BIT 2nd Year

Semester 3

IT 3405

User Interface Design Chapter 3 - Evolving Technologies for Rich Interaction

INTENDED LEARNING OUTCOMES

- Define the rich interaction between humans and computing machines
- Describe the role of technology for text, audio and video based input and output
- Identify different features of pointing and touch interfaces
- Explain the evolution of computing power towards natural interaction

Sub Topics

6.1. What is rich interaction
6.2. Text based input and out devices and systems
6.3. Pointing and touch sensitive devices
6.4. Voice based input and out devices and systems
6.5. Multimodal and natural interaction
6.6. Gesture based interaction
6.7. Effect of computing power for HCI

3.1.
WHAT IS RICH INTERACTION

From Batch to Real Time Processing

That was the way things started … ***batch*** **processing**

- punched card stacks or large data files prepared
- They had to wait days, hours, ….
- Very slow output - line printer ….

  … and one simple mistake ……

Now we are not willing to wait 5 seconds

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

real time processing !

Difference of Batch and Real Time

What is the time gap between input and output ?

Example:

- When you send a letter to a friend in your hometown, you will have to wait for his reply (few days)
- When you make a call to your friend, you will hear his reply in the next few seconds

There are things that you have to do in a batched type mode….

When there is no time gap between input and output, …….

……i.e.the beginning of interaction

What is the Interaction?

Can you interact with a dead person ?

……..irrespective of your feelings …….

Your belief and interaction……..

……..we believe that God will …..

When you talk to someone

…… if he understands your language, he will reply….

…… if he doesn't understand, he may not response properly

Interaction is two way communication between ……

Interacting with computers

- What is the language of …… human being/computers ……?
- What we say in Natural languages, can computers understand?
- How interaction takes place between Humans and computers? ……
- The human being is equipped with a number of "channels" through which we perceive and convey information.
  - "input" channels that we use for perceiving information in our surroundings, which is then passed on to our cognitive system. (WHAT YOU SEE/ WHAT YOU HEAR/ WHAT YOU FEEL)
  - "output" channels for conveying information to objects in surroundings (others/computers) (HOW YOU TELL….)

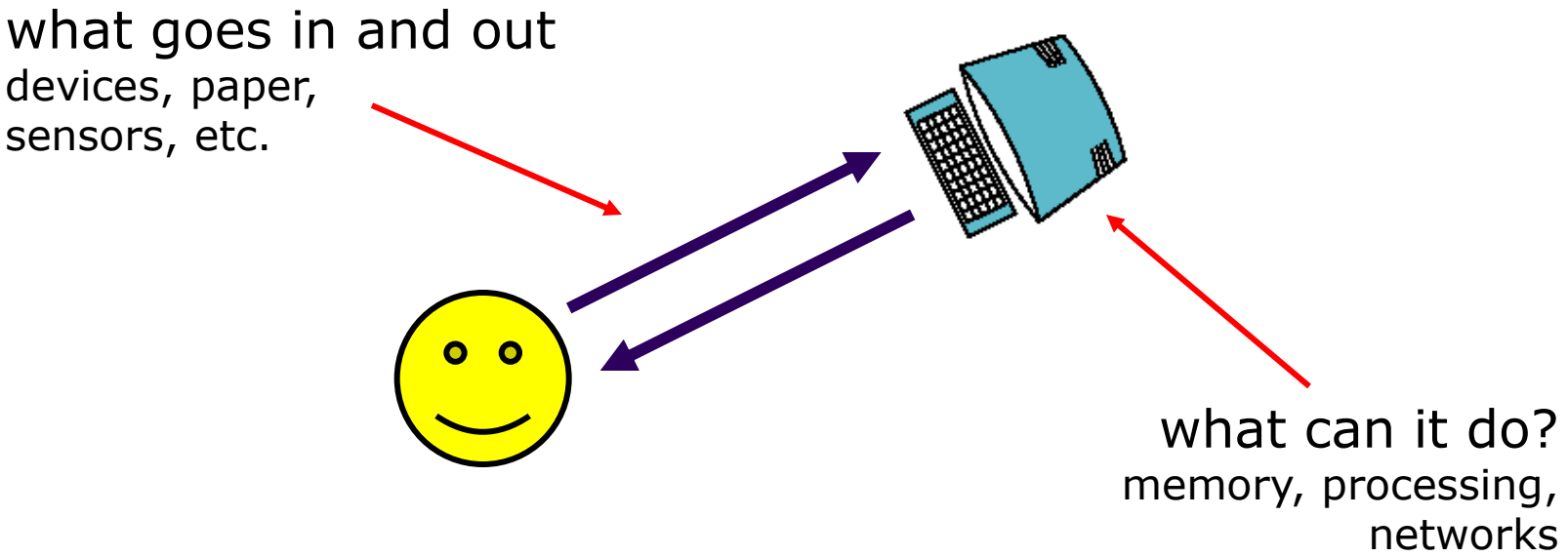
Gap between the computers and human users

- There is a gap between
  - input and output of human being
  - Input and output of computing devices
- When other party doesn't understand your language (what you say)
  - You need to express in a way that they can understand (speak their language)
  - Express in common language (visual language)
  - You may need a translator
- Sometimes, we do not say, it is understood indirectly
  - Explicitly Vs Implicitly communication
  - Emotions: When you are happy, your face ..... 

