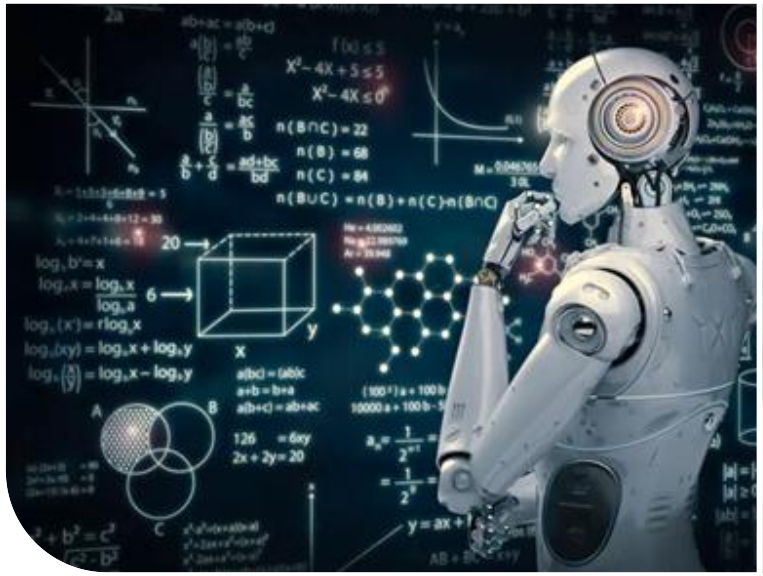
UNIVERSITY OF PASSAU

AI-Based Business Information Systems

Human-Centered Design



Prof. Dr. Ulrich Gnewuch

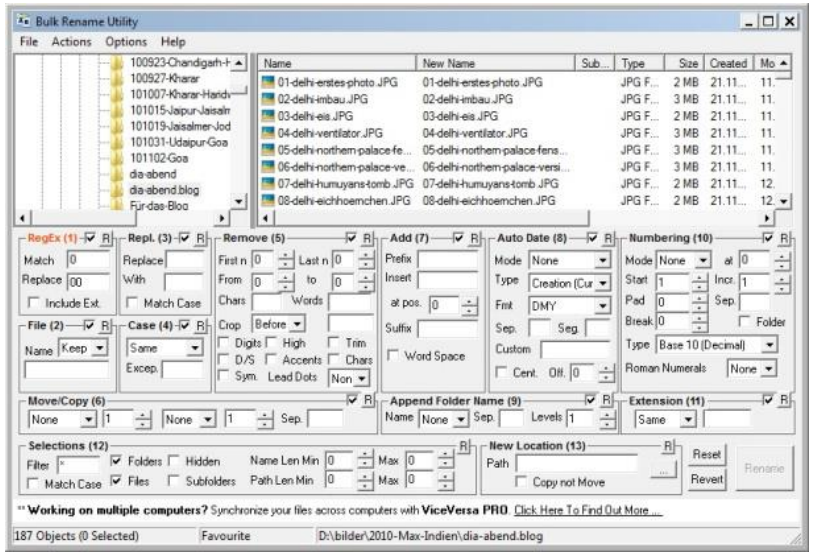
Learning Goals

- Explain the importance and the principles of human-centered design
- Describe the human-centered design approach and its key activities and deliverables
- Describe important methods, tools, and techniques for each activity

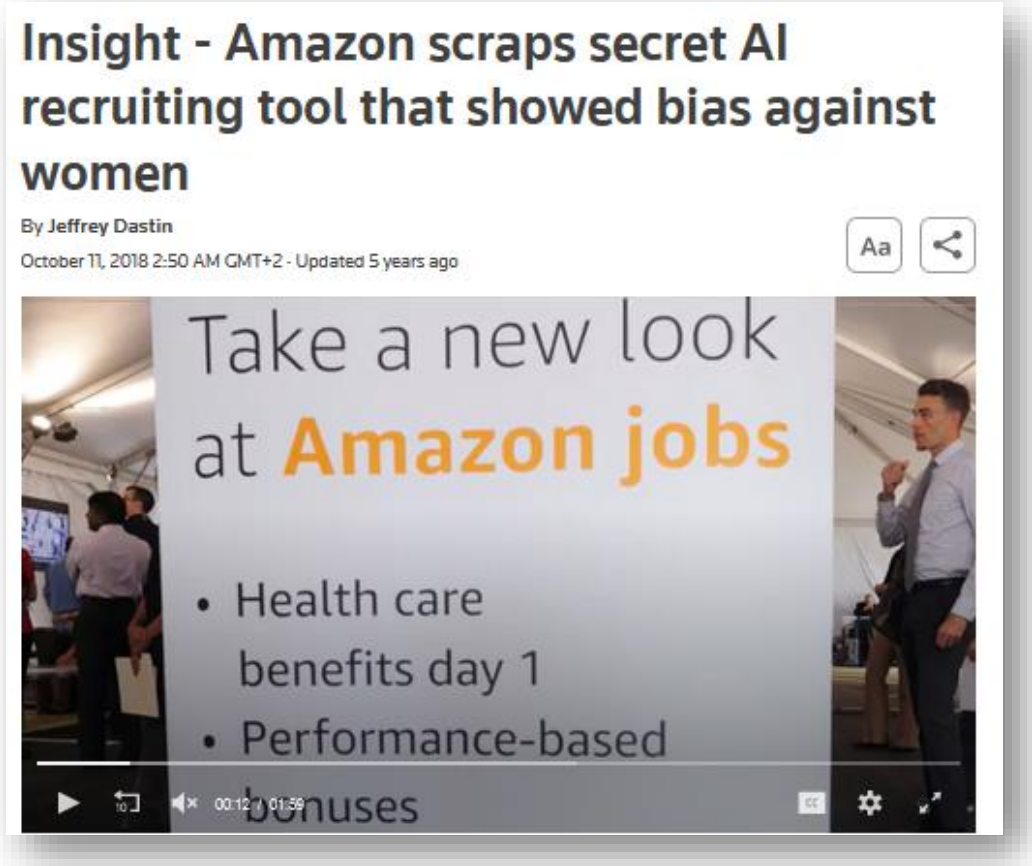
Why Human-Centered Design?

… in the physical world

… in the digital world



Why Human-Centered Design?



https://www.reuters.com/article/idUSKCN1MK0AG/

https://www.globalwitness.org/en/campaigns/digital-threats/new-evidence-of-facebooks-sexist-algorithm/

