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# **Human–Computer interacton (HCI) Introduction**

**2024 - 2025**



# Learning Objectives

- Understand core HCI concepts: utility, usability, ergonomics
- Distinguish interface vs interaction
- Identify major input/output modalities
- Recognize the multidisciplinary nature of HCI
- Preview how to design and evaluate interactive systems



# What is HCI?

- HCI — Human–Computer Interaction
- HCI studies how people interact with computing systems through an interface
- **Goal** enable effective, efficient, satisfying, and safe use in context
- UI — User Interface, GUI — Graphical User Interface, HMI — Human–Machine Interface



# Interface vs Interaction

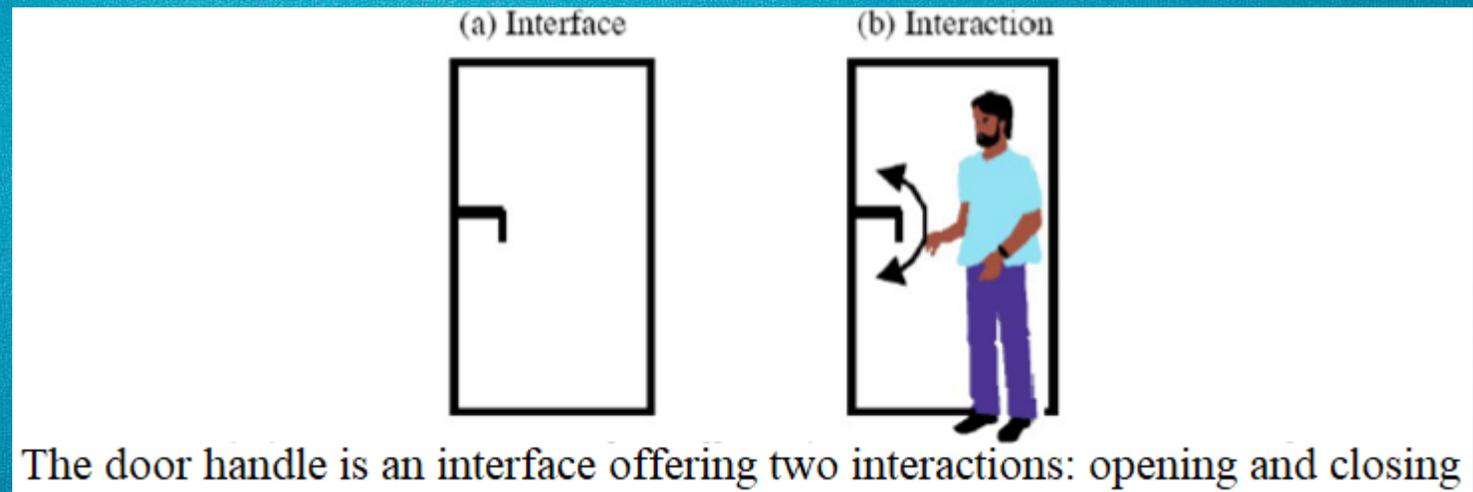
## Interface

the hardware/software  
“surface” (screens,  
buttons, menus)

## Interaction

the sequence of  
actions to  
accomplish tasks  
within a context of  
use

Both are inseparable in modern systems



# Utility, Usability, Ergonomics

Utility: does the system provide the right functions?

