User Interaction COMPSCI2031

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Recap: What we did last yesterday

- Statistical Analysis

- Statistical Task

- Reading: A crash course in fundamental statistical concepts

User Interaction Topics

☑ HCI History and Introduction

☑ Usability and Heuristics

☑ Heuristic Evaluation and Human Cognition

☑ Human Perception and Capabilities

☑ Experimental Design & Variables Research

☑ Personas and Scenarios

☑ Surveys in HCI

☑ Ethnography

☑ Statistical Methods

10. Theories in HCI & User-Centered Design

11. Models of Interaction

12. Large Scale and Mobile HCI

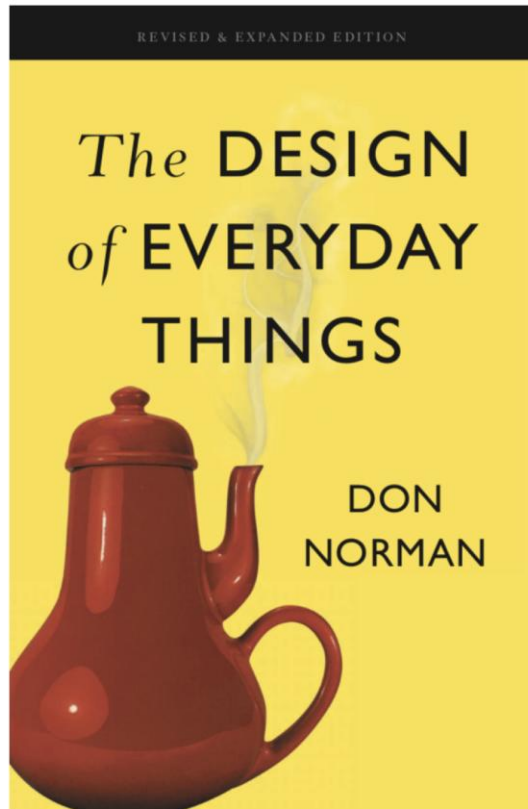13. Various Users and Ethics

14. Revision & Example Exams & Quiz

Theories in HCI

Lecture 10

Fantastic book about design!

Design principles

- Affordance
- Constraints
- Consistency
- Mapping
- Feedback
- Visibility

Design In Everyday Life

Affordances

Affordance

- An attribute of an object that allows people to know how to use it. → A mouse button invites pushing/clicking by the way it is physically constrained in its plastic shell.

- To afford means "to give a clue" (Norman, 1988).

- When the affordances of a physical object are perceptually obvious it is easy to know how to interact with it.

- **It is the relationship between physical object and person**
  - Not a property of an object
  - Objects convey essential info about how people could interact with them
  - The presence of affordance is jointly determined by object properties and person with capabilities that determine how it could be used
    →A chair affords sitting, but a chair also affords lifting (to some people)

Anti-Affordance

- Anti-affordance is the **prevention** of interaction:
  → Design a door without a knob to prevent 'pulling' and facilitate 'pushing'
- To be effective, affordances and anti-affordances must be discoverable
 - If it can't be perceived, need to signal its presence with a **signifier**

What is a Signifier?

- A signifier communicates behaviour

- Could be an image, text or sound that makes an affordance apparent

- Can be **deliberate**
  - E.g. Labels

- Can be **emergent**
  - Paths are worn onto the ground
  - Queues of people

Signifier
- Icons showing locked and unlocked states

Affordance
- Thumb-shaped button for opening lid
- Sliding lock for locking coffee mug
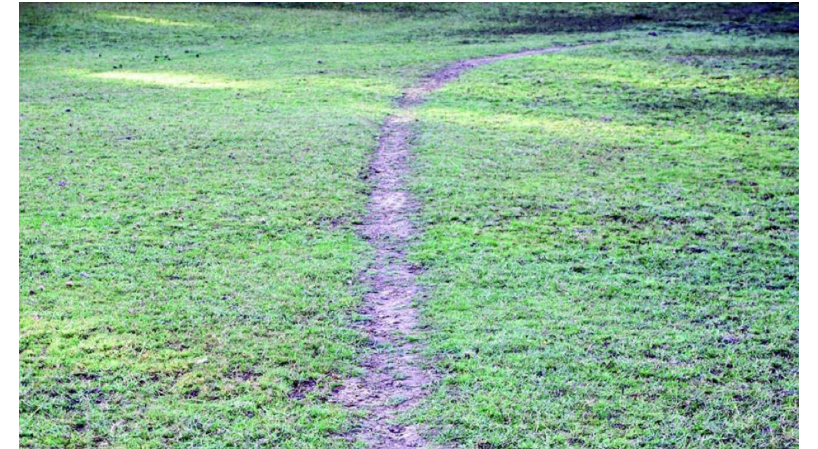
Constraints

