

Design and Evaluation of User Interfaces (DEB)

Introduction & Course Overview 05.09.2024
Fall 2024

Timothy Merritt (Tim) - Human-centered Computing Research Group

Agenda

- Introductions - Lecturer and 2 Teaching Assistants
- About the course - schedule, structure, lectures, exercises, exam
- Usability and UX
- Skills of a designer
- Envisionment (PACT and FACTOR/BATOFF)
- Process

Introductions

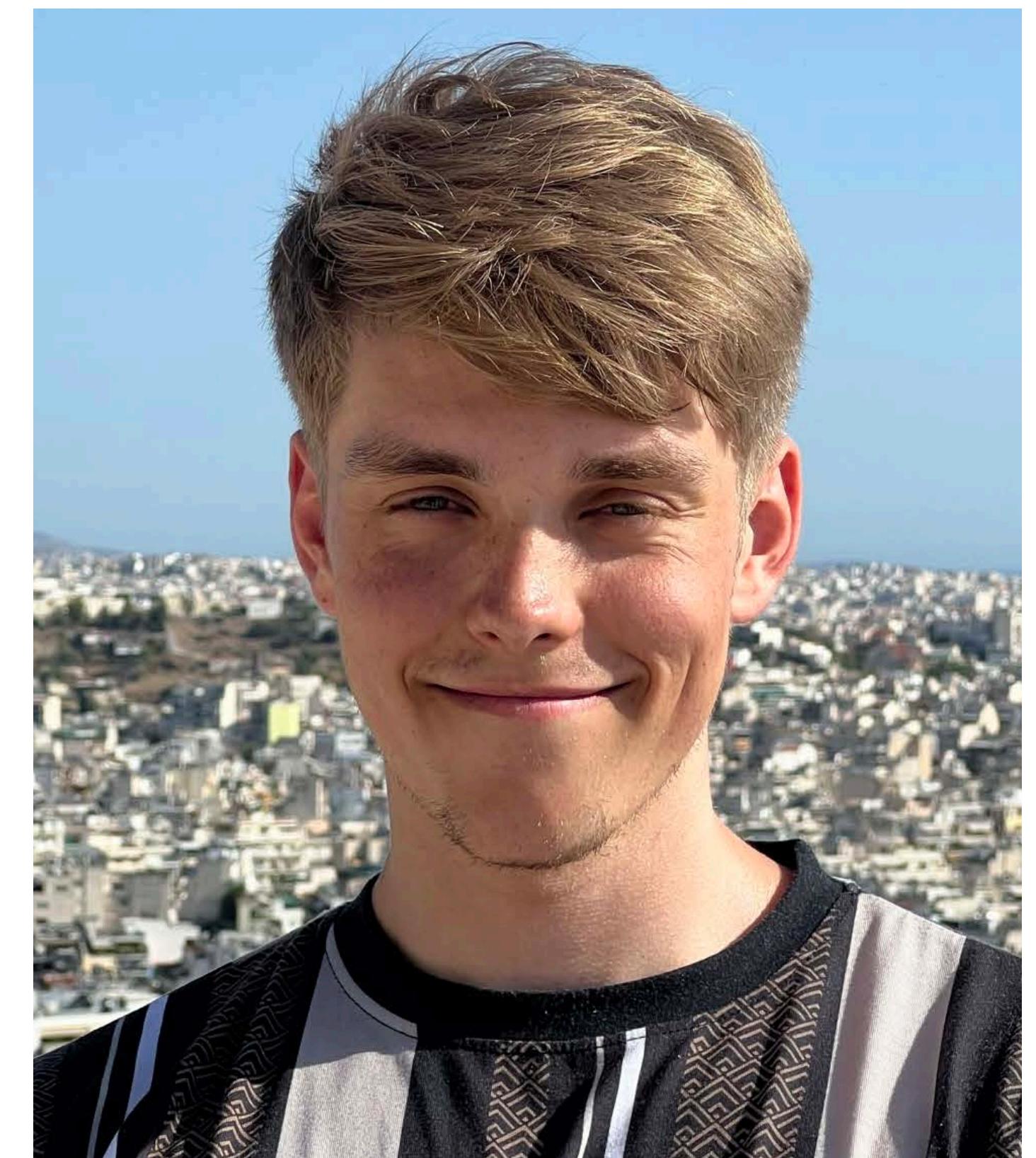
Who are we? Lecturer + 3 Teaching Assistants



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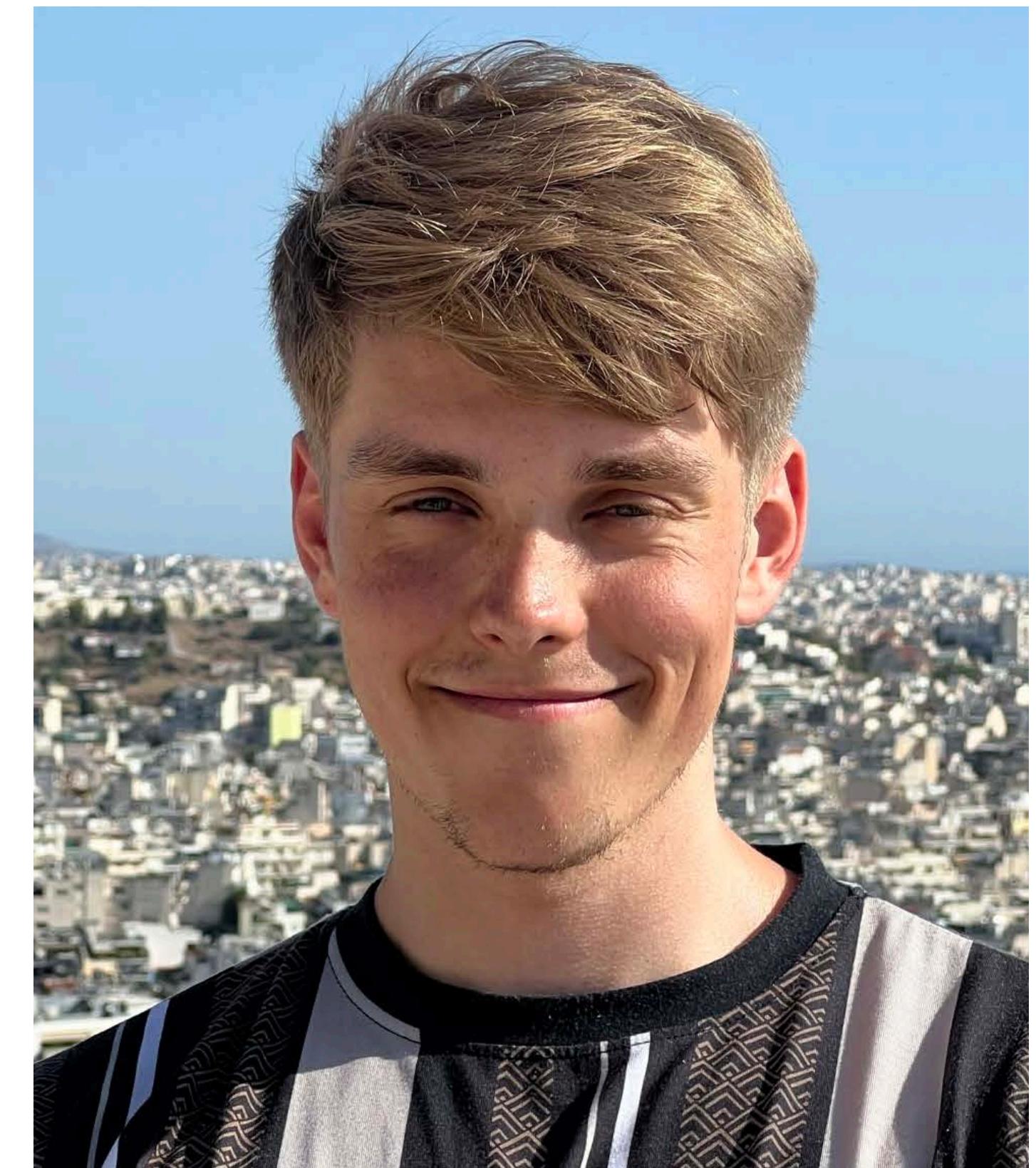
We will be circulating to your **group rooms** during the exercise sessions.
We will **help with course related exercises and project related exercises**,
however, make sure to **discuss with your supervisor** along the way.



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- Timothy Merritt (Tim), PhD NUS Singapore
- Associate professor, Human-centered computing



Human-centered AI - social responses to technology by considering **technology as a team-mate**.

How and why people respond to Artificial Intelligence in games and other real-time activities in which the technology cooperates with the human toward shared goals. These investigations go **beyond the screen** and include interactions with **robots** and physical materials such as **shape-changing and living media interfaces**.

Previous to academia - background in IT management consulting with Siemens IT Solutions and Services with over 12 years of experience developing and implementing enterprise solutions for Fortune 500 companies

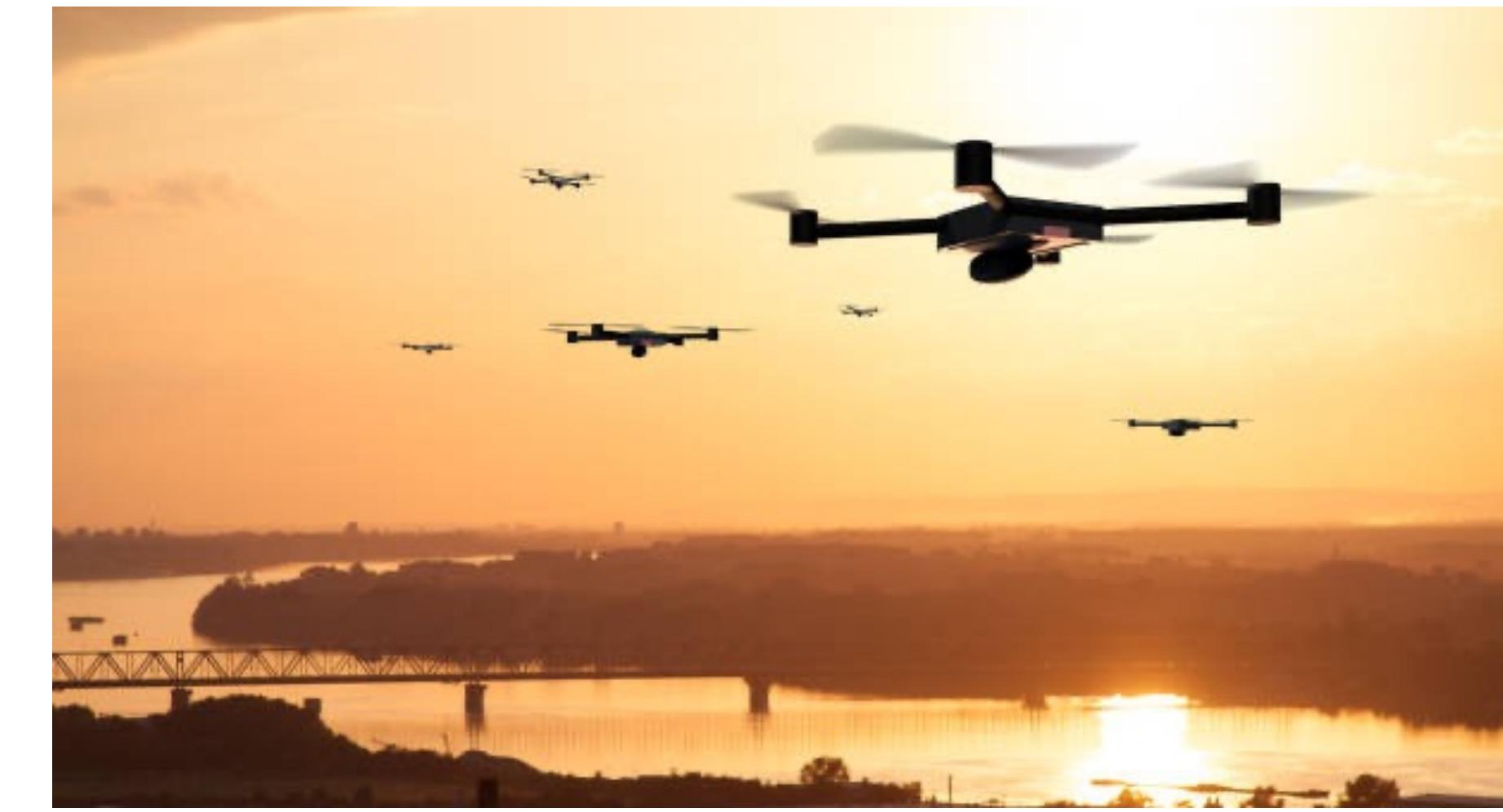
HERD: Human-AI collaboration: Engaging and controlling swarms of Robots and Drones

Multi-robot systems, or robot “swarms” provide benefits to real world problems:

