

Human Computer Interaction

Core Lecture, Winter Term 2026/27

What is Human Computer Interaction

Prof. Dr. Jürgen Steimle

Saarland University Computer Science

TOPICS

Topics

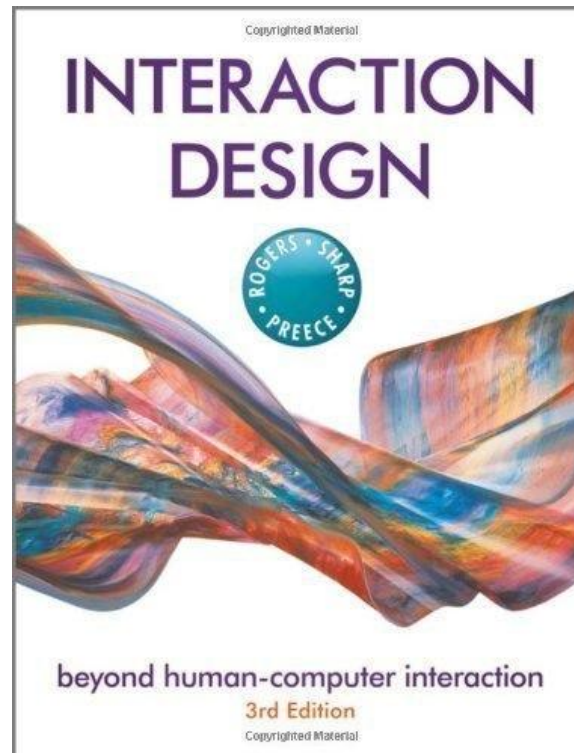
- What is Human-Computer Interaction?
- Why the user interface matters
- Usability and User Experience: how do we judge an interface

After this lecture you can:

- explain what HCI is and what it studies
- argue with real examples why UI quality affects safety, revenue and adoption
- distinguish usability from user experience and assess a UI against the six usability goals

Literature

Rogers et al.: Interaction Design, Chapter 1



Human-Computer Interaction

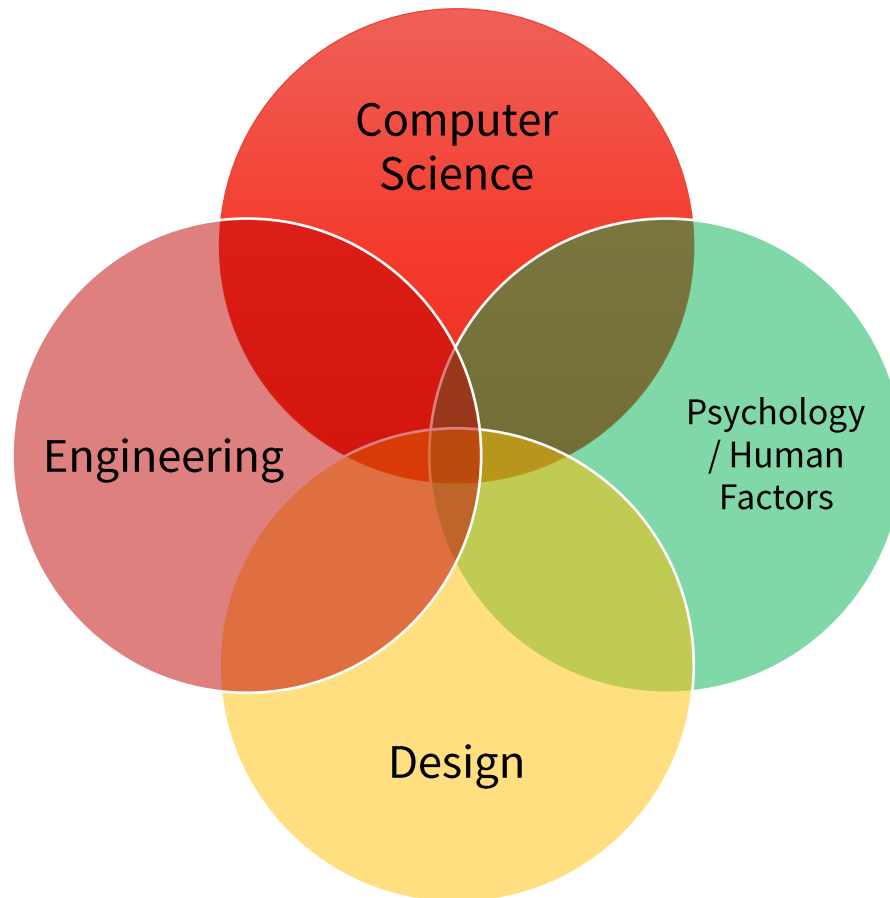
HCI

“Human-computer interaction is [...] concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.” (ACM SIGCHI)

- Developing good user interfaces
- Understanding what are successful ways of interaction, and why they are successful
- Evaluating the quality of a user interface, find ways to improve it
- Developing new ways of interaction (new principles, new technologies)
- Studying how interactive computing technologies affect people and society