Constraints

- Restricting the possible actions that can be performed.
- Prevents errors (ideally)
- Guides users towards correct, desired, or useful behaviour
- Three types of constraints (Norman, 1999)
  - Physical – rely on properties of the physical world
    - e.g. can only insert the correct way: USB-A 😡 , bank cards
  - Cultural – rely on socially learned behaviours
    - e.g., Moodle relies on roles that make sense to us because we know how a course is run
  - Logical – rely on trial and common-sense reasoning
    - e.g. An online form won't submit. Even if it doesn't highlight required fields, we can scan through and see if we left one empty – that one's probably the problem

Logical Constraints

A

- Exploit people's everyday common-sense reasoning about the way the world works

- Leverage natural mappings
  - Where do you plug in the mouse?
  - Where do you plug the keyboard?
  - Top or bottom connector?
  - Do the colour-coded icons help?

Logical Constraints

- A provides no mapping.
- B provides direct adjacent mapping between the icon and connector
- C provides colour coding to associate the connectors with the labels
- → Logical constraint: use reasoning

Forcing Functions

- Guiding Interactions with Constraints
- Forcing Functions: Preventing action until certain requirements are met. Balance error prevention with frustration
  - Interlocks – Requiring actions to occur in sequence
    - Web app that doesn't offer you functionality until you're logged in
  - Lock-Ins – Keeps an action active, preventing action from stopping
    - Gmail checks if an attachment is attached before sending an email
  - Lock Outs – Prevents an action from occurring (typically in safety context)
    - Operators of x-ray machines cannot enter a dangerous value

Where/when should forcing functions be used?

- Cash machine software varies significantly.
    - When and how long is card in machine?
    - When do you enter PIN?
- Where should forcing functions be implemented?
    A. At the beginning of all interactions
    B. Distributed throughout interactions at the point where security is needed
    C. Some other approach?
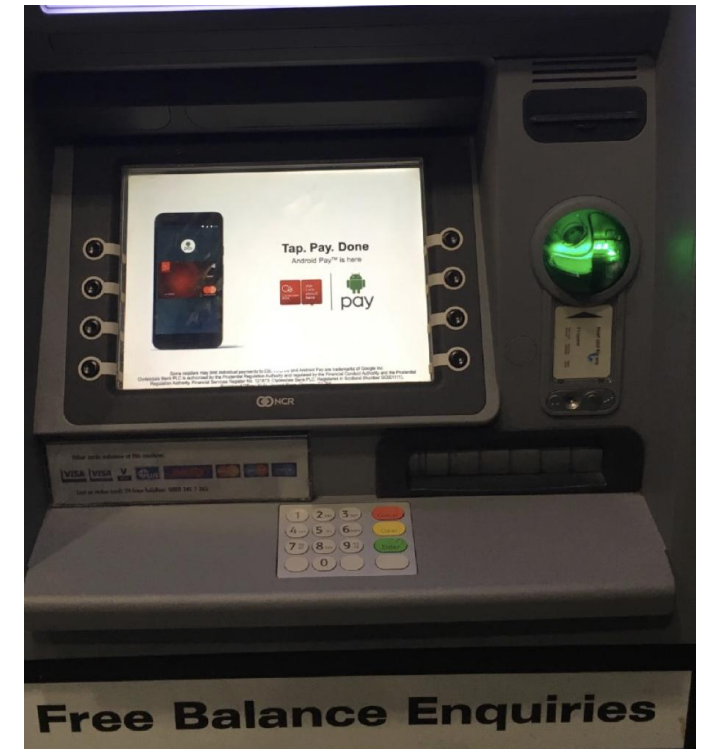
Consistency

Consistency

- Design consistency
  - Lessons learned from one system transfer to others
  - Design interfaces to have similar operations and use similar elements for similar tasks
- Consistent interfaces are easier to learn and use
  - **internal** consistency: designing operations/ interfaces to be the same within an application
  - **external** consistency: designing operations/a to be the same across applications
  - Internal and external consistency can work against each other! 🙄
    → E.g., Banking app: fit with the brand or banking standards?

