The facets of Human Centered Design: Potentials and Challenges

Daniela Krainer, 29.11.2022
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NOI Park, Bozen

KÄRNTEN
University of Applied Sciences

SENSHOME
sensing special needs

Interreg
Italia-Österreich
European Regional Development Fund

EUROPEAN UNION

INTRODUCTION

CUAS: 4 Cities /5 Campus

SPITTAL
Civil Engineering &
Architecture

VILLACH
Management
Engineeting & IT

KLAGENFURT
Engineering & IT
Health Sciences & Social Work

FELDKIRCHEN
Health Sciences &
Social Work

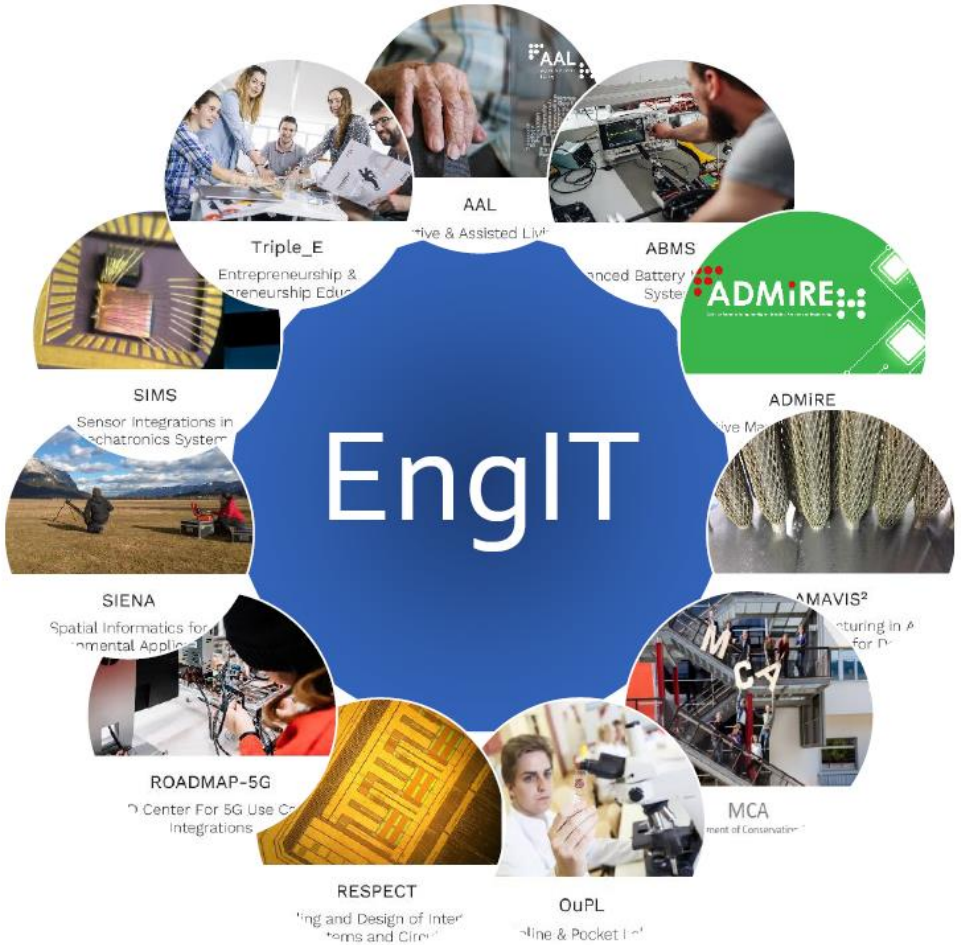
Research Units @EngIT

Goals

- Technology development
- Method development
- Research on the pulse of time

Hard facts:

- Number of Research Units: 11
- Research volume: 6,5 Mio €
- Number of Research staff: >50



