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The Gendered Implications of Digital Housekeeping

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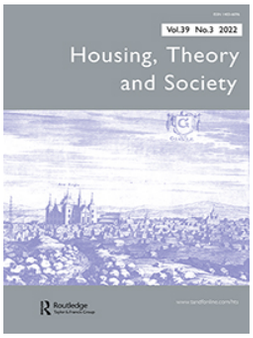

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When Smart Technologies Enter Household Practices: The Gendered Implications of Digital Housekeeping

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ABSTRACT

This paper investigates the social and gender implications of smart home technology (SHT) by looking at its role in everyday practices and domestic relations. Based on qualitative interviews and "show-and-tell" home tours in Danish smart homes, empirical insights on digital housekeeping are presented, a concept often associated with masculinity in the literature. By showing how digital housekeeping also relates to housework traditionally associated with femininity, including home decoration and cognitive labour, the paper nuances the gendered implications of the concept. The meaning and effects of digital housekeeping are discussed by critically examining the gendered manifestations in everyday practices and household members' experiences. The paper shows how digital housekeeping potentially redistributes (gender) roles of everyday practices and forms a new point of control in the home. Although involving acts of inclusion, digital housekeeping also risks reinforcing power imbalances and existing domestic gender roles.

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Smart home; social practices; gender; digital housekeeping; emerging technologies

Introduction

"Alexa is now being *built* into homes" (Strengers and Kennedy 2020, 82). Phillips Hue lights, Sonos speakers, Google Home and Alexa voice assistants – in the Global North, we fill our homes with more and more of these smart home technologies (SHT), sometimes building them into new houses before occupants move in. Although SHT uptake has been lower than expected for quite some time (Katuk et al. 2018), especially among women (Strengers et al. 2019), the market is growing and expected to more than double in size from 2020 to 2025 (Statista 2020). Denmark is a case in point, holding the European record for SHT use with 23% of the country's population using SHT in 2019 compared to 10% for Europe as a whole (Statistics Denmark 2020). Smart lighting, heating, alarm systems, speakers, voice assistants, lawnmowers, and robotic vacuum cleaners are some of the SHTs that characterize Danish homes. Notable is an overrepresentation of male users; almost two out of three SHT users are male (Statistics Denmark 2020).

While technology has historically been coded as masculine, the home has often been categorized as a female domain; a place of maternal care and labour (Berg 1994; Mechlenborg and Gram-Hanssen 2020). In spite of these historical associations,

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masculinity and femininity are neither stabile, inherent, or "natural" phenomena, rather gender can be understood as fluid and constituted through social interactions and performance of practices, as established by gender studies (Butler 2006; West and Zimmerman 1987). Furthermore, existing research has demonstrated the mutually constitutive relationship between technology and gender, underlining that to understand what technology is and to challenge its gendered meanings we must look to the cultures and practices around it (Wajcman 2010; Mechlenborg and Gram-Hanssen 2020).

Although new domestic technologies are often promoted as enablers of time savings and convenience, their consequences are not always predictable or desirable when implemented in real-life settings. In Cowan's (1985) historical account of the rise of modern domestic technologies, she documents how appliances like washing machines and vacuum cleaners actually intensified the gendered housework by accelerating cleaning standards and extending the responsibilities of the housewife. Cowan's study exemplifies the importance of looking at housework and everyday practices when understanding the gendered implications of new domestic technologies.

A new area of domestic practices that has emerged with the widespread use of smart technologies has been called *digital housekeeping*, referring to the different tasks and work involved in setting up and maintaining a networked home (Tolmie et al. 2007). In most households, one person tends to be in charge of the digital housekeeping, one "guru" (Poole et al. 2008) so to speak, and this person is frequently male (Kennedy et al. 2015; Strengers et al. 2019; Chambers 2020). Digital housekeeping as a male domain relates to smart homes not only being primarily targeted and designed for men; the industry behind the technology also reflects a male culture (Strengers and Kennedy 2020). Whether or not digital housekeeping relieves or intensifies domestic labour is contested in the literature, and some researchers argue that its gendered distribution may reinforce traditional gender roles and household responsibilities:

> "[D]igital housekeeping may create more work in the household, and further reinforce existing gendered divisions of labour by occupying more of a man's time in a heteronormative household rather than becoming one of many responsibilities shared by all within the home unit" (Sadowski, Strengers, and Kennedy 2021, 10).