Human-Centered AI

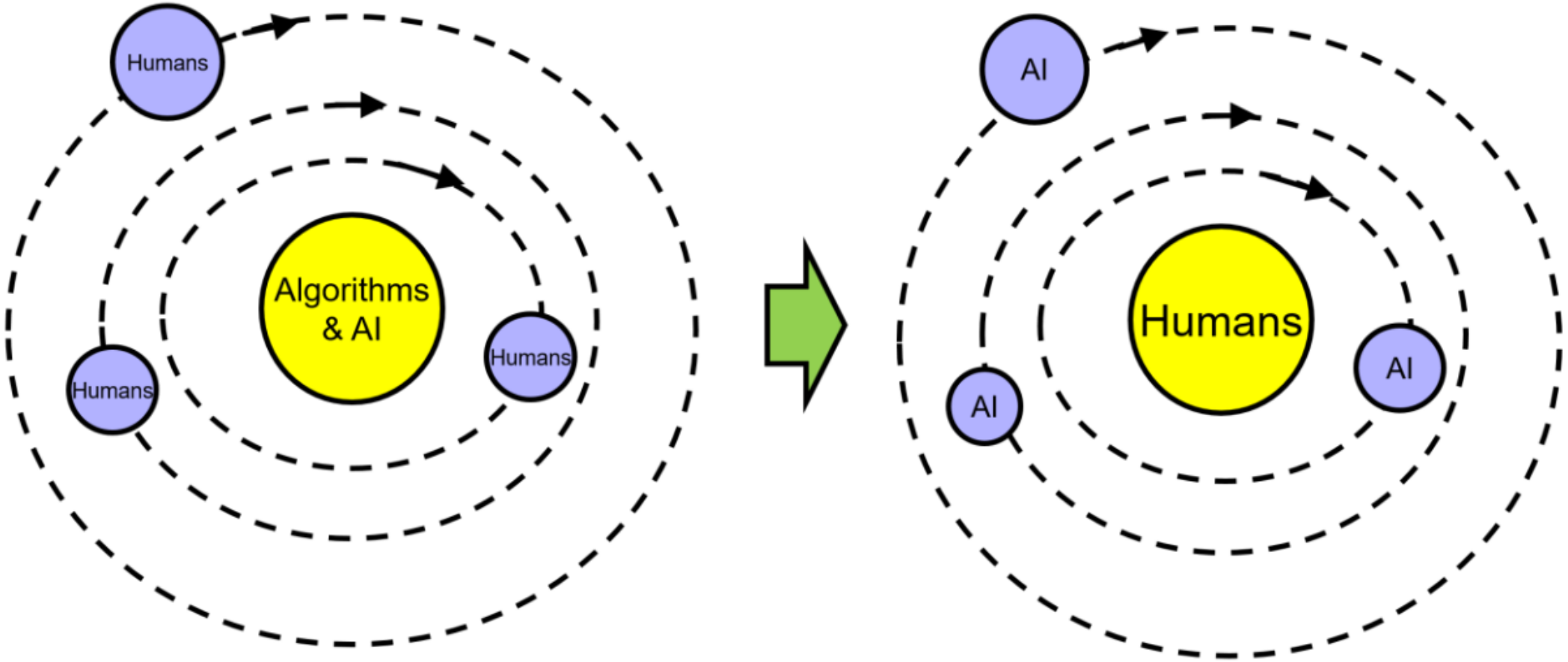
3 ways to center humans in your company's artificial intelligence efforts

Put Humans at the Center of AI

Human-centered AI: The power of putting people first

Stanford University
Human-Centered
Artificial Intelligence

Basic Idea of Human-Centered AI



Shneiderman 2020; 2022

How can we put humans at the center of (AI) design?

Human-Centered Design – ISO Standard

ISO 9241-210:2019

Ergonomics of human-system interaction

Part 210: Human-centred design for interactive systems

https://www.iso.org/standard/77520.html

Principles of Human-Centered Design

- A **human-centered design approach** should follow these principles:
  1. the design is based upon an **explicit understanding** of users, tasks and environments
  2. **Users are involved** throughout design and development
  3. the design is driven and refined by user-centered **evaluation**
  4. the process is **iterative**
  5. the design addresses the **whole user experience**
  6. the design team includes **multidisciplinary skills and perspectives**