You need to understand other party to interact

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

https://www.youtube.com/watch?v=oO0yzTW62xQ&feature=player_detailpage

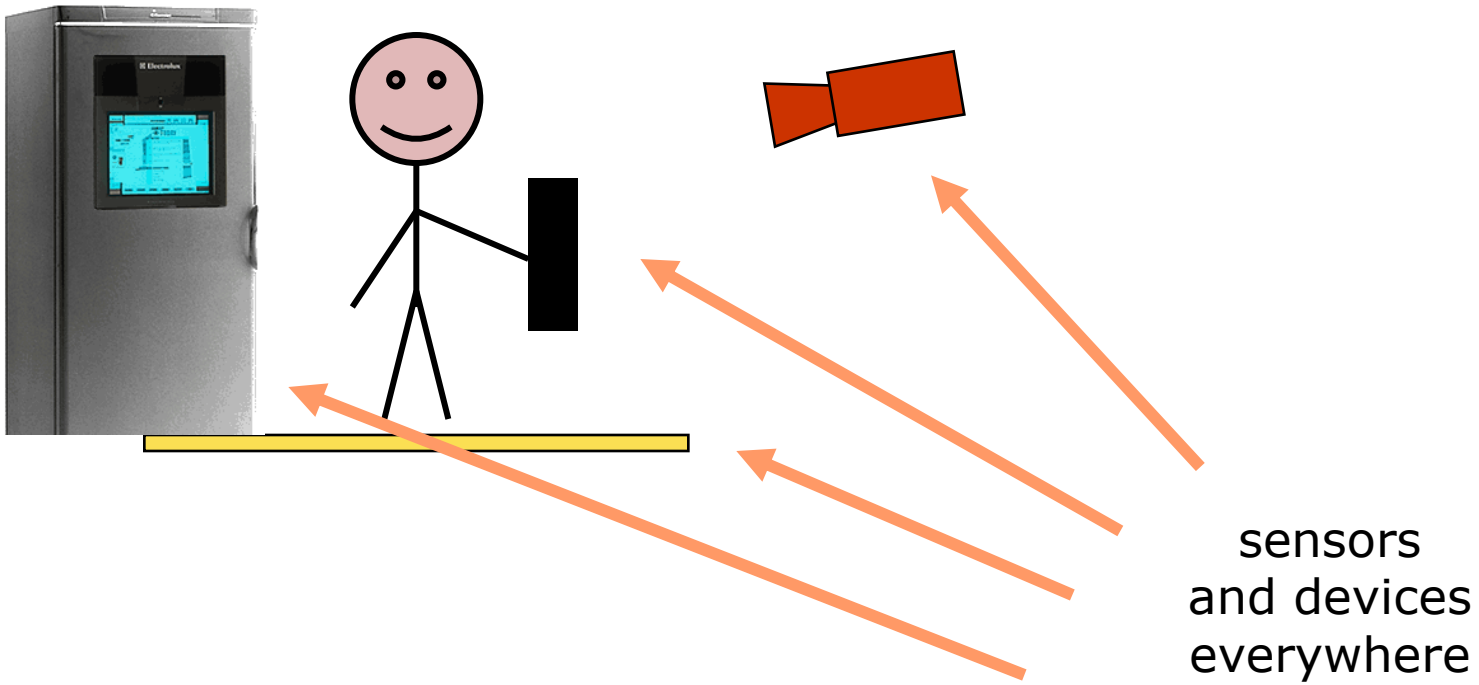


The Computer devices and elements

Each of these devices/elements affect the interaction

- **Input devices** – from text entry and pointing to….. gesture
- **Output devices** – VDU (Monitor) to……. digital paper
- **Virtual/Augmented reality** – from real to immersive world
- **Direct Vs Indirect 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

What makes it Richer ?



Think about Direct Vs Indirect interaction

Perceptual Computing ….

- For decades, we have been relying on mice, keyboards, and touch screens as the main ways to “command” the computers.
- These input methods are **not intuitive**. They also require **direct touches** on the machines.
- Then it was stated perceptual computing as the next wave of technology that will redefine the human-computer interaction.
- **Perceptual computing** is a technology that uses **voice commands**, **facial recognition**, and **gesture controls** to **interact** with a computer.
- The computer and the applications “perceive” the user’s intentions based on the **sensor data** it collects.

What sensors will do …

- Sensors can **convert** a physical signal into an electrical signal that can be **manipulated symbolically** on the computer.

- Today many devices like **tablets**, and **handheld devices** incorporate a wide range of hardware sensors. These sensors enable
  - **high definition image processing,**
  - **audio processing, motion detection,**
  - **environmental conditions detection,**
  - **geographical and proximity location detection**,
  - and many more ……

Result = Richer Interaction …

- These sensors create **multi-channel, multi-dimension** connections between the user and the device.

- Combining with **high computation performance** and **low energy consumption**, these sensors provide foundation for innovative changes in the interfaces between people and the devices, and the interactions between people and the world through the devices.

- Research in HCI explores the application of sensing to enhance the interaction.
  - Watch User Interface 2020 (https://www.youtube.com/watch?feature=player_embedded&v=dFQKqfgVeR8)

What is Richer Interaction …

- Some says that **perceptual computing** will be the next wave of technology that will redefine the human-computer interaction.

- It's is a technology that uses **voice commands, facial recognition,** and **gesture controls** to interact with a computer.

- The computer and the applications “perceive” the user’s intentions based on the sensor data it collects.

Examples: Richer Interaction …

- Examples where sensors are used for interaction:

1. You use voice commands to ask your computer to start the eReader app, open your favorite book title in the digital library, and use hand gestures to turn the pages without touching the screen.

2. In a 3D car racing video game, the app detects the angles and gestures of how the player holds the steering wheel and controls the vehicle's movements.

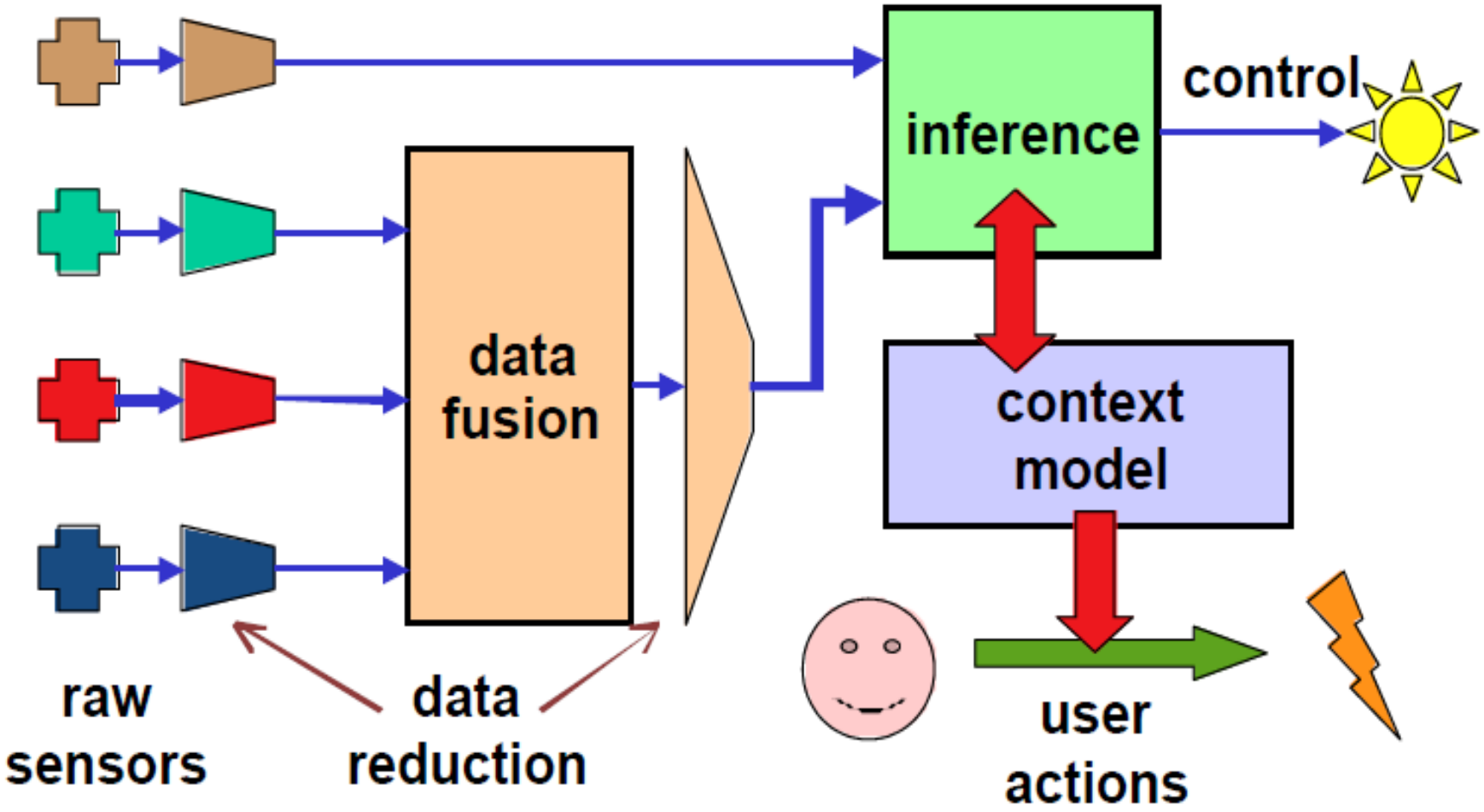
Sensors in Interaction

- Devices can take decisions itself without the help of a human after taking inputs. To get inputs computer use sensors.

