

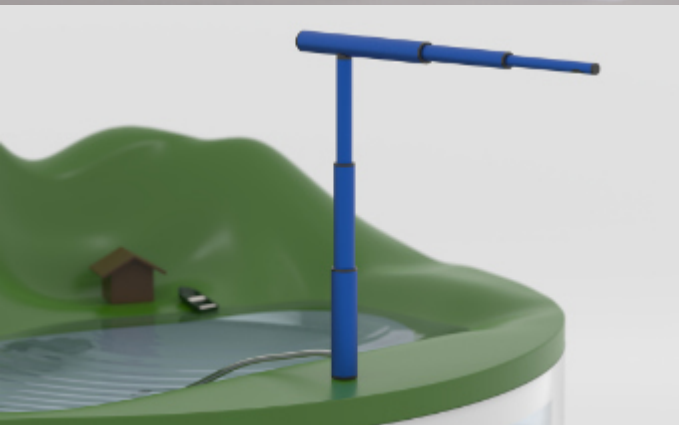
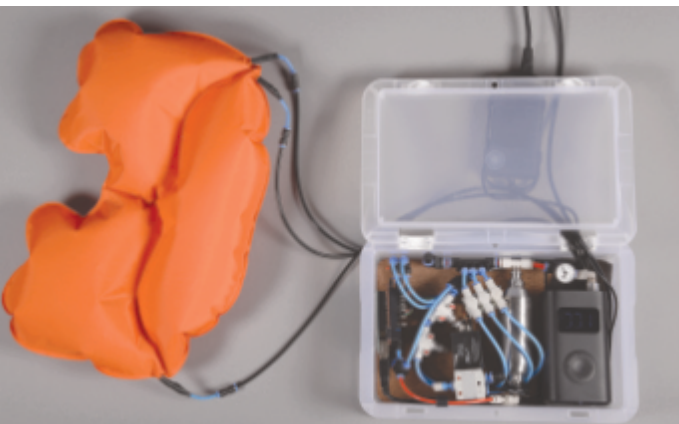
# PROJECT SUMMARY

2019 - 2023



## ReThiCare ReThinking Care Robots

A research project on elderly care technology of the future



# OVERVIEW



Frustration

Social Needs +  
Communication

Activation

Kindy  
Body  
contact

Trigger  
Behavior  
Patterns

Group  
Activity

Social  
Connections

Living  
Room

Humor

avoidance

Autonomy

Group  
Building

Communi-  
cation

depression  
inactivity

mood

Self-  
Expression

Cooperation

Self-  
Care

Ring the  
Bell

Empower-  
ment

Music/  
Noise

modular wheel-  
based  
platforms

(lim-)  
mobility

"Slowness"

Paths  
/  
Lifeways

Bath-  
Room

Entertain

gongs/  
vats/  
rollers

Practical  
care activities

Diapers

Individual  
Needs/Desires

llators

Transfer  
↔

Geborgen-  
heit  
(feeling of  
Security)

Self-Service: Caregiver  
- Individual Power  
- Help Applied: Power may be  
- or Applied: Power

rollator  
bumper car game  
every if

# CONTENTS

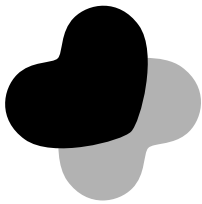
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# INTRODUCTION







re  
think  
care



[www.rethicare.info](http://www.rethicare.info)

## ABOUT: ReThiCare

The topic of technical and robotic assistance systems in the context of care is becoming increasingly important. However, the discourse is often dominated by images of humanoid robots - ever present in research and public media - and technology-centred research projects. In view of the complexity of care practice, however, next to questions of technical feasibility and cost-benefit relations, significant design-related, social and ethical questions arise.

The ReThiCare project takes a pragmatic definition of 'robots' as adaptive actuator-sensor systems (systems that receive information about the outside world via sensors and can interact with it or act on it via actuators) as its starting point. This opens up a new thinking space of assistive robotic helper-machines.

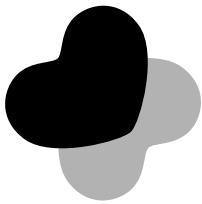
ReThiCare uses a user-centred, creative design and development approach, as well as design-led rapid prototyping methods, to demonstrate new possibilities for care technologies that support caregivers and enhance the quality of life of the cared-for. The aim is to identify a wide range of application scenarios and concepts, and to develop and test prototype implementations.

The project further explores methods and approaches for interdisciplinary cooperation that engender appropriate design of technical solutions for the care context. Appropriateness' refers to appearance, behaviour and embedding of robots in the social context of use. Robotics experts, machine learning specialists, product designers, sociologists and human-computer interaction experts cooperate in the project.

*ReThiCare is funded by the Volkswagen Foundation as part of the funding initiative 'Artificial Intelligence - Its Impact on Tomorrow's Society' (April 2019 - January 2023).*

# EXECUTIVE SUMMARY





re  
think  
care



[www.rethicare.info](http://www.rethicare.info)

# ReThinkingCare Robots ?!

## A RESEARCH PROJECT ABOUT FUTURE CARE SCENARIOS

The research project ReThiCare explores & develops concepts and systems for user-friendly assistance in elderly care.

In context analyses, concept studies, prototype development, user studies and case studies, the interdisciplinary research project focuses on central questions regarding the challenges and opportunities of using technical assistance systems to support elderly care. In doing so, we center around on the following general questions:

***For which applications can robotic assistance systems be useful and how can they be designed adequately and ethically acceptable for the context of use?***

***How can robotics be embedded in the everyday life in residential care homes?***

***What scope for design, product categories and interactions can be newly opened up for the development of 'technology that helps in being human'?***

***How do carers and the cared-for react to novel robotic concepts?***

This brochure provides an overview of working methods, studies, concepts and results of the interdisciplinary research project. It illustrates the existence of alternatives for making care more human, beyond the purely technologically motivated approaches to automating care often presented in science and the press as inevitable.



Funded by the Volkswagen Foundation.  
Project period April 2019 to March 2023.



## Practice partners:

OK-Fonden, Odense, Dänemark

Diakonie Sozialdienst Thüringen,  
Residential care home Sophienhaus, Weimar

Bauhaus-  
Universität  
Weimar

Bauhaus-  
Universität  
Weimar

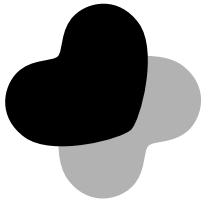


TECHNISCHE UNIVERSITÄT  
CHEMNITZ



SYDDANSK | UNIVERSITET

PARTNERS



**re  
think  
care**

## **PROJECT GROUP ReThiCare**

**BAUHAUS-UNIVERSITÄT WEIMAR (Stand 2022)**

**Human Computer Interaction**

Prof. Dr. Eva Hornecker (Project leadership)

Kevin Lefeuvre, M.F.A.

**BAUHAUS-UNIVERSITÄT WEIMAR**

**Interaction Design & Produkt-Design**

Prof. Wolfgang Sattler

Kristian Gohlke, M.Sc.

**TECHNISCHE UNIVERSITÄT CHEMNITZ**

**Sociology / Science & Technology Studies**

Jun.-Prof. Dr. Andreas Bischof

Philipp Graf, M.A.

**UNIVERSITY OF SOUTHERN DENMARK**

**SDU Robotics**

Prof. Dr. Norbert Krüger

Associate Prof. Leon Bodenhagen

Associate Prof. Emanuela Marchetti

Avgi Kollakidou, M.Sc.

Christian Sønderskov Zarp, M.Sc.

Lakshadeep Naik, M.Sc.



# CONTEXT: 24 hours of care work

## ETHNOGRAPHIC CONTEXT ANALYSIS AS PROJECT BASIS

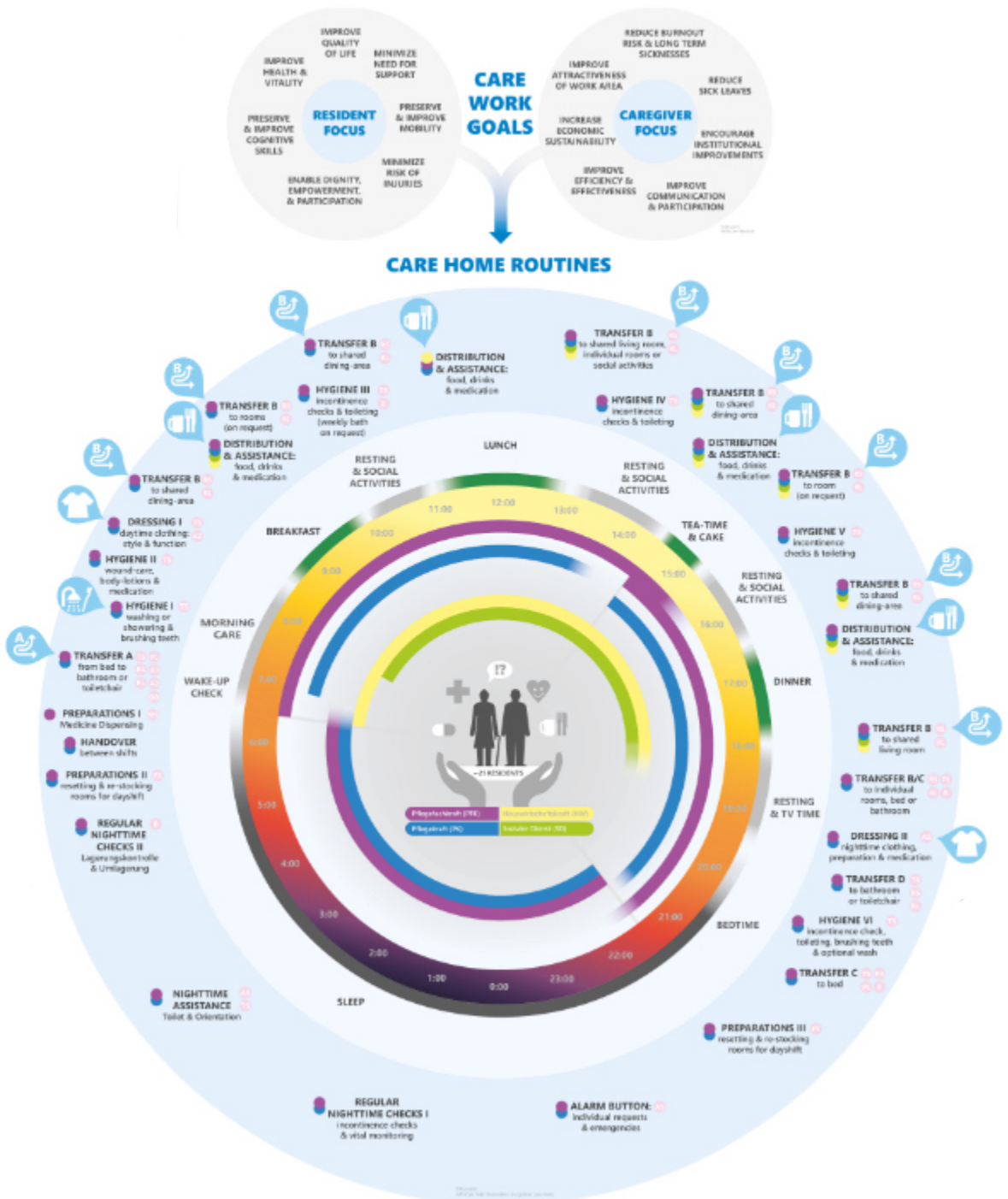
The development and evaluation of new tools and concepts for care work requires a detailed understanding of complex work processes and practices.