Human-Computer Interaction

is multi-disciplinary



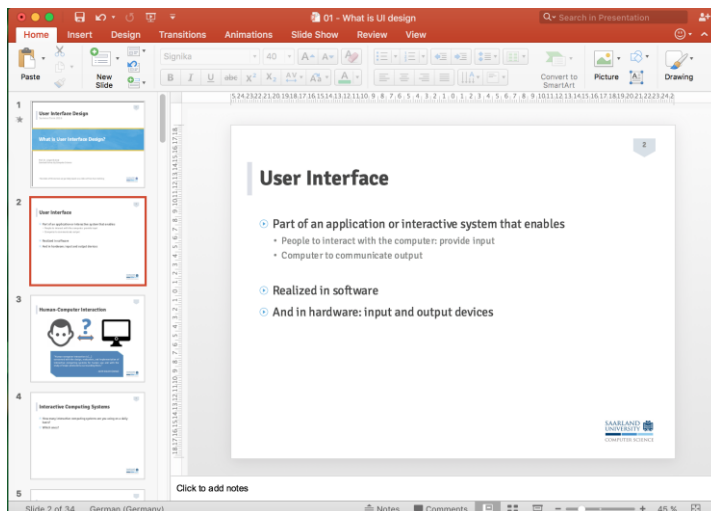
User Interface (UI)

UI

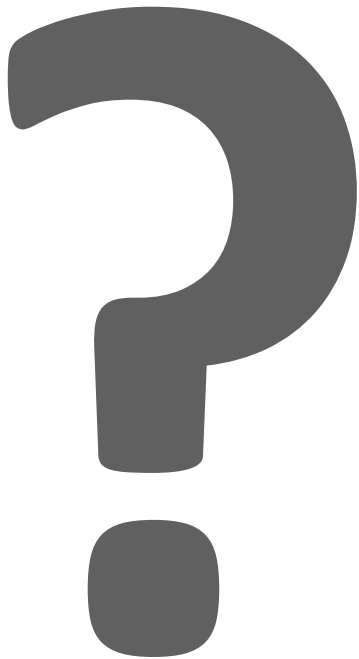
Part of an application or interactive system that enables the user to interact with the computer (*input*) and the computer to communicate to the user (*output*)

Realized in **software**

and in **hardware**: input and output devices



User Interfaces



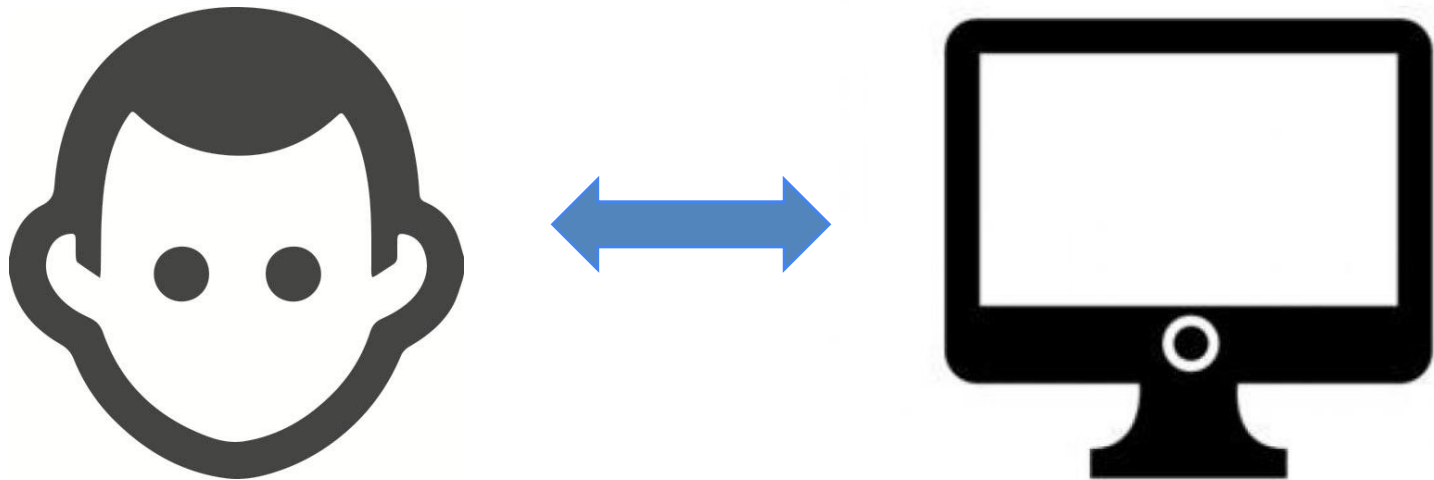
Name one user interface that failed you last week.

Which one?