- Almost all the devices you that comes today are based on sensors. There's no rich interaction without sensors.

- Following diagram will show you the model used in most of the modern devices. It is the basic architecture. There may be major changes from device to device (or system).

Data flow from Sensors to Interaction …



Sensors in action

- In rich interaction we are most concentrating on devices or systems which are very intelligent and make decisions without the help of humans.

- In order to take decisions the device should get inputs. This is where the sensors comes in to play.

- Sensors take various inputs depending on its capability. Based on the inputs device receives, it makes decisions. The decision making process is done using a program (based on a neural network).

Sensors based systems ….

- **Sensor-based systems** employ quite simple sensors.
- However the raw sensors are capturing richer data and there may be too much data to process fully.
- The reason to deploy many sensors is the more sensors used the more the input is accurate.
- In these cases the sensors may have to somehow filter or pre-process their outputs before passing on their data.
- These processed sensor readings are then used to drive some form of inference.

Sensors based systems …

- Most of the time developers need to write the logic from a hardware readable language or use a neural network to take decision.
- Finally the contextual information has to be integrated. (may be from other hardware devices).
- This is just flow in simple architecture used in rich interaction devices.

Example: Rich Interaction in a System

- For an **Example** take a smart phone.
  - When you take call at the moment you bring the phone near to your ear the screen automatically turns off.
  - It is done using a very simple sensor called Proximity sensor.
  - Hence, the interaction between the device and the user is rich.
  - User feels it is comfortable that the screen wont be touched during a call.
  - So the role of the sensor is to take the input whether there is any object close to the phone. If it is true the OS turns off the screen.
  - Watch https://www.youtube.com/watch?v=cBXhNb8TI1o

3.2.
TEXT BASED INPUT AND OUT DEVICES AND SYSTEMS

What do you know about Keyboards?

- It is the most common text input device
- It allows rapid entry of text by **experienced** users
  - Can you type without looking at keys (touch typing)?
- Normal keyboards are connected by a **cable**, but there are **wireless keyboards**
- How is a keyboard connected to computer?
  - PS/2 port
  - USB port
  - Bluetooth

How keyboards work?

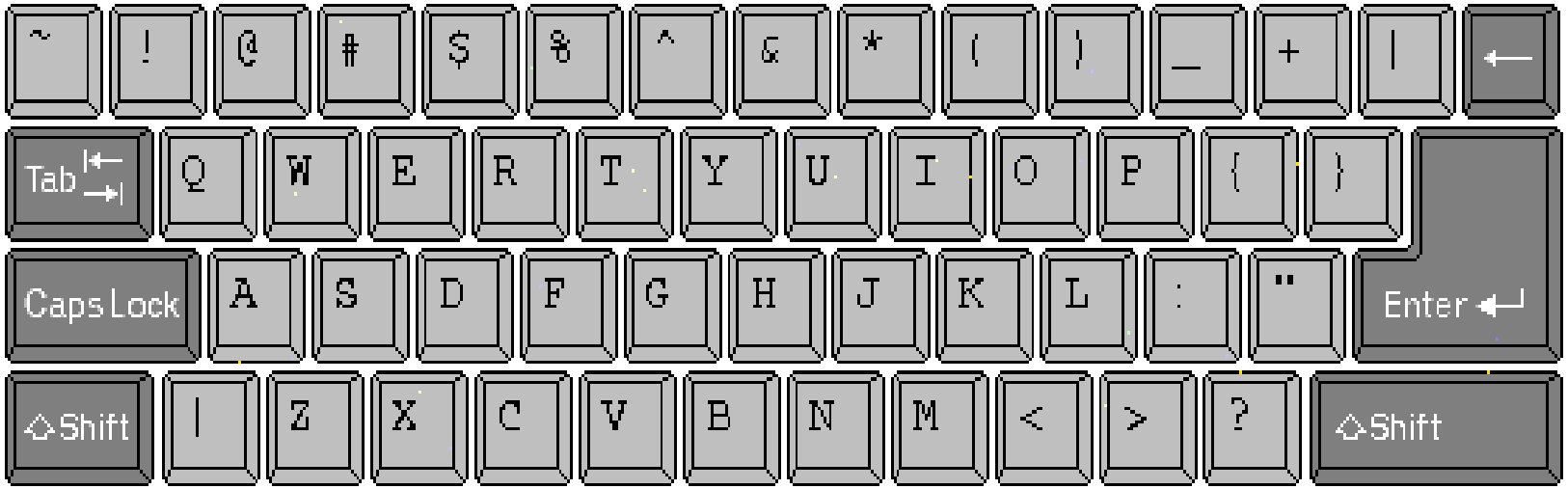
- When a key is pressed, computer keyboards send scancodes to the OS rather than sending characters directly to the OS.
- Keyboard layout software is used to convert scancodes to character stream by keyboard layout software
- This allows a physical keyboard can be mapped to any number of layouts by changing the software that interprets the keystrokes

Keyboard layout - QWERTY

- Standardised layout

  but …
  - non-alphanumeric keys are placed differently
  - accented symbols needed for different scripts
  - minor differences between UK and USA keyboards

