Towards Panopticons of Convenience: Power in the Nordic Smart Home Assemblage

Power in the Nordic Smart Home Assemblage

Nils Ehrenberg*
Aalto University, Department of Design
nils.ehrenberg@aalto.fi

J. Tuomas Harviainen
Tampere University, Faculty of Information Technology and Communication Sciences
tuomas.harviainen@tuni.fi

Jaakko Suominen
University of Turku, Faculty of Humanities
jaasuo@utu.fi

ABSTRACT

The introduction of smart home technologies shifts the social relationships in the home by replacing parts of the home assemblage with digital components. This article makes two contributions, first it analyses the influence of panopticons of convenience, which it conceptualises as *'The acceptance of additional surveillance upon one's life for the purpose of acquiring actual or presumed convenience'* in smart homes. Second, through an empirical expert interview study it identifies several examples of how intentions and implementations of smart home technologies facilitate behaviours that cause or reinforce inequalities in the home. These examples are then used to understand how the panopticons of convenience contribute to the abjection of the less tech-savvy residents of these homes and to reflect on how these technologies shape energy consumption in the home.

CCS CONCEPTS

• **Human-centered computing**;

KEYWORDS

smart homes, power relations, convenience, alienation

ACM Reference Format:
Nils Ehrenberg, J. Tuomas Harviainen, and Jaakko Suominen. 2023. Towards Panopticons of Convenience: Power in the Nordic Smart Home Assemblage: Power in the Nordic Smart Home Assemblage. In *26th International Academic Mindtrek Conference (Mindtrek '23), October 03–06, 2023, Tampere, Finland*. ACM, New York, NY, USA, 10 pages. https://doi.org/10.1145/3616961.3616962

1 INTRODUCTION

The past years have seen a huge wave of smart home technologies making their way into our homes which has garnered the attention of researchers discussing the implications of technology in the home [50]. While a major aspect of the smart home involves technologies such as heat pumps and tools for measuring energy consumption such as smart thermostats to save energy, other technologies include smart doorbells or locks as ways of improving the security of the home, air quality sensors, entertainment systems that allow us to access and control all our media throughout the home, and appliances such as robot vacuum cleaners that allow us to automate housework. In Intel's vision of the ambient home these devices are to deliver protection, productivity and pleasure [53] which is to be realised through lower energy costs, reduction of labour, added convenience, or improved security. Despite these promises various scholars argue that these kinds of automation increasing devices have historically fallen short of similar promises and instead offer increased domestic labour due to shifting expectations [12, 54]. The way these technologies fall short is not unique to smart technologies, but rather a trend that is visible for nearly a century, starting with the electrification of the home and the introduction of electric domestic appliances such as vacuum cleaners [12]. The premise of the smart home delivering improved energy efficiency appears to be similarly unfulfilled [14]. Drawing on Strenger's [52] notion of the resource man, Johnson [29] suggests that the smart home create a *'flexibility woman'*, where women who are familiar with the chores need to do additional labour of adjusting household tasks in accordance with new technologies. This additional labour is further explored by Aggeli et al. [4] and Aagaard and Madsen [2], who explore the additional physical and mental load of this labour and how it falls on women. And while the smart home may offer various conveniences, they also reshape the domestic practices and the power structures of the home [17, 52].

Domestic technologies supposedly enable more conveniences and energy consumption control at home, by freeing their users from certain tasks and allowing better measurement of others. Utilitarian thinkers such as Jeremy Bentham argued that morality was based on what brings the greatest happiness to the largest number of people [7]. Within this mindset there is a notion of how if things can be measured, we can know how good they are. One of the critiques to Bentham's thinking was done by Michel Foucault [19] who perceived measuring and normative judgements as disciplinary tools of control. Yet this idea of quantifying decisions remains popular and can be seen through self-tracking practices such as Quantified Self [36] and by extension in the smart home where sensors observe every action or inaction. A central idea to the introduction of smart technologies is to free up humans from mundane tasks so that they can focus on what is important. The vision of computing as a tool for extending human cognition and freeing ourselves from mundane tasks also brings challenges in terms of who participates and benefits from this vision. This implementation of technology has also brought forward new discourse

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Mindtrek '23, October 03–06, 2023, Tampere, Finland
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ACM ISBN 979-8-4007-0874-9/23/10.
https://doi.org/10.1145/3616961.3616962

in research of what these technologies mean for domestic work as all these new technologies need to be set up and maintained (e.g., [23, 55, 58].

In this exploratory article, we consider the re-shaping of domestic power structures through smart technologies and how they involve the acceptance of additional surveillance in return for perceived advantages. This article makes two contributions. First, we analyse the influence of panopticons of convenience which we conceptualise using existing literature. Second, we explore how panopticons of convenience create new power imbalances and experiences of surveillance, and how they affect energy and invisible work.

