

CSU44051 - Human Factors

Rob Bowman

Dr. Camille Nadal

cnadal@tcd.ie

Module Aims

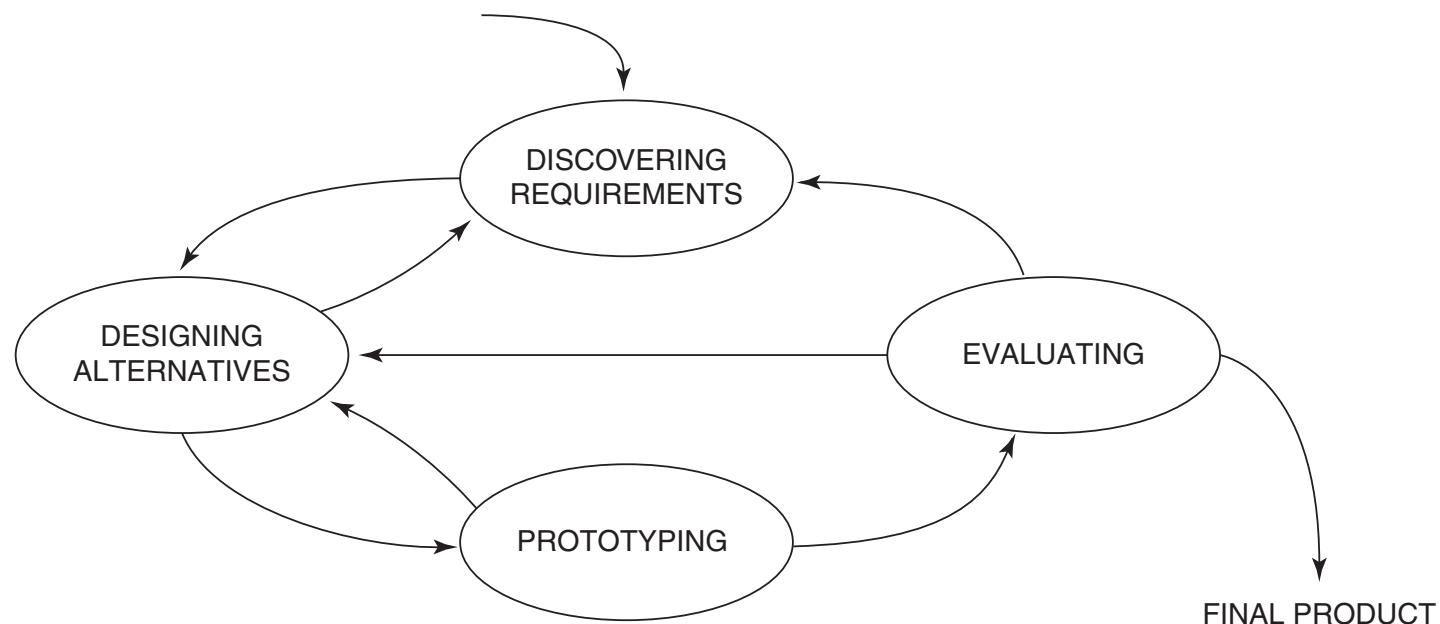
This course is an introduction to human factors and human-computer interaction (HCI).

It aims to give you:

1. A set of concepts, models for thinking about interaction between people and computers.
2. Understanding, and experience, of the human-centred design process.
3. Knowledge of more specialised subtopics such as CSCW, human performance, user engagement.

Course Structure

- This course is structured around the *design process*.
- A large part of the course (and assessment) is a group design project.



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Provisional Plan

Before Reading Week	After Reading Week
<ul style="list-style-type: none">• Material about people and interaction• Discovering Requirement• HCI Research	<ul style="list-style-type: none">• Designing Alternatives• Prototyping• Evaluating• Specialised Topics

Coursework

- Continuous assessment 20%
- Reading assignment 10%
- Design assignment 30%
- Prototyping assignment 30%
- Group prototype presentation 10%

Lectures & Tutorials

Tutorial	Lecture	Lecture
Tuesday 9am	Wednesday 11am	Thursday 10am
TBD	LB01	LB04

- Lecture and tutorial attendance is mandatory.
- The first tutorial is Tuesday 26th September

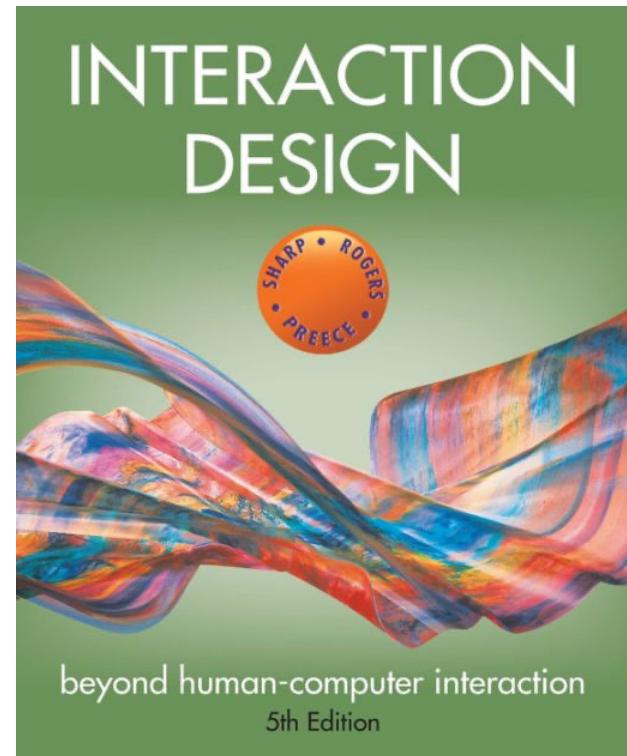
Contact

- Email Dr Nadal
- Put HF-CSU4051 in the subject

Recommended Reading

Interaction Design: Beyond Human-computer Interaction

Y. Rogers, H. Sharp, J. Preece
4th (2015) or 5th (2019) Edition



Further Reading

- **The Design of Everyday Things**, D. Norman, MIT Press, 2013

An influential book and author. A good introduction to thinking about interaction design

- **User Friendly**, C. Kuang, R. Fabricant, Penguin, 2019

A fun and easy read telling a history of user-experience design.

- **About Face**, A. Cooper, R. Reimann, D. Cronin, C. Noessel, John Wiley and Sons, 2014

Well known textbook that details in depth an approach for personas and scenarios.

Further Reading

- **Human-Computer Interaction**, 3e, A. Dix, J. Finlay, G. Abowd, R. Beale, Prentice Hall, 2004, hcibook.com/e3
- **Designing User Experience: A guide to HCI, UX and interaction design**, D. Benyon, 2019, Pearson.
- **Engineering psychology and human performance**, Wickens et al, 4th ed., 2013.
- **Sketching User Experiences**, B. Buxton, Morgan Kaufmann 2007.