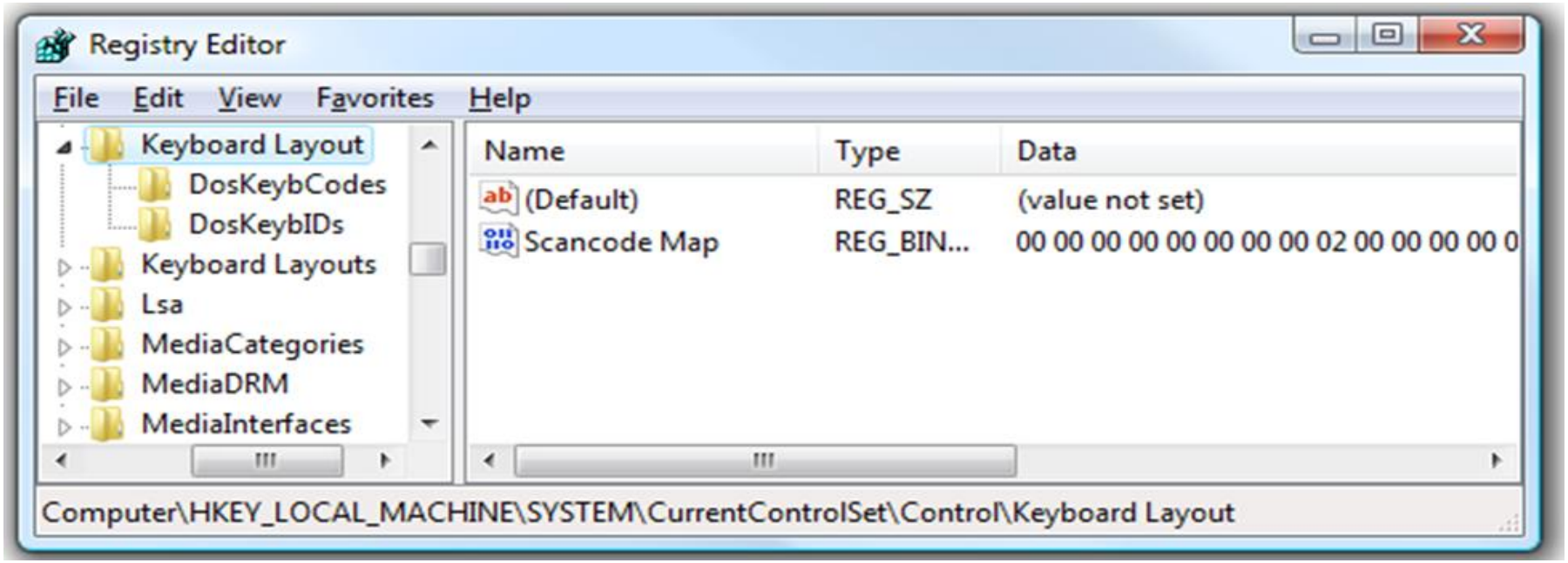
- QWERTY arrangement not optimal for typing but based on …..



A way to change the layout or keys assigned?

- Windows doesn't have a default setting to allow for disabling the key, so what we have to do is, re-map the key to something non-existent so as to completely disable it
- To do this manually, you'd open up regedit.exe and browse down to the following key (find more details, before trying out)

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Keyboard Layout



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

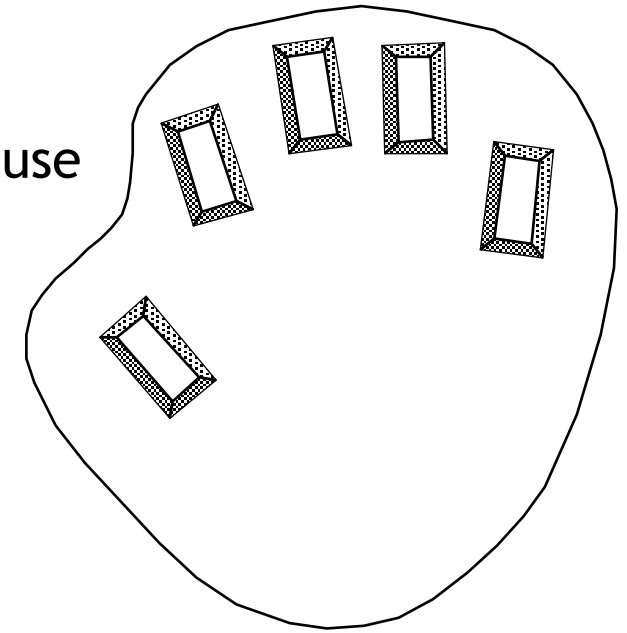
designs to reduce fatigue for RSI for one handed use

Chord Keyboards

- Only a few keys - 4 or 5 keys
- 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 z

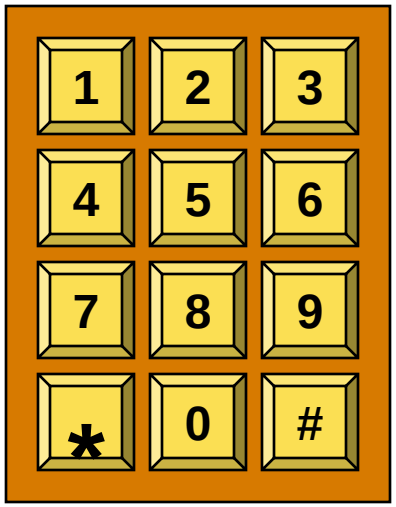
  hello = 4433555[pause]555666

  surprisingly fast!

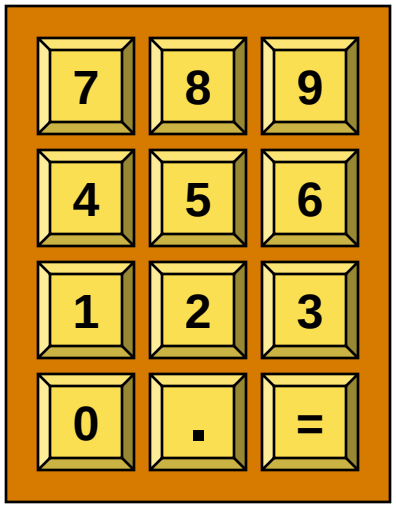
- T9 predictive entry
  - type as if single key for each letter
  - use dictionary to ‘guess’ the right word
  - hello = 43556 …
  - but 26 -> menu ‘am’ or ‘an’

Numeric keypads

- for entering numbers quickly:
  - calculator, PC keyboard
- for telephones
- not the same!!
- ATM like phone



telephone



calculator

Virtual Keyboard

- A virtual keyboard is a software component that allows a user to enter characters.

- A virtual keyboard can usually be operated with multiple input devices, which may include a touch keyboard and a computer mouse.

- http://en.wikipedia.org/wiki/Virtual_keyboard

Predictive Text Entry

- **Predictive text** is an input technology used where one key or button represents many letters, such as on mobile phones's numeric keypads and in accessibility technologies.
- Each key press results in a *prediction* rather than repeatedly sequencing through the same group of "letters" it represents, in the same, invariable order.
- Predictive text could allow for an entire *word* to be input by single keypress.
- Predictive text makes efficient use of fewer device keys to input writing into a text message, an e-mail, an address book, a calendar, and the like.

Predictive Text Entry …

- The most widely used, general, predictive text systems are T9, iTap, and LetterWise/WordWise.
- There are many unique ways to build a device that predicts text, but all predictive text systems have initial, linguistic settings that offer predictions that are re-prioritized to adapt to each user.
- This *learning* adapts, by way of the device memory, to a user's *disambiguating* feedback that results in corrective key presses, such as pressing a "next" key to get to the intention.
- Most predictive text systems have a user database to facilitate this process.

Predictive Text Entry …

- Theoretically the number of keystrokes required per desired character in the finished writing is, on average, comparable to using a keyboard.
- This is approximately true providing that all words used are in its database, punctuation is ignored, and no input mistakes are made typing or spelling.
- In practice, these factors are found to cause tremendous variance in the efficiency gain.
- The theoretical keystrokes per character, KSPC, of a keyboard is KSPC=1.00, and of multi-tap is KSPC=2.03.
- Eatoni' LetterWise is a predictive multi-tap hybrid, which when operating on a standard telephone keypad achieves KSPC=1.15 for English.