Active & Assisted Living

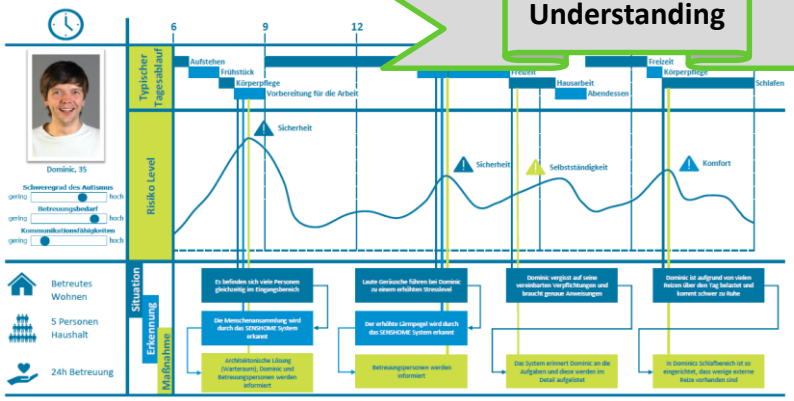
AAL Active & Assisted Living

Smart Home
Assistance – Autonomy - Safety

Smart Interaction
Accessibility – Universal Design - UX

Smart Health
Tele-X – Therapy - Prevention

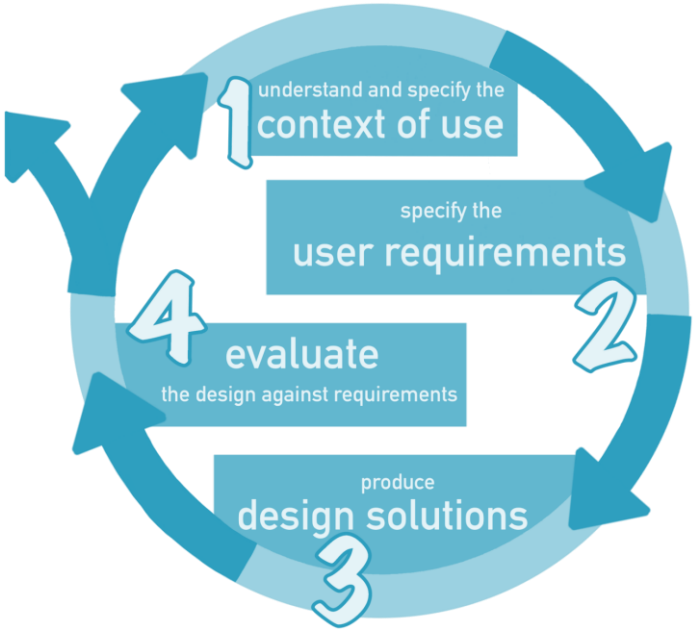
Understanding



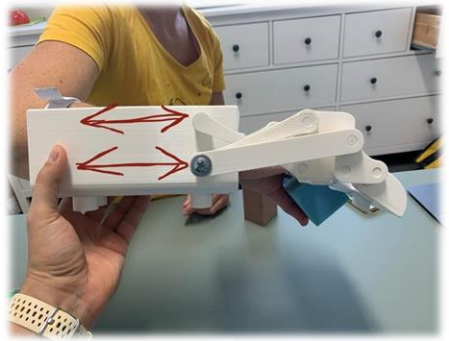
Living Lab Approach

Participatory Research

Human-Centered Design



Prototyping



Requirements & Design

@Project: SENSHOME

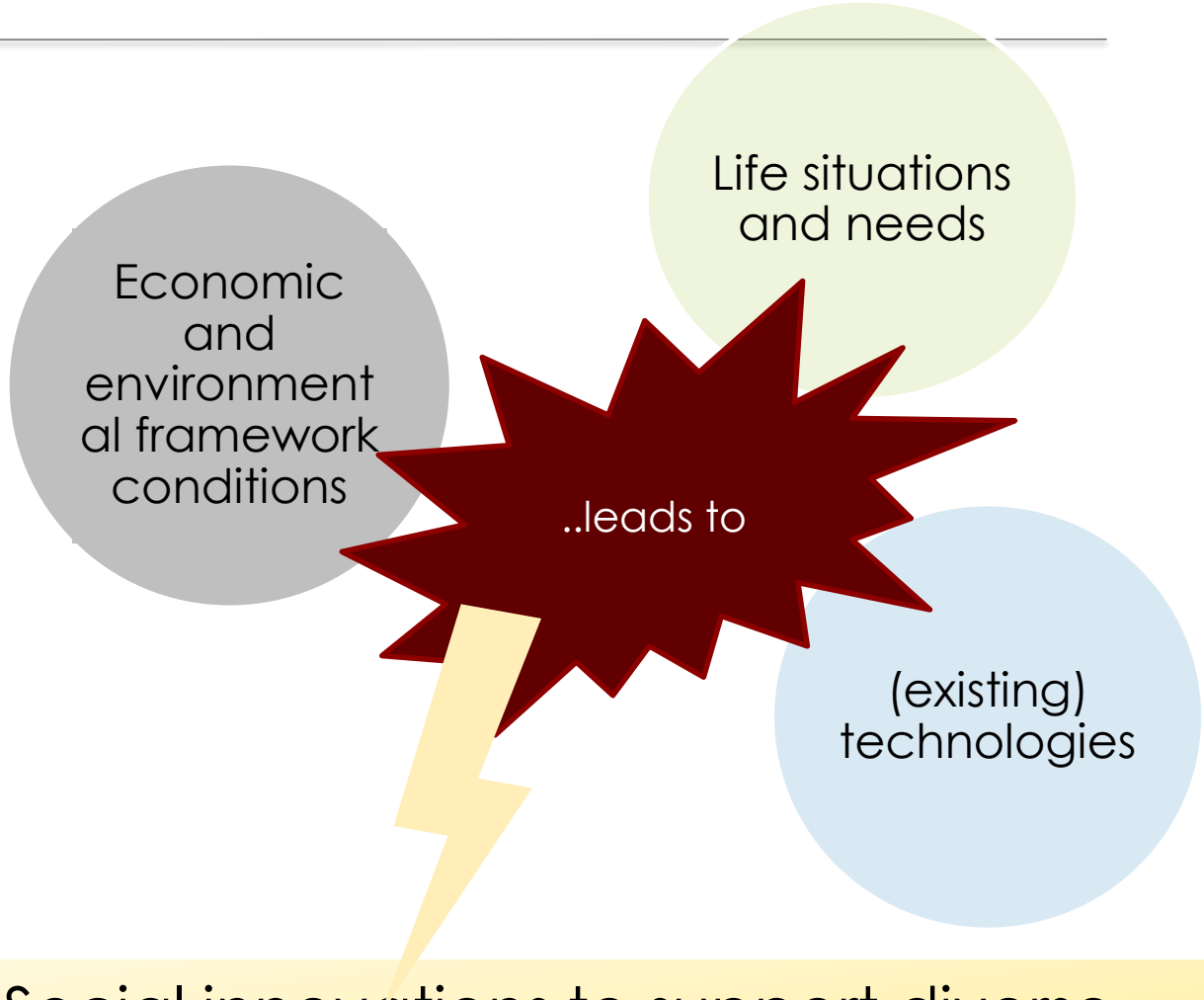
Co-Design & Evaluation

@Project: REHA2030

ABOUT HUMAN CENTERED DESIGN

WHY AND WHAT?

Dimensions of Applied R&D in AAL



Social innovations to support diverse realities of life

What is a social innovation?

- Solution to a social problem to increase the quality of life (individual, collective)
- Spatially, temporally or contextually a relative novelty
- More effective solution than existing approaches
- Contribute to permanent social change, they are accepted by target groups and sustainably anchored
- Can interface with technological innovations
- Can be scalable
- Emerge preferred in open innovation processes
- Empowerment of civil society → Participatory culture

How to start?

Developing sustainable solutions is a joint task!

- ✓ Stakeholder
- ✓ Understanding of ecosystem
- ✓ Methods and materials
- ✓ Endurance
- ✓ communication
- ✓ …

Stakeholder

Quadruple Helix Model

Triple vs. Quadruple Helix

Civil society / end-users were seen as passive product / service recipients assimilating to a new environment

potential consequences

- Product/service not used
- Lack of transparency
- Innovations and users do not understand each other
- Frustration
- Possibly technological innovations instead of social innovations

by Värmland County Administrative Board, Sweden
https://vb.northsearegion.eu/public/files/repository/20180924154616_QuadrupleHelixguide.pdf

Living Labs

- user-centric, open research and innovation ecosystems,
- ***innovation intermediary**, which **orchestrates open innovation processes** in a specific region in a "real-world" context.*
- ***Creative spaces** where people with many different interests and backgrounds can **collaborate***

*Its goal is to **co-design product and services**, in an iterative way, with key **stakeholders** […] in a **real-life** setting.*

*One of the **outcomes** of this co-design process is the **co-creation of social value** (benefit). To achieve its objectives, the Living Lab mobilizes **existing innovation tools and methods** or develop **new ones**".*

(based on ENoLL, Anna Ståhlbröst, Joelle Mastelic, Dave Carter)

Living Lab at FH Kärnten

prolida

- Professional Living, Innovation and Development Lab for an Ageing Society
- Certified ENoLL member

