg talking bus-stop) use a female-sounding voice since it is *nicer* to listen to.

Graphical audio displays have been developed where the horizontal coordinate was represented by time delay and amplitude of the signal and the vertical coordinate by frequency (Black, 1968). Fish and Beschle (1973) also used frequency for representing the vertical position of the scan but interaural differences for the horizontal. Phillips and Seligman (1974) developed a multi-dimensional auditory display in which frequency, amplitude and timbre were all utilised. Other variants include the use of a mouse to indicate position within the two-dimensional display area. However none of this work has produced an auditory

display which can be used in practice in conventional network terminals.

3. Large character displays

Large print books have been in use for many years; early examples include books large enough to be read by a whole church choir. Recent developments have concentrated on decreasing the cost of producing text in high quality large print; the decreasing cost of laser printers has been the stimulus for these developments.

The image on a visual display unit can be enlarged using conventional optical aids; these can be hand held (eg hand magnifier), mounted on the display (eg bar magnifier mounted on sliders) or head mounted (eg spectacle magnifiers). An alternative is to use closed circuit television reading aids. If a television camera is pointed at a television display, severe striation effects usually appear on the monitor because the two pictures are out of synchronisation. This can be overcome by connecting the camera to the display so that the two systems scan in synchronisation. However it is not always easy to obtain access to the synchronisation signal in the visual display unit.

On terminals for individual use, it is sometimes possible to connect a special display; this could be a larger monitor or a line display with large characters made up from a dot matrix. On personal computers, special software can be used to give larger characters on the monitor. However with computers which are IBM-compatible it is preferable to use plug-in boards which can selectively enlarge part of the screen without requiring any modification to the software package; these systems usually use a mouse or joystick to move the *window*.

For personal computer systems, the character size and colour of the display can usually be chosen to suit the individual's needs. On public terminals the display characteristics are pre-determined. One suggestion has been that for ATMs (cash dispensers) with CRT displays the user's card could be coded with information about their preferred display format.

4. Remote Activator (REACT)

Visually handicapped persons are likely to have considerable problems with the next generation of machines used in public places. One proposal, at the workshop, was that a small device (transponder) could be used to indicate the presence of a visually handicapped person. The device would be carried by the blind person in a pocket and have a very limited range (a few metres). Applications could include:

(a) at a light-controlled pedestrian crossing, it could activate the audio signal and increase the time allowed for crossing the road.

(b) with multi-destination ticket selling machines, it could activate speech output.

(c) in railway stations, it could be used to activate a synthetic speech message about the destination of the train from that platform.

(d) with passenger controlled doors on underground trains, it could activate an audio signal.

(e) at automatic barriers, it could allow more time for the guide dog and blind person to pass through.

(f) at cash dispensers, it could activate audio prompts.

(g) at entry control points, it could activate an audio signal for locating the keypad.

(h) at public telephones, it could activate a location signal.

(i) at road works on a pavement, it could activate an audible signal warning of the hazard.

References

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