The basis for deepening the understanding of the context of care work in the initial phase of the project was the active, nine-week observation of a project staff member in the shift work of a residential care home, accompanied by supplementary, shorter stays of other project staff members at different times of the day. The impressions and observations gained in this way were recorded in diary form. The resulting database of more than 150 pages of protocols was analyzed with regard to the questions of how inpatient care work is organized and which practices are used. In the process, we also identified central themes or problem areas, which we were able to later translate into concrete scenarios. Examples include the special importance of physical contact, mental and physical activation, the instruction of concrete everyday actions, and the importance of self-care for caregivers.

Processes, activities, organization, formal and informal care practices, interactions, tools and actors were visualized in a central diagram, which formed a reference point for further project work. The graphic representation makes the complexity of nursing practice visible and acts as a central communication and moderation tool in the research project.



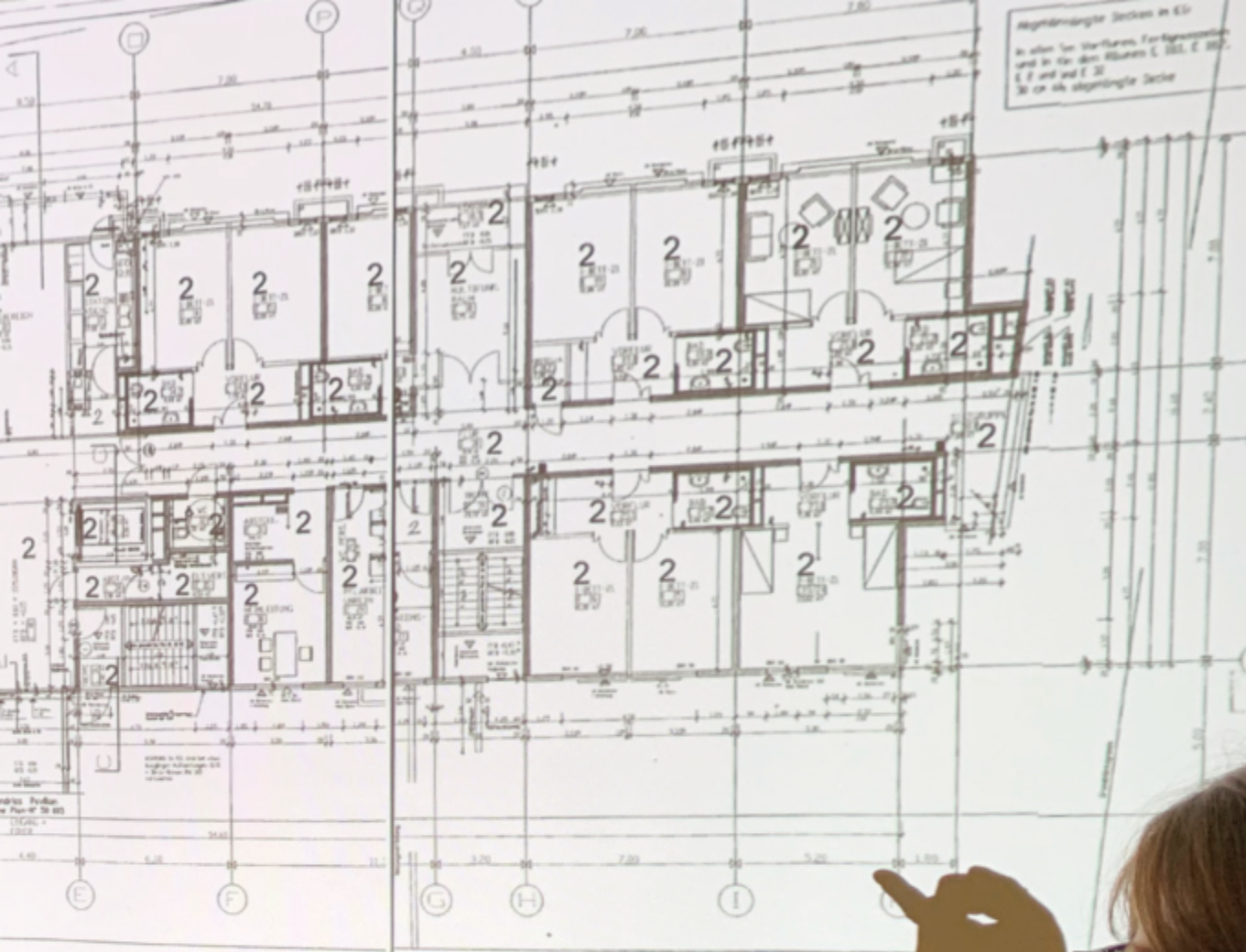




Visualization of the context analysis: 24 hours of care work, actors, processes, activities, tools. Presented in an overview.











## IDEA DEVELOPMENT

Based on the previous identification of topics, central fields of application and activities in everyday care were assessed and complemented with literature review on care-related technology research and an accompanying market overview of available care assistance systems. Although various approaches and technical systems exist for many central areas, these often find little acceptance, among other things because of additional effort or undesirable side effects.

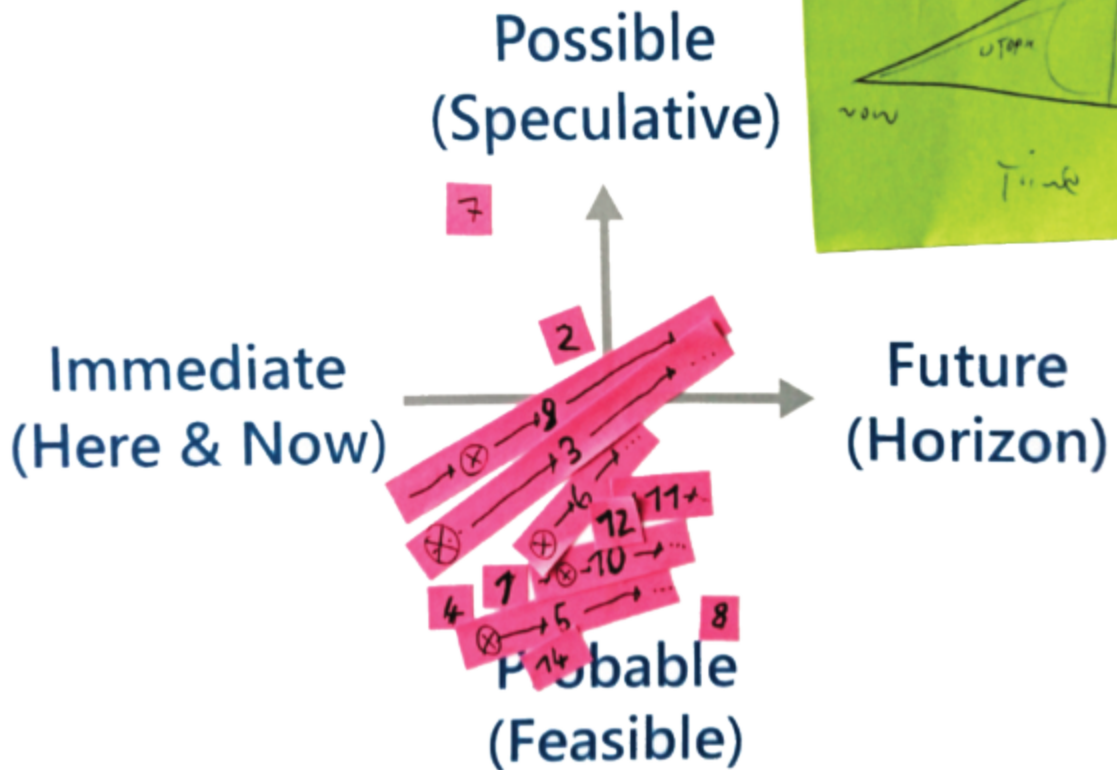
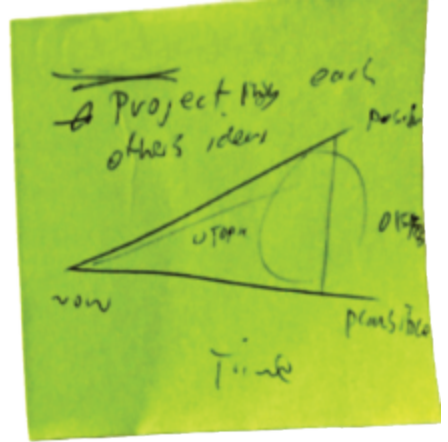
In order to develop a broad spectrum of ideas, several approaches for idea development were pursued in parallel.

First, we pursued the idea of small unobtrusive helpers, i.e., robots that are not perceived as such but are embedded, for example, in everyday objects. Such unobtrusive aids ('marginal gains') can sustainably facilitate everyday care and increase the quality of life. This perspective opens a critical position in the discourse about desirable scenarios for the future of care.

