

Department of Design

Panopticons of Convenience



The Internal Politics of the Smart Home

Nils Ehrenberg

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The Internal Politics of the Smart Home

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This thesis explores digitalisation, smart home technologies and how they may affect the power structures of the home. It proposes to view smart homes as emerging panopticons of convenience, where surveillance is accepted in return for conveniences. Digitalisation and smart technologies rely on the continuous collection of data which are used to examine and judge the behaviour of the residents, making it possible to interpret smart technologies as Foucauldian disciplinary technologies. This understanding is explored through three case studies that examine how smart technologies affect autonomy, agency, and equality. The studies - presented in four publications - use primarily interview data and thematic analysis to investigate narratives of technology in the home. The first case study explores privately owned homes; the second - rental homes, and the third explores IT helpdesks as quasi-public services and the limits of support for those who are marginalised by the process of public digitalisation.

The thesis asks two research questions: (1) how can the politics associated with the character of smart home technologies be conceptualised and (2) how do these politics, both intentionally and unintentionally, affect different members of the household and their relation to the home.

The thesis answers the first question by conceptualising smart homes as panopticons of convenience, which are defined as *'the acceptance of additional surveillance of one's life for the purpose of acquiring actual or presumed convenience'*. By drawing on a wide range of theories such as Foucault's theory of disciplinary power, Borgmann's device paradigm, assemblage theory, notions of abjection and foreignisation through technology, and ethical theories such as the capability approach and contributive justice, the thesis reflects on how the politics of smart homes re-shape power relations in the home.

The answer to the second question explores how these technologies reinforce asymmetric power structures, making them part of the infrastructure of the home. Smart home technologies divide the residents into different roles, thus, actively disempowering less technologically adept residents and displacing existing practices. By drawing on Borgmann, it is possible to understand how these technologies can commodify the home, exemplified through co-living sites, where a home experience is part of the offering. The asymmetric power relations are used to understand how smart home technologies become integrated into a sociotechnical assemblage which favours certain groups over others.

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Helsinki, 6 April 2023
Nils Ehrenberg

Contents

Introduction.....	7
1.1 Research Questions	9
1.2 Scope and Contribution.....	9
1.3 Structure of the Thesis	10
2. The Smart Home	13
2.1 The Home	14
2.2 The Smart Home as a Concept.....	15
2.3 Gender and Digital Housekeeping in the Smart Home.....	17
2.4 Users in the Smart Home	18
2.5 The Technologies of the Smart Home.....	21
2.6 Issues in the Smart Home	22
2.7 Summary: The Smart Home	23
3. Theory Framing	25
3.1 Disciplinary Technologies and Panopticons.....	26
3.2 Disaffected Subjects	27
3.3 The Home as an Assemblage.....	30
3.4 Autonomy - Capability, Control, and Contribution?	31
3.5 Assembling the Panopticons of Convenience	33
4. Case Studies and Methods.....	35
4.1 Case Study 1: Smart Home Makers.....	36
4.2 Case Study 2: Co-Living and Autonomy	37
4.3 Case Study 3: Volunteers, IT Helpdesks, and Seniors.....	39
4.4 Reflection on Methods	41
5. Findings and Outcomes.....	43
5.1 RQ1: Conceptualising the Panopticons of Convenience.....	43
5.2 RQ2: Different Subjects of the Panopticons of Convenience	47
6. Discussion.....	53
6.1 Smart Technologies and Trust	53
6.2 Ethical Design Practice in Digitalisation	54

6.3	Devices and Gadgets.....	54
6.4	Emerging Panopticons of Convenience	55
6.5	Limitations and Future Work	56

List of Publications

This doctoral dissertation consists of a summary and the following publications, which are referred to in the text by their numerals.

1. Ehrenberg, Nils; Keinonen, Turkka. 2021. The Technology Is Enemy for Me at the Moment: How Smart Home Technologies Assert Control Beyond Intent. In: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems. Paper No. 406, Yokohama, May 2021.

2. Ehrenberg, Nils; Harviainen, J. Tuomas; Suominen, Jaakko. Towards Pan-opticons of Convenience: Power in the Nordic Smart Home Assemblage. Unpublished manuscript.

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Author's Contribution

Publication 1: The Technology Is Enemy for Me at the Moment: How Smart Home Technologies Assert Control Beyond Intent

The research and related data collection was conceptualised, developed, and conducted by Nils Ehrenberg under the supervision of Turkka Keinonen.

Publication 2: Towards Panopticons of Convenience: Power in the Nordic Smart Home Assemblage

The data collection was planned and conducted by Nils Ehrenberg. The analysis and conceptualisation of the research was accomplished by Nils Ehrenberg in collaboration with J. Tuomas Harviainen with feedback from Jaakko Suominen. Nils Ehrenberg wrote the majority of the article text.

Publication 3: Co-Living as a Rental Home Experience: Smart Home Technologies and Autonomy

The research and related data collection was conceptualised, developed, and conducted by Nils Ehrenberg under the supervision of Turkka Keinonen.

Publication 4: Volunteer-based IT Helpdesks as Ambiguous Quasi-Public Services: A Case Study from Two Nordic Countries

The data collection and initial analysis were planned and conducted by Nils Ehrenberg and Camilla Christensen. The final analysis and writing were accomplished by Nils Ehrenberg, Camilla Christensen, Jörn Christiansson, Erik Grönvall, and Joanna Saad-Sulonen. Turkka Keinonen provided feedback and supervision during the process. Camilla Christensen and Nils Ehrenberg share first authorship.

Introduction

Digitalisation in society takes many forms and can be construed as a narrative within our contemporary society in which digital technologies are positioned, introduced to replace, complement, or otherwise improve existing services at all levels of society. Both private enterprises and public services are engaged in this process. Yet even a cursory glance at digitalisation reveals that, for many, it is challenging to engage with new technologies, often due to limited digital literacy. In Finland, digital inequality has been perceived as increasing existing inequalities, with those with lower incomes or other personal resources perceiving digital services as less useful (Heponiemi et al., 2021). The Covid-19 pandemic revealed how limited digital access further exacerbates these inequalities because it shapes access to education as well as defining who is able to work from home.

Throughout this thesis, digitalisation, digital access, and digital skills are connected both to society and to private homes. Public services are increasingly expected to be available online (Rowley, 2006), while so-called smart technologies have been making their way into our private lives for years. Many of these smart technologies are referred to as being part of the Internet of Things, which largely refers to physical devices with actuators or sensors that are connected to the internet (or at least to some sort of network) and in communication with other smart devices. The Internet of Things and smart technologies can be seen as an extension of the wider trend towards digitalisation, where digital technologies are brought into physical space. There is significant debate as to whether what these technologies are providing is actually valuable. For example, Sadowski (2020) argues that smart technologies offer modest conveniences in return for our personal data, while being sold as an inevitable next step in technological development. Another notable example is the notion of surveillance capitalism proposed by Shoshana Zuboff (2019), who argues that, as corporations harvest more and more data, they have commodified personal experiences. Zuboff argues that, by amassing huge amounts of data, corporations engage in radical behaviourism and '*unprecedented means of behavioral modification*' (Zuboff, 2019, p. 376). Although surveillance capitalism, and the emergence of the related data markets, fall beyond the scope of this thesis, it presents useful notions for how individual behaviour may be changed through the use of data in accordance with the interests of large tech corporations. It could also be said to argue

that smart technologies (or at least large-scale smart technologies utilising artificial intelligence and machine learning) are inherently political technologies which favour surveillance capitalism as a social order.

One area that is experiencing the impacts of digitalisation is the home, where technologies adopted over the past century are often credited with offering improved standards of living. While smart homes have been touted for decades as representing the future without any significant adoption, recent years have seen costs fall and access to digital home technologies rise. In the home, these technologies are often developed for the automation of various practices, such as housework, security issues, utilities, or leisure. While they appear to offer the promise of less or lighter domestic labour in various forms, they also represent an attempt at control over space beyond the physical presence of the operators. This control leads to a need to consider what the politics of these technologies are, and the implications of these politics. In Langdon Winner's book, *The Whale and the Reactor* (1989), he argues that technologies embody social relations, and in doing so he identifies two ways in which technologies may contain political properties: either as a way to settle an issue or as inherently political technologies. To exemplify the first, he shows how infrastructural projects have been used to favour the access of certain people over others, with lasting implications that linger long after societal perceptions have changed. The second kind, inherently political technologies, are those that Winner argues pre-suppose or at least strongly favour a particular order, as when a ship may require a captain and large-scale systems that do appear to favour a centralised order. Winner (1989) argues that '*some technologies have been devised to stack the deck in favour of some people*' (Winner, 1989, p. 25). As control over these technologies often appears to be unevenly distributed among members of a household, Winner's considerations regarding the politics of technology highlight the need to consider how smart home technologies affect the agency and control of the inhabitants and their relationship to the home. In this thesis, it is primarily smart homes as a way to settle certain issues that is explored; while the homes require access to electricity and the internet, they can also be at least partially operated locally. What is therefore explored is what issues they settle, and how these are embedded. Smart home technologies are plural, however, and some technologies may favour a particular societal order. While this is a related concern, this thesis is more engaged with the internal politics of the household. Winner's argument is not a rejection of technology, but a reminder that, if we are not aware of the political consequences, we risk sleepwalking into a future where technology reconstitutes human existence. This thesis is concerned with these issues, with how these technologies reshape the power (im)balances of the home, and it explores critical narratives of digitalisation as a way of questioning the ways in which these technologies are or are not desirable, following Winner's (1989) call for us to take responsibility for what we are making.

1.1 Research Questions

This thesis addresses an overarching concern with societal digitalisation from a perspective of autonomy and agency. In order to best address the wide scope of the topic, the project did not set out with a specific research question, but rather an area of interest. The research was conducted through three case studies that each look at digitalisation from different angles. This thesis creates a narrative for how human agency is shaped by the introduction of smart technologies into our domestic environment. As the research into digitalisation, smart homes, and autonomy developed, these research questions came to be formulated as:

RQ1 - How can the politics associated with the character of smart home technologies be conceptualised?

RQ2 - How do these politics, both intentionally and unintentionally, affect different members of the household and their relation to the home?

The first question addresses smart homes as places where values and practices clash, and considers what kind of narratives smart homes present beyond technical development or visions of the future. Focusing on the politics of the technologies enables a focus on human relations and lived experiences, rather than specific technologies or visions of the future. The second question focuses on the implications of the first, both intended and unintended. By considering smart homes as socio-technical assemblages where technologies shape human relations, both to each other and to the home. What kind of relationships does the smart home facilitate, how are practices affected, and what does this mean for different members of the household?

1.2 Scope and Contribution

This thesis explores how societal digitalisation, and especially smart home technologies, affects our relationship to the home and how it may affect inequalities within it. The thesis consists of three case studies. The first two explore the smart home, one from a private home perspective and the second from a rental home perspective, while the third considers digitalisation in society and support for seniors through volunteer-based helpdesks.

This research contributes to ongoing cross-disciplinary work on the intersections of interaction design, HCI (human-computer interaction), and gender discourse reflected in several special issues of journals on the topic of emerging technologies, gender, smart cities, and other interrelated topics that were announced during the development of the thesis. The research has been presented and submitted to both journals and conferences relating to interaction design, HCI, and feminist technoscience. The research is embedded in a Nordic cultural context and some of the research has been presented at a Nordic HCI conference.

This thesis contributes with an understanding of smart home technologies as disciplinary technologies using a Foucauldian interpretation of the smart home presented in publication 1. Here, five mechanisms through which technologies

shift power within the home are presented: Overt Observation, Discreet Observation, Constraining Interaction, Regulating Commodities, and Predefining Practices. Publication 2, as part of the first case study, continues exploring the Foucauldian understanding of technology. It makes the core theoretical contribution of the thesis by conceptualising smart homes as panopticons of convenience, drawing upon theoretical work on disciplinary power, panopticons, abjection, fluid assemblages, and autonomy. These theories all provide different understandings of power, how technology shapes our relationship to the world, and how devices, practices, and spaces are interconnected. The panopticon of convenience is employed as a lens for exploring how smart technologies affect autonomy and agency.

Publications 1 and 3 consider how smart home technologies shape power structures in the home in both private and rental homes, with publication 3 focusing on how autonomy is shaped by these technologies. This publication suggests that, in some ways, they have a cushioning effect that limits individual growth by guiding people towards certain lifestyles.

Publication 4 shifts the focus to offer a broader understanding of digitalisation and the support that is offered to those who are marginalised. It explores volunteer-led helpdesks as ambiguous, quasi-public services. Together, publications 3 and 4 consider the need for public policy to remain more up to date with the shifting needs implied by societal digitalisation.

1.3 Structure of the Thesis

This thesis is based on four publications that explore how digitalisation and technology shift power structures, with a focus on the smart home. In this introductory essay, I offer an overview of smart homes and the implications of emerging technologies. I also present my theoretical framing of the research, research methodology, case studies, and outcomes of the thesis, and reflect upon the implications of my thesis. The structure of the introductory essay is as follows:

Chapter 2 presents an overview of the smart home, gendered perspectives on digital housekeeping, a consideration of who the users of the smart home are, in both private and rental homes, and some of the challenges of smart home adoption.