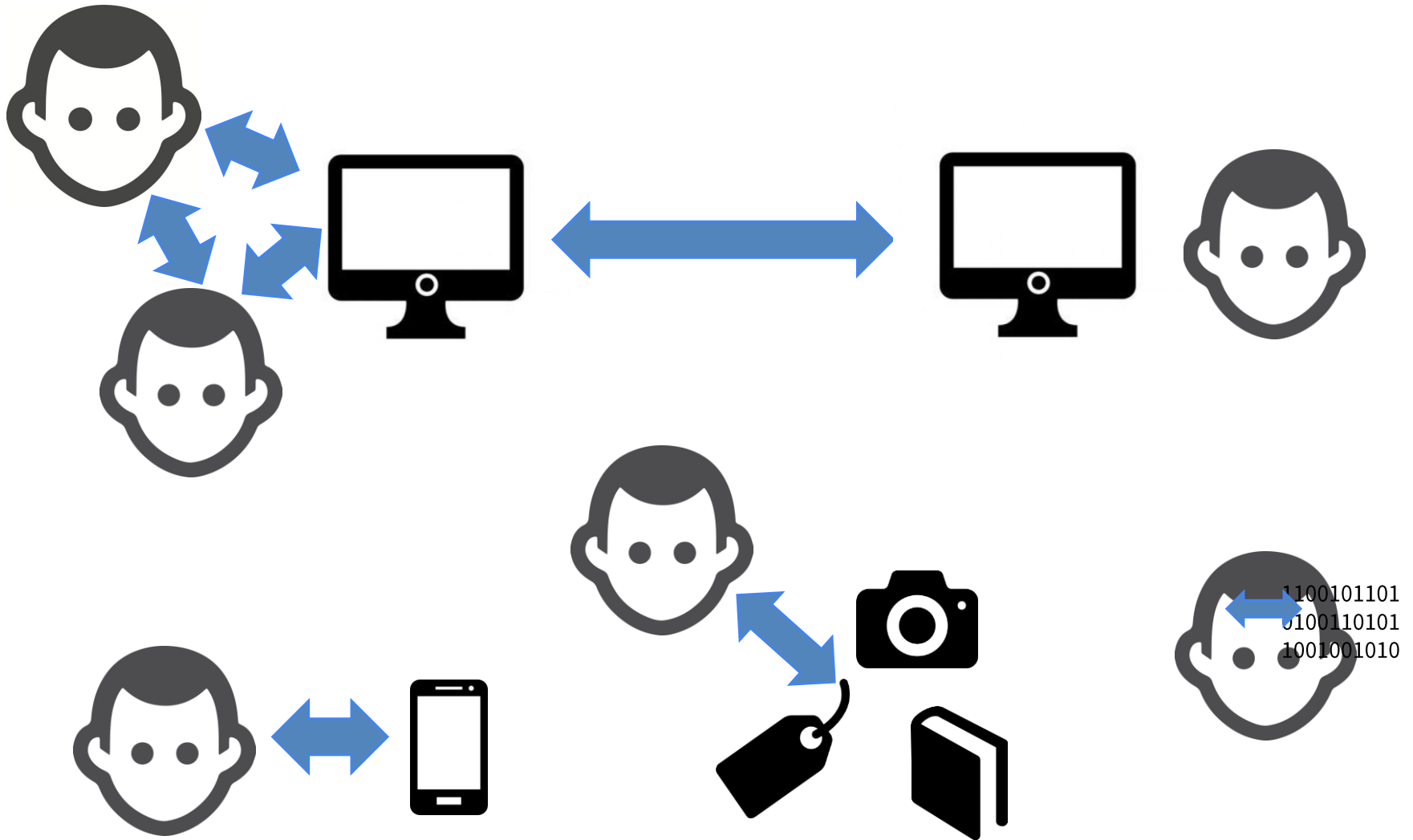
Was the system wrong?

Or could you not figure out how to make it what you wanted, see what it did, undo it, ...?