Predictive Text Entry …

- The choice of which predictive text system is the best to use involves matching the user's preferred interface style, the user's level of learned ability to operate predictive text software, and the user's efficiency goal.
- There are various levels of risk in predictive text systems, versus multi-tap systems, because the predicted text that is automatically written that provide the speed and mechanical efficiency benefit, could, if the user is not careful to review, result in transmitting misinformation.
- Predictive text systems take time to learn to use well, and so generally, a device's system has user options to set up the choice of multi-tap or of any one of several schools of predictive text methods.

Natural Interaction - Text Entry
"Handwriting recognition"

- The **translation of handwritings into digital format** capability of a computer **to obtain data about handwritings and interpret understandable handwritten input** from sources such as paper documents, photographs, touch-screens and other devices.

Two types – Natural Interaction

- **Real Time (Online) Recognition**
  - the automatic conversion of text as it is written on a special digitizer or PDA, where a sensor picks up the pen-tip movements as well as pen-up/pen-down switching.

- **Offline Recognition**
  - extended field of Optical Character Recognition OCR
  - The hand-written messages are scanned into a computer file in two-dimension image representation. That scanned image is passed through the recognition system. Hence there is no interaction with the user.

Real time Handwriting Recognition

- Writer's pen movements captured
- Velocity, acceleration, stroke order etc.
- Style can be constrained (e.g. Graffitti gestures)

Real time Handwriting Recognition …

Preprocessing –

- This process removes the unnecessary data pattern of the input, ensuring the accuracy and speed. It also consists of binarization, normalization, sampling, smoothing and denoising.

Feature extraction –

- purpose of this step is to highlight important information for the recognition model. This data may include information like pen pressure, velocity or the changes of writing direction.

Classification –

- In this step various models are used to map the extracted features to different classes and thus identifying the characters or words the features represent.

Software for Handwriting Recogntion

- cellwriter
- fluidity
- evernote
- ritepen
- Parascript
- Myscripnote mobile

Cell writer software

My scrip note mobile

ritepen

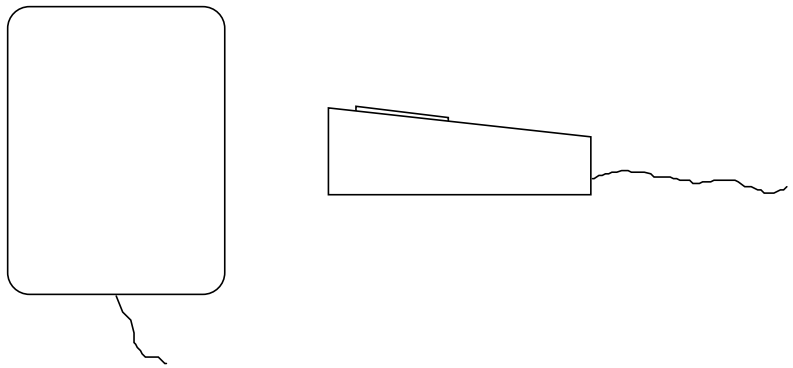
Text-to-Speech (TTS)

- How does it work?
  - reads aloud what is being displayed on the screen. (listen to your emails, eBooks while you do something else)
  - Software/Tools
  - Accessibility (the visually impaired population)
  - overcome the literacy barrier
  - Alternative Interaction Style in the interface design
  - Developing rich interaction for learnability

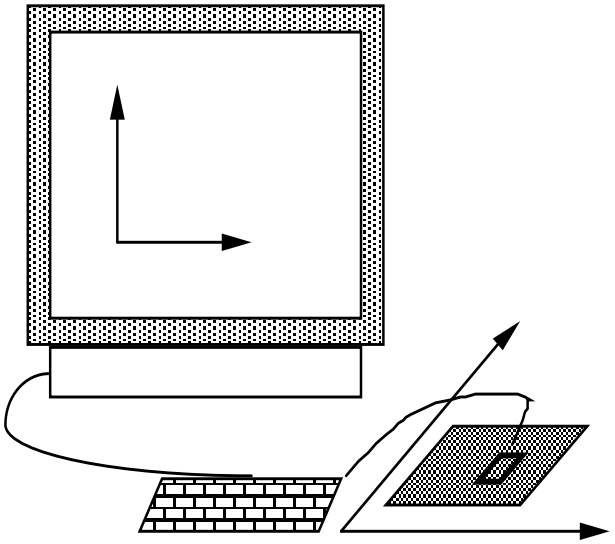
3.3. POINTING AND TOUCH SENSITIVE DEVICES

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 …

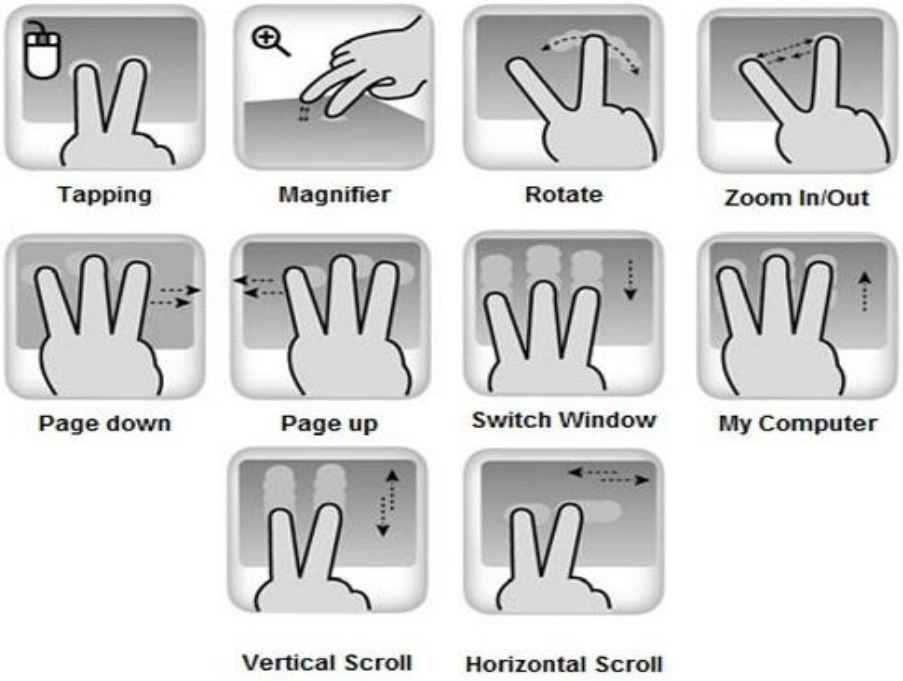
- some experiments with the *footmouse*
  - controlling mouse movement with feet …
  - not very common :-)

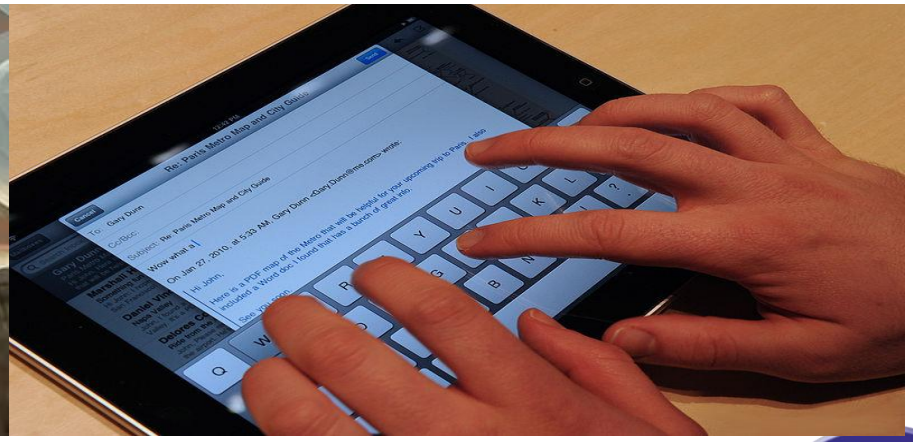
- but foot controls are common elsewhere:
  - car pedals
  - sewing machine speed control
  - organ and piano pedals

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

Multi-touch and guesture





Trackball

- 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.