Chapter 3 introduces the theoretical framework of the thesis, a perception of Foucauldian discipline, how these emerging technologies can contribute to an experience of alienation within the home, the perception of the smart home as an assemblage, and how the smart home relates to notions of autonomy, the capability approach, and contributive justice. The chapter then considers how these theoretical positions contribute to the conceptualisation of the panopticon of convenience, as well as how it can be utilised.

Chapter 4 presents the three case studies, along with the methodological framework used in each of them. Case study 1 depicts smart home makers and how smart home technology reshapes private homes, case study 2 considers co-living spaces and the implications when control of technology resides outside

the home, and case study 3 considers digitalisation as a wider trend and the support practices available for those who may be marginalised.

Chapter 5 presents the outcomes of the thesis and outlines how each case study contributes to my response to the research questions.

Chapter 6 opens up a discussion of and reflection upon the outcomes, and the implications that my research has for design practice when developing smart home technologies.

2. The Smart Home

This chapter outlines what the smart home is, how smart home practices are entangled with gendered practices, how the smart home shapes its users, the role of technology, and some of the challenges posed by the smart home. As a term, 'smart home' lacks a commonly agreed definition, but generally it assumes the presence of automated and connected technologies. To understand the smart home, we should first consider the home itself. This section will discuss place, the home, the smart home, and the technologies of the smart home in order to understand what the smart home aims to accomplish.

2.1 Place and Home

While this thesis is concerned with the home as a place to live, the notion of home can mean many things. One can feel at home in different contexts: at work, while engaging with a practice, or in a particular place. This thesis focuses on homes as places that we live in, similarly to the focus of Blunt and Dowling's book *Home* (Blunt and Dowling, 2022) on homes as '*a place where we live*' (Blunt and Dowling, 2022, p. 9). Easthope (2004) suggests that, in order to discuss homes as places, we must first have an understanding of the difference between space and place. Drawing on Massey (1995), Easthope argues that a place is a social construct, created and defined by human beings (Easthope, 2004), and defines places as '*nodal points within networks of social relations that have a particular significance for a person or group of people*' (Easthope, 2004, p. 137). Drawing on Duncan and Duncan (2001), Easthope reflects upon the importance of the notion of place when discussing housing as it is defined by human relationships, connecting it to the idea of a sense of place. Drawing on the notion of habitus, Easthope (2004) suggests that we feel at home where our sense of self has developed and, like Dupuis and Thorns (1996), Easthope (2004) connects the home to a sense of both security and control. Drawing on a broad range of literature, Easthope finally states her definition of the home as a '*particularly significant kind of place with which, and within which, we experience strong social, psychological, and emotive attachments*' (Easthope, 2004, p. 136).

Blunt and Dowling (2022) similarly argue that home is connected to built dwellings and shelters, but underline that the connection between house and home has been widely critiqued in housing studies, suggesting that home is a

'series of feelings and attachments' (Blunt and Dowling, 2022, p. 11), some of which may be connected to a 'house'. Sadowski et al. suggest that a home is '*best understood as a means of social reproduction*' (Sadowski et al., 2021, p. 2). Blunt and Dowling (2022) also discuss how different political ideologies shape our conception of the home; Marxists perceive the home as a space in which labour power is reproduced, while humanist geographers perceive it as an essential place for identity building and a place to which to retreat. The humanist notion of home has been strongly criticised in feminist theory, and Brickell (2012) argues that it neglects women's experiences and that the home is just as likely to be a place of oppression and violence. Blunt (2017) echoes this, stating that the home is an important but contested site of power and identity. Blunt and Dowling argue that '*The domestic sphere is as much about inequality between men and women as it is about the reproduction of labour power*' (Blunt and Dowling, 2022, p. 20), and state that feminist research has shown that home places are '*neither simply, nor only, private, familiar, or feminine*' (Blunt and Dowling, 2022, p. 21). Summing up the notion of home in this thesis, it is a significant place connected to social and psychological attachments, a means of social reproduction, and a place of contested gender politics. Home is also the place in which we live.

2.2 The Home

Throughout history, the home has played a central role in society. As Aureli and Giudici (2016, p. 105) argue, the home is '*a way to occupy and claim ownership of a place, as well as a space for the care of its occupants*'. According to Aureli and Giudici (2016), as the idea of the home developed, it also functioned to separate the roles of men and women, making it clear that not only is the home a place for production and reproduction, but it has always been a part of gender politics. The courtyard of ancient Greek homes would function both as a place to circulate, and also as a way to surveil and keep men who were not part of the household away from the women of the household (Aureli and Giudici, 2016).

While society has changed, the role of the home remains relatively similar. It is a place for both production and reproduction, while locks and surveillance systems serve to keep away outsiders and control those who are part of the household, much like the ancient courtyards. Després (1991) states that the home can be described as a place of security and control, a reflection of one's ideas and values, a material structure, an indicator of personal status, or a centre of activities and relationships with friends and family. Similarly to Easthope (2004) and Blunt and Dowling (2022), Mallett (2004) suggests that the home should be understood as a physical dwelling, a lived space of interaction, a space of both comfort and security and oppression, or a symbol of status, depending on the domain of study. These descriptions of home resemble the role that Aureli and Giudici (2016) ascribe to the home throughout history, as a space of production as well as a tool for security and control. However, how the home does this, and the gender performances and values that are embedded in the home, has changed over time.

The home as a construct is far from monolithic. Homes, especially in the Global North, are stereotypically depicted as detached villas, terraced houses, or apartments, either owned by the residents or rented from a landlord, and in this thesis private homes will refer to single-family, resident-owned places. While different notions of home have long been discussed in housing studies (Blunt and Dowling, 2022), in recent years HCI has also taken a greater interest in homes and the role of technology in the home. Beyond ‘private homes’, there are various forms of co-housing as well as nomadic lifestyles that should be recognised under the concept of a home that have all garnered attention within the HCI research community (Denefleh et al., 2019; Jenkins, 2018, 2017; Oogjes et al., 2018). These are sometimes referred to as non-stereotypical homes and the research encompassing them indicates a need for a more open interpretation of what constitutes a home (Oogjes et al., 2018). In addition to these non-stereotypical homes, there is also a need to look beyond the nuclear family stereotype when designing housing (Oogjes et al., 2018). Maalsen (2018) notes that there has been a shift whereby more people (primarily from younger generations) in both Australia and the USA are forced to live in shared housing due to the rising cost of living, and argues that there is a need for research into shared housing and how it is affected by digitalisation. Pirinen and Tervo (2020) have explored how facilities can be shared as a way to keep housing costs down. They argue that there is a need for housing policy to further consider single-person households because the average household size has been steadily shrinking in Finland, while the amount of space available for each individual has doubled since the 1970s (Statistikcentralen, 2019). Pirinen and Tervo’s (2020) notion of designing housing with shared facilities for solo-living adults can be connected to how Maalsen (2019) perceives smart housing as an assemblage. As housing policy and digitalisation become interconnected, smart housing can also be seen as an extension of the smart city.

Considering this shift in housing, whereby many people in the younger generations seem forced into shared housing solutions and rentals (Maalsen, 2018), while older generations have been able to buy their homes, this thesis explores two cases, one on each side of this divide. Firstly, it explores how smart home technologies shape the power dynamics in detached homes owned by their residents, and on the other side of this divide it considers how the dynamics shift within a co-living space.

2.3 The Smart Home as a Concept

While ‘smart home’ as a term lacks a commonly agreed established definition, there have been several attempts at characterising it. According to Berry et al. (2007, p. 242), it is a *fluid and unstable field of possibilities*. Keinonen (2009) suggests that a smart environment is one that allows people to act in a smart way, enabling the inclusion of human capabilities as part of the smart home. Harper (2003) argues that the smartness lies in the interactive technologies a smart environment or home would contain. Similarly, Gram-Hanssen and

Darby (2018, p. 94) claim that there is an '*understanding that smart homes incorporate digital sensing and communication devices*'. Aldrich (2003, p. 17) 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*'. Both Berry et al.'s and Aldrich's definitions are reiterated by Strengers and Nicholls (2017). These definitions suggest that the smart home contains various technologies that, to some degree, communicate both with the resident and with each other in order to automate household tasks. They also show how, to some degree, smartness is a moving target, whereby whether certain technologies are perceived as smart is based on how they are adopted or marketed, rather than any hard-and-fast criteria. These descriptions of smart homes appear to follow two primary approaches, a technologically driven perception where emerging technologies present new opportunities, and a vision of how to live in the future and the role of technology to facilitate this. In this thesis, the research is based on lived experiences of smart homes and the kinds of tensions that living with smart homes creates.

If one considers the term 'smart home' to imply home automation (sometimes referred to as domotics), then the beginning of the smart home can be traced back to the electrification of the home during the late 1800s and the availability of electric appliances such as vacuum cleaners, electric washing machines, air conditioners, and refrigerators during the early 1900s (Crowley and Coutaz, 2015). The X10 standard, conceived in 1975 and launched in 1978, which was created to control lights and appliances, can be considered another turning point as the first widely available home automation system (Rye, 1999). While early smart home technologies struggled to achieve mass-market success due to their cost, proprietary standards, and both architects and electricians finding the technologies difficult to understand (Crowley and Coutaz, 2015), the rise of the Internet of Things has led to an explosion of new, affordable, and easy-to-install devices. In this thesis, smart homes are understood as private residences equipped with various embedded digital technologies with the apparent or claimed aim of providing the residents with conveniences, security, comfort, cost efficiency, and control. Cowan (1983) has argued that, in many ways, technologies such as vacuum cleaners and washing machines actually lead to more domestic labour, as well as new forms of home practices. However, in a more contemporary context, we rarely consider vacuum cleaners or washing machines to be smart devices unless they involve additional technologies, such as robot vacuums or internet-connected washing machines.

It can be surmised that defining the smart home is difficult and perhaps undesirable, because it would attempt to render static something that is shifting by nature. There are, however, some shared understandings of what the smart home generally entails, such as the use of digital and information technologies that are not quite mainstream yet as a tool to facilitate comfortable or conven-

ient lifestyles. There is also the notion that a smart home often appears to involve technologies that are not yet available but might not be considered smart once they become entrenched.

2.4 Gender and Digital Housekeeping in the Smart Home

Technology and gender are deeply entangled and as, some research has shown, technology is a part of male gender identity (Rode and Poole, 2018). As noted above, the home has served to separate the roles and responsibilities of men and women for millennia (Aureli and Giudici, 2016), so it is therefore unsurprising that the practices of the smart home can also be seen as deeply gendered. Digital housekeeping refers to the work of setting up and maintaining home networks (Tolmie et al., 2007). This work includes anything from setting up the wifi networks in the home to programming and setting up a robot vacuum cleaner. Tolmie et al. (2007) defined this while extending the work of Grinter et al. (2005), who note that the maintenance of technology in the home is usually allocated to the person in the household with the greatest expertise. Wilson et al. (2015) have also observed how smart home technologies tend to concentrate power with a single user. However, while Grinter et al. (2005) describe expertise as the leading factor in the allocation of this work, Rode et al.'s research (Rode, 2010; Rode et al., 2004; Rode and Poole, 2018) demonstrates how men and women use technology to construct their gender identity, noting that technological expertise is, for many, a male attribute. Digital housekeeping is therefore often a task associated with the male members of the household, regardless of whether a female partner is capable or not.

Kennedy et al. (2015) have also extended Tolmie et al.'s (2007) notion of digital housekeeping by considering expertise as the comprehension of systems, the ability to transfer knowledge, and the automation of practice. Kennedy et al. (2015) also observe that, much like traditional housekeeping, digital housekeeping is unevenly distributed within the household, albeit with men doing the majority of the work in this case, and that women are often uninterested in maintaining these technologies. This lack of interest could be associated with the fact that, as more technologies (in particular domestic appliances such as vacuum cleaners) have been introduced to lighten the load of domestic labour, in fact they often result in an increase in such labour. In Cowan's (1983) seminal work, 'More work for Mother', she argued that the technologies cause an increase in labour due to shifting expectations of cleanliness, and that cleaning is largely performed by women. Similarly, Strangers and Nicholls (2018) have argued that the smart home means 'more work for father' and create new forms of digital housekeeping that is primarily performed by men, while also noting that digital housekeeping is also often driven by their own interest in technology, as part of how technology and gender performance are entangled.

It is not that the technologies are necessarily gendered, but, due to the ways in which they are socially embedded, the practices around them reflect existing gender roles. Smart home technologies may therefore exacerbate existing im-

balances in power. If technological expertise is perceived as part of a male gender expression, male members of the household are more likely to either possess, or at least have a desire to display, technical expertise, and this has led to them being more likely to take on digital domestic labour. As new smart home technologies become more integrated into maintaining the home, it therefore follows that the influence of the person doing the digital domestic labour increases, as their notions about how to live, and what kind of lifestyle and practices the technology should support, are reinforced through this labour. The need for technical expertise can be considered as meaning that the smart home requires certain capabilities in order to live comfortably within it. Without these capabilities, the residents risk becoming disempowered.

The smart home has also been perceived as a potential tool for abuse (Tanczer et al., 2018). It is possible to control the domestic environment, and former partners with technical competence can sometimes access the home to either spy on the current resident or change the settings of the home. This can allow someone a high degree of access to the home, and to the private life of others, without being physically present. While this perspective is not explored in depth in this thesis, which instead deals with different types of power dynamics where the inequality is often an unintended consequence, it is worth keeping in mind that these technologies can also be applied directly in this way.

