The Computer

Unit 4

CC7 Human Computer Interaction

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The Role of Computers in HCI

Interactions with computers | Computer peripherals and parts | Why know the computer devices?

Interaction with Computers

- What are our goals when interacting with people?
- How does our interactions with people relate to our interactions with computers?
- Interaction is a process of information transfer.

Computer Peripherals and Parts

- Input / output devices
- Virtual Reality systems
- Bio sensors
- Computer memory
- Computer processors

Why Know the Computer Devices?

- Match the devices that complements the capabilities and limitations of the human
  - Perceptual system
  - Human memory and processing
  - Human error
  - Human emotions
- Not every user would have all the required computer devices

Input Devices

Keyboard | Mouse | Microphone | Trackball | Touchpad |Touchscreen Devices | Controllers | Scanner | Drawing Tablet | Eye Tracking Devices | Hand Tracking Devices

List of Input Devices

- Keyboard
- Mouse
- Microphone
- Trackball
- Touchpad
- Touchscreen devices
- Controllers
- Scanner
- Drawing Tablet
- Eye Tracking Devices
- Hand Tracking Devices

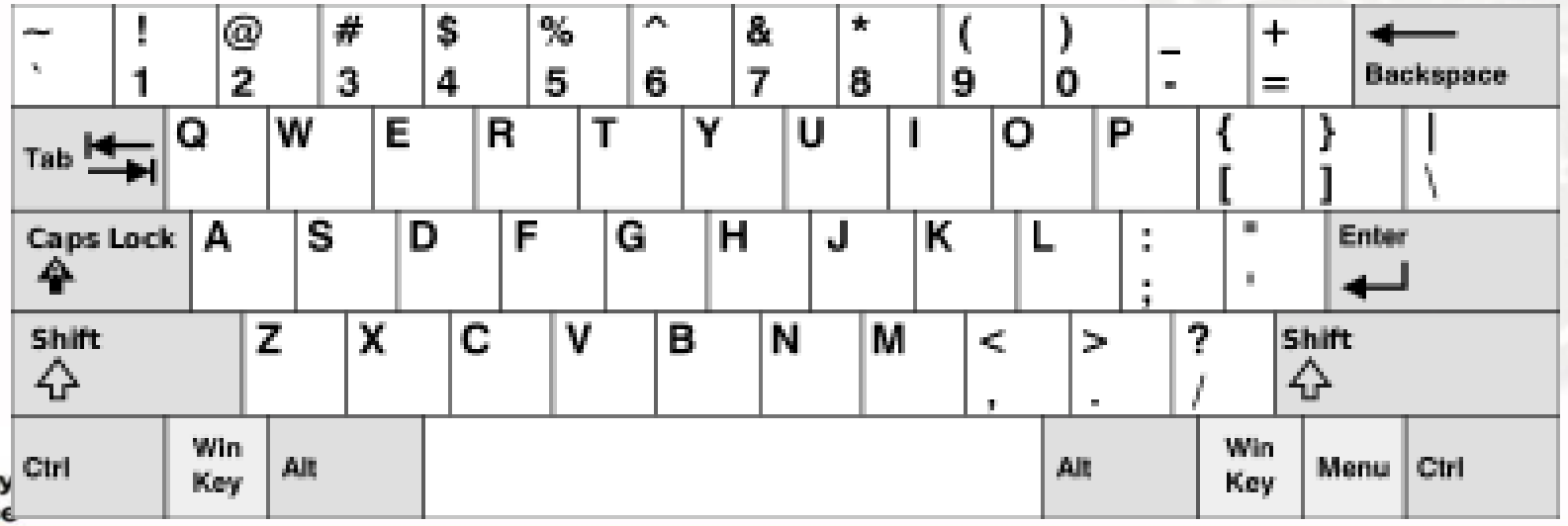
Input Device – Keyboard

- Like a typewriter, it is composed of buttons used to create letters, numbers, and symbols, and perform additional functions
- Buttons or keys act as mechanical levers or electronic switches
- Arrangement of buttons depend on the format:
  - QWERTY
  - QWERTZ
  - AZERTY
  - DVORAK

Input Device – Keyboard

QWERTY / Sholes Keyboard

- Named after the first 6 alphabetic keys on the top left
- May be created:
  - Due to mechanical failings in early typewriters
  - To make it easier to decode morse code