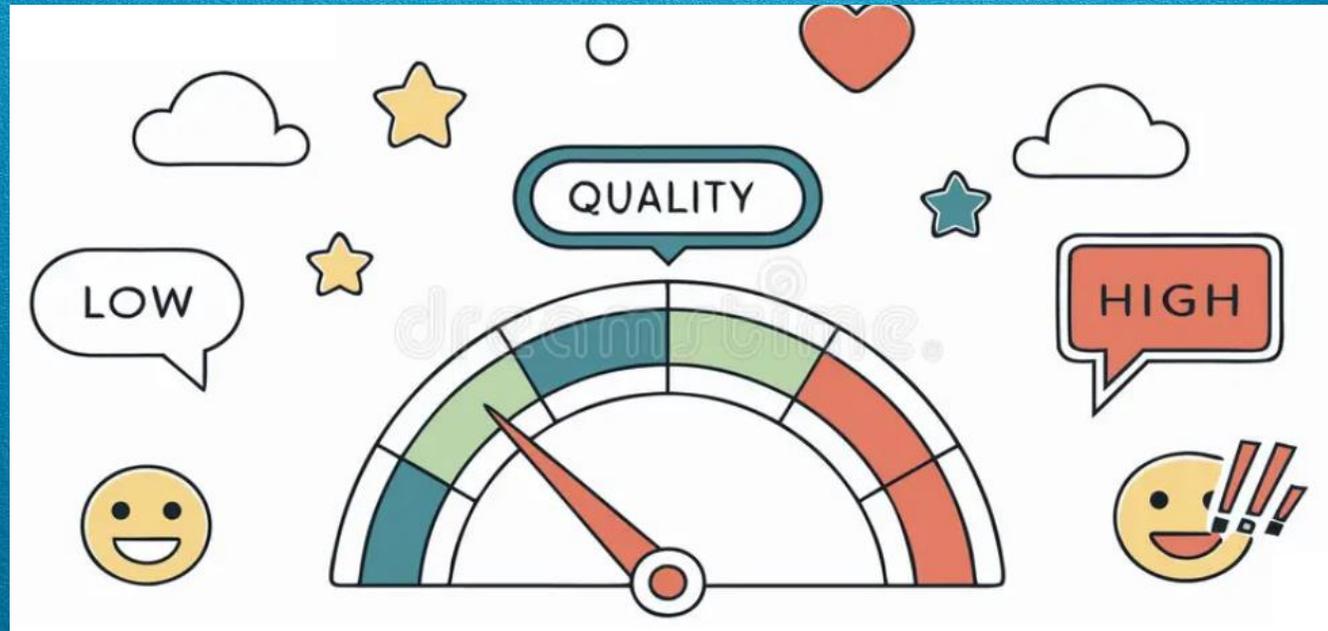
Usability: can target users use it easily to perform tasks?

Ergonomics: broader human-centered requirements (comfort, workload, safety)



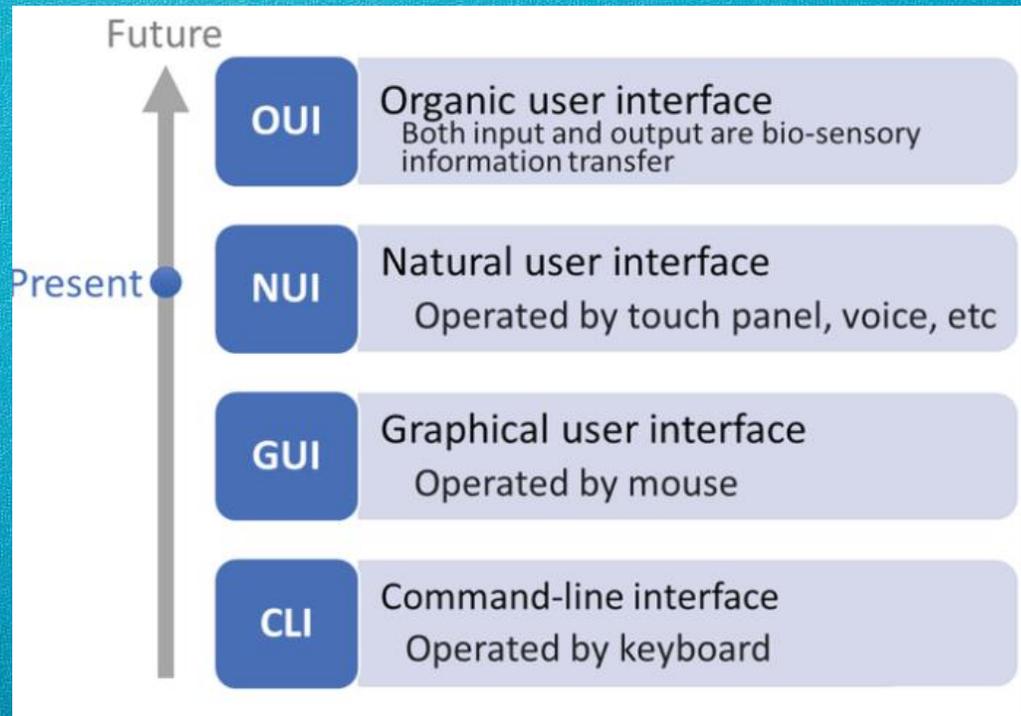
# Why Focus on Interaction (not only interface)?