What is *good* design?

What do you think?

- Think of a system or device that you really like using.
 - What's good about it?
- Think of a system that you really dislike using or which you find frustrating to use.
 - What's wrong with it?

The goal of the module is to help you build systems which deliver the first type of experience, and avoid the second.

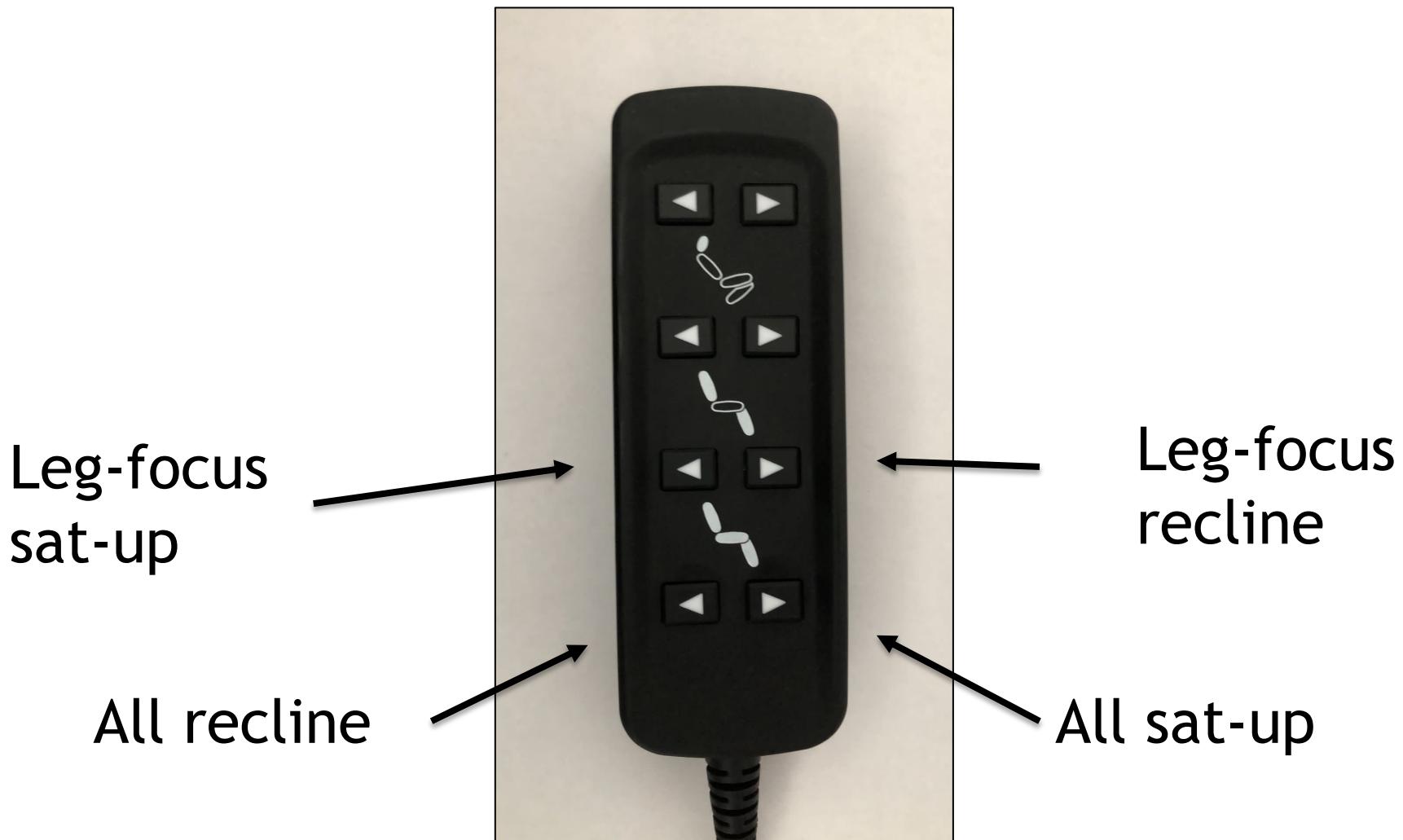
A Sofa Remote



How do the buttons relate to the images?

- How do the 3 images map to 4 sets of buttons?
- How do arrow icons map to reclined and sat-up positions?

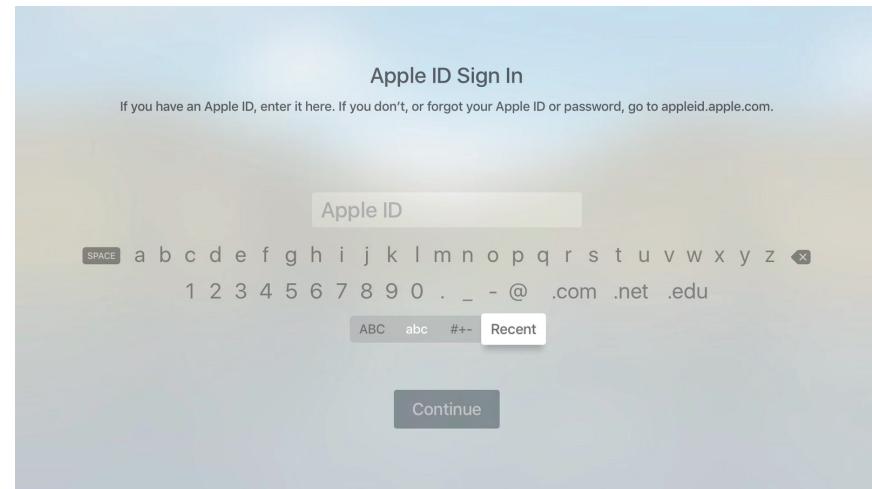
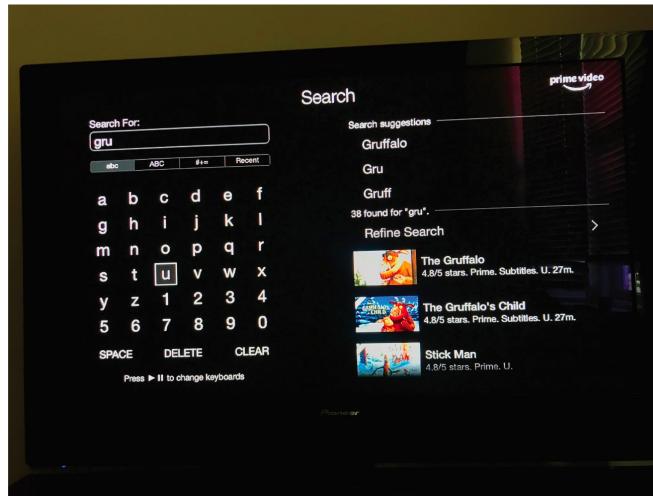
A Sofa Remote



Dilemma

Which is the best way to interact with a smart TV?
Why?

