

Position Paper for Workshop 10: “Physicalization from Theory to Practice: Exploring Physicalization Design across Domains”

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Abstract

This position paper is an application for the workshop “Physicalization from Theory to Practice: Exploring Physicalization Design across Domains”. I will first give a short introduction to the smart home domain, followed by a paragraph referring to connections to the suggested topics of personal informatics, sustainability, office vitality, and education. Finally, an overview of the challenges of designing for individuals living in smart homes will provide ideas for data physicalizations in this context. Devices could include, for instance, approaches for individuals to track habits to achieve personal goals or support reflection towards sociotechnical effects of technology used in the domestic environments, focusing particularly on the cohabitation of several people.

Keywords: smart home, data physicalization, reflection, habit tracking

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1 Introduction

The number of connected devices in households will increase significantly in the next years. Users access most information concerning the smart home network through touchscreens, typically on mobile devices such as tablets and smartphones. These interactions sum up to the already long screen time of most users. Cultural phenomena such as the video genre of

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“Oddly Satisfying Videos” suggest that individuals seek tactile experiences in their everyday lives while trying to satisfy this need in virtual environments [9]. We are investigating what more tangible interactions for the smart home should look like, including the input and output within IoT networks. Starting from incorporating materials that feel rather analog to users, we strive for connected devices that support users in reengaging with the physical world [6]. In this way, we hope to encourage individuals to utilize technology in the home more self-determinedly.

2 Domestic Environments as a Context for Data Physicalization

In the call for papers, the proposed domains *personal informatics*, *sustainability*, *office vitality*, and *education* are all situated in domestic environments, considered as the base where individuals reflect on their personal life. As climate change is one of the major challenges of this century, sustainability is, for many individuals, a goal towards which they would like to change their behavior. The purchase of smart home components is often advertised and justified with the motivation to reduce energy consumption [3, 8, 10]. With increased remote working and many self-employed individuals, work and private life blend more and more. Thus, office work is a relevant practice when designing home technology. The topic of education takes place in different forms at home. For instance, education is an everyday challenge for people living with children. Among adults in smart homes, sharing and passing knowledge about the network among cohabitants is, from our understanding, crucial for equally positive user experiences within shared, connected homes. In the context of personal informatics, the home is where humans mostly start from or return to while working on establishing or letting go of habits and routines. All these topics can be relevant for inhabitants of smart home environments as part of their everyday lives. However, talking about data in smart home environments often relates to quantitative data collected by connected sensors and systems in the network. The humans and their individual needs - associated with

their personal goals and efforts to achieve them - are rarely considered in the representation of smart home data.

3 Challenges in Smart Homes

Current user experiences of smart home components seem tailored to one primary user – the person who purchases, sets up, and maintains the connected devices, who typically has a strong technological interest [1]. They often enjoy making sense of statistical data associated with monitoring and automating their home. Other cohabitants in shared households often feel discouraged from engaging with the technology, and the associated data [5]. As a result, power and knowledge distribution in smart households often occur aligned with heteronormative gender roles and reinforce such [1, 5, 10]. One challenge in the smart home domain is counterbalancing the sociotechnical effects of cohabitation on gender roles aiming for equal access to information and control. To move in that direction, we are working on designing interfaces that foster collaborative usage of individuals, empowering users to co-create their shared, connected homes with positive experiences encouraging social behavior [6]. For instance, the distribution of household labor and associated cognitive load, often discussed along the term “mental load” [2], is, from our understanding, a suitable topic to include in data representations to support humans to reflect on and keep track of, ideally collaboratively. However, since furnishing a home is a highly individual process and continuously evolving, we aim to design solutions that support personalization and enable them to visualize any information users would like to keep track of or accentuate with data representations in their everyday lives.

Overall, we follow principles from calm computing, tangible [7], and blended interaction [4] and aim for an analog look and feel of the devices [6]. In our current work, we focus on designing interfaces for the documentation, set-up, and maintenance of IoT networks accessible to several users in a shared household. Incorporating data physicalizations for these topics might be beneficial since the tangible form facilitates collaboration and discussion among several individuals [7]. Accordingly, we are looking for tangible representations of, amongst others, the statuses of devices and associated notifications. Further, we would like to incorporate data about the cohabitants’ everyday life that goes beyond quantitative information to address their needs and promote their well-being, such as chores and their distribution among users or tracking of habits individually or acquired collaboratively.