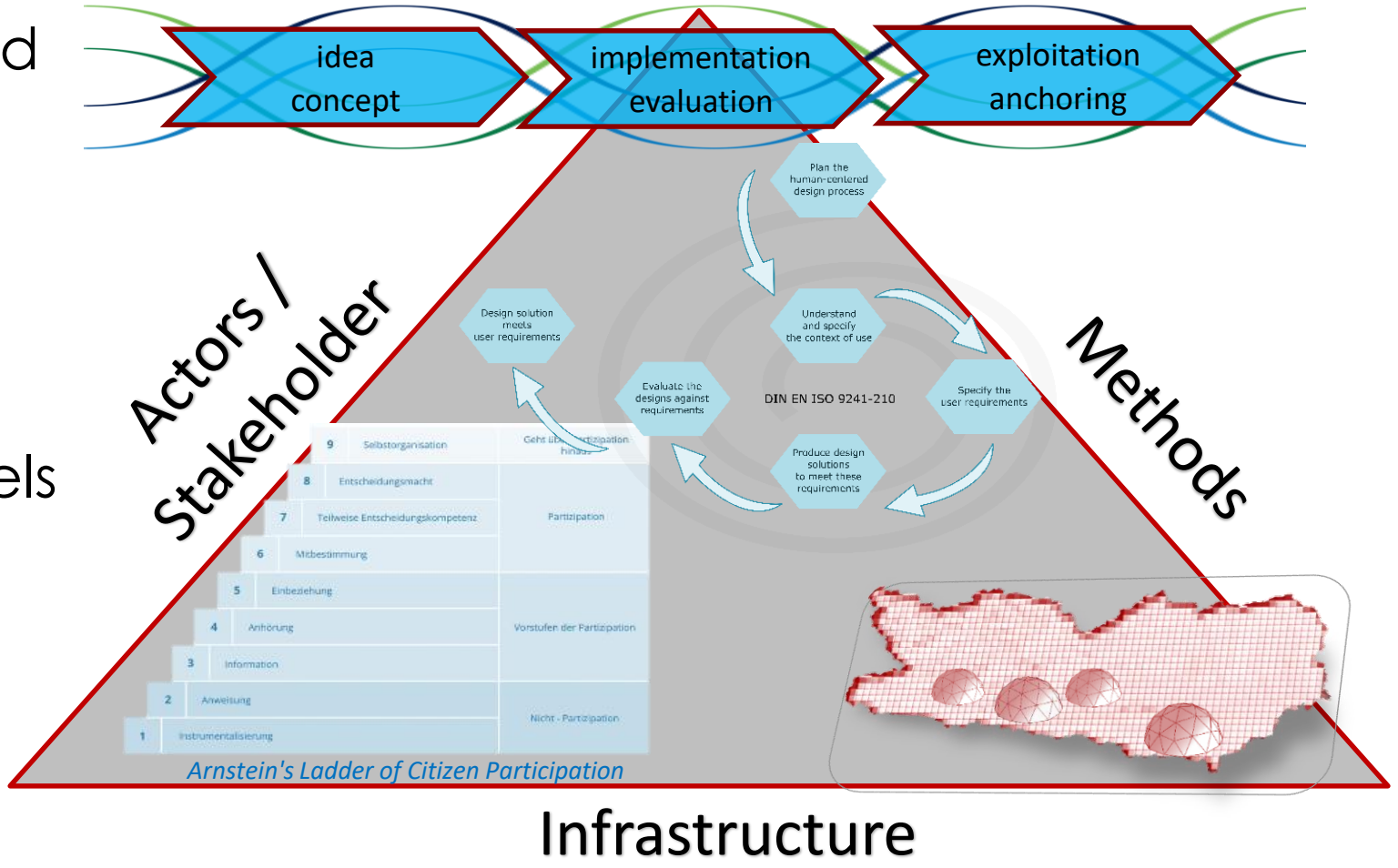
European Network of Living Labs

- Open research and innovation ecosystem
- Driving social innovation in health and well-being.
- Co-creation processes, user-centered, participatory methods.
- Evaluation in real-world situations, of networked health ecosystems

prolida … at a glance

Participatory research with multiple cornerstones for good quality:

- Continuous
- Involve the "right" people
- Selecting the appropriate methods, participation levels and frameworks
- Ethical principles



Arnstein's Ladder of Citizen Participation

Human Centered Design

- problem-solving approach
- commonly used in process, product, service and system design
- develop solutions to problems by involving the human perspective and emotion in all steps of the process

ISO 9241-210:2019 Ergonomics of human-system interaction — Part 210: Human-centered design for interactive systems

- Recommendations for human-centered design principles
- For planning and management of projects for the design and development of interactive systems
- Also provides a framework for usability issues
- Incl. checklist to prove conformity with this standard

ISO 9241-210:2019 – Why?

- **Economic** and **social benefits** for the user
- Legal obligation to protect users from risks to their health and safety, various risks can be reduced
- Increase in productivity of users
- Easy to understand and use, costs for training and support reduced
- Increase usability for people with a wide range of abilities → increasing accessibility
- Improvement of user experience
- Reduction of discomfort or stress
- Competitive advantage
- Achievement of sustainability goals

https://vcclite.com/wp-content/uploads/2020/02/ui-vs-ux.jpg

ISO 9241-210:2019 – Problem definition

- Different user groups and stakeholders, different needs
- Diverse context of use, different for different user groups
- Requirements for a solution often only become apparent when a solution is proposed
- Usage requirements can be diverse and contradictory to each other and to the requirements of other stakeholders.
- Initial solutions rarely satisfy all needs and requirements

ISO 9241-210:2019 – Principles

1. Design is based on a comprehensive **understanding** of users, work tasks and work environments
2. Users are **involved** during design and development
3. Refinement and adaptation of design solutions is **continuously** driven based on user-centered evaluation
4. The process is **iterative**
5. The **entire user experience** is considered during design
6. **Cross-disciplinary knowledge** and perspectives are represented on the design team

ISO 9241-210:2019 – Human Centered Design Activities

- Understanding and specifying the context of use
- Specifying the user requirements
- Producing design solutions
- Testing and evaluating the design