Consistency

Confusing cases of external inconsistencies:

(a) phones, remote controls

1	2	3
4	5	6
7	8	9
	0	

(b) calculators, computer keypads

7	8	9
4	5	6
1	2	3
0		

Consistency vs Progress

- People don't like change!
    - New learning is required
    - Which design 'better'? Irrelevant!
      → the change is upsetting
    - Better to be consistent if the new
      is only slightly better than the old?
    - If change to a new system,
      everyone has to change – mixed
      systems confusing

- Standards simplify life but can
  hinder future development
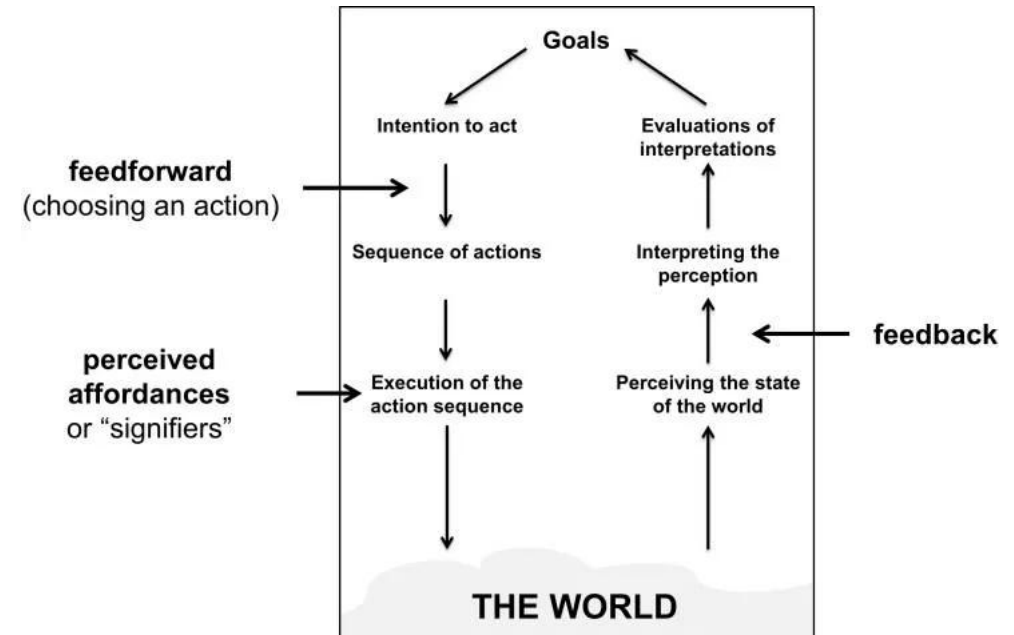
Mapping

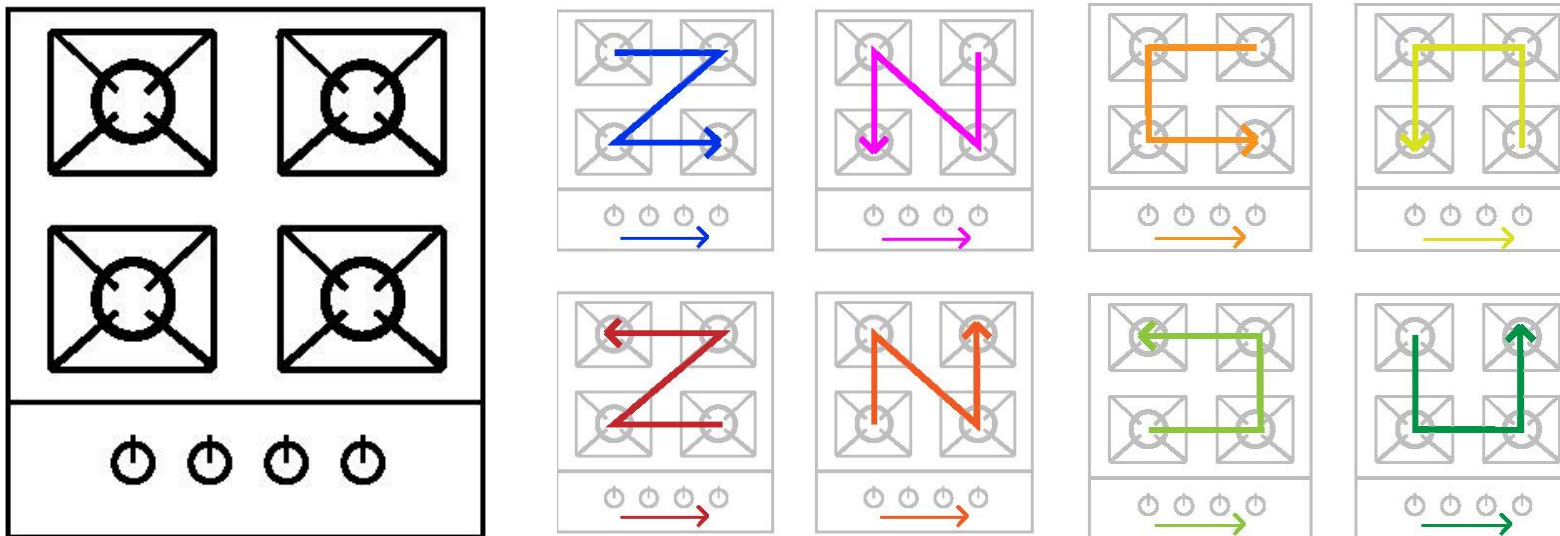# Mapping

- Relationship between controls and results
- How would you do it?