Input Device – Keyboard

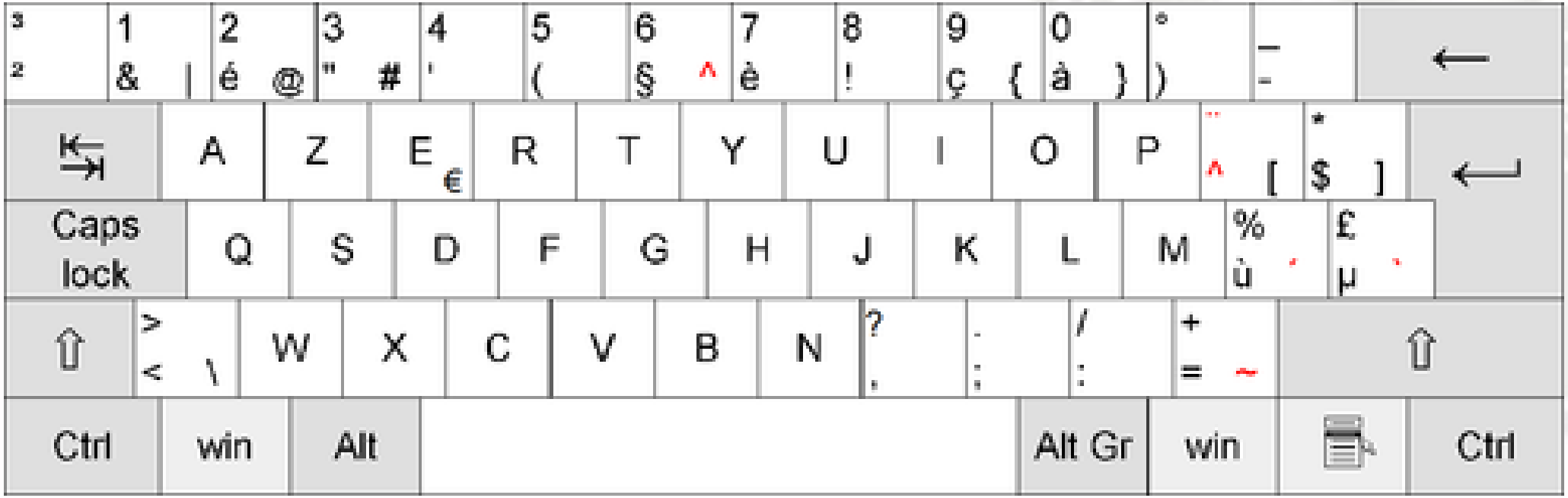
QWERTZ / Swiss Keyboard

- Used in German-speaking countries

Input Device – Keyboard

AZERTY Keyboard

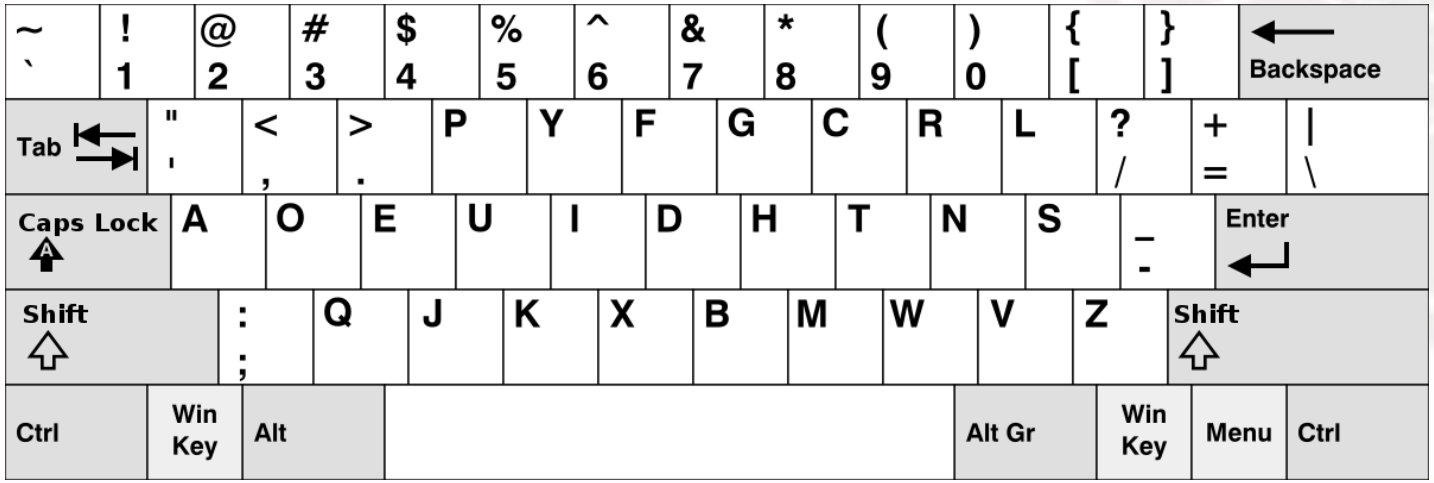
- Commonly used in France and Belgium



Input Device – Keyboard

DVORAK Keyboard

- Ergonomic alternative to the QWERTY layout
- All vowels and punctuation marks are on the left side
- All consonants on the right side
- Most used letters in the middle row so it's easier to reach



Input Device – Mouse

- Handheld hardware input device that controls a cursor in a GUI (graphical user interface)
- Move and select text, icons, files, and folders on computer
- Commonly makes use of a pointer on a display
- Types:
  - Ambidextrous
  - Left-handed
  - Vertical

Input Device – Mouse

Ambidextrous Mouse

- Designed to fit either left-handed or right-handed people
- Most common type of mouse

Input Device – Mouse

Left-Handed Mouse

- Specifically designed for users whose dominant hand is their left hand

Input Device – Mouse

Vertical Mouse

- Taller than it is wide
- Designed to reduce strain
- Mouse is held vertically, much like you would during a handshake
- Buttons are located right beneath the grasp

Input Device – Microphone

- Translates sound vibrations in the air into electronic signals or scribes them to a recording medium

Input Device – Trackball

- Small ball set in a holder
- Can be rotated by hand to move a cursor on a computer

Input Device – Touchpad

- For controlling the pointer on a display screen
- Done by sliding the finger along a touch-sensitive surface

Input Device – Touchscreen Devices

- Technically both an input and output device
- User places input through multi-touch gestures by touching the screen or through a stylus
- Output may be shown in another screen or in the same screen