2.5 Users of the Smart Home

While the smart home is often controlled, implemented, and maintained by one member of the household, other residents can also be considered smart home users. While researching smart cameras, Pierce et al. (2022) have created a framework that separates bystanders, incidental users, and cohabitants. Within this framework, guests or children without access become surveilled subjects, or usees, and neighbours caught on camera are nonconsenting subjects of the smart home.

The work of Pierce et al. (2022) and Hargreaves et al. (2015) is useful for understanding how the smart home divides residents into different categories, with different levels of access. While the home has always divided inhabitants to some degree, emerging technologies make it a part of the infrastructure of the home. It has always been possible to watch over the neighbours, but now these practices are automated and incorporated into the infrastructure of the home. As the smart home divides its users into different groups, we can take inspiration from Pierce (2022) and discern four primary categories of users in a private smart home: initiators, cohabitants, incidental users, and bystanders (see Figure 1). If it is a rental home fitted with smart technology, the landlord may take the role of initiator, indicating that power shifts outside the home rather than residing within it (see Figure 2). The research in this thesis is primarily focused on the first two groups, initiators and cohabitants, as they are the primary occupants of the home.

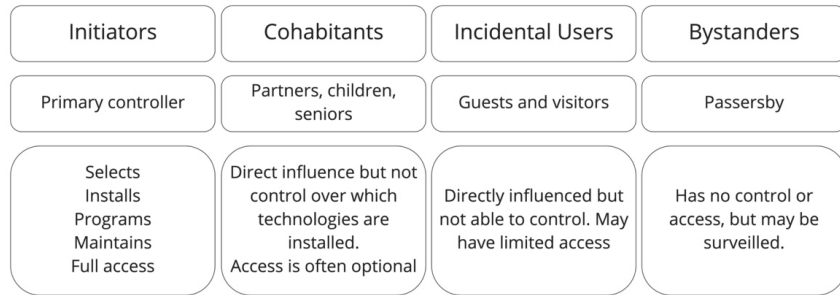


Figure 1. Different types of smart home technology users in a private home.

2.5.1 Initiators

Initiators are effectively the lead users or controllers of the smart home. In many cases, this is a role performed by a male member of the household, as implied by how digital domestic labour is embedded in the household. This role involves selecting, installing, programming, and maintaining the smart home technologies. In return, initiators are able to exercise more power because they have a clearer understanding of the systems, gained through setting them up. At the same time, they are also the ones who are held accountable when systems break down.

2.5.2 Cohabitants

Cohabitants are people living permanently in the smart home, alongside the initiators. This primarily refers to the partners of initiators, or other adults who may be involved in the decision-making process of implementing or setting up technologies in the home, such as parents or older children. While partners often exercise a certain influence, such as being able to veto or approve of technologies, they are not in charge of them, despite often being the most exposed to them. Cohabitants can use at least some of the technologies but may not be adept or interested enough to control the system. As smart home technologies often focus on shifting or replacing practices that are perceived as traditional domestic labour (i.e., what is often considered women's domain), they directly affect the cohabitants without them having direct access to or full control over the technologies.

Among the cohabitants, there is also a subcategory that could be considered dependents. This refers to those living in the home without any, or at least limited, influence over the technologies, such as young children, who generally are not part of the decision-making about what technologies should be part of the home. Similarly, senior family members may live with their younger family and may have some influence over the home because they are adults.

Access to the technologies is often optional for partners, while other cohabitants, such as younger children, may have access (supported, for instance, by parental control). As children grow older, they may be offered more influence within the smart home, while at the same time adjusting their behaviour according to the system.

2.5.3 Incidental Users

There are also friends, guests, and other visitors who may become subject to the technologies of the smart home, with only limited access, and these may be considered incidental users. Guests staying overnight may end up being surveilled or simply limited in how much control they have over the utilities in the home. And even if incidental users receive access to the smart home technologies, this might require installing and setting up apps, which creates an additional hurdle in terms of being included in the household, even for a brief stay.

In addition, incidental users often take an audience position whereby they might be guided through the smart home, whether as an introduction to make them feel more at home or to show off how modern the home is.

2.5.4 Bystanders

Neighbours and passersby can often be surveilled by smart home technologies without having any influence or giving consent. This is especially common with surveillance technologies such as smart doorbells, which record both audio and video of anyone passing by outside the home. As such, they are unwilling subjects of the smart home.

2.5.5 The Landlord as Initiator

In non-traditional homes, there may also be other groups, such as mixed or blended families living together. There are also other models of housing beyond traditional homes that may further add to these groups, such as co-living (i.e. forms of shared housing created by a developer, generally consisting of a small private studio with shared common areas), where the landlord plays a more prominent role (Ehrenberg and Keinonen, 2021a), or co-housing where the dynamics between residents or the notion of home differs from that of the more traditional homes primarily discussed here (Denefleh et al., 2019; Jenkins, 2018; Oogjes et al., 2018).

In rental housing where the technology is already installed and controlled by the landlord, such as co-living (Ehrenberg and Keinonen, 2021a), the role of the initiator is taken by the landlord. The residents enter a role similar to that of cohabitants (see Figure 1), whereby they do have some access and control over the technologies but no input or choice in which smart home technologies are installed or how they are implemented. Their access to the data is also dependent upon the landlord. Guests and bystanders have similar situations of being influenced or surveilled with no or limited access or control over the technologies. As the landlord collects data and controls the systems, they may also enter the realm of surveillance capitalism (Zuboff, 2019), should they choose to sell that data.

Landlords	Residents	Guests	Bystanders
Selects Installs Programs Maintains Full access	No control over which technologies are installed. Access is dependent on the landlord.	Directly influenced but not able to control. May have limited access.	Has no control or access, but may be surveilled.

Figure 2. Different types of smart home technology users in a rental home where the technologies are initiated by the landlord.

2.5.6 Seniors as Users in the Smart Home

Many seniors are likely to find themselves entering the smart home in a position similar to that of cohabitants, where the initiator role can in some situations be taken over by family members or even healthcare professionals (for health and ageing-related technologies). Smart home technologies, healthcare, and seniors has been an ongoing topic since the 1990s (e.g. Demiris et al., 2004) and seniors are still considered to be one of the primary cases for the smart home (Gram-Hanssen and Darby, 2018; Hargreaves and Wilson, 2013; Marikyan et al., 2019). At the same time, their role as users may require different accommodations than those for other users. For seniors, the advantage of smart homes is often depicted as greater independence, or even the ability to stay in their own homes rather than moving to senior centres if they agree to live with smart technologies that monitor their health. This presents a different kind of trade-off compared to that experienced by younger, able-bodied users, who may gain convenience or lower energy costs. However, as many seniors struggle with new technologies with limited support (Christensen et al., 2022), many smart home technologies may in fact limit their autonomy as previous practices become obscured.

2.6 The Technologies of the Smart Home

With the definition of smart home technologies shifting, it is not possible to define exactly which technologies are considered smart. However, there have been several attempts to describe the kinds of technologies that constitute the smart home. Hargreaves and Wilson (2013) suggest categorising smart home technologies as offering safety and security, leisure, healthcare, and home energy management. Marikyan et al. (2019) divide the technologies into providing comfort, monitoring, health therapy, support, and consultancy. Gram-Hansen and Darby (2018) list energy control, security, entertainment, ambience, health monitoring, and assisted living as categories. Crowley and Coutaz (2015) suggest an ecology based on how smart technologies interact with residents, dividing them into tools, housekeeping services, advisors, and media, while also adding what they perceive as desirable qualities for the interactions. Tools are devices designed to achieve a goal and should be predictable. Housekeeping services maintain the integrity of the home and should preserve trust and security.

Advisors are intended to improve the quality of life, rather than saving time (following Bowden and Offer, 1994) and can be exemplified by smart grids; these technologies should fade into the background without attracting attention. Lastly, media technologies involve turning surfaces into displays for new services, which lack a current analogue, augmenting objects to display data (e.g. traffic or weather data). Strengers et al. (2019) explore Intel's vision for ambient computing in the home through protection, productivity, and pleasure. Sadowski et al. (2021) have also explored the smart home as Big Mother, based on the work of Strengers and Kennedy (2020), and perceive it as '*a system that seeks to enact a commodifiable digital surveillance of the home under the guise of maternal care*' (Sadowski et al., 2021, p. 3). Focusing on a service perspective, Aldrich (2003) proposes that smart home technologies respond to the needs for comfort, convenience, security, and entertainment.

While these categories, such as utilities, security, and entertainment, can be useful, many technologies also cross into several categories. Automating lighting can be done for convenience, and it is also energy-saving. Lights can also be programmed to give the illusion of people being at home while they are on vacation, or to turn on when someone walks past outside; at this point they are also a security technology. Smart home assistants also act as a control interface and therefore cross several categories. A feature of the smart home is that these technologies do not necessarily have set natures; rather, they can cover several categories and the same device can be programmed to fulfil or stop fulfilling certain functions should the people controlling the smart home so wish or, in some cases, if the service provider cancels a particular service.

Furthermore, the understanding of what these services deliver can shift. Security and safety technologies may provide safety from outside threats or open up monitoring possibilities between residents. They may also involve other beneficiaries, such as landlords, who may value the integrity of the home as a building over the integrity of the tenants' privacy and daily lives.

2.7 Issues in the Smart Home

While there is a lack of clarity about what exactly constitutes a smart home, there has been considerable critique of what it delivers. Aldrich (2003) suggested that the smart home responds to the needs for comfort, convenience, security, and entertainment. While the use of energy-saving smart technologies can reduce energy consumption by up to 30% if they prioritise savings over comfort (Tuomela et al., 2021), Strengers (2013) argues that they facilitate a high-energy lifestyle.

In Strengers et al.'s (2019) investigation of Intel's vision of protection, productivity, and pleasure, they suggest that, while smart homes offer protection in the form of security or surveillance, there are several challenges that need to be addressed. Productivity often comes in the form of small conveniences that reduce labour and increase pleasure, often related to lighting or audiovisual systems, but the smart home overall often leads to increased digital housekeeping. In ad-

dition, Strengers et al. (2019) identify the risk of more capable users taking advantage of those who are less capable and argue that the smart home tends to favour existing gender norms.

A further concern is the datafication (Sadowski, 2020) of the home and its residents. In datafication, the practices and processes of the home are turned into data that represents the measurable actions taking place within the home. Data, by necessity, consists of abstractions and simplifications of reality, and the technologies dictate what is measured and thus valued. This is a further concern with off-the-shelf technologies, where the company making them may have access to the data generated. In terms of security and safety, Pierce (2019) explored how technologies move towards becoming creepy by shifting the boundaries of social acceptability, and offers three concepts for how these applications do this: digital leakage, hole-and-corner applications, and foot-in-the-door devices. Digital leakage refers to how digital information may be shared, stolen, or misused in ways unknown to the residents. Such digital leakage can be taken advantage of through hole-and-corner applications, where the re-use of the users' data is concealed or downplayed because it is not being done in their best interests. Finally, foot-in-the-door devices are devices that Pierce claims normalise a technology, thereby opening the way for future features. Some examples of these concepts involve the ability to share videos from home security cameras. There is also a documented history of smart doorbells sharing video with the police without the residents being aware of this (Ng, 2022). As the misuse of these technologies is clear, these concepts provide a useful lens for understanding how smart home technology developers may change what security and safety means within the smart home. Research also indicates that consumers are poorly prepared to handle the security issues of smart home technologies, suggesting a need for both companies and governments to act to protect consumers (Turner et al., 2022).

While the smart home may offer small conveniences, Coggins (2022) suggests that, rather than reducing domestic labour, smart home robots are more likely to alter the home, raising the question of what kind of efficiency the smart home provides, and for whom. Both Strengers (2013) and Darby (2018) note that there is limited evidence of energy-efficiency in the smart home overall and, although certain technologies help save energy, the overall vision of the smart home is one that leads to high energy consumption. In addition, there is a concern that many of the energy-saving efforts may be negated through rebound effects; in particular, when the focus is economic gain rather than energy efficiency (Walzberg et al., 2020).

2.8 Summary: The Smart Home

In this chapter, different users of privately owned smart homes have been outlined as initiators, cohabitants, incidental users, and bystanders, along with a modified version of these groups in rental homes. The roles, levels of access, and general implications for these different user groups were outlined in order to

identify how the smart home divides the inhabitants, as well as noting how even outsiders are surveilled by smart home technologies.

The home is a space for various practices, the expression of one's values, and of security and control (e.g. Després, 1991; Mallett, 2004). As new, emerging technologies are introduced into the home, they alter both our relationship to the home and its practices (e.g. Aldrich, 2003; Coggins, 2022; Strengers, 2013). Research into digital housekeeping indicates that the practices around smart technologies are shaped by both gender performances and expertise (e.g. Kennedy et al., 2015; Rode and Poole, 2018). While interest in technology has served as a driver for early adopters of these technologies, over the past decade they have become increasingly ubiquitous. And while the smart home can offer significant energy savings (Tuomela et al., 2021), the kind of lifestyle it facilitates, as well as rebound effects, may negate these potential gains (Strengers, 2013; Walzberg et al., 2020). It is therefore questionable whether the smart home actually enables smart behaviour, as Keinonen (2009) suggests a smart environment ought to. The limited support for marginalised users such as seniors (Christensen et al., 2022) suggests that, as these technologies become further embedded into our everyday lives, they may limit the agency and autonomy of users rather than enabling smarter decisions.

