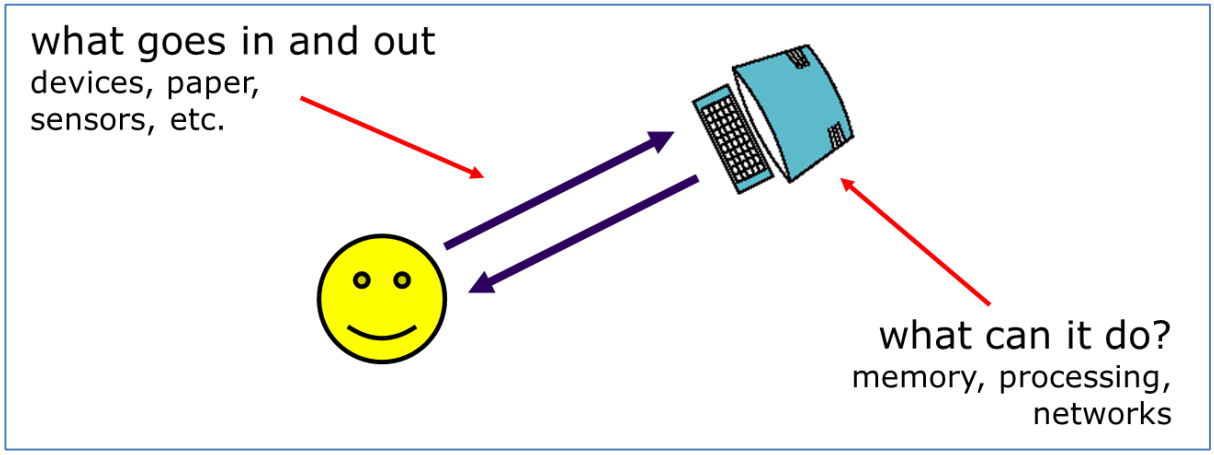
THE COMPUTER

In order to understand how humans interact with computers, we need to have an understanding of both parties in the interaction. This lecture considers the computer and associated input–output devices and investigates how the technology influences the nature of the interaction and style of the interface.

- **a computer system** is made up of various elements each of these elements affects the interaction

1. **input devices – text entry and pointing**
2. **output devices – screen (small &large), digital paper**
3. **virtual reality – special interaction and display devices**
4. **physical interaction – e.g. sound, haptic, bio-sensing**
5. **paper – as output (print) and input (scan)**
6. **memory – RAM & permanent media, capacity & access**
7. **processing – speed of processing, networks**

When we interact with computers, what are we trying to achieve? Consider what happens when we interact with each other – we are either passing information to other people, or receiving information from them. Often, the information we receive is in response to the information that we have recently imparted to them, and we may then respond to that. **Interaction is therefore a process of information transfer.** Relating this to the electronic computer, the same principles hold: interaction is a process of information transfer, from the user to the computer and from the computer to the user.



A typical computer system

Consider a typical computer setup as shown in Figure 2.1. There is the computer 'box' itself,

- a keyboard,
- a mouse and
- a color screen or monitor, on which there are windows

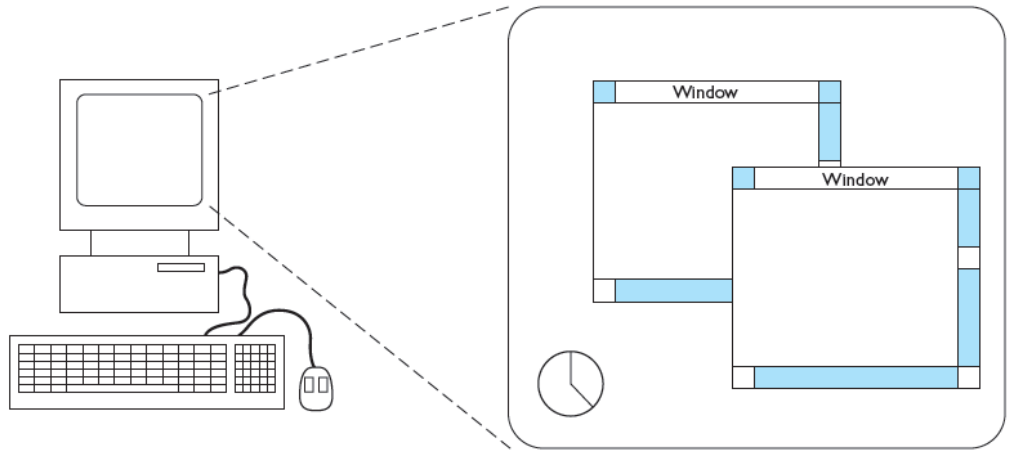


Figure 2.1 A typical computer system

The screen layout is shown along side it. If we examine the interface, we can see how its various characteristics are related to the devices used. Some of this variation is driven by different hardware configurations: desktop use, laptop computers, PDAs (personal digital assistants). Partly the diversity of devices reflects the fact that there are many different types of data that may have to be entered into and obtained from a system, and there are also many different types of user, each with their own unique requirements.