2 RELATED WORK

2.1 Smart Home Technologies

It is worth noting that in many ways smartness is, by its very nature, vague due to how new or emerging technologies are perceived as smart, while technologies that are already adopted often are not perceived as such despite largely fitting the criteria. The expectations for what automation is counted as *'smart'* are therefore continually shifting to function more as a marketing term or to indicate what is new or at least not yet mainstream. Berry et al. [8] suggest a smart home is more of a *'fluid and unstable field of possibilities'*. A human-centered design approach suggests that a smart environment is one which allows the residents to behave in a smart way [31]. Harper [24] refers to smartness in the smart home as based on the interactive technologies it contains. Aldrich [5] defines the smart home as: *'a residence equipped with computing and information technology which anticipates and responds to the needs of the occupants, working to promote their comfort, convenience, security and entertainment through the management of technology within the home and connections to the world beyond.'*, a definition also supported by Strengers and Nicholls [54]. Gram-Hanssen and Darby [22] suggest that what defines a smart home is a shared *'understanding that smart homes incorporate digital sensing and communication devices'*, devices which communicate seamlessly. Implicit in these definitions is a non-trivial, or at least non-customary, extent of seamlessness, sensing, anticipating, and responding beyond a few individual responsive devices.

There have been several critiques to both the smart home and to smart technologies as such. Sadowski [48] argues that smart technology is sold as the inevitable next generation of technology that offers modest conveniences in return for filling our lives with machines collecting data about every aspect of our lives. Sadowski [48], while drawing on Foucauldian discipline theory, then asserts that the data is used to build technology aimed at managing the users. Similarly to Sadowski, Ehrenberg and Keinonen [17] also utilise Foucauldian theory to explore how smart homes reshape power relations between couples through various mechanisms. These mechanisms show how control is exercised beyond intent through observation, examination, and judgement. Through these mechanisms smart technologies can shift or reinforce existing power relations in the household due to how smart homes are often introduced or supported by one person in the household (See [3]. The presence of Foucauldian power relations in the smart home can be perceived through how smart technologies determine actions of non-users, as well as the difference in levels of control between users even while there is no clear conflict (e.g., [27]). The maintenance of technology in the home is often associated with technical expertise, which by extension has been associated with male gender identities [23, 32].The dominant role of men in introducing and managing smart home technologies is something that has been observed by other researchers in the field [20, 26, 43, 56], and Strengers [52] argues that the smart home is an attempt to perform an archetypal male vision focused on energy efficiency and reduced household labour. Mechlenborg and Gram-Hanssen [41] have called for the inclusion of gender perspectives with more nuanced understandings of gender when conducting energy research, considering how the energy practices and household technologies are shaped. Sadowski et al. [49] argue that the smart home can be understood as a *'Big Mother'* which can be understood as *'a system that seeks to enact a commodifiable digital surveillance of the home under the guise of maternal care'* [49], and connect that to the development of new markets of data. Companies like Amazon and Google are also deploying smart home technologies, in an attempt at shaping consumer behaviour through the use of data with an offer of convenience, which Huberman [25] perceives as an example of Surveillance Capitalism [62]. Goulden [21] also explores the corporate entry into the home and argues that it is an vehicle for domestic consumption aiming to pacify domestic life. Although these are closely related and important concerns, unlike Surveillance Capitalism this paper is focused on intra-home surveillance rather than the external threats to the household.

The adoption of the smart home is often presented as either an inevitable development or as a necessity in order to make housing more sustainable, as we try to reduce energy consumption while facing climate change. Wilson et al. [60] identify managing the home as the main benefit presented in marketing materials for the smart home. As a result, research often focuses on the obstacles for adoption of the smart home, rather than on the desirability of such an environment. However, in recent a study on smart home marketing materials, Chambers [10] notes that smart home technologies have often been designed with men's need in mind, questioning the gendered scripts embedded in smart home technologies. Chambers [10] notes that while smart home technologies have the potential of being designed with a caregiving approach (including for the environment), this potential remains unrealised as the designs often neglect the care practices within diverse households. Wilson et al. [59] identify privacy and control as key challenges for smart home adoption. This is further expanded by Marikyan et al. [38]) who note a combination of technological challenges (e.g., security, complexity, and interoperability), financial and legal challenges (price and uncertain regulations), as well as knowledge gaps and psychological resistance to adoption. Jensen et al. [28] identify three personas for users to adopt the smart home based on reason, ethics, and aesthetics. There is an underlying assumption that the smart home is desirable and the ethical arguments supporting adoption are rooted in efficiency with little reflection on how these technologies will re-shape social relations and structures.