In order to explore the gendered implications of digital housekeeping, this paper unpacks the concept by looking at how it is enacted in daily life and how it relates to other household practices. As such, digital housekeeping is approached not merely as a "male domain" but rather as an area of homemaking practices that contributes to the production of certain *kinds* of masculinities (Pink 2004; Gorman-Murray 2008).

Based on qualitative interviews and home tours, the paper presents empirical insights on digital housekeeping in a Danish context. It will be shown how digital housekeeping relates to other forms of housework traditionally associated with femininity, presented in the first section of the research findings. In the second section, it is illustrated how digital housekeeping forms a nexus of control within the households. Section three describes how digital housekeeping involves acts of inclusion and negotiation. Section four discusses the gendered implications of the research findings for existing everyday practices.

Before elaborating on the paper's findings, a literature review is provided to describe the conceptual and theoretical framework of the paper. Following this, the methods are described, and afterwards, the findings. Finally, the conclusion discusses how SHT not only reconfigures the performance of gender in the home, but also reconfigures the gendered meanings of everyday practices. These dynamics deserve ongoing attention in addressing issues of digital inequality and power imbalances within the home.

Gender, Technology, and Social Practices in the Home

Existing research shows that homes constitute significant types of places as nodes of social networks and intimate household relations (Easthope 2004). Households are organized around different tasks, roles, and positions in the household hierarchy (Ellsworth-Krebs et al. 2015; Thoyre 2020), and technologies play a role in shaping their organization. As Wajcman (2010, 150) notes: "The materiality of technology affords or inhibits the doing of particular gender power relations". Gender, technology, and everyday practices are closely entangled and mutually shape each other.

Digital housekeeping comprises a new domain of domestic practices, e.g. installing, programming, and maintaining SHT. Digital housekeeping somewhat contrasts with traditional forms of housework, such as cooking and cleaning, which are coded as feminine. Like traditional housework, digital housekeeping is also gendered, but is associated with masculinity (Kennedy et al. 2015). Being most often performed by men, digital housekeeping is conceptualized as a form of masculinized tech-work in existing research (Chambers 2020; Strengers and Nicholls 2018). Furthermore, the ideal SHT user is often framed within the smart technology industry as what Strengers (2013) has termed the "resource man": a male, rational, and tech-savvy individual. Gendered stereotypes of this kind reinforces norms about who the technology is for and how it should be used (Strengers and Kennedy 2020). As a new practice domain, it can be discussed to what extent digital housekeeping should be considered house*work*. People who engage in digital housekeeping often find it enjoyable and fun, as a form of leisure and play, and it is questionable whether it actually saves time from existing household labour (Strengers et al. 2019; Strengers and Nicholls 2018).

Strengers and Nicholls (2018) have conducted research on the implementation of SHT in Australia. Their findings indicate that "other household members may end up taking back more of the traditional household responsibilities if the digital housekeeper's time becomes increasingly occupied with troubleshooting and maintaining the networked (and smart) home" (Strengers and Nicholls 2018, 78). This element of shifting time use and household responsibilities was also observable in this study. However, to further unfold the gendered implications of digital housekeeping, the present paper explores how digital housekeeping relates to and involves other forms of housework. As the findings will show, digital housekeeping in the interviewed households was not just characterized by rational calculations and technical installations, but also closely related to caring for other household members and to aesthetic considerations. To illuminate these aspects, the notion of cognitive labour and home creativity provide useful as will be described below.

Although often overlooked in sociological studies of housework, cognitive labour is a central dimension of housework that includes anticipating needs, making decisions, and overseeing family logistics (Daminger 2019). More specifically, Daminger defines cognitive labour as the work of:

(1) Anticipating needs
(2) Identifying options for meeting those needs
(3) Deciding among the options
(4) Monitoring the results

(Daminger 2019, 618)

According to Daminger, cognitive labour is highly gendered, and her study points towards women more often than men are the ones carrying it out. To illuminate gendered divisions of labour in the home, cognitive labour is therefore useful to include in line with other forms of more visible forms of housework.

Similar to cognitive labour, home creativity has historically been associated with femininity, "as a feminine creation of visual imagery and physical and emotional comfort" (Pink 2004, 43). However, (male) digital housekeepers indeed engage in creating aesthetic experiences and atmospheres as both the present paper and existing research show (Kennedy et al. 2015; Strengers and Nicholls 2018; Strengers et al. 2019). To include acts of home creativity in the analysis of digital housekeeping questions the division of the two domains as either pure feminine or masculine and instead draws attention to the fluidity of gendered categories. Practices of homemaking and home creativity are closely related to self-expression and identity creation (Gram-Hanssen and Bech-Danielsen 2004). These practices can be understood as something through which people "constitute their diverse gendered identities, and as such participate in changing gender" (Pink 2004, 45). Thus, to understand how gender is related to technology, it is useful to look at different kinds of household practices and the relation between them. In exploring this and men's engagement in digital housekeeping, it is possible to see how a certain "domestic masculinity" emerges; a concept that "draws attention to how men's [gender] identities are made through domestic ideals and homemaking practices" (Gorman-Murray 2008, 376).

