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Diversifying Smart Home Contexts

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Abstract. Advances in smart home technological innovation over the years has seen an increase in consumer interests. However, research contexts for smart homes tend to skew towards "traditional" living and housing situations. Through my Ph.D. research, I raise awareness of the need to consider other user contexts and living situations. I do this by exploring opportunities for smart home innovation with elderly women who live alone. I work with the elderly women to understand their values, needs, and collaboratively create new smart home devices. The outcome of my research would be smart home devices that support the lives and contexts of elderly women living alone.

Overview of Research

The past five years has seen a rise in user interests in smart home devices especially in Germany. Nonetheless, the smart home concept is yet to be realized on a massive scale. This is attributed to research not acknowledging the household as a complexity of relationships and the concept of smart homes advanced as a neutral and bland place (Richardson, 2009). In CSCW and HCI, domestic and home research like Odom et al. (2019) & (2010), Leshed et al. (2014) and Jenkins (2017) examine less mainstream contexts such as collective and mobile living, divorced families, farm families, and co-housing. There however still exists a research gap for other family and living situations (e.g. older lone persons, one parent families with children, etc.). This means including the less mainstream and avoiding the one-size fits all concepts in design. My PhD

research approaches the smart home discourse with a diversity lens. I raise awareness of the diverse contexts of the "home", living situations and social relationships. I work with elderly women (≥65 years) who live alone and investigate opportunities for smart home devices that meet their values, needs, skills and experiences.

Owing to the gender gap in life expectancy, elderly women spend a greater part of their elderly lives alone. In the EU, elderly women represent the largest proportion of women living alone. Elderly women may suffer more from advances in technological innovations as they are designed with young adults in mind. They may also have financial constraints in purchasing smart home technology. Elderly women living alone will have different sets of needs as compared to what Hargreaves et al. (2013) describe as the typical notion of smart home consumers: middle-class white family with children. Furthermore, the social relationships of persons living alone differ from persons who live with others. Identity factors such as age, education, gender, economic status are key determinants of the quality of life in old age (WHO, 2002). Diversifying smart home design acknowledges the complex identities of persons and claims these should drive design.

Research Motivations and Methodology

This PhD research is part of an overarching research project INTeGER (Innovation through Gender in Computing). The project examines innovations in Computer Science and its gendered aspects. Examining gender and diversity aspects in technology use and development can advance gender equality, avoid oppressive technology, address biases in technology use and ownership and uncover overlooked perspectives (Everts et al., 1998, Eubanks, 2018).

My PhD research examines smart home innovations and the role of gender and diversity in driving design. Academic research is narrow in providing guidance in extending Information Technology development and design to cater for the complexities of user identity, gender and diversity aspects. My research also examines collaborative creation of smart home technology. As tools and techniques in collaborative creation must reflect the users skills, interests, etc., it is interesting to discover which materials, artefacts, tools and techniques deliver prototypes when working with elderly women. My research questions are:

- What tools and techniques support the collaborative creation of smart home technology with elderly women?
- What factors allow the carry-on of gender and diversity stereotypes in creating smart home technology?
- What effects does working with diverse users have on generating diverse ideas?

My first approach to this research was to conduct a literature review of theories and related research in smart homes, innovation, gender & diversity and collaborative creation. I adopted Participatory Design as the design approach for collaborative creation as it empowers less heard voices to equally participate in the design process (Spinuzzi, 2005). Data (qualitative & quantitative) from semi-

structured interviews and co-creation sessions will be analysed to provide insights and inform the design of a smart prototype for the home. Next, a field evaluation using qualitative and quantitative research methods (interviews and device logging) will be conducted.

Work/Findings to Date

I present below the four stages I have defined to carry out my research work.

- Background Research: Initial research into related research projects and literature was done find the research guiding path. The literature review concentrated on the topics (smart homes, innovation, gender & diversity and collaborative creation above) and gave an assessment of the current state of research on the topics and direction on how to position my research.
- User Research: In the next stage, seven elderly women (see Table I.) were recruited for the study. A getting-to-know session, semi-structured interviews and a study of use experience with a smart speaker (Amazon Echo Dot) have been carried out. The studies brought to light the values of the women. These include freedom, independency, social circles. It highlighted the role of their friends, hobbies, and social as key structure. All women were unable to use the smart speaker due to factors such as lack of Wi-Fi, privacy & security concerns.

Table I. Demographics of the elderly women. All names have been anonymized.

PID	Age	Years living in current home	Years living Alone
Anna	81	51	10
Heike	83	50	7.5
Emma	82	50	3
Beate	80	38	3
Eva	79	45	11
Hanna	75	19	19
Barbara	79	55	1.5

- Collaborative Sessions: The next stage will be to conduct co-creation workshops with diverse user groups with tools and techniques identified for this purpose. This will provide the platform for further classification of methods, tools and techniques for gender and diversity driven PD. These workshops will empower users with the needed tools and techniques to innovate smart home technology based on user contexts.
- Development & Evaluation: Design insights, ideas and prototypes from the step above will be conceptualized and developed into research prototypes. A further step will evaluate the prototypes with the elderly women.

Next Steps

I look forward to conducting regular co-creative sessions with the elderly women this year. This will consist of make activities that lead to smart prototypes for their homes with materials and tools they are familiar with. The prototypes from will inform the design of a smart home device that I will develop. The device will be evaluated with the elderly women for a period.

Expected Contributions

I contribute to the dialogue on diversifying smart home contexts and raise awareness of the complex identities of older persons. My research addresses age stereotypes especially in the design of smart home technology. It shifts the focus from the stereotypical notions of disability, illness, etc of old age and finds other needs that accommodate the diverse (intersectional) identities of elderly women. Finally, I look forward to presenting design considerations and prototypes to the CSCW and HCI community that works with diverse user groups for smart home design at the end of my research.

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