Agriculture robots that coordinate to efficiently work the fields



Search and Rescue with drone swarms to quickly locate and save people



AGROINTELLI



AALBORG UNIVERSITY
DENMARK

CBS COPENHAGEN
BUSINESS SCHOOL
HANDELSHØJSKOLEN

ROBOTTO

SDU



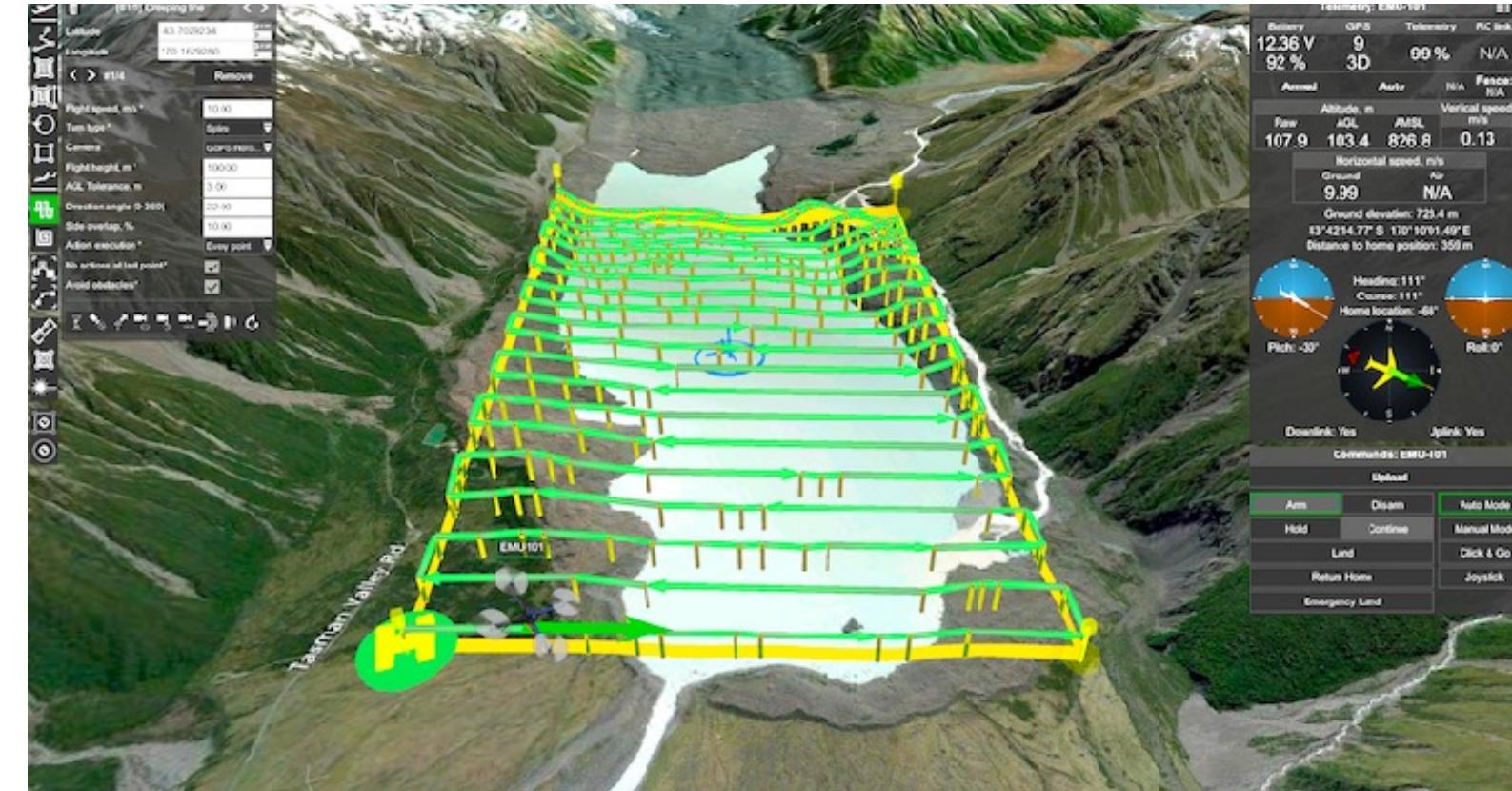
TEKNOLOGISK
INSTITUT

User interfaces to support complex relationship between humans, AI, and autonomous robots

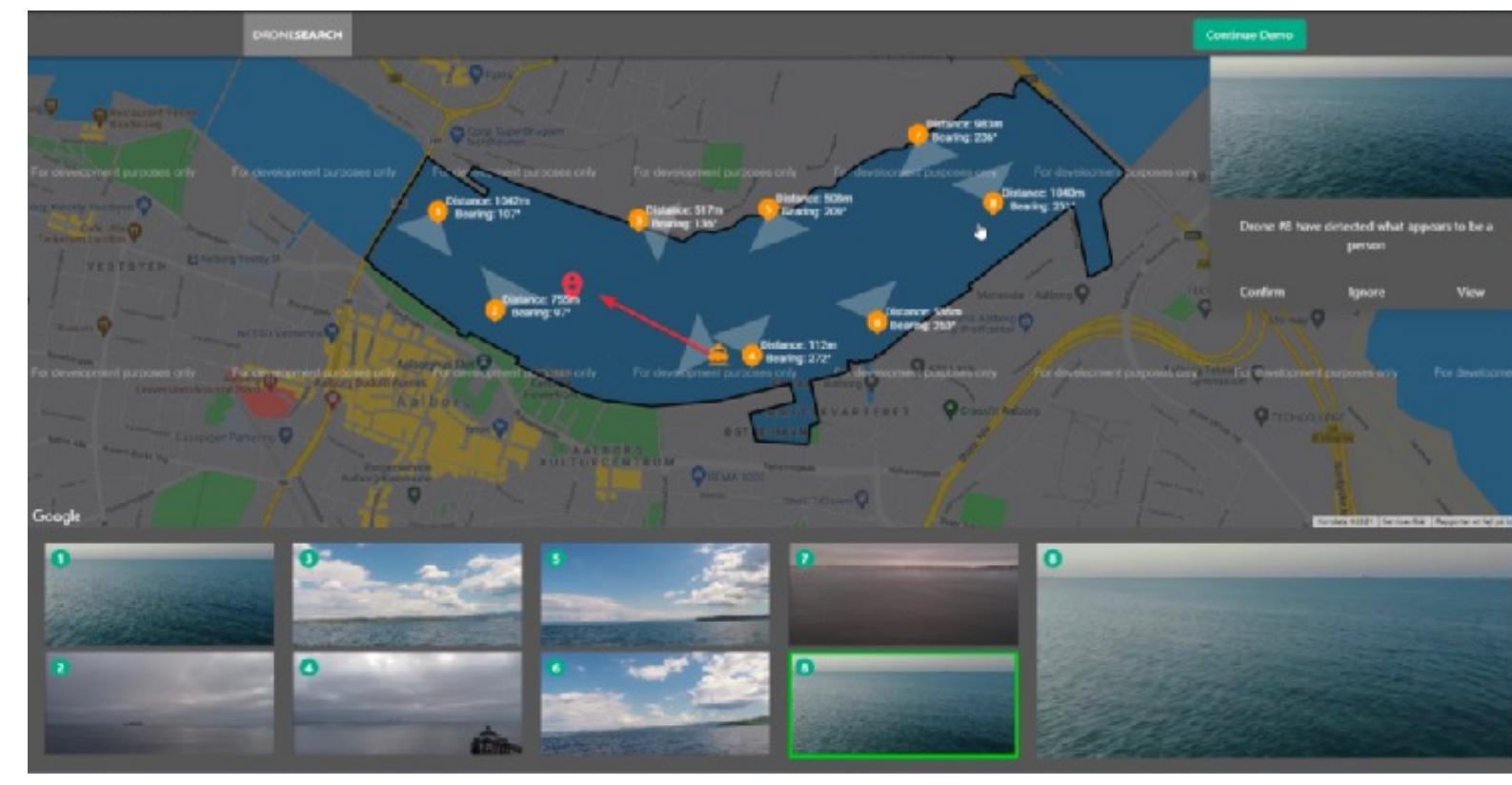
Understanding user needs



Develop novel methods for human-swarm interaction.



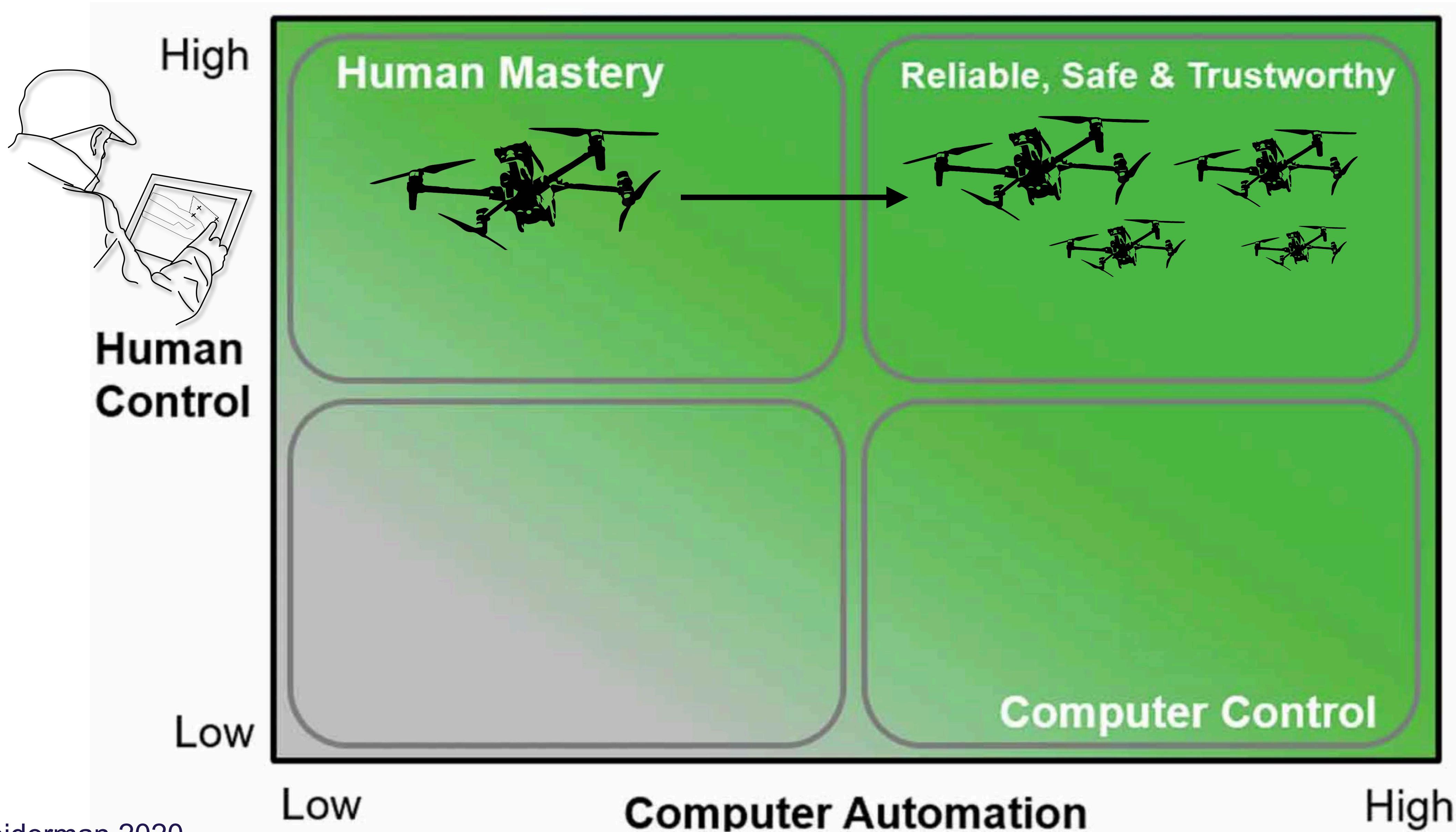
Evaluation with industrial partners



HERD: Human-AI collaboration: Engaging and controlling swarms of Robots and Drones
WS5: Human Computer Interaction, CSCW, and InfoVis