Methodology

The study is based on qualitative interviews and "show-and-tell" home tours in 15 Danish households with SHT installed, conducted in the Fall of 2020. The households were located in both rural and urban areas including the mainland part of the country, Jutland, and the two biggest islands, Zealand and Funen. No strict requirements were applied regarding how much or what type of SHT households should possess. However, the study aimed to include participants with multiple types of SHT. Thus, in the sample selected, some households had smart lighting combined with a few separate gadgets (e.g. a smart bathing scale or plant watering sensors), while others had more comprehensive smart homes with voice assistants, robotic vacuum cleaners and lawn mowers, automated heating, automated blinds, smart alarms, etc.

Nine of the 15 selected households were recruited through Facebook groups in which people exchange experiences and advice about SHT. These groups mainly consisted of male members, and only men replied to the research call. An additional six households were recruited through snowball sampling, referred from participants recruited through the SHT Facebook groups and from the author's social network. With the exception of one single male, all participants were living in opposite-sex couple households and were encouraged to bring their partners with them to the interview. 12 out of 14 households did this. Thus, the final sample comprised a total of 26 participants including 14 men and 12 women.[1]

Experiences and meanings of home vary across gender, class, ethnicity, and more (Gorman-Murray 2007), however, as the majority of the study's participants live in opposite-sex relationships, the findings are limited to this particular group. Rather than quantitative generalizability, the study provides an in-depth insight into a small segment of SHT users with an outspoken interest in SHT. People engage with SHT on many different levels. Larsen and Gram-Hanssen (2020) for instance differentiate between *tech-savvy* and *reluctant* households. Although participants of this study could be categorized as tech-savvy, this only applies to the male participants. Most women were characterized by reluctance towards the technology, as will be clarified in the paper. Thus, the 15 households can neither be categorized as solely tech-savvy nor reluctant, but rather by a mix and an internal tension between the two.

To investigate the implications of SHT in an everyday setting, a focus during the home tours and interviews was to explore the different practices directly related to, or indirectly affected by, SHT. Furthermore, an aim of conducting the interviews was to map particular routines, competences, and meanings (Shove 2012) and to investigate possible changes in practices, newly emerging practices or those that had been discarded. Questions of agency were also explored in asking about choices, preferences, and decisions in relation to SHT implementation and its use in everyday life.

In analysing how SHT take part in household practices, the study draws on practice theory. This theoretical framework takes social practices as the unit of analysis and draws attention to the mundane doings and sayings of everyday life (Schatzki 1996, 2002). Materiality (including technologies) plays a central role in practice theory, as materiality is seen as an integral element constituting practices. In Shove, Pantzar, and Watson's (2012) model of practices, practices are, apart from materiality, defined by two other elements: competence and meaning. When one element is changed in a practice, the other elements often also change, reconfiguring the practice in question. E.g. when a manual vacuum cleaner is replaced with a robotic one, the practice of vacuuming will suddenly require digital competences. Thus, when SHT enters household practices, these are performed in new ways and change accordingly. Although focusing on the materiality in practices, namely SHT, the present study also pays attention to how competence and meaning are reconfigured in the performance of household practices.

The home visits lasted from one and a half to two hours and included a semi-structured interview and a "show and tell" home tour which were both audio-recorded. During the home tours, which took place in the beginning or middle of the visit, I was shown around to see the technology, where it was located, what participants used the most, the stories behind, how they were acquired, how and when they were used. The semi-structured interviews, which were conducted both during the home

tours, before and after while sitting down, took an open form and the gender topic was not initially planned as a focus of the study. Thus, the questions asked during the interviews were not gender-specific but related to different roles and experiences in the family on a general level, focusing on the performance of everyday practices, various routines, preferences, understandings, meanings, and competences. All interviews were conducted in Danish by the author and subsequently transcribed verbatim. Quotes in the paper have been translated by the author from these transcriptions. The coding of interviews was conducted in the software tool NVivo, and during this process, gender emerged as a key theme. This will be clarified in the next section, which presents the findings of the study.

