

# Human Factors and Human-Machine Interaction

## Usability Engineering – Analysis and Design

**FACULTY**  
OF COMPUTER SCIENCE



# OVERVIEW

- Analysis
  - Observation
  - Contextual analysis
  - Personas
  - Scenarios
- Design
  - Methods
  - Principles of dialogue design



# USABILITY: DEFINITION

“The extent to which a **product** can be used by specified **users** to achieve specified **goals** with **effectiveness**, **efficiency** and **satisfaction** in a specified **context of use**.” (Usability – ISO 9241-11)

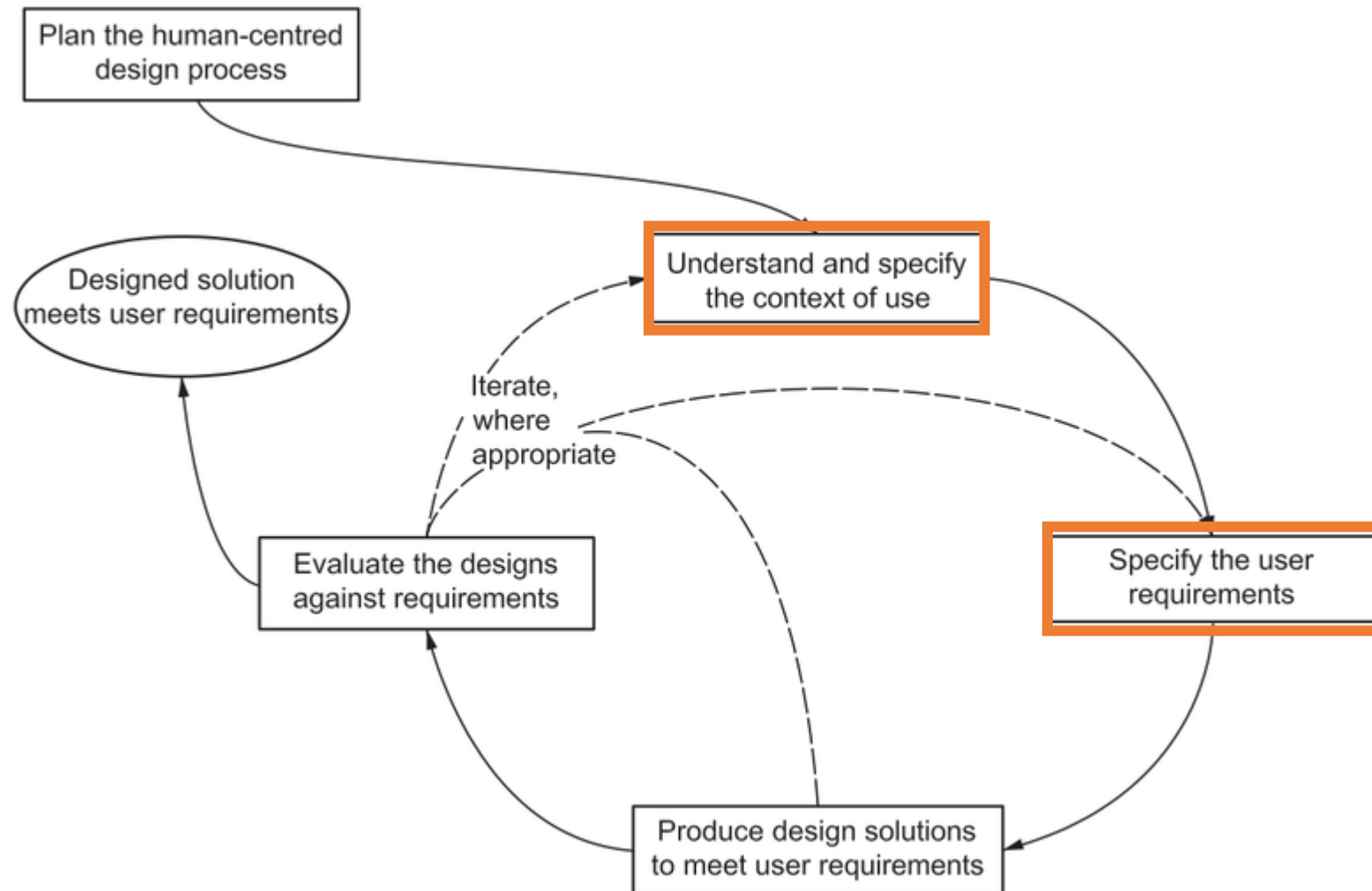
**effectiveness**: the accuracy and completeness with which specified users can achieve specified goals in particular environments