Autonomy vs. Human control in Human-centred AI



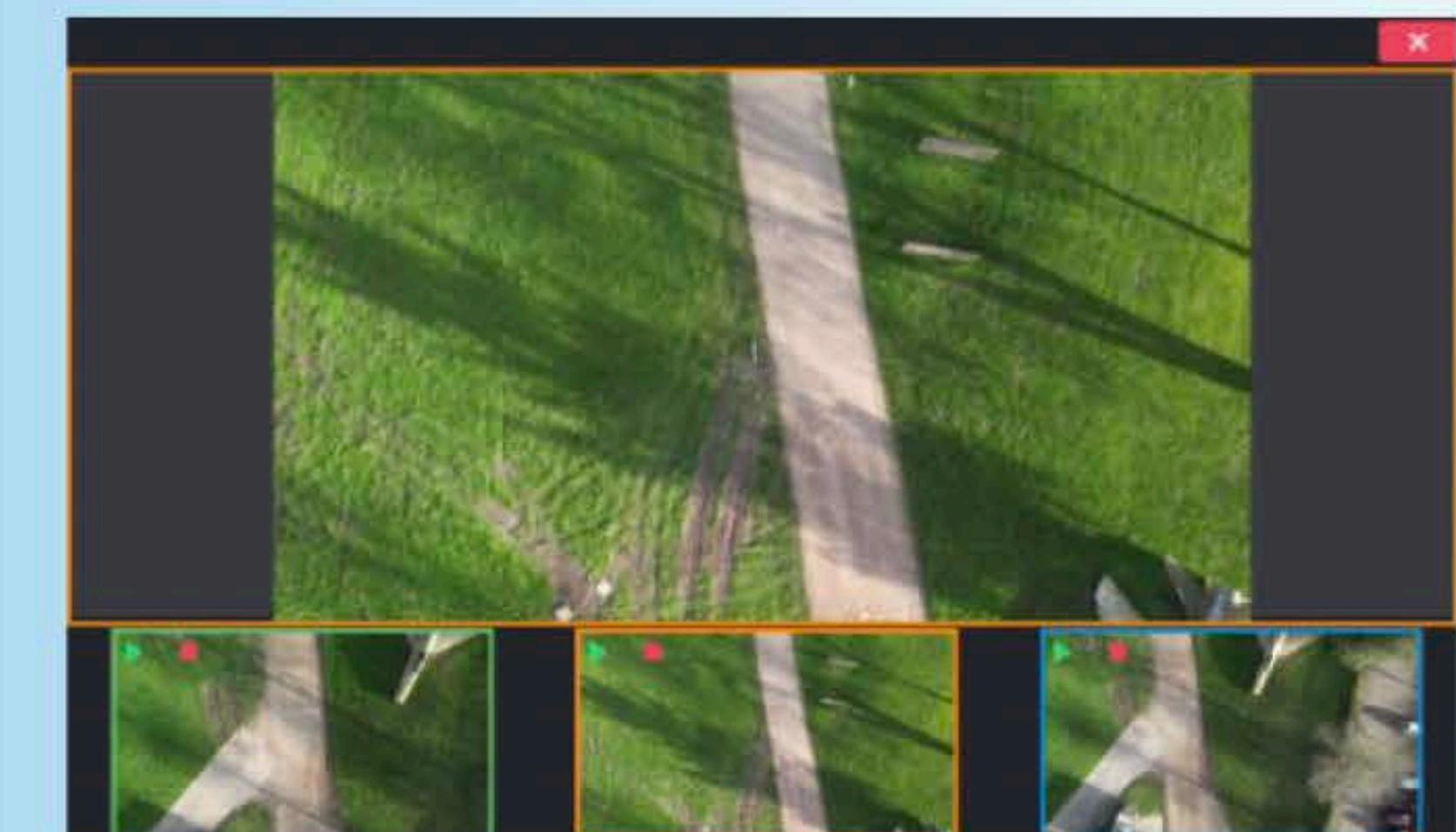
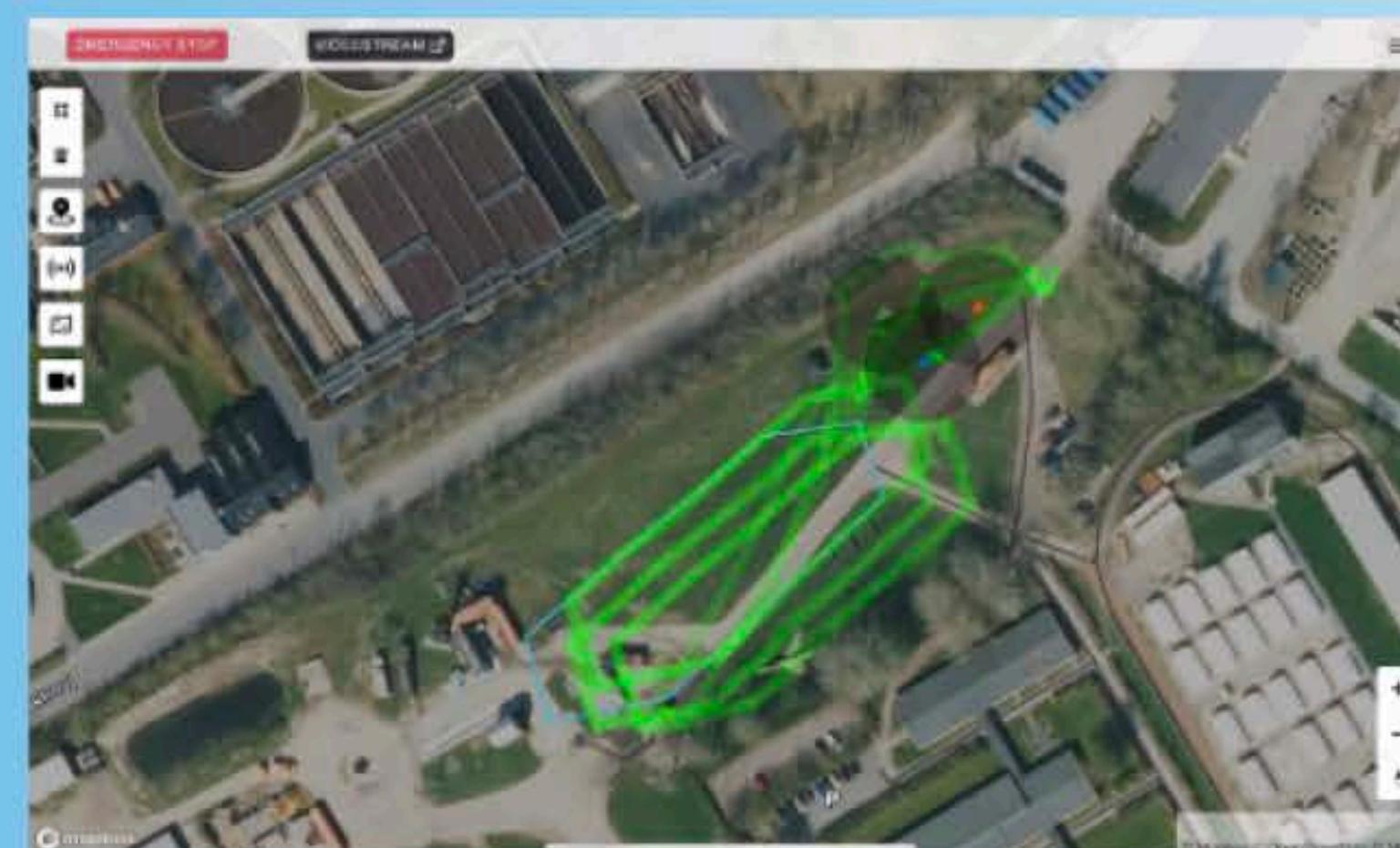
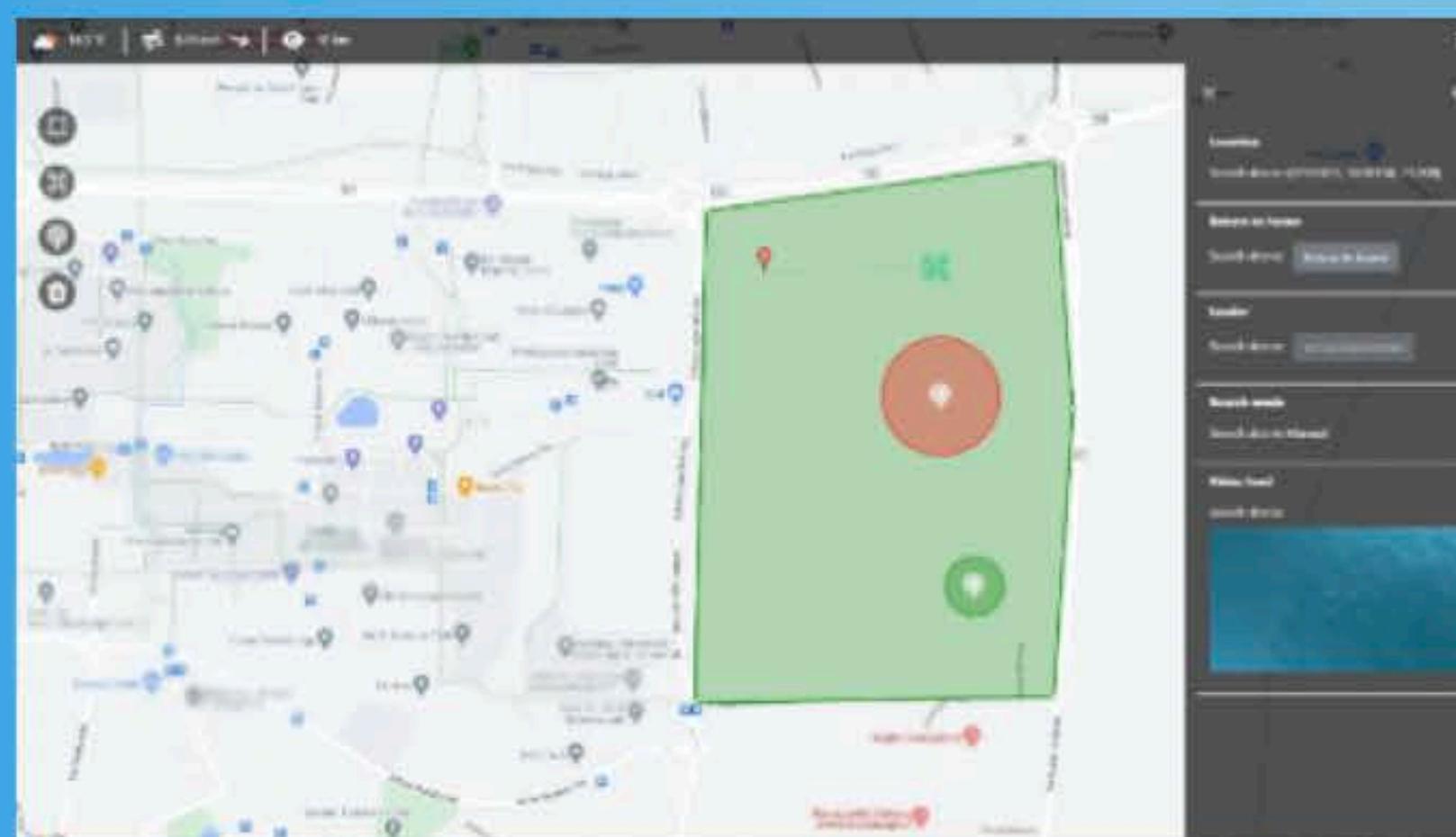
Understanding user needs



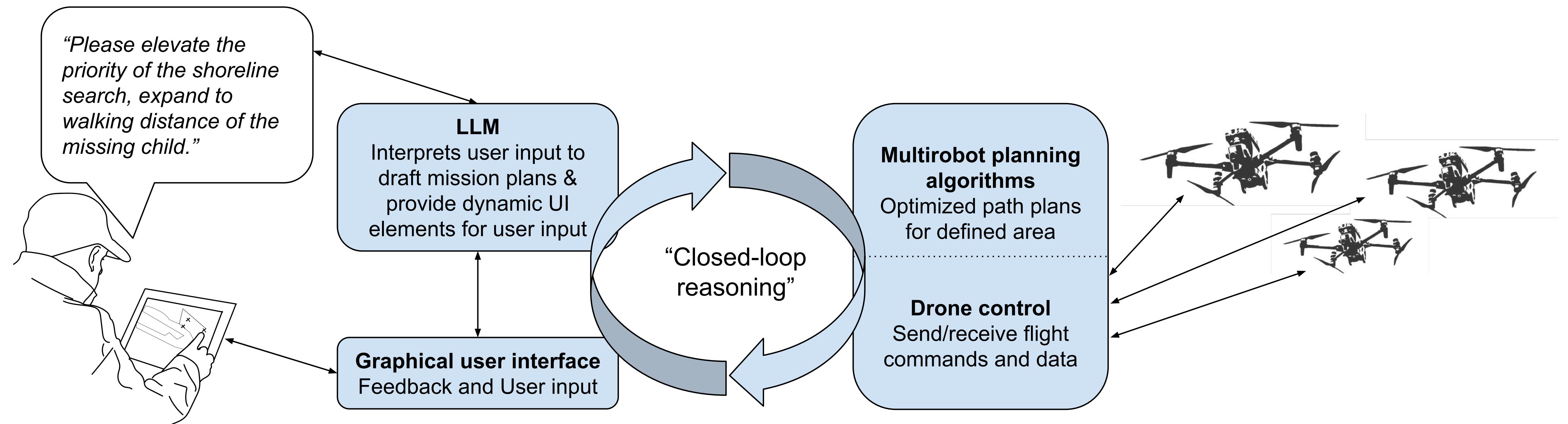
Evaluation with end-users



Develop novel methods for human-swarm interaction.