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

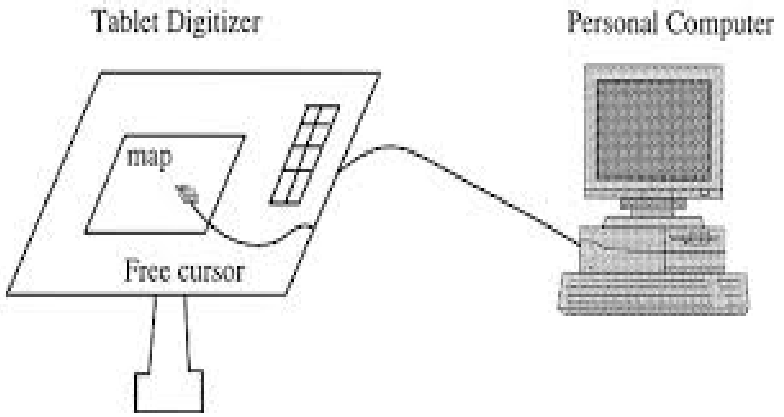
    - **Advantages:**
      - fast, and requires no specialised pointer
      - good for menu selection
      - suitable for use in hostile environment: clean and safe from damage.
    - **Disadvantages:**
      - finger can mark screen
      - imprecise (finger is a fairly blunt instrument!)
        - » difficult to select small regions or perform accurate drawing
      - lifting arm can be tiring

Stylus and light pen

- Stylus (for sensitive screen)
  - 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 (for non sensitive screens)
  - 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

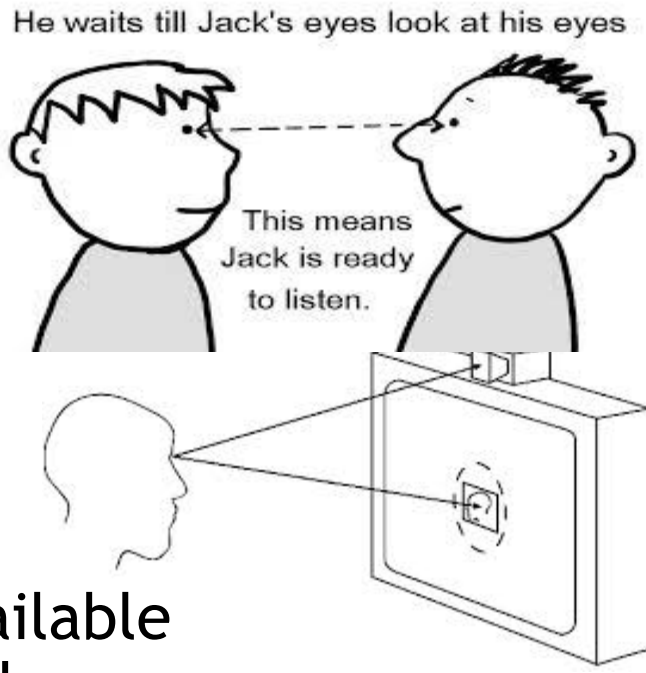


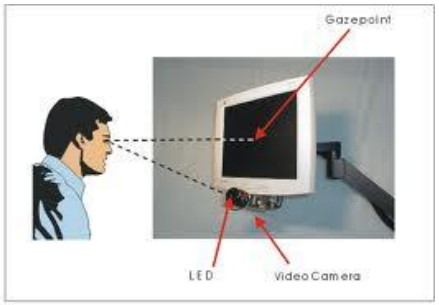
- used on special surface
  - rather like stylus

- very accurate
  - used for digitizing maps

Eyegaze

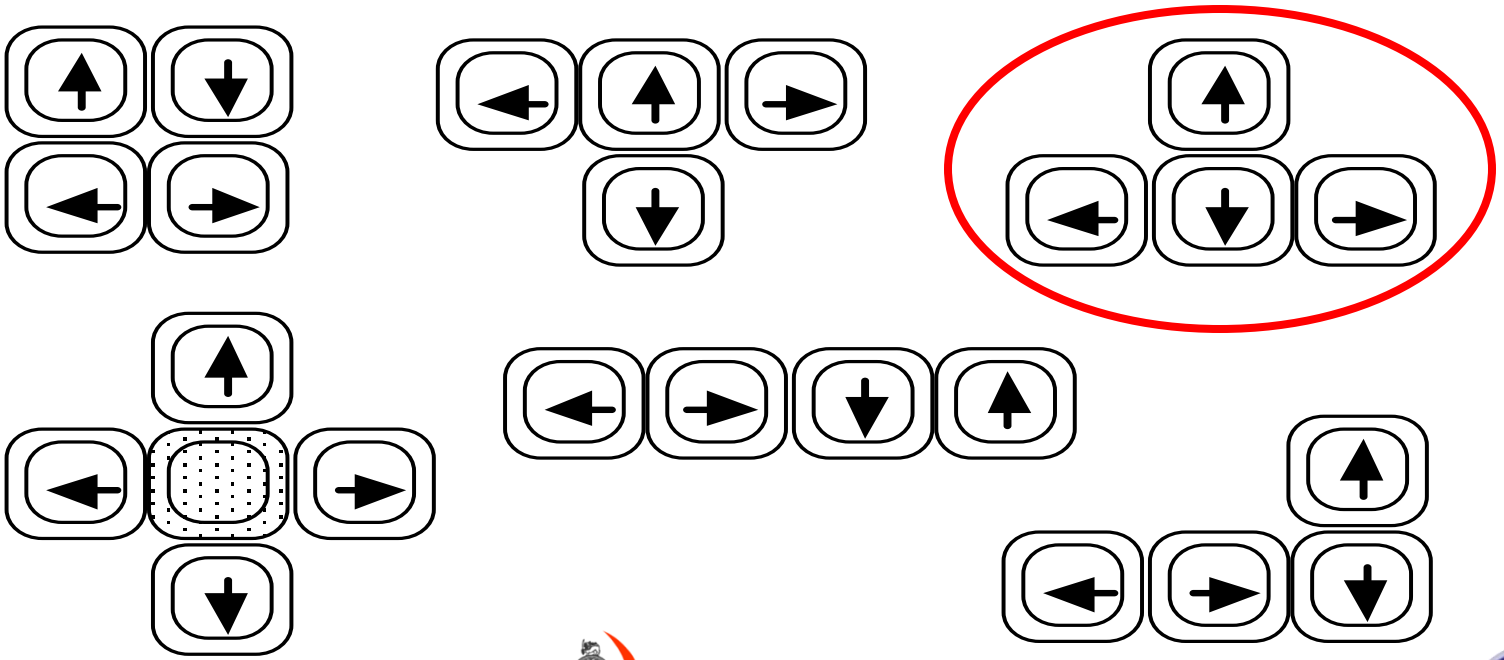
- control interface by eye gaze direction
  - e.g. look at a menu item to select it
- uses laser beam reflected off retina
  - … a very low power laser!
- mainly used for evaluation (ch x)
- potential for hands-free control
- high accuracy requires headset
- cheaper and lower accuracy devices available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