**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

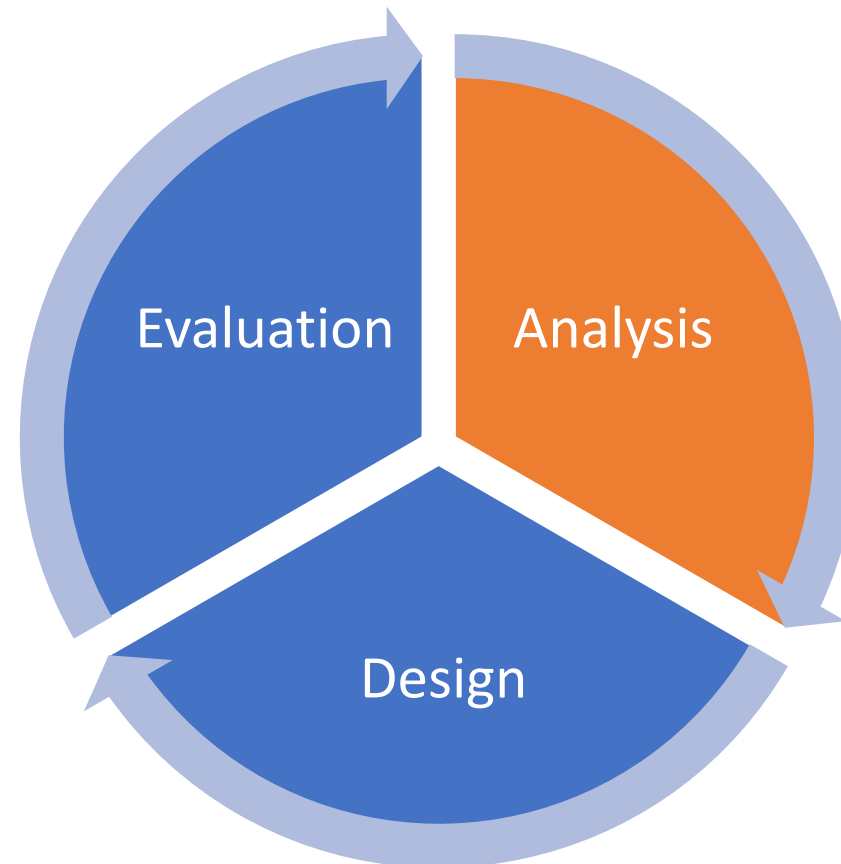
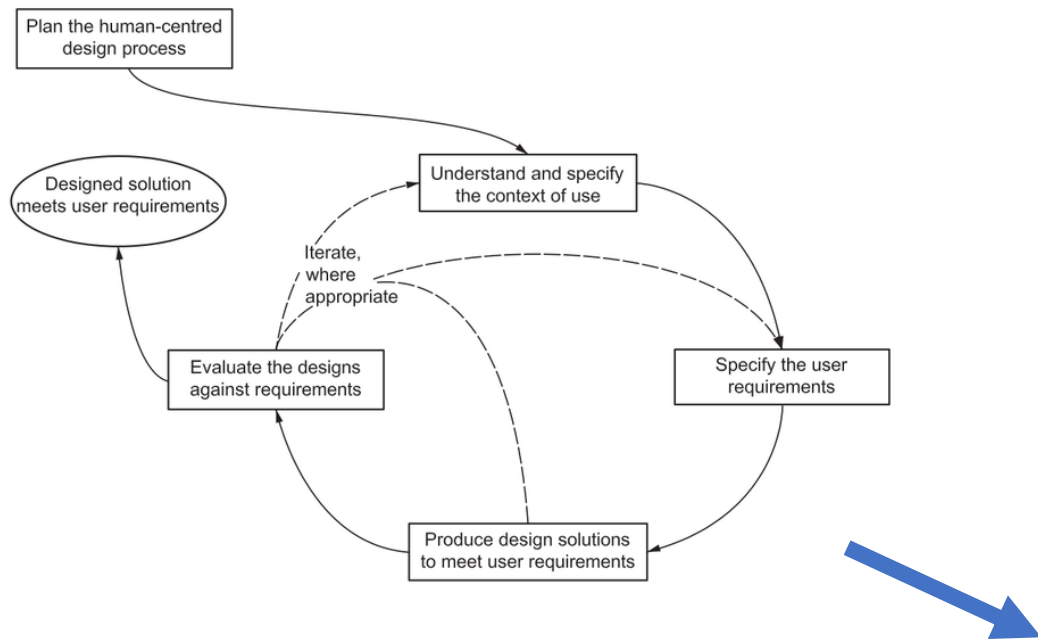