Input Device – Game Controller

- Also known as a gaming controller or controller
- Used to provide input to a video game
- Can be haptic
- Gamepad
  - Common game controller
  - Came from console games
  - Used for better mobility of a character

Input Device – Game Controller

- Other game controllers
  - Paddle
  - Steering wheel set
  - Touchscreen
  - Motion sensor
  - Light gun
  - Rhythm game controllers

Input Device – Scanner

- Uses a light beam to scan codes, text, or graphic images directly into a computer or computer system

Input Device – Drawing Tablet

- Converts movements from a stylus pressed on a designated area on the tablet's screen
- Commonly used for digital arts

Input Device – Eye Tracking Device

- Sensor technology that makes it possible to know where a person is looking in real-time
- Uses a specialized camera
- Detects the presence, attention, and focus of the user

Input Device – Hand Tracking Device

- Makes use of various sensors
- Captures data on the position, orientation, and velocity of hands
- Can be a device that is attached to the hand or a device away from the hand

Output Devices

Monitor | Speaker | Headphone | Printer

List of Output Devices

- Monitor
- Speakers
- Headphones
- Printers

Output Device – Monitor

- Displays information in pictorial or text form
- Modern monitors use liquid crystal display (LCD)
- Three popular LCD monitor types:
  - Twisted nematic (TN)
  - IPS (In-Plane Switching)
  - VA (Vertical Alignment)

Output Device – Monitor

Twisted Nematic (TN) Panels

- Oldest type of LCD panel
- Most budget-friendly; has low cost production
- Limited viewing angles, particularly on vertical axis
- High refresh rates; low input lag
- Colors of the TN panels:
  - Reproduction is not strong
  - Can invert completely when viewed from an extreme angle