Notes

- the devices dictate the styles of interaction that the system supports
- If we use different devices, then the interface will support a different style of interaction

Levels of interaction – batch processing

In the early days of computing, information was entered into the computer in a large mass – **batch data** entry.

- There was **minimal interaction** with the machine: the user would simply dump a pile of punched cards onto a reader, press the start button, and then return a few hours later.
- With batch processing the interactions **take place over hours or days**.

In contrast Now most computing is interactive

- the typical desktop computer system has interactions taking seconds or fractions of a second (or with slow web pages sometimes minutes!). The field of Human– Computer Interaction largely grew due to this change in interactive pace. It is easy to assume that faster means better.
- the user in control (most of the time)

Richer interaction – everywhere, everywhen

Computers are coming out of the box! Information appliances are putting internet access or dedicated systems onto the fridge, microwave and washing machine: to automate shopping, give you email in your kitchen or simply call for maintenance when needed. We carry with us WAP phones and smartcards, have security systems that monitor us and web cams that show our homes to the world. Is Figure 2.1 really the typical computer system or is it really more like Figure 2.2?

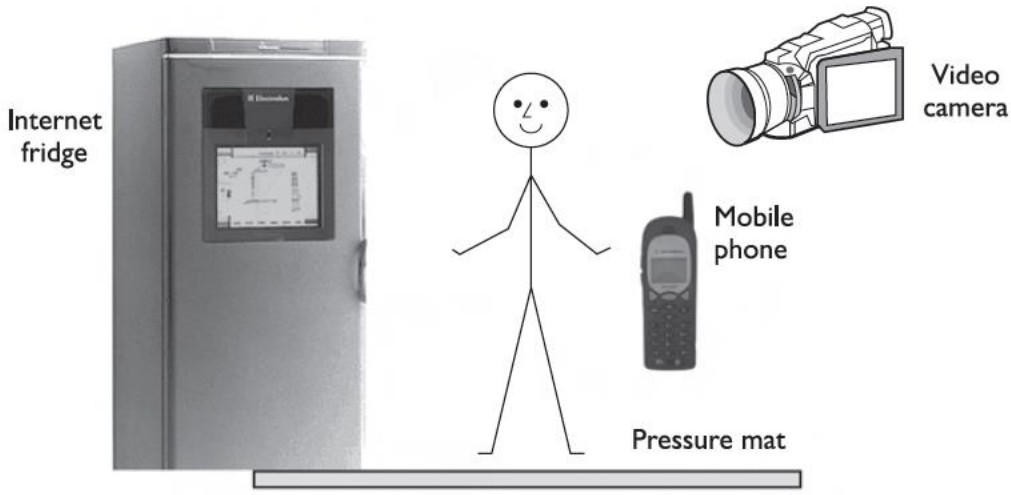


Figure 2.2 A typical computer system? Photo courtesy Electrolux

Input Devices: Text entry devices

1. The alphanumeric keyboard

The keyboard is still one of the most common input devices in use today. It is used for entering textual data and commands. The vast majority of keyboards have a standardized layout, and are known by the first six letters of the top row of alphabetical keys, QWERTY. Today, the keys can also be arranged in alphabetic order (the alphabetic keyboard), but this does not improve typing performance. The DVORAK keyboard does, placing the keys in a di¤erent order on a similar layout as found on the QWERTY keyboards. The layout minimized the stretch of .ngers and the use of weak fingers, reducing fatigue and increasing typing speed (10-15%).

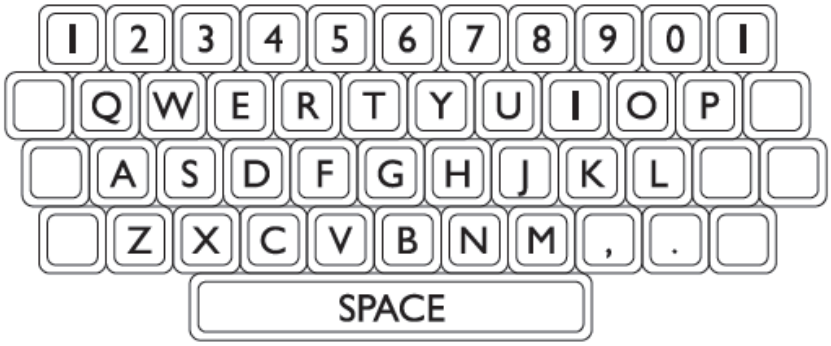


Figure 2.3 The standard QWERTY keyboard

Alternative keyboard layouts

Alphabetic

- keys arranged in alphabetic order
- not faster for trained typists
- not faster for beginners either!