# USABILITY: PROCESS



-210 (2010)







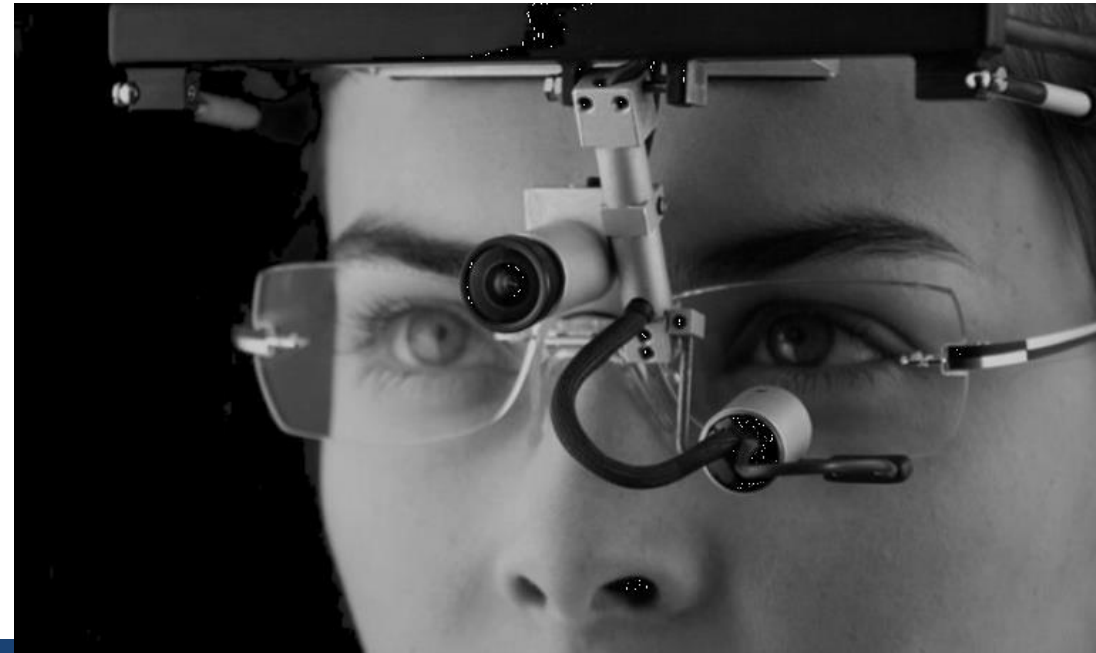
# METHODS: ANALYSIS

## Types of data **collection**:

- Survey: Interviews, focus groups
- Observation: Field studies, ethnography
- (e.g., Hierarchical) task analysis, contextual inquiry
- Laboratory experiments
- Critical incidents method
- Literature studies
- User research, market research

## Types of **representation**:

- Personas & scenarios
- Quantitative user models (e.g., GOMS)



## OBSERVATION

"when perception is determined by a deliberate, selective search attitude and is directed towards the **possibility of evaluating the observed** in terms of an overarching intention"



# SYSTEMATIC OBSERVATION VS. EVERYDAY OBSERVATION

- **What** is being observed?
- **Who** is observing?
- What is **irrelevant** for the observation?
- In what way can the observed behavior be **interpreted**?
- **When** and **where** does the observation take place?
- **How** is the observed behavior documented or recorded?