ISO 9241-210:2019

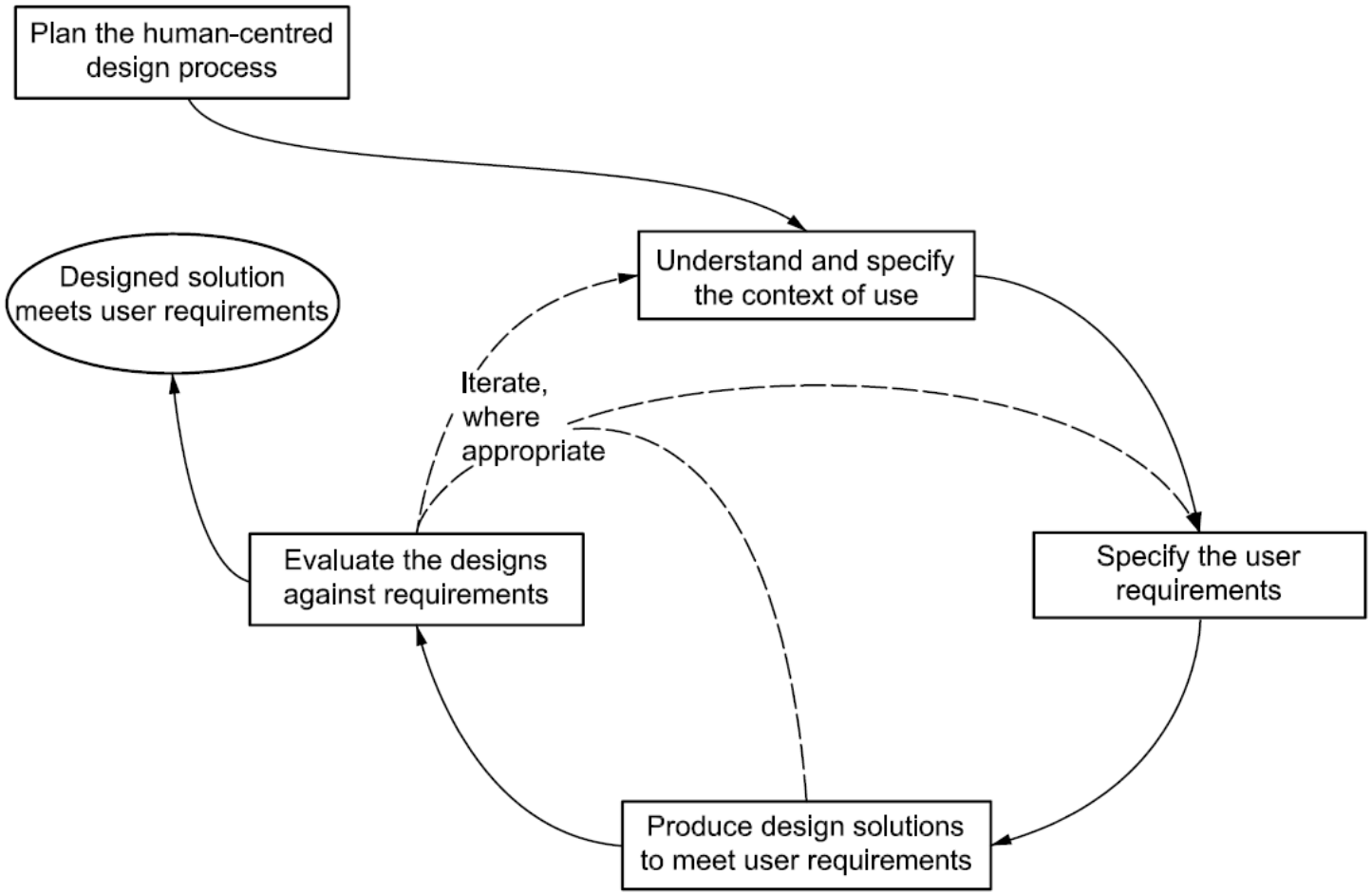
Ergonomics of human-system interaction

Part 210: Human-centred design for interactive systems

https://www.iso.org/standard/77520.html

ISO 9241-210

Human-Centered Design Approach



ISO 9241-210:2019

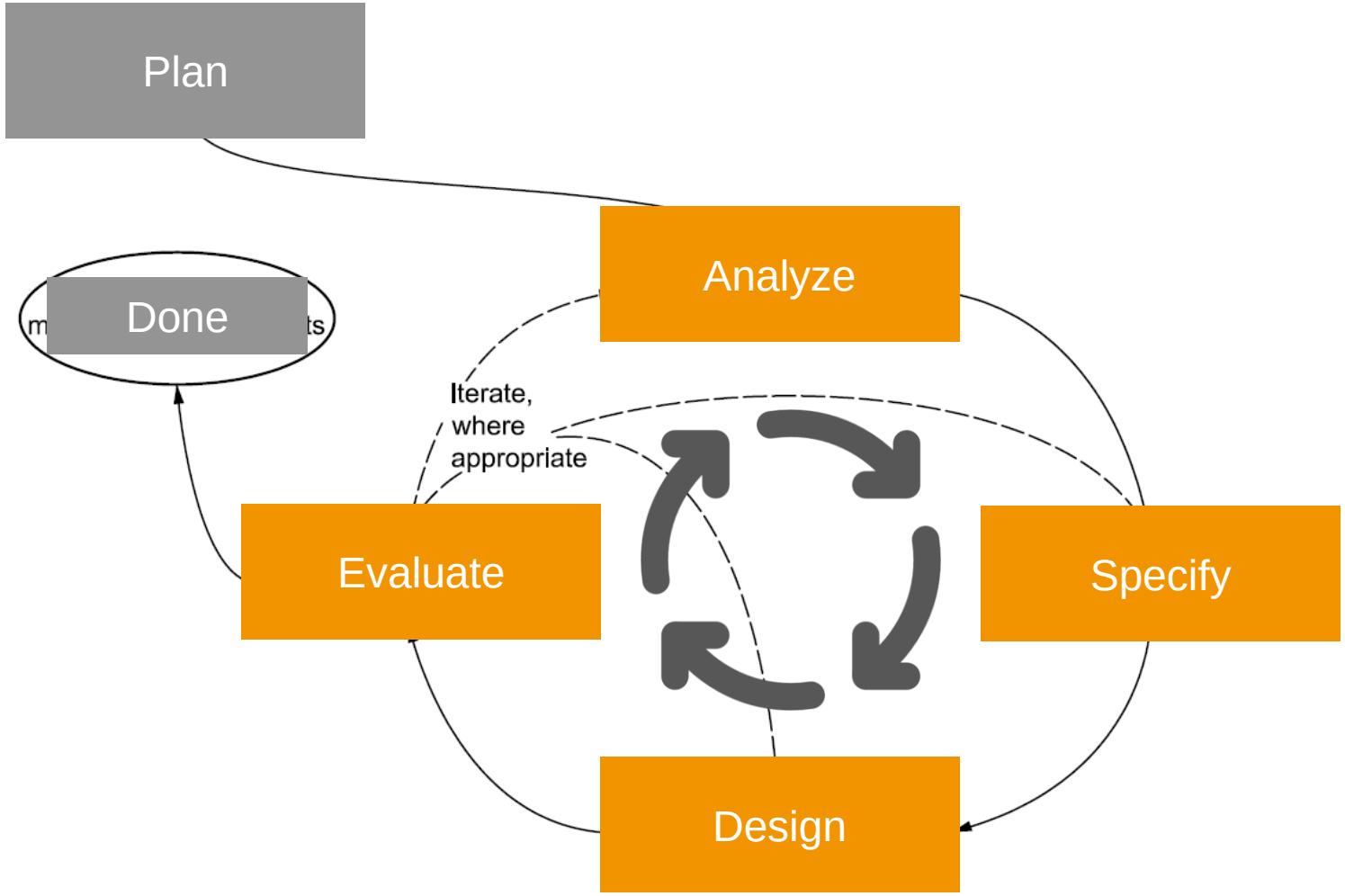
Ergonomics of human-system interaction

Part 210: Human-centred design for interactive systems

https://www.iso.org/standard/77520.html

ISO 9241-210

Human-Centered Design Approach: 4 Key Activities



ISO 9241-210:2019

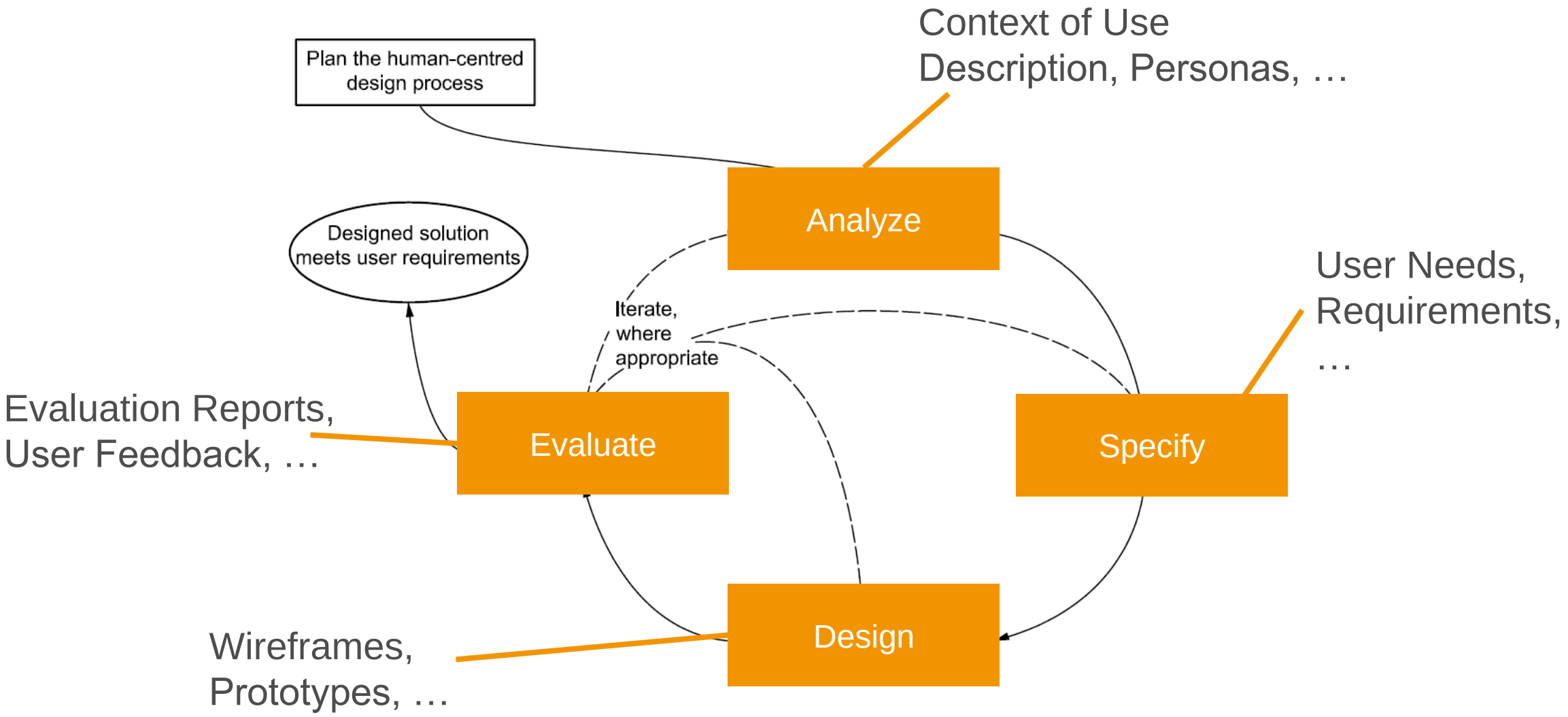
Ergonomics of human-system interaction

Part 210: Human-centred design for interactive systems

https://www.iso.org/standard/77520.html

ISO 9241-210

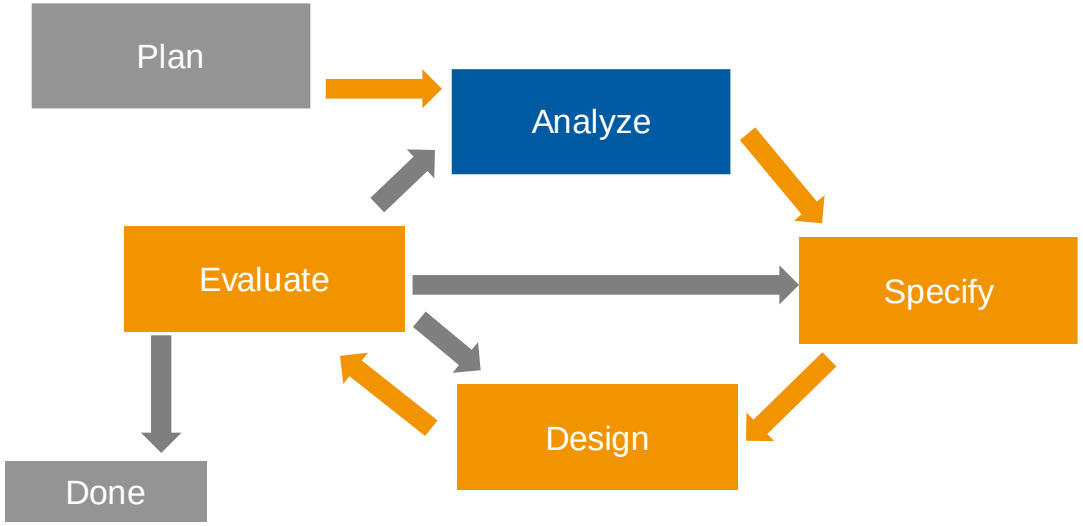
Human-Centered Design Approach: Deliverables



