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Human Computer Interaction

Lecture 1

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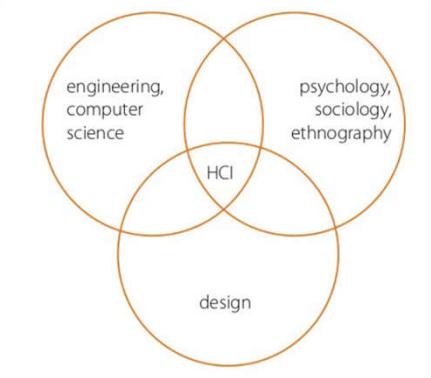
Human Computer Interaction

Human-computer interaction (HCI) is a multidisciplinary field of study focusing on the design of computer technology (or digital products) and, in particular, the interaction between humans (the users) and computers.



- Some examples of what interaction techniques are:
  - Mouse, Icons, Menus
  - Gestures based interaction
  - Voice based commands
  - Sensor based Interaction
  - Virtual Reality
  - Brain-Computer Interface (Futuristic)

When to use which interaction techniques

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Human-Computer Interaction (HCI) is a multidisciplinary field concerned with the design, evaluation, and implementation of interactive computing systems for human use and the study of different contextual issues surrounding them.

- Issues can be Cognitive processes, User behavior, Emotional responses, Accessibility and inclusivity, Ethical considerations

- HCI focuses on understanding users and their interaction.
  - What are users' needs?
  - What are users' expectation from a product?
  - How they perceive the task in mind before taking actions?
  - What actions do the users perform while interacting?
  - How they respond to the systems behavior?
  - What emotions they go through?
  - If and why users make errors?

- HCI plays a crucial role in ensuring that technology is usable, useful, and accessible to users.
- It enhances user satisfaction, productivity, and overall experience with interactive systems.
- HCI principles are fundamental in designing everything from websites and mobile apps to smart devices and virtual reality interfaces.

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Usable and Useful

- **Usable**
  - Usability refers to the ease with which users can accomplish their goals and tasks when interacting with a system. It focuses on the efficiency, effectiveness, and satisfaction of the interaction process.
  - A system is considered usable if it is easy to learn, easy to use, efficient, and provides a satisfying user experience.
  - Usability is often assessed through usability testing, user surveys, and heuristic evaluations.
    - Intuitive navigation
    - Responsive feedback
    - Error prevention and recovery

- **Useful**
  - Usefulness refers to the extent to which a system or product fulfills users' needs, goals, and requirements. It focuses on the utility and value that the system provides to users in accomplishing their tasks or solving their problems.
  - A system is considered useful if it effectively addresses users' needs and helps them achieve their objectives.
  - Usefulness is often evaluated based on user satisfaction, task completion rates, and the system's ability to meet users' goals.

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Core concepts in HCI

- **Interaction Design:**
  - Designing the interactive aspects of systems, including interfaces, input methods, and feedback mechanisms.
- **Evaluation:**
  - Assessing the usability, effectiveness, and user experience of interactive systems through various evaluation methods.
- **Usability Evaluation:**
  - Evaluating or testing design to assess the degree to which a system is easy to use, efficient, and satisfying for users.
- **User-Centered Design (UCD):**
  - Designing systems with the user's needs, preferences, and abilities in mind.
- **Accessibility:**
  - Accessibility involves designing systems that are usable by individuals with diverse abilities and needs, including those with disabilities. HCI addresses accessibility guidelines and techniques to ensure that technology is inclusive and accessible to all users.

- Evaluation and Usability Methods:
- These techniques are used to conduct user studies in order to evaluate effectiveness of interactive systems.
  - These techniques includes
    - Usability Testing
    - Expert Evaluation
    - Heuristic evaluation
    - User Studies

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HCI ➔ Interaction Design ➔ User Experience Design

- **HCI Principles as Foundations:**
  - HCI provides a rich set of theories, principles, and models that elucidate (explain) how users interact with technology.
  - These insights serve as the foundation for designing user-centered systems and interfaces.
- **Guiding Interaction Design:**
  - HCI principles play a fundamental role in guiding Interaction Design, the process of designing intuitive and effective interfaces.
  - By applying HCI principles, designers can create interfaces that enhance user experience and usability.