## OBSERVATION: SYSTEMATIZATION

"The **degree of systematization** of an observation depends on the research objective (finding hypotheses, testing hypotheses, or description) or the precision of prior knowledge about the subject under investigation. The more precisely one knows the object of observation in principle, the more systematic the observation should be designed."



## OBSERVATION: TYPES

- Participatory – non-participatory
- Open - covert
- Apparative (instrumental)
- Automatic
- Multiple observers: Inter-rater agreement
- Self-observation



## OBSERVATION: ADVANTAGES/DISADVANTAGES

- 😊 Compared to self-reports: not rationalized or **filtered**
- 😊 Compared to laboratory: no influence of the (possibly artificial) **experimental situation**
- 😊 Interpretable **facial expressions and gestures**
- 😊 Exploring the terrain: **gathering information**, generating hypotheses
- 😞 Compared to surveys: higher **effort**, reduced repeatability



# CONTEXTUAL INQUIRY

- **Observation interview:** observation + questioning or follow-up questions
- Based on the master/apprentice model
- **User: Master** - Observer: Apprentice
- Literature recommendation (Chapter 3; accessible at <http://wtf.tw/ref/holtzblatt.pdf>): Holtzblatt, K. (2015). Contextual Design - Evolved. San Francisco: Morgan & Claypool.



# CONTEXTUAL INQUIRY: PRINCIPLES

- **Context:** Collecting data at the location of the events; observing real and concrete occurrences.
- **Partnership:** The goal is to achieve a shared understanding of the work.
- **Interpretation:** Individual observations gain significance; to be verified by the user; deriving requirements.
- **Focus:** Pre-determining and directing interaction towards relevant aspects; considering nonverbal aspects.



# CONTEXTUAL INQUIRY: GUIDING QUESTIONS

- Who primarily uses the system?
- What goals does the user have?
- What tasks does the user have?
- What aspects of the environment (interruptions, noise, etc.) need to be considered?
- What is the initial situation at the start of the task?
- What is the situation like at the end of the task?
- What individual steps does the user take?
- Are additional tools or aids used?
- How long does it take to complete the task?
- ...





- **Preparation**
  - Define goals
  - Select companies/locations
  - Select and recruit participants
  - Create a schedule
  - Choose and refine methods
  - Prepare materials
  - Coordinate approach with all stakeholders
  - Determine and prepare documentation procedures
  - Determine data analysis approach
- **Execution**
  - Arrive at the company, greet participants
  - Coordinate approach with all involved parties
  - Prepare all necessary items (e.g., recording equipment)
  - Observe and ask questions, remain neutral
  - Take notes throughout the visit
  - Conduct interviews if necessary
  - Express gratitude, say goodbye, possibly provide a gift
- **Post-processing & Evaluation**
  - Analyze and interpret data; discuss with team and users
  - Summarize key findings and document them
  - Communicate results to responsible parties and possibly all involved parties



# CONTEXTUAL INQUIRY: PROS AND CONS

- 😊 Can uncover tacit knowledge
- 😊 Detailed information
- 😊 Reliable information: Less assumptions compared to questionnaires or tests
- 😊 Flexibility
- 😞 Difficult for statistical analysis
- 😞 Requires time and personnel





# EXERCISE: USABILITY ENGINEERING - ANALYSIS

Choose **one** of these options and gather requirements.

- Option 1: Design the user interface of an **alarm clock** (which can also be an app).
- Option 2: Design the user interface of an **answering machine** (which can also be an app).
- Option 3: Design the user interface of an app that allows you to track and assess the **fuel consumption of your car**.
- Option 4: **Any other app** with similar complexity