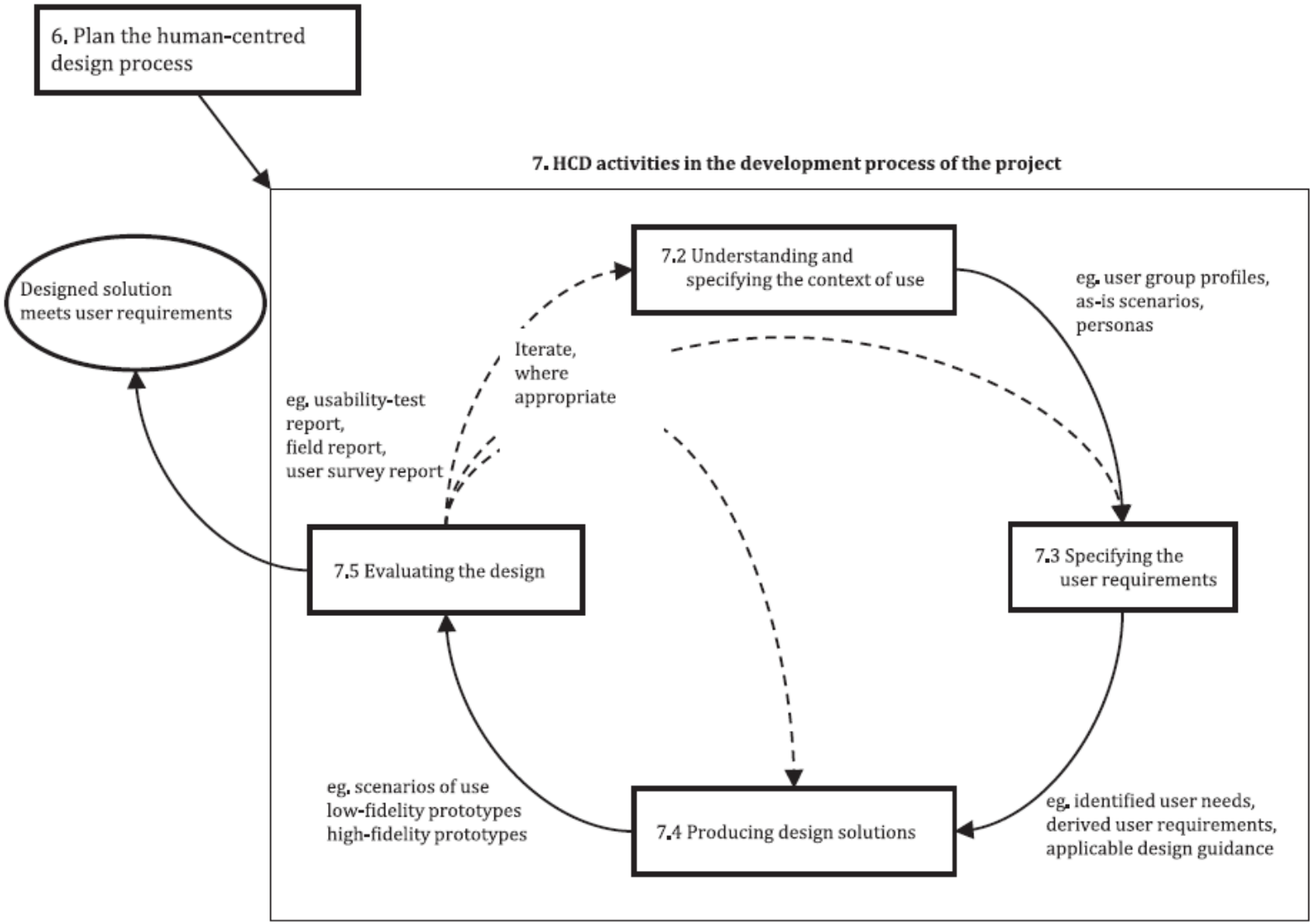


Figure 1 — Interdependence of human-centred design activities

ISO 9241-210:2019 - Understanding and specifying the context of use

- collect and analyze information about the current context to understand and define the context that will apply to the future system.

Description of the context must include:

- Users and other stakeholders
- Characteristics of the users or user groups
- Goals and activities of the users
- The environments of the system

ISO 9241-210:2019 - Understanding and specifying the context of use - Example

Personas

- fictional characters
- specific and concrete representation of users with a diverse bundle of characteristics

- Serve the understanding of and empathy with users
- Users are no longer perceived along a single characteristic but in the totality of their life situation
- In the project team personas create a common understanding of the users
- Help in the development of products, services, etc.

Persona C | REHA2030

Name:	Maria
Age:	75
Marital status:	widowed, 2 adult children
Life Course:	retired (pharmacist)
Country:	Slovenia
Area:	rural area

Background

Maria lives together with her daughter and her son-in-law in a large and beautiful house in a small rural village. Her son emigrated to Australia many years ago and therefore he visits his mother and his sister only once a year.

Since her stroke, Maria suffers from a severe spasm in her arm and a mild aphasia. Her fine motor skills are particularly affected. For her elbow/wrist/finger flexors she needs botulinum toxin injections every 4 months. After her stay in the hospital, she was treated with functional electrical stimulation (FES) in the rehabilitation clinic to reduce muscle spasm.

Description of the problems and needs

Because of the received treatments, Maria also experiences less-spastic periods. Although the therapy works well, the FES treatment is difficult to use. Therefore Maria would like to support the less-spastic periods with a better treatment opportunity that could also have a better impact on improvement of the passive range of motion.

Technology Acceptance

Use of technology	Low	High
Fear of technology	Low	High
Mobile device skills	Low	High
Need for support (ADL/iADL)	Low	High

Health Concerns

- Dorsal pain
- Malposition
- Risk of falling

Therapy Concerns

Currently she needs her botulinum toxin therapy every four months. She would also like to have physiotherapy, speech- or occupational therapy at home, but no private therapists are available in her area and this kind of treatment is expensive.

Effects of stroke

- Spasm | mild
- Apraxia | mild
- Aphasia | mild

Daily living

Maria gets up at 07:30 and likes to have a long breakfast. She reads the newspaper every morning before she goes for a walk where she uses a crutch. Maria loves to spend her leisure time in the garden to take care of the flowers and relax on the terrace. After lunch, she likes to take a short nap before her daughter and son-in-law come home from work. On some days they sit together in the afternoon with coffee and cake to talk about what has been happening in the past few days. Before she goes to bed at 21:30, she likes to watch TV or read a book.

What is important to Maria?

- Live independently as long as possible
- Reducing the limitations of spasm
- Spending time with her friends.
- Being well informed about her rehabilitation process

Unmet Needs

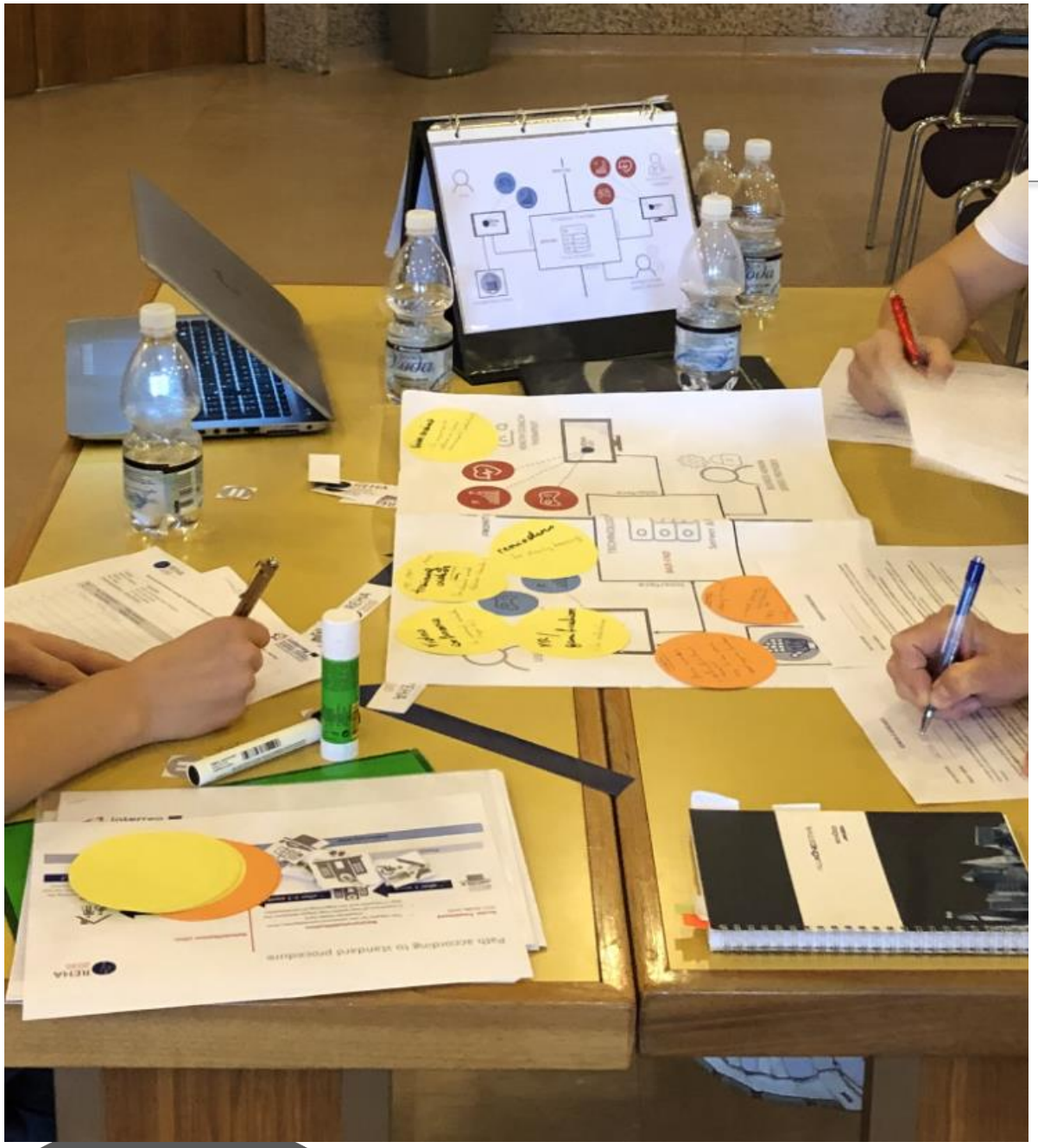
- Possibility of monitored physiotherapy and/or occupational therapy
- She is looking for a continuous passive motion assistive device to enhance effects of the botulinum toxin therapy