Second, we followed a more speculative, playful approach that explores alternative roles for robots. Here, we were guided by themes that stood out as gaps in our observations of nursing practice, such as monotony in everyday life and few contacts between residents\*. The concepts we developed are intended to introduce novel ideas into the care robotics discourse and to challenge existing problem-solution definitions.

Based on the recorded status quo and in direct coordination with actors from the nursing practice, ideas, concepts and studies for the support of care work were developed in the further course of the project, selectively implemented and tested in studies.

# CONCEPT SCOPE(S):





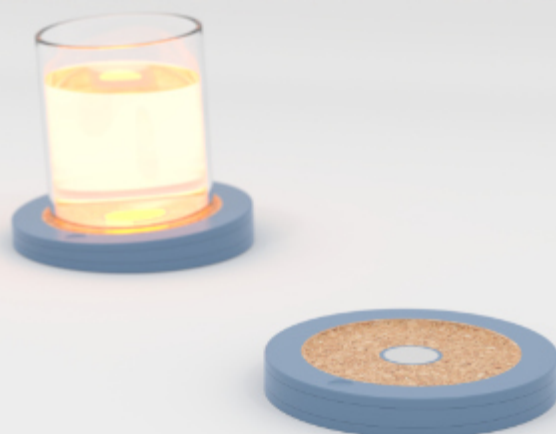
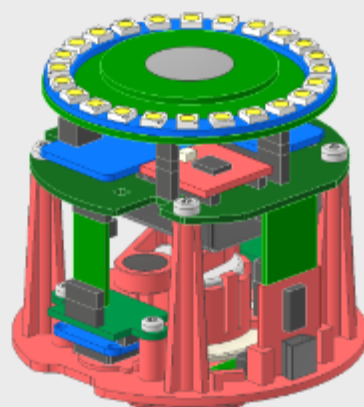
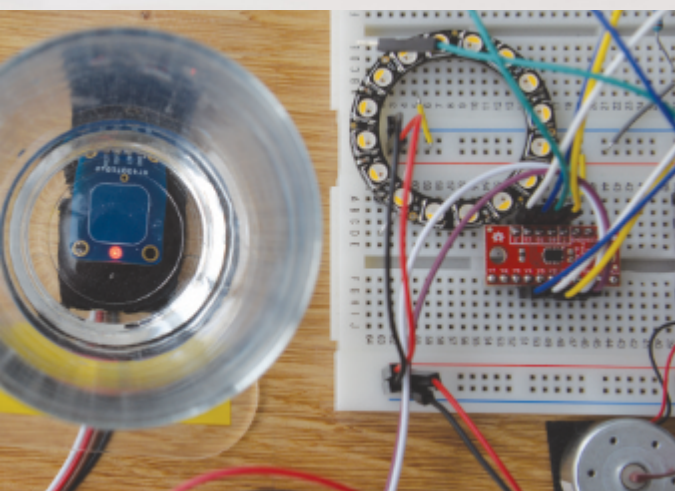
## CONCEPT STUDIES & PROTOTYPES

The project explores new design spaces, opportunities and impacts of novel assistance systems in the context of care work through concept studies and prototypes, involving different user groups.

The concepts developed can present specific solutions and research subjects for studies with users or inspire discourse about future care scenarios, depending on the underlying questions and objectives.

The scope of implementation ranges from simple mock-ups and drawings, videos showing application scenarios (video prototypes) to the detailed design and technical implementation of functional prototypes that are tested in specific application contexts.

Concepts and prototypes have been developed, among others, for automatically controllable pneumatic cushions to support care processes, which can also be used as sensor-based input devices, playful robots to promote communication and joy of life, a friendly vacuum robot, care-specific voice assistants or an interactive cup to promote the individual drinking behavior of persons with dementia.



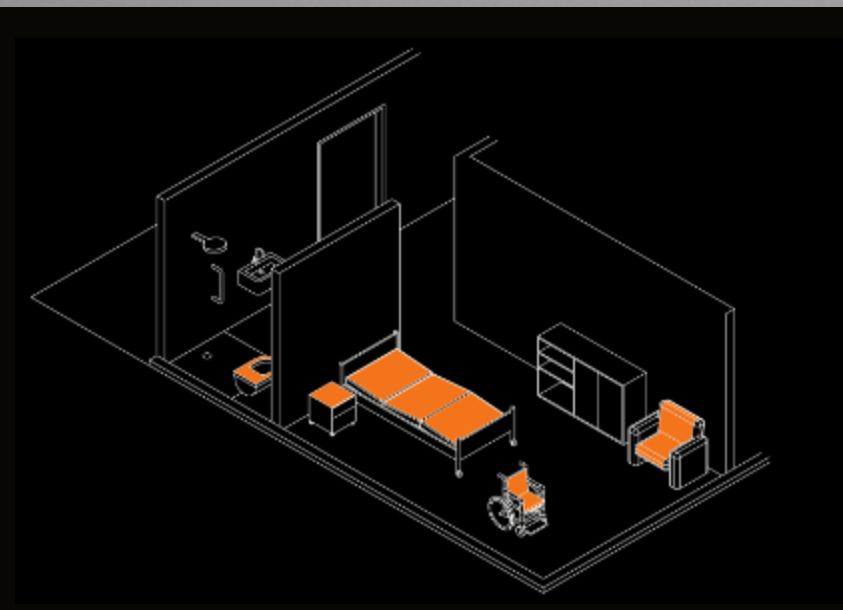
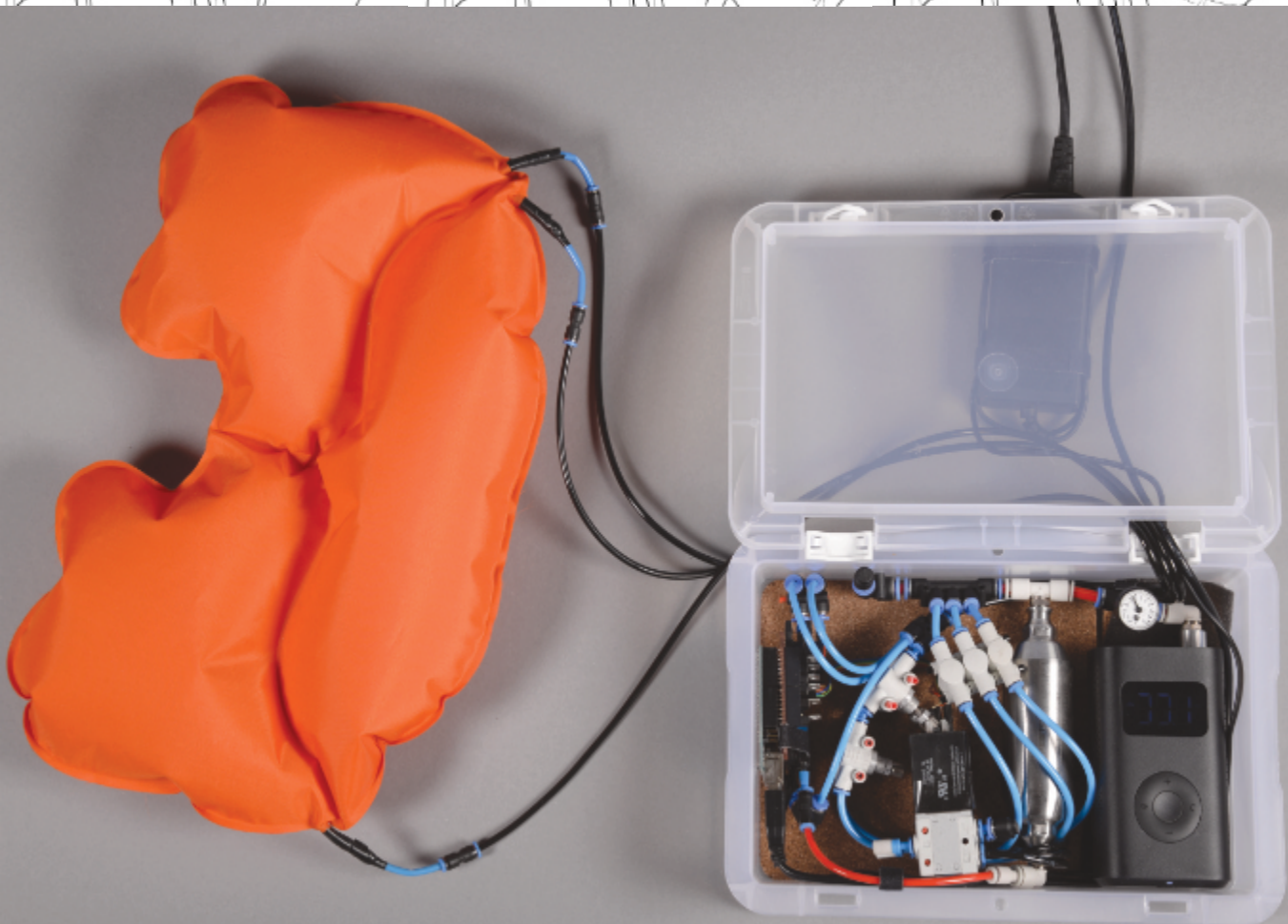
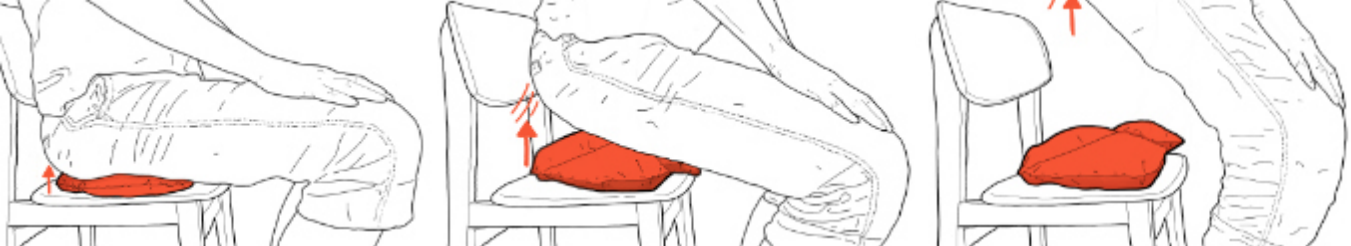
## PROTOTYPE: BIBO

### A CUP WITH MEMORY FUNCTION

In particular, residents with dementia do not drink enough and have to be repeatedly encouraged by care staff to do so. BIBO takes on this task. With BIBO, it is examined whether and how a drinking vessel that actively draws attention to itself can positively influence daily fluid intake.