- Pecking using a grid keyboard via a remote control
- Swiping across two alphanumeric rows using a touchpad on a remote control
- Voice control using remote or smart speaker

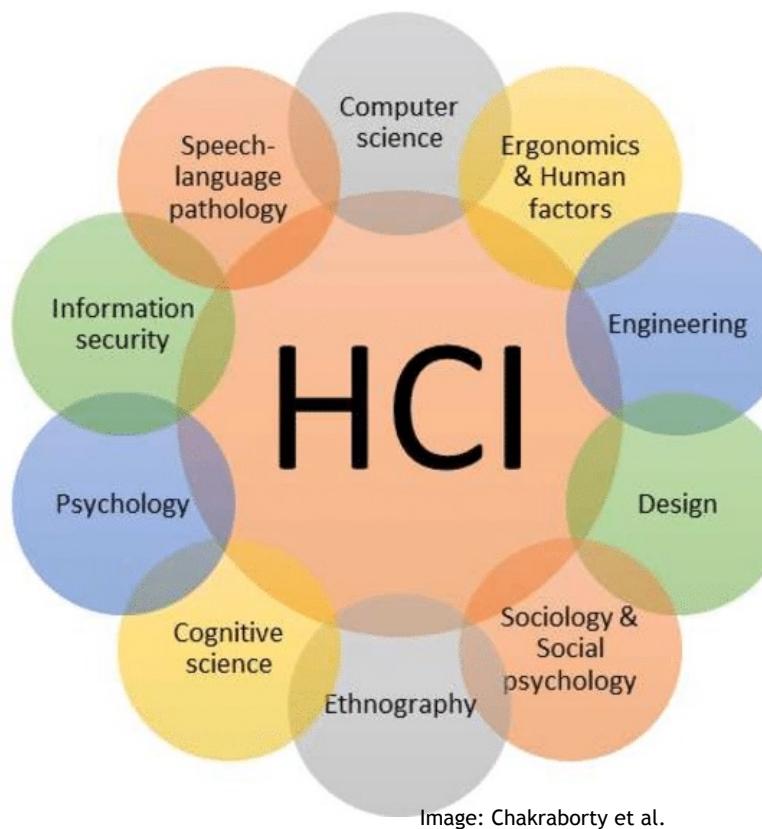


What makes for a successful product?

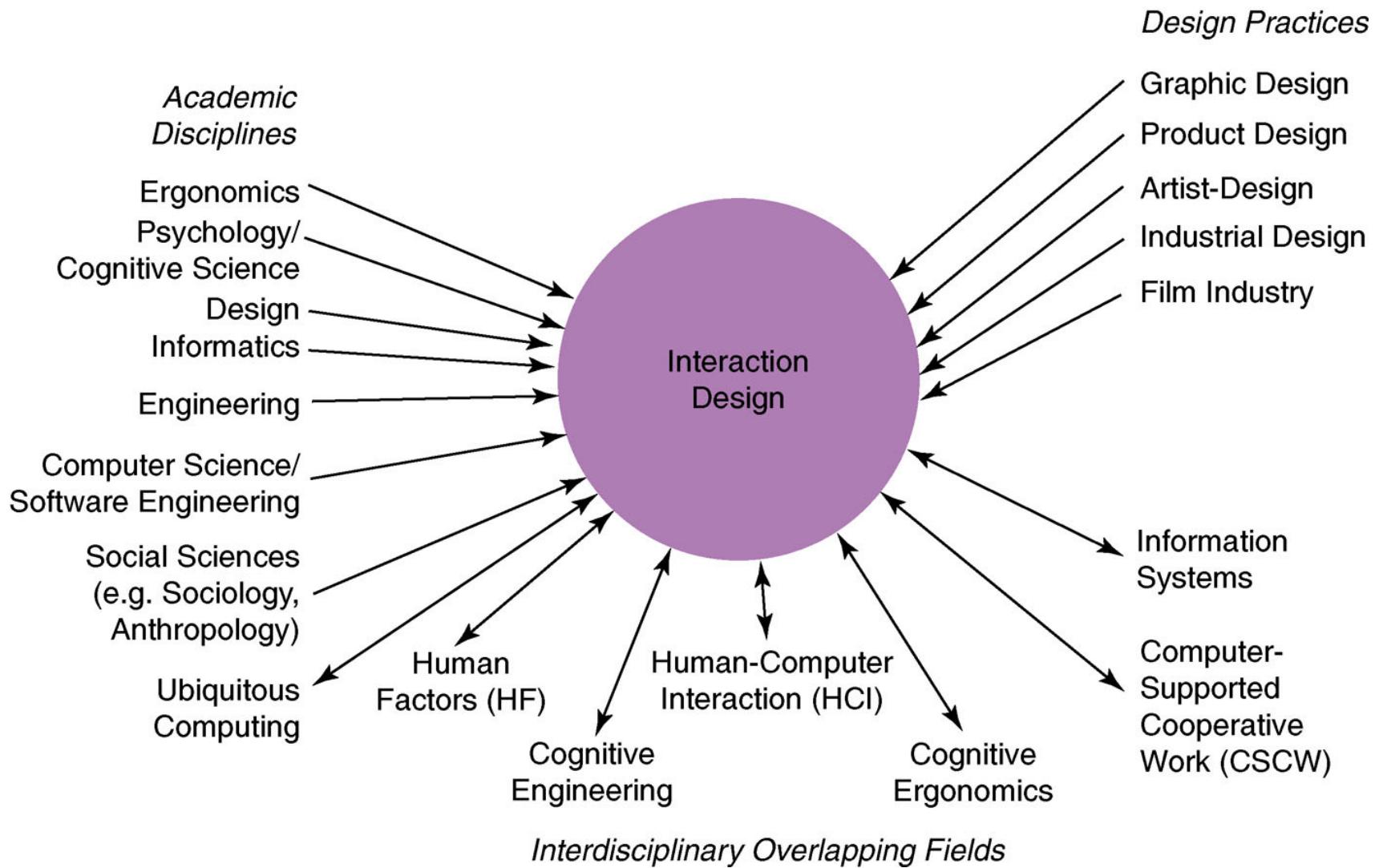


HCI and Human Factors

- Human Computer Interaction (HCI) is concerned with the design, evaluation and implementation of interactive computing systems for human use, and the study of phenomena surrounding them.