Mapping
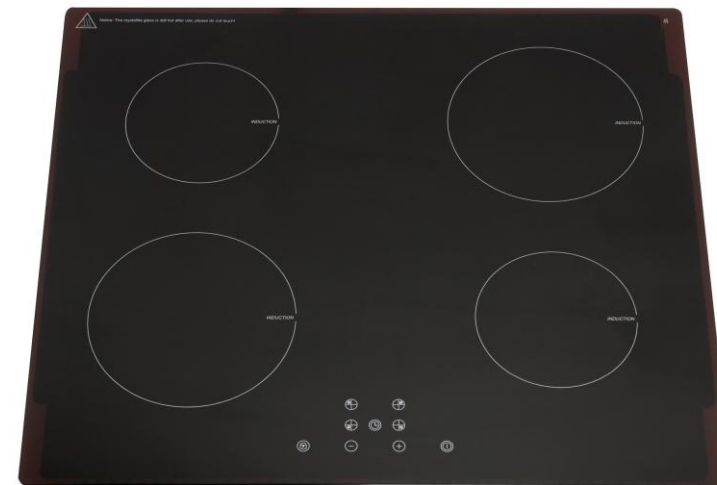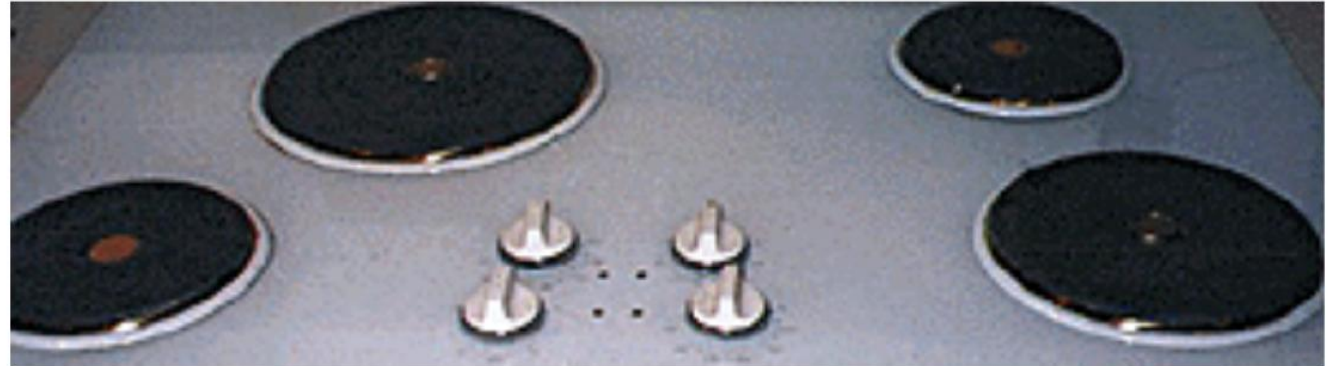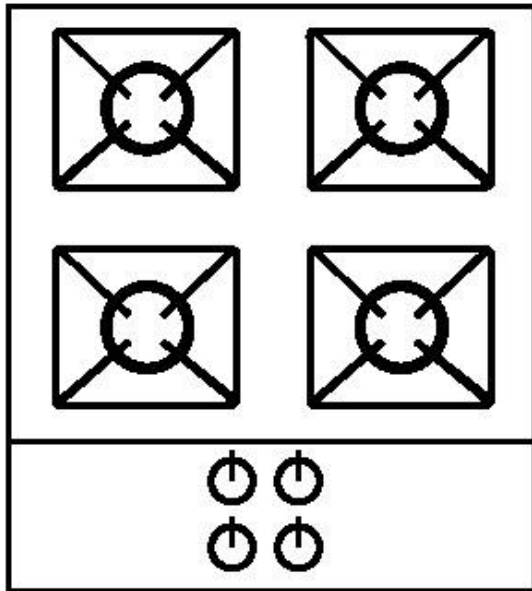
- Relationship between controls and results

- How would you do it?