Output Device – Monitor

In-Plane Switching (IPS) Panels

- Developed to improve limitations of TN panels
- Vastly superior viewing angles
- Best color reproduction:
  - Good black color reproduction
  - Best used for graphic design

Output Device – Monitor

Vertical Alignment (VA) Panels

- Compromise between TN and IPS
- Has best contrast ratios
- Used extensively for TV manufacturing
- Viewing angles are in the middle of IPS and TN
- Have slower response times than TNs
- Ideal for general use

Output Device – Speakers

- Connects to a computer to generate sound
- Signal is created by the computer's sound card

Output Device – Headphones

- Small speakers that can be worn in or around the ears
- Traditional headphones:
  - Have two ear cups
  - Attached by a band
  - Placed over the head
- Earbuds or earphones:
  - Placed inside the outer part of the ear canal

Output Device – Printer

- Accepts text and graphic output from a computer
- Traditional printers transfer the information to paper

Output Device – Printer

3D Printer

- Computer-aided manufacturing (CAM) device
- Creates three-dimensional objects
- Builds a three-dimensional model out of a custom material


Mashable
explains

Virtual Reality Systems

What is virtual reality? | VR headset | Motion controllers | Optical tracking

What is Virtual Reality?

- Simulated experience that can create an artificial world
- Can look and move around the artificial world, and interact with objects around
- Utilizes limited visual and auditory processing and high haptic feedback for a more immersive experience

Virtual Reality Devices

- Virtual reality headset
- Motion controllers
- Optical tracking

VR Device - Headset

- Also called VR goggles
- Head-worn apparatus that completely covers the eyes for an immersive 3D experience
- Can be attached to a computer (Valve Index)
- Can be self-contained (Oculus Quest 2)

VR Devices – Motion Controllers

- Collection of devices that detect the user's motion in different levels
- Tracked with cameras, sensors in the controllers, or both
- Examples:
  - Hand controllers
  - Wired glove
  - Omnidirectional treadmill

VR Devices – Optical Tracking

- Process of monitoring the user's position through visual information
- Mostly done through sets of cameras and other sensors in or out of the headset
- Can track smaller body parts (fingers) to the entire body

