Information Technology and Visual Impairment: New Developments

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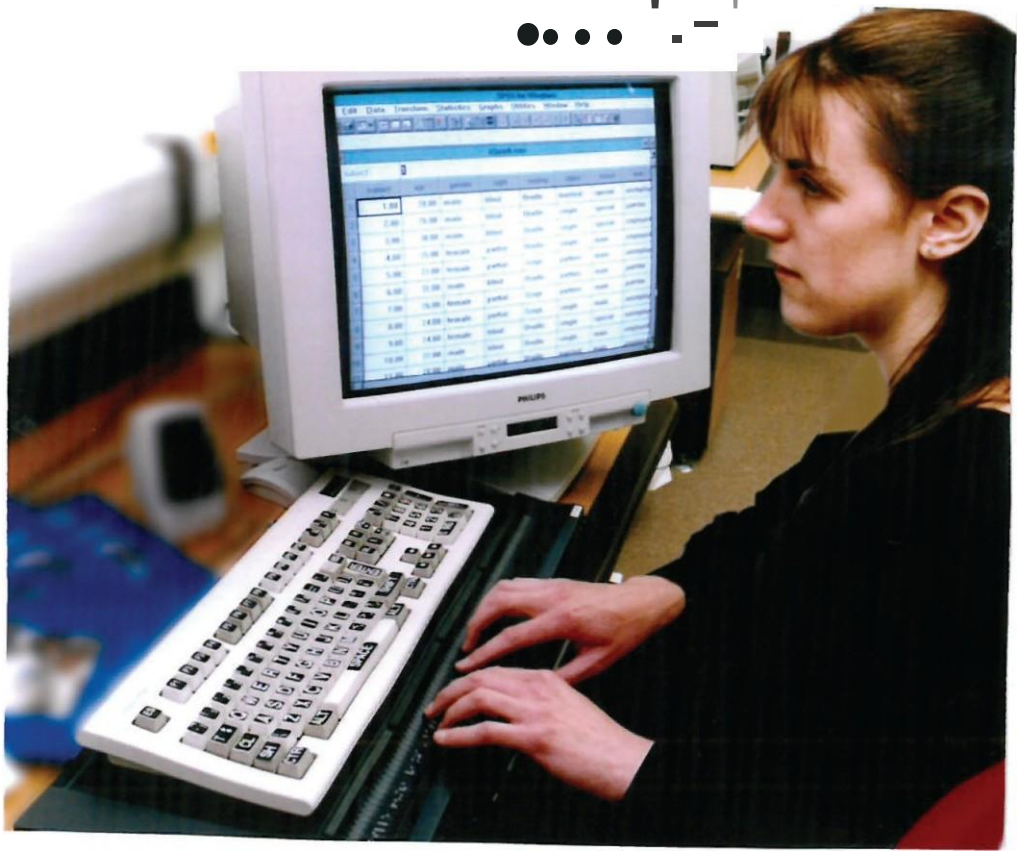
Fiona, a severely visually impaired graduate pictured here, has like many other blind students, been unable to access independently specialjzed computer software such as the Statistical Package for the Social Sciences (SPSS), as part of her undergraduate and postgraduate universjty career in psychology. To succeed with four separate projects, she had to seek assistance with statistical analysis from sighted lecturing staff and students.



However, the arrangement shown here now allows Fiona to analyse research results without assistance. She accesses the SPSS screen depicting research data by using her fingers to read across the refreshable Braille display.

The number of visually impaired students studying in further and rugher education is rising in all industrialised countries. In Britain alone, there are now thousands, and a significant number have no useful sight for study

purposes. For many, the solution to accessing information has been to develop a high degree of skill in non-sighted study methods such as Braille and speech synthesis.

Access through Windows

For some years, these solutions were largely confined to a narrow range of DOS applications in word-processing . More recently, the development of non-sighted access has followed the shift to Windows packages such as Word for Windows but has lagged somewhat behind the mainstream development.

Recent advances in speech and Braille access solutions have enabled blind students to work independently on the most popular applications which generally underlie university studies: Microsoft Word and WordPerfect, Excel, Internet Explorer and Eudora. More specialised applications, such as SPSS, are often required by curricula but have still to be included in such advances. This is because the more specialised programs lack customised interfaces which link them to the Braille and speech solutions.

The simple 'left-to-right' strategy of artificial reading programs breaks down when used with packages reliant on windows and menus that can appear all over the screen. The advances in computer interface 'visualisation' are designed to facilitate computer use for sighted users, but turn out to hinder visually impaired users. Blind students cannot access SPSS.

Reading SPSS

SPSS was first designed at Stanford University in 1965 and has developed over the years into a highly sophisticated, international data management package. A Windows application dates from 1993. SPSS in social sciences is an almost universally used tool across educational institutions.