3. Theory Framing

This chapter explores the theoretical frameworks supporting the thesis, taking a perspective on technology as an attempt to control the world around us. While the most central framework used is Foucauldian discipline and panopticon theory, there are several other notions that support the understanding of technology presented here. Discipline is understood as hierarchical observation, normalising judgement, and examination (Foucault, 1995), which can be perceived as the principles by which smart technologies operate. Sensors are used to observe both the environment and the people in it, which enables the setting of standardised judgements. The examinations combine the observations and the judgements to punish inhabitants, should they act beyond the parameters of the system.

The understanding of technology presented here suggests that technology is about control, and an attempt to exercise control, either over oneself or over the world around us. However, smart technologies are interesting because they do not only affect the world directly around us, but can also be used to automate decisions beyond our physical presence, which in turn also affects others who may not be part of the decision-making process. The Device Paradigm (Borgmann, 1984) suggests that technology can obfuscate important practices, instead opening up the world for consumption. The Theory of Technological Mediation (Verbeek, 2011) argues that technology shapes the ways in which we perceive and interact with the world.

Rather than considering each individual technology, this thesis attempts to grasp the overall implications of the smart home, arguing that these involve not only the various smart technologies, but also how they shape the practices of the inhabitants. Redström and Wiltse (2018) conceptualise digital technologies as fluid assemblages that can be reshaped and reprogrammed to generate inequalities in terms of access, while Shove (2017) perceives the home as an assemblage where new technologies may displace existing practices. Through an understanding of autonomy formulated by Doyal and Gough (1991), this thesis considers how smart home technologies affect the autonomy, not just of the initiators, but also of those around them. It then uses Amartya Sen's notions of freedom and wellbeing (Sen, 2011), as well as the ability to contribute as a form of justice (Sayer, 2011), to consider the implications of how these technologies affect autonomy. As this thesis deals with the home, which is often considered a gendered space, it also adopts an understanding of the practices of the home as being, while not inherently gendered, embedded in a gendered way, such as the

way in which technological expertise in itself is part of a male gender expression (Rode and Poole, 2018). This is followed by a consideration of how the disaffected inhabitants of the smart home may become object.

These theoretical frameworks are utilised in order to conceptualise panopticons of convenience. The different frameworks serve to understand how these panopticons exercise power, reshaping the home as an assemblage, and therefore shifting the agency of the inhabitants and their relations both towards the home and with each other.

3.1 Disciplinary Technologies and Panopticons

As this thesis is concerned with how power is distributed within the household, the work of Michel Foucault, and in particular his book *Discipline and Punish* (Foucault, 1995), provides an important lens. The work of Foucault has been particularly influential in the discourse around surveillance (e.g. Haggerty, 2006; Matzner, 2017, 2016; Sewell and Barker, 2001) as well as around governance (e.g. de Laat, 2019). In *Discipline and Punish*, Foucault outlines disciplinary power as a way to train people into particular behaviours, rather than selecting the most suitable person, and as a tool that is used in education, the military, or other public institutions. However, these institutions can also be extended to include the home, as Deleuze (1992) demonstrates.

According to Foucault (1995), disciplinary power consists of three components: hierarchical observation, normalising judgement, and examination. Hierarchical observation involves the process of continuously observing subjects in order to improve their performance. Normalising judgement works by establishing a standard by which they can be measured. Finally, examination combines the observations and judgements to classify and punish the subjects. As discipline serves to train the subjects' behaviour, once their behaviour is satisfactory the exercise of power fades into the background, and the subjects internalise the disciplinary power. To extend Foucault's notion of the disciplinary society, in which public institutions function to discipline citizens into obedient and docile bodies, Deleuze (1992) argues that we are moving from a disciplinary society towards a society of control, where the training never ends and a form of perpetual training displaces the examination. Deleuze argues that, in the society of control, institutions no longer have a stable form but are continuously changing, therefore making it even more difficult to escape their reach.

In 1785, Jeremy Bentham proposed the design of a prison he called a panopticon, after the Greek word *panoptes*, meaning 'all-seeing' (Bentham, 1995). In Bentham's design, the prison was designed in a circular manner, with the guard sitting in the centre and able to observe the prisoners at any time. While the prisoners can be surveilled at any time, they are unable to see whether the guard is actually observing them or not because the guard station has blinds to stop the prisoners from seeing the guard. In the original design, the guard can also be observed by the public, in a similar manner. The design forces the prisoners to self-regulate their behaviour as if they are being observed, because they have

no way of knowing whether they are being observed or not. The aim of the design is to ensure that a single guard can watch over a large number of prisoners, minimising the labour needed. Bentham also considered this to be a humane solution because it would achieve the aims through apparent rather than actual punishment.

In contemporary discourse, the use of the panopticon is more dystopian and primarily derives from Michel Foucault's use of the concept as a metaphor to critique what he considered to be the disciplinary society (Foucault, 1995). In Foucault's vision, the panopticon refers to the exercise of societal institutions which require everyone to regulate and shape their behaviour as if they are being observed. The panopticon, in Foucault's vision, is a tool of governance that is exercised through governmental institutions, subtly shaping people into desirable behavioural patterns through discipline. While the panopticon exercises power, the subjects may be unaware of how it does so as they internalise the power structures and shape their behaviour appropriately because the mere threat of punishment is sufficient to influence them.

The term 'panopticon' has since been used by various scholars, including Shoshana Zuboff (1988), who refers to an information panopticon to describe workplace surveillance, where the managers shift towards observing the output rather than the workers. The term synopticon was also suggested by Thomas Mathiesen as a reverse order whereby the many watch the few; for example, celebrities and mass media (Mathiesen, 1997). With digitalisation, there is also the notion of digital panopticons to indicate the constant harvesting of personal data by both governments and companies, which exercise what de Laet (2019) refers to as predictive discipline. In common language, the term panopticon is also used to indicate surveillance societies in general. Understanding smart home technologies as disciplinary helps us to understand how these technologies exercise power, by continuously training the behaviour of the residents.

3.2 Disaffected Subjects

A discussion of practices in the home that did not include gender would be incomplete. As the smart home replaces practices in the home assemblage, it also reshapes the gender (im)balance of the home. As noted by Rode and Poole (2018), technological expertise is part of a male gender identity or performance; hence, not being able to handle the technical requirements of the home can be perceived as emasculating.

The smart technologies within a home are often chosen, implemented, and maintained by an initiator, who acts as evangelist for the smart home. This may lead to inequality, with the members of the household becoming divided between the initiator, who has control over the technology, and cohabitants who lack either access or sufficient knowledge to control the technologies to the same level as the initiator. While all members of the household are observed by the smart technologies, the cohabitants experience this surveillance differently because they lack control over the systems. One way to understand this is through a re-interpretation of Kristeva's (1982) notion of abjection. Kristeva describes

an object as neither a subject nor an object, but something repressed that will not conform as expected. Hence, the technologies may end up displacing them from their practices and make them feel like strangers in their own home. The datafication of the home requires the continuous collection of data through constant surveillance. Meanwhile, the cohabitants are treated as outsiders in relation to the home. If they want to make any adjustments to the technologies, they have to ask the initiator to do it for them because they lack control over those technologies. The initiators on their part are usually happy to be of service because they perceive this as part of maintaining the systems. As the smart home systems become further integrated, they continue to encroach upon the control the cohabitants can exercise, thereby increasing the alienation.

Gender serves as a useful lens for examining how and why certain practices in the home are altered or displaced, and which subjects of the smart home become disaffected. The early conceptions of digital domestic labour (Grinter et al., 2005; Tolmie et al., 2007) focused on the maintenance of home networks and stated that the work was done by those with the greatest expertise. The smart home technologies extend these networks towards other aspects of the home, whether it be cleaning, security, entertaining, or energy and utility practices. Many of the practices that are displaced by the smart home are those that have traditionally been performed by women but are reshaped through the technology practices of men, who stereotypically tend to perceive them as tedious or uninteresting (see Sayer, 2011), while not being directly involved in these practices.

In his critique of technology and consumption, Albert Borgmann considers the device paradigm to be the way in which technological devices are perceived and consumed. A device is a means to an end, which differentiates it from 'focal things and practices', the things that matter (Borgmann, 1984). According to Borgmann, technology obfuscates focal practices and makes them into something that is ready to be consumed (Borgmann, 2000, 1984). Commonly, this may include things such as heating, where the practice of heating the home can involve cutting wood and maintaining a fire, while central heating turns the heat into something that is ready to be consumed. While this makes life easier, it also separates humans from these focal practices. In Borgmann's world, this form of consumption is referred to as paradigmatic consumption, and while it is not morally wrong, he considers it to be inherently disengaging because it allows for the pleasure without any of the work, thereby devaluing whatever is being consumed.

In her critique of Borgmann, Michelfelder (2000) claims that, while the device paradigm does obfuscate certain practices, this is a limited perspective because it also enables new practices. Using the telephone as an example, she argues that, while it might disconnect us from our local community, it also allows people to maintain a stronger connection with friends and family from afar. Maintaining these connections can also be considered a form of care labour, especially with those who may be unable, or struggle, to leave the home to connect with their local community, or are part of marginalised groups without anyone nearby to talk to (as is sometimes seen in how the internet allowed LGBTQIA+

people to connect with others who shared their experience). A similar sentiment is described by Deschamps-Sonsino (2018), who presents how the phone reshaped the home, making it more private because people no longer needed to connect or host visitors to take part in local news, instead closing the home to outsiders. This reflects a similar disengagement with local communities that has sometimes shaped discourse around the internet, where those who spend a lot of time online are perceived as asocial, despite maintaining a large social network online.

Another critique of Borgmann is presented by Verbeek (2002), who argues that Borgmann presupposes an authentic way of living, suggesting instead that we experience the world through technology. Verbeek argues that focal practices do not need to serve specific goals, such as gathering wood for the hearth, but that they still require effort and exertion and exist for their own sake. Verbeek's (2011) theory of Technological Mediation presents a more open approach to technology than Borgmann's, arguing that technology is a lens that mediates the way in which we see and experience the world, rather than a threat to important, focal, practices. Verbeek, utilising the work of Don Ihde (1990), argues that there are four ways in which technologies mediate our lives (Verbeek, 2011): embodiment, whereby we see the world through technology such as glasses; hermeneutic technologies, whereby we interpret the world through the technology, such as thermometers; alterity, which indicates interactive technologies; and background technologies, such as heating or other utilities that exist around us. What is important about new, and in particular digital, technologies, is that they share several of these qualities, making them hybrid technologies. The notion of hybrid technologies is also a way for us to understand smart environments, where background technologies are no longer merely in the background but can become immersive by simultaneously being interactive. According to Verbeek (2011), because these technologies shape our understanding and experience of the world, designing technology is the same as ethics, but by other means.

In the context of smart home technologies, the device paradigm can be utilised to understand how they serve to commodify space, shifting the focus away from practices within the home and towards consumption. Practices are disconnected from those who would practise them but, because smart home technologies are primarily implemented as a way to avoid work that is perceived as uninteresting, it also serves to commodify the home. At the same time, these technologies turn the home into a site of production because technologies, especially energy-related ones, often involve energy production through geothermal heating or solar panels, for example. Panopticons of convenience, such as smart homes, filter our knowledge of the world. Both our understandings of and interactions with the home are mediated by the smart home technologies, which are thus able to adjust our behaviour.

3.3 The Home as an Assemblage

The notion of an assemblage largely derives from the work of Deleuze and Guattari (1987), and suggests that there is no single way to understand the world, but rather perceives a relational understanding of the world. Each component is understood in relation to its material, social, and narrative properties, redistributing individual agency to the interdependent network of these various properties that form an assemblage. The home can be considered one such assemblage (Shove, 2017), and Maalsen (2019) argues that understanding the smart home as a socio-technical assemblage is critical to understanding its possibilities, while Crabtree and Tolmie (2016) identify designing for methodically created assemblages as a key challenge for the smart home.

Redström and Wiltse (2018) assert that digital technologies take the form of what they refer to as fluid assemblages; digital technologies can be reprogrammed, and therefore repurposed, with new intentions and shifting properties dependent on different users. A smartphone does not exist solely as a smartphone but is dependent on the network of cell towers to function, as well as the social practices surrounding it. On top of that, smartphones can use a variety of different software that may change the way they function. In addition, software is designed to adapt differently to different users: an expert or admin user may have a different interface and permissions than a basic user.

While smartphone apps are natural examples of this, many internet-connected devices could also be considered to form fluid assemblages, where the functionality can be changed with a software update. These updates can extend functionality, but they can also be deceptive to the users. In 2019, Google Nest was shown to have a microphone (Ng and Wollerton, 2019) and while the company has claimed that this was a mistake and it was never activated, it can be used as an example of how functionality can be added through remote updates, as well as an example of how service operators have a different user experience and permissions compared to home users.

The smart home assemblage also involves the combination of resources, devices, and infrastructures within the home, such as the kind of layout and furniture that is required for a robot vacuum cleaner to operate, the need for electricity, and residents' need to ensure that the home is sufficiently in order for the robot vacuum cleaner not to get stuck, as shown by Coggins (2022), who describes how the robot vacuum cleaner alters housework rather than reducing it. This transforms the home assemblage into increasingly opaque and difficult-to-operate 'black boxes', where the technology is, effectively, operated by others without the need (or even possibility) for the residents to fully understand them.

