



chapter 2

Elements of traditional computer

The Computer

a computer system is made up of various elements

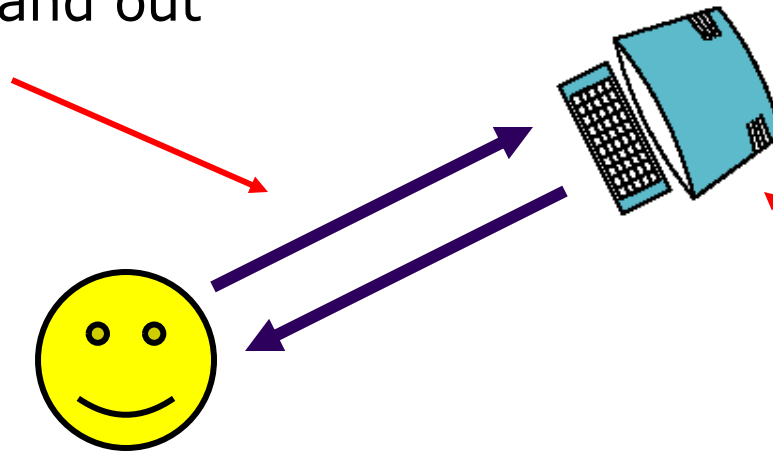
each of these elements affects the interaction

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

Interacting with computers

to understand human-*computer* interaction
... need to understand computers!

what goes in and out
devices, paper,
sensors, etc.



what can it do?
memory, processing,
networks

A 'typical' computer system



- screen, or monitor, on which there are windows
- keyboard
- mouse/trackpad

- variations
 - desktop
 - laptop
 - PDA

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



How many ...

- computers in your house?
 - hands up, ...
... none, 1, 2 , 3, more!!
- computers in your pockets?

are you thinking ...

... PC, laptop, PDA ??



How many computers ...

in your house?

- PC
- TV, VCR, DVD, HiFi, cable/satellite TV
- microwave, cooker, washing machine
- central heating
- security system

can you think of more?

in your pockets?

- PDA
- phone, camera
- smart card, card with magnetic strip?
- electronic car key
- USB memory

try your pockets and bags

Interactivity?

Long ago in a galaxy far away ... *batch* processing

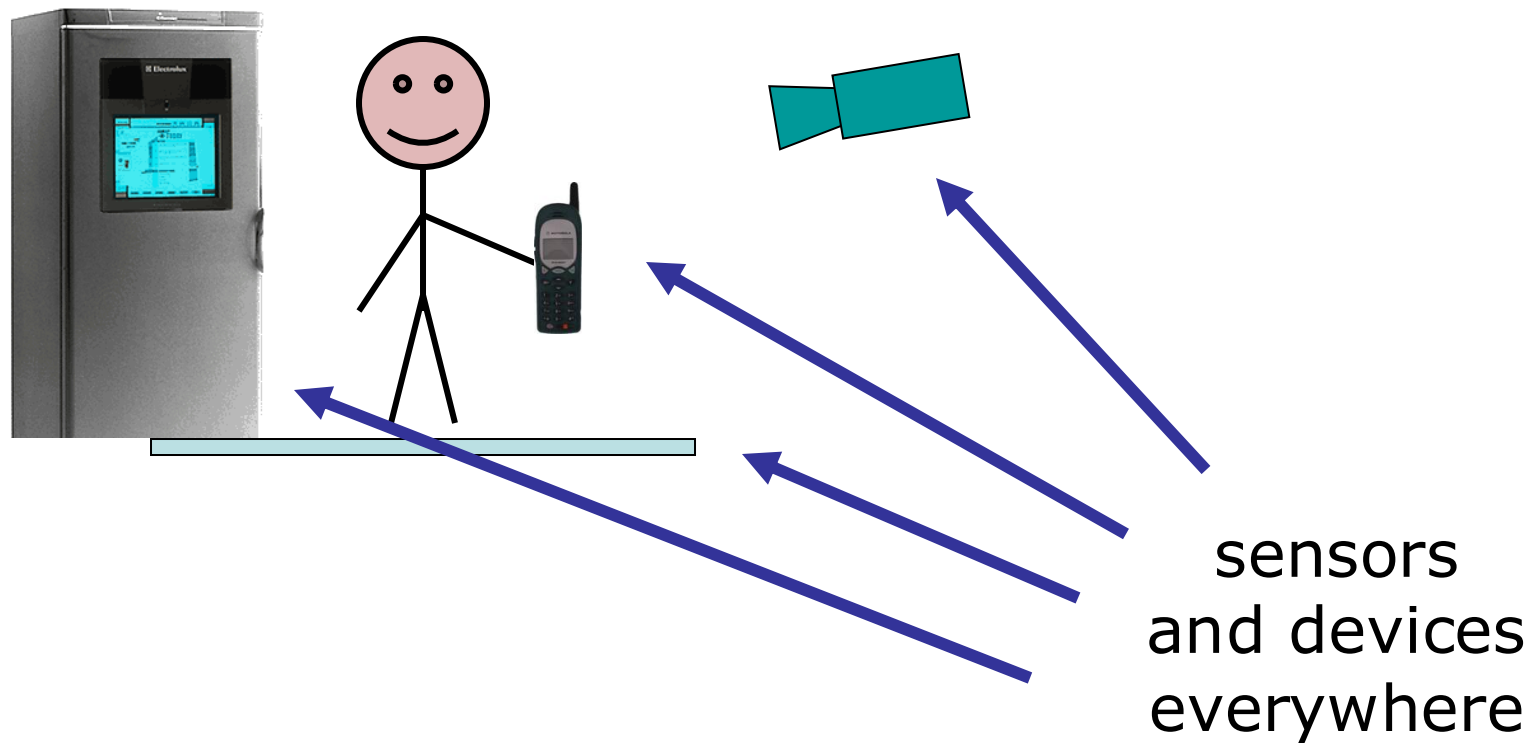
- punched card stacks or large data files prepared
 - long wait
 - line printer output
- ... and if it is not right ...