Findings

The Gendered Expressions of Digital Housekeeping

This part of the analysis shows what the performance of digital housekeeping entailed in the interviewed households, how it was divided among male and female participants, and how it related to other household practices, including home creativity (Pink 2004) and cognitive labour (Daminger 2019).

During the home tours and interviews it became clear that male participants were primarily, and in many cases solely, in charge of the digital housekeeping. Male participants described practices within this domain as enjoyable, fun, a matter of playing around, and satisfying when they could make things work:

> **Adam**: I feel I discovered even more of my 'inner nerd' with [our] smart home. It's kind of like playing with Lego again, that thing about it suddenly being fun, because it's not just about some coding on a screen. The fun part about smart home is that when I do something in here [the Home Assistant dashboard], then the lights turn on and off. It's something tangible. That the speaker gives you some kind of message. I think that's fun.

Digital housekeeping requires interest, knowledge, and competence. All male participants had an outspoken interest in technology, with some specifically referring to themselves as "nerds", such as Adam in the quote above. Many had a technical background, education and/or a job in technology, and several mentioned that they had been fascinated by technology since childhood. The technical language they used in the interviews revealed their knowledge and technological interest and segmented their role as the main driving force of SHT implementation in the household. Female participants would more often rely on their male partners to take care of the technology as the latter enjoyed and engaged in digital housekeeping more:

> **Interviewer**: Is it Martin who sets it [the SHT] up, or do you do it yourself?
>
> **Tina**: I would like to be able to do it myself, but it ends up being Martin. He gets to play with it, then I can do something else.

Tina's view of Martin "playing" with SHT is notable. Their division of tasks seem like a matter of interest, although Tina would ideally like to be more involved – as she says, she would like to be able to set up the SHT herself. Most participants in the study made a connection between making their home smarter and its aesthetics and atmosphere: the smart home should look

and feel nice, and some of the technological installations should add to the decor and cater to the senses. The most common examples of this were: smart lighting, including designing the perfect light settings (e.g. those automated with particular colours) for watching movies or creating a cosy atmosphere; and music settings, which were set for particular times of the day to create a pleasant atmosphere in the living room or when having friends over for dinner. A concrete example is provided by Frederik who had created lighting and music settings, controlled by a Flic button (a button that can be connected to smart lighting, music, TV, etc.) which he could move around between the living room and the dining area:

> **Frederik**: When I press [the button] once, then it turns off [the music] and turns on a lighting scene in the living room with these kinds of dimmed TV lights. [. . .] When I press it twice, that's if I have guests over for instance, and I'm not going to watch TV, but I still want a lighting scene and if I'd like a bit of music, then I put on a playlist.

These acts of creating an atmosphere through aesthetic and sensory elements show how digital housekeeping relates to acts of home creativity. During interviews and home tours it became clear that most male participants would engage in these forms of creative housework practices as part of their digital housekeeping. There are differences in how much participants engaged in the different parts of digital housekeeping. Kasper was a participant who was not particularly interested in spending a lot of time on programming. However, he enjoyed making light settings, especially with his favourite colour magenta-blue:

> **Kasper**: I like magenta-blue, I don't know if it's the feminine side of me finding expression there. I love coloured lights.

Notably, Kasper associates his SHT implementation with his "feminine side", as something not to be associated with masculinity. In his living room, he has designed a particular lighting effect with the magenta-blue colour, aimed to create a calm and sophisticated atmosphere. Even though not all participants have chosen to have coloured lights in their homes, all male participants engaged in forms of home creativity to some degree, especially with the creation of lighting and music settings. Although associated with femininity by Pink (2004) and by Kasper in his interview, home decoration is obviously not a female activity per se. Rather, male participation in home creativity shows how the gendered organization of these practices is dynamic and subject to change.

During the interviews, male participants described the design of their smart home and how it involved a mapping of the household members' routines and preferences, accommodating for these. Thus, apart from the physical performance of setting up and running the smart home, the main digital housekeeper would also engage in cognitive labour. Most cases of SHT installation are designed to meet a need, involving cognitive labour to identify and implement that need. For instance, in several examples of digital housekeeping involving cognitive labour, the households have installed automated dimmed lights and adjusted them to the bedtime routines of the household to avoid the triggering of bright lights when household members use the bathroom at night-time. In a second example, John and his wife Connie installed a light signal in their children's bedrooms. Instead of having to knock on the children's doors when dinner was served, John and Connie blink the lights in their children's bedrooms through an app. This arrangement serves a number of purposes: first, John and Connie can communicate with their son

while he is wearing headphones and playing computer games; and second, they avoid disturbing their teenage daughter's privacy (as John said, "It's not always a good idea to walk into a teenager's room"). Furthermore, Connie suffers from joint pains, describing it as hard to run up and down the stairs to the children's rooms; she therefore appreciated the light signal solution.