The practices of maintaining the smart home can be considered part of that assemblage, such as whether the residents need support and the practices surrounding such support. This is particularly important because one of the primary applications of smart home technologies is technology for ageing and welfare technologies (Marikyan et al., 2019). It is therefore worth considering how the technology practices of seniors are shaped by the smart home (and vice versa); for instance, if seniors struggle to use technologies that are considered relatively commonplace, such as smartphones (Christensen et al., 2022). If so,

how can they be expected to engage with and exercise full agency over the smart home? Understanding the smart home as an assemblage also enables the consideration of porous boundaries. Which is to say that, while the smart home may be made up of the building, the technologies, the people, and the practices of those people, it also extends beyond the building itself. Software updates can be initiated from outside the home, and home technologies can be accessed from outside; for example, via the phone.

3.4 Autonomy: Capability, Control, and Contribution?

The Capability Approach is an ethical framework proposing that the agency to pursue well-being is of primary moral importance, where well-being is understood as the capability to achieve what one wants to achieve, even if it causes personal hardship (Sen, 2011). Hence, the Capability Approach is concerned with the distribution of capabilities, rather than outcomes. A warm home may offer well-being, but agency to pursue energy efficiency is important and may offer another form of less hedonic well-being. In Martha Nussbaum's interpretation of the Capability Approach, control over one's environment is a central capability (Nussbaum, 2003), and the level of autonomy that residents of the smart home possess can therefore be directly linked to the ethical framework of the Capability Approach. If autonomy is understood as meaning: *'To have the ability to make informed choices about what should be done and how to go about doing it'* (Doyal and Gough, 1991, p. 53), then the control here should be seen as a combination of the transparency of the smart home systems and the residents' ability to act as they prefer and to control these systems. Approaches that attempt to shape the behaviour of users towards positive choices from the perspective of the designer, such as Design with Intent (Lockton et al., 2010), or nudging (Thaler and Sunstein, 2008), could be seen as threatening the autonomy of users, even when self-imposed (Nagenborg, 2014).

Within design, the Capability Approach has been proposed as an ethical framework to support value-sensitive design (Jacobs and Huldgtren, 2018) and Oosterlaken (2009) has argued that the Capability Approach represents a missing link between social justice and design. Oosterlaken (2009) has developed Design for Development as a form of capability-sensitive design. Utilising the Capability Approach, control and autonomy could be seen as central values when designing technologies for the smart home, in terms of how these technologies shape human autonomy as well as the degree of autonomy the technologies have to act independently. Interaction with these technologies can be separated into direct interaction and implicit interaction. Direct interaction refers to interactions where a human operates the technology, such as apps for controlling the lighting. Implicit interaction refers to indirect interactions with technologies, where an algorithm is used to respond to sensor readings, such as the Nest smart thermostat, which attempts to optimise the temperature based on the activities of the residents. Another way of describing these would be technologies where smartness refers to the device connecting to a network, or the smartness refers to some form of algorithm controlling the device.

The way in which control is understood in the design shapes the autonomy of the people living in the smart home. If control is perceived as instrumental, or as a means to an end, such as greater control over the technology to achieve something, perhaps security or leisure, then it can be discussed by considering what it accomplishes. Instrumental control may encounter moral conflicts when there are multiple contending values, such as comfort and sustainability; for instance, Ehrenberg and Keinonen's (2021b) example of Regulating Commodities, where access to hot water becomes more difficult in the name of sustainability. However, if we consider control in itself to be the aim (or as an end), then it matters who is affected by it; control over self and over your own space is a good or even a central capability, according to Nussbaum. Smart technologies allow us to extend control into physical space beyond our immediate presence. They inevitably become entangled with how others in the direct vicinity use their space. When we understand smart home technologies as disciplinary, non-instrumental control (or control as an end) is morally problematic unless everyone affected has equal access and control.

While the smart home can be understood in terms of the capabilities it extends and the control it allows over our environment, another perspective can be perceived in Sayer's (2011) argument for contributive justice. Sayer presents contributive justice as a normative theory concerned with how the division of labour provides different people with unequal opportunities to fulfil their potential. While the Capability Approach is concerned with distributive justice, or the distribution of capabilities, Contributive Justice is concerned with the ability to contribute. As Sayer (2011) notes, feminist research into the division of labour in the home has been concerned with the contributive injustice of men contributing less to domestic labour, while also reserving less tedious or more rewarding tasks for themselves. It does not take much of a stretch to compare this to digital domestic labour. Digital domestic labour requires technical expertise and is not perceived as tedious like laundry or vacuuming, especially by the smart home makers. A contributive perspective opens up the question of how the cohabitants and dependents of the smart home can contribute to digital domestic labour, as well as which practices are being transformed into higher-value tasks reserved to the initiators.

Within the panopticons of convenience, both the capability approach and contributive justice provide a lens for understanding how smart home technologies re-allocate agency and the ability to contribute within the home (See Table 1).

Table 1. How each theory contributes to the understanding of panopticons of convenience.

Topic	Key Theorists	Role in the Panopticons of Convenience
Disciplinary Technologies and Panopticons	Foucault	How smart technologies exercise disciplinary power
Disaffected Subjects	Borgmann, Verbeek	Commodification of the home and how smart technologies mediate our experience of the home
The Home as an Assemblage	Redström & Wiltse, Shove	Understanding the technologies as an assemblage rather than individual technologies
Autonomy: Capability, Control, and Contribution	Sen and Sayer	How the technologies shape autonomy and agency

3.5 Assembling the Panopticons of Convenience

This chapter began by outlining Foucauldian discipline and panopticons. By understanding smart technologies as exercising disciplinary power, while smart homes are a form of fluid assemblage, smart homes can be seen as a kind of panopticon. An important difference from the panopticons in Foucault's theory is the way in which they are willingly embraced, or at least accepted, by their subjects for the sake of convenience, where convenience refers to either a reduction in labour or lighter labour. Panopticons of convenience can therefore be defined as *'The acceptance of additional surveillance of one's life for the purpose of acquiring actual or presumed convenience'* (Ehrenberg et al., No date).

This chapter then continued by introducing various frameworks that allow us to understand, firstly, how the panopticons exercise power through discipline and how the subjects of the smart home may become disaffected and alienated from the home as it becomes commodified. The theory of technological mediation was then introduced to show how the technologies mediate and filter our experience of the world, while the notion of assemblages was introduced to indicate that it is a network of technologies, devices, practices, and people that make up the panopticons of convenience. Finally, the notion of autonomy, from the perspective of capabilities and contribution, was introduced to show how panopticons of convenience affect the agency of the subjects.

An initial exploration of the panopticons of convenience could perceive them as a behavioural pattern for how societal developments may compromise the values of autonomy or privacy in favour of comfort. This could also be seen as a feature characterising smart home technologies; thus, we could claim that some houses are closer to being panopticons of convenience than others. However, the primary use of panopticons of convenience here is to consider the concept as a lens through which we can try to understand how smart home technologies affect autonomy, agency, and power within the smart home assemblage.

Meanwhile, it is worth underlining that, while it is possible to discern the panopticons of convenience as a vision for how emerging smart technologies exercise power, they are not yet internalised, and the exercise of power is quite obvious. The lack of subtlety is a significant difference from the Foucauldian panopticons, where the subjects might be unaware of how they modify their behaviour. However, this can be understood by considering panopticons of convenience as emerging, and not yet complete in their exercise of power.

The different theories used to conceptualise panopticons of convenience have different implications for the home, and while none of them alone offers a complete picture, they each provide a partial understanding. Considering smart home technologies as disciplinary technologies, following Foucault (1995), helps to explain how they shape behaviours. Interpreting smart homes through the Device Paradigm and technological mediation offers an understanding of what this means for our relation to the home (Borgmann, 1984; Verbeek, 2002). The concept of fluid assemblages helps in understanding how digital technologies are fluid and interconnected, indicating that it is useful to consider smart homes as connected assemblages of devices, rather than analysing each tech-

nology independently (Redström and Wiltse, 2018). Applying ethical frameworks, such as the capability approach and contributory justice, allows us to consider how the shifts in power in an interconnected system affect our ability to contribute to practices, and what that means for equality within smart homes (Sayer, 2011; Sen, 2011).

4. Case Studies and Methods

The research undertaken for this thesis was conducted through three case studies, which have been analysed and described in four different publications: *The Technology is Enemy for Me at the Moment* (Ehrenberg and Keinonen, 2021b; Publication 1), *Towards Panopticons of Convenience in the Nordic Smart Home Assemblage* (Ehrenberg et al., No date; Publication 2), *Co-Living as a Rental Home Experience* (Ehrenberg and Keinonen, 2021a; Publication 3), and *Volunteer-based IT Helpdesks as Ambiguous Quasi-Public Service* (Christensen et al., 2022; Publication 4). These four texts are based on three separate case studies. The first two (Ehrenberg et al., No date; Ehrenberg and Keinonen, 2021b; Publications 1 & 2) investigate how the smart home shifts and reifies power structures within the household by interviewing smart home makers and their cohabitants. *Co-Living as a Rental Home Experience* (Ehrenberg and Keinonen, 2021a; Publication 3) explores the lived experience of residents of smart home apartment hotels. The final paper, on volunteer-based IT helpdesks (Christensen et al., 2022; Publication 4), explores the implications of digitalisation in terms of the kind of support that is needed. The studies are presented according to the order that makes the most sense in terms of discussion, rather than chronologically.

Table 2. Overview of the data from each study.

Case Study 1: Smart Home Makers			
Type	Encounters	Data Generated	Notes
Semi-structured interviews	8	Audio recording / transcripts	5 initiators, 3 partners
Case Study 2: Co-Living and Autonomy			
Type	Encounters	Data Generated	Notes
Semi-structured interviews	11	Audio recording / transcripts	6 women, 5 men 18–45 years old
Case Study 3: Volunteers, IT Helpdesks, and Seniors			
Type	Encounters	Data Generated	Notes
Semi-structured interviews	15	Audio recording	Volunteers, library workers, public employees, NGO staff
Group interviews	2	Audio recording	
Survey	1		6 volunteers
Mapping workshops	2		7 volunteers, 2 library workers
Meetings	4	Recording / notes	
Observations	4	Notes	

4.1 Case Study 1: Smart Home Makers

The Technology is Enemy for me at the Moment (Ehrenberg and Keinonen, 2021b; Publication 1) and *Towards Panopticons of Convenience: Power in the Nordic Smart Home Assemblage* (Ehrenberg et al., No date; Publication 2) form the primary theoretical contribution of the thesis and develop a Foucauldian interpretation of the smart home, identifying how smart homes observe, judge, and examine the residents. In the first paper, we identify five mechanisms of power, and then in the second paper we explore the implications for the feeling of home, and conceptualise panopticons of convenience. The notion of panopticons of convenience should be kept in mind as we continue with the final two papers, because they hint at how this notion may extend beyond the smart home and towards both housing in general and smart cities.

4.1.1 Case Study 1: Data Collection

In this case study, two series of semi-structured interviews were conducted, with a total of eight interviews, firstly with the initiators and then a second round with their partners. Each interview lasted 30–120 minutes. The households were selected on the basis of being early adopters of smart home technologies and were found through a snowballing approach. The participants are living or working in the capital region of a Nordic country. All the initiators have jobs related to technology, entrepreneurship, or research.

4.1.2 Case Study 1: Analysis

Each interview was transcribed and coded in three rounds. An initial round of coding involved two researchers. A second round was then undertaken to explore control in the smart home. This resulted in five mechanisms of control, presented in *The Technology is Enemy for me at the Moment* (Ehrenberg and Keinonen, 2021b; Publication 1). A third round of coding was then conducted in order to explore the perceived aims of the smart home and how the technologies are embedded in the social structure of the home. This resulted in the conceptualisation of Panopticons of Convenience (Ehrenberg et al., No date; Publication 2).

4.1.3 Case Study 1: Results

By understanding smart homes as exercising disciplinary power, the first paper establishes five mechanisms by which power is shifted within the household. These are as follows:

Overt Observation, which involves the explicit monitoring of interactions within the home, such as smart doorbells. These technologies allow the users to be remotely present in the home, but also shift the way in which information is shared within the household, leading the cohabitants to experience surveillance.

Discreet Observation, which indicates technologies primarily designed to monitor the environment, thereby indirectly also monitoring the inhabitants. An example of such a technology is CO₂ monitors. Much like overt observation,

these technologies shift the flow of information within the household; however, they are perceived as more innocuous because they are intended to observe the space. Nevertheless, because the data responds to interactions within the home, the cohabitants are also observed.

Constraining Interactions, which refers to technologies that define how one interacts with the home. Voice user interfaces are an example of such technologies. These technologies require cohabitants to follow the initiator's perception of how best to interact with the technologies of the home, but the cohabitants may become frustrated at needing their phone to interact with their home.

Regulating Commodities, which refers to when smart home technologies are used to define when and how otherwise available commodities, such as hot water, can be accessed. While these technologies treat all users the same, the experience is very different for an initiator who sets up the system than for someone who is subjected to it.

Predefining Practices, which is when technology is used to define how a space can be used through technology, such as programming lights for particular uses, such as mood lights. These technologies allow the initiator to predefine how a space ought to be used through technology, rather than by means of a discussion between those who are present in the space at the time.

