Human Computer Systems

Input/Output Devices

Input Devices

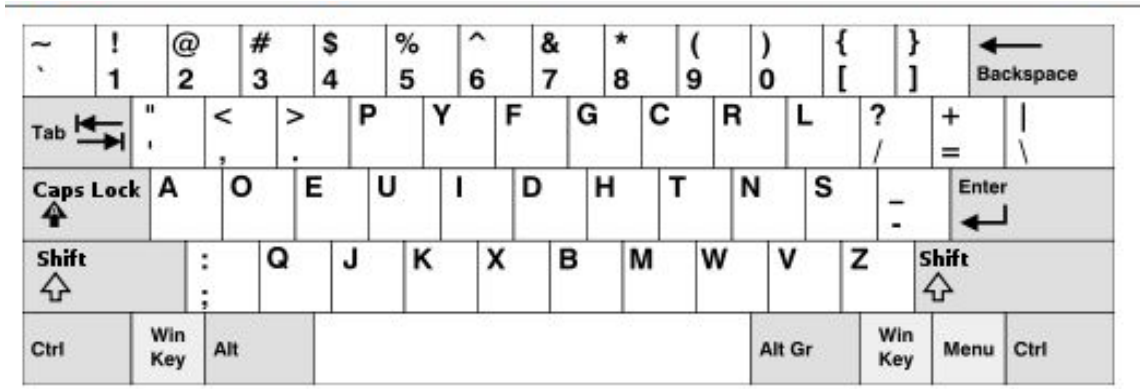
- definition " ***a device that, together with appropriate software, transforms information from the user*** "
- recording & entering data into the computer
- issuing instructions to computer
- users need to be able to communicate their intentions in a way that the machine can interpret

Input Devices

- Key aim in selecting input device & deciding how it will control events in the system is to help users carry out their work *safely*, *effectively*, *efficiently* and, if possible, to make it *enjoyable*
- Choice of input device should contribute positively to the usability of the system
- usability of a device depends largely on the provision of appropriate feedback

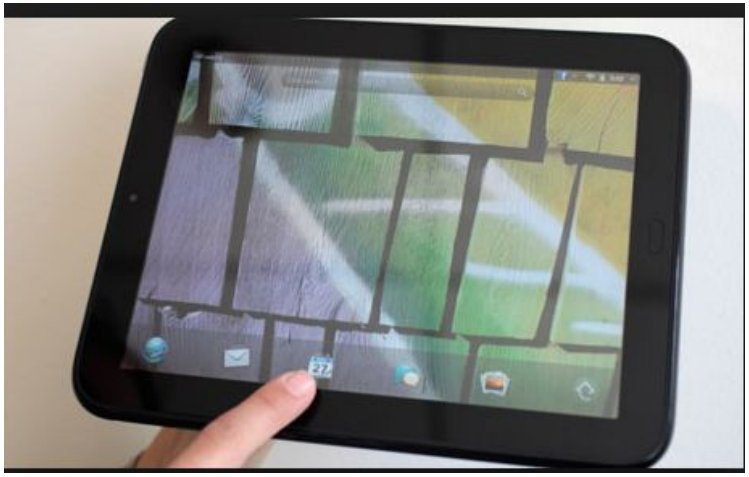
Input Devices

- Keyboards:
- Many types of keyboards to suit different situations (e.g. Dvorak keyboard), different layouts etc



Input Devices

- Positioning,pointing & tracking devices - most suit particular users or tasks
  - Mouse
  - Touchpad, Trackpad
    - Small touch sensitive tablets
    - ‘Stroke’ to move mouse pointer
    - Good ‘acceleration’ settings needed



Input Devices

- Joystick
  - Indirect
    - Pressure of stick = velocity of movement
  - Buttons for selection
    - On top or on front like a trigger
  - Often used for computer games
    - Examples
      - Aircraft controls
      - 3D navigation

Input Devices

- Eyes, heads & feet can control computers as well as hands (hands-free useful)
- Eyegaze
  - Control by eye gaze direction, e.g. look at a menu item to select it
  - Uses laser beam reflected off retina
  - Potential for hands-free control
  - Good accuracy requires headset but cheaper & lower accuracy devices available)
  - Problem: human's visual system is used for in- and output at the same time

Input Devices

- Gesture Interfaces
  - Positions or poses are compared to a stored set of defined gestures
  - Glove types differ in
    - Amount of sensors
    - Types of sensors
    - Resolution of the sensors
    - Sampling rate of the glove
    - Interface connection
  - More accurate than tracking devices
  - Problem:
    - Size of the users hand
    - Calibration needed