Cursor keys

- Four keys (up, down, left, right) on keyboard.
- Very, very cheap, but slow.
- Useful for not much more than basic motion for text-editing tasks.
- No standardised layout, but inverted “T”, most common



Discrete positioning controls

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

3.4.
VOICE BASED INPUT AND OUT DEVICES AND SYSTEMS

Speech Recognition

- Natural Interaction with the computer
- Improving rapidly during last decade
- 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

Speech to Text

- Speaker Independent Vs Speaker Dependent
- Interaction Objectives
  - Voice Commands to control the computer
  - Dictate text to take it down
- How to incorporate into your application

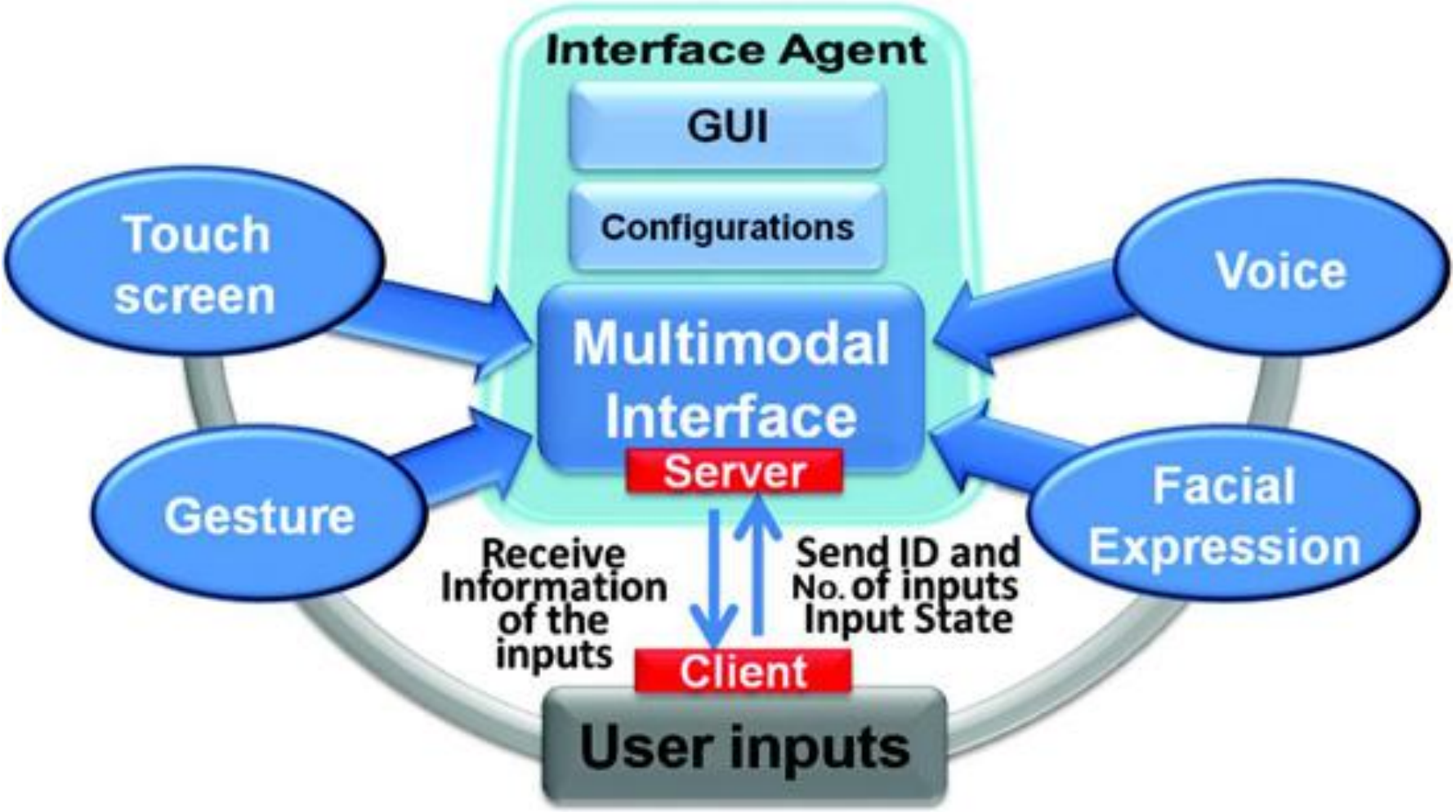
Towards Ubiquitous Computing

- There are sensors all around us
  - **car courtesy light** – small switch on door
  - **ultrasound detectors** – security, washbasins
  - **RFID security tags** in shops
  - temperature, weight, location

- … and even our own bodies …
  - iris scanners, body temperature, heart rate, galvanic skin response, blink rate

3.5. MULTIMODAL AND NATURAL INTERACTION

Multimodal Interfaces



Multimodal Interfaces …

- **Multimodel interaction is the situation where the user is provided with multiple modes for interacting with the system.**
- Multimodel interfaces process two or more combined user input modes (speech, pen, touch, manual gesture, head & body movements) in a coordinate manner with multimedia system output.

Reasons to use Multimodel interaction

- Use more users' sensors
- Users perceive multiple things at once
- Users do multiple things at once (speak & use hand gestures, body position, orientation, gaze)

Advantages of Multimodality

- **Bandwidth & efficiency of information coding**
  - To communicate more information per time unit.
- **Redundancy & robustness**
  - Less errors by putting same information into different modalities
  - Mutual disambiguation of modalities
  - Less stress and abrasion in each modality
- **Adequacy of information coding/multi-functionality**
  - Different information conveyed in different modalities.
  - Propositional (content) vs. interactional (turn-taking, feedback).
  - Symbolic vs. Iconic vs. Indexical.
- **Adaptively & universal design**
  - To utilize best modality under changing conditions.
  - To allow different user groups (e.g. blind) in different situations.

Advantages of Multimodality

- **Naturalness & Intuitively**
  - Better adaptation to human user.
  - More automatic/unconscious interaction.
  - Different modalities on different users.
  - Better acceptance especially with unexperienced users.
- **Error-proneness**
  - User intuitively select the modus which is least error-prone, change modality after errors
  - User employ simpler instructions/language when interacting multimodally – reduces complexity by distribution of information.
  - Under cognitive load, users tend to employ multimodal ways of instructions, with less cross-modal coordination.