Dvorak

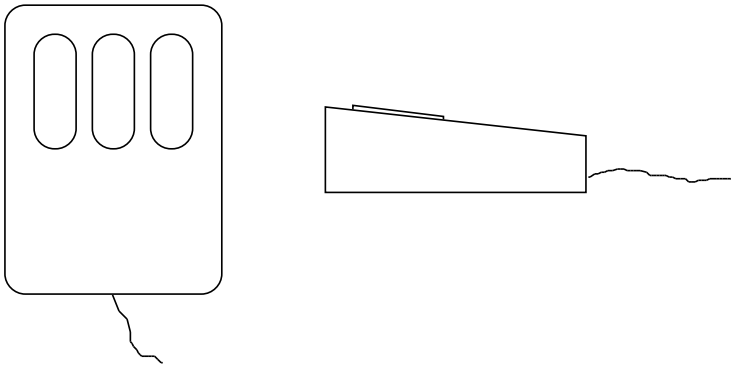
- common letters under dominant fingers
- biased towards right hand
- common combinations of letters alternate between hands
- 10-15% improvement in speed and reduction in fatigue

But - large social base of QWERTY typists produce market pressures not to change

Input Devices: Positioning, Pointing and Drawing

Central to most modern computing systems is the **ability to point at something on the screen and thereby manipulate it, or perform some function**. There has been a long history of such devices, in particular in computer-aided design (CAD), where positioning and drawing are the major activities. **Pointing devices allow the user to point, position and select items, either directly or by manipulating a pointer on the screen.** Many pointing devices can also be used for free-hand drawing although the skill of drawing with a mouse is very different from using a pencil. The mouse is still most common for desktop computers, but is facing challenges as laptop and handheld computing increase their market share. Indeed, these words are being typed on a laptop with a touchpad and no mouse.

1. Mouse



- Handheld pointing device
  - very common
  - easy to use
  - Two characteristics
  - planar movement
  - buttons

  (usually from **1 to 3 buttons on top**, used for making a selection, indicating an option, or to initiate drawing etc.)

Mouse located on desktop

- requires physical space
- no arm fatigue

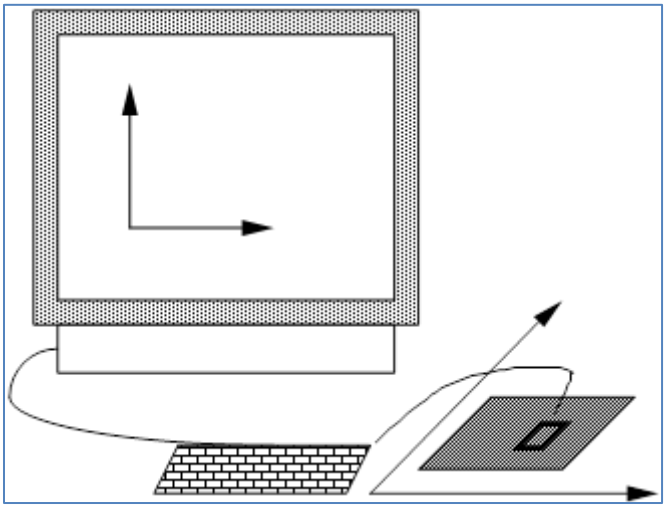
Relative movement only is detectable.

Movement of mouse moves screen cursor

Screen cursor oriented in (x, y) plane, mouse movement in (x, z) plane …

… an *indirect* manipulation device.

- device itself doesn't obscure screen, is accurate and fast.
- hand-eye coordination problems for novice users

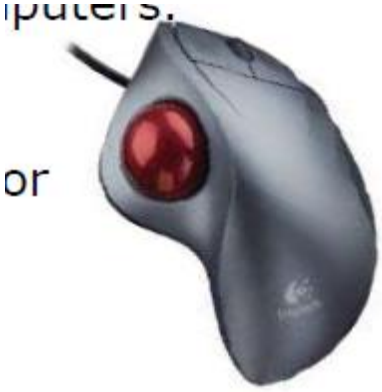


2. Touchpad

Touchpads are **touch-sensitive tablets**, operated by sliding the finger over it and are mostly used in notebook computers. Performance can be increased using accelerators.

3. Trackball and thumbwheel

A trackball is an **upside-down mouse**: instead of moving the device itself, the ball is rolled to move the cursor. Trackballs are often used by RSI users. Thumb-wheels (in 2 dimensions) offer less usability because they can only manipulate the horizontal and vertical movement of the cursor. 1-dimensional thumbwheels are often included on the normal mice the enhance the scrolling.



4. Joystick and keyboard nipple

There are two types of joysticks: absolute sticks, in which the position of the cursor corresponds to the position of the joystick in its base, and isometric sticks, in which the pressure on the stick (in a certain direction) controls the velocity of the cursor in that direction. Keyboard nipples are tiny joysticks that are sometimes used on notebook computers.

5. Touch-sensitive screens (touchscreens)

Touchscreens detect the position of the user's fiinger or stylus on the screen itself and are **therefore very direct**. They work by having the finger/stylus interrupting a matrix of light beams, making capacitance changes on a grid overlaying the screen or by ultrasonic reflections. It is a direct device: no mapping is required. However the selection of small area's is difficcult and intensive use can be tiring.


Start
acer