Mathias Klingner[1], Stefan Vogt[1], Robert Erzgräber[1], Christian Bruchatz[1], Frank Bahrmann[1], Catharina Wasic[2], Manja Unger-Büttner, Undine von Gahlen (3), Elmar Graessel[2] and Hans-Joachim Böhme[1] (2022): Experiences of Co-Creative Development within Co-Care Settings. In: Proceedings of the 20th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing on the Design of Cooperation Technologies - Exploratory Papers, Reports of the European Society for Socially Embedded Technologies (ISSN XXX-XXXX), DOI: 10.18420/ecscw2022-to-be-added

Experiences of Co-Creative Development within Co-Care Settings

Mathias Klingner[1], Stefan Vogt[1], Robert Erzgräber[1], Christian Bruchatz[1], Frank Bahrmann[1], Catharina Wasic[2], Manja Unger-Büttner, Undine von Gahlen (3), Elmar Graessel[2] and Hans-Joachim Böhme[1]

1 University of Applied Sciences Dresden, Germany; 2 University Hospital Erlangen, Germany; 3 Cultus gGmbH

Contact Author: mathias.klingner@htw-dresden.de

Abstract. * Future care systems are expected to be heavily supported by artificial intelligence and robotics. In this positional paper we present field observations of two learning spaces within our AI/robotic-assisted health care living lab. As groups of stakeholders in such care environments are the same with common expectations and concerns, fundamental insights like the necessity of transparent communication and a participatory design process can be transferred between specific spaces. Subsequently, we display our approach for two different environments: nursing home and SMART CO-CARE apartment.

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Introduction

The digital transformation of care environments (inpatient and outpatient) using artificial intelligence and/or robotics is a highly relevant research topic, as it often projects hopes for significantly improving the care system and counteracting effects of demographic change (Sonnenburg and Schröder (2019)). In order to take the interests of the various stakeholders into account (in the best possible way), a co-creative introduction and iterative development is necessary for the initiation of such technology-supported care environments. In this paper we present findings from our Living Lab, which we define as a general concept of AI/robotic-assisted health care around an inpatient geriatric care facility ecosystem focusing on nursing homes (NH) and assisted living apartments (ALA). These two physical spaces with many intersections lead to distinguishable learning spaces that we present in single chapters. While ALA, individual or shared, should feel like home and support the autonomy of its residents, NH provide a more clinical environment focusing on all day medical care. Particularly in the field of ambient assistance systems for people with dementia, it is evident that the involvement from patients is little to none. The focus of research is mostly on safety aspects of care recipients and workflow of caregivers (Topo (2009)). This research gap can be filled by looking at the heterogeneous network of stakeholders under the roof of a living lab.

Stakeholder Focus Groups

Identifying all groups of stakeholders and differentiating between their concerns and wishes is a key aspect for the participatory design process, as they all have their specific interests and cannot be generalized into one group. Table I provides an overview of the involved interest groups, that we identified in our projects. One point mentioned frequently by residents and caregivers is that relatives underestimate the will to autonomy of care recipients. For the administration there might be some concern to include new technologies into a working system. In our case some of the concerns could be leveraged by using demonstrators and showing its usefulness. This can be done by showing that the solution is reducing the workload in specific scenarios or by including new features that amplify aspects within the workflow.

Deploying a Mobile Robot in a Nursing Home

In nursing homes, medical care is provided continuously and needed extensively. Our goal is to support the stakeholders of an inpatient care facility throughout the entire day by the deployment of a mobile robot (Bahrmann et al. (2020)). Therefore we conducted several workplace visits and hospitations for an interdisciplinary process mediation. Participatory design helped us getting to know the work processes and gain a better understanding of the heterogeneous context. This was accompanied by a requirements analysis together with all stakeholders (see Table I). The scope of functions was then discussed in a focus-group-assisted

Stakeholder	Expectations	Concerns	Wishes
Residents / care recipient	• Non-deterioration of well-being and health • Simplification of everyday life	• Violation of the most personal sphere of life • Technology fear or aversion • Unfamiliarity, changing routines	• Preservation of residents own dignity • Longer autonomy • Improvement of well-being • Higher participation in real world
Caregiver	• No deterioration in routines • No additional work, only little technical training needed • Relief in workload*	• Fear of the unknown • De-socialisation of the profession* • Exposure of own weaknesses	• Stress relief • More time for personal interaction with residents
Administration	• Ensure/improve care • Rising of well-being and/or health of residents • Workload relief	• Expense factors* • Adaption of work routines, workshops / trainings	• Reduction of care deficiencies • Collection of a variety of different data together • Increasing attractiveness for residents and as an employer through technology*
Relatives	• Better health monitoring • More security, custodial function	• Unwanted observation • Higher cost of care	• Involvement in care recipient's life • Effort minimisation for aid situations
Scientist	• Holistic real-world data from the natural living environment • Interdisciplinarity	• Not exhaustive content for statements • Ethical considerations on the inclusion of people with dementia	• Phenomonological observation without influence