Natural-language Assisted Human-Multirobot Interaction and Planning (NAMUR)



supertools here we come!



Traditional UI/TUI

Garmin G1000



Tool calling

Apple Intelligence

“understand and create language and images, take action across apps, and draw from personal context to simplify and accelerate everyday tasks...”

<https://www.apple.com/newsroom/2024/06/introducing-apple-intelligence-for-iphone-ipad-and-mac/>

Tool making

ReAct, LangChain,
Multi (OpenAI)



We will need to catalog and learn from all the design experiments, successes, failures, emerging conventions and vocabularies!

About the course

Knowledge of- and skills in:

- The process of designing interactive systems
- Eliciting and representing user needs
- Visual design and underlying principles
- Usability evaluation

Course materials

Knowledge of- and skills in:

- BOOK: Benyon, D., Designing Interactive Systems, 3rd ed.

Physical book - AND/OR

Online version free through AUB: [https://www-vlebooks-com.zorac.aub.aau.dk/Vleweb/
Product/Index/339969?page=0](https://www-vlebooks-com.zorac.aub.aau.dk/Vleweb/Product/Index/339969?page=0)

- Scientific papers
- Slides in PDF form + Video Lecture



Course Structure

- 9 exercise sessions + Q&A session
- Flipped classroom
- Video lectures + slides available each week (See Moodle for specific dates) Your calendar is blocked in for lectures, there are few physical lectures
- Physical presence in group rooms for help with exercises and to answer questions + MS Teams channel. This will include the lecturer and teaching assistant available for all groups, circulating on Tuesdays/Thursdays
- <https://teams.microsoft.com/l/team/19%3ANnLERVCzVpIAC4xRQK34kit5Szjfo2tcJZZfWWJ2tCw1%40thread.tacv2/conversations?groupId=65e93a6d-75ff-403d-aee4-57a24235cb91&tenantId=f5dbba49-ce06-496f-ac3e-0cf14361d934>
- <https://tinyurl.com/DEB-2024-Team>

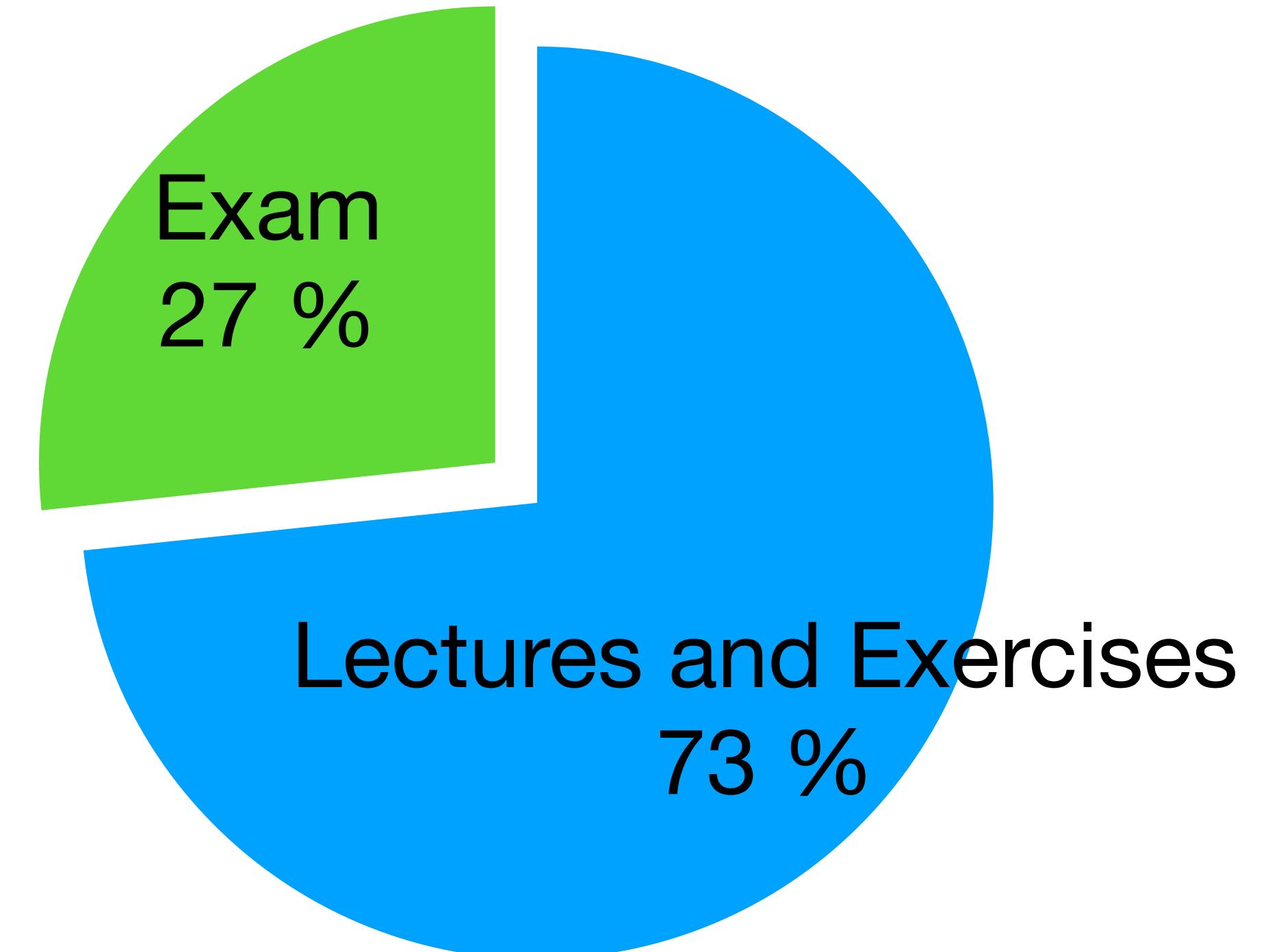
Exam

- 3-hour written exam (Moodle-based): multiple choice, short answer, etc.
- All aids allowed (notes, textbooks, research papers and other curricula related materials). Videos are not practical, no headphones, etc...
- Internet connection allowed for Digital Exam submission only! no Google searching, etc.
- 7-point scale

Workload distribution

5ECTS x30 hours = 150 hours

Approximately 110 hrs for lectures & exercises + 40 hours for preparation and exam



Usability and UX

What is this all about?



Usability

The **effectiveness**, **efficiency**, and **satisfaction** with which specified users achieve specified goals in particular environments.

Effectiveness: the accuracy and completeness with which specified users can achieve specified goals in particular environments

Efficiency: the resources expended in relation to the accuracy and completeness of goals achieved

Satisfaction: the comfort and acceptability of the work system to its users and other people affected by its use

UX - User Experience

A person's perceptions and responses that result from the use or anticipated use of a product, system, or service...

CHI 2011 • Session: User Experience

May 7–12, 2011 • Vancouver, BC, Canada

Old Wine in New Bottles or Novel Challenges? A Critical Analysis of Empirical Studies of User Experience

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ABSTRACT

This paper reviews how empirical research on User Experience (UX) is conducted. It integrates products, dimensions of experience, and methodologies across a systematically se-

more encompassing notions of quality are needed. Later research aims at defining, conceptualizing, and designing for UX (see [29] for a review).

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ABSTRACT

This paper reviews how empirical research on User Experience (UX) is conducted. It integrates products, dimensions of experience, and methodologies across a systematically selected sample of 51 publications from 2005-2009, reporting a total of 66 empirical studies. Results show a shift in the products and use contexts that are studied, from work towards leisure, from controlled tasks towards open use situations, and from desktop computing towards consumer products and art. Context of use and anticipated use, often named key factors of UX, are rarely researched. Emotions, enjoyment and aesthetics are the most frequently assessed dimensions. The methodologies used are mostly qualitative, and

more encompassing notions of quality are needed. Later research aims at defining, conceptualizing, and designing for UX (see [29] for a review).

In contrast to an instrumental, task-oriented view of interactive products, UX research focuses also on hedonic qualities of use. Such qualities concern for instance aesthetics [77] or self-actualization [20]. Another frequently mentioned characteristic is a focus on the positive emotions and affect that people experience while interacting with products [66, 29]. UX research focuses on the dynamics of experience, and on modeling how interactive products, person characteristics, and context work together in shaping the experience of use [88]. Finally, UX research calls for new methods and ap-

Skills of a Designer

...across academic disciplines

A variety of skills needed to design interactive systems:

Studying and understanding peoples' activities and contexts

Know the technologies

Design solutions that fit people and the context of use

Evaluate and reiterate designs

Skillset spans various academic disciplines:

Computer Science

Engineering

Sociology

Psychology

Neuroscience

Communication

Frameworks for thinking about human-centred design

Many approaches to this challenge, however...

For this course, we will look at 2 frameworks for building a mission statement, an **envisionment** for the software development project:

Benyon's **PACT** analysis &

FACTOR (BATOFF på dansk) analysis by Mathiasson et al.

***We will look at PACT more closely, however, you choose for your project whatever helps you the best**

Frameworks for thinking about human-centred design

Kickstarting alignment

BATOFF/FACTOR criteria is similar to **PACT** analysis.

The purpose of both is the same: To **create an initial alignment** at the beginning of a software development project.

It's like a **mission statement of the system**. Keep it short and concise - approximately half a page. The idea is to keep iterating over this description throughout the project, which **ensures that stakeholders are working towards the same goal**.

Therefore, it should **not be confused with the requirements specification**, which is an entirely different and detailed animal.

Frameworks for thinking about human-centred design

FACTOR (BATOFF) criterion

2.7 The FACTOR Criterion

The FACTOR criterion consists of six elements:

Functionality: The system functions that support the application-domain tasks.

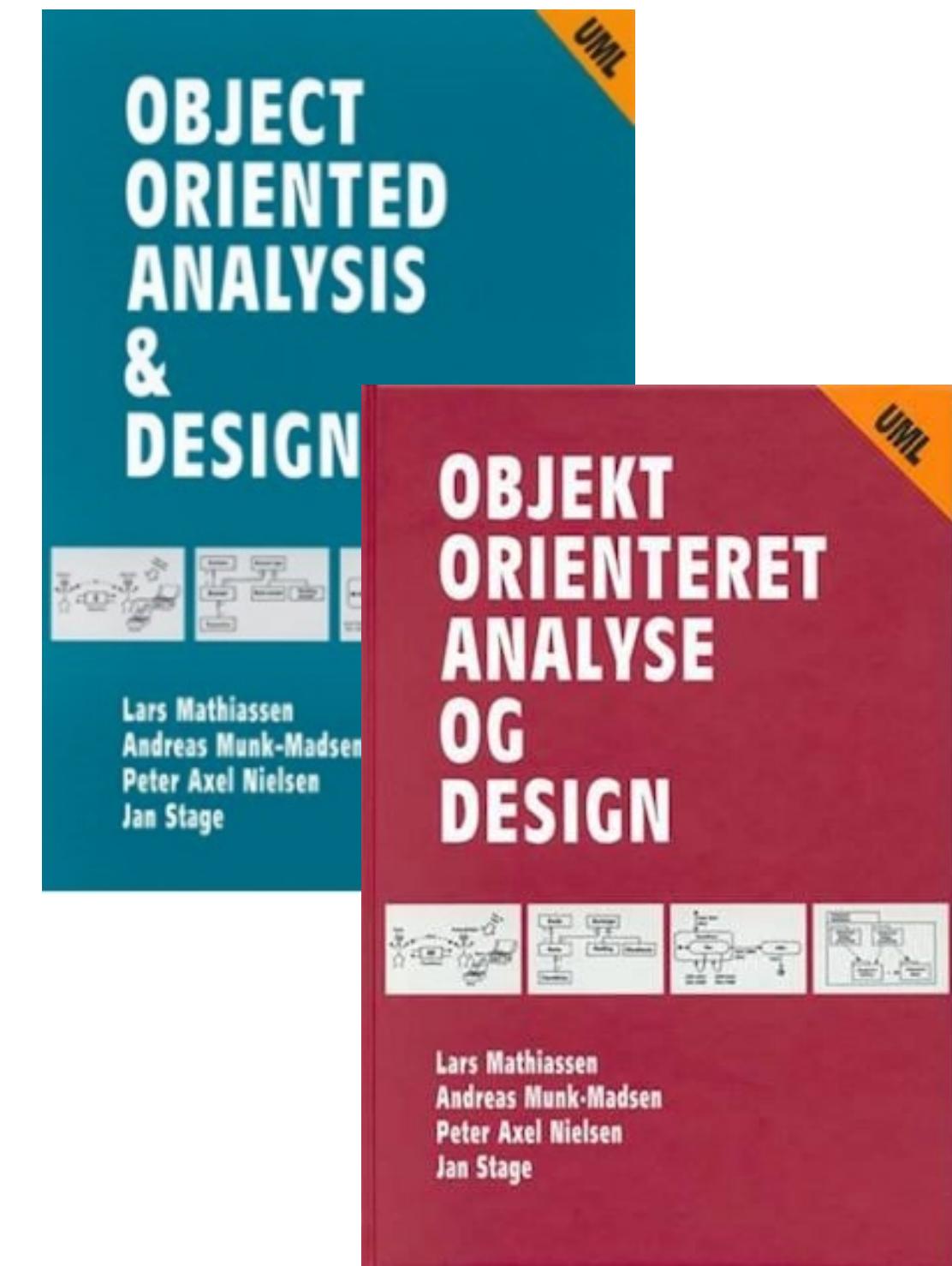
Application domain: Those parts of an organization that administrate, monitor, or control a problem domain.