Disciplines involved

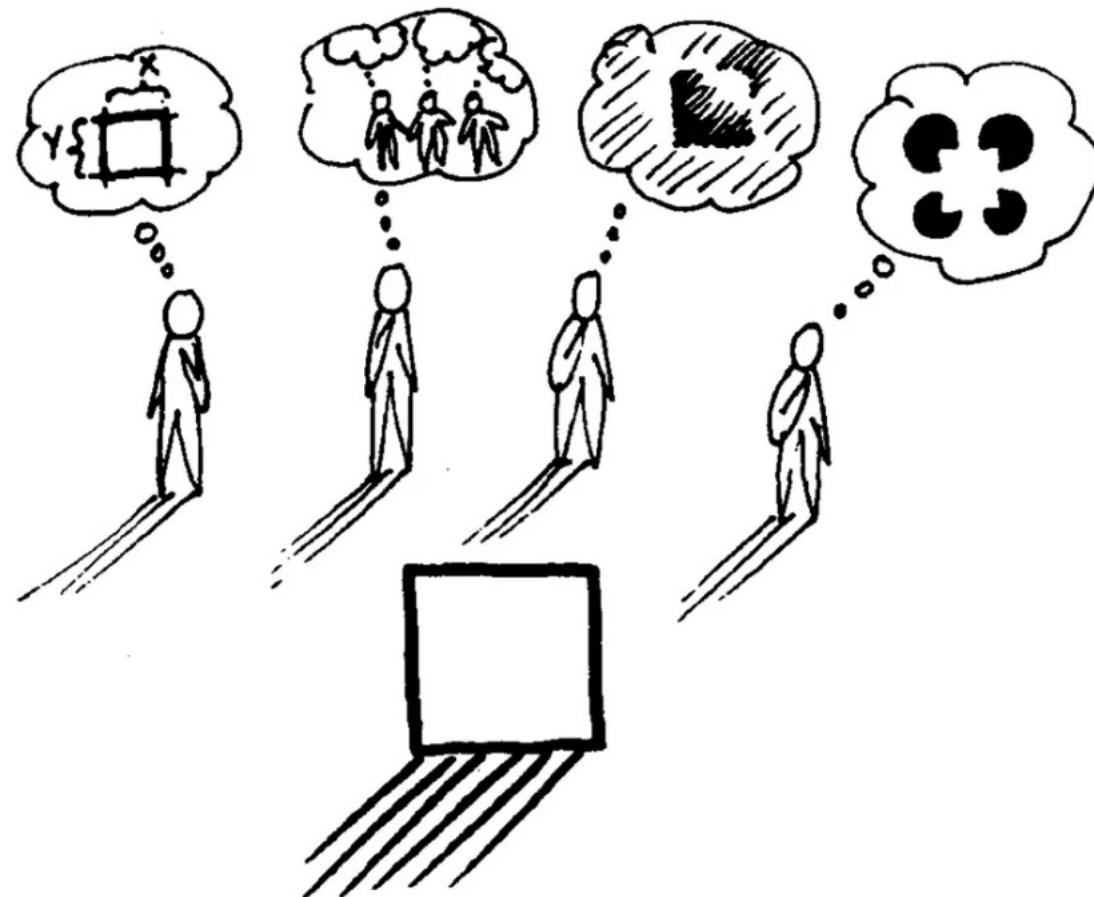


Why study Human Computer Interaction?

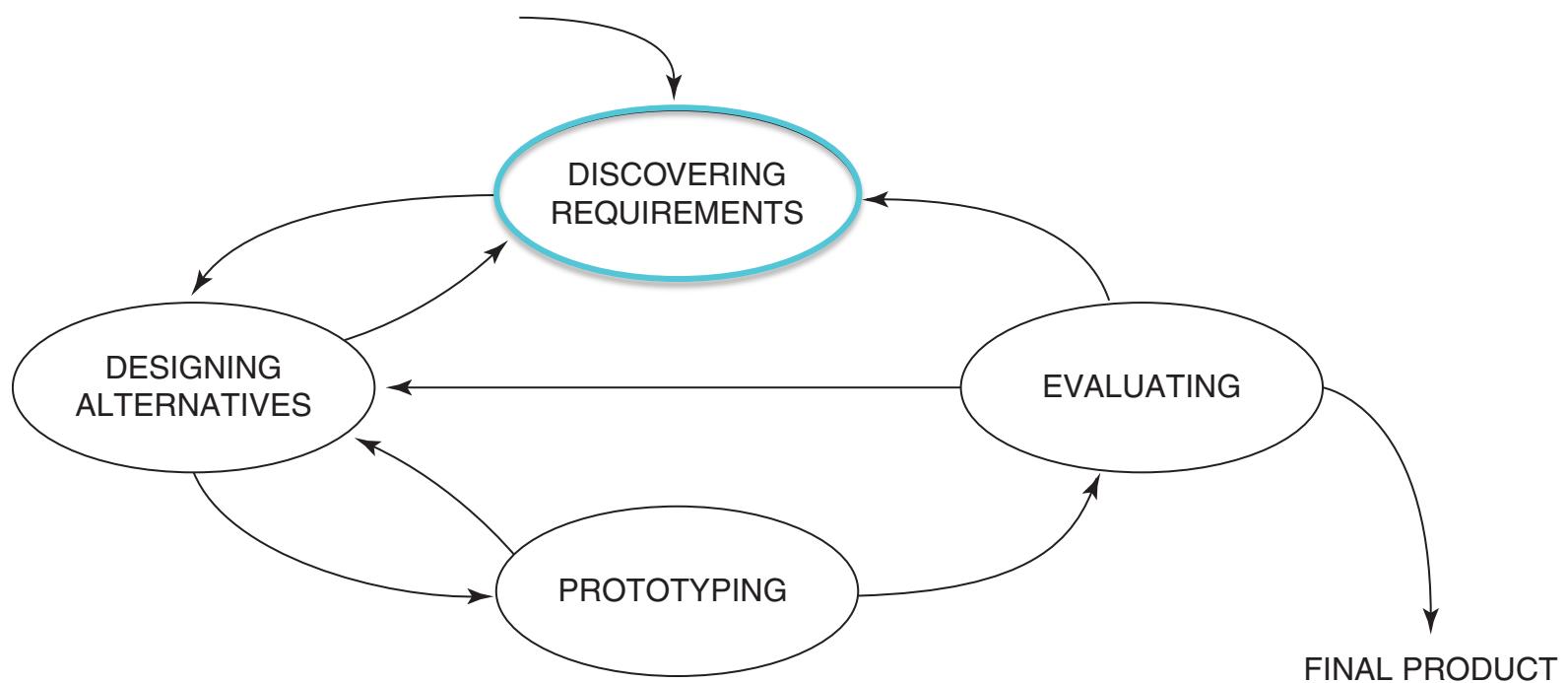
Help produce systems which are:

- ***Useful***; accomplish what is required;
play music, fly aircraft, format a document.
- ***Usable***; do it easily and naturally,
without danger of error, etc.
- ***Used***; make people want to use it,
be attractive, engaging etc.