Although the light signal solution for the children's bedrooms came from John's cognitive labour, the act of monitoring the results was shared by both John and Connie. Indeed, Connie's evaluation was central to the SHT solution being considered a success. John also installed dimmed lights under his and Connie's bed that would turn on automatically during the night if they got up, to avoid them stepping on their dog. As John said, "This is product development happening on the spot, where we can adjust everything to our peculiar habits". Thus, in making their home smart, John analyses the routines of the household and creates solutions to fit with what he refers to as the household's "peculiar habits". This exemplifies that cognitive labour is an important part of digital housekeeping, including anticipating needs, creating solutions, and monitoring the results. John's notion of "product development" furthermore indicates how digital housekeeping relates to the broader field of DIY activities which are likewise characterized by enjoyment, leisure, and home creativity in the pursuit of creating the ideal home (Mackay and Perkins 2019).

Another illustration of how cognitive labour relates to digital housekeeping was the case of a so-called smart cube that John had programmed with a "night routine" for Connie. The cube was about the size of a small fist and looked like a toy building block. It was "smart" in the way it could control devices via bluetooth when shaken. Connie explained:

> **Connie**: After 9 pm it turns on the flytrap, turns off the kitchen lights, locks the front door, turns on the bedroom lights, also the bed light, uhm, and draws the blind [. . .]. It's kind of because my joints are so weak as they are and my memory by now is like a sieve, then that thing about remembering to do this and that and do all sorts of stuff – it's just been – it's been a help.

John had programmed this "night routine" for Connie to give her less stuff to do and fewer things to remember when she went to bed. Integrating different SHTs into such "routines" or "flows" is a central part of the digital housekeeping that entails one knows about and analyses the needs and rhythms of the household. As such, smart "routines" or "flows" represent certain ways of remembering and managing domestic chores, reflecting a cognitive dimension of the digital housekeeping.

SHT as a Point of Control

When participants spoke about their everyday practices involving SHT, it became clear that being the main digital housekeeper implies a central position of control in the household. In the case of Nadia and Erik, for example, Erik had purchased their Google Assistant on a weekend when Nadia was out of town. As he said jokingly, he "almost forced it on Nadia", to which Nadia confirmed that she indeed thought it was "silly". Once it was installed, she was still reluctant to use the voice commands and preferred Erik to do it for her:

> **Nadia**: I don't do it myself [make voice commands]. Instead, I say to Erik, could you fix the light, or change the colour of the lamps, or turn up the . . . I mean, in that way. Where I might do it myself, but . . . there is something about it being yours [Erik's]. Like when I say, turn off the music [to Erik], where I could have just said it myself, I mean, I just had to add one more word [Google], then it would have done it. Then I put it on you [Erik], all that fancy stuff.
>
> **Erik**: What I started up, I get to control myself.
>
> **Nadia**: Yes, exactly.

Nadia's reluctance to use the SHT is clear from the quote; she considers SHT to be Erik's domain. Furthermore, Erik's words are notable: "What I started up, I get to control myself". Being the initiator of their smart home, Erik also becomes the one in control and the gateway to the technology in their smart home. On the other hand, Nadia's position in their smart home is rather passive; she is more detached from the technologies and primarily uses them *through* Erik. This kind of gendered relationship with SHT was expressed in most of the interviews, for instance by Sara who also referred to her partner Tobias as the one in charge of their SHT:

> **Sara**: It's him who knows all about it. Then I'm told what he has set up. [. . .] It's mostly Tobias who does the research. I sometimes have a look at what could be nice to have, and then I tell him what I wish for.

Although Sara did express an interest in the technology – she herself had SHT wishes and ideas – it was Tobias who evaluated her requests and made the final decisions about what SHTs they would eventually install in their home. Gendered differences also found expression in terms of engagement and interest:

> **Ida**: In the beginning when we got the new lights, I would ask Andreas [Ida's partner] to turn it on every time. Because I didn't bother to study the app, I didn't bother to download it.