Conditions: The conditions under which the system will be developed and used.

Technology: Both the technology used to develop the system and the technology on which the system will run.

Objects: The main objects in the problem domain.

Responsibility: The system's overall responsibility in relation to its context.



Frameworks for thinking about human-centred design

Benyon's PACT analysis

“People use technologies to undertake activities in contexts” (Benyon 2014)

**PEOPLE
ACTIVITIES
CONTEXTS
TECHNOLOGIES**

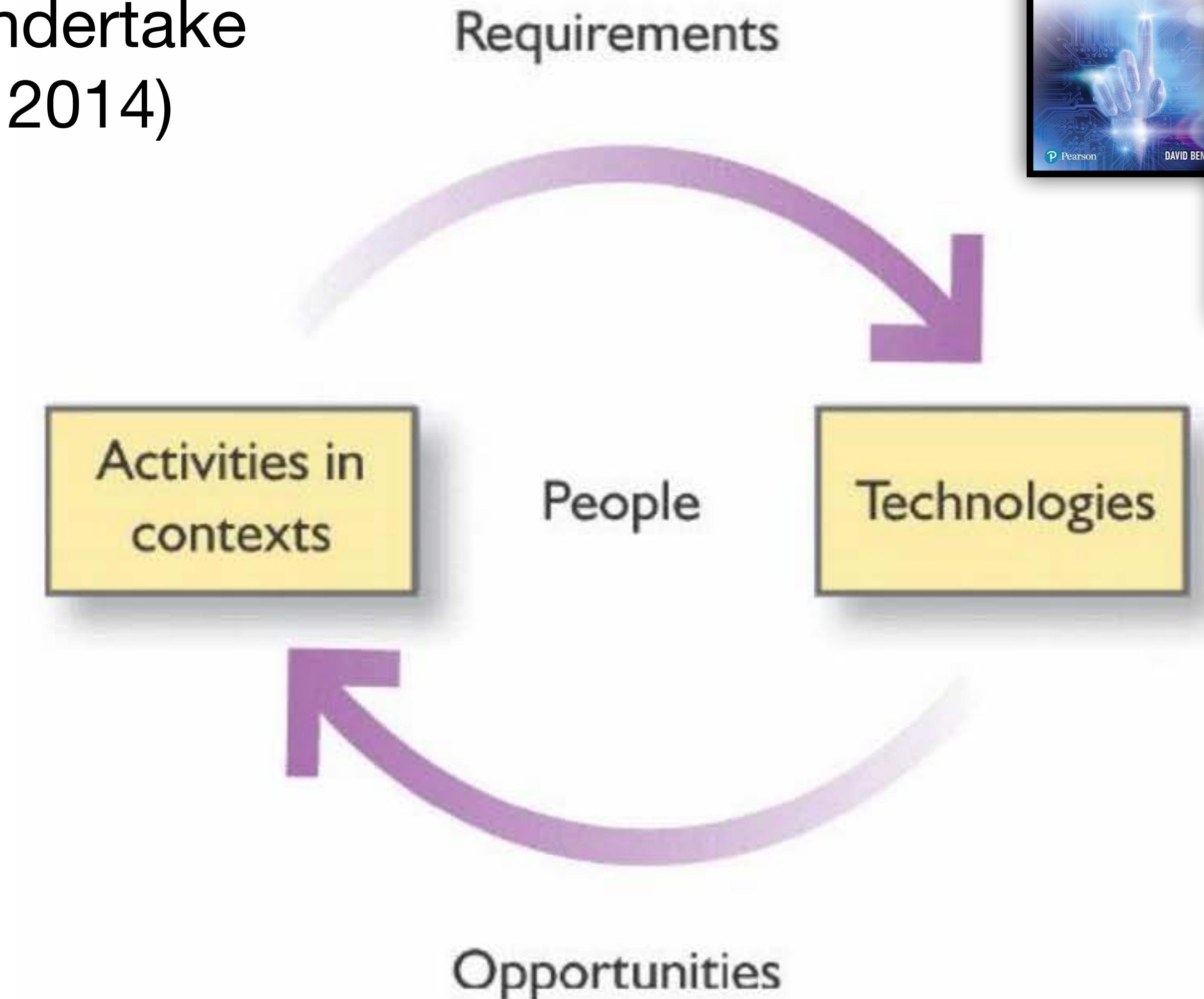




Image by [Charles McArthur](#) from [Pixabay](#)

What kind of vehicle would suit this family?





Image by Dimitris Vetsikas from Pixabay



Image by [Stan Petersen](#) from [Pixabay](#)



Image by [Carlos Alcazar](#) from [Pixabay](#)



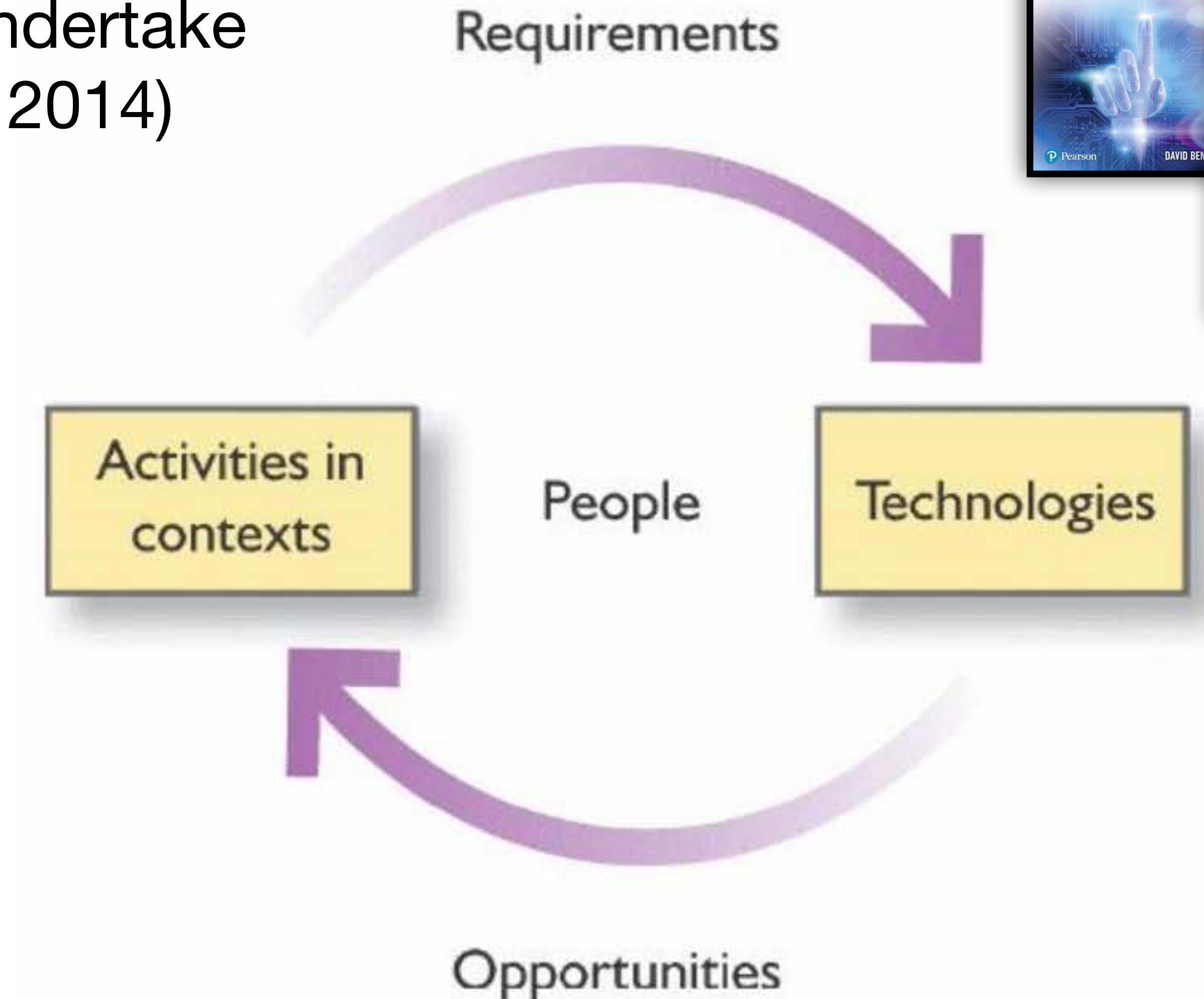
Image by [Charles McArthur](#) from [Pixabay](#)

Frameworks for thinking about human-centred design

Benyon's PACT analysis

“People use technologies to undertake activities in contexts” (Benyon 2014)

**PEOPLE
ACTIVITIES
CONTEXTS
TECHNOLOGIES**



People

a variety of ways that people can differ...

- Physiological differences
- Psychological differences
- Mental models
- Social differences

Physiological differences

- Disabilities (blindness, motor control etc.)
- Anthropometrics, measurement of a person, Finger size (male/female, thick/thin)
- Ergonomic knowledge about the capacities of a person.

An example is Fitts' Law (measuring motor control)

Fitts's law is a mathematical formula which relates the time required to move to a target as a function of the distance to the target and the size of the target itself, say moving a pointer using a mouse to a particular button.

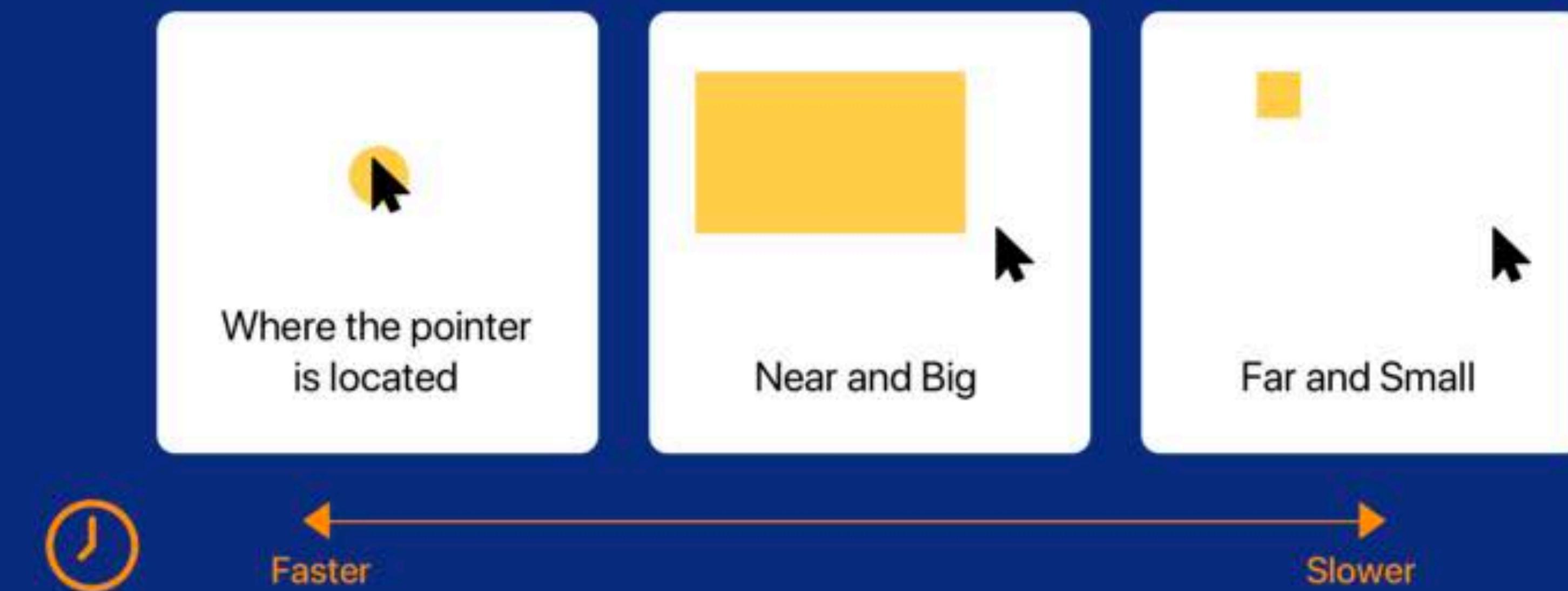
$$T_{(\text{time to move})} = k \log_2(D/S + 0.5)$$