Interdisciplinary nature of HCI



Users



Users

- In the early days of computing, building interfaces for the devices was relatively ‘easy’:
 - Designed for one type of users (white educated men)
 - Well-educated programmers
 - Similar tasks (ballistics, particle simulations)



Users

- From then to now:
 - Different goals (work, social, health, entertainment...)
 - Diversity in users (demographics, intersectionality)
 - Diversity in contexts of use (at home, public spaces, on the go)
 - Different usages (casual, frequent, limited in time)



Understanding disability

Disabilities can be classified as:

- Sensory impairment (such as loss of vision or hearing)
- Physical impairment (having loss of functions to one or more parts of the body after a stroke or spinal cord injury)
- Cognitive (including learning impairment or loss of memory/cognitive function due to old age)

Each type can be further defined in terms of capability:

- For example, someone might have only peripheral vision, be color blind, or have no light perception

Impairment can be categorized:

- Permanent (for instance, long-term wheelchair user)
- Temporary (that is, after an accident or illness)
- Situational (for example, a noisy environment means that a person can't hear)

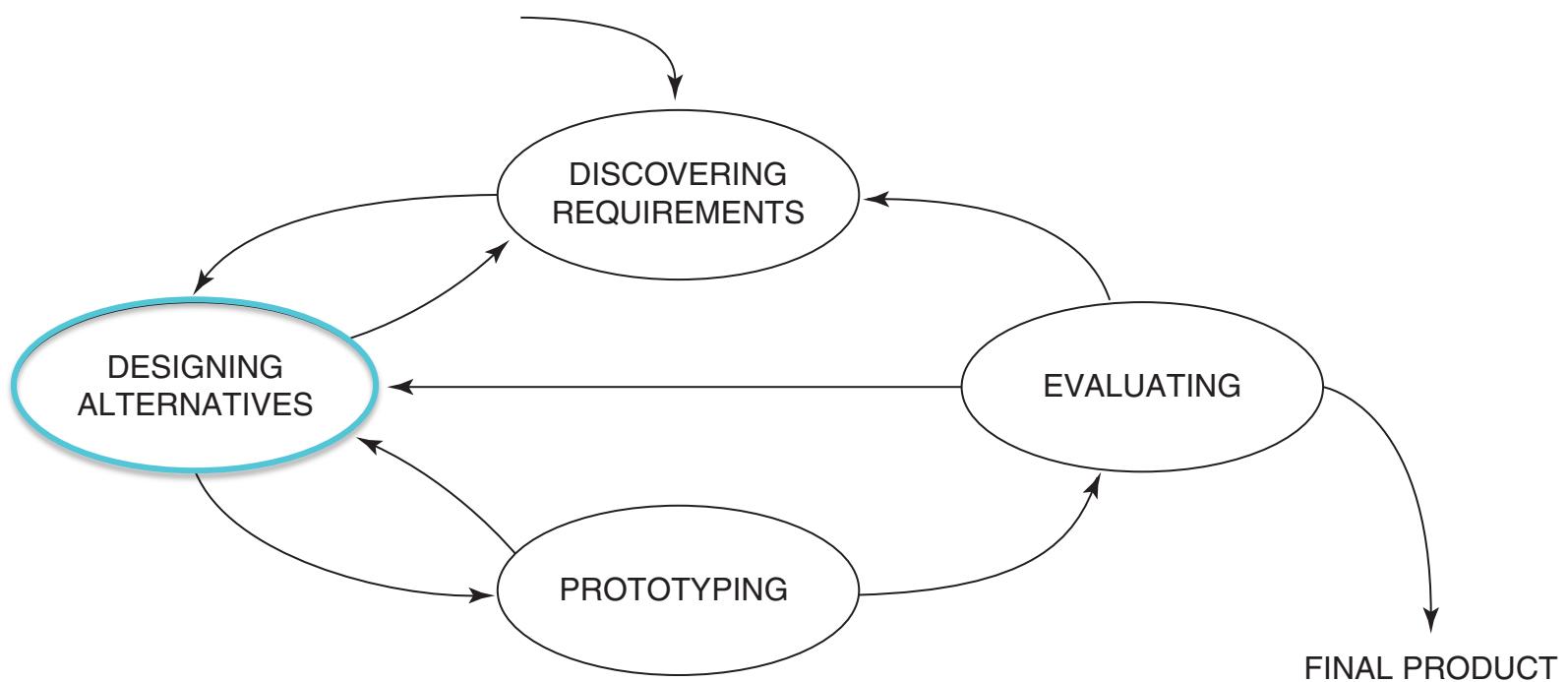
Understanding the users' needs

- Consider what might help people in the way they currently do things.
- Listen to what people want and get them involved.
- Understand what they do, and the environment they do it in.
- Use tried and tested user-based methods.

Tasks and Goals

- Users are goal directed:
 - have specific problems to solve;
 - have tasks to accomplish;
 - feedback from interface must address this.
- Tasks are complex:
 - few relate solely to the computer;
 - decomposed into sub-tasks.
- For example:
 - task is to produce a letter;
 - sub-task to format address.

Design



Usability

- If the user can't use it, it doesn't work. It's broken.
- Many systems are broken by design.
 - They make “human error” highly likely, sometimes inevitable.
- If you’re an engineer and you’re producing systems which are poorly matched with the end users, their tasks, and their environment, you’re not doing your job properly.



Interaction Design

- Need to take into account:
 - Who the users are
 - What activities are being carried out
 - Where the interaction is taking place
- Need to optimize the interactions users have with a product:
 - So that they match the users' activities and needs
- “Designing interactive products to support the way people communicate and interact in their everyday and working lives.”
 - Preece, Sharp and Rogers (2015)

Usability goals

- Effective to use
- Efficient to use
- Safe to use
- Have good utility
- Easy to learn
- Easy to remember how to use

User Experience

- How a product behaves and is used by people in the real world
 - The way people feel about it and their pleasure and satisfaction when using it, looking at it, holding it, and opening or closing it
 - “Every product that is used by someone has a user experience: newspapers, ketchup bottles, reclining armchairs, cardigan sweaters.” (Garrett, 2010)
 - “All aspects of the end-user's interaction with the company, its services, and its products. (Nielsen and Norman, 2014)
- Hassenzahl’s (2010) model of the user experience
 - Pragmatic: how simple, practical, and obvious it is for the user to achieve their goals
 - Hedonic: how evocative and stimulating the interaction is to users

Usability and user experience goals

- Selecting terms to convey a person's feelings, emotions, and so forth can help designers understand the multifaceted nature of the user experience
- How do usability goals differ from user experience goals?
- Are there trade-offs between the two kinds of goals? (for example, can a product be both fun and safe?)
- How easy is it to measure usability versus user experience goals?