Now most computing is interactive

- rapid feedback
- the user in control (most of the time)
- doing rather than thinking ...

Is faster always better?

Richer interaction



text entry devices

keyboards (QWERTY et al.)
chord keyboards, phone pads
handwriting, speech

Keyboards

- Most common text input device
- Allows rapid entry of text by experienced users
- Keypress closes connection, causing a character code to be sent
- Usually connected by cable, but can be wireless

layout - QWERTY

- Standardised layout
but ...
 - non-alphanumeric keys are placed differently
 - accented symbols needed for different scripts
 - minor differences between UK and USA keyboards
- QWERTY arrangement not optimal for typing
 - layout to prevent typewriters jamming!
- Alternative designs allow faster typing but large social base of QWERTY typists produces reluctance to change.

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

special keyboards

- designs to reduce fatigue for RSI
- for one handed use
e.g. the Maltron left-handed keyboard



Chord keyboards

only a few keys - four or 5

letters typed as combination of keypresses

compact size

- ideal for portable applications

short learning time

- keypresses reflect letter shape

fast

- once you have trained

BUT - social resistance, plus fatigue after extended use

NEW – niche market for some wearables

phone pad and T9 entry

- use numeric keys with multiple presses
 - 2 - a b c 6 - m n o
 - 3 - d e f 7 - p q r s
 - 4 - g h i 8 - t u v
 - 5 - j k l 9 - w x y zhello = 4433555[pause]555666
surprisingly fast!
- T9 predictive entry
 - type as if single key for each letter
 - use dictionary to 'guess' the right word
 - hello = 43556 ...
 - but 26 -> menu 'am' or 'an'



Handwriting recognition

- Text can be input into the computer, using a pen and a digitizing tablet
 - natural interaction
- Technical problems:
 - capturing all useful information - stroke path, pressure, etc. in a natural manner
 - segmenting joined up writing into individual letters
 - interpreting individual letters
 - coping with different styles of handwriting
- Used in PDAs, and tablet computers ...
... leave the keyboard on the desk!