Physiological differences

Fitts' Law (measuring motor control)

Fitts's law is a mathematical formula which relates the time required to move to a target as a function of the distance to the target and the size of the target itself, say moving a pointer using a mouse to a particular button.

$$T_{\text{(time to move)}} = k \log_2(D/S + 0.5)$$



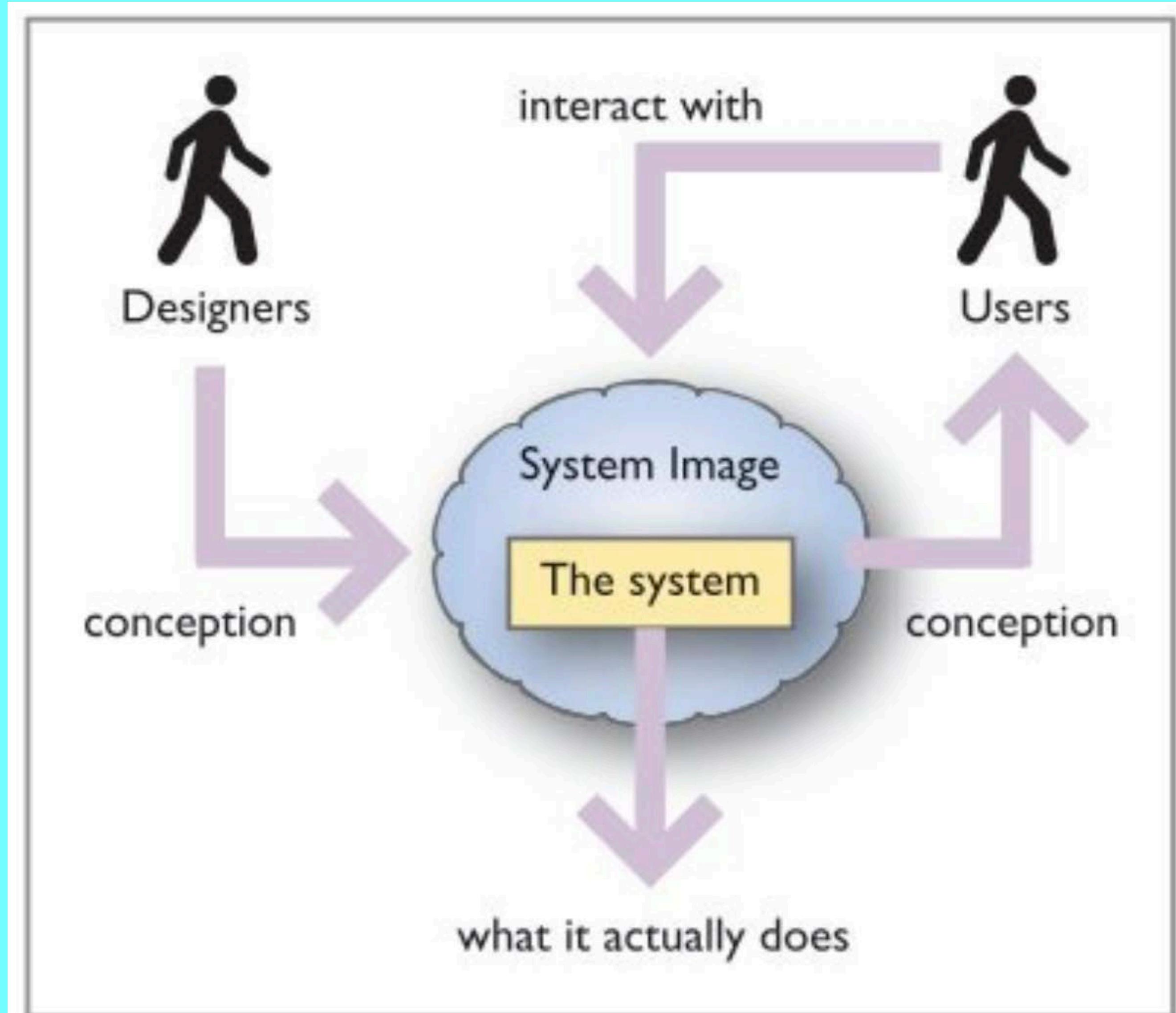
Psychological differences

- Spatial abilities
- Attention
- Memory
- Emotional disorders (depression)
- Personality types

Mental Models

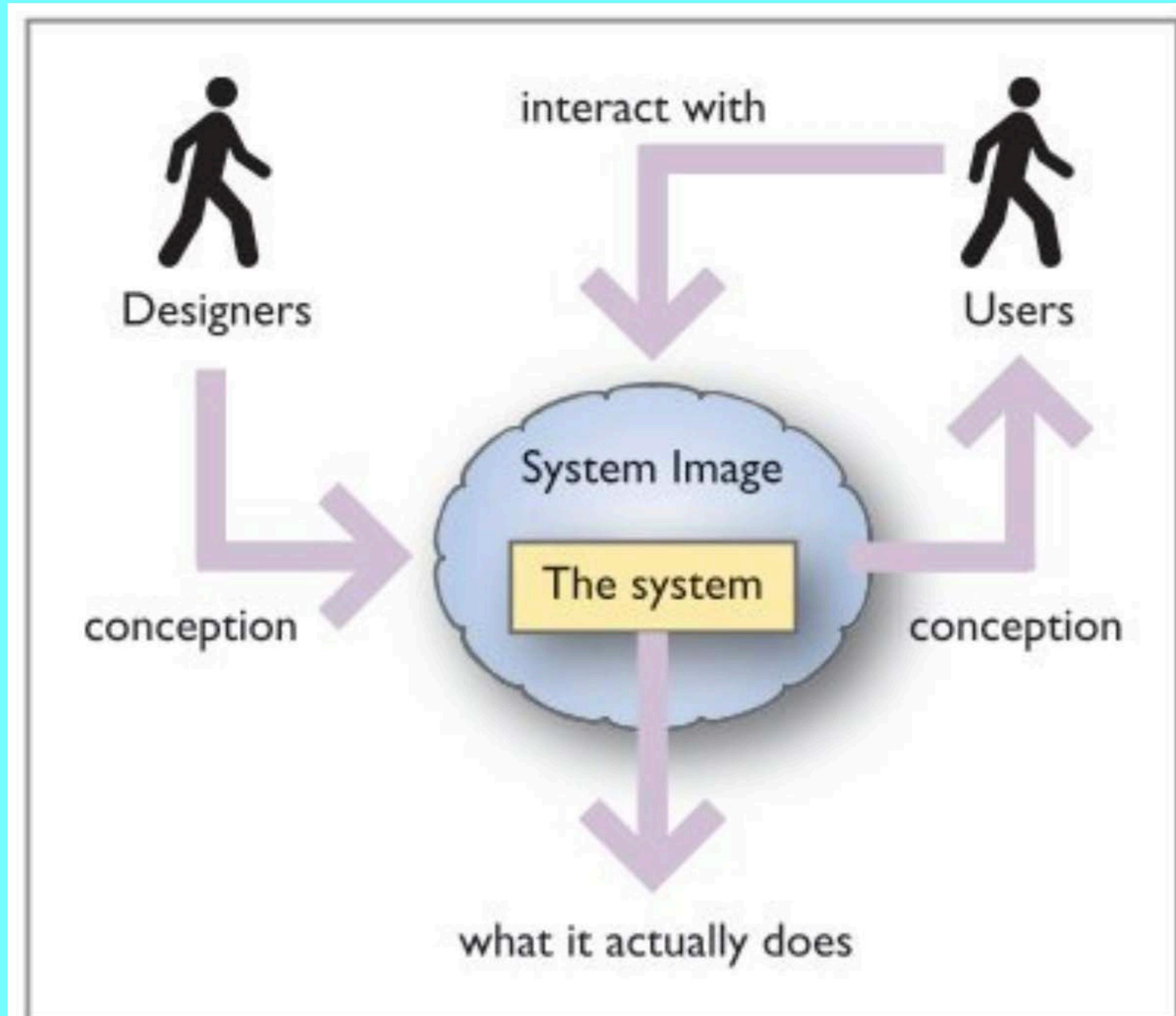
- Designers design a system (system image/interface) that they hope will reveal the designers' conception.
- The user builds a mental model through interaction with the system image/the interface.
- “I think this is the intention of the system, I think the logic is organised like this, or the expected process is...”

*Ask your grandmother/grandfather to explain how they think email works. How does a message get from one computer to another? You might uncover an interesting mental model or two :)



Mental Models

- Mental models are **incomplete**. People will understand some parts of a system better than others.
- People can ‘run’ (or try out) their models when required, but often with limited accuracy.
- Mental models are unstable – **people forget** details.
- Mental models **do not have firm boundaries**: similar devices and operations get confused with one another.
- Mental models are **unscientific**, exhibiting ‘superstitious’ behaviour.
- Mental models are **parsimonious**. People are willing to undertake additional physical operations to minimize mental effort, e.g. people will switch off the device and start again rather than trying to recover from an error.



Social differences

- Motivation
- Novice/Expert
- Homogeneous groups
- Heterogeneous groups

momondo



Fly



Ophold



Bil



Oplevelser

NYHED



Pakkerejser

Mere

Trips Log ind

Velkommen! Find en fleksibel flybillet til din næste rejse.

Tur/retur

1 voksen

Economy

København (CPH) ×



Puerto Plata (P... ×



1 fre. 8.10



1 fre. 15.10

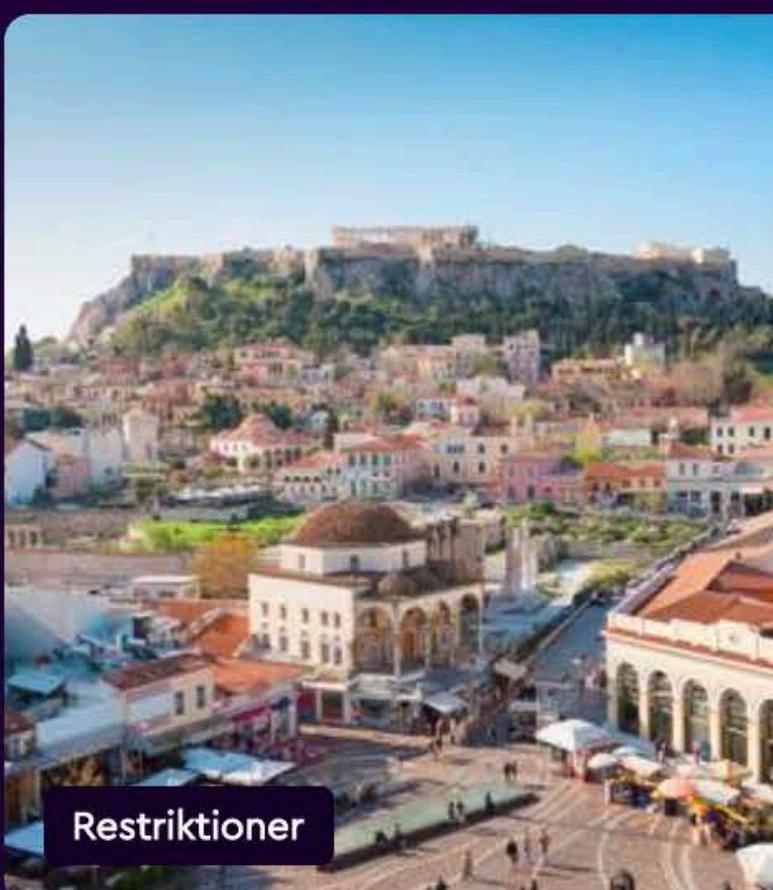


Søg

Destinationer, du kan rejse til nu

Populære destinationer, som er åbne for de fleste besøgende fra Danmark

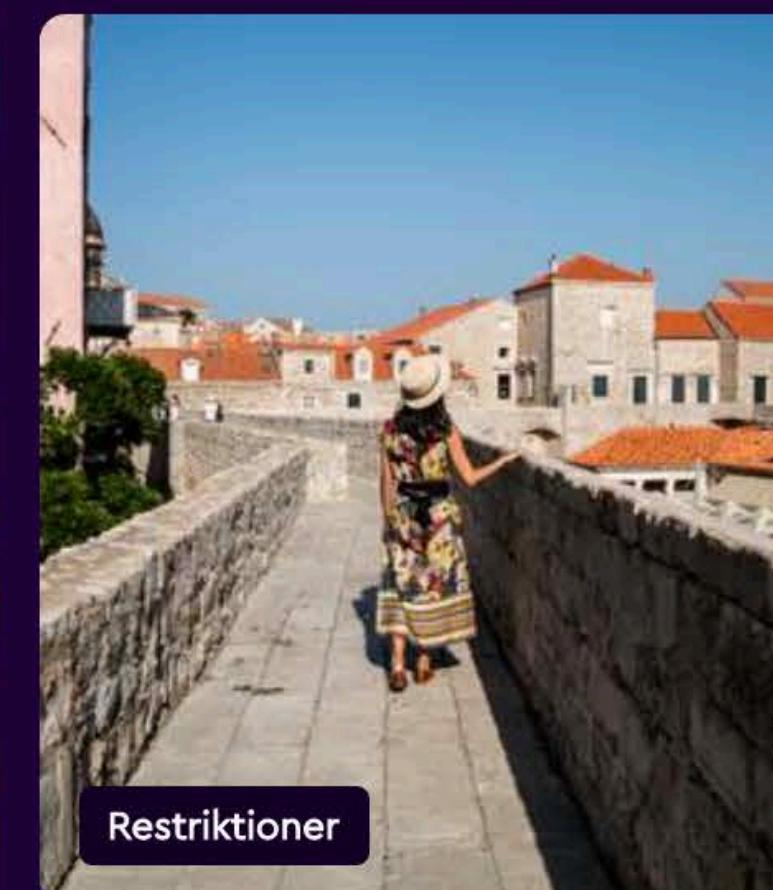
Vis alle



Grækenland

COVID-19 test påkrævet

Vaccinerede reisende kan komme på



Kroatien

COVID-19 test påkrævet

Vaccinerede reisende kan komme på



Frankrig

COVID-19 test påkrævet

Vaccinerede reisende kan komme på



Østrig

COVID-19 test påkrævet

Vaccinerede reisende kan komme på





**Interaction Design 7:
Design Studio Methods
(IxD7)**

Participants

Badges

Competencies

Grades

.