User experience goals

Desirable aspects

satisfying	helpful	fun
enjoyable	motivating	provocative
engaging	challenging	surprising
pleasurable	enhancing sociability	rewarding
exciting	supporting creativity	emotionally fulfilling
entertaining	cognitively stimulating	

Undesirable aspects

boring	unpleasant
frustrating	patronizing
making one feel guilty	making one feel stupid
annoying	cutesy
childish	gimmicky

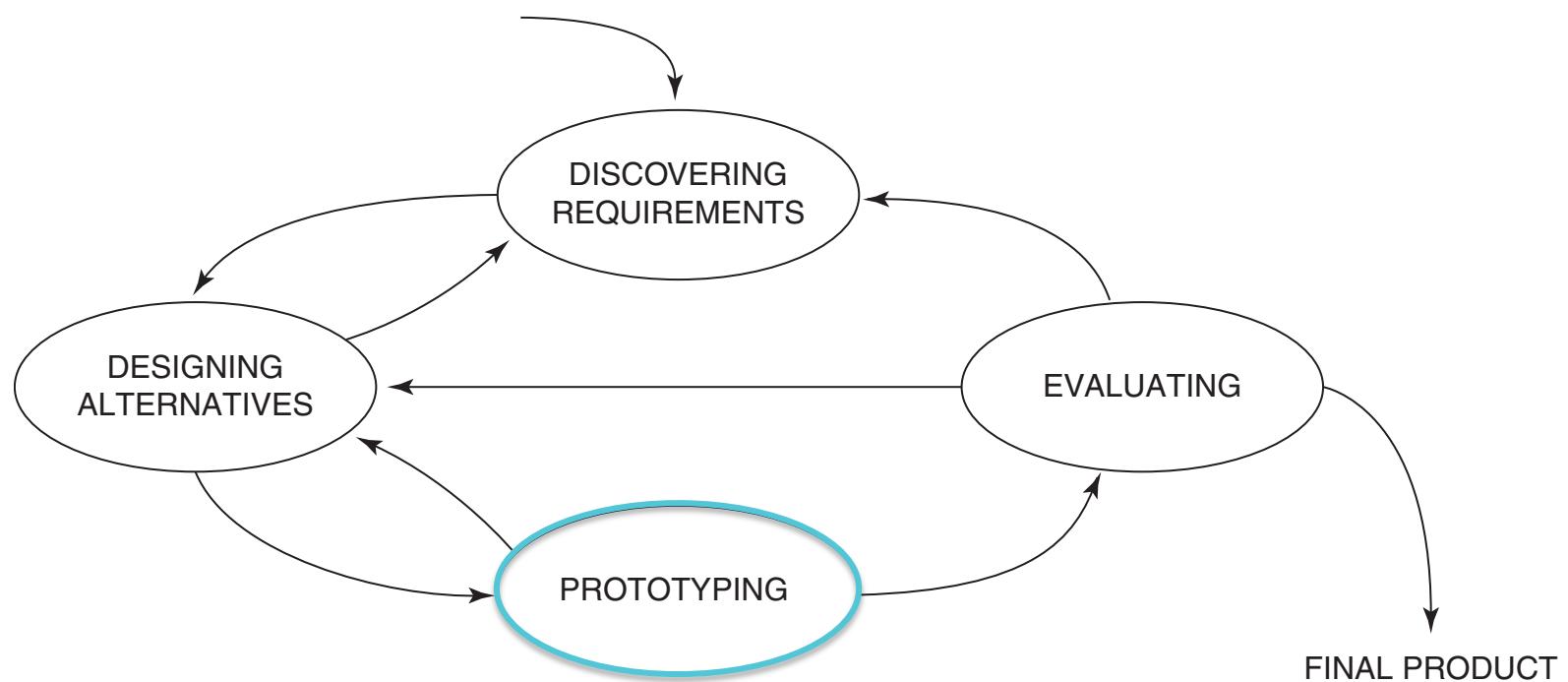
Bad user experiences

- It's simply not possible to do what you want to do.
- You can't work out how to do what you want to do.
- Working out how to do things takes a long time.
- Doing simple things takes longer than it should do.
- You regularly make the same error.
- You make an error which causes you to lose a lot of work/melts down the reactor.
- You find it frustrating to use.
- The system does something automatically which makes you irritated/angry.
- You think the system looks ugly.

Factors affecting design

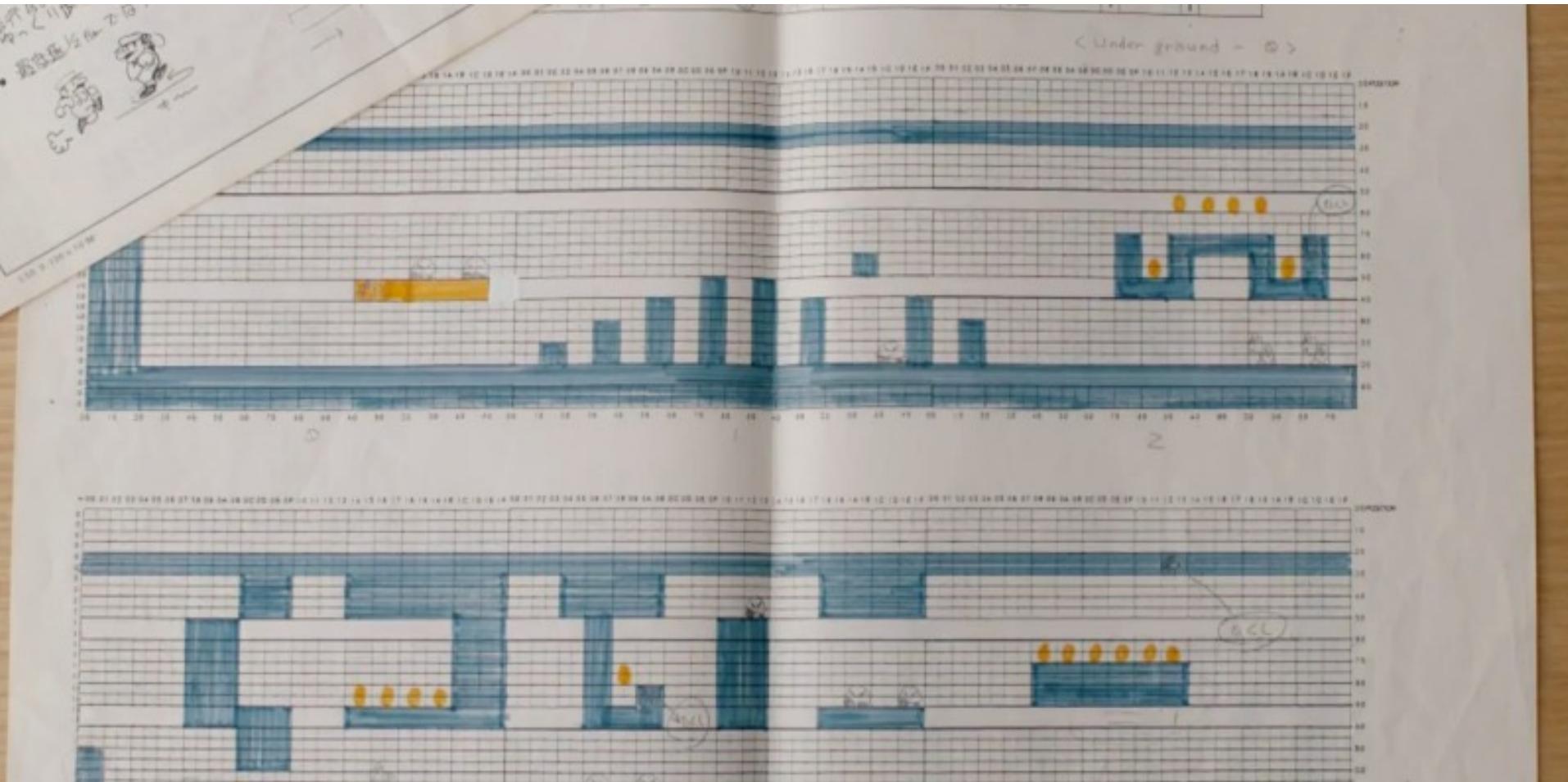
- Human factors: “Know thy user”
 - Physical capabilities (motor skills, sight, hearing)
 - Cognitive capabilities (memory, attention span, decision making).
 - Social, cultural influences.
- Environmental factors
 - Lighting, ambient noise, operational conditions (eg. time pressure).