- Good visuals  $\neq$  good interaction
- Usability indicators: learnability, efficiency, error rate, memorability, satisfaction
- Interaction design considers tasks, sequences, and context



# A Brief History of User Interfaces

- Command-line → Menus & forms → WIMP (windows, icons, menus, pointer)
- Multi-window/iconic interfaces and direct manipulation
- Networked and cross-device experiences



# Evolution of Interactivity

- Parallel tasks and rich graphical interfaces increased interaction density
- Quantity of exchanges grew; the nature of exchanges also broadens with new modalities



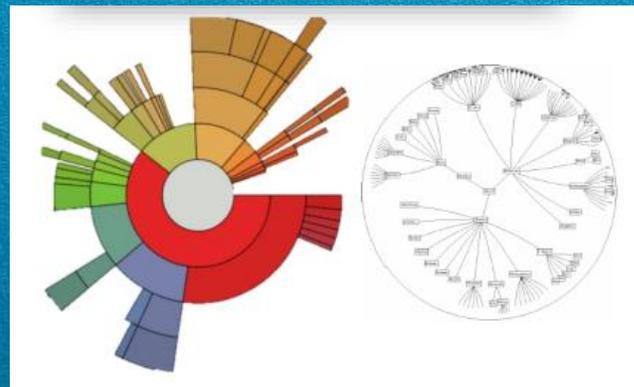
# Output Devices

- Screens (2D, high DPI, various sizes)
- Audio (speech synthesis, spatial/3D sound)
- Printers
- Haptics (force feedback, vibration)



# Visualizing Information (2D & 3D)

- 2D: dashboards, forms, charts, document views
- 3D: specialized visualization (CAD, medical, VR)
- Match visualization to task and user expertise



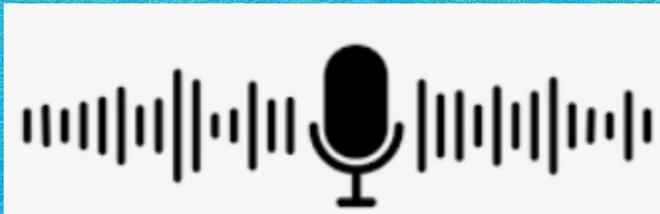
# Input Devices: Classic

- Keyboards (AZERTY/QWERTY; ergonomic layouts)
- Pointing: mouse, trackball, joystick, touchpad
- Touch input (multi-touch gestures)



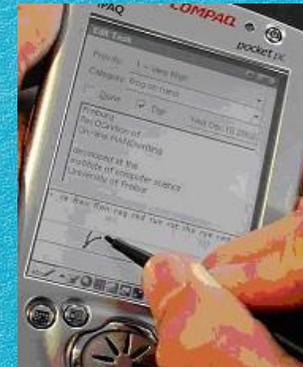
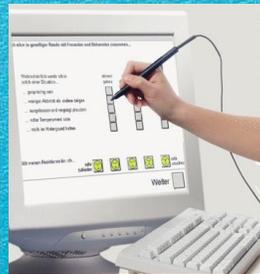
# Input: Speech & Audio