Speech recognition

- Improving rapidly
- Most successful when:
 - single user – initial training and learns peculiarities
 - limited vocabulary systems
- Problems with
 - external noise interfering
 - imprecision of pronunciation
 - large vocabularies
 - different speakers

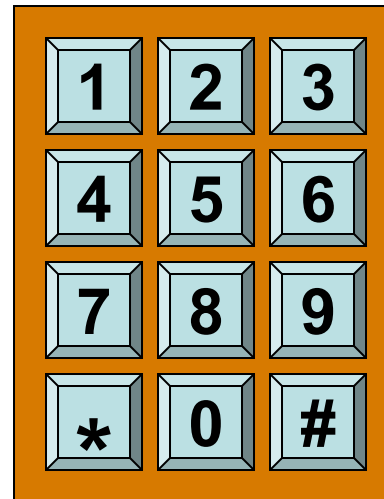


Numeric keypads

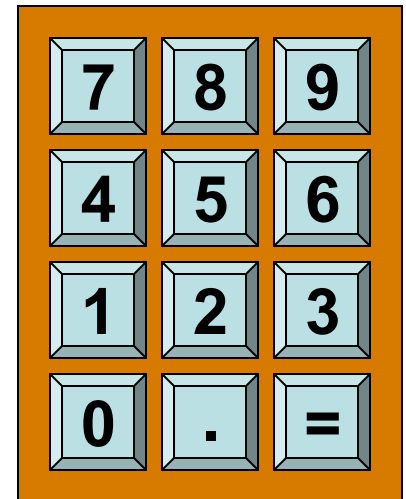
- for entering numbers quickly:
 - calculator, PC keyboard
- for telephones

not the same!!

ATM like phone



telephone



calculator

positioning, pointing and drawing

mouse, touchpad
trackballs, joysticks etc.
touch screens, tablets
eyegaze, cursors

the 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.)

the mouse (ctd)

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

How does it work?

Two methods for detecting motion

- Mechanical
 - Ball on underside of mouse turns as mouse is moved
 - Rotates orthogonal potentiometers
 - Can be used on almost any flat surface
- Optical
 - light emitting diode on underside of mouse
 - may use special grid-like pad or just on desk
 - less susceptible to dust and dirt
 - detects fluctuating alterations in reflected light intensity to calculate relative motion in (x, z) plane

Even by foot ...

- some experiments with the *footmouse*
 - controlling mouse movement with feet ...
 - not very common :-)
- but foot controls are common elsewhere:
 - car pedals
 - sewing machine speed control
 - organ and piano pedals

Touchpad

- small touch sensitive tablets
- 'stroke' to move mouse pointer
- used mainly in laptop computers
- good 'acceleration' settings important
 - fast stroke
 - lots of pixels per inch moved
 - initial movement to the target
 - slow stroke
 - less pixels per inch
 - for accurate positioning

Trackball and thumbwheels

Trackball

- ball is rotated inside static housing
 - like an upside down mouse!
- relative motion moves cursor
- indirect device, fairly accurate
- separate buttons for picking
- very fast for gaming
- used in some portable and notebook computers.

Thumbwheels ...

- for accurate CAD – two dials for X-Y cursor position
- for fast scrolling – single dial on mouse

Joystick and keyboard nipple

Joystick

- indirect
pressure of stick = velocity of movement
- buttons for selection
on top or on front like a trigger
- often used for computer games
aircraft controls and 3D navigation

Keyboard nipple

- for laptop computers
- miniature joystick in the middle of the keyboard

Touch-sensitive screen

- Detect the presence of finger or stylus on the screen.
 - works by interrupting matrix of light beams, capacitance changes or ultrasonic reflections
 - *direct* pointing device
- Advantages:
 - fast, and requires no specialised pointer
 - good for menu selection
 - suitable for use in hostile environment: clean and safe from damage.
- Disadvantages:
 - finger can mark screen
 - imprecise (finger is a fairly blunt instrument!)
 - difficult to select small regions or perform accurate drawing
 - lifting arm can be tiring

Stylus and light pen

Stylus

- small pen-like pointer to draw directly on screen
- may use touch sensitive surface or magnetic detection
- used in PDA, tablets PCs and drawing tables

Light Pen

- now rarely used
- uses light from screen to detect location

BOTH ...

- very direct and obvious to use
- but can obscure screen

Digitizing tablet

- Mouse like-device with cross hairs
- used on special surface
 - rather like stylus
- very accurate
 - used for digitizing maps

Eyegaze

- control interface by eye gaze direction
 - e.g. look at a menu item to select it
- uses laser beam reflected off retina
 - ... a very low power laser!
- mainly used for evaluation (ch x)
- potential for hands-free control
- high accuracy requires headset
- cheaper and lower accuracy devices available
 - sit under the screen like a small webcam

Discrete positioning controls

- in phones, TV controls etc.
 - cursor pads or mini-joysticks
 - discrete left-right, up-down
 - mainly for menu selection