Together, these mechanisms help us to understand how power is transferred within the household, separating residents into different categories while also actively shaping their behaviour, not only when denying access but also by making certain practices less convenient. It was noted that the initiators also take on a maintenance role, indicating that it is not only power that shifts towards them, but also responsibilities. The need for equity in the deployment of the smart home was noted, and also that these technologies are best utilised to address household issues, rather than those of individual members. The notion of treating the smart home as a collection of systems or an ecosystem was also noted.

The second publication makes two contributions. Firstly, it explores the notion of the smart home assemblage in order to conceptualise it as a panopticon of convenience, defined as *'The acceptance of additional surveillance over one's life for the purpose of acquiring actual or presumed convenience'* (Ehrenberg et al., No date). Secondly, it explores the panopticons of convenience within the home, considering the intentions and implications of these for the cohabitants. While the first paper referred to cohabitants as partners, not only in the relationship but also in the home, the second article critiques this because the technologies limit their agency within the smart home assemblage, instead referring to them as cohabitants because partner implies shared control. The study then reflects upon the smart home's role in alienating the cohabitants as a cause of abjection among some cohabitants.

4.2 Case Study 2: Co-Living and Autonomy

In the second case study, the thesis takes a step back to consider the implications of smart housing, rather than simply individual homes. This case study is

presented in Publication 3 (Ehrenberg and Keinonen, 2021a). Co-living is identified as distinctly separate from co-housing as a commodified and top-down version of shared housing, where techno-landlords are in charge of selecting, installing, and maintaining the technologies. Utilising a protection–appreciation space (Keinonen, 2010), we explore how co-living solutions affect the autonomy of the residents and how the use of technology may be deployed to cushion this. The case study considers the compromises and advantages these solutions offer for residents. The focus of the analysis was on how autonomy is shaped through access to and design of space, contracts, and community.

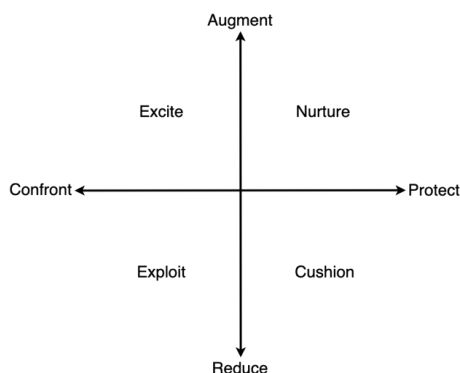


Figure 3. Protection–Appreciation Space examining whether a design protects the user from harm or respects their autonomous agency. Source: (Ehrenberg and Keinonen, 2021a), adapted from Keinonen (Keinonen, 2010).

4.2.1 Case Study 2: Data Collection

The data collection was achieved through 11 semi-structured interviews conducted at two different co-living locations. All of these interviews took place on location and lasted 24–60 minutes. The participants were 18–45 years old and were recruited by approaching some residents, who then volunteered to help recruit more participants within the building. The selection was made on the basis of an intent to embark upon longer-term residency. At the beginning of the interviews, the buildings had been open for six months. Aside from the interviews, publicly available material, such as websites, was also used as part of the data.

4.2.2 Case Study 2: Analysis

Each interview was transcribed and coded. After an initial round, 11 codes were identified: surveillance, smart access, guests, defining the mood, cleaning services, personal space, communal space, smart utilities, house managers, community guidelines, and booking and contract

. After this initial coding, three themes emerged during the thematic analysis: contracts, community, and space.

4.2.3 Case Study 2: Results

While power in Case Study 1 only shifts within the household, Case Study 2 explores how power shifts out of the household when the landlord implements the smart technologies. As the research was conducted in the context of an apartment hotel, it also considers how rental housing may be transformed through the use of technology. While temporary forms of housing during various periods of life, such as worker hotels or student dormitories, are nothing new, the use of smart technologies facilitates new power dynamics between tenants and landlord. Meanwhile, there are various benefits for the tenants who are, by and large, satisfied with their living situations. These benefits include not having to go through a tedious application process to gain access to housing in the city centre, contracts bundled with other amenities, and access to the local community. To understand how this relates to autonomy, a Protection–Appreciation space is used (see Figure 3). This space suggests that designs that both protect users from harm and simultaneously appreciate their agency can be seen as nurturing. Designs that only achieve one of these two dimensions may be exciting but fail to protect the users, or protect the users but cushion their growth. Designs that do neither can be considered exploitative. The analysis using the Protection–Appreciation space indicates that, while the approach of easier contracts may excite users by providing opportunities such as easier access to the city centre, it also fails to protect them from other aspects; in this case, residents find themselves giving up tenant rights because they are unable to register the co-living space as a permanent home. Other aspects involve how the access to community may cushion and limit the tenants' social life, with some residents admitting that it becomes more difficult to maintain close relations with those outside the co-living space and that while there is the comfort of an accessible community when moving in, it limits growth beyond that. The use of space is defined in some ways by the housing company, and again cushions them. Finally, while the rules and regulations of the housing company are largely sensible, the residents have limited influence over them. This case study indicates that, if these technologies become embedded and enable new forms of housing, there is a need for public agencies to follow up and ensure that the rights of residents are considered when developing new housing policies.

4.3 Case Study 3: Volunteers, IT Helpdesks, and Seniors

The final case is presented in publication 4 (Christensen et al., 2022). This study considers the role of the societal project of digitalisation, how it is maintained, and what opportunities citizens may have to access support when digital services are the primary option. In this case study, two volunteer-based helpdesk services for seniors were studied, one in Finland and one in Denmark, identifying them as a form of quasi-public services. Through this identification, we indicate that they fill a role that ought to be a public service and are perceived as such by many of the users, while the public relies on it to function, despite offering limited support for it to do so. These quasi-public services of digital support for seniors raise the important question of how citizens with limited digital

literacy are expected to manage. They also encourage reflection upon smart homes, as seniors and people with disabilities are considered some of the primary markets for smart home technologies. If many seniors are struggling with common devices such as smartphones, how much agency and control are they able to exercise over smart technology within their homes?

4.3.1 Case Study 3: Data Collection

In this case study, we employed a mixed-methods data collection process at two libraries, one in Denmark and one in Finland. The primary data consists of interviews, observations, and workshops at both libraries. The data collection process was shaped by Covid-19 pandemic restrictions. At the Finnish site, the libraries were closed to the public and interviews were conducted remotely, while at the Danish site it was possible to conduct in situ observations and face-to-face interviews and meetings. There were also workshop activities that were conducted in person at both sites. Alongside the empirical data, we also conducted desk research on digitalisation, library strategies, and volunteer organisations.

4.3.2 Case Study 3: Analysis

An initial analysis was undertaken by two of the researchers¹ following an iterative model that allowed for adjustments to be made based on the ongoing findings, focusing especially on volunteer motivations and the organisational setup of the volunteer NGOs. Once all the data had been collected, a thematic analysis was conducted, which resulted in three themes: tensions in the setup of the IT helpdesk, the critical role of volunteer-based IT helpdesk services in public digitalisation, and the IT helpdesk as a ‘quasi-public’ service.

4.3.3 Case Study 3: Results

The primary outcome of the study was the identification of IT helpdesks as quasi-public services, and how the implementation of these services, with their reliance on volunteers, renders them vulnerable. The quasi-public aspect implies that it is often perceived and treated as a public service by the seniors using it, and the cities consider it a part of their digitalisation strategy. At the same time, the cities offer limited support for these IT helpdesks. In the context of digitalisation and the smart home, this study indicates that, although seniors are among the primary audiences of the smart home, it is likely to negatively affect the autonomy of less tech-savvy seniors because many are still struggling with the use of a smartphone. While smart technologies may permit seniors to continue living in their own home, their control of that home will be infringed upon and they may end up taking on a role similar to that of cohabitants, without the competence needed to operate and maintain their smart home, thus becoming reliant upon outside help.

¹ Including the author.

4.4 Reflection on Methods

Throughout the case studies, semi-structured interviews (Flick, 2018) were used as the primary data collection method, and then complemented with observations, workshops, surveys, and meetings, as needed. As the aim was to conduct exploratory studies into smart homes, semi-structured interviews were perceived as a suitable method for collecting data about the participants' experiences of the research topic in their own words. In all the case studies, the participants were recruited through direct recruitment snowballing approaches (Flick, 2018). Snowballing participant recruitment was perceived as appropriate since most of the participants were either highly specific within a relatively small group, such as case study 1, or recruited from a very specific context, such as the co-living spaces in case study 2 and the seniors in case study 3. While a larger sample size would have offered better opportunities for generalisation, Braun and Clarke note that the focus of thematic analysis is on the participants' standpoint, and that six to ten interview participants are sufficient for a small project (Braun and Clarke, 2013), or exploratory case study, as in this thesis.

Both the size of the sample and the aim were important considerations when selecting the methods of analysis. The data sample used in each study is relatively small, so the methods chosen were considered to accommodate exploratory studies rather than explanatory research. Thus, thematic analysis was used as the primary analytical method, rather than narrative inquiry. Because the research aims to construct and explore narratives, thematic analysis offers a versatile method for analysing and exploring the themes that emerged from analysing the interviews. While narrative inquiry is more focused on the participants' own voices and discourse analysis (Yin, 2018), thematic analysis instead allowed us to build narratives exploring ways to understand smart technologies and their implications for autonomy through themes that were identified during the analysis (Braun and Clarke, 2013). In addition, the interviews were conducted in English, rather than the local language, and a discourse analysis would therefore have been difficult due to nuances getting lost in translation.

The cohesion of the primary methods with themes functioning as broad units of analysis between the case studies provides a useful foundation for building an overarching theme and narrative encompassing the case studies. As the research was focused more on areas of interest than specific questions, the methods of both data collection and analysis were selected on the basis of flexibility, as well as on their ability to generate rich descriptions of the research context that could support reflection through the relevant theory.

5. Findings and Outcomes

While the case studies in this thesis are critical of the impacts of smart technology in both the home and the wider society, this is not intended as a rejection, but rather as an attempt to open up and address some of the challenges of digitalisation and smart technologies. While smart homes, housing, and cities may improve overall wellbeing from Bentham's perspective, there will always be outliers and marginalised groups who ought to be considered as these technologies become commonplace. The research into smart homes presented in this thesis goes beyond existing descriptions of smart homes, which are often oriented around the aims of such homes or the use of technology. Instead, I focused on the relational aspects and how smart home technology affects relationships both within and towards the home. This section answers the research questions as well as explaining the role played by the different publications in supporting these answers.

RQ1 - How can the politics associated with the character of smart home technologies be conceptualised? (Publications 1 and 2)

RQ2 - How do these politics, both intentionally and unintentionally, affect different members of the household and their relation to the home? (Publications 1, 2, 3, and 4)

5.1 RQ1: Conceptualising the Panopticons of Convenience

How can the politics associated with the character of smart home technologies be conceptualised?

The politics associated with the character of the smart home can be conceptualised as panopticons of convenience, whereby the residents accept additional surveillance and reduced autonomy in exchange for convenience. The idea of panopticons of convenience emerged from Publication 1 (Ehrenberg and Keinonen, 2021b), where the disciplinary nature of smart technologies was explored using the work of Foucault (1995). It was noted that, even without intent, these panopticons affect the power dynamics within the household in favour of the initiator, who sets up and maintains the smart home technologies. During the initial phase of the study with the initiators, it became clear that it was their own vision that they were implementing, rather than that of their family. As a

result, their partners were invited to participate in the study as well. The outcome was an understanding of smart technologies as Foucauldian disciplinary technologies, and the identification of five mechanisms through which they exercise power. In addition, it was also noted that this exercise of power was not necessarily intentional on the part of the initiators. Publication 2 (Ehrenberg et al., No date) takes this initial understanding further and explores the exercise of power in the smart home. Firstly, the smart home was perceived as an assemblage, in that it is not just the smart technologies or the building containing the technologies that constitute the smart home, but the inhabitants and their practices are also a vital part of it. Therefore, it does not make sense in this context to discuss individual technologies, but rather the collection of technologies, people, and practices. This led to a consideration of assemblage theory, and in particular fluid assemblages (Redström and Wiltse, 2018). The collected data showed that the smart home projects were constantly ongoing and shifting.

In Publication 2 (Ehrenberg et al., No date), *Towards Panopticons of Convenience*, the idea of the smart home is explored, as well as how it alienates cohabitants within the home. The existing attempts to describe some of the qualities of the smart home, while useful, were found to be insufficient because they do not consider the experience of living with and in a smart home, instead focusing on the aims or kinds of technologies that may be included. Therefore, instead of considering whether the smart home allows for smart actions (Keinonen, 2009), the inclusion of digital sensing and communication devices (Gram-Hanssen and Darby, 2018), or the use of interactive technologies (Harper, 2003), or whether it works to promote the comfort, convenience, security, and entertainment of the residents (Aldrich, 2003), this research considers the perspectives of the residents and how smart homes shape the lives of different residents and affect both the power dynamics within the household and their relationship to their home.