ISO 9241-210

Analyze:

Understanding and documenting the context of use

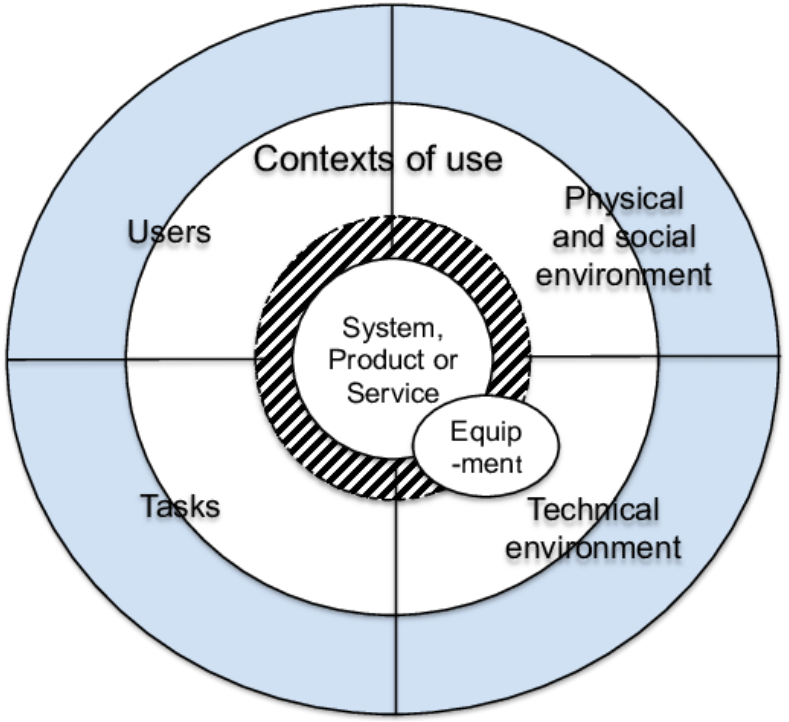


ISO 9241-210

Context of Use

- The context of use has the following components:
  - Users (people who interact with the system)
  - Goals (what users want to achieve)
  - Tasks (what users do to achieve their goals)
  - Context (in which the interaction takes place)
  - Resources (the means required to perform the task)

- A context-of-use description can be a description of the current context of use, or a description of the context intended for design



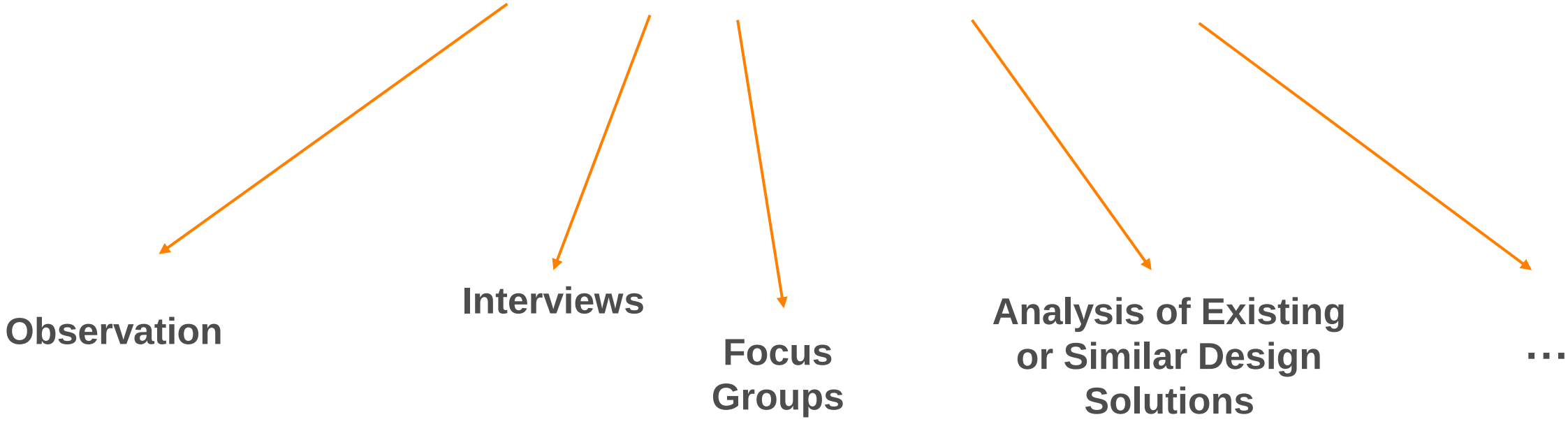
UXQB 2022

Context of Use: Example

Teenagers waiting for a bus use their smartphones to send funny videos to their friends, hoping to make them laugh.

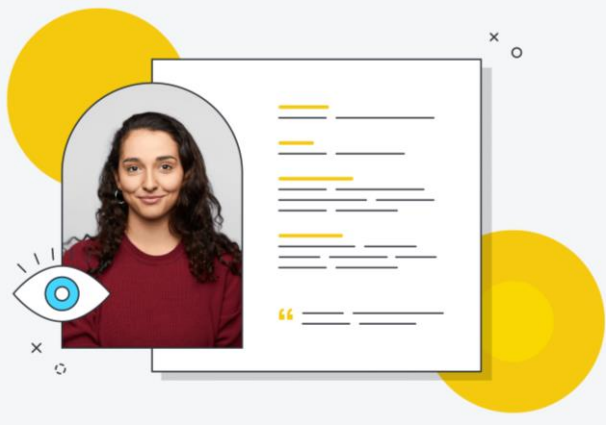
- **Users**: Teenagers
- **Goal**: Make friends laugh
- **Task**: Send videos
- **Context**:
  - Social context: Friends
  - Physical setting: Bus station
- **Resource**: Smartphone

How can we understand the current (or future) context of use?



Key Deliverables

Personas

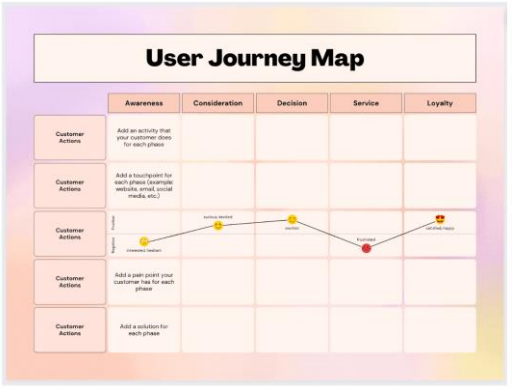


Who are the users? What are their goals?

As-Is Scenarios

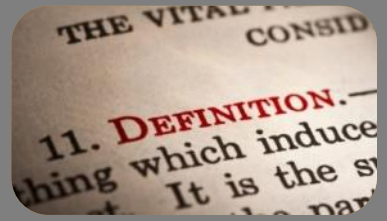
How do users currently do tasks? In which contexts? What resources are available?