- Automatic speech recognition for commands and dictation
- Audio recognition (music, sounds) for ambient interaction
- Design considerations: noise, feedback, privacy



# Input: Visual 2D

- Barcodes/QR (quick access to links/content)
- Optical pens / stylus
- Handwriting/gesture recognition
- Touchscreens



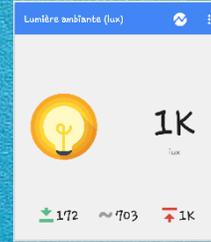
# Visual 3D & Tracking input

- Position/orientation/velocity sensors, depth cameras
- Body/hand tracking for spatial interaction
- Calibration and fatigue considerations



# Other input sensors

- temperature, ambient light,



- proximity, motion, acceleration, rotation, magnetic field;



- pressure, heart rate, noise level, barometer, odor, **fingerprint** (biometrics)

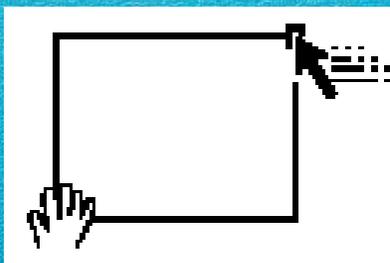


# Multimodality

- Combine input/output **modalities** to match the task and context.
- Example: “**Put that... here**” = **voice** (“put that...” ) + **gesture** (“...here”).



- Two-hand interaction, voice + touch, audio + haptic cues, etc.



# Extended realities & novel interfaces

- **Virtual Reality (VR):** immersive, 3D, user represented by an avatar.



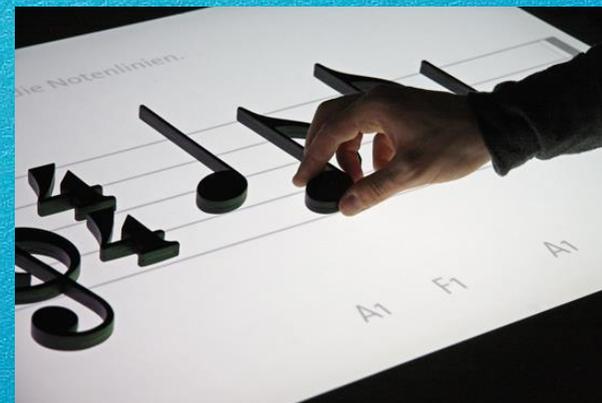
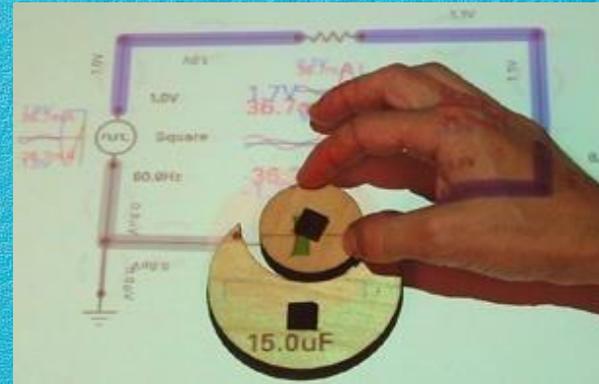
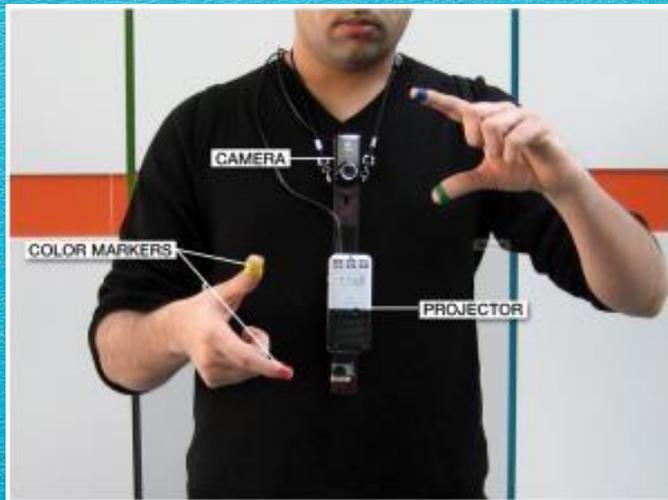
# Extended realities & novel interfaces