The premise of the smart home requires the continuous collection of data through sensors. According to Foucault [19], the idea of constant surveillance is enough to regulate the daily behaviour of those under it. Foucault [19] critiques Jeremy Bentham's [6]

notion of a panopticon. Bentham, a 18th century British philosopher, conceptualised a prison that he called a panopticon (meaning *'all-seeing'*) where the prisoners could be constantly surveilled without seeing the guard [6], and although this is often perceived as a dystopian vision it was intended as a humanitarian solution by Bentham, as it would achieve its aims through apparent rather than real punishment. Foucault extended this as a way of describing how power is exercised by institutions in society, regulating and shaping the behaviour of anyone that falls under the panopticon. As those who are under a panopticon have no way of knowing whether they are currently surveilled, they have no choice but to internalize the surveillance and self-regulate their behaviour as if they are surveilled, whether someone is watching or not. The concept has since been explored in various contexts such as Zuboff's information panopticon for workplace monitoring [61] or Mathiesen's synopticon [40] where the many watch the few. With the rise of digital technology, the term digital panopticon has come to refer to the constant harvesting of personal data by companies or governments to track, predict, or shape the behaviour of citizens through what de Laat [34] refers to as predictive discipline, which he argues is even more diffuse and where the deviation from norms may trigger close attention or restrictions. Here, we raise the issue that if a smart home is filled with convenience-giving technologies that surveil and measure the inhabitants, while only one partner is able to fully control those technologies, what happens to the others who inhabit such spaces?

2.2 Smart Home Making

It is difficult to discuss homes and homemaking without considering gender and how certain practices in the home are considered gendered, which creates an imbalance in expertise (e.g., [12]). Research into technology in the home has explored digital housekeeping as the practices of setting up and maintaining home networks, as well as the comprehension of systems, ability to transfer knowledge, and automation of practice [23, 32, 58]. Further research has also explored how technical expertise in the home relates to male identity and masculinity [47]. Martin [39] has also extended the notion of digital housekeeping towards energy housekeeping, to further examine the gendered aspect of energy management in the home, noting that men control the domestic practices of others by interpreting, policing, and orchestrating energy use. Energy housekeeping also resonates with Mechlenborg and Gram-Hanssen's [42] study on photovoltaic systems, where energy management and monitoring is perceived by the participants (and accepted in society) as a masculine homemaking practice. Homes and homemaking have historically been domains which are dominated by women and while many of the smart home technologies are rooted in the home technologies which are more likely to be associated with men - technologies related to efficiency and energy-saving - they also extend into the rest of the home, as such digital domestic work has garnered the attention of researchers in the past years [50]. Kennedy et al. [32] observe that much like traditional housekeeping, digital housekeeping is unevenly distributed both within the household but also between genders, with men often taking on a larger amount of the digital housekeeping while women are often disinterested even when possessing the necessary expertise. Strengers and Nicholls [55] extend this further by commenting that while this leads to *'more work for father'*, to play on Cowan's [12] seminal work, it is also work that is driven by their interest, while Coggins [11] suggests that smart domestic technologies alter rather than reduce labour. As such, the smart home is usually introduced and maintained by male actors, and Strengers and Nicholls [55] also express that new digital technologies lead to new forms of domestic labour. Going further, Strengers et al. [53] consider smart homes to offer protection, often in the form of security or surveillance. Productivity in particular, often comes in the form of small conveniences of reduced labour, and pleasure that often relates to lighting or audiovisual systems. And while greater male engagement with domestic domains ought to improve equality within the home, Ehrenberg and Keinonen [17] show how these technologies may infrastructure existing inequalities, in part because smart technologies have a strong tendency to concentrate power towards one user [59].

Rode and Poole [47] refer to the maintenance of technology in the home as digital housekeeping, showing both how technology is part of the co-construction of gender identities but also arguing for a need for expanding our understanding of the co-construction and for designers to take it into account. Other researchers have also argued for the inclusion of non-expert users in the design process as a way to mitigate inequality [20, 43]. However, while the smart home maker participates in selecting the technologies in the smart home, they also become responsible for maintaining the system, thereby perpetuating certain notions of what kind of labour is worth doing and whose labour matters (e.g., [30]), indicating that the new order is no more balanced than the old.

2.3 The Smart Home Assemblage

As the smart home is defined by the technology that is integrated and how these technologies communicate, it is worth considering that the home is increasingly an assemblage of technologies (e.g., [51]). Maalsen [37] argues that due to the rise of the Internet of Things (IoT) and smart technology approaches, we must reconceptualise the smart home as an assemblage. When reconceptualising the smart home in this way the notion of a fluid assemblage, introduced by Redström and Wiltse [45], provides a useful lens for understanding how the smart home exerts power by shifting the flow of information and material in the home. The term fluid assemblage is used to describe how contemporary digital technologies are not just made up by a variety of components and connections, but also changing over time through either user inputs or through self-learning algorithms. We thereby extend the smart home to not just be the building with the technology but an assemblage that also includes the people within it, their practices of maintaining and living in the smart home, and where the physical boundary of the smart home is porous as the technologies extend beyond the walls of the building [15, 22].