Types of User Interfaces

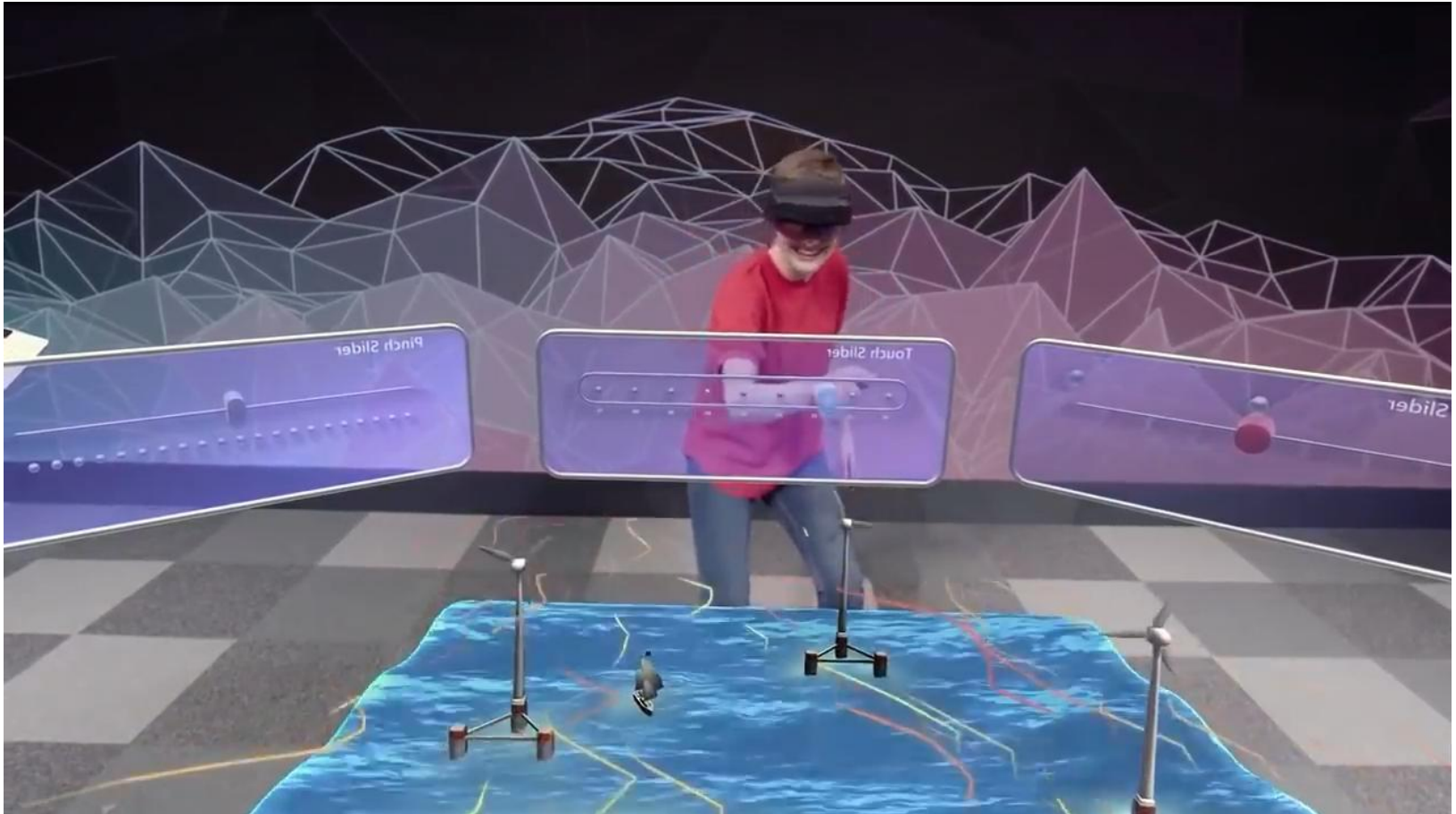


Types of User Interfaces



Augmented Reality

Interactive 3d Graphics

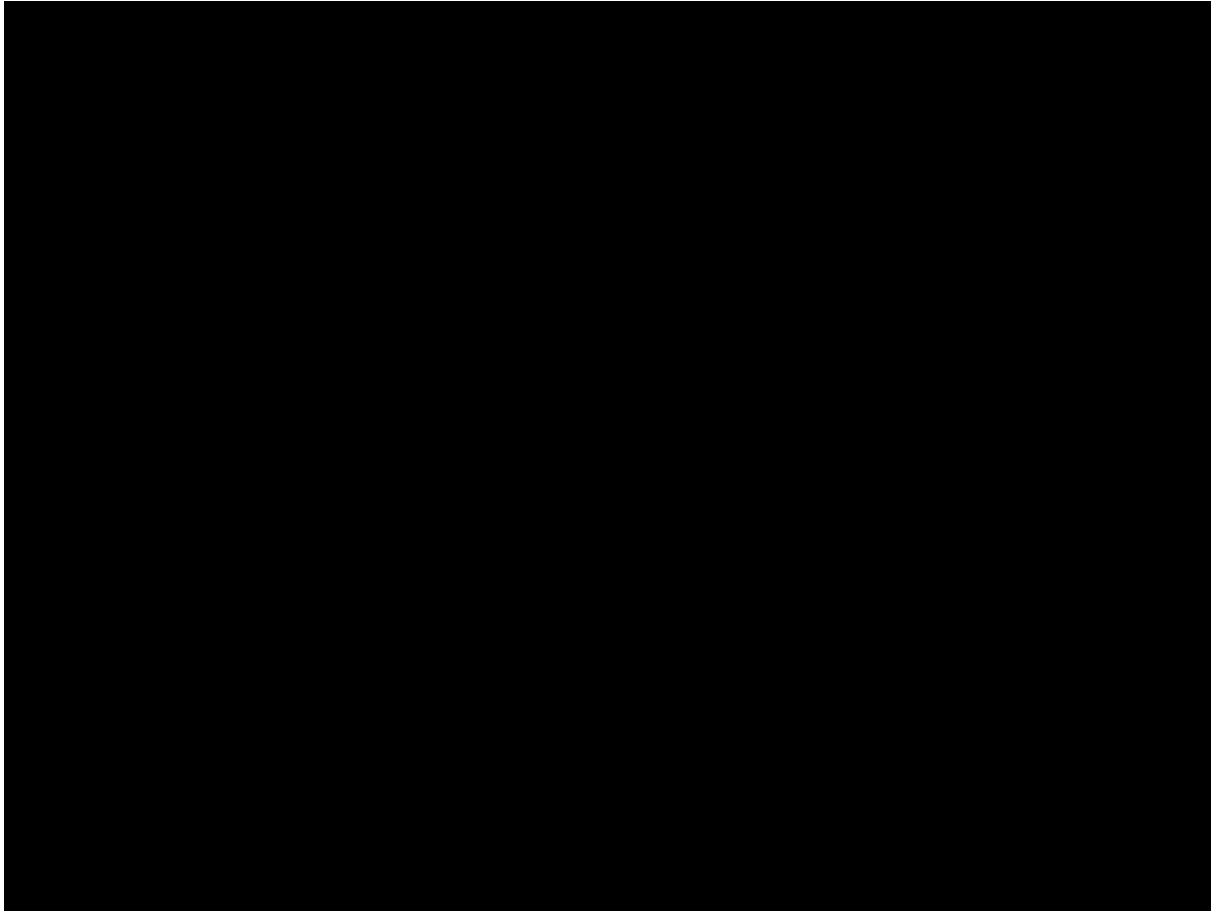


Virtual Reality

Rendering haptic effects

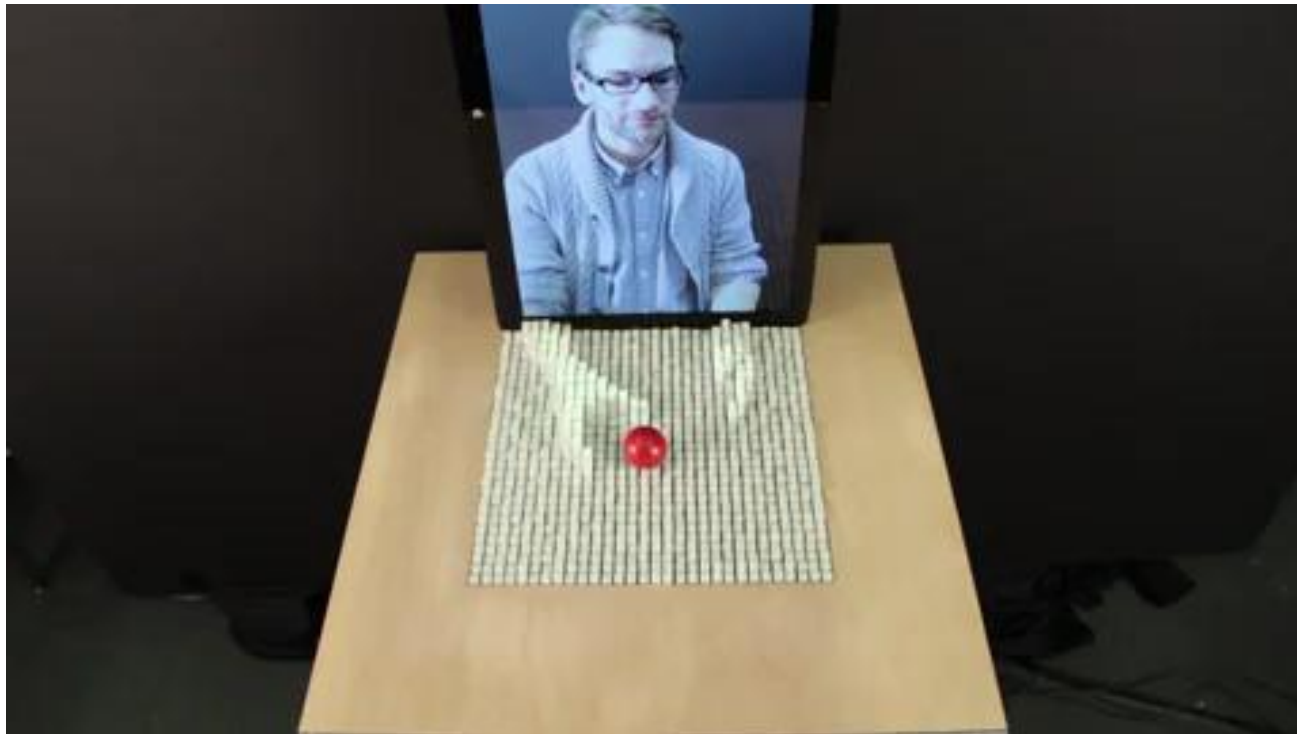


reactable, an interactive table



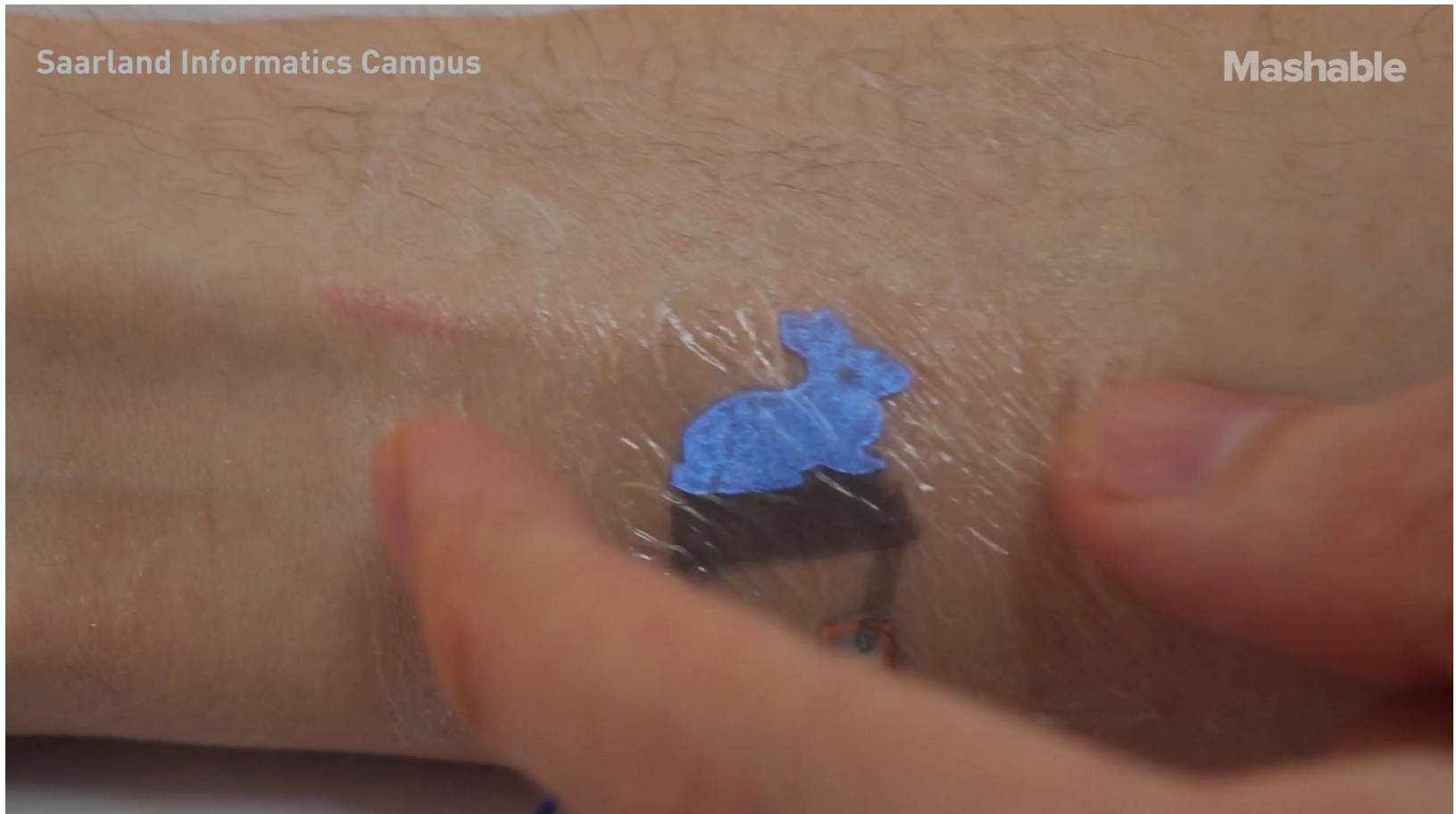
Tangible Interfaces: Inform Table

Table with mechanical pin-array can visualize, actuate, and support telepresence



On-Skin Interfaces

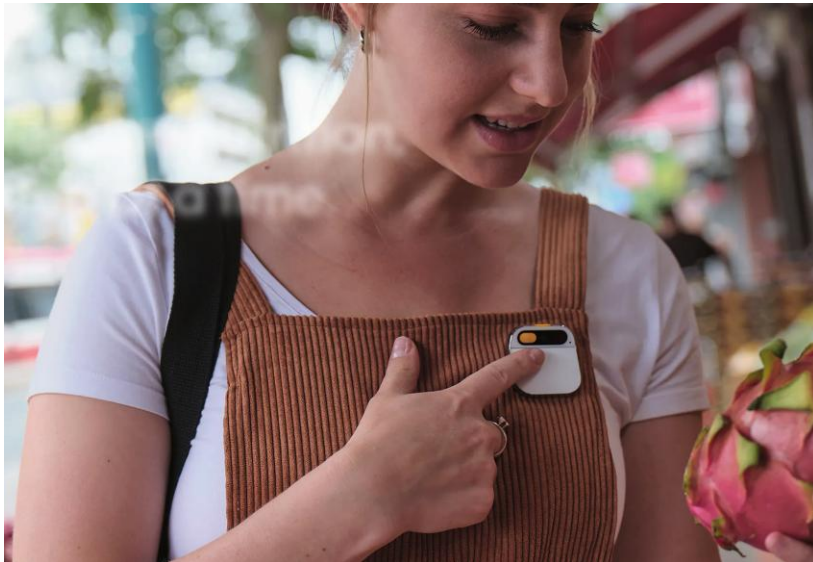
Direct interaction, anywhere and anytime



Wearable AI Interfaces

Humane AI Pin: Wearable UI

- Touch, speech input, camera, audio and laser projected output
- Ask questions – device answers