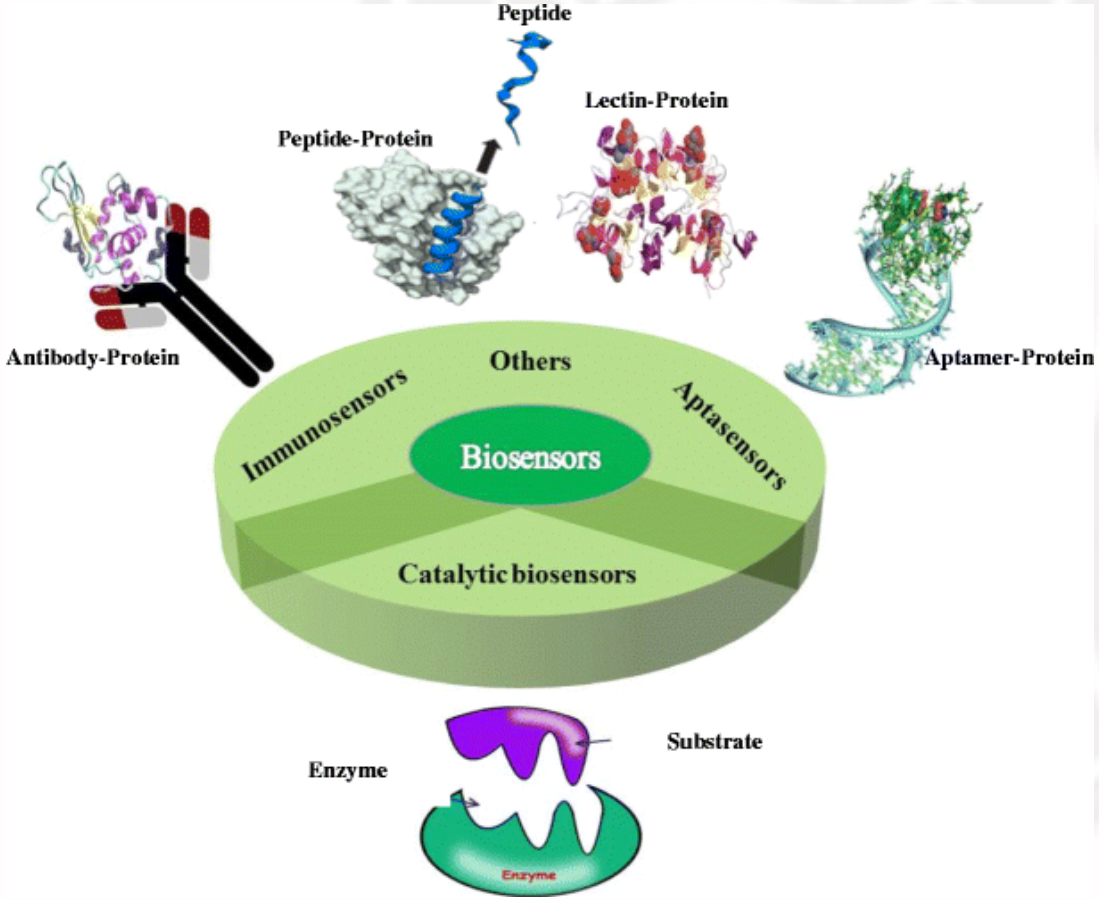
VR - Mojo Contact Lens

Bio Sensors

What is biosensing? | Biosensors | Brain sensors

What is Biosensing?

- Detection of target molecules based on the principles used by a living system
- Can be used for a more precise means of determining user input with little movement



Biosensor

- Self-contained integrated device
- Capable of providing specific quantitative analytical information using a biological recognition element
  - Enzymes
  - Antibodies
  - Natural receptors
  - Cells

Brain Sensors

- Can allow to control software, apps, and machines
- Done by developing new virtual reality, augmented reality, and brain-controlled technology with brain-computer Interface (BCI) software

Computer Memory

Non-volatile memory | Volatile memory

Computer Memory Devices

- Non-volatile memory
  - Hard disk drive
  - Solid state drive
  - Flash memory
  - Nonvolatile memory express
- Volatile memory
  - Random access memory

Non-Volatile Memory

- Type of computer memory that can retain stored information even after power is removed
- Common examples:
  - HDD (Hard Disk Drive)
  - Flash memory
  - SSD (Solid State Drive)
  - NVMe (Nonvolatile Memory Express)

Non-Volatile Memory

Hard Disk Drive (HDD)

- Magnetic storage medium for a computer
- Hard disks are flat circular plates made of aluminum or glass and coated with a magnetic material
- Used for general storage, but quite slower

Non-Volatile Memory

Flash Memory

- General term for electronic non-volatile memory
- Can be electrically erased and reprogrammed
- Used for a lot of modern memory devices:
  - USB flash drives
  - Memory cards
  - SSDs and NVMes

Non-Volatile Memory

Solid State Drive (SDD)

- New generation of storage device used in computers
- Uses flash-based memory
  - Much faster than a traditional mechanical hard disk
- Used for more modern systems that require fast access of storage

Non-Volatile Memory

Nonvolatile Memory Express (NVMe)

- New storage access and transport protocol for flash and next-generation solid-state drives
- Delivers the highest throughput and fastest response times yet for all types of enterprise workloads

Volatile Memory

- Computer memory that only maintains its data while the device is powered
- Used for primary storage in personal computers
- Much faster to read from and write to than the other kinds of storage in a computer
- Data stored in volatile memory are temporary data used in computer systems or ones needed by the processor

Volatile Memory

Random Access Memory (RAM)

- Short-term memory where data is stored as the processor needs it
  - Play a game from computer's hard drive
  - Stream a movie from the Internet
- Processor can get to the data quickly

Computer Processors

Computer processing and processors | Limitations that decrease processor performance

Computer Processing

Processing can be too slow or too fast

Too slow

- Unable to catch input when it happens
- Input is buffered; feedback is too slow

Too fast

- Output comes out too quickly; user is unable to read it

Computer Processor

Central Processing Unit

- Circuit board inside a computer that executes instructions on behalf of programs
- Modern computer processors can process millions of instructions in a second
- Processors are considered the main chip on a computer

Computer Processor

Limitations that Decrease Processor Performance

- Computation limitations
- Storage channel limitations
- Graphics limitations
- Network limitations