BIBO is a small-format robot. The motorized drinking vessel detects the drinking behavior of its users through integrated sensors and reminds them by means of dynamic light patterns and slight movements at intervals to drink enough.

Bibo uses colored LEDs and a vibration motor to attract attention. A motion sensor detects when the glass is picked up. The light and movement behavior is also customizable and configurable. A built-in sensor detects when the glass is empty and then lights up in a different color to inform care staff.



## PROTOTYPE: REAKT

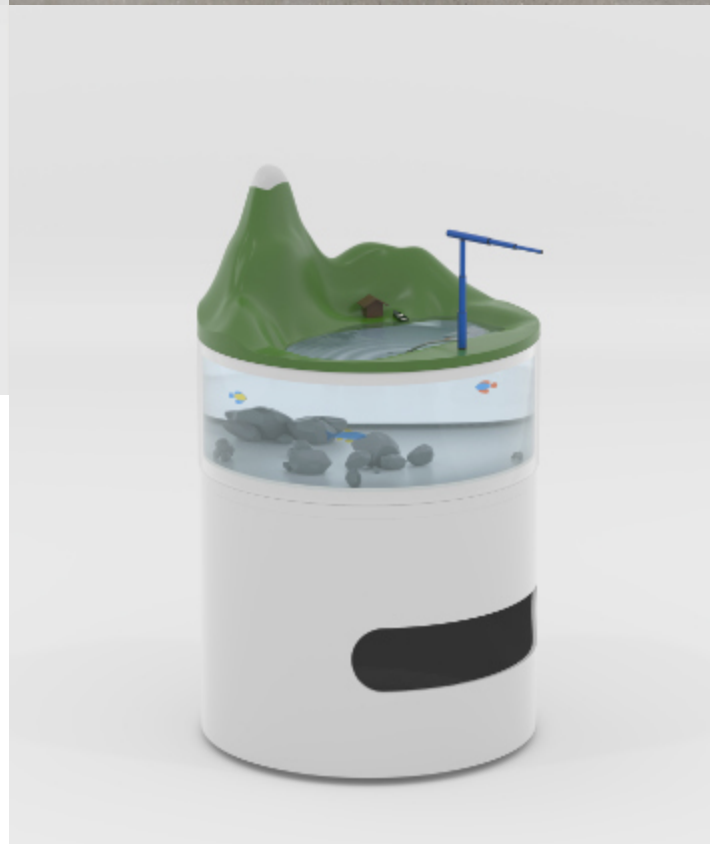
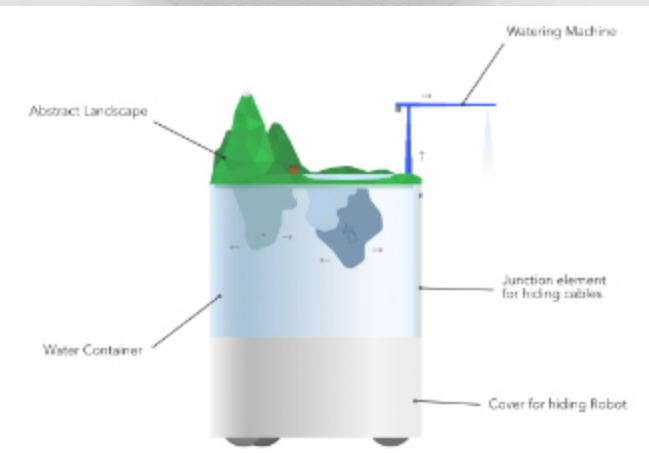
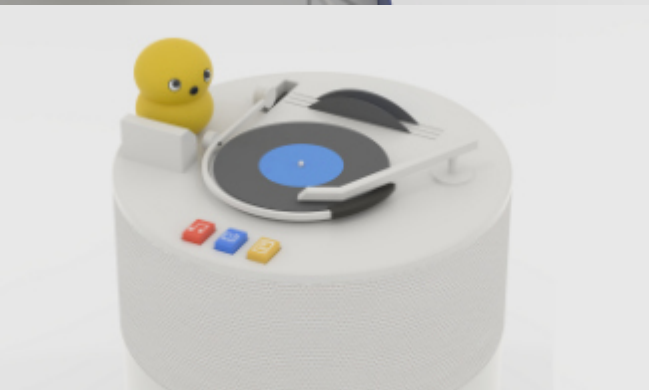
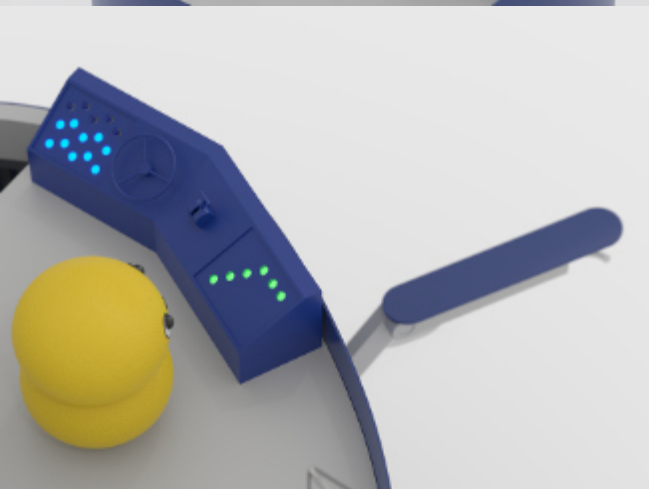
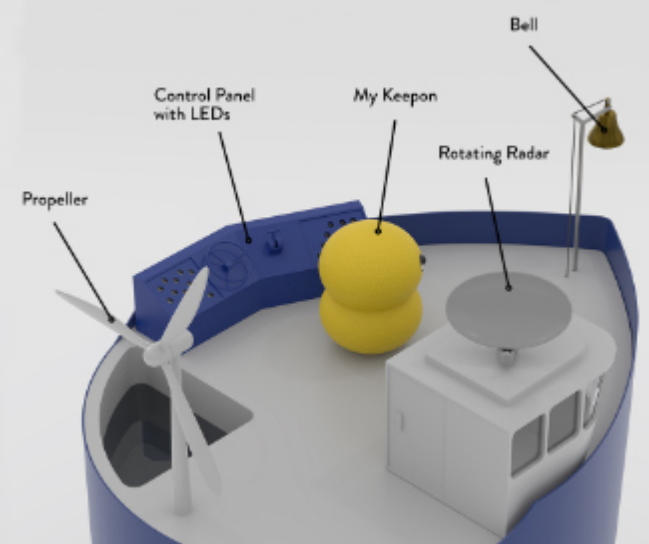
### TEXTILE PNEUMATIC ACTUATORS FOR UNIVERSAL CARE SUPPORT

REAKT is a platform for controlling interactive pneumatic cushions with integrated sensors for functional or playful support of rehabilitation and care work.

The air chamber systems can be used as dynamically controlled textile-pneumatic actuators in close proximity to the body, to support physically demanding care activities (e.g. transfer situations) or to increase the autonomy of the person being cared for (e.g. as a turning aid in bed). Existing seating furniture and wheelchairs can be extended with versatile support functionality by textile air chambers, which can be produced according to individual needs using CNC technology.

Through integrated sensors, the air chambers can also be used as input devices - for example, for controlling games, apps, or sound installations. There are various scenarios for promoting physical activity or social and cognitive activation.





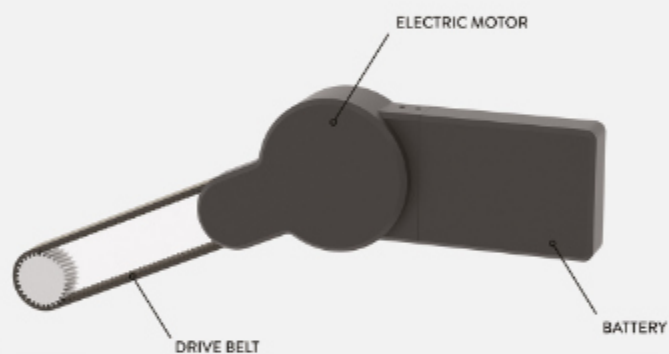
## PROTOTYPE: MS ILMA

### A ROBOT AS A SOCIAL EVENT?

M.S. Ilma is a robot designed as a small ship, seemingly controlled by a small captain - visible on the ship's deck. While the ship's main purpose is to water houseplants, we are actually interested in investigating whether the design can help to liven up everyday routines and provide entertainment.

The robot is designed to make its actions visible in a playful and visually exciting way. For example, the propeller indicates where the ship is about to move next, a rotating radar visualizes the search process and the ship can make itself audible with a small bell. The small captain apparently coordinates the action by moving synchronously and operating a control panel.

We are scientifically interested in the question of whether the robot appears less as an "autonomous robot" and more as a "controlled machine" through such a design.