User Journey Maps



How do users interact with the (new) system and the organization providing it?

Personas



A description of a fictitious but realistic user and what they intend to do when using a system.

- Personas are **not real people**; they are realistic representations of users, constructed for example from observations or interviews
- Personas are usually captured in a document or presentation, providing an easily digestible visualization of the target user(s)

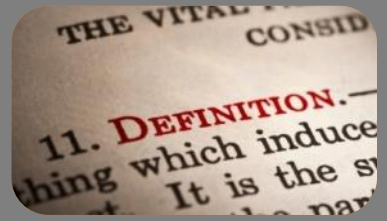
UXQB 2022

Components of Personas & Example

- Typically, a persona includes:
  - The persona's name
  - An image (e.g., a photo)
  - Demographic information such as age, gender, family/living situation, employment status, …
  - Their needs and goals in relation to the current or future system
  - A summary of their challenges, frustrations and pain points in relation to the current or future system
  - Quotes from real users whom the persona should represent
  - …

https://www.uxdesigninstitute.com/blog/what-are-ux-personas/

As-Is Scenario



An as-is scenario is a narrative text description of the procedure a specific user currently follows to complete one or more tasks.

Example:

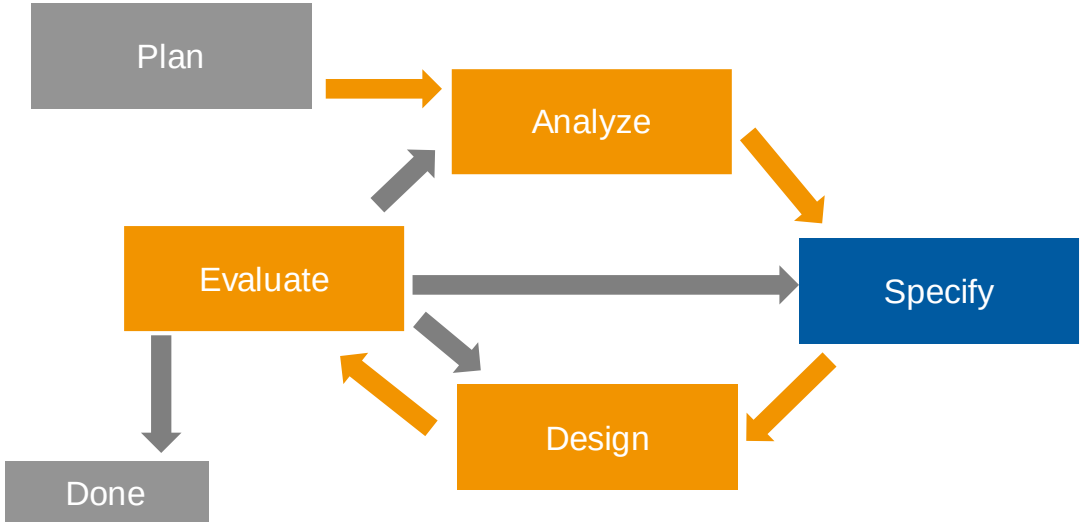
“John Doe is an IT consultant who frequently shops for groceries online due to his busy schedule. He prefers to use the same grocery delivery service because it allows him to quickly reorder items from his past purchases. However, every so often, he forgets to check the delivery time slots. This often results in frustration when he realizes his preferred delivery window is already fully booked, causing him to wait much longer for groceries to arrive than expected.”

UXQB 2022

*Human-Centered Design Approach: **Specify***

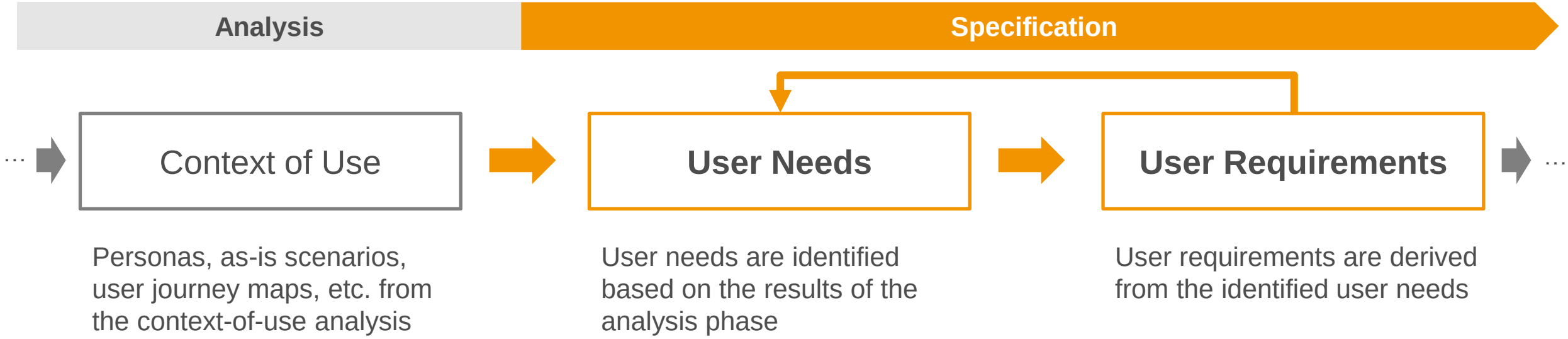
Specify:

Deriving and defining user requirements that must be met by the system



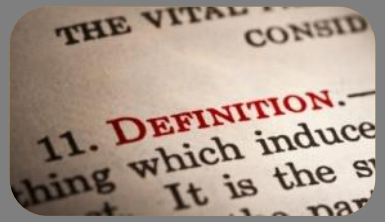
ISO 9241-210

How to Derive User Requirements?



ISO 9241-210

User Need



A prerequisite identified as necessary for a user, or a user group, to achieve a goal, implied or stated within a specific context of use.

- The purpose of user needs is to serve as a helpful intermediate step in the transformation of the context of use information into user requirements
- Each component of the context of use (users, goals, tasks, resources, etc.) can be a source for user needs
- User needs are independent of any proposed solution for each need
  - → **A user need must not refer to, for example, “the system” or “the website”**

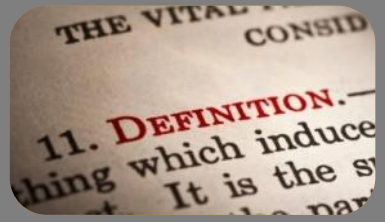
UXQB 2023

Example: Identifying User Needs in Context of Use Information

Context of Use	Identified User Needs
Patients often **have to wait for treatment beyond the agreed time** of their appointment. Being forced to wait is very annoying for patients, especially when they have to sit in the waiting room for up to 90 minutes without any clear indication of how long it will be until it is their turn.	The patient **needs to know when their scheduled appointment will in fact begin** before arriving at the doctor's office in order to make good use of the time remaining.
Patients often **make appointments well in advance**, because good doctors are not available at short notice.	The patient **needs to have an appointment** to ensure they receive treatment at the agreed time.

UXQB 2023

User Requirement



A requirement for use that provides the basis for design and evaluation of a system to meet user needs.

- User requirements are precise criteria from **the users' point of view** that must be met by the system before its release
- User requirements are derived from user needs
  - For simple systems, user requirements can be derived directly from the context of use description without first identifying and documenting user needs

UXQB 2022

Qualitative vs. Quantitative User Requirements

UNIVERSITY OF PASSAU

Qualitative: A statement of what users must be able to locate, recognize, understand, select or input as part of conducting a task with the system to meet identified user needs in a specified context of use.

Quantitative: A required level of usability to meet identified user needs expressed in terms of measures of effectiveness, efficiency, satisfaction, accessibility, user experience and avoidance of harm from use in a specified context of use.