Prototypes





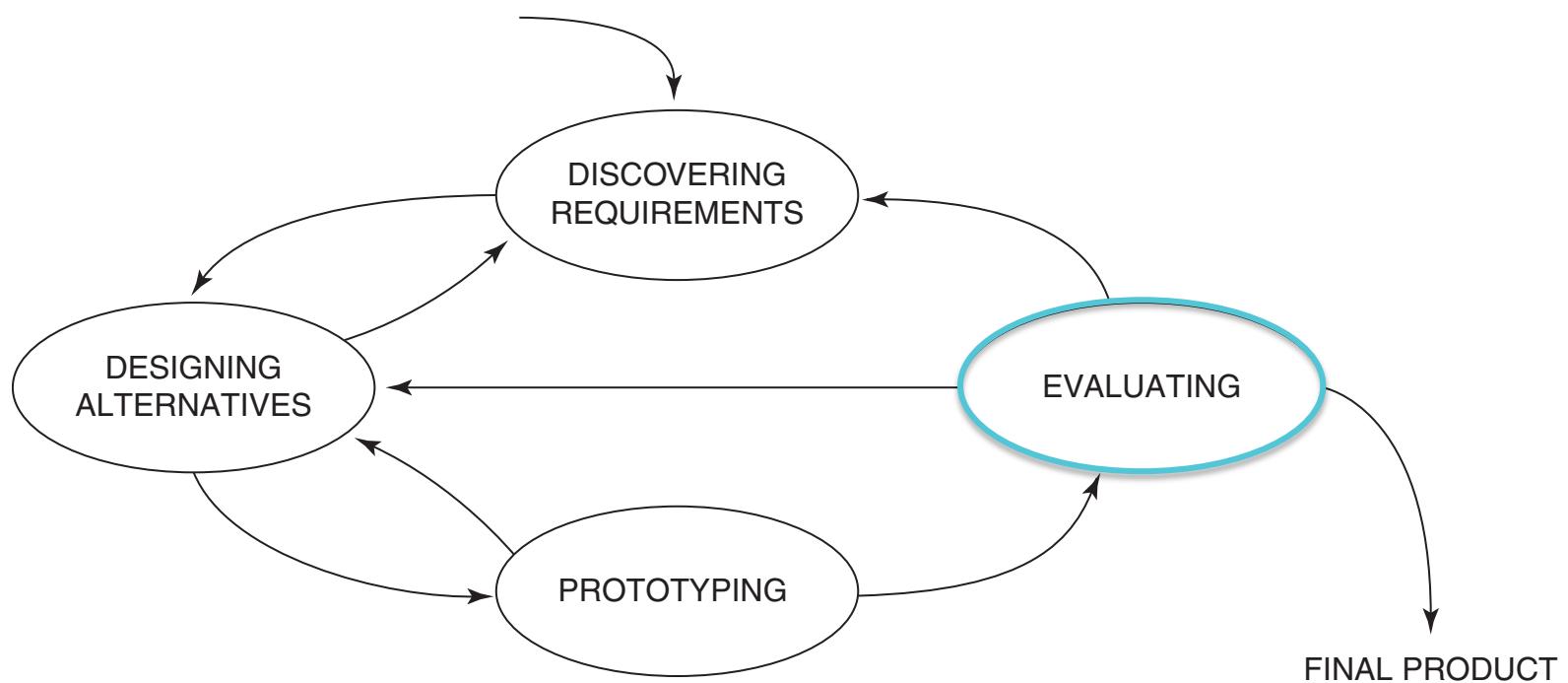
Low fidelity (paper) prototype



High fidelity prototype



Evaluation



Measures of Success

- What are the measurable factors:
 - Ease of learning, how much time and training is required for a new user to perform competently with the system.
 - Productivity measures, should support performance of tasks quickly and efficiently.
 - Error rates, error detection and error recovery, good feedback and awareness of situations by the user greatly aids.
 - User satisfaction - interviews and questionnaires.

Usability Heuristics

Nielsen Norman Group

Jakob's Ten Usability Heuristics

1 Visibility of System Status

Designs should *keep users informed about what is going on, through appropriate, timely feedback.*

Interactive mall maps have to show people where they currently are, to help them understand where to go next.

6 Recognition Rather Than Recall

Minimize the user's memory load by making elements, actions, and options visible. Avoid making users remember information.

People are likely to correctly answer "Is Lisbon the capital of Portugal?".

2 Match between System and the Real World

The design should speak the users' language. Use words, phrases, and concepts *familiar to the user*, rather than internal jargon.

 Users can quickly understand which stovetop control maps to each heating element.

7 Flexibility and Efficiency of Use

Shortcuts — hidden from novice users — may speed up the interaction for the expert user.

 Regular routes are listed on maps, but locals with more knowledge of the area can take shortcuts.

3 User Control and Freedom

Users often perform actions by mistake. They need a clearly marked "emergency exit" to leave the unwanted action.

 Just like physical spaces, digital spaces need quick "emergency" exits too.

4 Consistency and Standards

Users should not have to wonder whether different words, situations, or actions mean the same thing.

Follow platform conventions.

 Check-in counters are usually located at the front of hotels, which meets expectations.

5 Error Prevention

Good error messages are important, but the best designs carefully prevent problems from occurring in the first place.

 Guard rails on curvy mountain roads prevent drivers from falling off cliffs.

8 Aesthetic and Minimalist Design

Interfaces should not contain information which is irrelevant. Every extra unit of information in an interface competes with the relevant units of information.

 A minimalist three-legged stool is still a place to sit.

9 Recognize, Diagnose, and Recover from Errors

Error messages should be expressed in plain language (no error codes), precisely indicate the problem, and constructively suggest a solution.

 Wrong-way signs on the road remind drivers that they are heading in the wrong direction.