Table I. Key aspects of each stakeholder in a robotic co-creation environment in nursing care. Items with * can also be found in Fehling and Dassen (2017) .

feasibility analysis. We did not only take primary users into account, but also secondary user-groups. Wasic et al. (2022) claimed that the acceptance of a mobile robot by secondary user-groups is significantly influenced by the perceived usefulness. Furthermore we involved the workers' council due to data protection interests like camera monitoring of the workplace and handed out information sheets and informed consents to all participants. The development process was accompanied by regular exchange to ensure the understanding of feasibilities and work progress/statuses. We used the Wizard of Oz technique to explore the action domain in iterative roll-outs / deployments.

The identified use cases include the support of a multi-modal psychosocial group therapy for people with dementia, patrolling in the night and serving as a vigil/guard. The group therapy covers motor, everyday practical, cognitive and social activation (Grässel et al. (2011)) and is intended to maintain the cognition and practical abilities of the patients as long as possible. During the night the robot patrols the corridors and can, if necessary, drive towards wandering or fall-endangered patients, involve them in a conversation and notify the staff via an app while transmitting an image of the situation. Furthermore, the robot has a first aid kit attached and can be called by the staff to any place in the facility. When patients with severe cognitive impairment need to be observed, the robot can be used as an alternative to medical or physical fixation or a human sitting vigil. If necessary, the robot can also observe vital parameters and calm down patients in a

state of distress. In all of this, the robot's embodiment proved to be an important factor for conveying its technical capabilities and during interactions it was personified and addressed with she, although everyone knew it is a robot.

SMART CO-CARE Apartment

Planing and integrating a cyber-physical system into an existing assisted living complex was a challenging project, where previous experience was of great benefit. Former living lab projects allowed us to gain insight not only into the necessary administrative processes, but also into the expectations, concerns, and prejudices of relevant stakeholders (see Table I). Introductory sessions were held in the assisted living complex for the local administration as well as for residents and caregivers. At these events information was gathered through discussions and Q&A sessions. In addition, a workshop series took place to bring together local and top-level administrators, caregivers and researchers from different fields in a structured design thinking process (Bruchatz et al. (2019)). The goal of these events was to clarify what the stakeholders thought the apartment could be used for, what benefits they expected, and how these could be achieved. Furthermore, nine months of experiences from the first long term resident are available.

The SMART CO-CARE apartment and a mobile robot have some commonalities. Both can be perceived as autonomous agents. Both can observe and interact with their environment via sensors and actuators. However, there are differences. The most prominent is the missing embodiment. Currently, caregivers and other stakeholders prefer to visually perceive their counterpart in an interaction. To counteract this invisibility, we will render the apartment perceptible in two ways: (1) Incorporating a mobile robot and (2) using a virtual avatar (Gross et al. (2019), Ortiz et al. (2007), Costa et al. (2014)). The integration of a mobile robot can be done in at least two ways. Choosing the robot as an embodiment of the apartment or as an autonomous agent connected to the apartment and expanding its functions (Bahrmann et al. (2020)). Augmenting the environment of a physical learning space like the apartment with additional information, functions and an interactive avatar is promising with regard to all stakeholders Liu et al. (2022)). Both integration strategies can also exist aside, extend each other and therefore extend the spectrum of functionalities of the mobile robot as well as those of the learning space SMART CO-CARE apartment.

Conclusion

In the context of inpatient geriatric care facilities participatory design and co-creation lifelong learning spaces are essential pillars to develop systems which are both useful for and accepted by all involved stakeholder. Especially the interdisciplinary participatory design process is a necessity for sucessfull projects regarding all aspects of the digital transformation in health care settings. The resulting mutual understanding and appreciation helps to prevent the development

of technical sound products which are of no real in-field use and clarifies the current technological capabilities.

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†Ethical Statement - All human studies described have been conducted with the approval of the responsible Ethics Committee, in accordance with national law and in accordance with the Helsinki Declaration of 1975 (as amended). A declaration of consent has been obtained from all persons involved.