Ida's unwillingness to use the technology appears as a question of impatience and a lack of interest, but the resistance or scepticism – which all female participants to a greater or lesser extent expressed – were for many also related to a feeling of awkwardness when using the voice commands:

> **Nadia**: I still find it a little difficult to speak to it [. . .] it feels quite unnatural.
>
> **Tina**: I speak to it [Google Assistant] once in a while, but then I'm told [by her children], 'Oh mum, now you sound real sulky again'.

Some of the participants also noted that the voice assistants would have more trouble picking up the voice commands of women than those of men – a tendency that is confirmed by research. For example, Perez (2019) found that Google Home is 70% more likely to respond to men's voices than to women's. This gender bias may be further reinforced by what is indicated by this study: that men use the voice assistants more often than women, and that the voice assistants therefore become more familiar with the sound of a male voice:

> **Karl**: I think it [Google Home] generally takes me more seriously. I use it more.
>
> **Eva**: It knows you better. [. . .] It learns to recognize Karl's voice because he uses it more.

The unequal use and gendered distribution of control over SHT in the home is also reflected in SHT ownership. Some SHTs require that users have an account for their software. Male participants are more likely to oversee these accounts, and in some cases have sole access to configuring the devices, as illustrated below:

> **Connie**: The only one who can tell her [their Google Assistant] to configure the devices is her 'Lord and Master' [the name that John has programmed into the Google Assistant for addressing him]. [. . .]
>
> **John**: Yes, one of the problems with the Google Assistant is that there is only one owner of what's called the 'home'. [. . .] I'm the owner, it's my Google account, I own it.

Thus, John is not only the driving force making the home smarter and the main digital housekeeper, but also the formal "owner" of the SHT technology and software which inevitably grants him more control over the SHT than Connie. The quote above further illustrates how people joke about the way they interact with their smart devices. As noted, John has programmed their Google Assistant to address him as "Lord and Master". This playing with relations and hierarchies is a common tendency in smart homes and human-technology relations. Other participants such as Kasper described how he addressed his Alexa voice assistant as "Lady A", and Frederik said during an interview with his wife and teenage daughter present: "I really enjoy that at least one woman [their Google Assistant] speaks nicely to me". Although these exchanges and terms of address have a humorous intention, the gendering of the technology – i.e. the feminization of smart assistants – may have implications for how we perceive gender and technology thereby risking the reproduction of feminized servant stereotypes (Strengers and Kennedy 2020).

Despite the clear tendency of male participants to be more in control of the SHT than their female partners, many of the female participants also had access to the control software, such as through smart home interfaces on their mobile phones. Although female participants did not express as much interest and engagement with the technology as their male partners, many did appreciate how the technologies had enhanced their lives, through added convenience and feelings of control. For instance, Susanne described how she had very quickly become accustomed to using apps to control different things in the home, describing how she would drive into their garage and open the gate via her phone. She particularly highlighted the value she gave to feelings of control provided by some of the SHT. For example, before going to sleep every night, she checks an app on her phone to make sure that the front door is locked. From the smart home interface, she is also able to turn off the lights and other devices from the bed. She said that these things had contributed to a "new normal", characterized by more convenience and control that she had come to appreciate:

> **Susanne**: It quickly becomes the new normal, that it's easy. And I like it – and that's not just our particular [smart home] system – but that you have the overview, that you can see whether the door is locked and check stuff [. . .]. That kind of comfort, that's difficult to give up now, I think.

The "Wife Acceptance Factor" and Household Negotiation

As described above, the male participants took a leading role in the digital housekeeping. However, the opinions and preferences of their female partners were not seen as irrelevant; in fact, in some instances, they were seen as decisive. One participant, Mikael, ran a blog where he reviewed different types of SHT. He maintained that the key factor in determining whether his (male) readers would approve of the SHT reviewed was whether their female partners would approve:

> **Mikael**: After all, it is up to them [the readers of the blog] to decide whether or not [the technology] fits well with Pia or Hanne [Danish female names] or whoever they live with. They [female partners] are the ones who must feel ok looking at it.

During the interviews, there were examples of negotiation and dialogue in relation to what kind of SHT and how much of it couples should have in the home. During a few of the interviews, a particular term came up referring to the importance of female partners' opinions, namely the "wife acceptance factor" (or simply the abbreviation "WAF"). Although not literally referred to in most interviews, "WAF" was somehow present in all household decision-making over SHT. As the name suggests, "WAF" was understood as the likelihood of female partners accepting a new piece of technology. For instance, Nikolas explained:

> **Nikolas**: Well, it's a whole concept. If you go down to HiFi Klubben [a Danish electronics shop] for example, some of those most well-known speaker stores, then they use the slang 'WAF', that's the 'wife [acceptance] factor' - if a speaker has a high or low 'WAF'. And it's not on a scale from one to ten, I guess it's just the feeling of whether it generally goes down well with the wives or not.