Within the assemblage of the smart home expert users can exert power by shifting the flow of information and material throughout the home, causing other residents to feel disempowered due to lack of control or understanding of the technology [3, 17]. When the home assemblage shifts into a smart home assemblage, it is through the replacement of certain parts of the home assemblage

with technological alternatives. This is often done with a focus on so-called *'invisible work'*, a term used to describe unpaid women's labour such as housework or volunteering that while essential is economically devalued [13]. In the smart home assemblage, men who are themselves not responsible for the domestic work replace existing practices such as manual cleaning with robot vacuum cleaners. This creates a power discourse in terms of which practices are deemed important enough to be done by humans and which should be automated and shaped by how these practices are considered gendered. Recent research has also paid attention to how women adopt the smart home, noting obstacles both in terms of inadequate awareness of the smart technologies available but also how the technologies do not match the users' desired product types [44].
The ways in which control of the involved technologies are often solely understood by one partner invite us to observe the presence of foreignizing abjection here. This is, in an institutional and organizational, neo-Kristevan reading of displacement an exclusion from agency (see e.g., [46]). The abject is that which is neither a subject or an object of actions, being a pushed-away part of humankind that does not conform to the normative expectations of the surrounding environment. Abjects are simultaneously displaced and desired [33], in this case as partners. As discussed below, panopticons of convenience evoke sensations of alienation from control functions of one's home, of being neither in control nor being controlled, but rather of having a presence inside a space (the home) that is experienced as essentially alien due to the smart technologies which one does not fully comprehend nor is able to control. At the same time when the non-tech-savvy inhabitants experience abjection due to this lack of control, they also experience the constant surveillance. the surveillance does not control them per se, but it is omnipresent in the home and thereby a regular influence on their everyday lives.

2.4 The Panopticons of Convenience

While the idea of the panopticon has its origins in Bentham's 18th century prison design as a tool of surveillance and control, it was further expanded upon by Foucault [19] as a metaphor for the modern disciplinary society, especially in governmental institutions. It has since remained a popular lens for interpreting how surveillance shapes society by making the surveyed internalize the surveillance and act as if they were constantly under observation. Deleuze [16] expanded the institutions to also consider family as an environment of enclosure while arguing that the disciplinary society is in the process of being replaced by a society of control where the enclosures are more modular, without clear beginning or end. Considering family, or the home, as an enclosure further has implications in terms of whether, as much of literature on smart home threats, one considers external forces which is an important avenue of research, or the implications of intra-home surveillance.

However, while the smart home discourse above shares many of the aspects of the panopticon discourse, it is also different in that it is willingly implemented as well as embraced or at least accepted by the people most directly affected by it for the sake of convenience. The smart home forms a new kind of panopticon. We define a panopticon of convenience as, *'The acceptance of additional surveillance upon one's life for the purpose of acquiring actual or presumed convenience.'* Panopticons of convenience form a useful lens for understanding how the smart home reshapes social relations and the agency of its residents. Ehrenberg & Keinonen [17] applied a similar framework focused on Foucauldian discipline where they identify five different mechanisms of control. Going further it might be possible to separate these mechanisms into those that shape behaviour through surveillance or by creating affordances. However as one does this it is worth noting that even when smart technologies that shape behaviours through affordances require surveillance through sensors, even if the data collected is not further utilised. Smart technologies therefore contribute to the acceptance and experience of surveillance, regardless of whether the data is actually utilised or viewed.

3 METHODS

We conducted an empirical study consisting of eight semi-structured interviews [18] in five two-gender households. The households were selected based on one of the inhabitants in each being an early-adopter expert on smart home technologies and were found through a snowballing approach. Expert plus partner interviews were initially selected as the key method in order to gain access to insight about why people have welcomed the technologies into their homes and what they perceived as implications of said technologies, well before the technologies have become commonplace and the resulting panopticons of convenience accepted without reflection. The approach enabled us to also detect potential power imbalances as well as co-dwellers' possible reluctance to actually accept the presence of the technologies involved. The interview study consisted of two phases, first one where we sought out people who introduced significant amounts of smart technologies into their home, followed by seeking out their partners, henceforth referred to as co-dwellers. While we did not set a defined limit on the number of smart technologies, the initiators all share some intent in terms of an intentional *'smartification'* of the home as a goal. The initiators were all men (which follows common narratives of the smart home in other research) which reinforced the need to also interview their partners. Two of the co-dwellers declined to participate and while they did not give any reason as to why, other co-dwellers also expressed uncertainty about what they could contribute to the conversation as their husbands were the ones who built, set up, or introduced the smart home technologies.

Each semi-structured interview with the initiators took between 60-120 minutes while the co-dweller interviews each took 30-60 minutes, although the same amount of time was available for the interviews. The interviews were conducted individually to ensure the participants were not influenced by their partners. The interviews were transcribed, coded, and analysed. The coding was done in three rounds. An initial coding of themes was done by two researchers (the first author and one external researcher) while analysing the initiator interviews. After this a second coding based on the initial coding was done on both initiator and co-dweller interviews to explore control in the smart home, in the second coding nine codes were identified: definition, direct management, house management, power/control, motivation, UX (User Experience) problems, managing, and perceptions of the partner, differences in relationship. After the second coding, the codes were analysed and developed into six themes that focus on how the co-dwellers experience and respond

Table 1: Households in the study along with stated motivations and the expertise of the adult members.