- Qualitative user requirements address **the way in which the system is used to arrive at a user goal**
- Quantitative user requirements set **measurable quality objectives**

UXQB 2022

Qualitative User Requirements

Syntax rule:

With the system, the user must be able to recognize / select / input / … <information or resource> under <optional condition>.

Example “Shopping Website”:

With the system, the user must be able to recognize which products are in his/her shopping basket (information), before starting the payment process (condition).

Quantitative User Requirements

Quantitative user requirements can be formulated by taking the following components into consideration:

- The user group(s) who must fulfil the requirement during use
- The number or percentage of users who must fulfil the requirement during use
- The units of measurement (e.g., task time, error rate, precision)

Example “Shopping Website”:

After completing their shopping process, 80% of users must answer ‘Agree’ or ‘Strongly agree’ to the statement ‘The shopping website is easy to use’. (satisfaction)

UXQB 2023

Example: Deriving User Requirements from User Needs

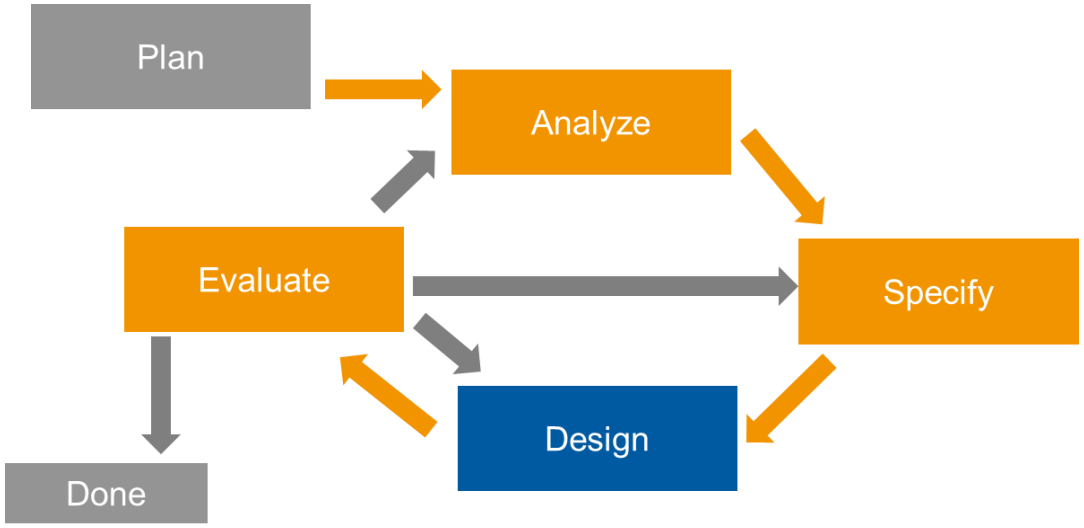
Identified User Needs	Derived User Requirements
The patient **needs to know when their scheduled appointment will in fact begin** before arriving at the doctor's office in order to make good use of the time remaining.	• With the system, the user must be able to **recognize that a scheduled appointment will be delayed**. • With the system, the user must be able to recognize **for how long** the scheduled appointment will be delayed.
The patient **needs to have an appointment** to ensure they receive treatment at the agreed time.	• With the system, the user must be able to **recognize which dates and times are available** for appointments. • With the system, the user must be able to **select a date and time for the appointment**.

UXQB 2023

UNIVERSITY OF PASSAU

Design:

Producing design solutions to meet user requirements



ISO 9241-210

Design Iterations & Outputs

Convert user needs and requirements into:

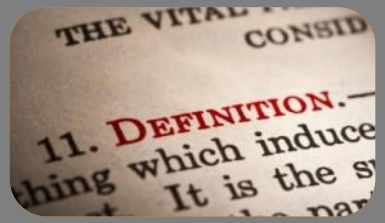
- **Use scenarios**
- Storyboards
- User journey maps

Create:

- **Low-fidelity prototypes**
- **Wireframes**
- **High-fidelity prototypes**

UXQB 2022

Use Scenario



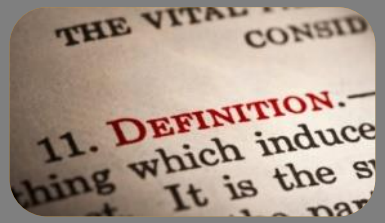
A narrative text description of how a user will carry out one or more tasks with the planned system.

Example:

“Before starting his busy workday, John Doe logs into the grocery delivery website. After selecting his usual items from his previous orders with a single click, he is prompted to reserve a delivery slot. He sees that his preferred delivery slot is still available and books it right away. John can now focus on his work, knowing that his groceries will arrive when it’s most convenient for him.”

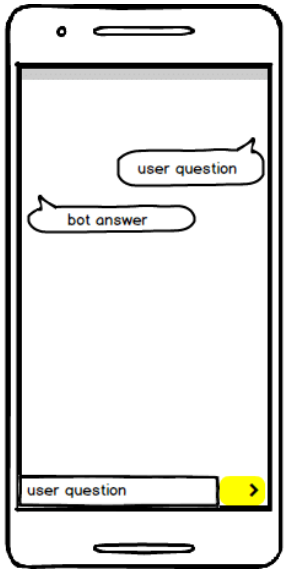
UXQB 2022

Low-Fidelity Prototype



A low-cost illustration of a design or concept used to gather feedback from users and other stakeholders during the early stages of design.

- A low-fidelity prototype is often created using paper, pens, sticky notes, etc.
- Digital prototypes are often created with a prototyping tool
- Low fidelity prototypes should be quick and cost-effective to create and update