Nikolas elaborated that the technology can "have a low wife [acceptance] factor, if you have a lot of chords lying all over the place". His partner Laura also used the "WAF" term, e.g. when she spoke about what kind of technology she did not approve of and gave an example of something with a "low WAF":

> **Laura**: In the place we lived before, you [Nikolas] had your router on display. And it had four antennae, so that one didn't have a high 'WAF'.
>
> **Nikolas**: No, it looked like a kind of spaceship.
>
> **Laura**: So that was a bit difficult, having it on top of the TV stand.

Notably, the quotes from Nikolas and Laura, as well as the quote from Mikael, indicate that "WAF" does not necessarily relate to whether women are likely to use the technology or not, but rather whether they "feel ok looking at it" as Mikael said. "WAF" is thus closely linked to aesthetics. Although only a few participants used the "WAF" term, this aspect of whether the technology "goes down well with the wives" as Nikolas formulated it, was something that all participants deemed fundamentally important. During the interview with Karl and Eva, Eva said that she needed to be "persuaded" when Karl wanted to purchase new SHT. When describing how they got their smart thermostats, she said that she was "sceptical" at first, but that she was eventually convinced by the possibility of saving energy and money:

Eva: [. . .] so the deal was that we would spend less on heating, so we could both save energy and money on it. It would almost pay for itself; that was kind of like the sales pitch.

Karl: That was my USP [Unique Selling Point].

The terms "sales pitch" and "USP" underline the element of persuasion that is part of the negotiation taking place when couples implement new SHTs. Referring to their Google Home, Nadia said that Erik had "really tried to sell it". The female partner's approval is important in relation to how well the technology is integrated into the household. Many male participants expressed a concern that their SHT should be accessible not just to themselves, but to everyone in the home, including their female partners. These considerations about accessibility found expression in various acts of inclusion. For instance, Peter had designed a smart home interface so that his wife could become more familiar with it:

Peter: I chose to make it a bit like Apple on purpose, because we already use Apple products, so it's something my wife knows about. She can relate to those kind of buttons [. . .] she is used to that from her phone. [. . .] I designed the buttons, so it looks like what she is used to looking at. And that's for her sake, it's not for my sake.

Another participant, Markus, spoke about how SHT was primarily his interest and domain in his and his female partner's home. However, when he started making their home smart with automated lighting, the first thing he did was to purchase a smart makeup mirror, connected to Phillips Hue, and give it as a gift to his partner for the home. He had a feeling that his partner would be sceptical about the smart lighting, but by getting something specifically for her – the makeup mirror – he calculated that she would more readily accept it:

Markus: If I'd asked her whether we should have a big fat mirror in the bathroom that would light up, then she'd probably have said that we shouldn't have that. So, I just bought it, I gave it as a gift for the home, then it was accepted.

Interviewer: Was there any resistance?

Markus: No, it was quickly accepted, mainly because it has this makeup function, then it was very quickly accepted.

Although Markus' gift for his partner appears calculated, the example shows how the smart home is also framed as something through which household members consider each other's needs and try to include each other.

(Re)configuring Household Practices

With the implementation of SHT, not only practices of digital housekeeping were introduced. SHT also reconfigured existing household practices. Smart speakers and voice assistants for instance became part of the practice of listening to music, making the practice easier, as Hans noted:

Hans: Alexa, we use it all the time. I mean, we use Alexa a lot for listening to music. We never listened to as much music as we do now. No doubt about it.

Another outcome of SHT implementation was a change in how existing traditional housework practices were performed and by whom. After Adam and Cecilie had purchased a robot vacuum cleaner, a robot lawn mower, and sensors for their plants giving notifications about when they needed watering, Adam had become more interested in traditional household practices:

> **Adam**: You're [Cecilie] actually lucky, now I water the plants way more. I never watered the plants before, it's only within the last year I began doing it. When I get a notification, then sure I'll do it.
>
> **Cecilie**: Yes, I never do it anymore. Only if Adam says they need watering.
>
> **Adam**: But now I'm doing the watering, I just got a notification about doing it today. Vacuum cleaning, lawn mowing, watering plants, that's all something I love doing now.