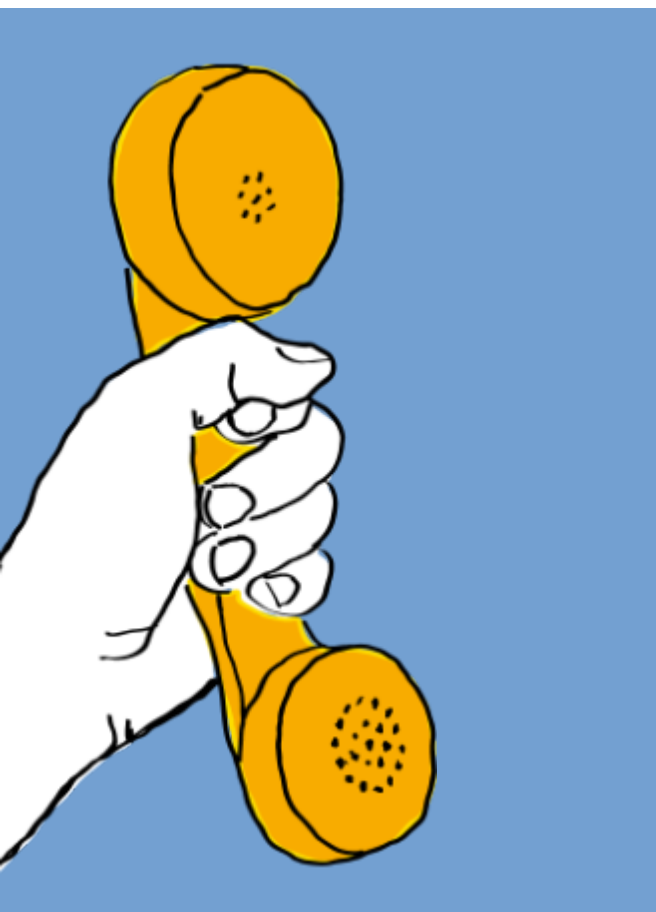


## CONCEPT STUDY: UMA

### UNIVERSAL MOBILITY ASSISTANT

UMA is a design study for a modular, personal mobility platform that adapts to the individual change of requirements of the users, following the principles of UNIVERSAL DESIGN.

A drive module, sensor modules, and a control unit enable the flexible addition of existing mobility aids for various scenarios, from gentle support to autonomous navigating robotic mobility assistants.



**ELYZA:** Hello! I am ELYZA, your virtual assistant. How can I help?

**RESIDENT:** I want to talk to my grandson on the phone!

**ELYZA:** Let's see if we can reach him ...

**ELYZA:** ...oh, Unfortunately, he's not answering.

**ELYZA:** Do you want to listen to his last voice message?

**RESIDENT:** Well... If I can't talk to him now... okay.

**ELYZA:** ...or do you want to send him a voice message?

**RESIDENT:** Of course! I haven't spoken to him for a long time...

**ELYZA:** Okay, I'm listening! Speak your message now:

**RESIDENT:** Hello?! It's grandpa, I'm happy if you call!

...

**ELYZA:** Your grandson sent you a message, do you want to listen to it now?

**RESIDENT:** Oh nice, yes please!

**MESSAGE:** Hallo Grandpa, hope you are fine! I will call you tonight.



**ELYZA:** This is ELYZA ... How can I help you?

**RESIDENT:** ...?

**ELYZA:** Are you feeling ok? ...checking biosignals.

**RESIDENT:** ...?

**ELYZA:** Biosignals checked, Stay with me! I will tell the nurses to take a look.

**ELYZA:** Staff Attention. We have a possible situation in Room 4. Can I connect you?

**NURSE:** OK! Put me through!

**RESIDENT:** ...?!

**NURSE:** Herr Erich? Are you ok? ... Hold on I will be there in a second.



## CONCEPT STUDY: ELYZA

### A VOICE ASSISTANT IN THE FAMILIAR GUISE OF A LANDLINE TELEPHONE?

The ELYZA concept investigates - through a video prototype - the potential of personal voice assistants to promote the social and digital participation of individuals requiring care and to complement care procedures as well as emergency detection.

ELYZA can be called by picking up the receiver and speaking questions or requests, but it can also ring proactively to report news.

To increase acceptance, ELYZA is designed in the form of a traditional telephone with a dial plate and a receiver. Familiar design and accustomed practices enable engagement with new technologies and their possibilities.



## CONCEPT STUDY: IntiMe/Us

### INTIMACY AND THE DESIRE FOR TOUCH

Intimacy is often still a taboo topic when it comes to care. However, those who are involved in care know that there is a large gap here and that physical needs are sometimes unmet.

The IntiMe and IntimUs concept studies are objects of speculative design; they ask 'what is possible' or 'desirable'. They encourage discussion about how intimacy and physical contact can be experienced and lived in care and what supportive role technology can play.

IntimUs invites exploration of the interior of a multi-pronged textile tunnel, creating opportunities for playful mutual touch and responding with sounds to the exploration of the object. Can residents come closer to each other nonverbally and experience physical attention in this way?

IntiMe is an interactive blanket that reacts to touch on the top with vibration and can thus sexually stimulate the body. It is intended for 'private' use in a single room.





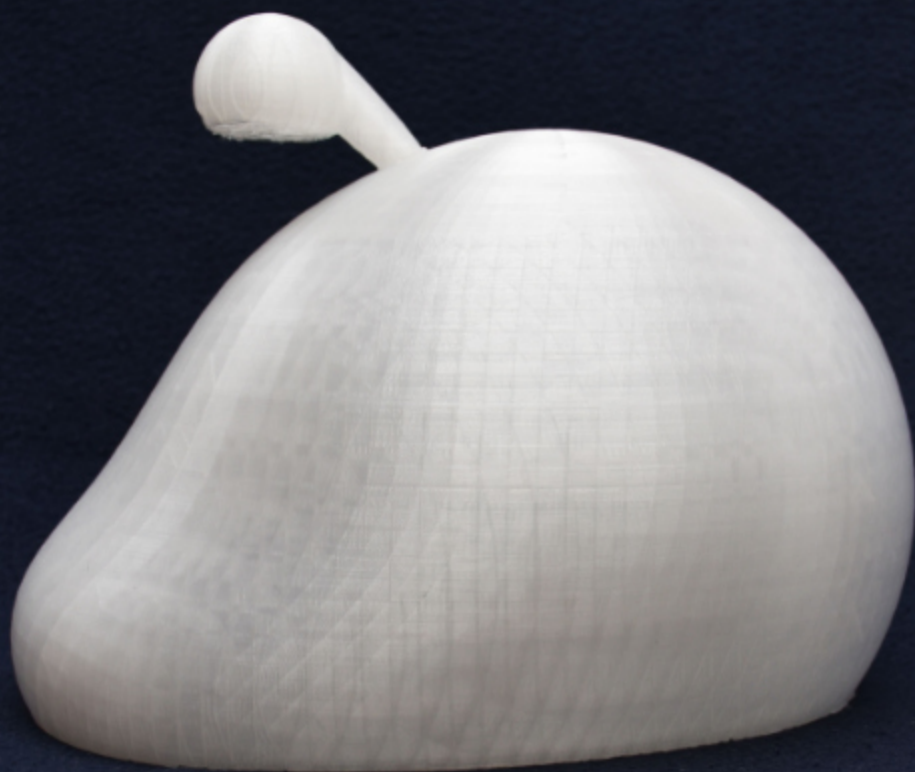
## **PROTOTYPE: SANNE**

### **A FRIENDLY, PLAYFUL CLEANING ROBOT**

Floor care is important for hygiene but it takes valuable time. However, residents of one of our partner care homes were afraid of commercial vacuum cleaning robots.

Sanne is a playful cleaning robot in the form of a cartoon-like cat. When Sanne is not vacuuming, she cautiously initiates contact by moving back and forth and approaches if called to.

With Sanne, we are exploring how autonomous mobile robots are perceived by individuals with dementia and how they react to them. Can zoomorphic assistive robots contribute as functional toys or playful helpers for activating those being cared for and for lightening up daily routines in care facilities? How should Sanne move? When are residents 'responsive'? Do they understand that Sanne is a machine? Is the cat shape too childish?





## PROTOTYPE: AURORA

### A CLEANING ROBOT WITH A DUAL FUNCTION

Aurora builds on the idea of Sanne by being deliberately abstract in form and having a more ethereal presence that evokes a contemplative mood. The colored light emitted by Aurora indicates the time of day (or upcoming activities) - red-orange when a meal is about to start (red is appetizing) or cool, calming green-blue in the evening, similar to the popular Nordic light lamps in Scandinavia.

The robot is also noticeable by an abstract, harmonious sound collage in the room. It can announce its presence through musical tones, ask for its way to be cleared, or respond positively to attempts of contact from residents.

How do residents react to an abstract robot? Does Aurora need different movement patterns than Sanne? Do the generated color and sound atmospheres have an effect on the behavior and well-being of the residents being cared for?