- Many users, many mappings!

Mapping: Spatial.

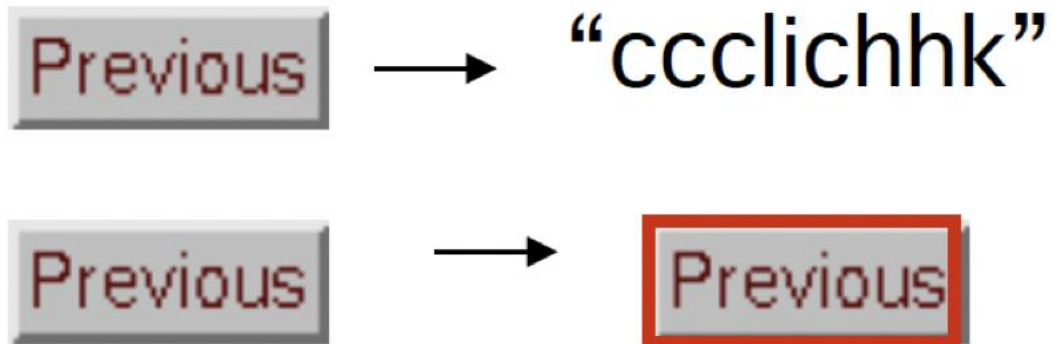

Better mapping, better design

Feedback

Feedback

- Sending information back to the user about what has been done
- Includes sound, highlighting, animation, …
- and a combination

Feel the interaction with your lips ?

Or vibrations on your hands?

Visibility

Visibility

- An elevator control panel
- How does it work?
- Push button for the floor you want ✅
- You push a button, and nothing happens. 🤔
- Push any other button? Still nothing. 🤬
- What do you need to do?
- It is not visible what to do!
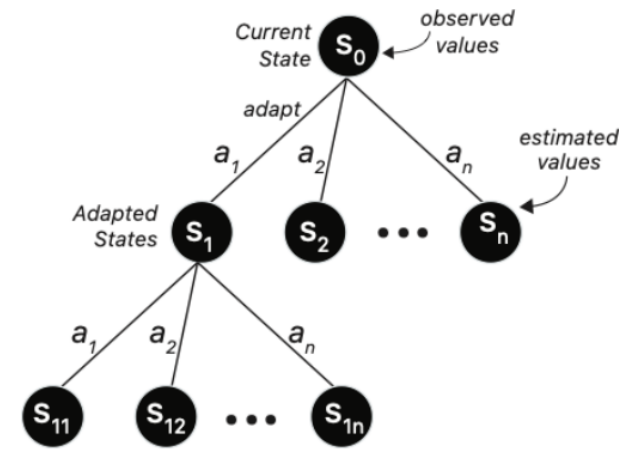
Visibility

- You need to insert your room card in the elevator to get it to work 🙄

- How would you make this action more visible?
  - Make the card reader more obvious
  - Provide an auditory message that says what to do (in what language?)
  - Provide a big label next to the card reader that someone enters

  → Make relevant parts visible
  → Make what has to be done obvious

One Solution: Adapting Interfaces

- Adaptable interfaces consider behaviours taken by a user and change as a result

- How to adapt is challenging:
  - Could get trapped in a suboptimal design if learning or playing around
  - Wrong adaptation?

- Again, goes back to what is beneficial design, and to whom.

Reference: Adapting User Interfaces: https://dl.acm.org/doi/10.1145/3411764.3445497

Design?

Jakob Nielson Ten Usability Heuristics (1993)

1. Visibility of System Status
2. Match between real world and System
3. User Freedom and Control
4. Consistency and Standards
5. Error prevention
6. Recognition over recall
7. Flexibility and efficiency of use
8. Aesthetics and Minimalist Design
9. Recognize, Diagnose, and Recover
10. Help and documentation
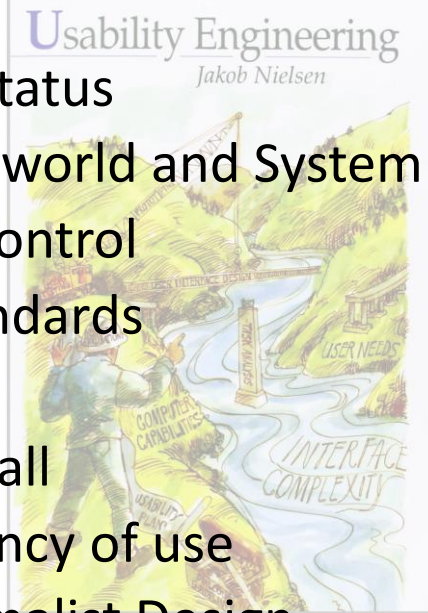
Don Norman's Design Principles (1988)

1. Affordance
2. Constraints
3. Consistency
4. Mapping
5. Feedback
6. Visibility

Jakob Nielsen. 1994. Usability Engineering. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.