HCI, Interaction Design, User Experience Design

- **Enhancing User Experience:**
  - Interaction Design aims to optimize user experience by:
    - Making products usable for performing tasks efficiently.
    - Reducing error rates and enhancing reliability.
    - Facilitating ease of learning, minimizing the need for extensive training, etc.

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Positioning HCI

System = Interface + Functionality

- Testing is performed to confirm Functionality.
- HCI deals with the Interface aspect.
- Usability Testing is used to check if the Interfaces are usable and what problems if any exist.

HCI mostly deals with the interface part and deals with developing and assessing usability of a computer system.

Interaction Design and HCI

- The scope of Interaction Design is wider than HCI.
- Interaction Design is designing interactive products to support the way people work, communicate and interact in their everyday and working lives.
  - The focus of Interaction Design is on the process of achieving a task successfully with good user experience.
  - Interaction Design goes beyond specific interfaces or interaction methods – it is more about how users would interact with specific products – not just interfaces.

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HCI's position on Human Errors

Human Error? No, Bad Design

Human errors are related to Bad System and Interaction Design. The following is an example suggests that 5 Whys questions can reveal design problems.

Five Whys

Question	Answer
Q1: Why did the plane crash?	Because it was in an uncontrolled dive.
Q2: Why didn't the pilot recover from the dive?	Because the pilot failed to initiate a timely recovery.
Q3: Why was that?	Because he might have been unconscious (or oxygen deprived).
Q4: Why was that?	We don't know. We need to find out.
Etc.	

- Humans do make errors.
- Complex devices will always require some instruction, and someone using them without instruction should expect to make errors and to be confused.
- But designers should take special pains (while designing systems) to prevent errors and make errors as cost-free as possible.

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Why do Interfaces have Problems?

Why people make errors while using computer systems?

Because mostly designers have designed those for the people the way the designers would like those systems to be, not for the way people would like those systems to be.

Design Solutions without understanding Users Needs

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Some examples of design and interaction problems, which could have been discovered if HCI and Interaction design guidelines and principles were properly used.

Design Issues: matching labels with buttons

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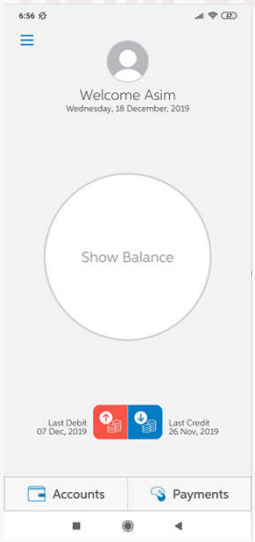
A Good Design to avoid mistake

Interaction Design Issues...

Before

After



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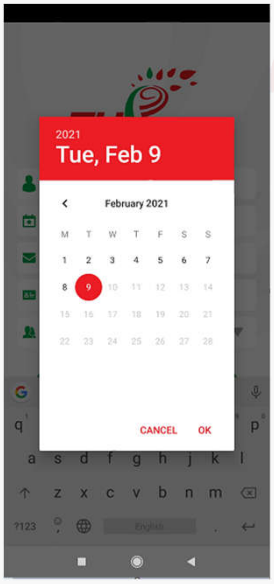
Interaction Issues...

Invisible Bank Names due to same background.

HCI discipline provides ways of identifying and addressing such issues.

Affordance Issue : Select Date of Birth



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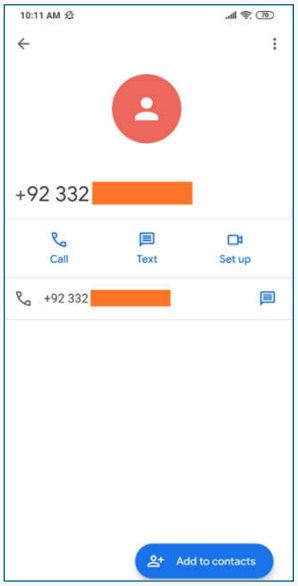
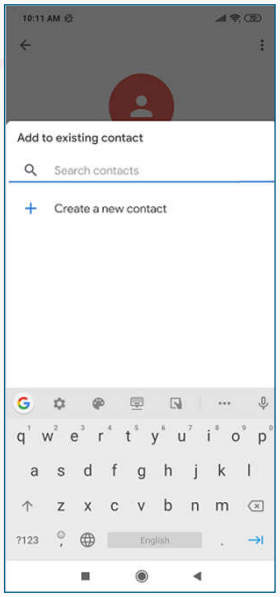
Interaction Design Issues...