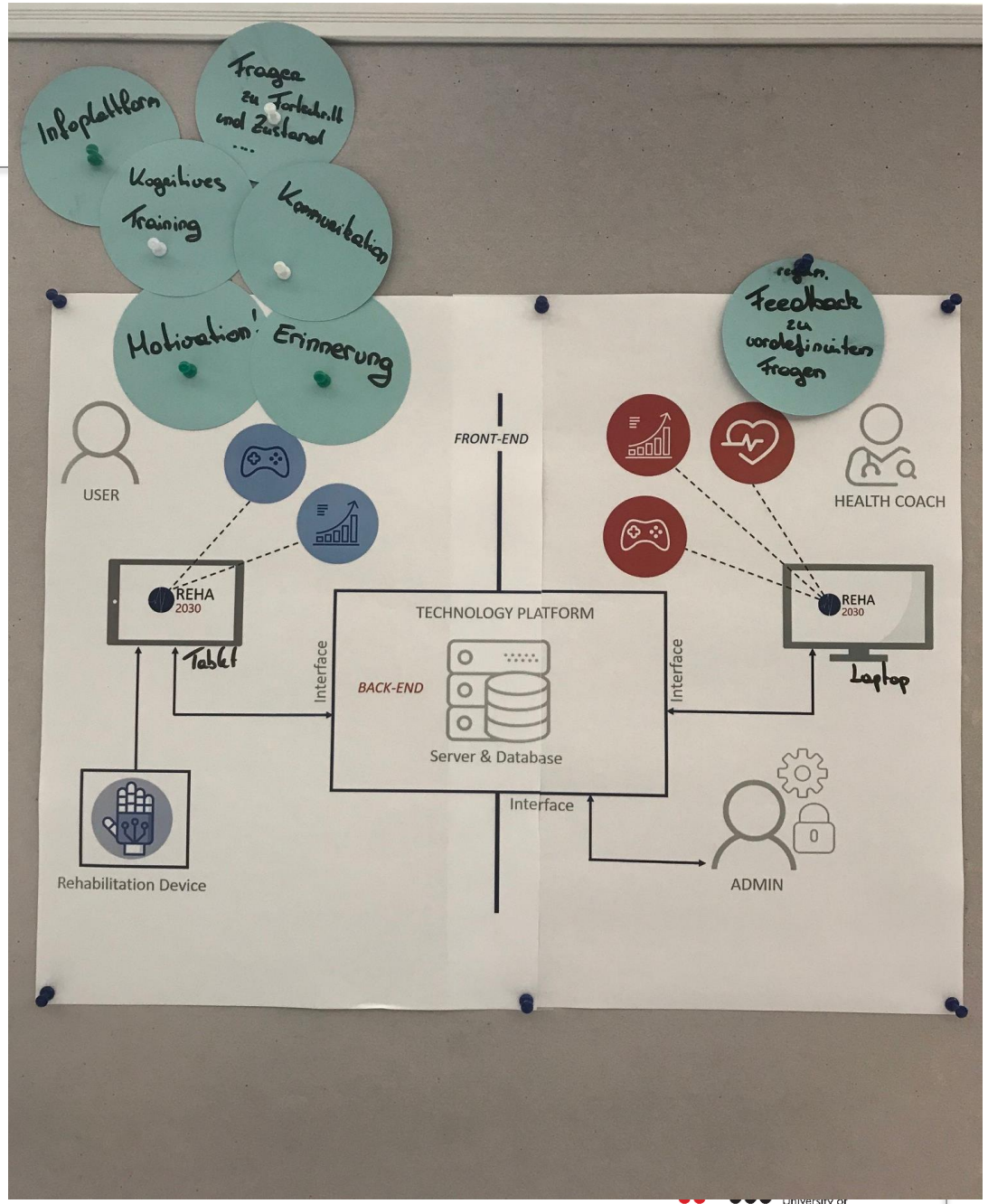
ISO 9241-210:2019 - Specifying the user requirements

- Requirements of users and other stakeholders should be identified, taking into account the context of use - What do users want?

These includes

- Intended context of use
- Requirements of the users
- General requirements regarding ergonomics, usability





Examples from project REHA2030

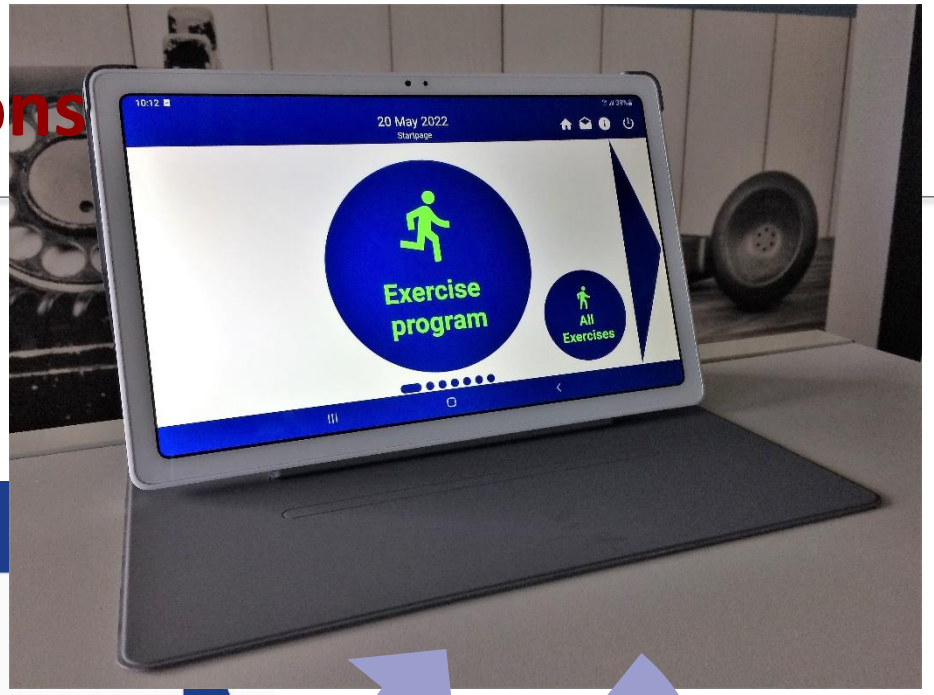
ISO 9241-210:2019 - Producing design solutions