Norman, D. A. (1988). *The psychology of everyday things*. Basic Books.

User Centered Design

What is User Centred Design?

OBSERVATION • IDEA GENERATION • PROTOTYPING • TESTING

NOT SURE IF USER IS STUPID

OR DESIGN IS JUST BAD
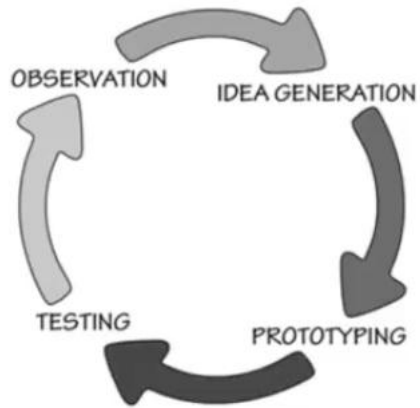
User-Centered Design (or UCD)
→ Iterative Process

- Investigative methods and tools e.g., surveys and interviews)

- Generative tools (e.g., brainstorming)

- Term coined in 1970

- Don Norman adopted to improve peoples' experiences of items.
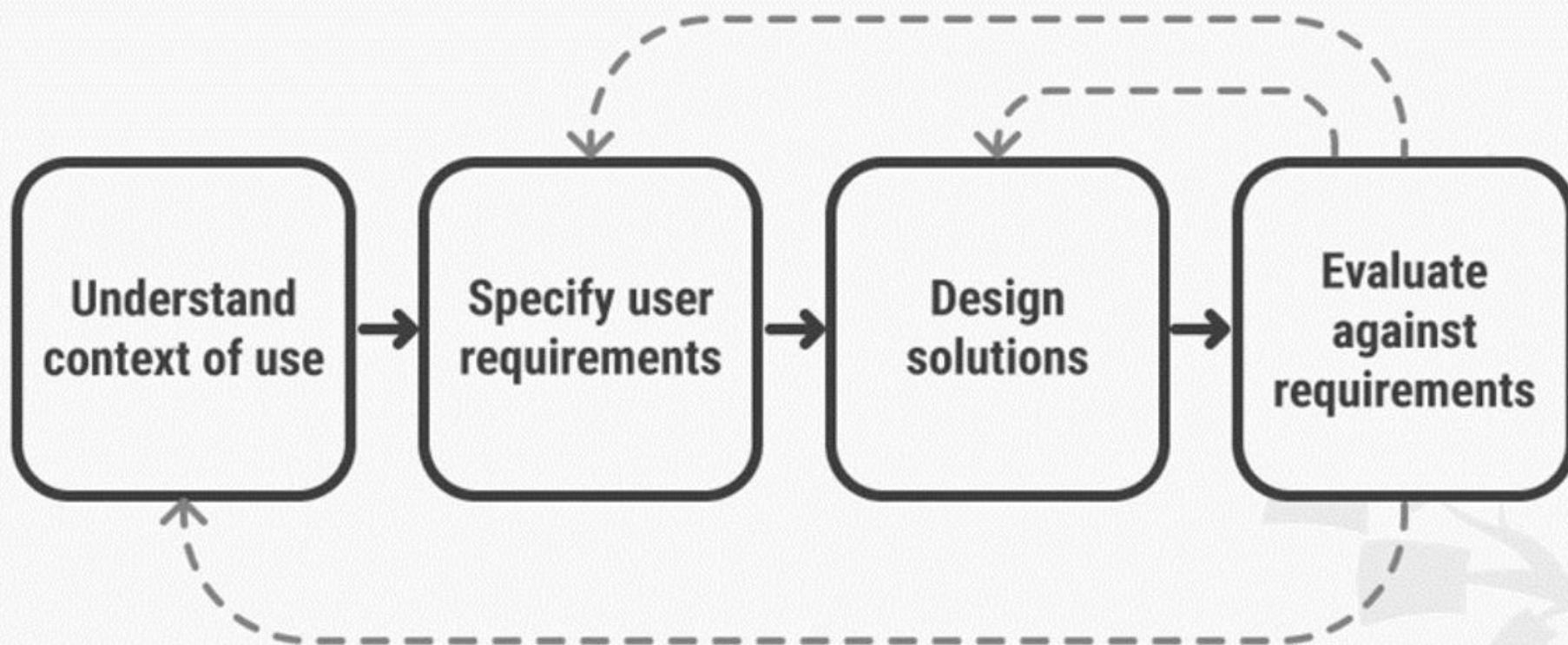
- Also: Human-Centered Design