Input Devices

- Haptic devices :
  - touch, vibration & motion

Handwriting recognition

- Handwriting recognition & pen systems may become increasingly important for some tasks and users, but currently it is important to understand their limitations and the trade-offs that must be made in any given situation

Input Devices - Speech Recognition

- Speech recognition systems are very well suited to some tasks and environments, but for effective use, their strengths and weaknesses must be understood. Speech recognition is increasing in importance

Input Devices - disabled users

- Various input techniques & systems exist that can allow disabled users to control computer systems provided they can make some movement and perceive the system feedback.
- For these types of systems to be effective, careful consideration of the person and the task involved is required

Output Devices

- Provide information or feedback in a form perceptible by humans
- Visual output using a screen or VDU and hard copy from printers are common forms of output today, but other forms are becoming increasingly popular

Displays

	Small Scale	Medium Scale	Large Scale
Devices	• PDA's • Mobile phones	• Tablets • Notebooks • Single monitor configurations	• Multi monitor configurations • Projection-based display walls • Immersive VEs
Diagonal	< 0.1 m	< 1.5m	> 1.5m
Purpose	• Check emails • Personal navigation	• Working	• Entertainment • Large-scale visualization
Portability	• Developed for portability	• Can be portable (tablets) or immobile	• Mostly immobile
Limits	• Computational power • Display power, e.g. resolution	• Mostly single user systems	• For high resolution, arrays of smaller displays must be used

Output Devices - trends

- New trends and possibilities include:
- GUIs and multi-window systems
- Devices that can fit in a laptop or tablet
- vision, moving pictures, sound, and in some cases,touch are being combined in hypermedia e.g virtual reality and virtual collaborative Environments
- various forms of 3-D output are available for specialised purposes

Output Devices - trends

- the use of both speech and non-speech audio have become more common, with facilities for synthesized speech and synthesized/sampled sound now standard on many machines
- specialized forms of output that stimulate the sense of touch are available. Many are experimental, or for specialized markets, or disabled users (e.g. braille pads)

Head-Mounted Display

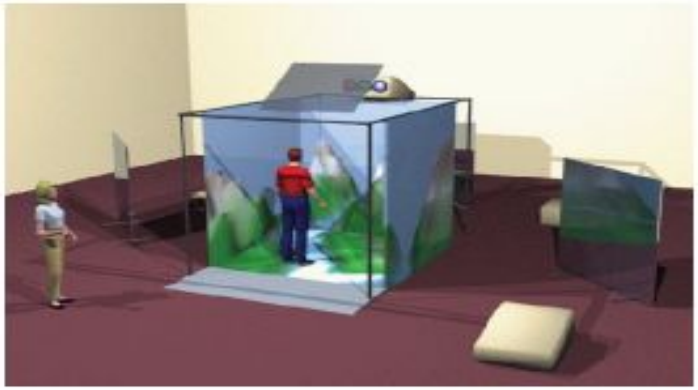
- Two small displays embedded in helmet or eye-glasses
- Pictures for left and right eye computed ("stereo")
- Together: 3D impression

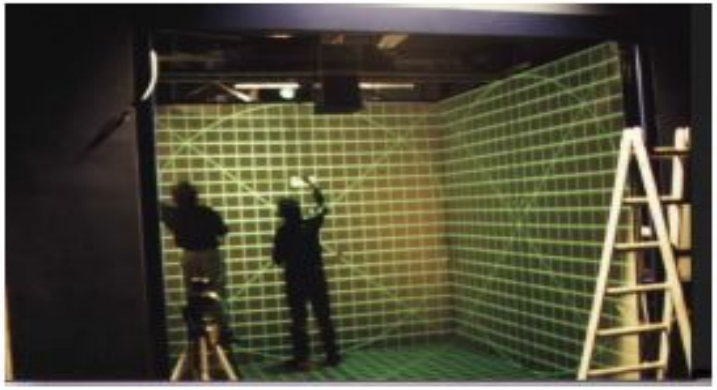
- Single user system
- Immersive, but low-res

Holographic Displays

CAVE (Cave Automated Virtual Environment)

- Projection-based VR system
- Stereoscopic shell display device





Visualization & Perceptualization

- Dynamic visualization is becoming increasingly important in particular application areas, such as the visualization of data, programs, algorithms, industrial processes, scientific phenomena, financial data and many other areas
- “perceptualization” is a general term covering the use of sound and touch feedback as well