Differences Between GUIs & Multimodal

- **Traditional GUIs Multimodal Interfaces** Assume there is a single event stream that controls event loop with sequential processing. Typically process is continuous and simultaneous input from parallel are incoming streams.
- Assume that interface actions (e.g selection of items) are atomic and unambiguous. Process input modes using recognition-based technology are good at handling uncertainty and ambiguity.
- This can be separable from application software and resides centrally on one machine.
- It has large computational/memory requirements and it is typically distributed (e.g. multi-agent systems). No temporal constraints and architecture is not time sensitive beyond parallel mouse operations.

Advantages over GUI & unimodal systems

- **Natural/realism:** making use of more(appropriate) sensors
- **New ways of interacting**
- **Flexible:** different modalities excel at different tasks
- **Wearable computers & small devices**
- **Helps the visually/physically impaired**
- **Faster, more efficient, higher information processing bandwidth**
- **Robust:** mutual disambiguation of recognition errors
- **Multimodel interfaces are more engaging**

3.6.
GESTURE BASED INTERACTION

Imagination : Gesture Based Interaction

- The 2002 scifi-movie, “Minority Report” portrayed a future where interactions with computer systems are primarily through the use of gestures. Wearing a pair of futuristic gloves, Tom Cruise, the protagonist, is seen performing various gestures with his hands to manipulate images, videos, datasheets on his computer system.
- A decade ago, it might seem a little far-fetched to have such a user-interface where spatial motions are detected so seamlessly.

https://www.youtube.com/watch?v=QH-6UImAP7c

Gesture Based Interaction

- Today, with the advent of motion-sensing devices like **“Wii Remote”** in 2006, **“Kinect”** and **“PlayStation”** Move in 2010, user interfaces of the future might just be heading in that direction.
- In gesture recognition, the input comes in the **form of hand or any other bodily motion** to perform computing tasks, which to date are still input via device, touch screen or voice.

Gesture Based Interaction ……

- The addition of the z-axis to our existing two-dimensional UI will undoubtedly improve the human-computer interaction experience. Just imagine how many more functions can be mapped to our body movements.

https://www.youtube.com/watch?v=ABgt6lpdq1I

Tangible User Interfaces

- Tangible user interface (initially called **Graspable User Interface**) is an interface which we can use to interact with digital information through physical devices.

- In a way it's like a **touch interface**.

- But the difference is that we interact with the system through physical environment.

https://www.youtube.com/watch?v=lvtfD_rJ2hE&list=PLe8w1-dcPI0caFhI4SR7diamTcUQMpOLR

Six Sense

- **SixthSense**, a " **wearable gestural interface**" created by Pranav Mistry of the MIT Media Lab's Fluid Interfaces Group, outfits humans with a small projector, mirror and camera worn around the neck (or on a helmet), and little colored markers worn on the fingers.

- The prototype lets the user project a computer onto a wall, to check e-mail and browse the Web similarly to how an Apple iPad works, except that the gestures can be made in the air without touching a screen.

3.7. EFFECT OF COMPUTING POWER FOR HCI

Future of HCI

The past, Present and Future of HCI, lets watch …….

https://www.youtube.com/watch?v=J_FvdyhtVHg

Future of HCI

- Future of HCI is towards the concept of NUI (natural user interfaces).
- In NUI the computer devices concentrate on reading natural human behavior, interpret them as commands and output the desired action.
- A NUI is effectively invisible, or becomes invisible with successive learned interactions, to its users, and is based on nature or natural elements.
- ***"A NUI relies on a user being able to quickly transition from novice to expert. While the interface requires learning, that learning is eased through design which gives the user the feeling that they are instantly and continuously successful. Thus, "natural" refers to a goal in the user experience - that the interaction comes naturally, while interacting with the technology, and that the interface itself is natural."***

Future of HCI …

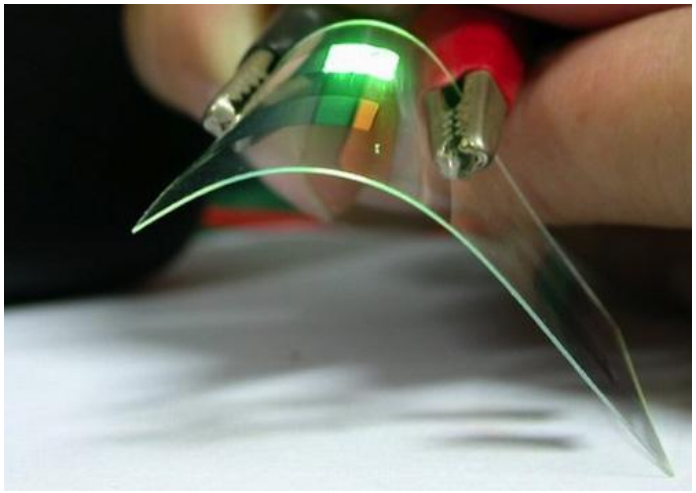
- This is also described as "exploring human-centric ways for people to interact with future computing paradigms".
- Touch, face- and voice-recognition, movement sensors – all are part of natural user interface.
- Microsoft Surface and Microsoft Kinect can be considered as two pioneering technologies, which really evolved as NUI's.
- The "Kinect" was introduced due to "Project Natal", code name for an research done on Xbox 360 add-on that incorporates face, voice, gesture, and object recognition technology to give users a variety of ways to interact with the console, all without needing a controller. The human whose interacting will become the controller!!!

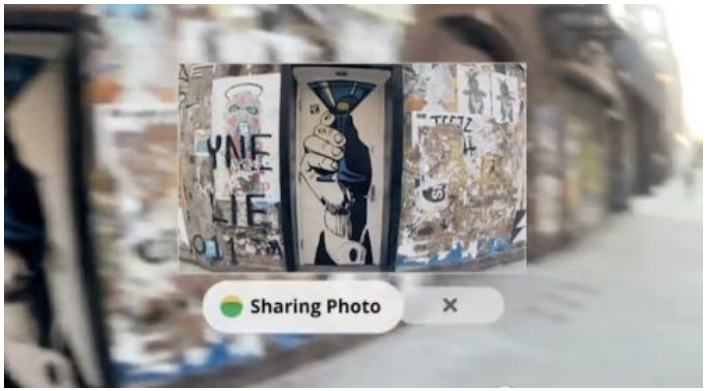
Future of HCI …

- The "Surface" gathers ideas on how users interact with content, with the ability for the device to optically recognize objects placed on top of it.

- In this way, users can trigger actions on the computer through gestures and motions, and the objects become a part of the control mechanisms.

Future Innovation in HCI - Augmented Reality





Future Innovation in HCI – Augmented Reality…

- The Computer technologies have been changing since last two decade in the world where we live in. This is obvious not only on our desktops and in our hands, but in virtually all aspects of our lives, in our communities and in the wider society.
- When considering the future in computer technology we will have two main questions as below.
  1. What will the world be like in 2020 with computer technologies ?
  2. What will HCI be like in the year 2020 ?
- A main important aspect of this evolution in computing is how we interact with the many thousands of devices increasingly at our disposal like the keyboard and mouse, and the computer screen ‘graphical user interface,' or GUI.