Quick words from Don Norman Himself…

How does UCD work?
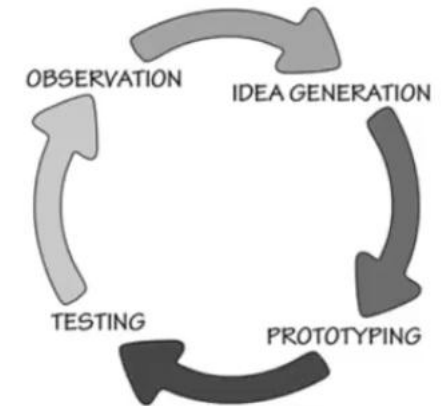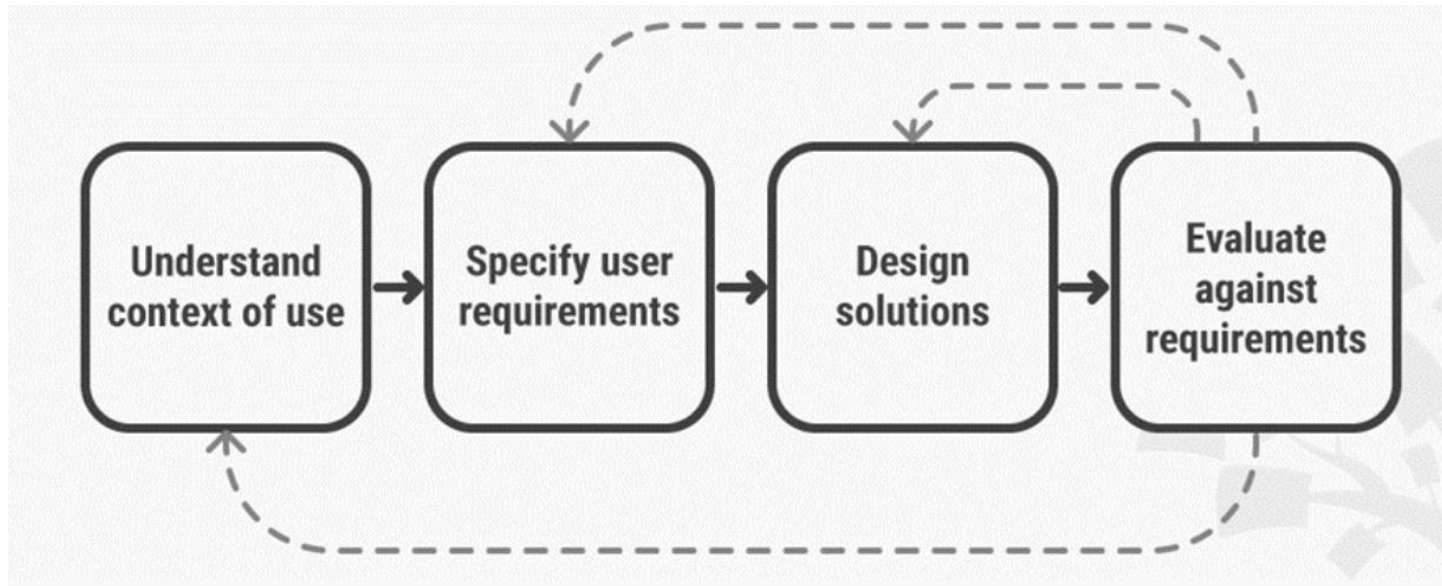
How does UCD work?

UCD to Consider the Whole User Experience

- Goal: Understand the users, tasks and environments

- Capture the whole of the users' experience

- Two critical things:
  - Must involve users for evaluation
  - Ensure long-term monitoring of usage

Multidisciplinary Design Teams for User-Centered Design

Engineer   Designer   Researcher   Marketer   Stakeholder

Why is UCD useful?