ID	Household	Description	Stated Motivation	Expertise
1	Couple with two adult children who have moved out.	Built in 2018 as a smart home. Has extensive use of smart technology, lighting, heating, hot water, as well as entertainment systems.	Interest in technology and reducing energy costs.	Initiator: Technology and Research Expert Co-dweller: University educated, non-technical
2	Couple with two children, one still living with them.	Old house that has been upgraded with smart technology. The technology revolves around utility and maintenance such as air quality and heating.	Easing maintenance and reducing costs.	Initiator: Technology and Research Expert as well as Tech Entrepreneur Co-dweller: University educated, non-technical
3	Couple with two small children.	The house has been upgraded with commercially available off the shelf technologies such as lighting, appliances, entertainment systems, and some security systems.	Interest in technology and convenience.	Initiator: Technology professional / developer Co-dweller: University educated, non-technical
4	Couple where the children have moved out. Co-dweller did not participate.	Built in the late 90's as a smart home. Integrated network technologies as well as new materials at the time.	Exploring the possibilities of the smart home for improving quality of life.	Initiator: Technology professional / developer.
5	Couple with two children who moved out. Co-dweller did not participate.	Moved into the house in 2003 and has continuously added and upgraded technologies for utilities, leisure, as well as security.	Interest in technology and conveniences that reduces domestic labour.	Initiator: Technology professional and Entrepreneur.

to smart home technologies: *avoiding technology, not my concern, disconnecting from care, the smart home façade, using and controlling the smart home, and convenience and acceptance.* The final analysis focused on how the smart home technologies were embedded in the home, what the initiators perceived as the aim of the smart home, and how the technologies affect the social structures and practices of the home. The data was collected and handled in accordance with the Finnish guidelines for ethical principles in research [57].

3.1 Participants

The participants came from five different Nordic households, each belonging to a two-gender couple (see Table 1). All the participants live in freestanding villas that they own themselves. The houses in the study were built between 1998-2018, in some cases as smart homes outright or retrofitted with smart technology (but are also in continuous development as new technology is introduced). The technology initiators are all experts at technology, working either with technology directly, as educators in technology-related fields, or as entrepreneurs in technology-oriented companies, in several cases with more than 20 years of experience of working with information technologies. None of the interviewed co-dwellers were experts in technology. The primary motivations are either reducing energy costs, interest in technology or a reduction of domestic labour often phrased as a desire for convenience.

4 RESULTS AND ANALYSIS

In our analysis we identify several examples of how intentions and solutions create behaviours that lead to panopticons of convenience, and thereby abjection and the sense of the home becoming an alien space. These exemplify how smart home technologies can disconnect the residents from existing practices, making them avoid technology or shift their concern for the home. Going further, the results indicate how the smart home can function as a performative façade, how the usage and control of smart home technologies favour certain power relations, and then returning to how convenience and acceptance of surveillance supports this kind of panopticon.

4.1 Avoiding Technology

The first phenomenon that exemplifies how the panopticons of convenience disconnect the residents from the home is the avoidance of technology, by which we refer to when someone disengages from interacting with everyday technologies that have been modified using smart technologies. Avoiding smart technologies can be perceived as a form of resistance towards technology that permeates everyday life.

In household 1 there are a number of technologies aimed at convenience or utility. Among them the heating system has been connected to the fireplace so a fire transfers and distributes heating in the house beyond the immediate effect of the fire. The fireplace is also connected to the sprinkler system which requires the user to press a button to ensure it will not go off; after the co-dweller had the sprinklers go off in the living room, she is instead avoiding the fireplace unless her husband is home. Similarly, the co-dweller also dislikes the smart lighting as they were originally coded for insufficient brightness levels for working, so while her husband is away she prefers to use old lamps to not have to interact with the smart technologies in her home. While the co-dweller notes that after these technological failures she is no longer as interested in the home overall, including decorations or furnishing it, she has noted that her husband is now much more interested in it, beyond just the technology. This connects to the issue of disconnection, discussed further below.

In a similar vein, there are installed smart technologies that the co-dwellers simply avoid using, household 3, 4, and 5 all have smart doorbells that allow the residents to surveil who the guest is or if someone was at the door from their phone. In both household 3 and 5 the co-dwellers have opted to not have access to the devices as they are not interested in the technology and although their partner would be happy to help them get access, it is installed because the initiator finds it convenient.