Ideally, these representations will promote reflection of humans in their surroundings and encourage behavior changes towards reaching their personal goals. However, a shared household is an environment in which social dilemmas, as stated in the call for papers concerning sustainability, created by the clash of individual and collective interests, often

occur on a large scale as well as locally, regarding, for example, the distribution of mental load of cohabitants. Further, the reflection of their behavior is inconvenient sometimes – users might feel uncomfortable facing some topics. Several questions regarding the presentation of data in domestic environments arise. When are users willing to engage with representations of data? How are there differences regarding the kind of information? Does the display of the information cause stress for other cohabitants? How to deal with social dilemmas, tensions, and conflicts in a shared household? For the design of physicalization in domestic environments, some users might enjoy statistical and quantitative visualizations of data, whereas others prefer more tangible representations. Further, the dynamics of relationships might impact users’ attitudes towards devices and data representations; an individual might reject or feel intimidated by an artifact just because another person is pushing them to engage with it. In other situations, rituals designed around data exploration at home might motivate users to engage with data collaboratively. In another context, an individual might enjoy spending time with a data representation to take a moment for themselves, understanding the experience as a personal retreat. In this case, privacy and the location within the home might play an important role in the design of a physicalization. Conclusively, although domestic environments are quite specific locations, they inhabit many different contexts and domains for data representations that each come with specific requirements worth exploring and discussing.

4 About the Author

Currently, I am a PhD Student at the Media faculty of the Bauhaus-University Weimar in cooperation with the Robert-Bosch GmbH. I am located in the company’s research department for User Experience, exploring tangible interactions in the smart home context. My focus is currently on experiences appealing to the different users in shared households. In designing interactions, I aim to balance addressing users’ individual needs while fostering social behavior. Participating in this workshop will allow me to learn about tangible representations of data and how to incorporate them into interaction designs. I will bring experience with designing for the context of smart homes considering the usage of devices by multiple individuals simultaneously and a sensitive view to sociotechnical effects.

References

- [1] Line Kryger Aagaard. 2022. When Smart Technologies Enter Household Practices: The Gendered Implications of Digital Housekeeping. *Housing, Theory and Society* 0, 0 (June 2022), 1–18. <https://doi.org/10.1080/14036096.2022.2094460> Publisher: Routledge_eprint: <https://doi.org/10.1080/14036096.2022.2094460>.
- [2] Liz Dean, Brendan Churchill, and Leah Ruppner. 2021. The mental load: building a deeper theoretical understanding of how cognitive and emotional labor overload women and mothers. *Community Work & Family* (Nov. 2021). <https://doi.org/10.1080/13668803.2021.2002813>

- [3] Kirsten Gram-Hanssen and Sarah J. Darby. 2018. "Home is where the smart is"? Evaluating smart home research and approaches against the concept of home. *Energy Research & Social Science* 37 (March 2018), 94–101. <https://doi.org/10.1016/j.erss.2017.09.037>
- [4] Hans-Christian Jetter, Harald Reiterer, and Florian Geyer. 2014. Blended Interaction: understanding natural human–computer interaction in post-WIMP interactive spaces. *Personal and Ubiquitous Computing* 18, 5 (June 2014), 1139–1158. <https://doi.org/10.1007/s00779-013-0725-4>
- [5] Jennifer A. Rode and Erika Shehan Poole. 2018. Putting the gender back in digital housekeeping. In *Proceedings of the 4th Conference on Gender & IT (GenderIT '18)*. Association for Computing Machinery, New York, NY, USA, 79–90. <https://doi.org/10.1145/3196839.3196845>
- [6] Annika Sabrina Schulz and Eva Hornecker. 2022. Can you please cover both the "smart" and the "home"? Exploring expectations on smart homes considering changing needs. In *Proceedings of the 21st International Conference on Mobile and Ubiquitous Multimedia (MUM '22)*. Association for Computing Machinery, New York, NY, USA, 128–137. <https://doi.org/10.1145/3568444.3568447>
- [7] Orit Shaer and Eva Hornecker. 2009. Tangible User Interfaces: Past, Present, and Future Directions. *Foundations and Trends® in Human–Computer Interaction* 3, 1-2 (2009), 1–137. <https://doi.org/10.1561/11000000026>
- [8] Yolande Strengers and Larissa Nicholls. 2017. Convenience and energy consumption in the smart home of the future: Industry visions from Australia and beyond. *Energy Research & Social Science* 32 (Oct. 2017), 86–93. <https://doi.org/10.1016/j.erss.2017.02.008>
- [9] Stefan Werning. 2020. Remediating Tactility: The re-negotiation of sensory experience in satisfying videos on YouTube. *interin* (2020). <https://seer.utp.br/index.php/i/article/view/2229>
- [10] Charlie Wilson, Tom Hargreaves, and Richard Hauxwell-Baldwin. 2015. Smart homes and their users: a systematic analysis and key challenges. *Personal and Ubiquitous Computing* 19, 2 (Feb. 2015), 463–476. <https://doi.org/10.1007/s00779-014-0813-0>