- Powerful way of finding out what works well, what does and why

- Users are early warning indicators

- Help with usability and accessibility

"Being human-centred is an additional cost to any project, so businesses rightly ask whether taking so much time to talk to people, produce prototype designs and so on is worthwhile. The answer is a fundamental 'yes'." — David Benyon https://jnd.org/user-centered-system-design-new-perspectives-on-human-computer-interaction/

Methods available at UCD stages

Planning	Context of Use	Requirements	Design	Evaluation
• Usability planning and scoping • Usability cost/benefit analysis	• Identify stakeholders • Context of use analysis • Survey of existing users • Field study / user observation • Diary keeping • Task analysis	• Stakeholder analysis • User cost-benefit analysis • User rqmt interview • Focus groups • Scenarios of use • Personas • Existing system / competitor analysis • Allocation of function..	• Brainstorming • Parallel design • Design guidelines and standards • Design Patterns • Storyboarding • Affinity diagrams • Card sorting • Paper prototyping • Software prototyping • Organizational prototyping	• Participatory evaluation • Assisted evaluation • Heuristic or expert eval. • Controlled user testing • Satisfaction questionnaires • Assessing cognitive workload • Critical incidents • Post experience interviews

"Principles are undervalued" (Gould and Lewis, 1985)

- Not worth following
- Confusion with similar but critically different ideas
- User diversity is underestimated
- User diversity is overestimated
- Belief that users do not know what they need
- Belief that one's job does not require it or permit it
- Belief in the power of reason
- Belief that design guidelines should be sufficient
- Belief that good design means getting it right first time
- Belief that the development process will be lengthened
- Belief that iteration is just fine-tuning
- Belief in the power of technology to succeed
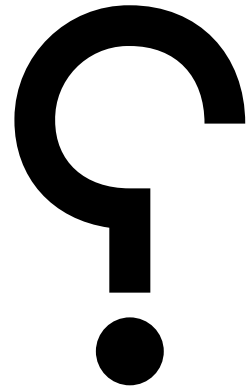
Problems with User Centred Design

- Takes time, demands a lot and effort

- Difficult to integrate into current processes

- Difficult to integrate into the team

Terminology

- Some people also call these human-centred designs (not wanting to call people users..)

- More than human-centered design
  - Interesting question of how do we centre things around non-human users?
  - How do we centre things around children?
  - Can we even centre around anything other than ourselves?

In UCD often talk about User Experience

- User Experience (UX)

- Meeting needs & making joy

- UX and UI are not the same thing

- UX and Usability also different
  - User-centered design is what you do to achieve usable systems
  - Usability is the way a user-centered design product is evaluated

User experience

Design

For reference: https://www.nngroup.com/articles/definition-user-experience/

Summary

- UCD/HCD is a theory and concept that can be applied
- Four stages:
  - Context,
  - Requirements
  - Design solutions
  - Evaluate against requirements
- Not always so easy to implement, but can give rewards
- Introduced UX and the differences in UI and usability

Questions? Comments? Concerns?

User Interaction Topics

✅ HCI History and Introduction

✅ Usability and Heuristics

✅ Heuristic Evaluation and Human Cognition

✅ Human Perception and Capabilities

✅ Experimental Design & Variables Research

✅ Personas and Scenarios

✅ Surveys in HCI

✅ Ethnography

✅ Statistical Methods

✅ Theories in HCI & User-Centered Design

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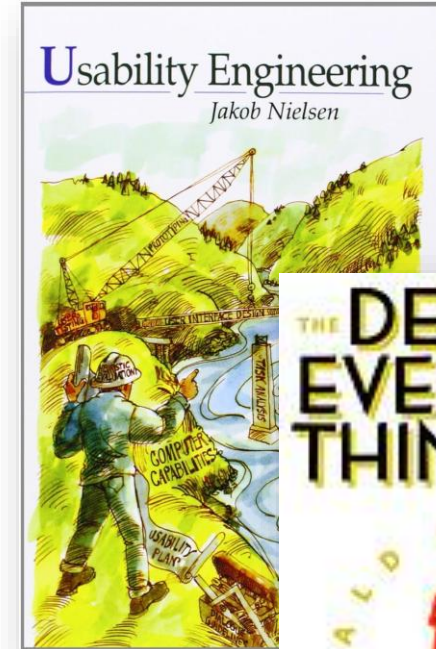
14. Revision & Example Exams & Quiz

Design Theory Task

- In your group, pick two principles of design theory (Norman) and look at the design of the Glasgow University website. Think about:
  - How does this principle apply to this design?
  - What changes can be made to meet these design principles?
  - Write in your teams' channel what design principle you picked, how this applies to the design, and what changes you would make.

- ➔ Write your answer to these in your team's space.

Reading: optional books ☺

- Norman, Donald A. *The Psychology of Everyday Things*. Basic Books, 1988. https://search.worldcat.org/title/17550682

- Jakob Nielsen. 1994. Usability Engineering. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA. https://dl.acm.org/doi/10.5555/2821575

Thanks!