- 10,000 sold; stopped working in Feb 2025



Images: Humane.com; Meta

Ray-Ban Meta AI glasses

- Photo and video capture, livestreaming, calls, texting, live translation and captions, navigation
- Violations of bystander privacy. Currently public pushback



Types of User Interfaces

UI designers build an **unprecedented breadth of user interfaces**

- Ranging from classical computers, mobile interfaces to everyday things and wearables
- Ranging from individual users to collaborative systems
- Ranging from productive workplace systems to highly emotional systems
- Ranging from everyday users to specific user groups (e.g., elderly or disabled users)

The User Interface is Important

Windows Mobile smart phone vs. Apple iPhone



The User Interface is Important



Ford's **reputation damaged** due to touch screen interface

“Despite Ford’s improvements in manufacturing quality, their overall ratings fell precipitously this year [from 5th to 23rd] due solely to the poor software interaction on their dashboards.” – [Cooper Report](#) based on an article from [New York Times](#)

The User Interface is important

Poor UIs risk users' privacy

- Meta's chatbot app had a confusing user interface design
- Button “Share” directly shared with the user's public feed
- Users **accidentally shared highly sensitive chatbot conversations** in their social feed
- Screenshots from the Discover feed showed personal addresses, phone numbers, and even legal documents published in plain view