## METHOD: UNIVERSAL ELEMENTS of CARE

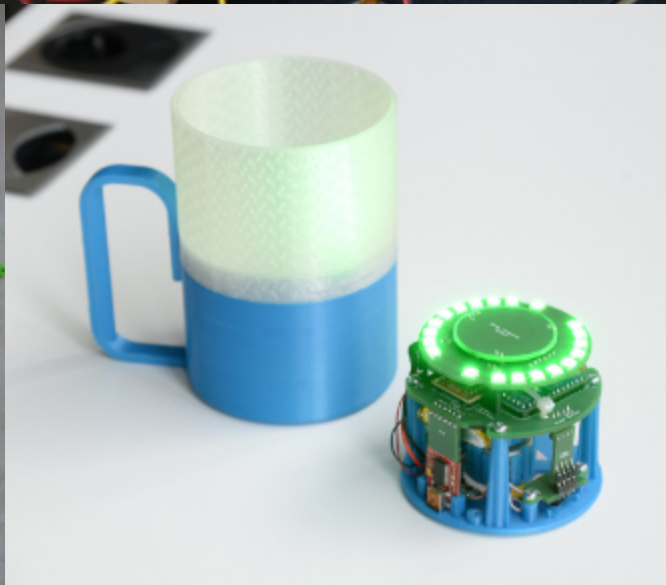
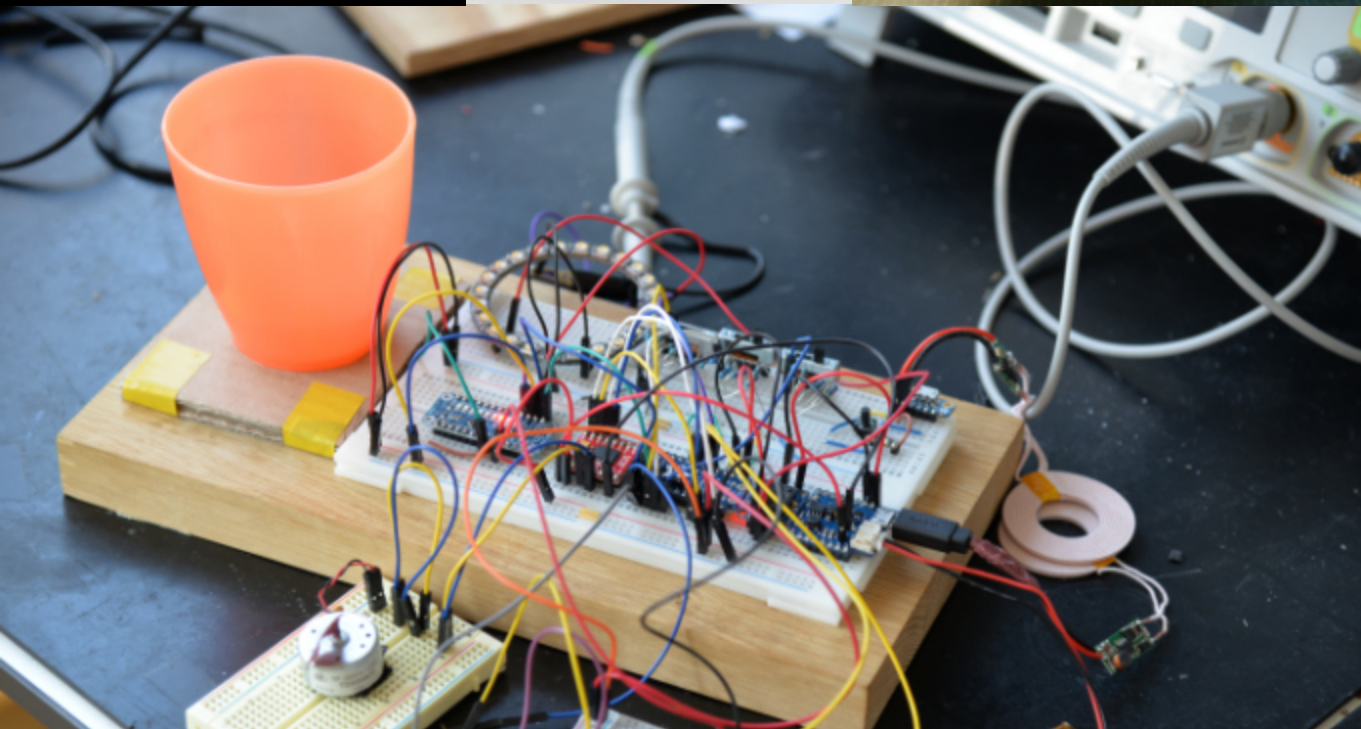
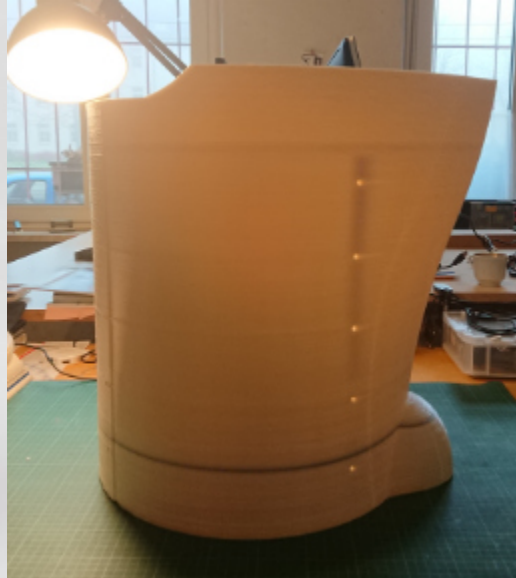
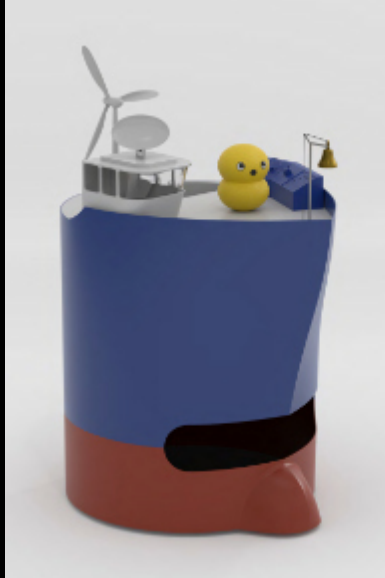
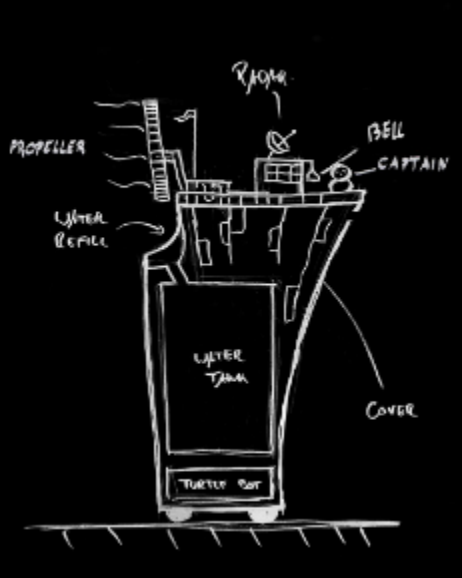
### IDEATION CARDS:

**A visual vocabulary for the participatory development of user-centered care environments.**

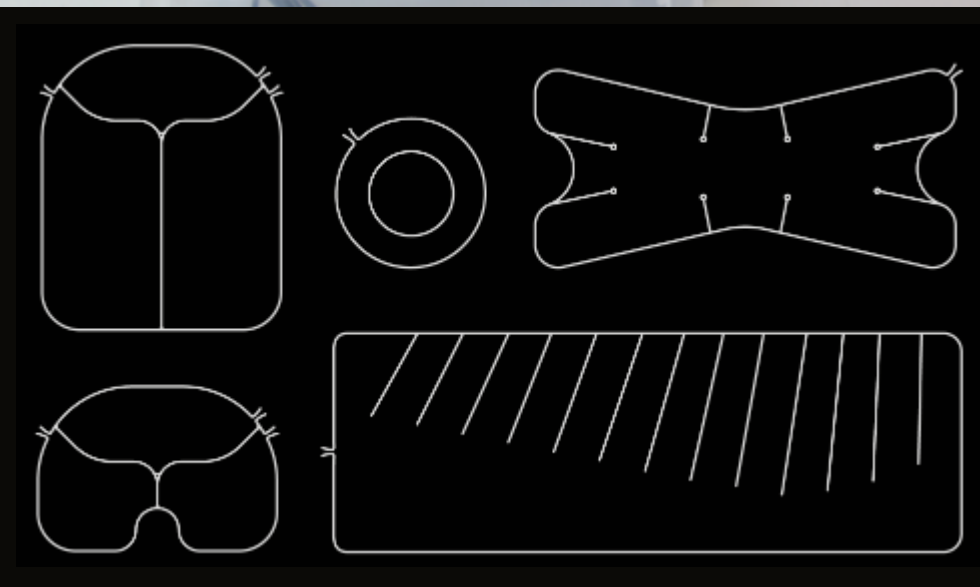
#### *WHO PLANS CARE ?*

The moderation and planning cards 'Universal Elements of Care' are a modular, pattern-based communication tool for the participatory development and analysis of technically supported care scenarios and room structures for elderly care today and in the future.

In addition to their effect as a communication and (support) tool for participation in planning workshops, the cards also provide orientation and an overview of an expert-curated selection of innovative aids and assistance systems for elderly care.







## „M.S. Ilma“

### Beschreibung

Die „M.S. Ilma“ hat eine doppelte Aufgabe: Unter dem Vorwand, Pflanzen zu bewässern, durchbricht das autonome Schiff „M.S. Ilma“ die alltäglichen Routinen der Bewohnerinnen. Das von einer kleinen Figur gesteuerte Gefährt soll Gespräche anregen und für Ablenkung sorgen, indem es sich um die Bewässerung der Pflanzen kümmert. Wir hoffen damit, mehr Leben in Pflegeeinrichtungen bringen zu können.



## „M.S. Ilma“

### Art und Weise der Nutzung

### Design und Funktionen

### Anmerkungen zur Idee allgemein



# **FOCUS GROUPS and PRETESTS**

## **FEEDBACK AUS DER PRAXIS**

In order to get early feedback and suggestions for adjustments from caregivers and cared-for persons on our concepts, workshops with care staff in care facilities were originally planned. Due to the pandemic situation, these took place as online focus groups instead.

In total, we conducted 14 online workshops with more than 40 participants from all over Germany. Most participants were professionally active in the field of care or caring for relatives, some were in need of care themselves.

To provide an illustrative presentation of the concepts, we developed so-called video prototypes - short animated films in a comic style - showing specific use scenarios. These also indicate possible problems in order to invite critical comments. An additional note book provided an overview beforehand and could be used to give us feedback.

It is also important to scientifically test the developed prototypes. The cat-shaped cleaning robot Sanne was successfully tested and evaluated in several common rooms of the OK-Fonden care home in Odense, Denmark. BIBO, the drinking cup, was also tested to see if people with dementia drink more with BIBO.





## PROTOTYPES & CONCEPT STUDIES

FUNCTIONAL PROTOTYPES FOR HUMAN-CENTERED EXPLORATION OF THE EFFECTS & POTENTIALS OF NEW ASSISTIVE DEVICES AND TECHNOLOGIES TO SUPPORT ELDER CARE.

**BIBO** A cup with memory function



The **BIBO** research prototype investigates the question of how a drinking vessel that draws attention to itself through movement and light can positively influence daily hydration.

**MS ILMA** A robot as social event?



**MS ILMA** is an experimental robot that aims to challenge the general notion of robots as unitary actors by being designed as a ship seemingly controlled by a small captain. This is intended to break up everyday routines while better embedding the robot in a social context.

**REACT** Textile pneumatic care support



**REACT** is a platform for controlling interactive pneumatic cushions that can be used in a variety of ways to dynamically support rehabilitation and care work in diverse scenarios, functional or playful.

**ELYZA** A voice assistant for elderly care



A voice assistant for the care context in the familiar guise of the landline phone? How can personal voice assistants increase social and digital participation for seniors and help support care processes and emergency recognition?