Overview

Week 1 - 3.09.2020 -
Introduction

Week 2 - 08.09.2020 -
City Scale Methods,
Design Thinking

Week 3 - 15.09.2020 -
City, Design Thinking &
Methods

Interaction Design 7: Design Studio Methods (IxD7)



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[Turn editing on](#)

Interaction Design 7: Design Studio Methods

Short name: **ID7DSM**

Teacher: [Tim Merritt](#)

Purpose, content and evaluation - E20

Literature (Overview of sources for lectures and reading)

News forum

Study regulation/Participants: [IxD7 \(0\)](#)

Search forums

Search



[Advanced search](#) ?

Latest announcements

[Add a new topic...](#)

18 Dec, 16:03

Ulla Øland

[Important information on the ID7: DSM exam](#)

18 Nov, 15:14

Timothy Robert Merritt

[Follow up from last class session](#)

16 Nov, 09:39

Timothy Robert Merritt

Activities in Contexts

10 characteristics of activities - what is the purpose?

- **Temporal Aspects**
 1. Frequency of activity
 2. Time pressure and peaks
 3. Continuous or interrupted?
 4. System response time

Activities in Contexts

10 characteristics of activities - what is the purpose?

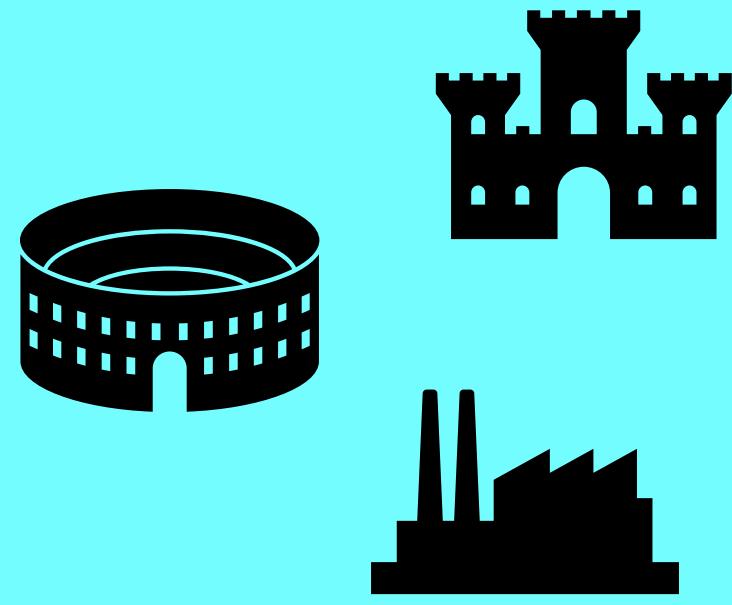
- **Collaboration**
- 5. Alone or with others?
- **Complexity**
- 6. Well-defined or vague tasks?

Activities in Contexts

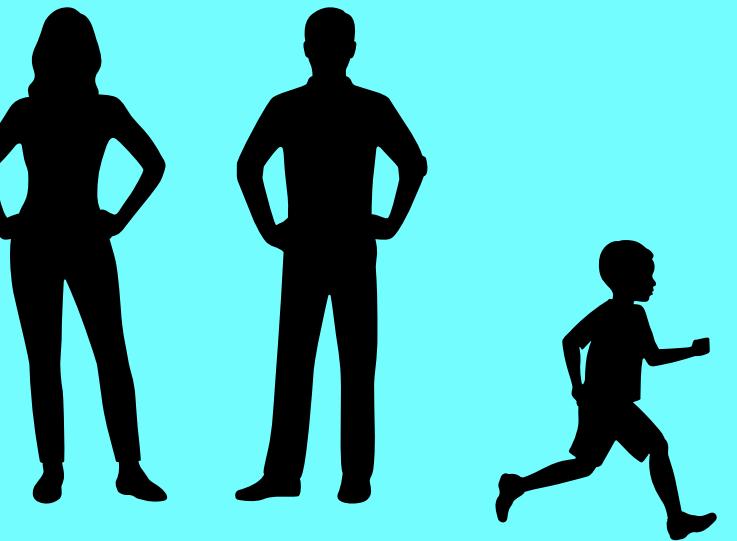
10 characteristics of activities - what is the purpose?

- **Safety-critical**
 7. Risk of Injuries?
 8. Generally, what happens when mistakes are made?
- **Nature of the content**
 9. Amount of data entries?
 10. Media types?

Activities in Contexts



Physical
Organizational
Social



Technologies

Input & Output



7 Input Technologies

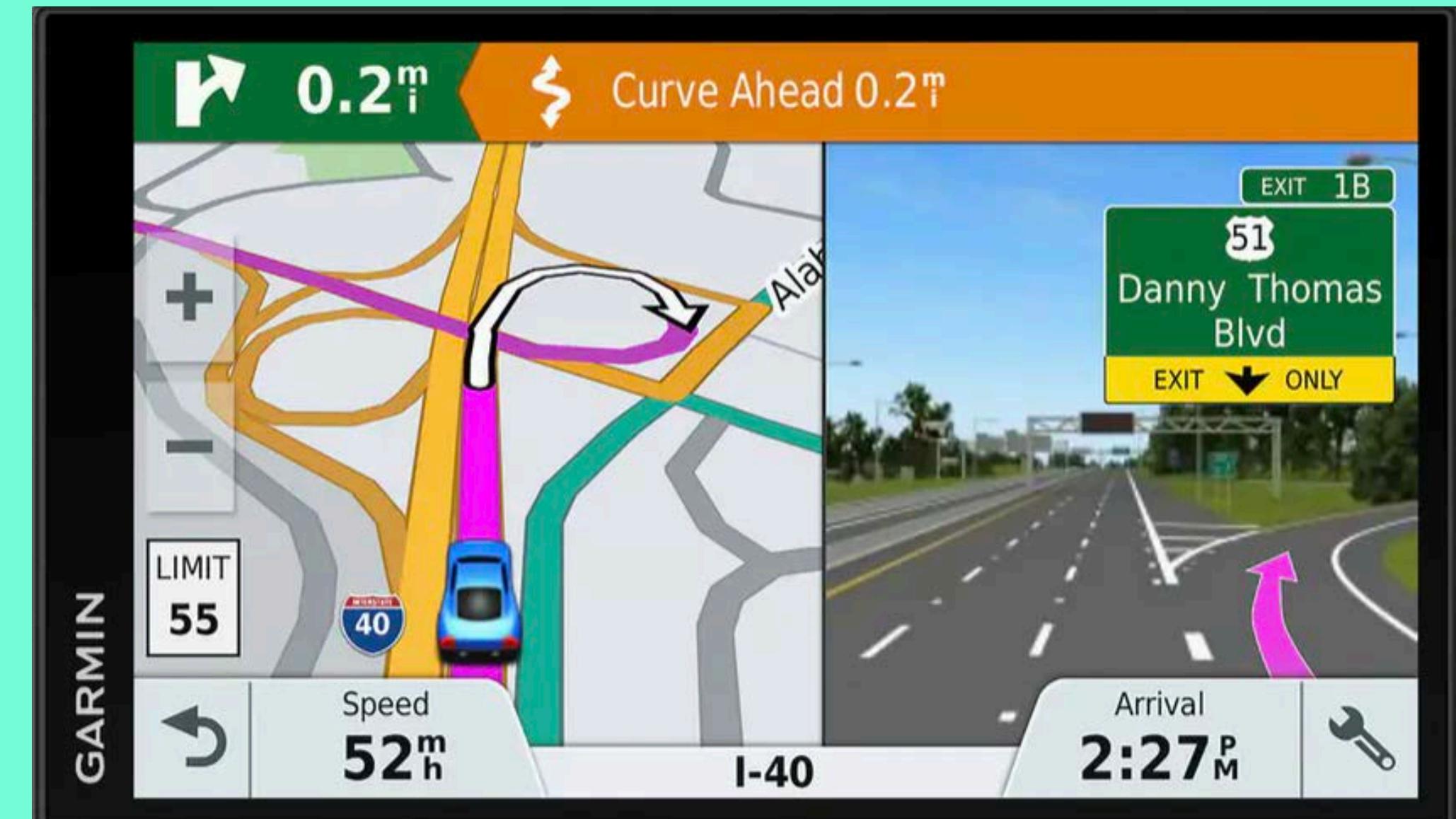
- 1.Touch**
- 2.Tactile (buttons)**
- 3.Auditory (microphone)**
- 4.Compass**
- 5.Accelerometer**
- 6.GPS**
- 7.Biometric**

Output Technologies

Any means of the system acting in the world, 2D displays, 3D displays, auditory, heat, etc...

What is the main output modality?

Primarily audio visual?



Both are vehicles, but they might be suited to different purposes, activities, contexts, and demands from the technology





Image by [Charles McArthur](#) from [Pixabay](#)

PACT - Analysis



P: Primary users are female and male adults with a drivers license. They typically have a family and need extra space for children and luggage. They have a mid to high income.

A: Daily activities include driving children to daycare and picking them up as well as driving to work. Spare time activities include field trips in semi-rough nature, trips to the beach and fishing. Activities are safety critical!

PACT - Analysis



C: Outdoors only, sometimes in semi-rough terrain. Socially, there may be up to five persons (typically family members).

T: Simple input in terms of steering, moving forward/backwards and changing gears. Safety technology include airbags, ESC and ABS. Engine technology must ensure an effective fuel consumption.

