HCI-Specialised Devices

Techniques to make computer systems **more accessible** to users with **disabilities** such as impaired mobility (or dexterity), hearing loss or reduced visual acuity are a paramount concern; the goal should be nothing less than **universal access**.

It is important to consider Specialist needs or specialist uses eg input or output for the visually, orally, aurally or physically challenged, remote control devices, head up displays

Graphical User Interfaces (GUI)
These are now the standard interface for modern operating systems. Although they generally rely on mouse and keyboard, some have voice recognition software that allows the operating system to respond to vocal commands.

This is particularly useful to those with limited mobility. In addition, narrator software is also present to describe events and options on screen for those who are visually impaired.
Both aim to improve equal opportunities among users.

Measure the GUI- A Scorecard

Criteria	Yes or No
They are very user friendly	
They are easy to configure to suit different user's preferences.	
They provide comprehensive input device support	
There's no need to remember complex CLI instructions	
They make computer systems more accessible to those with disabilities	
No need for users to understand 'behind-the-scenes' technical issues	
Basic operations can take longer to perform than using the CLI for an expert.	

On the negative issues graphically-intensive GUIs require faster processing:
This can make them slow to respond on less powerful hardware and newer operating systems require more hard disk space to install. They also need greater system resources (processor, memory etc.) to run

Disability	interface
Visual impairment	**Font magnification** – enlarges the screen (or 'zooms in' on sections of it) **Narrator** – describing what is happening on the screen **Text-to-speech** – converting written text into spoken words (screen reader) **Display settings** – high contrast colour settings improve readability
Hearing impairment	**Closed captions** and subtitles on video **Visual alerts** as well as error 'beeps' to indicate a problem **Speech-to-text** using word recognition software
Physical impairment	**Key chords** using 'sticky' keys to slowly build a key-combination **Keyboard** for cursor movement as alternative to the mouse **Voice recognition** to control key elements of a user interface **Configurable keyboard** repeat and delay rates **Alternative** hardware devices to mouse such as: rollerball, joystick, mouth stick/head pointer, touch screen or eye-tracking

Outside of the detrimental effects of the normal aging process, it must always be remembered that potential users of a computer system may have disabilities that make traditional user interfaces difficult to use.

In these cases it is necessary to adapt interfaces and devices to accommodate users with physical or cognitive challenges. This is often referred to as using assistive technology (AT).

Types of disability

<u>Visual disabilities</u>
e.g. blindness or colour blindness
Screen-reading software for blindness. JAWS (Jobs Access With Speech). Colour cueing and high contrast for colour blindness.
Colour blindness (usually red/green but blue/yellow also exists) affects between eight and ten per cent of the male population. Rather than relying on colour coding alone to group elements or stress importance, use colour cueing (e.g. using other visual indicators such as underline).

High contrast display settings also work well.

 High Contrast example

Websites often employ cascading style sheets (CSS) which permit sitewide formatting of content. Such technology can be used to let the user select their personal colour preferences.
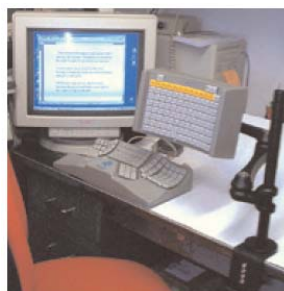
Text-to-speech systems are also popular solutions. AT&T has an online text-to-speech demonstration that is free to use. Simply type in your phrase and ask it to speak it out loud.

http://www.research.att.com/~ttsweb/tts/ demo.php

<u>Physical disabilities</u>
e.g. motor disabilities
Adapted input devices such as keyboards that use head/mouth

Hearing impairments
e.g. deafness, hard of hearing

The most common solutions to hearing impairments often involve the generation of additional visual stimuli to replace interface sounds (e.g. warning beeps, confirmation tones) that the user can't hear. However, this causes its own problems as it can lead to an overload of visual information that makes the user interface difficult to comprehend.

Speech disabilities
This mainly affects users who have to use some form of voice recognition software in order to use a computer system. Generally their disability may affect the loudness or clarity of their voice. The obvious solution is to provide an alternative input mechanism (e.g. a keyboard).

Telephone banking systems often use voice-recognition systems to validate bank account numbers or telephone numbers. When this isn't possible, the user should have the ability to input the information in another manner, e.g. using the telephone keypad itself.

Cognitive and neurological disabilities
e.g. dyslexia and dyscalculia attention deficit disorder (ADD)

Dyslexia (difficulty with written words) and Dyscalculia (difficulty with numbers and numeric calculations) make it difficult for some users to interpret information which is presented in a single format. In such case it is advisable to present the same information in a number of different formats, i.e. as text, as spoken words, as an animation. Each format will then reinforce the understanding of the other.

Users with learning barriers such as ADD need user interfaces that are simple, linear and without distractions (such as unnecessary links or flashing animations) in order to keep them focused.

Memory impairments
Short- or long-term memory loss may affect a user's ability to operate a computer system reliably. A well-designed HCI solution can help by making navigation and usage consistent; this can be achieved by keeping dialogues, screen layout and menu systems the same throughout. Colour-coded keyboards or keyboard overlays can also prove useful.