4.2 Not my Concern

Smart technologies often overlap with traditional gender roles of technologies, where men are typically imagined have a more active role in managing the energy consumption and maintenance of the house itself [3, 52]. New technologies invited into the house therefore inherit this labour division legacy, in addition to possibly being technically complicated. This can lead to new smart technologies being perceived as solely the responsibilities of the initiator, rather than as something that concerns everyone in the household.

The smart technologies in household 2 are, for example, exclusively focused on utility or maintenance of the home, such as humidity sensors, air quality sensors, or other ways to reduce the energy usage or cost of maintaining the home. The co-dweller initially did not see why her opinion would be relevant, as the smart home is her husband's interest and responsibility. As the functions of these technologies correspond to the division of labour in the home, the smart technology does not extend to the co-dweller' practices of maintaining the home.

In Household 3, where most of the technologies are bought off the shelf, the co-dweller has a somewhat resigned outlook on the smart home. She accepts that her husband is interested and finds some technologies useful but while her husband is interested in exploring how each new device can be connected, she has expressed that the limit is the laundry room as she does not want to deal with smart technologies there. As she does not consider the technologies to be her concern, she would prefer that they are not too involved in the tools that involve her side of the household.

4.3 Disconnecting from Care

Domestic labour can be considered a form of caring for the home as a form of maintenance. As smart technologies aim to lighten or automate the domestic labour, it may also disconnect the residents from the acts of caring for the shared home. We note that the introduction of these technologies comes from a perception of domestic work as a chore that the initiator would like to avoid by outsourcing it to the house.

In household 5 the initiator envisions his home to be automated by connecting various devices to each other, such as connecting the lights to the burglar alarm so that the lights are activated by the motion sensors. He motivates this as an energy-saving feature that is also convenient, where he no longer needs to turn lights on or off. It is especially important to this initiator that the technologies are only connected to internal systems within the house, and he therefore set up his smart home to use physical cables rather than wireless connection. In a similar manner of connecting two internal devices together he has also connected ventilation in the kitchen to thermal cameras, because that way there is no need for the internet, which he perceives as a security risk.

In household 1 there are some applications of smart technology to control the access to hot water, hot water is available during certain times and if you for instance want a shower outside of these times you will need to tell the system to heat up water, with an app. The initiator admits that the aim is in part to optimise the behaviour of the residents alongside the house, where the residents are forced to conform their behaviour according to the settings of the smart home.

4.4 The Smart Home Façade

The smart home presents a façade of efficiency, technologies such as smart thermostats and CO2 sensors ensure comfortable temperature and air quality, however they also allow for discreet observation where the activities inside the house can be measured. As the smart devices detect behaviour that negatively affects energy consumption such as open windows they warn the residents, thereby training them to self-regulate their behaviour. The automation of lighting is an important aspect of the smart home, in some cases it is the most visible smart feature. Lighting automation, in particular turning off lights automatically, is often presented as an energy-saving feature (and can be, in the case of certain instalments but not others). However, as some of the initiators admit, for example automated lighting in the home is more about the performance of sustainability than any real benefits. The consumption of energy with modern low-energy lights is relatively negligible and having a smart home system that is always on requires some energy as well. In this way, the smart home is in some ways a façade. This is especially concerning in the light of sustainability, where it is a façade of sustainability and lower energy consumption - while

the real aim is convenience, which likely results in higher energy consumption.

The smart home also performs other visions; a home that is at your service when you call it and can in this way be likened to a house servant from the first half of the 20th century, capable of performing menial tasks for the benefit of the family. While the servant is convenient, for the technology to be able to respond it must observe, and the house must be set up for the smart technologies to do their job. For the co-dweller not interested in the technologies, each action by the technological servant emphasises that one's movements are tracked and that one's sphere of control in one's home is diminishing.

4.5 Using and Controlling the Smart Home

While several of the initiators discuss the value of good interfaces and interactions with smart technology this consideration tends to focus on their own experience. Some initiators express that their co-dweller has the final vote, which is something that several other researchers have noted as well (e.g., [56]). However, while the initiators are often happy to adjust the smart home technologies according to the preferences of the co-dweller, the control over the technologies remains with the initiators, and this is especially true when the technologies are created by the initiators themselves. As a result, the co-dwellers are able to use the smart technologies, but as they do not have the skills, knowledge, or interest to modify them, they can not be in control of it. Living in a smart home assumes both that the technologies function as intended and that the residents have access to them. If a technology breaks down it needs to be repaired, because it is a nested part of the assemblage and merely removing that technology does not mean that the previous order will be restored. The behaviour of the residents has been re-shaped by the technologies that replaced the previous situation, having been internalized, and thus going back to earlier alternatives is rarely an option. In this way and through their expertise, the initiators become responsible as maintenance workers for the panopticon of convenience which they themselves initiated.