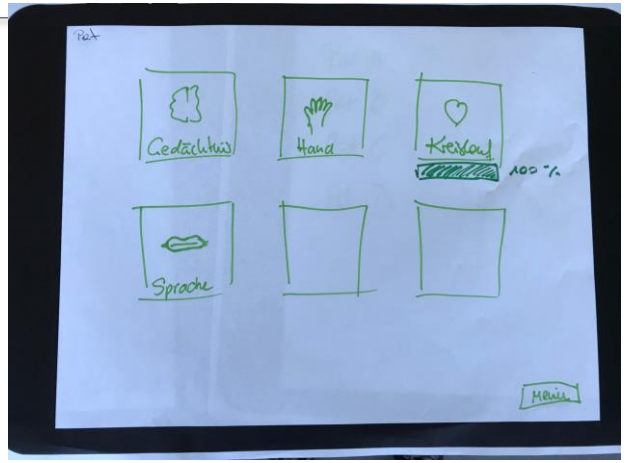
- With the help of scenarios, simulations, models, various prototypes, design drafts can be communicated to users/stakeholders in order to receive feedback
- Very valuable in the early stages to consider alternative design solutions

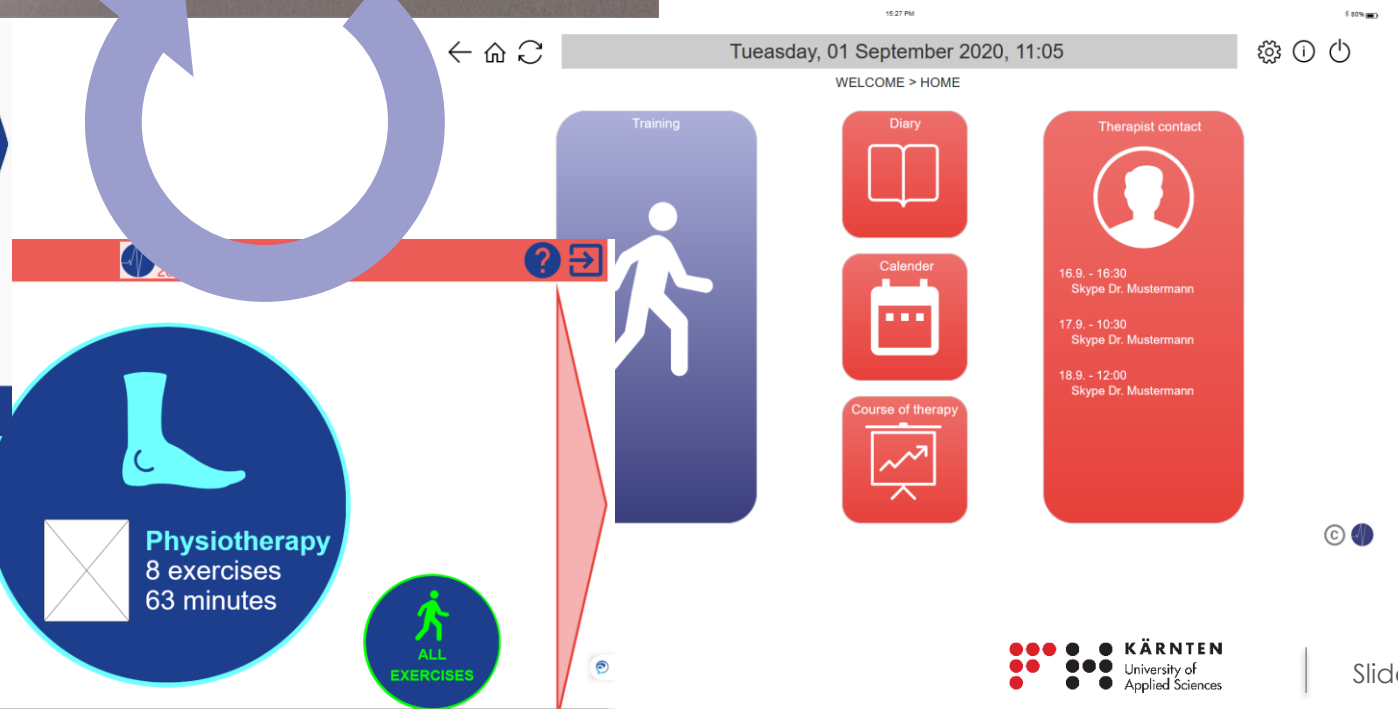
Includes:

- Designing the user tasks, the user-system interaction, the user interface
- Concretization of the design solutions (simulations, prototypes)
- Modifying the design solutions based on the results of human-centered evaluation

Prototype iterations







Examples from project REHA2030

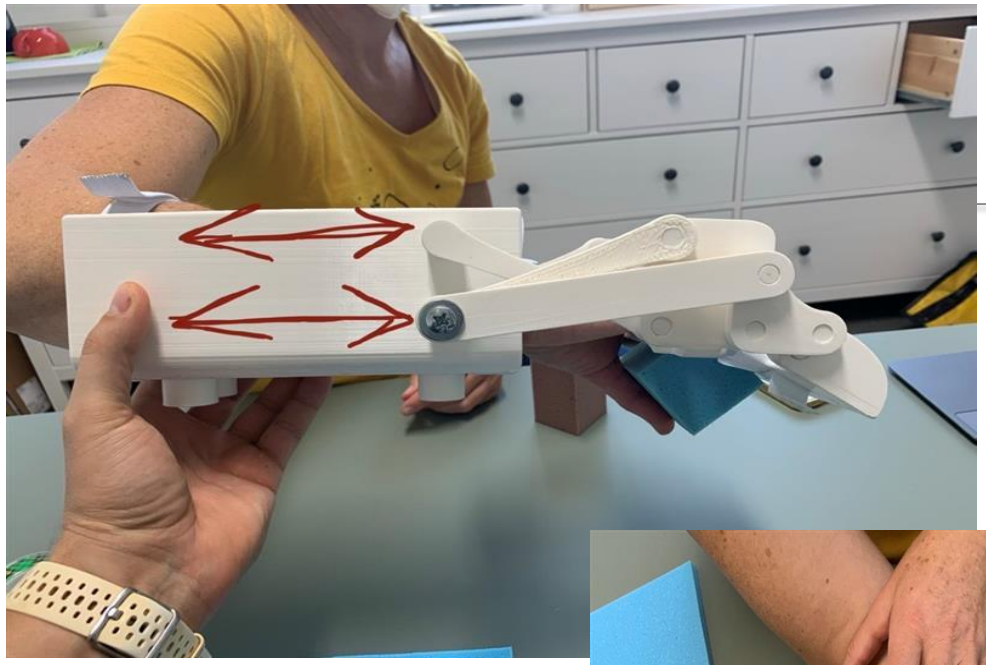
ISO 9241-210:2019 - Testing and evaluating the design