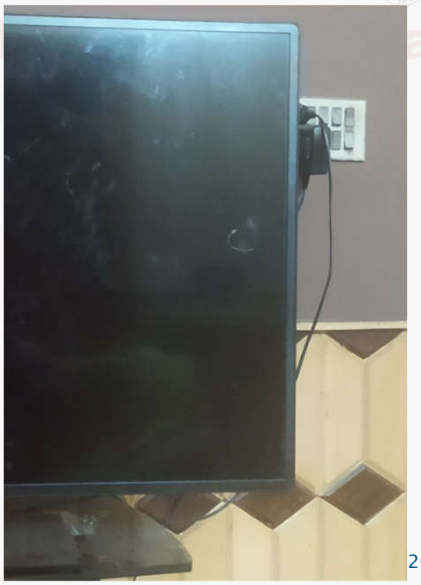


Design Issues...

Visibility Principle Violation:

Hidden physical buttons / controls without any hint.

The functionality is there but there is no clue where to find it.



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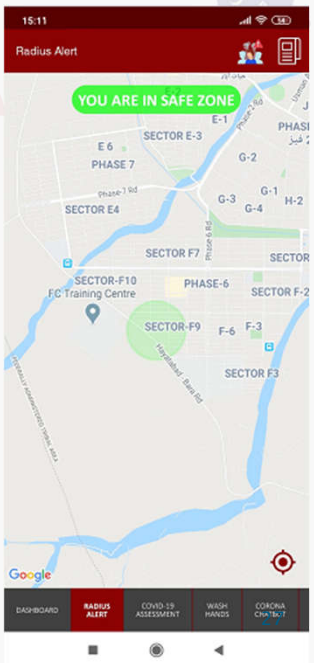
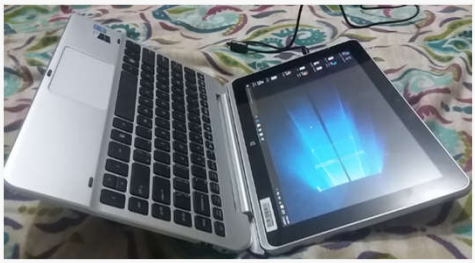
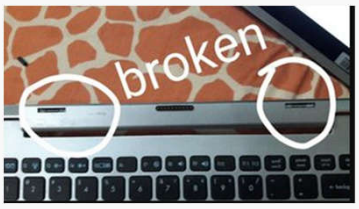
Interaction Design Issues:

Usable but NOT useful
You are in Safe Zone… screenshot during lockdown.



Ergonomics issues





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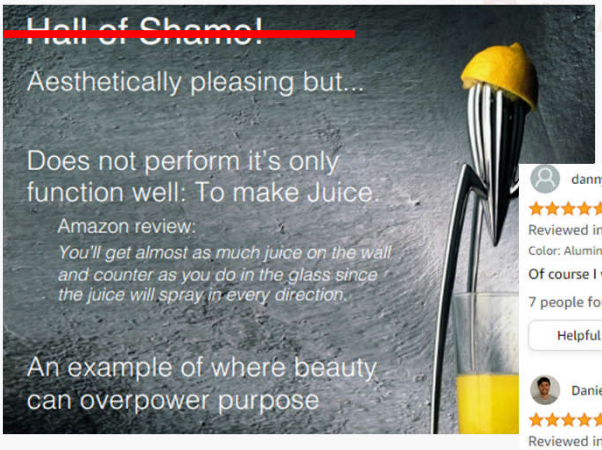
Aesthetic vs Usability in Design



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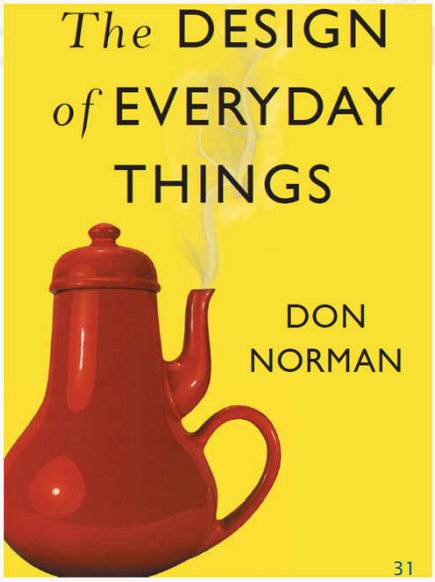
Most Recommended Book for HCI

This book is highly recommended for HCI students and researchers.