Process - human-centred interactive systems design

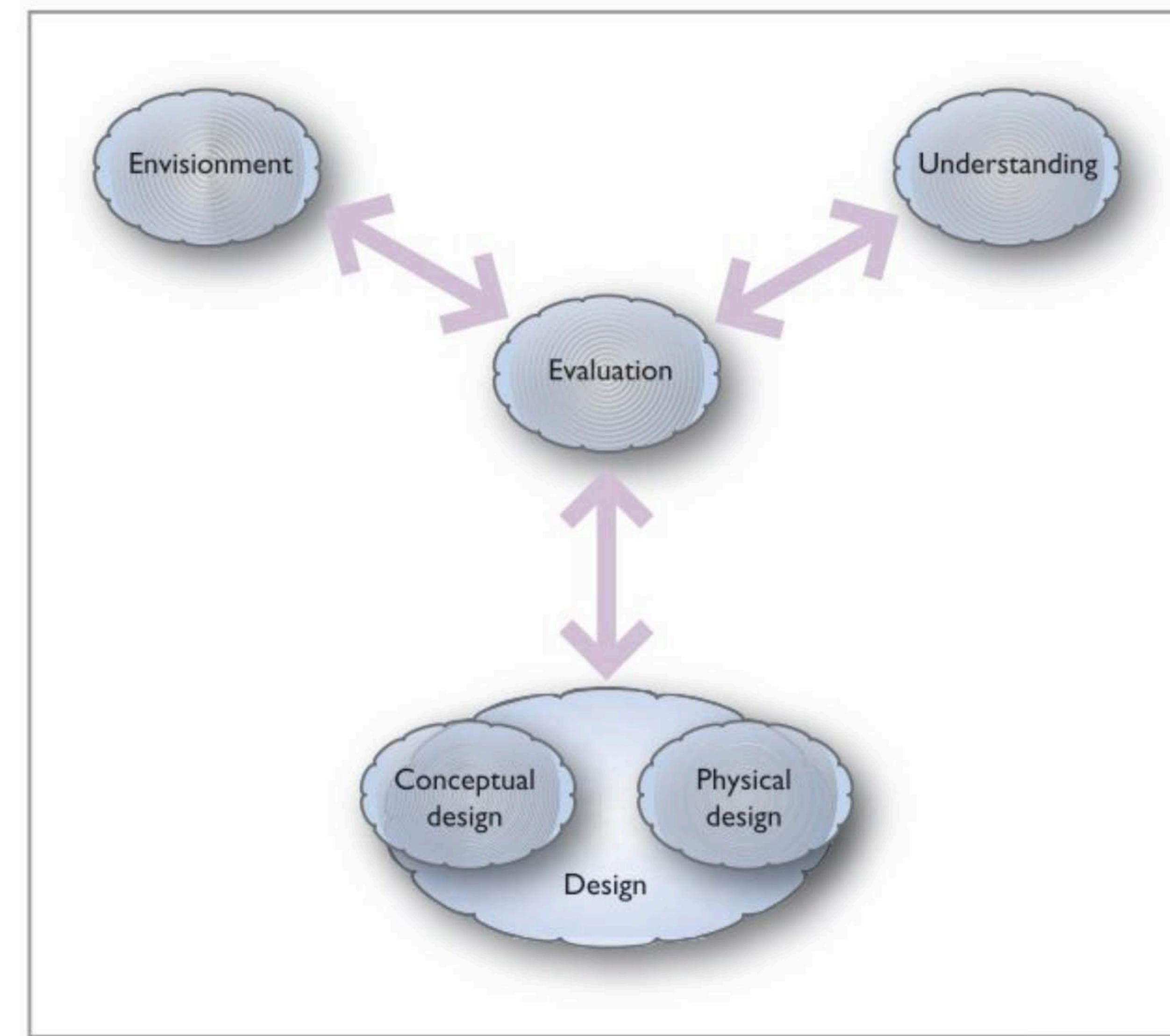


Figure 3.1 Understanding, design, evaluation, envisionment

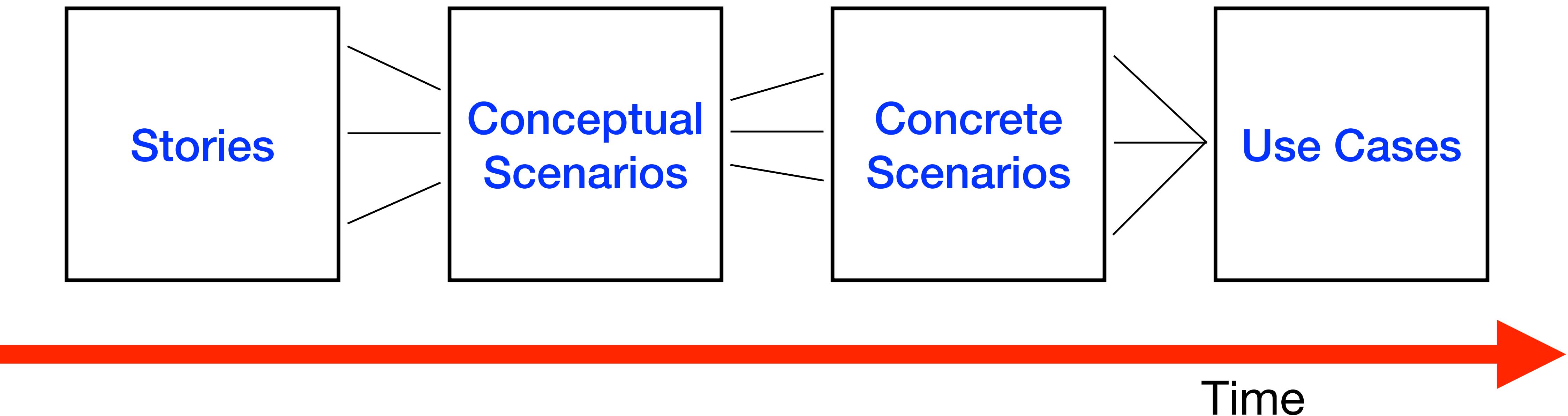
Process - human-centred interactive systems design

Understanding

Envisionment

Design

Conceptual Physical



Process - scenarios throughout design

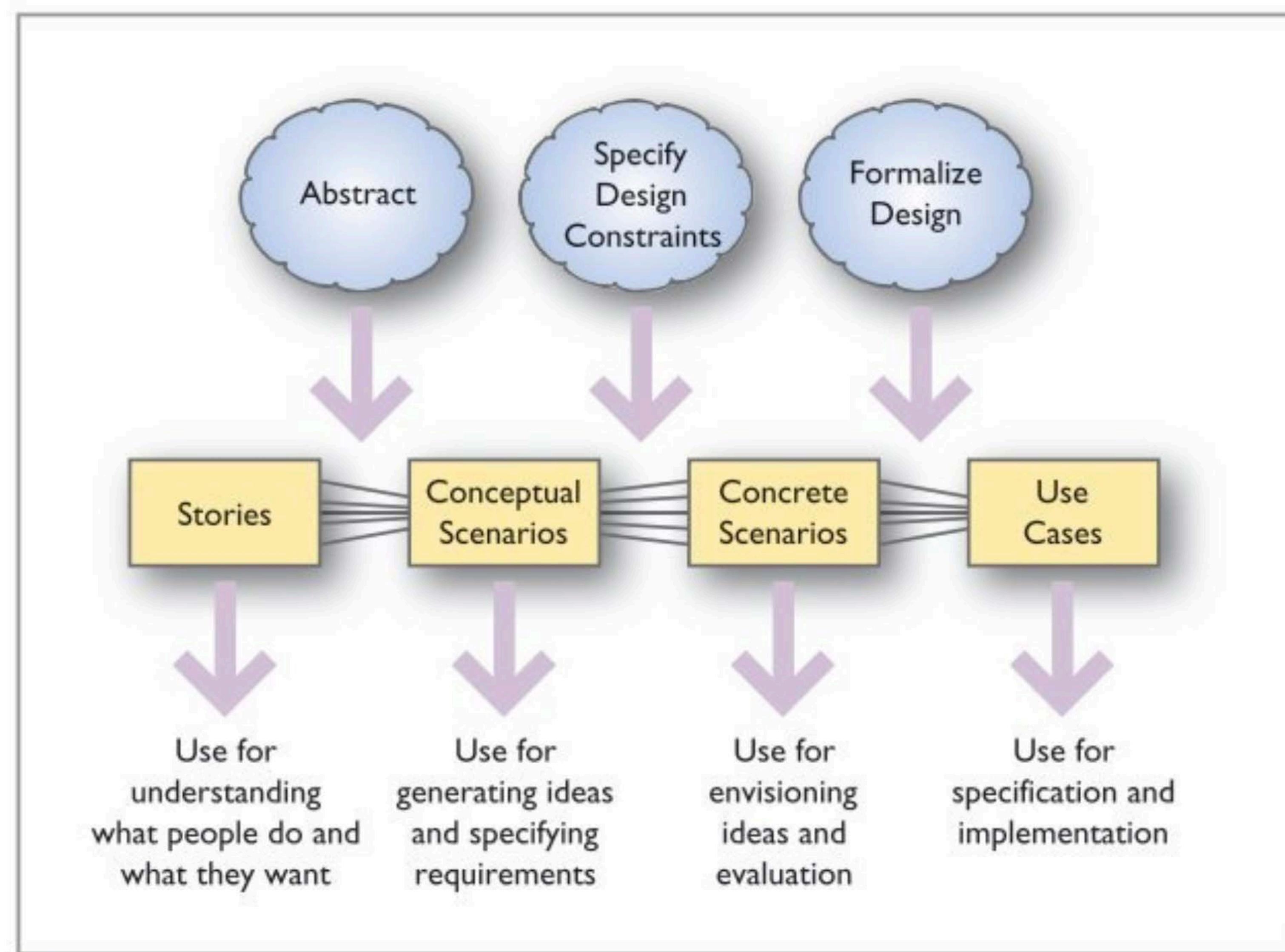


Figure 3.10 Scenarios throughout design

Stories

Real world
experiences

Anecdotes

Elicited through:

- PACT Analysis
- Observations
- Interviews
- Diaries
- Artifacts
- etc...

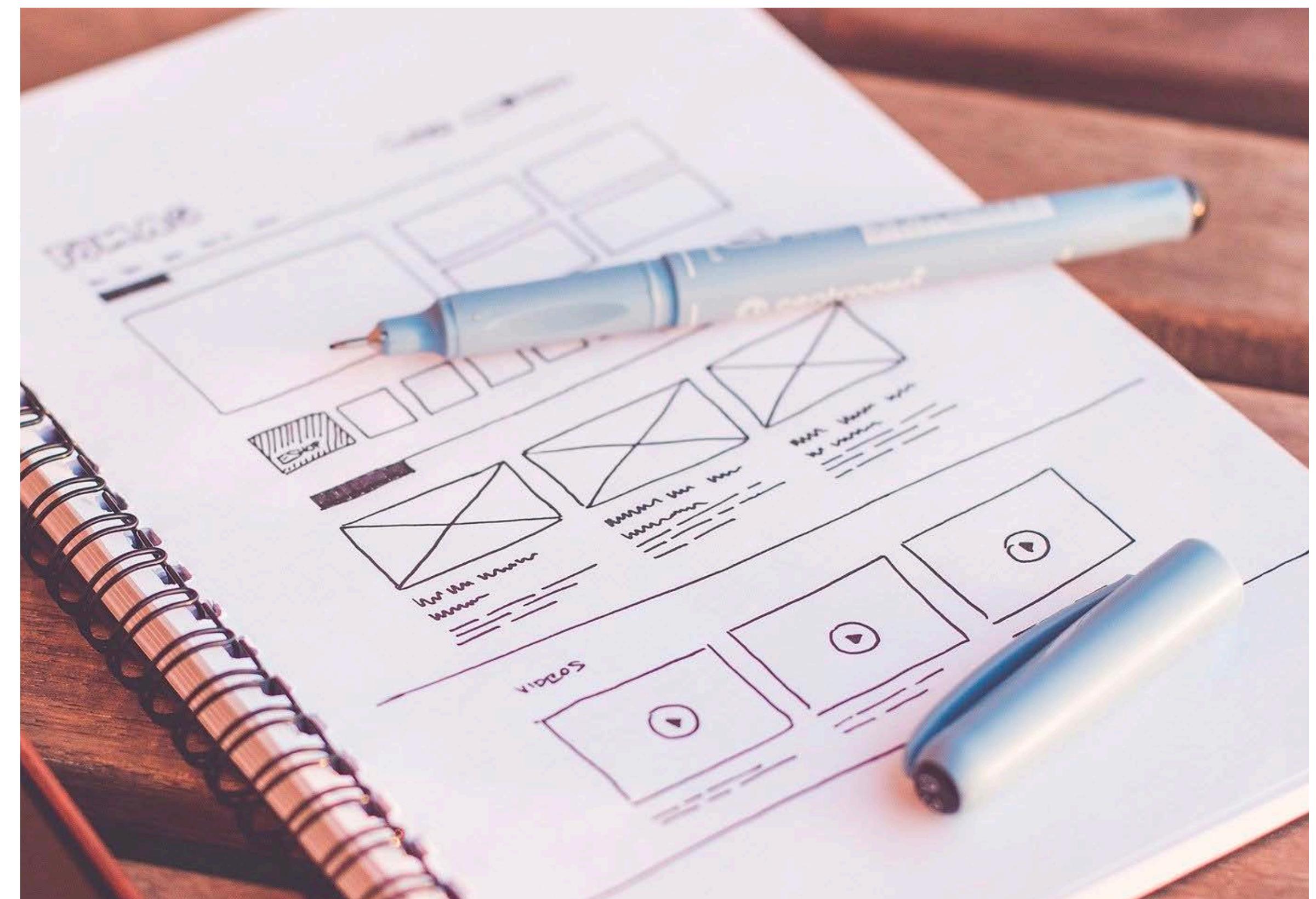


Conceptual Scenarios

Abstractions of stories

Creation of design ideas

- Elicited through:**
- **PACT Analysis**
 - **Sketching**
 - **Prototyping**
 - **Storyboards**
 - **etc....**



Concrete Scenarios

**Features applying to certain circumstances
Particular interface design emerges**

Elicited through:

- **PACT Analysis**
- **Metaphors**
- **Object/action analysis**
- **Flow modeling**
- **etc...**

Use Cases

**Interactions between users/systems
Input/output**

Elicited through:

- Design language definition (collection of UI components and patterns, style guides, documentation of semantics)
- Transition diagrams
- Interaction patterns
- Etc...

To Do:

- Read for this week, we covered most of it, but other chapters provide a wider view, e.g. user experience models, etc.
- 1st exercise session will be today, 14.30-16.15
- Do the 2 exercises, PACT analysis for a system that gives a poor experience and one with a good experience (Moodle)
- Week topics are posted, read ahead if desired
- Make sure to check Moodle messages/bulletins
- Add yourself to Teams: <https://tinyurl.com/DEB-2024-Team>