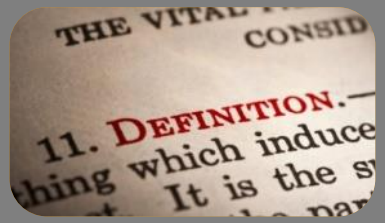


UXQB 2022

Low-Fidelity Prototype: Example

https://www.youtube.com/watch?v=yafaGNFu8Eg

Wireframe

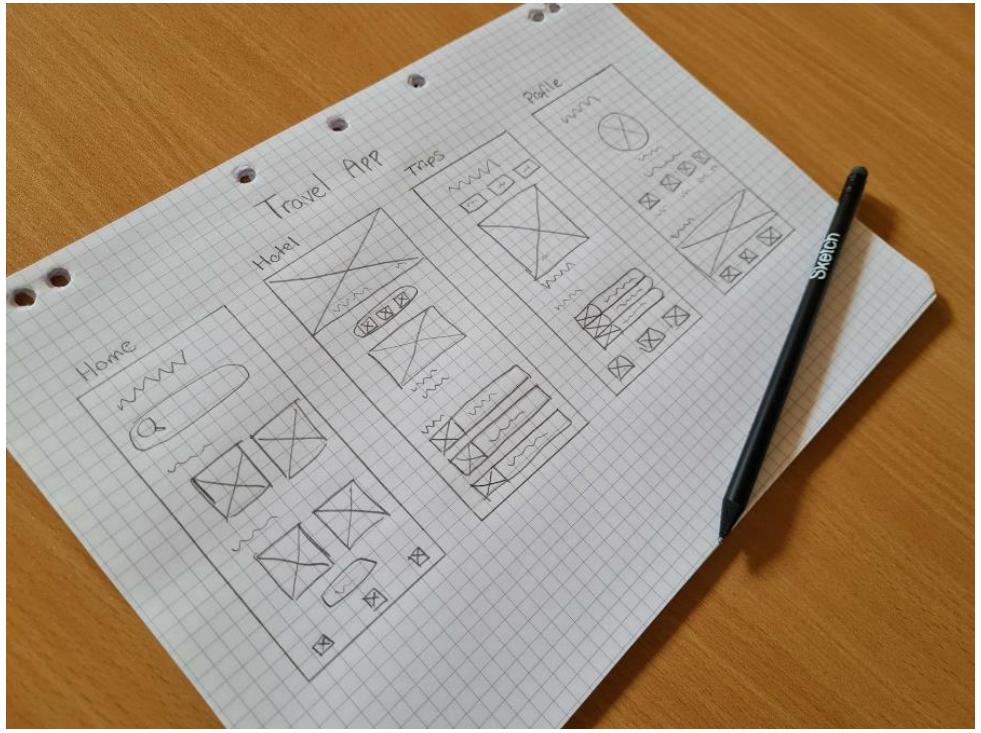


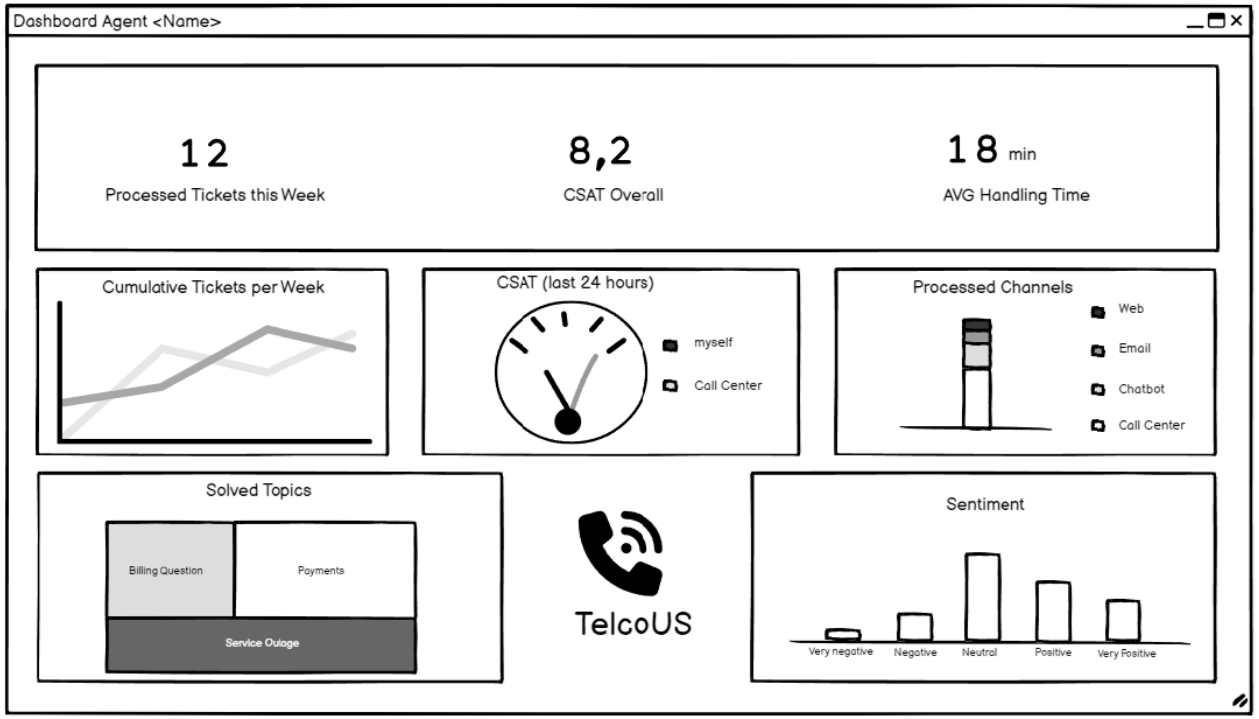
A screen or page in a low-fidelity prototype for a user interface comprised of lines, rectangular boxes and text that represent the intended interaction design.

- The purpose of wireframes is to define a **skeletal layout that is easy to understand**, and encourages iteration and feedback
- Wireframes typically do not address visual design (e.g., colors) and precise layout
- Wireframes can be created using pen and paper or with tools such as Balsamiq

UXQB 2022

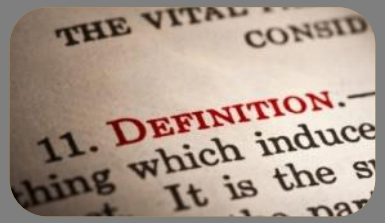
Wireframe: Examples





balsamiq®

High-Fidelity Prototype



A prototype that mirrors the user interface of a system as closely as possible, often displaying pixel-perfect user interface elements and visual design.

- High-fidelity prototypes are computer-based, and usually **allow realistic (mouse/keyboard) user interactions**
  - Created using tools like Figma
- High-fidelity prototypes take you **as close as possible to a true representation of the user interface**
- After a successful evaluation, the high-fidelity prototype informs the development of the system

UXQB 2022

High-Fidelity Prototype: Example

Figma

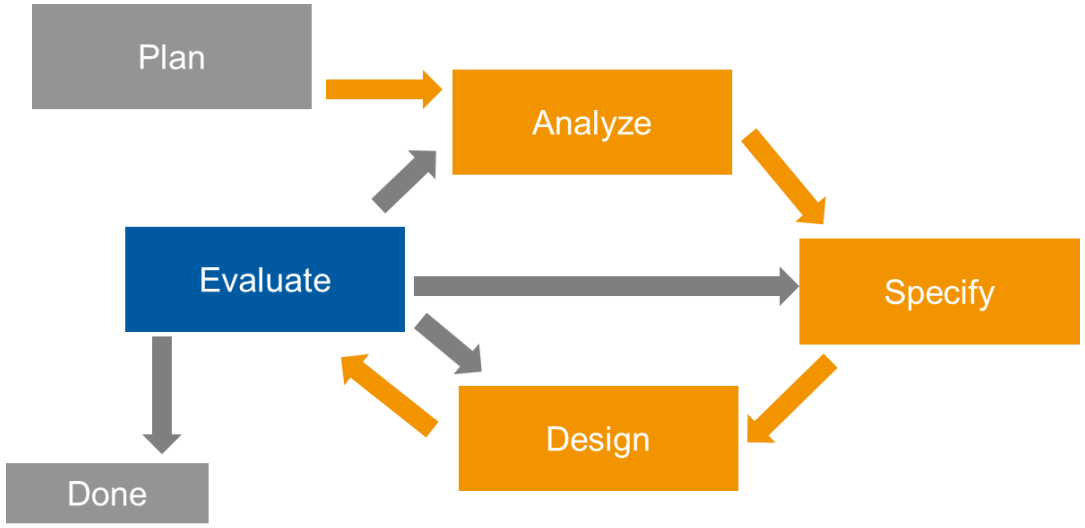
Example: App for Finding Table Tennis Players

https://www.youtube.com/shorts/yyk5FF7t_2U

*Human-Centered Design Approach: **Evaluate***

Evaluate:

Evaluating design solutions against user requirements



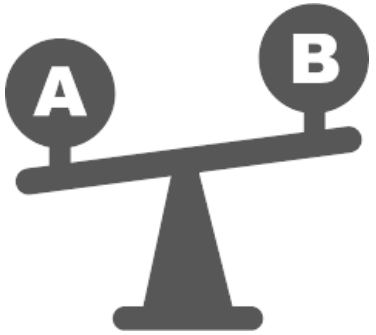
ISO 9241-210

Evaluation Goals

Collect **new information** about user needs

Provide **feedback** on strengths and weaknesses of the design solution from the user's perspective

Assess whether user requirements have been met



Establish baselines or **make comparisons** between designs

ISO 9241-210

Evaluators & Methods

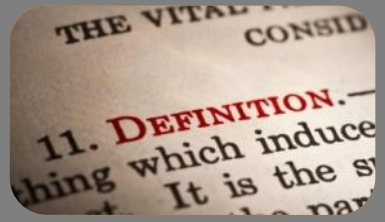
Users

- Usability Test
- User Survey
- …

Experts

- Usability Inspection
- …

Usability Test



A usability evaluation that involves representative users performing specific tasks with the system to enable identification and analysis of usability problems, or the measurement of effectiveness, efficiency, and user satisfaction.