**The 24 Hour Care Cycle** A visualization of care work



Visualization of complex care processes, aids, rituals and people, which as a communication and moderation tool makes potentials visible and contributes to the engagement of all relevant people involved in design and development processes.

**Universal Elements of Care** Ideation Cards



A creative card set as a modular, pattern-based communication tool for the participatory development and analysis of technically supported care scenarios and spatial structures for the care of the elderly of the present and future: A visual vocabulary!

**SANNE/AURORA** Perception of robots



How are autonomous, self-propelled floor cleaning robots perceived by people with dementia in residential care homes? What interactions, reactions and irritations does their use entail?

**IntimUs** A speculative design artefact



**IntimUs** is a platform for exploring how intimacy is experienced and lived in residential care homes for the elderly and what supporting role technologies can play in this process. The prototype - as an artifact of Speculative Design - invites you to touch it.

**UMA** Universal Mobility Assistant



**UMA** is a design study for a modular, personal mobility platform that adapts to individual changes in user requirements according to the principles of UNIVERSAL DESIGN.

The project work of ReThiCare focuses on the research and development of concepts and solutions for the technical support of elderly care.

On the basis of concept studies and prototypes, the project explores - with the ongoing involvement of diverse user groups - new design scope, opportunities and effects of novel assistance systems in the context of care work.





**AVENEO Talks**  
 Live on stage! Moderation: Susen Nowara

**13:00 Uhr 26.04.**  
**DENKRAUM PFLEGE**  
**Rethinking Care Robots**

Sind Roboter in der Pflege eine Zukunftsvision, auf die wir bauen können?

Oder machen technische Lösungen die Care-Arbeit unpersönlich berechnend?

Prof. Wolfgang Sattler und Prof. Norbert Krüger stellen das interdisziplinäre Forschungsprojekt **ReThiCare** vor und liefern Denkanstöße zu den Chancen und Gefahren der Robotik in der Pflege.

09-45 **FIT IN DEN TAG**  
Aktivierungsprogramm für alle Generationen

10:00 **START UP CHALLENGE 2022**  
Smart Objects & Smart Solutions

11:30 **START UP CHALLENGE 2022**  
Concept & Strategy

13:00 **DENKRAUM PFLEGE**  
**Rethinking Care Robots**

14:00 **START UP CHALLENGE 2022**  
Living & Entertainment

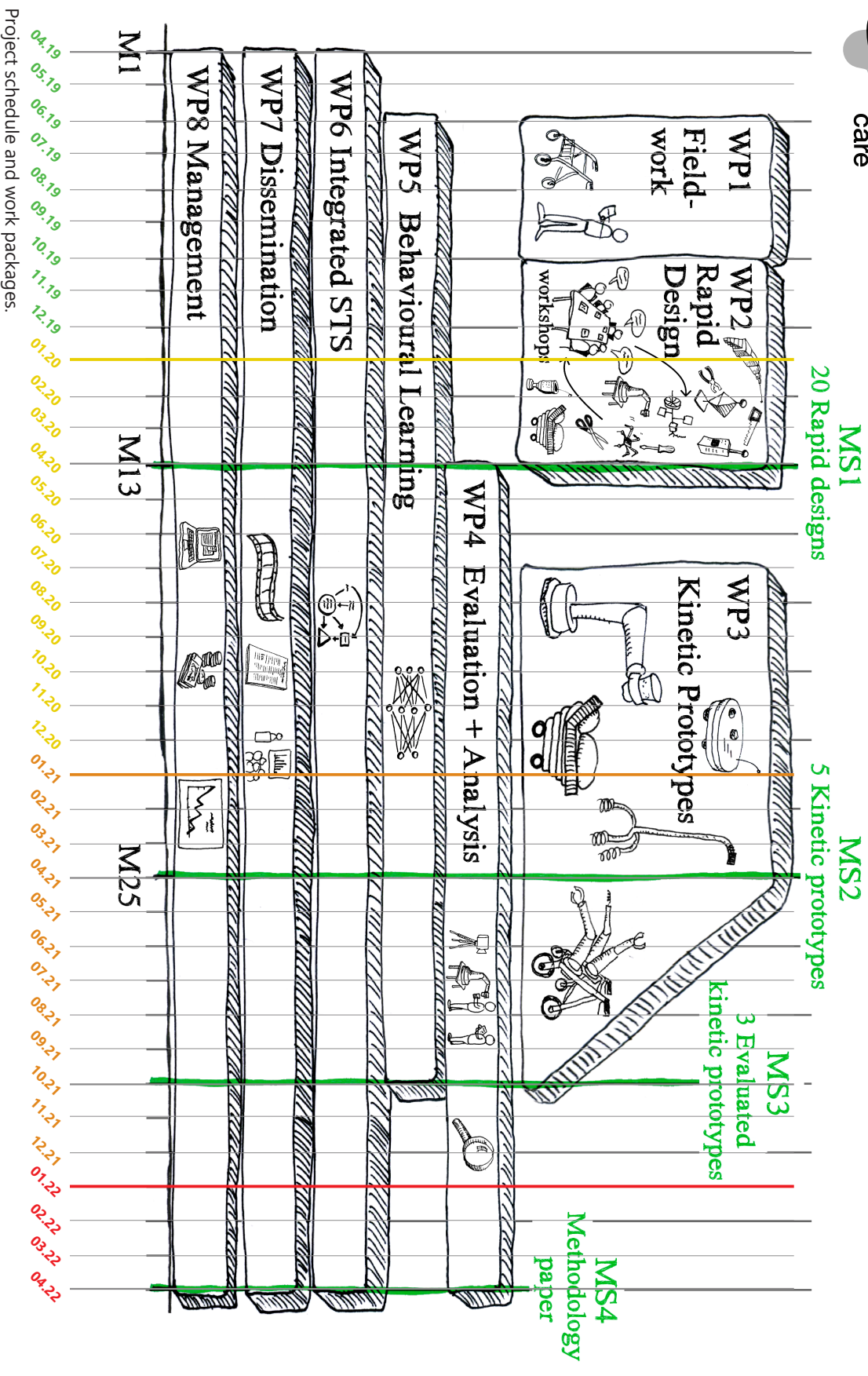
15:30 **START UP CHALLENGE 2022**  
Communication & Documentation

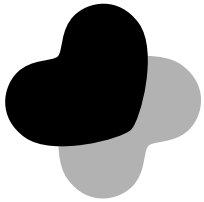
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## STUDIES & VIDEO PROTOTYPES

The development of functional models, technical feasibility studies, video prototypes and visualizations in interdisciplinary teams of designers, sociologists, HCI researchers and engineers forms the basis for testing assumptions and hypotheses with the involvement of actors from care practice.

The developed artifacts are primarily to be understood as scientific experimental setups for dealing with complex questions (and not as finished products). The depth of realization is based on the requirements of the respective study or on the technical or design development goals set in the project context.

### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

Technical feasibility study of a pneumatic control system for dynamic control of air pressure in textile pneumatic actuators as the technical basis for the REAKT prototype.

### FINDINGS

Development of a freely programmable, miniaturized three-channel pneumatic control system based on industrial pneumatic components with integrated compressor and sensor technology. Suitable for fast and finely controlled actuation of small pneumatic actuators, e.g. for the generation of tactile feedback. Larger air chamber systems can also be used with restrictions at reduced actuation speed. Implementation and testing of control patterns.

#### **AirPinch — An Inflatable Touch Fader with Pneumatic Tactile Feedback**

*Gohlke et al. ACM TEI 2022*

### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

What opportunities, possibilities and challenges can novel developments from the field of soft robotics research offer for human-machine interaction? Which fields of application can be opened up?

### FINDINGS

Planning and implementation of an international expert and innovation workshop on the issue of rapid prototyping of novel pneumatic actuators and the transfer of soft robotics technologies for human-machine interaction.

#### **Actuated Materials and Soft Robotics Strategies for Human-Computer Interaction Design.**

*Brocker, Gohlke et al. CHI 2022*



### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

Could alternative design concepts for service or care robots open up new ways of interacting with residents? How can robots break up everyday life in care institutions in an entertaining way, offer something worth observing, possibly even stimulate communication among residents? What happens if the robot is not designed as a classical robot, but as a machine controlled by a small agent? How can a robot communicate its future actions in a narrative, entertaining and poetic way?

### FINDINGS

Using the example of a service robot designed as a ship that appears to be steered by a small captain, we explore the idea of a robot as a theater stage. The three publications present the concept of MS Ilma from different angles. Two metaphors were considered for implementing the idea of a 'stage': that of a moving landscape (Lilliput) and that of a ship. Prototypically, the idea of the ship was implemented, animated by several elements on its deck, including a small toy robot (a 'myKeepon') as captain. Based on feedback from the focus groups, a third metaphor was developed for a new target function - a mobile jukebox, also controlled by a small robot.

#### **Fostering well-being in care with the nautical designed Plant Watering Robot.**

*Graf et al., HUCAPP'22 International Conference*

#### **Designing A Robot for Elderly Care Homes based on the Notion of 'Robot as Theatre'.**

*Lefeuve et al., ACM MUM 2021*

#### **Staging Machines as Controlled by Robotic Agents – The „Plant Watering Robot“**

*Graf, Workshop Contribution, NordiCHI 2020*

### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

How can we motivate people with dementia to drink more? How will our cup work that can move and light up?

### FINDINGS

The first publication describes the idea of Bibo and explains the technical functioning of the first prototype and its development process. In a later journal article, we additionally report on ethical considerations that had to be clarified in this context - is it justifiable to replace human work of caregivers in order to remind them to drink? Does the cup interfere with the privacy or autonomy of people with dementia? Findings from initial exploratory testing of the cup in a residential care home are discussed.

#### **Bibo the dancing cup: Reminding people suffering from dementia to drink.**

*Kollakidou et al. Proc. of IC-IHAW 2021*

#### **Bibo the moving cup for people affected by dementia: Design, ethical considerations and first observations in use.** *Kollakidou et al, SN Journal 2022/23*

### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

How could the topic of intimacy be addressed in the context of care? Which objects could enable or promote physical needs or also intimacy?