Very recently, Braille solutions have been applied in some British and German universities as an experimental way to access SPSS (see picture), but these are not yet generally available. Braille allows the user to read and review information at his or her own pace, examining it character by character if necessary.

The hardware solution, such as Powerbraille, is attached to the computer through a serial or parallel port. A 'parallel pass through' allows the parallel port to be used simultaneously for attachment to other peripherals such as a printer or embosser. The Braille display uses eighty Braille cells (each with an eight-dot Braille display) corresponding to 80 characters on the screen. A 40 cell display option is also available for portable use with laptops. A refreshable set of Braille pins rises and falls in the Braille cells as the user reads the PC screen display.

Screen reading software such as JAWS for Windows (Jobs Access With Speech) takes information from the screen line-by-line and sends it to the Braille array through the serial or the parallel port. It enables the user to navigate around and read the PC screen by means of the Braille display, presenting the visual screen in tactile form.

The refreshable Braille array can be configured to give vital information over and above character sequences; information such as cursor position, presence of tabs and whether text is highlighted or not. The system can be used with Windows 3.x, Windows 95, 98 and NT. Intandem with Powerbraille under Windows 3.x, blind university students in Scotland have recently used screen reading software successfully with SPSS.

Feeling or hearing

Visually impaired students who have not learned Braille but need to utilise a non-sighted study strategy will have to rely on speech output by means of a speech synthesiser connected to the computer's built-in sound card. Over the last two years, the University of Glasgow has worked on the speech configuration of the DOS (less user friendly) and Windows versions of SPSS.

A trial of Jaws version 3.2 with SPSS version 7.5 has been performed under Windows 95. The trial followed the configuration of some non-standard features, such as unlabelled buttons to which labels were assigned allowing a more intelligible interpretation of these buttons. Speech output is reasonably fast, for instance when compared to Braille, but speech solutions need more keyboard interaction and special awareness in relation to the screen layout. This becomes particularly evident when using tables, both when constructing data as input to a statistical procedure and when reading the output of statistical analysis.

Instead of reading tables in an intelligent (or flexible) way, screen readers read the table line-by-line. This presents an almost insurmountable problem for visually impaired users ifthe output tables are non-standard. One possible solution would be to transfer the SPSS output tables into a spreadsheet (for example Excel) for which configuration files already exist in many screen readers. However, this is not an ideal solution because the user then has to manoeuvre back and forth between two applications. Transfer of additional descriptive information not included in the SPSS tables themselves could also be problematic.

Reading tables

Blind users need clear horizontal and vertical markers for navigating around a matrix, and need the technical capability to do this flexibly. This is a problem that cannot be addressed simply by adding speech output to the existing program. The constraints of human memory mean that it is going to be difficult for blind students to process matrices of data of any non-trivial size.

Sighted students may look at a matrix and examine it for interesting patterns (for example, do the numbers in the top right look larger than those in the bottom left?). This type of data perusal is difficult for blind students. Glasgow University's Psychology Department is investigating these problems currently with a view to reducing the load on the user's working memory, and hence making tables more accessible to blind people. Interface visualisation reduces the load on sighted users, and we are investigating analogous devices in the auditory and tactile domains.

The configuration of a screen reader remains the most labour intensive part of any interface design. Most applications are not written with screen readers in mind. The onus lies with the screen reader's authors to configure it for as many applications as possible. Some screen readers cope better with the unconfigured state of SPSS than others. However, because of many non-standard features in SPSS, some configuration work always needs to be undertaken whichever screen reader is used. For example, macros have to be written for JAWS by Access software specialists, while Window-Eyes' setfiles can be created relatively easily by users. These con.figuration files are designed to load automatically when changes are detected on the screen.

Continuing updating

Some screen readers give only speech output, some others allow both speech and Braille. For example Screen Power for Windows and JAWS for Windows provide both tactile and audio access to Microsoft Windows. The user can decide whether the information should be spoken or shown on the Braille display. Screen readers where users can easily choose the output medium seem to be more appropriate in university settings where some blind students will need speech access to SPSS and others to Braille access.

Progress at linking SPSS to access technology has been greatest in relation to personal computer Braille displays. Braille emulates the spatial configuration of the SPSS screen more accurately than speech. On the other hand, speech solutions are cheaper and easier to configure but create major challenges when encountering data which is not well structured as a left-to-right, one-dimensional array.

Both systems have to be updated continually and adapted to keep pace with ongoing progress in the SPSS application. At the same time though, it is important to make visually impaired students aware of the developments in accessing SPSS so that they can study as independently as possible alongside their sighted classmates.

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