4.6 Convenience and Acceptance

While the initiators implement smart home technologies for convenience, it is often not a shared decision but rather digital domestic labour that they have taken as their responsibility. While the co-dweller might veto some smart devices, they often end up as passengers along for the ride when the smart technologies are implemented throughout the home, rather than being active participants in what new technologies should be introduced. Due to this imbalance, what is a convenience for the initiator can easily end up an obstacle for other people in the same household. As noted above, the initiators remain in control of the technologies in part because they are the ones who decided on what technologies to implement and how they should fit into the home, but also because there is no significant learning process among the co-dwellers, who learn how to use but not how to modify the smart home. As some of the co-dwellers expressed, it is their partner's (the initiator's) project. The convenience of the initiators and the acceptance of the co-dwellers show the panopticons of convenience are justified when introduced. These also show how they may reinforce existing inequalities based on the interest of those who install, set up, and maintain the smart home assemblage

5 DISCUSSION

The power structures of smart homes can be seen as an extension of those not familiar or literate with the technologies not wanting to engage with configuring and updating them. This is somewhat logical, as nowadays using technologies that one does not thoroughly understand brings in additional risks. Our research, however, does not suggest this risk as a key reason for the alienation, even though unfamiliarity with the technologies certainly plays a significant part in who is perceived as having control and who gets abjected by them. While there are gendered practices in regard to these technologies, as shown in the ongoing discourse in the field revealing how these are entangled with expertise and control (i.e., [3, 23, 32, 58]). The alienation is, at least in part, due to how the implied beneficiary (who manages the household, often a woman) is not in control over the technologies that shape their household practices.

A panopticon of convenience abjects non-tech-savvy users through their lack of control, displacing them into performing technology-defined practices and internalizing the presence of those technologies even though they are not directly objectified by the technologies. The smart home tools replace certain parts of familiar household processes with new elements promising more convenience, but they do not replace the assemblages to which those elements belong. Many of the assemblages necessary for smart home work involve patterns that combine devices, resources and infrastructures (e.g., house structures, electricity and a vacuum cleaner, together, are needed for vacuuming to take place; (see [51]. This results in a situation where home-makers experience less ability to understand what they are doing (and especially how they are doing it) and thereby less of a sense of control. Smart home technologies become mandatory *'black box'* steps in their practices, steps which are ultimately controlled by someone else.

The technologies together form a surveillance apparatus the presence of which is internalized by those living in the home, particularly the co-dweller of the initiators, who lack full control over said technologies. This leads to a sense of alienation and abjection, exemplified through altered actions, as reported in the interviews. The home is no longer a safe and private space, having instead become a measured, surveilled environment. The co-dweller is no longer an active subject in her home, nor even the object of its technologies, but rather an abjectified *inhabitant* there (as per [9], building upon [33]), affected by the technologies and adjusting her behavior to account for their presence.

Home-makers therefore become bystanders to the technologies installed in their homes by the smart home makers. They are abjects inhabiting the panopticon-surveyed, panopticon-measured space rather than people living within it as active subjects (as per [9]).

The co-dweller's agency is in many tasks limited to performing the practices outlined by the assemblages that are present, under the surveillance of the panopticon that her home has become. As with other panopticons, the surveillance is internalized by the co-dweller through her practices of invisible work, and therefore leads to further abjection. In some cases the co-dwellers resist parts of

this displacement, such as in Household 3, where the co-dweller has accepted most of these technologies but requested that the laundry room remain as it is, so the technologies do not interfere with her work there, and she retains a subjective control over that space.

The human element becomes external to the control mechanisms of the smart home technologies. That element is rejected from decision-making unless co-dwellers appeal to those able to control the technologies (i.e., the tech-savvy initiators). The initiators are often happy to be of service and adjust the home to ensure that their partners, the co-dwellers, feel that the solutions are satisfactory. The initiators also justify the technologies by referring to their partners as a form of gatekeeper, someone who can reject a bad implementation. They nevertheless appear to see this more as a form of quality control or indication that they need to find a better technological solution than a rejection of smart technology by the co-dwellers. However, due to a difference in knowledge and understanding the ability to adjust and re-program the smart home appears to remain with the initiator. They control what surveillance takes place. The assemblage nature of invisible work spreads the influence of the panopticon to work tasks and thereby encompasses those, too, into being parts of the surveillance. As this supposed *'convenience'* added to invisible work grows, the non-technological co-dweller's sphere of actual control diminishes further and further, while their alienation increases. This, in turn, grants more and more power to the panopticon. Meanwhile, the partners in charge of the technologies are likely to think that they are providing a beneficial service for their partners. The existence of power is felt only by those who do not have it [19]. As noted by e.g., Judith Butler [9], this is common in abjection: the ones in privileged positions do not see how others inhabit spaces without being afforded the status and possibilities of being subjects within them.