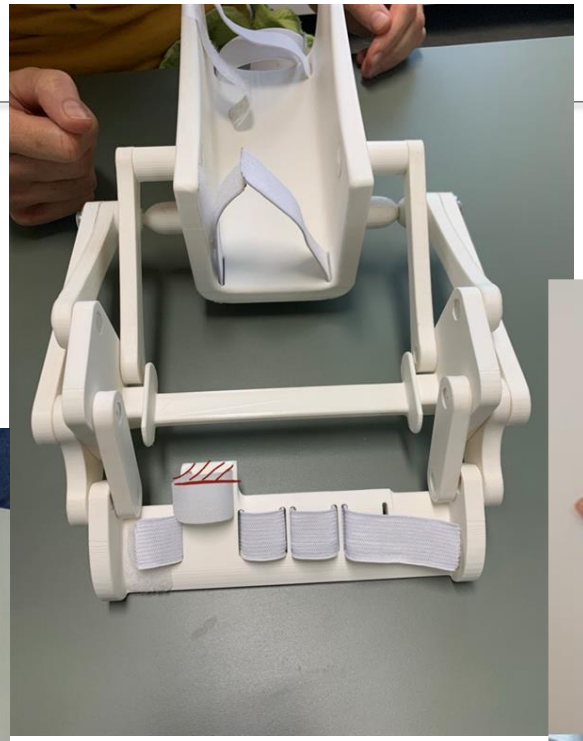
In all phases of the project, design concepts will be tested and evaluated to gain a better understanding of user needs, it serves to:

- Gather new user requirements
- To obtain feedback on strengths and weaknesses
- To assess whether user requirements have been met
- To make comparisons between alternatives

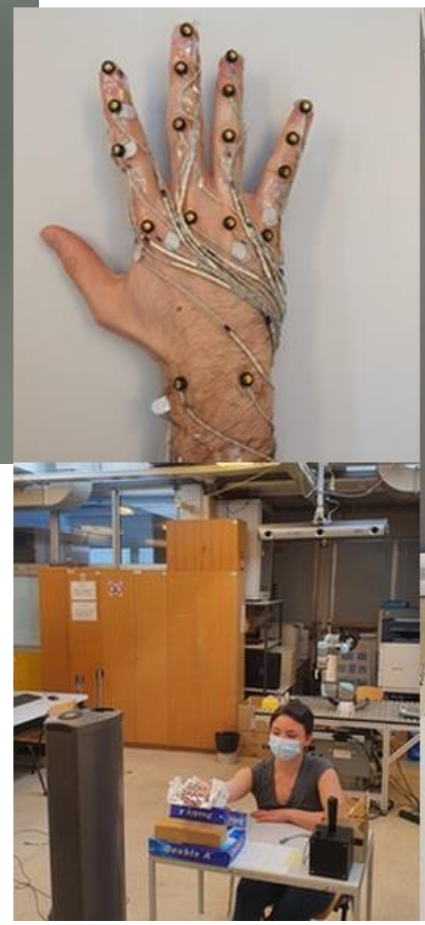
Evaluation settings:

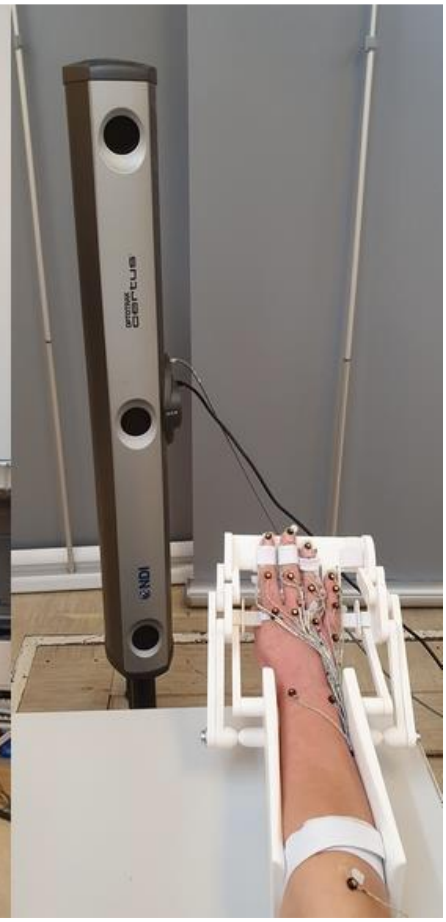
- User testing (usability, acceptance analysis) and inspection-based evaluation (e.g., checklists, standards, heuristic evaluation)
- Lab test – real life evaluation



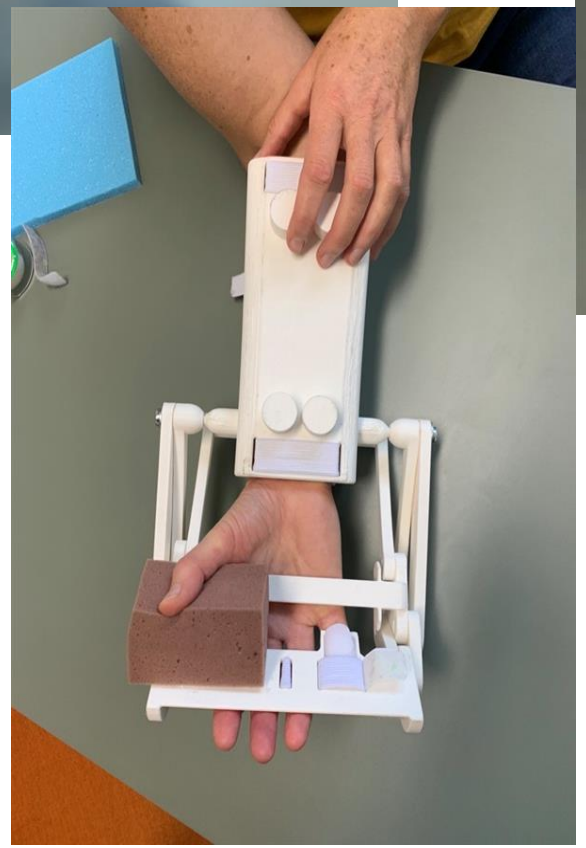


Evaluation of
3nd Prototype:
lab validation





Evaluation of
2nd Prototype
with therapists



Examples from project REHA2030

Overview Human Centered Design for process and product development

Krainer, D., Wohofsky, L., Schubert, P. (2022): Design Requirements for a (Tele-) Rehabilitation Platform: Results from a Participatory Process. Studies in health technology and informatics, 293, 224–231. https://doi.org/10.3233/SHTI220373.