This led to a consideration of how the collection of data is internalised and datafication as a trait of a panopticon. However, unlike Foucauldian panopticons (Foucault, 1995), the stated aims and the adoption were somewhat different. The initiators considered convenience and utilities such as lower energy costs, as well as satisfying their own interest in technology, to be their primary drivers for building a smart home. The role of convenience, which came to mean less or lighter domestic labour, while limiting the ability of non-technical members of the household to contribute, along with panopticon traits, led to the consideration of smart homes as panopticons of convenience, as a lens to understand how smart technologies shape autonomy. These panopticons of convenience were defined as *'The acceptance of additional surveillance of one's life for the purpose of acquiring actual or presumed convenience'* (Ehrenberg et al., No date). Another differentiation from Foucauldian panopticons is the rather obvious way in which they exercise power. This is interpreted here as panopticons of convenience being something that is emerging rather than already being in place, indicating that their exercise of power is often obvious. However, as they become internalised, they may fade into the background.

In Publications 1 & 2 (Ehrenberg et al., No date; Ehrenberg and Keinonen, 2021b), the work reflects upon how the smart home affects the power dynamics of the household, and the implications for the cohabitants as they become disempowered and alienated. However, as the home is already in many ways an unequal domain, a cursory glance might suggest that male actors taking a more active role is a positive step. In this thesis, the capability approach and contributive justice are introduced as ethical frameworks for considering how panopticons of convenience shape autonomy and agency. The findings suggest that, while the more active role of male initiators is desirable, smart home technologies may alienate cohabitants in such a way that they do not feel in control within their own homes.

The alienation and subsequent foreignisation of the cohabitants were understood in Publication 2 (Ehrenberg et al., No date) through a re-interpretation of abjection and, in this thesis, this was connected to the device paradigm and how technology can disconnect us from practices enabling the commodification of the home (also discussed in RQ2).

The concept of panopticons of convenience is intended as a critical lens for understanding how smart home assemblages affect autonomy and agency, and as a tool for considering the kinds of practices that smart home technologies affect and the politics that are embedded in them. It is intended to enable us to consider what kind of home we want, which technologies may be desirable, and to make the choices more transparent. A technology such as smart doorbells may be considered desirable, and most of the initiators are very satisfied with it, yet it should also consider how others within the home are affected, alongside the benefits it may bring.

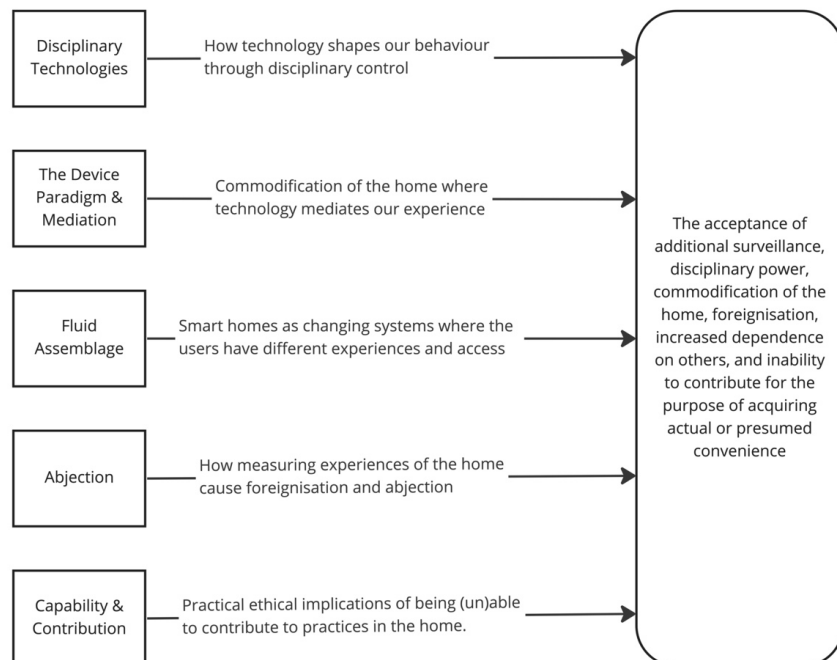


Figure 4. How different ideas contribute to creating panopticons of convenience.

Convenience is commonly stated as a motivation for adopting smart home technologies, and it is therefore pertinent to consider its moral valence. Convenience can be considered to offer users a form of pleasure. Jordan (2003) explored how Tiger's (2000) four-pleasure model can be utilised for product design. According to this model, the four pleasures are physio-pleasure, psycho-pleasure, socio-pleasure, and ideo-pleasure. An important consideration relating to these pleasures is that, due to how panopticons of convenience divide the members of a household, individuals experience these pleasures differently.

Physio-pleasure is associated with sensory pleasures and can be experienced through the ability to adjust the environment in order to be able to live comfortably without effort, such as controlling temperature, lighting, and air quality. Initiators have better and easier access to the technologies and therefore experience more physio-pleasure from the conveniences of the smart home. The convenience of physio-pleasure in the smart home is also part of mediating our experience of the home and contributes to commodification in Borgmann's (1984) device paradigm.

Psycho-pleasure is achieved through things that satisfy the intellect, which in smart homes is especially apparent in the pleasure that initiators derive from managing and building the system and converting routine tasks into technically exciting challenges. However, it is through these practices in particular that the cohabitants experience the lack of control that leads to foreignisation, as seen in Publication 2 (Ehrenberg et al., No date).

Socio-pleasure refers to the way in which a product may form part of a user's social identity, such as being an early adopter of smart home technologies, as well as a perception of taking care of the family and building what the initiators perceive as an ideal home. For the cohabitants, the initiator's notion of an ideal may be constricting and may push them to adjust their practices or face the disciplinary technologies.

Ideo-pleasure is associated with how the technologies embody the values of users, such as perceiving smart homes as offering a more technically advanced and desirable way of living. This desirable way of living can be presented as lower energy consumption, or a home that takes care of its residents by reducing domestic labour, thereby freeing up time for leisure. While smart homes do not appear to lead to less domestic labour, the aim of acquiring this was stated as a driver for smart home adoption among the initiators.

However, as shown in Figure 4, smart home conveniences come with unintended consequences of which the initiators appear to be unaware, and the lens of panopticons of convenience can shed light on these. The valence of convenience is therefore dependent upon the implications it has beyond the immediate convenience of the initiators; for example, whose convenience, and whether it limits the autonomy of others. What one does with the time that smart home technologies are supposed to free up can also be a consideration: whether it is used for the residents' own pleasure, be it hedonic or eudaimonic, or to be more productive, thereby creating more labour, as Cowan (1983) argues that many household technologies of the 20th century have done. Thus, the politics that smart home technologies could be said to settle is that they allow the initiator

(or landlord in the case of rental housing) to pre-emptively settle ideas about how to live, how to light the home, how high to set the temperature, issues of energy consumption, etc. Thus, the choice about how to live is made part of the infrastructure, rather than something to discuss and decide together.

5.2 RQ2: Different Subjects of the Panopticons of Convenience

How do these politics, both intentionally and unintentionally, affect different members of the household and their relation to the home?

The research in Publications 1, 2, 3, and 4 (Christensen et al., 2022; Ehrenberg et al., No date; Ehrenberg and Keinonen, 2021b, 2021a) is utilised in this thesis to answer this research question and explores the roles that different people play in the panopticons of convenience. The first publication, *The Technology is Enemy for Me at the Moment*, investigates the ways in which smart home technologies divide the residents within the home into various roles. In Publication 2, *Towards Panopticons of Convenience*, the implications of these divisions are explored further, with a consideration of how cohabitants may become abject as they are alienated from the practices of the home. Publication 3, *Co-Living as a Rental Home Experience*, explores how rental homes and co-living spaces may be affected by the implementation of smart home technologies. Publication 4, *Volunteer-based IT Helpdesks as Ambiguous Quasi-Public Services*, shifts the focus to helpdesks, and offers insights into how seniors may be affected by smart home technologies. This serves both as an example of the implications of digitalisation for those left behind, while also illustrating the kind of support they are currently being offered, and as a way to consider the capability of living in the smart home.

The first publication, on smart home makers, primarily serves to provide an understanding of the mechanisms by which power relations within the home become altered. It also shows that the relationship the smart home makers and their partners have to the home is altered. One example of this is smart doorbells, which several of the initiators consider to be among the more useful smart home technologies, while one cohabitant describes the experience of these devices as: *‘Whenever I walk in, whenever I open the door or close the door I’m being watched. Like this morning and I go out with some trash and [Husband] asks “what did you do?” because he got a notification and it’s like, let me go out of the door without being asked, you know [laughs]. I just went out with some trash’* (Ehrenberg and Keinonen, 2021b, n.p.).

As noted above, digital domestic labour is in part performed by the members of the household with the greatest expertise (Grinter et al., 2005; Kennedy et al., 2015; Tolmie et al., 2007), where expertise refers to the comprehension of systems, the ability to transfer knowledge, and the automation of practice (Kennedy et al., 2015). As a result, the members of the household are, to an extent, characterised by their digital expertise. It would be both unfair and inaccurate to describe cohabitants in the smart home makers case study as digitally illit-

erate. Although the initiators interviewed for Publications 1 and 2 work with developing digital or smart technologies in some form in their professional lives, several of the cohabitants are also highly educated and, while they do not develop new technologies, they use them in their everyday life. The initiators' higher level of digital expertise can be attributed to their professional practice, yet Rode and Poole (2018) note that, in households where a woman might hold a higher degree of expertise, the household technologies are still managed by her male partner, which they attribute to how expertise in technology relates to male gender performance. Many of the practices of the smart home are perceived as positioned on one side of a gendered divide, and this division is related to how the technologies are being embedded in existing gender structures, rather than the technologies themselves being inherently gendered. The smart home divides its inhabitants into different roles. Those involved in installing and maintaining the technology, who fulfil one role and may have greater influence, are also responsible for the technology when it stops working. This is observed when some of the initiators become empowered maintenance workers. Using the panopticons of convenience developed in Publication 2 (Ehrenberg et al., No date) as a lens, we can observe some characteristics of the smart homes studied in this thesis.

As the initiators engage in smart home practices, they also become more engaged with other parts of the smart home assemblage, while their partners are alienated. One initiator describes their relationship with his smart home as: *'It's sort of like dogs when you come home, that the dogs come and meet you. It feels nice'* (Ehrenberg and Keinonen, 2021b, n.p.). To the initiators, these actions are sometimes described as an act of care for the home, while also allowing them to indulge in their interest in technology. While, as noted, this engagement could be perceived as a positive development, it should also be seen in the context of how it affects others. Cohabitants may become alienated and even abject as they are disempowered by the technologies and guided to adjust their practices in a way that accommodates the technology. One cohabitant describes her relationship with technology as: *'It's like [an] enemy. The technology is [an] enemy for me at the moment'* (Ehrenberg and Keinonen, 2021b, n.p.). This cohabitant explains that it is easier to avoid the smart lighting during summer because: *'It's like a disco. So maybe you understand that it's not so nice. At the moment it's good because it's summer almost, or anyway there's the light coming [from] outside so we don't need that'* (Ehrenberg and Keinonen, 2021b, n.p.). While the relationship between the initiator and cohabitants may be affected, this alienation reveals how the initiator exercises power beyond their direct presence and creates situations where the cohabitants become frustrated with their home, as the directly responsible agent, rather than with the initiator who set it up.

Similarly to how smart homes appear to create asymmetrical relationships within the household, Publication 4 (Christensen et al., 2022) identifies digitalisation as a factor in creating an asymmetrical relationship between citizens and service providers, in its examination of volunteer-based help desks as a tool to bridge the digital divide. This asymmetrical relationship indicates that digital

literacy is becoming a critical part of the skillset required as an active citizen. While there are differences in how digital literacy affects autonomy and agency in the home compared to societal digitalisation, they are still interlinked. In both cases, being able to utilise new services and devices depends on digital literacy or technical expertise, and lacking these skills may lead to alienation. These services, especially in the case of public digitalisation, are also generally motivated by the goal of delivering a better service, or at least the same service at a lower cost, and thereby saving tax money. Public services are also obliged, at least in the Nordic countries, to continue offering services for those who are unable to access them through digital means. The shift towards digital services is reminiscent of the constrained interactions in Publication 1, where the way in which cohabitants interact with their home is defined through technology.

In the second case, presented in Publication 3 (Ehrenberg and Keinonen, 2021a), the power shifts out of the household, rather than remaining within it, as the housing company is the entity with control over the technologies. One resident describes the co-living space as: *'it's not born out of what the community who live here want, whoever designed the place and thought would be a good idea has thought they should be and [then] implemented it without actually asking what the people need'* (Ehrenberg and Keinonen, 2021a, p. 93). While the reduction in required labour can be a positive outcome, it also serves as part of commodifying the home and turns it towards the experience of a home without many of the expectations of independence, control, and security that are often tied to our notion of a home. While commodification of the home is one consideration, as the technologies mediate the experience of the home, they may also open up opportunities for new practices and a new understanding of the home. The concept of panopticons of convenience provides a tool for considering what kind of practices are affected and how the technologies may shape our relationship to the home.

While the rental homes provide a relevant case to illustrate the commodification of the home, the study also presents grounds for discussing the cushioning of tenants, as well as the experience of guests in the smart home. While the rental smart homes in this research can be seen as more akin to a Foucauldian panopticon in that their technology is implemented from above, several of the tenants did state that convenience was a motivating factor for moving in. In this sense, it could be argued that the tenants willingly adopt and embrace increased surveillance of their personal lives in return for conveniences such as easier access to housing, simple contracts, and reduced maintenance through cleaning services. They are aware that some of these services also function as observational tools and admit that they do feel as though they are not always treated as independent adults, yet the prevailing view among them is that this is a worthwhile exchange. As one resident describes it: *'It is weird to be a grown-up person and have your own apartment somehow, but to have to be respondent to hosts [house managers] or to the building, let's say. It's a bit weird'* (Ehrenberg and Keinonen, 2021a, p. 93).