- **Augmented/Mixed Reality (AR/MR):**
- superimpose **virtual** elements on the **real** world in **real time** (on a screen or see-through device).



# Extended realities & novel interfaces

- **Tangible interfaces:** direct manipulation of **physical objects** that are linked to functions.



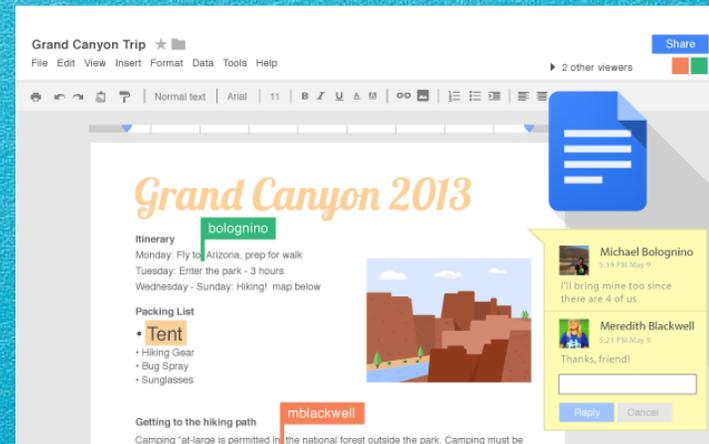
# Extended realities & novel interfaces

- **Wearables:** embedded computing in **clothing** or **accessories**



# Extended realities & novel interfaces

- **Collaborative systems** (co-located or remote):  
interactive whiteboards, multitouch tables,  
shared editors; **collaborative AR overlays**



# Formal definitions

- **Interactive system:** its behavior depends on inputs from an **external environment** not controlled by the system (vs. a closed, fully specified algorithmic system).
- **Interactive human–machine system:** an interactive system whose environment includes **one or more humans**.

“Human Computer Interaction is a discipline concerned with the design, evaluation and implementation of interacting computing systems for human use and with the study of major phenomena surrounding them.”



# HCI & programming: why it matters

- Most applications are **interactive**; the UI often dominates **cost and risk**.
- Interface code can be a **large share** of the codebase and is **reworked repeatedly**.
- Therefore we need an **early, methodical, iterative, experimental** approach—not “just make it pretty” or rely on taste alone.



# What you should be able to do

- **Design** an interface (task/user analysis → flows → wireframes/prototypes).
- **Implement** an interface (separation of **UI** and **core** logic).
- **Evaluate** an interface (heuristics, user tests, analytics).
- Know **when to involve specialists** and how to work in a **multidisciplinary** team.



# Goals of user interfaces

- Enable users to accomplish tasks:
- **Effectively** and **productively**
- **Safely** and **reliably**
- With **enjoyment** and **low effort to learn**



# Multidisciplinarity of HCI

- HCI draws from **computer science, psychology, ergonomics, design, linguistics, sociology**, and more.

Good interfaces emerge from **cross-disciplinary** collaboration.



# Conclusion

- **HCI** = Human–Computer Interaction: a discipline covering the design, implementation, and evaluation of interactive systems.
- Great interfaces are built by focusing on interaction quality, usability metrics, and human factors, not just visual elements.
- This course equips you to design, build, and evaluate such systems.



# Thank You!