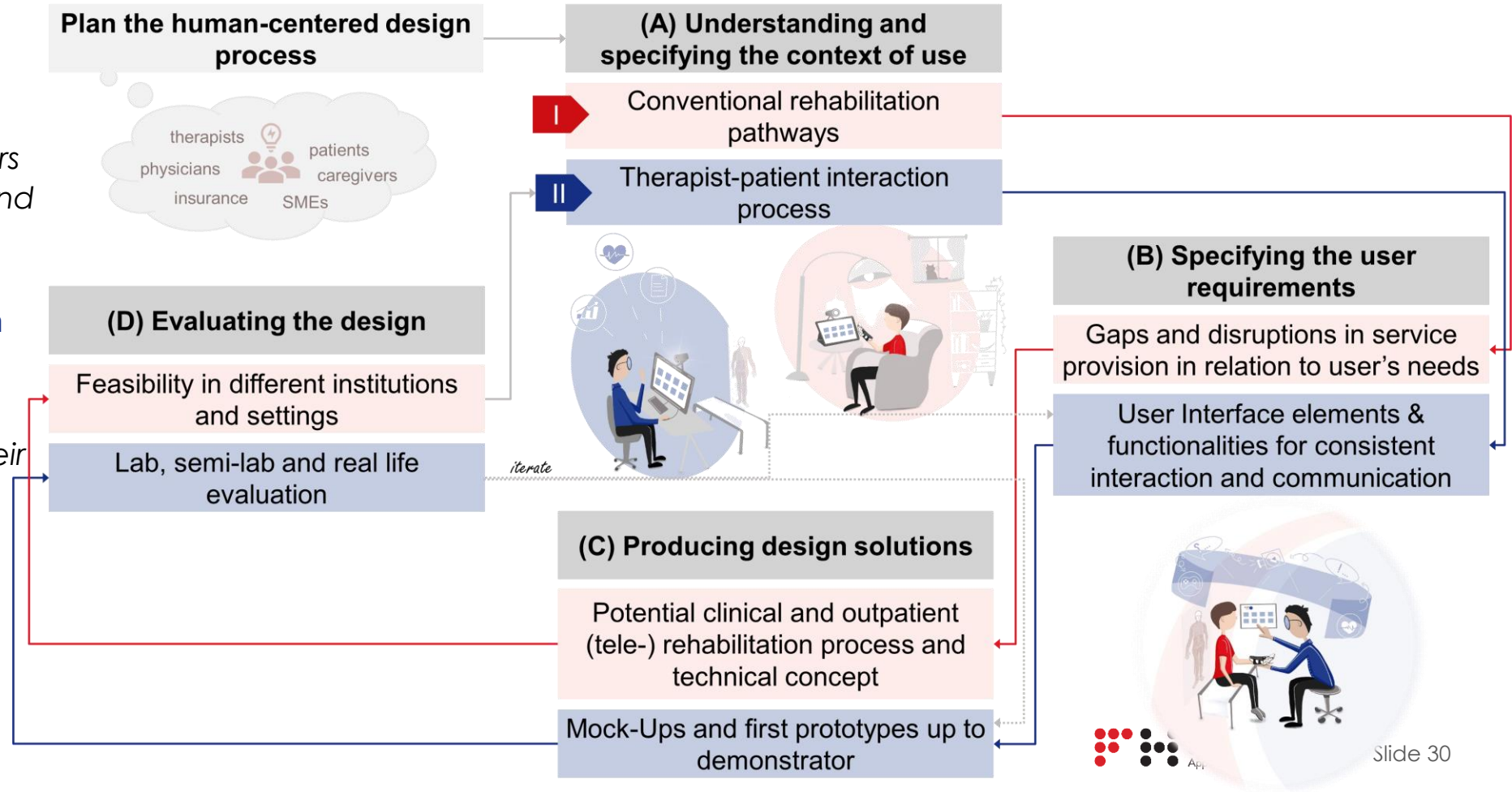
The HCD process, which is iterative by nature, was spitted into two main loops:

I) Rehabilitation pathways

"analyses the conventional rehabilitation paths and barriers in this supply chain in Austria and Slovenia"

II) Therapist-patient interaction

"focuses on the therapist – patient process for defining process steps, features and their interrelationships for achieving this seamless supply chain and high-quality therapeutic interventions supported by telerehabilitation"



POTENTIALS AND CHALLENGES OF HUMAN CENTERED DESIGN

Potentials of „doing it together“

Solution tailored to the needs of the target groups

- Fits in their work environment or everyday life
- Are accepted, will be used when needed and has an impact on specific Quality of Life domains

- **Economic:** adapting a design to users' needs and abilities improves its use, quality, and efficiency, providing low-cost design solutions and reducing the likelihood that systems, products, and services will be inefficient or rejected by their users
- **Social**: a human-centered approach results in systems, products, and services that are better for the health, well-being, and engagement of their users, including users with disabilities

Challenges and pitfalls

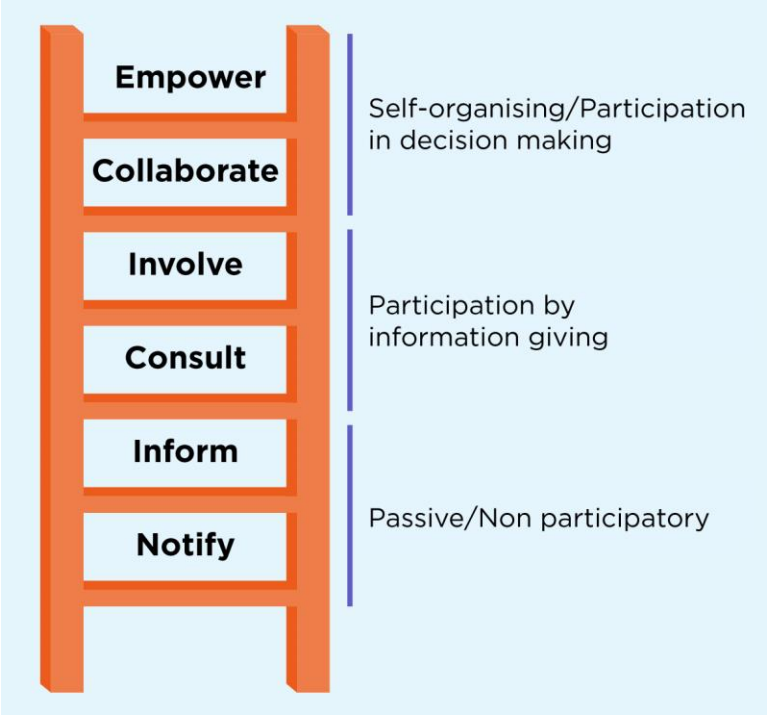
- It‘s probably „not the fastest“
- Time and ressources need to be planned
- The results may differ from your vision
- Can you accept the user‘s opinion?

→ The **HOW** is a key success factor

HOW – doing research together (1)

Ethical principals & Good practice in user involvement

- Time and expertise of the experts is precious → avoid fake participation
  - Clearly define your goals and level of participation
  - *Use proper methods that support outcome*
  - *Choose your questions and topics well consideres for the group you are targeting*
- Data are valuable → plan to use it if you collect it
- Show your appreciation → feed back the results
- If your product is so great that people really want to use is → think about the time after a field trial



Arnstein, S.R. (1969): A Ladder Of Citizen Participation, Journal of the American Institute of Planners, 35:4, 216-224 [Available online http://dx.doi.org/10.1080/01944366908977225].

HOW – doing research together (2)

Interacting and communicating with participants

- Targeting the „right“ people
  - Try to avoid bias
  - It is easy to recruit people who are already deep in the topic and highly interested
  - Think about how the receive the others
- Use gender-sensitive research design
  - language
  - communication channels
- What‘s the right task for the technology readiness level
- Trust is important
- **Not the persons are tested, it is the technology that is the object of study**

„People ignore design that ignores people“ (Frank Chimero)

Research Unit AAL

Contact:
Daniela Krainer
Head of Research Unit AAL
d.krainer@fh-kaernten.at
+43 (0) 5 90 500 3225

AAL
Active & Assisted Living

http://forschung.fh-kaernten.at/aal

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