Our findings suggest this potentially being an extension of initiators' tech masculinities (e.g., [35]), this resonates with ongoing research showing how smart home technologies embed gender roles such as Johnson's [29] *'flexibility woman'* and the added physical and mental labour that smart home technologies often create for women [1, 4]. Chamber's [10] indication of how smart home technologies fail to realise the possibilities of careful design connects to the way some participants disconnect from practices in the home, rather than engage in the additional labour required to participate. The parallel increased engagement by men in the smart home relates closely to Martin's [39] notion of energy housekeeping, where many of the energy practices are perceived as masculine tasks. Our participants avoiding or showing a lack of concern is therefore highly understandable, indicating how panopticons of convenience negatively influences the energy practices of the residents. Their roles as early adopters of the technologies in question emphasise their dominant positions in relation to the adopted technologies, a fact reflected in our data. The technologies that they install and retain control over define the household practices of their partners, while removing the partners' agency and adding elements of measuring and surveillance. This does not mean that the initiators are in any way malevolent or that their particular IT masculinity is in any way necessarily toxic, but rather that the effects of their desire to deploy technologies they see as beneficial for their homes and to their partners actually create abjecting power and knowledge imbalances (e.g., [17]). More research in this area is nevertheless needed, to e.g., ascertain to what extent the power imbalances are inherently gendered, or whether they are solely the result of certain partners (who are currently very likely to be male) being much more tech-savvy than their co-dwellers.

6 LIMITATIONS

There are two core limitations that should be addressed, sample size and geography. The study has a very limited sample size, and although we perceive the initiators as expert subjects, it limits the possibility to generalise. While it is difficult to generalise with the current sample size, we are currently collecting data to further explore the concepts presented in the paper beyond this exploratory study. However, as an exploratory study, as well as noting that many of the characteristics are in line with existing research on gender and smart homes, we believe it is sufficient to conceptualise panopticons of convenience, although further research to explore this is needed. Further, it is limited to the Nordic region, which is not only wealthy and safe, but also known for its relative gender equality. As such, the way these technologies would be embedded in other parts of the world might have different implications for gender (im)balance.

7 CONCLUSIONS

In this exploratory article we have conceptualised panopticons of convenience as, *'The acceptance of additional surveillance upon one's life for the purpose of acquiring actual or presumed convenience'*, how they can be used to understand how the smart home assemblage affects the agency of people living in a smart home, and how they differ from traditional panopticons in that they are, to some degree, willingly embraced or accepted by the subjects of the panopticon. We note that it is not simply a matter of power transitioning from one party to the other, but rather that the technological devices of the smart home act as intermediaries in what would otherwise have been a negotiation within the household and thereby alienate both the initiator and their co-dweller from the home. We have presented an empirical study where we placed particular focus on how panopticons reshape domestic relationships in the analysis, where we observe several examples of how intentions and implementations of smart homes can cause abjection among less tech-savvy partners in a smart home. This abjection by extension may push smart home residents away from practices that are focused on lower consumption, or create a rebound effect which may facilitate more energy intensive lifestyles. By accepting increased measuring of energy consumption in their homes, the inhabitants of domestic spaces are accepting more surveillance according to which they then adjust their behaviours. These behaviours are often connected to technologically facilitated practices, which appear to promote higher energy lifestyles by disconnecting the inhabitants from the direct implications of their consumption. By seeing the ways in which these domestic environments may alter behaviours, we can attempt to separate the façade of sustainability in smart homes from narratives of control and how feeling at home with smart technologies relates to energy practices.

As our data set comes from households where the initiators can be considered early adopters of these technologies, more research is needed. Our exploratory findings point out that the initiators'

partners are submitting to the presence of the technologies and the initiators are accepting the technologies as parts of their household practices and invisible work. But the question remains whether these technologies and continuous tracking actually produces the desired convenience or even a lighter workload, as well as to what extent the co-dwellers agency is reduced. At this point the panopticons of convenience are something that is not yet fully in place but rather something that can be discerned as it becomes possible to measure more activities in the household. The incompleteness of the panopticons is what allows these power issues to be more easily observed as the exercise of power is not yet seamless or fully internalised. The panopticon in itself would not be built if it was just tracking, but the digital measuring of the invisible labour also combines e.g. air quality measures and energy consumption measures - this together creates the panopticons of convenience that in turn becomes internalised and changes the behaviour of the dweller and thereby increasingly transforms, in particular the co-dwellers into an inhabitant (as per [9] rather than someone who is being at home. We therefore argue that the development of smart home technologies should involve not only technical solutions but questioning what kind of tracking is done and whether it is producing desirable outcomes while developing a clearer understanding of further ramifications these technologies have to the smart home assemblage.

ACKNOWLEDGMENTS

The multi-disciplinary nature of the work has involved the help and support of a number of colleagues, we therefore wish to thank Ilyena Hirskyj-Douglas, the INUSE research group, Sini Numminen, Tuula Juvonen, Mika Loponen, Virpi Roto, Sampsa Hyysalo, and Turkka Keinonen who all provided valuable comments and feedback throughout the process. This research is partially funded through Academy of Finland grant no: 353873 as part of the SMARTUP research project.

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