Using the Protection–Appreciation space (see Figure 3), the analysis suggested that, while the tenants were cushioned in the sense that the apartment

hotels were comfortable, they also became dependent because their social life was reliant upon them living there, making it difficult to move out. Similarly, the use of space is in some ways predefined, with the tenants having limited influence over how it can be shaped. The maintenance of the space is managed through surveillance technologies that in some ways supplant the tenants' own sense of belonging or their desire to take care of and maintain the space. These surveillance technologies also provide indications of how guests become non-consenting subjects of the smart home, as they may not be aware of the extent of the surveillance technologies.

In Publication 1, the involvement of the cohabitants is identified as a criterion for developing smart homes that do not automatically shift power in favour of the initiators. This observation relates to the suggestion in Publication 4 that groups such as seniors are more at risk of becoming marginalised due to societal digitalisation (Christensen et al., 2022). Although, as noted above, technical expertise does not always guarantee an active role in managing these technologies, even when they are present in the home, it does enable the capability to participate and thereby contribute. It is also possible, following Winner's (1989) reflections in relation to the politics of artifacts, that the apparently unintentional nature of these power shifts could suggest that smart home technologies favour and empower certain people, which appear to follow existing power relations (i.e. initiators in private homes and landlords in co-living). There is no indication in the data that this is by intent, although it could be considered a favourable side-effect for those implementing smart home technologies.

While smart home technologies divide the users into categories with different roles and levels of access within the panopticons of convenience, the technologies themselves are still motivated by and embraced for their convenience or utility. As there is no real punishment for disobedience, panopticons of convenience can only function if the participants willingly subject themselves to the rules. Highly skilled subjects, who are able to understand the technologies and take advantage of the potential benefits, become not only empowered maintenance workers as described above, but also proselytisers for the smart home, eager to convert new users. However, for those who are uninterested, or otherwise not as adept at using the new technologies, it may be more difficult to benefit from the advantages of the smart home, and there are limited resources for assistance beyond those already convinced by the benefits. An example of this is the IT helpdesks described in Publication 4 (Christensen et al., 2022), where seniors who perceive the benefits are ensuring that the project of digitalisation continues by onboarding marginalised users to the new technologies. While the volunteers represent seniors who benefit from digitalisation, it is also evident that many seniors lack the digital skills needed to operate digital devices, much less control a smart home. Although there is a public mandate to offer digital support, resources are limited, as evidenced by the volunteer-based services that exist to cover the gap left by public services. Although the volunteers are providing an important societal service, their actions are also motivated by their own benefits of feelings of community, learning, and contributing. Volunteers are also likely to already be reasonably well off, resulting in better support in

areas with higher social capital. The smart home thus becomes integrated with the technical and social infrastructure of available support, where the technology in itself is not marginalising seniors but is connected to a sociotechnical assemblage that stacks the deck in favour of certain groups, to use Winner's (1989) terminology.

6. Discussion

Throughout this thesis, I have focused on how digitalisation reshapes power structures within the home. I have presented the contributions that this thesis makes to the body of knowledge and discourse surrounding digitalisation and smart home technologies, focusing on the conceptualisation of ‘panopticons of convenience’ as the primary contribution of the thesis.

In this chapter, I reflect upon and discuss the findings, the implications, and how I believe the results of this thesis could be utilised. I outline some of the limitations of the research and conclude with what I perceive to be the next steps to be explored.

6.1 Smart Technologies and Trust

In the vision of smart technologies and home automation, the technologies are often designed to act independently as autonomous agents. In the discourse of smart homes, trust is often conflated with security and focused on whether the companies producing them can be trusted (e.g. Cannizzaro et al., 2020). While this is a worthwhile discourse, trust in technology can also be extended to whether self-tracking truly helps us to improve our lives. Turner et al. (2022) argue that there is considerable risk if children are not taught about IoT and risk management in school, because many parents do not teach their children sufficient security practices. However, the consideration of these technologies should go further than security and privacy because these technologies allow us to outsource agency beyond our bodies. Automated temperature control is not just a technology exercising power, but an example of the person who programmed it outsourcing the work to a technological agent that cannot be argued with. This form of automation is also a useful example of Winner’s (1989) argument that some technologies favour certain people.

I have used a Foucauldian understanding of discipline to elucidate how smart technologies exercise power. One aspect of Foucauldian discipline is the hierarchical observation; in order to operate smart technologies, one needs to continuously measure and observe the environment and actions within it. Whether it is air quality in the bedroom, internet-connected doorbells, or automated lights, such measuring is necessary for automation. As they become measurable, these factors are no longer a point of discussion, whether it is a question of when a teenage child got home, whether a partner left the home, or what the air quality is like in the bedroom, the devices provide data that displaces trust, because we

can discover the answer. This form of observation is akin to Zuboff's (2019) argument that instrumentarian power is exercised in surveillance capitalism, yet without necessarily involving data markets. These technologies may be useful, but it is worth at least reflecting upon the kind of human interactions that are also lost as we automate practices throughout our lives. Shifting trust from people to technologies also ensures that panopticons of convenience become more deeply embedded in the social structures of the smart home assemblage as they displace existing practices.

6.2 Ethical Design Practice in Digitalisation

Throughout this thesis, various inequalities are examined where technologies limit the capabilities of some residents. This opens up the question of what responsibility designers have to address these concerns. While technologies that have these impacts are not illegal, at least under current legislation, some of the findings would at least suggest that they do not address core issues, as new problems emerge alongside the resolution of old ones. Tonkinwise (2018) argues that design is a destructive practice that destroys current products, habits, and values in order to materialise new ones. Tonkinwise goes on to suggest that designers ought to take responsibility and instead aim to restore more sustainable forms of living. However, at this point, there appears to be little incentive to attempt to create products that address inequality. If the product sells and is compliant with current legislation, there is no incentive to allocate resources to address how these technologies may affect the social fabric. The ethical stakeholders in most of the technologies considered in this thesis are also unclear. For example, it is unclear where the responsibilities may lie; the designers and developers of a product, the initiators who implement them, the companies that produce them, public services, and educational institutions all share a part of the responsibility. This suggests that what this thesis is attempting to address is a systemic issue with the vision of smart home systems, and perhaps with digitalisation as a societal project more generally. Perceiving the smart home as a panopticon of convenience, as well as considering it as a fluid assemblage, would generate a new lens for how agency and responsibility are distributed and where we find the meaningful boundaries within the system.

6.3 Devices and Gadgets

While this thesis is critical of smart technologies, my intention is not to reject smart home technologies outright but to critique what I perceive as the underlying narratives of these technologies. One aspect is that the category of smart home technologies covers technologies that aim to provide a societal benefit (such as reducing energy consumption) or a household benefit (such as security technologies), as well as technologies that are, effectively, pure gadgetry. And even technologies that are intended to reduce consumption are subject to rebound effects (Galvin, 2020), where lower energy costs may facilitate even more energy-intensive lifestyles in other ways. By gadgets, I mean technologies that

provide more of a spectacle than a benefit. Because much of the take-up of smart home technologies is motivated by a general interest in technology, and is sometimes implemented as a way of learning more about technology, many devices are obtained or developed in order to display how advanced the home is, rather than for the explicit usefulness of the technologies themselves. This also came up during the data collection, when some of the participants were very eager to explain that their implementations were functional (mentioning technologies such as CO₂ monitors that measure air quality), unlike others, whom they felt would build smart homes just to show off.

While Borgmann (Borgmann, 1984) believes that devices obscure focal practices, they are still associated with, and attempt to address, what could be perceived as useful aims beyond being merely a technological spectacle. The work presented here aims to discuss these devices because they often at least claim to offer something beyond convenience, whether it be lower energy consumption, additional home security, or reducing domestic labour. As noted above, many technologies may fit into several categories, especially because they can be re-programmed, so they may offer both usefulness and spectacle. Considering what these technologies do beyond their stated intent may allow us to recognise the true intent of the gadgets. And if convenience, rather than, for example, lower energy consumption appears to be the underlying aim of many of the technologies, they are unlikely to meaningfully address the latter. An aspect of panopticons of convenience is that they displace existing practices, and once these practices have been displaced, they facilitate a high-energy lifestyle involving certain conveniences. We then become dependent on them, and it is difficult to find a way back towards lower consumption.

6.4 Emerging Panopticons of Convenience

In order to explore the power imbalances within the smart home, this thesis has conceptualised panopticons of convenience as an emerging pattern that we can use to better understand how smart technologies exercise power, and the implications of that. They are described as emerging due to the way in which, at this point, they exercise power. Another consideration would be that they emerge from attempts to solve non-technological problems using technology. The issues that smart technologies attempt to address are not necessarily caused by technology, but rather are social challenges. Foucault's panopticons exercise power in a subtle way and if what are perceived here as panopticons of convenience, meaning the acceptance of additional surveillance in return for convenience, are indeed panopticons, it is likely that, as they become more sophisticated, they will also become more subtle and, much like the moral responsibilities of smart technologies, also more distributed. Even so, they are also useful; they do not merely obfuscate practices, but enable new practices. These new practices require us to consider which technologies are worthwhile, as well as the need for transparency and a consideration of what the cost of these conveniences are. The aim of the conceptualisation of panopticons of convenience is to provide a way to understand and consider the emerging technologies. While it is tempting

to create a taxonomy or specific criteria for what exactly constitute panopticons of convenience, further research is needed in order to better understand how they work and what their implications are. While this could make them more solid, creating a defined taxonomy pre-emptively is likely to result in an insufficient understanding or poorly defined criteria.

6.5 Limitations and Future Work

There are a few limitations to this thesis. The first is that the studies upon which it is based are exploratory, with limited datasets. We therefore do not intend to provide generalisable conclusions, but rather to gather perceived narratives and themes from small, qualitative studies. The conceptualisation of panopticons of convenience is based on the literature and case studies, but remains untested as a framework beyond these cases and would need to be tested in other contexts. The data is exclusively from the Nordic region, indicating that additional field-work is needed in order to understand how panopticons of convenience might be understood in other regions and cultures. Finally, these studies primarily consider relatively mainstream audiences in the Nordic countries and, while smart home technologies are becoming more widely available, they still require the adopters to have significant disposable income; thus, the implications for some societal groups, such as lower-income groups, immigrants, or LGBTQ people, may not be fully understood from these studies. However, because it is possible to discern how the technologies studied in this thesis reinforce inequalities among the relatively privileged, it can also provide a useful basis for looking beyond these groups.

Throughout this thesis, I have explored digitalisation and the smart home in order to conceptualise and understand the device paradigm. Further work is needed in several directions. The studies presented here are case studies intended to explore the topic, and it would be useful to further develop the notions suggested here through additional studies addressing other groups. This would involve exploring the panopticons of convenience beyond the Nordic context, as well as further exploration of how smart home technologies shape tenant–landlord relations. Further studies should also consider whether the power relations shaped by smart home technologies are embedded in the nature of these technologies, and whether landlords using them intended the implications they have for autonomy, or if they were an unintended, but favourable, side-effect. During the interviews, it did not appear that gender issues in technology were something to which the initiators had given significant thought. It would therefore be worthwhile to explore their perspectives on issues of gender in the smart home as well as further exploring how gendered these phenomena really are, through directed studies of smart homes that encompass different gender roles or dynamics. A further line of inquiry might involve that of surveillance capitalism in the context of rental homes; whether the data collected by landlords will enter markets, or how data collected by commercially available devices might be used. There is little indication that data collected by the technologies examined in this thesis significantly enters the market; however, exploring technologies such as

Amazon Alexa or Google Home could offer clearer connections to surveillance capitalism.

Beyond the smart home, I believe there are two directions that further research should take. The first is directed towards the self and the body, connecting the notions of control and discipline to self-tracking technologies such as the quantified self. The second is to look more widely, towards societal structures such as smart city initiatives. Further research ought to consider which of the mechanisms, practices, and narratives presented here may be applicable to technologies oriented towards the self or towards societal bodies, and also how these ideas may need to be adjusted in order to consider the particularities of these contexts.

While a critical analysis of smart homes will not change how digitalisation and emerging technologies are developed, a critical understanding of how they are embedded may allow us to reflect and better recognise when they reshape our practices.

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This thesis explores digitalisation, smart home technologies and how they may affect the power structures of the home. It proposes to view smart homes as emerging panopticons of convenience, where surveillance is accepted in return for conveniences. Digitalisation and smart technologies rely on the continuous collection of data which are used to examine and judge the behaviour of the residents, making it possible to interpret smart technologies as Foucauldian disciplinary technologies. This understanding is explored through three case studies that examine how smart technologies affect autonomy, agency, and equality. The studies - presented in four publications - use primarily interview data and thematic analysis to investigate narratives of technology in the home. The first case study explores privately owned homes; the second - rental homes, and the third explores IT helpdesks as quasi-public services and the limits of support for those who are marginalised by the process of public digitalisation.

The thesis contributes to the discourse on smart home technologies through a Foucauldian understanding of smart home technologies as disciplinary technologies and conceptualising smart homes as panopticons of convenience, where convenience implies less or lighter housework.



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