The User Interface is Important

Bad user interfaces can cause disasters and cost people's lives



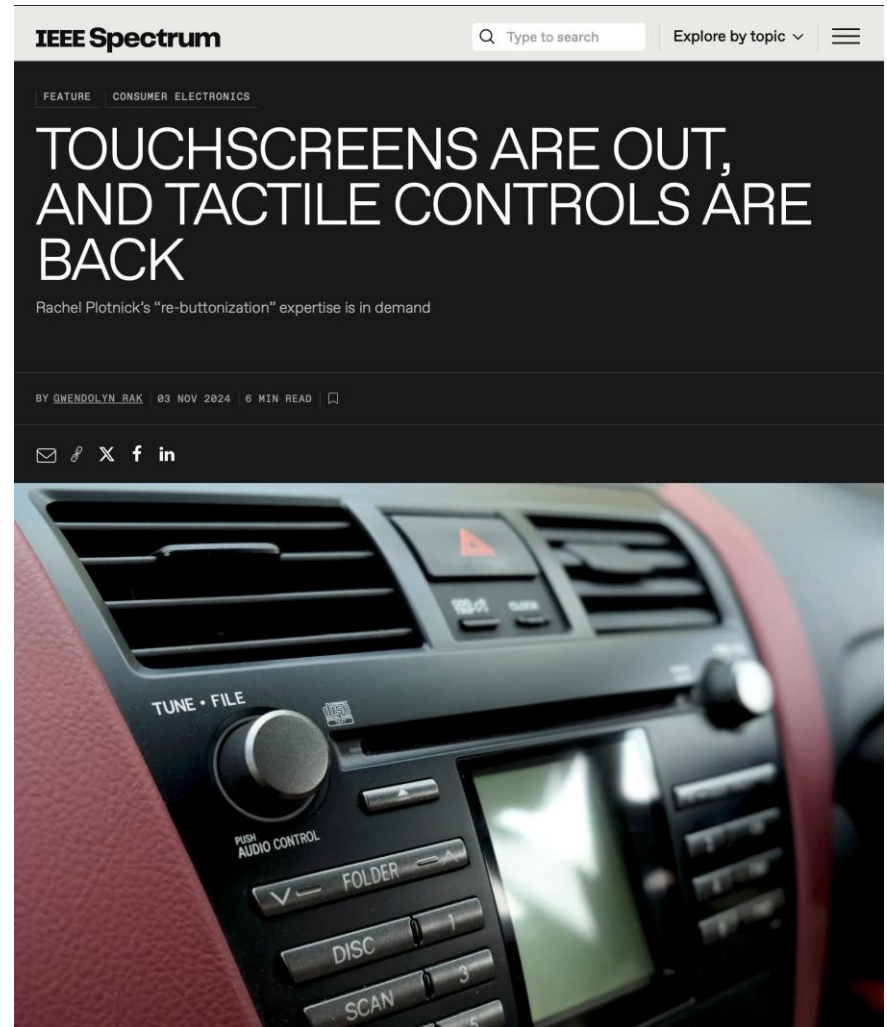
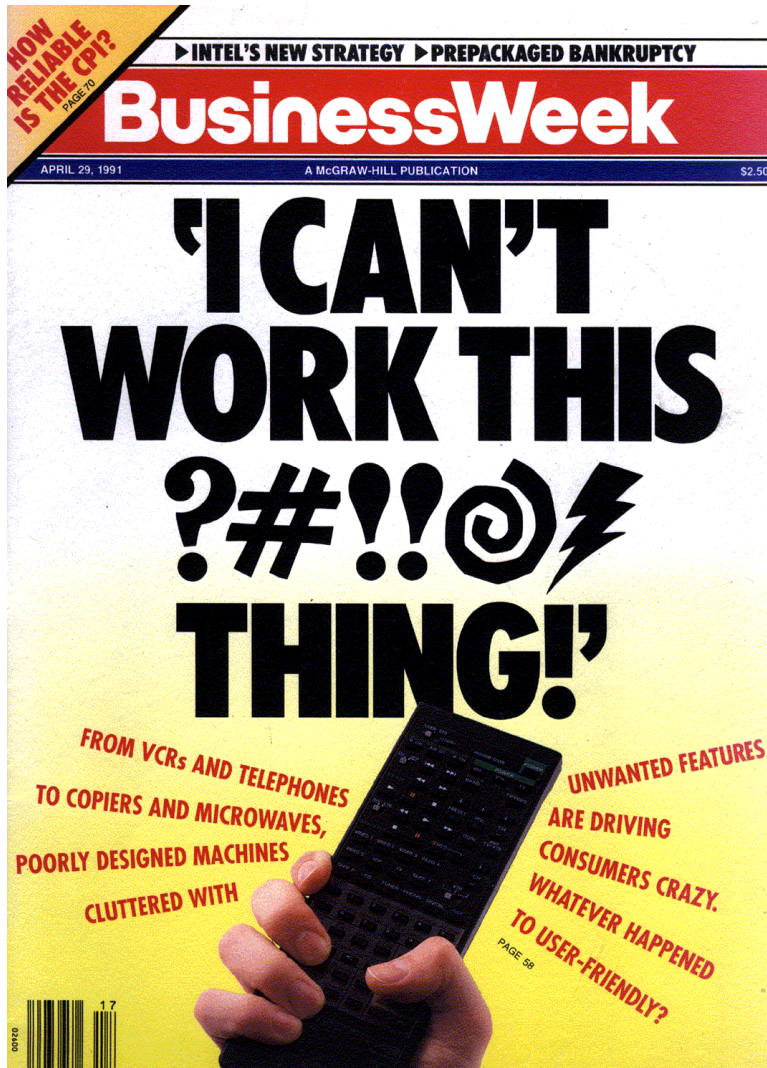
Deadly crash of American Airlines jet in 1995

- Aircraft was approaching Rozo waypoint (Colombia)
- Pilot entered “R”, to program the waypoint
- System reported 12 waypoints starting with R, sorted by distance; waypoint “Romeo” listed first; pilots selected it without verifying
- The autopilot executed turn to head for Romeo waypoint: collision course
- The aircraft collided with a canyon wall

The User Interface is Important

- The user interface is a (the?) **major part of work** in the development of computer programs
- The user interface and user experience has become a key element for the **market success** of a product
- Bad user interfaces are **costly** (time, revenue, lives, ...)
- User interfaces are **hard to get right**

Good vs Bad Design ?