This book is not about design of Computer Systems, however, this book gives an idea of why human makes mistakes while using different things, devices, machines, interfaces, etc.

The guidelines identified in this books can be useful in designing computer system interfaces.



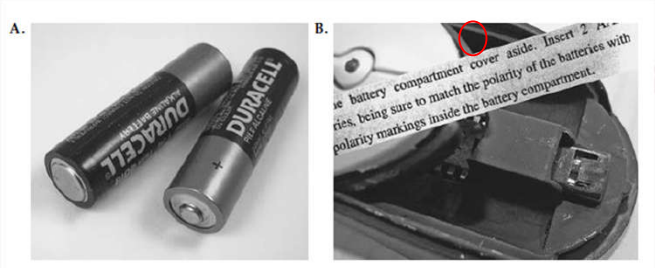


FIGURE 4.2. Cylindrical Battery: Where Constraints Are Needed. Figure A shows the traditional cylindrical battery that requires correct orientation in the slot to work properly (and to avoid damaging the equipment). But look at Figure B, which shows where two batteries are to be installed. The instructions from the manual are shown as an overlay to the photograph. They seem simple, but can you see into the dark recess to figure out which end of each battery goes where? Nope. The lettering is black against black: slightly raised shapes in the dark plastic.

FIGURE 4.3. Making Battery Orientation Irrelevant. This photograph shows a battery whose orientation doesn't matter; it can be inserted into the equipment in either possible direction. How? Each end of the battery has the same three concentric rings, with the center one on both ends being the "plus" terminal and the middle one being the "minus" terminal.

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Concepts from the physical world principle:

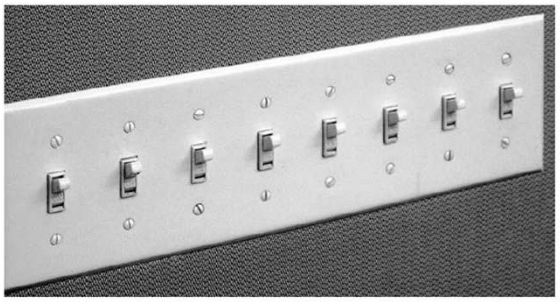
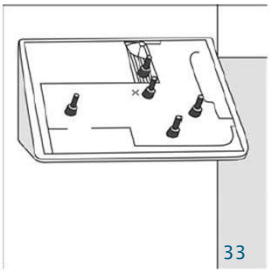


FIGURE 4.4. **Incomprehensible Light Switches.** Banks of switches like this are not uncommon in homes. There is no obvious mapping between the switches and the lights being controlled. I once had a similar panel in my home, although with only six switches. Even after years of living in the house, I could never remember which to use, so I simply put all the switches either up (on) or down (off). How did I solve the problem? See Figure 4.5.

FIGURE 4.5. **A Natural Mapping of Light Switches to Lights.** This is how I mapped five switches to the lights in my living room. I placed small toggle switches that fit onto a plan of the home's living room, balcony, and hall, with each switch placed where the light was located. The X by the center switch indicates where this panel was located. The surface was tilted to make it easier to relate it to the horizontal arrangement of the lights, and the slope provided a natural anti-affordance, preventing people from putting coffee cups and drink containers on the controls.



A label can help avoid affordance problems

FIGURE 1.3. **Sliding Doors: Seldom Done Well.** Sliding doors are seldom signified properly. The top two photographs show the sliding door to the toilet on an Amtrak train in the United States. The handle clearly signifies "pull," but in fact, it needs to be rotated and the door slid to the right. The owner of the store in Shanghai, China, Photo C, solved the problem with a sign. "DON'T PUSH!" it says, in both English and Chinese. Amtrak's toilet door could have used a similar kind of sign. (Photographs by the author.)

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Wrong Expectations based on Bad Designs

There is no U Turn at the end of this road

What happens when products deployed without Usability Testing?

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