Basic steps:

1. Create a **usability test guide**
2. Recruit test participants (e.g., potential users)
3. Conduct several test sessions (e.g., think aloud sessions, post-session interviews)
4. Analyze feedback and create **usability test report**

UXQB 2022

Usability Test Guide

A guide used by a moderator in a usability test to prepare for and conduct a usability test session.

- The guide should include:
  - Goal(s) of the usability test
  - Number of planned usability test participants and their characteristics
  - Usability test tasks
  - Approximate length of each usability test session
  - Procedure of the session
  - Pre- and post-test questions
  - Name of the moderator

UXQB 2022

Template for Usability Test Guide

UNIVERSITY OF PASSAU

Moderator: Who?

Date/Location: When? Where?

Prototype Under Evaluation

What's being tested?

Evaluation Goals

Why are we doing this test?

Participants

How many partici-pants will be recruited? What are their key characteristics?

Test Task(s)

What are the test tasks?

Pre- and Post-Test Questions

What questions will be asked to participants before and after the session?

Procedure & Techniques Used

… … …

What are the main steps in the test procedure? Which techniques will be used in each step?

Usability Test Report

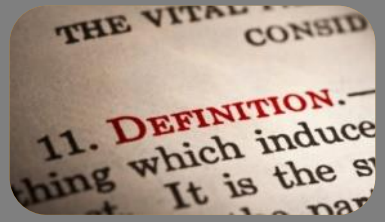
A document that describes the results of a usability test.

- A usability test report typically contains:
  - an executive summary
  - all usability findings (including positive usability findings), meaningfully grouped
  - screenshots or pictures that supplement the description of important usability findings
  - characteristics of the test users, including selection criteria for recruiting
  - the usability test guide

- A usability test report is **always required**! If you have limited resources, produce a basic usability test report:
  - This may consist of 3-5 pages or slides, which include an executive summary, the key findings and the list of usability test tasks

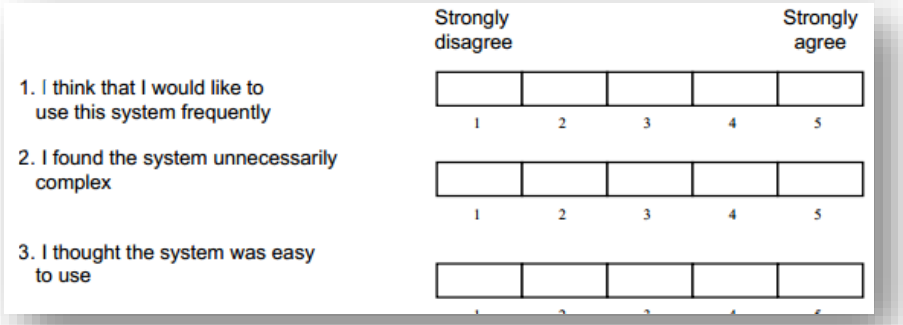
UXQB 2022

User Survey



A usability evaluation where users are asked to complete a questionnaire about their experience of using a system.

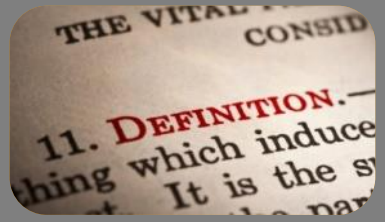
- Questionnaire: a set of questions that is used to collect data from users
  - Open questions: *Where did you encounter problems?*
  - Closed questions: *On a scale from 1 to 5, please rate how satisfied you are with the system*
- A significant number of responses (100+) is required for them to be statistically reliable



Example “System Usability Scale” (SUS)

UXQB 2022; Brooke 1996

Usability Inspection



A usability evaluation based on the judgment of one or more evaluators who examine or use a system to identify potential usability problems and deviations from user requirements.

- Usability inspection is often performed by **UX professionals or subject matter experts**, who base their judgement on prior experience of usability problems encountered by users and their own knowledge of design guidelines and principles
- Unlike usability tests and user surveys, usability inspections do not involve users
- Why? Evaluation by users is not always possible or cost-effective at every stage of the project

UXQB 2022

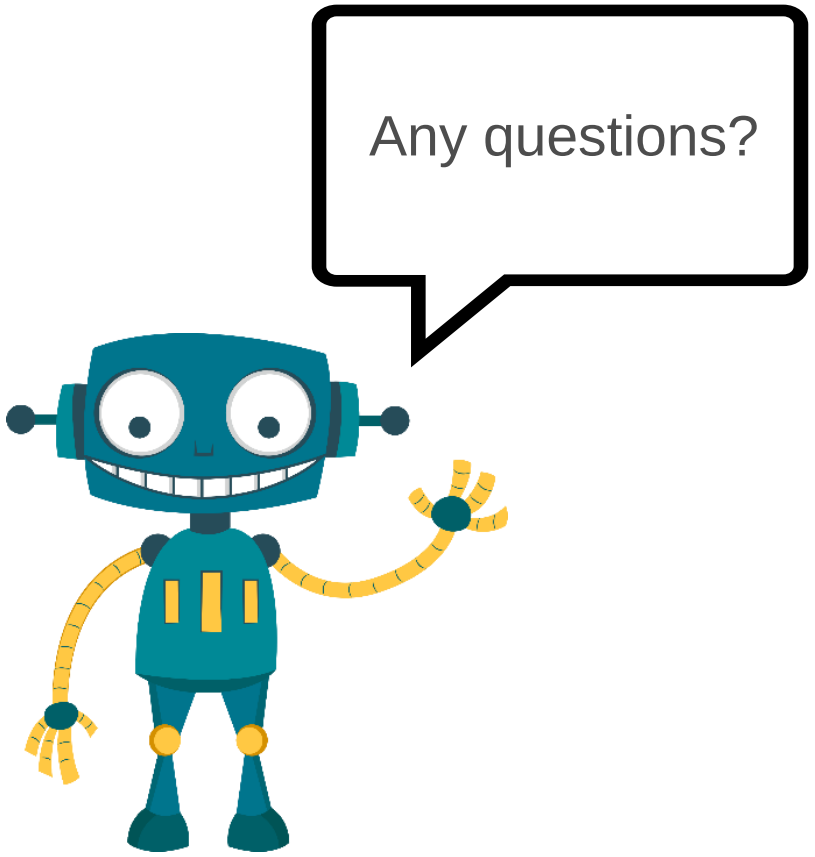
Key Takeaways

- It is important to involve humans in the design of AI-based information systems

- A human-centered design approach consists four key activities that are performed iteratively:
  - Analyze
  - Specify
  - Design
  - Evaluate

- For each activity, there are different methods, tools, and techniques, which result in key deliverables for the next activity

Thank you for your attention!



References

Brooke, J. (1996). SUS: A quick and dirty usability scale. Usability Evaluation in Industry. https://digital.ahrq.gov/sites/default/files/docs/survey/systemusabilityscale%2528sus%2529_comp%255B1%255D.pdf

ISO. (2019). ISO 9241-210:2019: Ergonomics of human-system interaction – Part 210: Human-centred design for interactive systems. International Organization for Standardization. https://www.iso.org/standard/77520.html

Shneiderman, B. (2020). Human-centered artificial intelligence: Three fresh ideas. AIS Transactions on Human-Computer Interaction, 12(3), 109-124.

Shneiderman, B. (2022). Human-centered AI. Oxford University Press.

UXQB e.V. (2022). CPUX-F Curriculum. Certified Professional for Usability and User Experience Foundation Level. Version 4.01 EN, 7 November 2022. https://uxqb.org/public/documents/CPUX-F_EN_Curriculum.pdf

UXQB e.V. (2023). CPUX-UR Curriculum. Certified Professional for Usability and User Experience – User Requirements Engineering. Version 3.2.2 EN: 14 March 2023. https://uxqb.org/public/documents/CPUX-F_EN_Curriculum.pdf