Good vs Bad Design

Bad Design



TV Remote Control

- Shape does not naturally fit the hand
- No logical key layout
- Only few hints (e.g., color-coding)
- Buttons are hard to locate

Good vs Bad Design

Bad Design



TV Remote Control

More functions = more buttons?

Good vs Bad Design

Better Design?



Less might be more ?

Siri Remote (1st gen)

Siri Remote (2nd/ 3rd gen.)



Good vs Bad Design

Bad Design



IP Phones at our university

How would you display a missed call?

- Read the user manual and find out: By clicking on „Directories“ – Select „Missed calls“

How would you program a speed-dial key?

- Not possible on the device. Call the helpdesk and they will (maybe) program it for you.

Lack of visibility: confusing, difficult to use

Lack of directness: inefficient

Good vs Bad Design

Better Design?



The Marble Answering Machine

- Based on how everyday objects behave
- Easy, intuitive to use
- Only requires one-step actions to perform core tasks

How it works:

For each message recorded on the answering machine, a marble rolls out. Each marble represents a single message left on the answering machine. Dropping a marble onto the dish plays back the associated message or calls back the caller.

Good vs Bad Design



Which UI is better, and by what criteria?

What Makes a Good User Interface?

A good UI has a **high degree of usability** and offers a **good user experience**



Usability Goals

User Experience
Goals

Usability

Usability

"The extent to which a system, product or service can be used by specified users to achieve specified goals **with effectiveness, efficiency, and satisfaction** in a specified context of use."
(ISO 9241)

- Usability centers on ease-of-use and learnability of a system
- More objective criteria, can be measured in quantitative tests
- Historical focus of HCI (usability engineering)

But:

- This broad definition is hard to operationalize
- Therefore, usability is specified using specific usability goals (or usability criteria), see next slides

Usability Goals

effective to use

Is the product capable of allowing users to perform tasks accurately and completely?

- doing “right” things; can users complete tasks successfully?

efficient to use

Once users have learned how to use a product to carry out their tasks, can they sustain a high level of productivity?

- doing things in the most economical way

safe to use

What is the range of errors that are possible using the product and what measures are there to permit users to recover easily?

Usability Goals (2)

have good utility

Does the product provide the necessary set of functions that will enable users to carry out all their tasks in the way they want to do them?

easy to learn

Is it possible for the user to work out how to use the product by exploring the interface and trying out certain actions?

easy to remember

What kinds of interface support have been provided to help users remember how to carry out tasks?

Usability Goals (3)

effective to use

efficient to use

safe to use

have good utility

easy to learn

easy to remember

A long list of goals that are difficult to achieve all at once!

- Focus on particular goals
- Trade-offs between goals

User Experience

UX

Captures user's emotions and attitudes about using a product

- Pleasure & satisfaction when interacting
- Focus on „soft“, subjective and emotional qualities
- Wider scope than usability alone
 - Good usability avoids *negative* emotions (e.g., frustration)
 - Good user experience creates *positive* emotions
- Overlaps with usability; in some definitions UX comprises usability

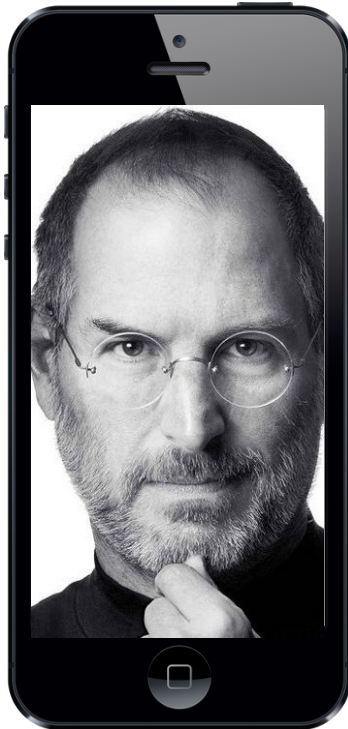
“Every product that is used by someone has a user experience: newspapers, ketchup bottles, reclining armchairs, cardigan sweaters.” (J.J. Garrett, UX Salon, 2003)

Design Goals: User Experience Goals

- Satisfying
 - Enjoyable
 - Engaging
 - Exciting
 - Aesthetic
 - Creative
 - Fun
 - Helpful
 - Motivating
 - ...
- Boring
 - Annoying
 - Frustrating
 - Gimmicky
 - Childish
 - Making one feel stupid
 - ...

User Experience

Example



Good UX is important for the success of a product

Would the iPhone have been so successful without Steve Jobs and the whole UX package?

- Quality user experience
- Simple & elegant
- Distinct brand
- Catchy names
- Must-have fashion item for many

HCI in the AI era

What changes?

- People can communicate their goals at a higher level of abstraction
- New design problems: e.g. learnability (capabilities and limits are invisible), human control, safety

What stays?

- Human perception and cognition
- Usability and user experience goals
- Designing, prototyping and testing with users are must-haves
- Existing interfaces remain dominant. Natural language interaction gets integrated with graphical and physical interaction
- The interface & interaction still decide user adoption !



SUMMARY

HCI covers the **design, implementation and study of user interfaces**

UI designers build an **unprecedented breadth** of user interfaces, for desktop, mobile, AR/VR, smart objects, conversational AI...

The user interface decides success: bad user interfaces cost time, revenue, and even lives

A good UI combines good **usability** with good **user experience**

Goals conflict, so **design means trade-off**, and we test with real users