### FINDINGS

The workshop contribution introduces the idea of IntiMe and IntimUs. Both ideas approach the topic of intimacy from different angles: While IntiMe asks how the fulfillment of sexual needs of older people could be assisted, IntimUs takes the approach of promoting physical contact between older people in a playful (but non-sexual) way.

#### **Intimate Others**

*Schulte, Workshop Contribution, NordiCHI 2020*

### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

What can we learn from machines that are already being used in care for the design of care robotics? What social situation do we find in such contexts - and how must robotics adapt to it? Who are the users and who has how much influence on the interaction?

### FINDINGS

In a self-test, we tried out so-called lifting devices, which are used to move bedridden residents from the bed to the wheelchair/recliner and back, as well as stand-up aids. The lift is the closest thing to a robot, even if it is controlled. It became apparent that this is an extremely communicative situation in which caregivers AND the cared for actively participate and relate to each other. Caregivers moderate the process, making it a fun event and establishing trust. We discuss that caregiver robotics must take this social situation into account. In a later article, we combine our observations with those of colleagues in Human-Robot Interaction research who had developed a 'reminder robot' for individuals in assisted living and made a similar argument.

**The Interactive Enactment of Care Technologies and its Implications for Human-Robot-Interaction in Care.** *Hornecker et al., NordiCHI 2020.*

**Beyond dyadic HRI: building robots for society.**

*Hornecker et al., interactions magazine 2022*

### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

What can a cleaning robot look like that residents with dementia are not afraid of? How can it be given a second function that activates the residents and creates a joyful ambience? And how do residents react to our cat-shaped robot Sanne?

### FINDINGS

What can a cleaning robot look like that residents with dementia are not afraid of? How can it take on a second function in addition to cleaning? Sanne was tested in several common rooms of a care home. The two publications report results of this study. The reactions of the residents were recorded and analyzed. It turns out that almost all of them (with very few exceptions) either react positively and interested or simply ignore the robot. Even if residents react playfully to the cat form and talk or interact with Sanne as a cat, they are recognizably aware that they are dealing with a machine. It seems important that they can decide for themselves whether Sanne approaches or not and that Sanne is obedient.

### **Don't be afraid! Design of a playful cleaning robot for people with dementia.**

*Grimme et. al., IC-IHAW 2021*

### **Pet-Robot or Appliance? Care Home Residents with Dementia Respond to a Zoomorphic Floor Washing Robot.** *Marchetti et al., Proc. of ACM CHI 2022*

### **Floor cleaners as helper pets – projecting assistive robots' agency on zoomorphic affordances.**

*Grimme et al., SI-Journal 2022/23*



### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

Caregiving robots have long captured our imagination, but many images operate within a fairly narrow understanding of what caregiving should mean. For this publication, we describe fictional robots that deal with themes of spirituality, intimacy, and grief, among others. In doing so, we use the literary trick of writing as if we were doing a market analysis of care robotics in the last decades in the year 2040 - that is, of robots that do not yet exist today.

### FINDINGS

Although many of these robots would not yet be technically feasible, the fictional robots in our publication create a basis for discussion about what kind of caregiving robots in the future, would be desirable and what they could do.

#### **Hospital Beds, Robot Priests and Huggables:**

#### **A (Fictional) Review of Commercially Available Care Robots**

*Schulte et al., NordiCHI 2020*

### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

The article presents the special methodological approach of the ReThiCare project, specifically the collaboration with affected groups and the orientation towards a general needs assessment. It describes how we implemented the so-called paradigm of "integrated research" in practice, i.e. how we worked with a focus on the people affected by the technologies we developed and in close exchange with practice partners and scientists from the fields of ethics as well as social sciences and humanities.

### FINDINGS

We report experiences from our project, which offer concrete tips for other similar projects. For example, we emphasize the importance of the constellation of partners involved, the methods used, and the direct reference to practice - in our case, the proximity to care practice.

**Integrierte Roboterentwicklung für die Pflege. Konzeptuelle und praktische Herausforderungen am Beispiel ReThiCare.** *Bischof et al 2022, TATuP Journal*

### RESEARCH QUESTION / HYPOTHESIS / RELEVANCE

When the social relevance of robot applications is discussed today, the use of assistive technology in care is almost always the first example. So-called care robots are presented as the solution to the nursing crisis, even though there are doubts about their technological readiness and there are no concrete scenarios for their use in everyday care. Why is that?

### FINDINGS

Our analysis of innovation discourses and concrete development practices shows how three social arenas are made available to each other to make the idea of the care robot so powerful: European innovation policy, care organizations, and robotics. From this diagnosis, we derive a threefold critique of robotics in health care that draws attention to the politics, historicity, and social situatedness of care robotics in elderly care.

### A critique of robotics in health care

*Maibaum, Bischof, Hergesell, Lipp, AI & Society 2021*

# CONCLUSION & OUTLOOK



## CONCLUSION & OUTLOOK

With the prototypes and concept studies developed in the project, we want to demonstrate an opportunity space for human-oriented technology design in care. All of these can only be exemplary and representative of new approaches.

On the one hand, our focus was on 'small' robots that serve as intelligent tools or aids, and can be integrated into everyday life and the working environment. This is in contrast to the typical view of large (and often human-like) robots that are imagined as universal autonomous helpers - but on the one hand often do not function technically and on the other hand are also not practicable in the concrete context of care. On the other hand, we developed creative ideas to respond to the 'voids' noted in our empirical research in everyday care - for example, with robots that entertain and encourage communication.

Our work has clearly shown us that the human element in care cannot be replaced and robotics can only be a tool here. Moreover, these tools need to integrate into the overall context. This requires an understanding of work processes as well as the training of caregivers, the organisational conditions in care facilities, etc. Also, ethical challenges are immense if complex technology is to be integrated into this context.

***We all will be old one day and need care. How do we want to be cared for?***



# PUBLICATIONS



# PUBLICATIONS

## 2022

*Sophie Grimme, Avgi Kollakidou, Christian Sønderskov Zarp, Eva Hornecker, Norbert Krüger, Philipp Graf and Emanuela Marchetti.* Floor cleaners as helper pets – projecting assistive robots' agency on zoomorphic affordances. SN Computer Science Journal, Special Issue "Digital Healthcare and Wellbeing" (accepted)

*Avgi Kollakidou, Kevin Lefevre, Christian Sønderskov Zarp, Elodie Malbois, Leon Bodenhagen, Norbert Krüger and Eva Hornecker.* Bibo the moving cup for people affected by dementia: Design, ethical considerations and first observations in use. SN Computer Science Journal, Special Issue "Digital Healthcare and Wellbeing" (submitted)

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*Philipp Graf*. 2020. Staging Machines as Controlled by Robotic Agents – The „Plant Watering Robot“. Workshop Contribution: Otherware needs Otherness. NordiCHI 2020. ACM.

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# PERSONS / PARTNERS

## Universities

Bauhaus-Universität Weimar, Fakultät Medien (BUW)

Bauhaus-Universität Weimar, Fakultät Kunst & Gestaltung (BUW)

Technische Universität Chemnitz (TUC)

University of Southern Denmark / Syddansk Universitet Odense (SDU)

## Practice partner

Diakonie Sozialdienst Thüringen, Residential care home Sophienhaus, Weimar

OK-Fonden, Odense, Denmark

Odense Kommune

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# ADVISORY BOARD

Thomas Bade, CEO/managing director

IUD | Institut für Universal Design GmbH & Co. KG

Dr. med Henning Gockel, chief physician

Klinik für Geriatrie, Sophien und Hufeland Klinikum Weimar

Prof. Dr. Phil. Manfred Hülsken-Giesler,

Institut für Gesundheitsforschung und Bildung, Universität Osnabrück

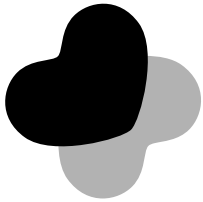
Prof. Dr. Johanna Seibt

University of Aarhus, Denmark, School of Culture and Society

Prof. Dr. Florentin Wörgötter

Arbeitsgruppe Computational Neuroscience, Georg August Universität Göttingen





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## PERSONS A-Z

### Professors

Jun.-Prof. Dr. Andreas Bischof (TUC / Sociology, Science & Technology Studies)  
Prof. Dr. Ing. Eva Hornecker (BUW, Germany / Human Computer Interaction, Project leading)  
Prof. Dr. Norbert Krüger (SDU, Odense, Denmark / Robotics)  
Prof. Wolfgang Sattler (BUW, Germany / Product Design & Interaction Design)  
Associate Prof. Leon Bodenhagen (SDU, Odense, Denmark / Robotics)  
Associate Prof. Emanuela Marchetti (SDU, Odense, Denmark / Robotics)

### Research assistants

Kristian Gohlke, M.Sc. Digital Media (BUW, Product Design & Interaction Design)  
Philipp Graf, M.A. (TUC, Sociology / Science & Technology Studies)  
Avgi Kollakidou, M.Sc. (SDU, Robotics)  
Kevin Lefeuvre, M.F.A. Product Design (BUW, Human Computer Interaction)  
Lakshadeep Naik, M.Sc. (SDU, Robotics)  
Christian Zarp, M.Sc (SDU, Robotics)

### Student assistants

Paul Ballack (BUW)  
Yazan Joseph Banna (BUW)  
Ebbe Vincent Just Christensen (SDU)  
Arika Dodani (BUW)  
Tobias Friedel (BUW)  
Sophie Alice Grimme (BUW/SDU, Master's thesis + student assistant)  
Laurits Valberg Hemmingsen (SDU)  
Roland Kiss (BUW)  
Annika Richter (BUW)  
Mads Bergholdt Sørensen (SDU)  
Mira Thieme (BUW)

### Former team members

Lena Franzkowiak, M.Sc. (BUW, Human Computer Interaction)  
Oskar Palinko, PhD (SDU, Robotics)  
Eduardo Ruiz Ramírez, M.Sc. (SDU, Robotics)

### Associated researchers

Britta Schulte, PhD (BUW, Human Computer Interaction)



**ReThiCare** ReThinking Care Robots

A research project on elderly care technology of the future

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