10 Help and Documentation

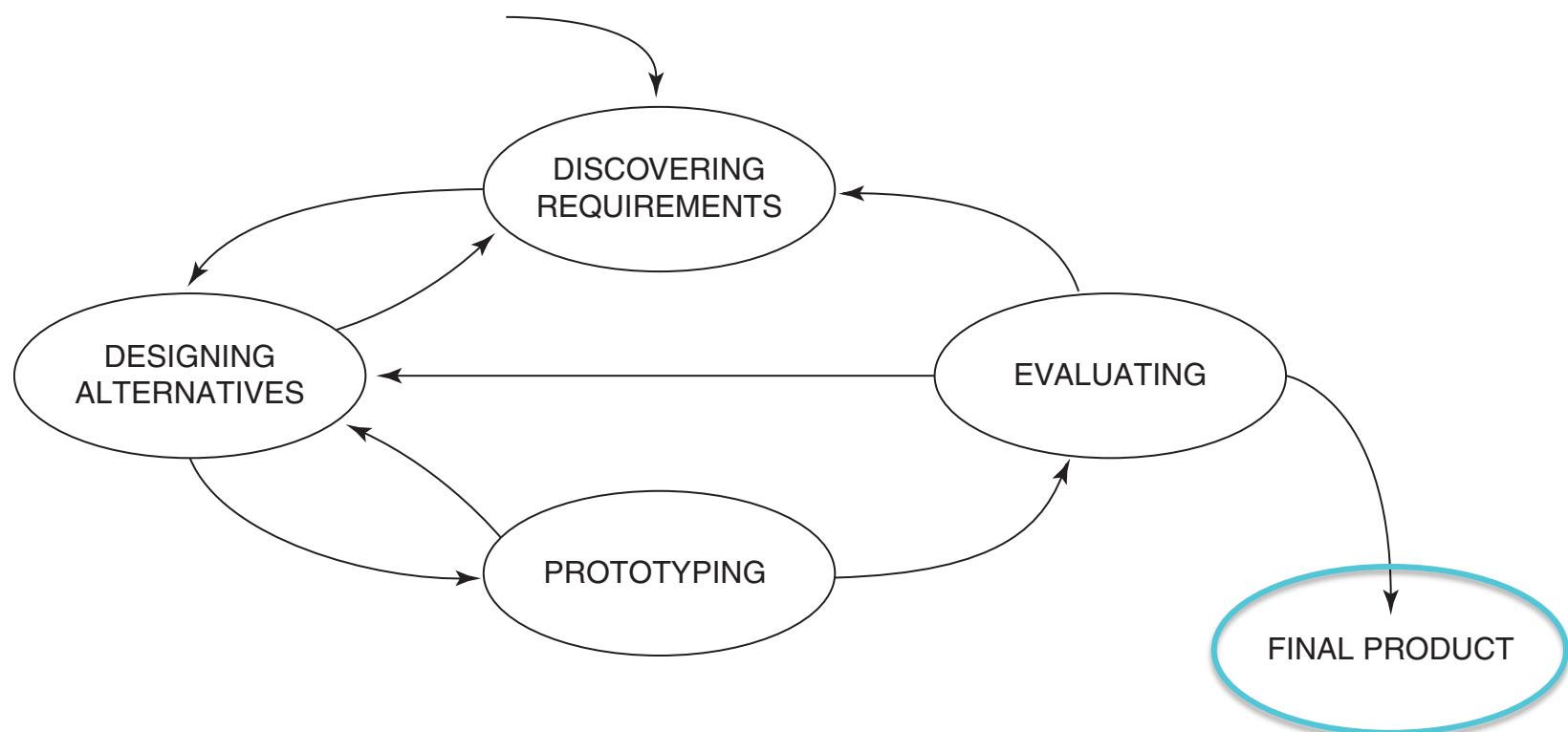
It's best if the design *doesn't need any additional explanation*. However, it may be necessary to provide documentation to help users complete their tasks.

 Information kiosks at airports are easily recognizable and solve customers' problems in context and immediately.

Measures of Success

- Fiscal measures
 - Increased market share.
 - Reduced number of modifications.
 - Reduced need for customer support.

Deployment



Real world impact

- So what?
 - Who is *actually* using the product?
 - How are they *actually* using it?
- Ethics, unexpected (malicious?) uses

Real world impact

Apple and Google submit plan to fight AirTag stalking

Companies join forces to tackle unwanted tracking via Apple's gadget and similar devices such as Tile



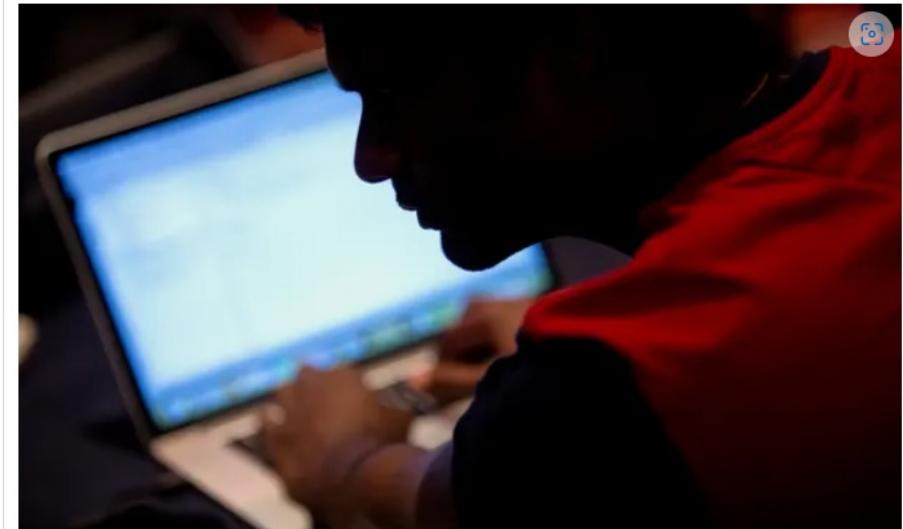
AirTags were released in 2021. Photograph: Apple Inc. Handout/EPA

Apple and [Google](#) are teaming up to thwart unwanted tracking through AirTags and similar gadgets.

The two companies behind the iPhone and the software that powers Android phones on Tuesday submitted a proposal to set standards for combatting secret surveillance on Bluetooth devices that were created to help people find lost keys, keep tabs on luggage or to locate other things that have a tendency to be misplaced.

'I log into a torture chamber each day': the strain of moderating social media

As jobs screening US, UK and EU platforms are shifted to India, viewing 'gore' to clean up the web has traumatised moderators



Workers in the IT hub of Hyderabad in India said moderating sexual and abusive content had left them depressed, distressed and struggling to sleep. Photograph: Bloomberg/Getty Images

I had to watch every frame of a recent stabbing video ... It will never leave me," says Harun*, one of many moderators reviewing harmful online content in [India](#), as social media companies increasingly move the challenging work offshore.