Thus, existing practices and roles are reconfigured with the implementation of SHT. The introduction of SHT into the household is changing the gendered organization of traditional practices resulting in changes in the necessary competences required to complete these tasks. Thus, vacuum cleaning no longer implies running around the house with a manual vacuum cleaner but instead requires programming a route and time schedule for the device, and activating the technology via a voice command or an app. Traditional housekeeping has become "smart" in Cecilie and Adam's home and has become Adam's domain to a greater degree than before. This example of traditional household practices changing also raises the question of whether their very meaning has changed in the process. Adam was not necessarily motivated to perform these practices because he wanted a clean house, but also because he enjoyed programming and controlling the technologies. Thus, the very meaning or goal of the practices might also change in this process.

SHT is not only involved in new practices within the home, but also reconfigures existing ones such as cooking and cleaning; activities associated with "traditional" housework. Bringing SHT into these practices in some cases motivated male participants to participate in them more. For instance, with the installation of the plant sensors, Adam had become very keen on caring for the plants, while his wife Cecilie had originally thought that the device was unnecessary.

When asked directly about whether roles and the division of tasks and housework within the home had changed with the implementation of SHT, most participants denied this. However, many male participants said that they spend more time on various forms of digital housekeeping than previously, and as a result perhaps they participated less in other household tasks. This can reinforce existing roles in the household, as the following quotes from Erik and Nadia illustrate.

> **Interviewer**: Do you feel that the division of tasks has changed with these technologies [. . .] that any roles have changed?
>
> **Erik**: I think the roles have just become more affirmed. I would say, at least in our home, it's always been me who takes care of all technical and technology –
>
> **Nadia**: Yes.
>
> **Erik**: – and since we've added more technology to our everyday lives, then I've been granted a bigger part of those tasks.

Such traditional gender roles were also apparent among other participants, resulting in a division of what parts of the home that ended up "being smart":

> **Peter**: We are still that traditional that it's my wife who does the cleaning, does the laundry, etc. And her approach to this [the smart home] is . . . Let's say, more hesitant than mine, right? Before we moved, we had an automatic washing machine that you could operate online. But she never used it. The only thing she used was that it was very nice just to be notified when it had finished.

Peter and his wife no longer had a smart washing machine, and the quote shows how new technology does not necessarily lead to practices being performed differently. By making some practices "smart" and others not, the division of housework and gender roles generally become reinforced. Peter's quote also shows that it is possible to work around the affordances of the technology: Although they had a smart washing machine at first, his wife simply refrained from using its smart properties.

Such workarounds were a recurring theme in the interviews. Oliver had for instance installed smart lighting in his bathroom, with the lights turning on automatically via motion detectors and turning off automatically after five minutes. Thus, the practice of lighting was changed, making manual switching unnecessary. However, his partner Anna had not adjusted to this change. As Oliver said, "she can't figure out how to use it". Anna kept switching off the lights manually, which would hinder the lights from turning on automatically afterwards. Oliver would then have to turn on the switch again before the automated lights would work.

> **Anna**: I do it [use the switch] because I think [the automated lighting] works too slowly.

Anna and Oliver had different preferences and degrees of patience with the technology, as Anna's quote illustrates. Their different engagement with the technology shows that while the introduction of SHT reconfigures practices for some, others refrain from performing existing practices in new ways because of SHT. These differences in the performance of practices around the smart home can collide potentially disrupting the nature of these new material arrangements: When Anna turned off the lights manually, the lights could not turn on automatically afterwards thus disrupting the smart solution.

Differences in the performance of practices around the smart home and engagement with new technology could be resolved through parallel SHT systems, for instance, installing a manual switch or button that could work alongside voice commands or motion sensors. During a home tour, Martin described the household's smart speaker system, and how they would operate it through voice commands to their Google Assistant. However, Tina was not fond of making the voice commands as it felt unnatural to her. Therefore, Martin had instead installed a smart button remote located on their dining table, a "music button" for Tina, making her able to control the music without having to speak to Google. As Martin said, half-jokingly, "It's only Tina who's allowed to use it". The button was a way for her to stay comfortable within the practice of operating music. This example also illustrates the cognitive labour involved in the digital housekeeping as Martin had detected a special need on Tina's behalf which had led to the button as a solution.

Concluding Discussion

When the home becomes smart, everyday practices and gender relations are rearranged in a number of ways. Previous studies of smart homes have illustrated how digital housekeeping is central in the process of SHT implementation (Tolmie et al. 2007), and that practices associated with this field are primarily a male domain (Kennedy et al. 2015; Strengers et al. 2019). However, as the present study shows, practices of home decoration and cognitive labour – often associated with femininity (Pink 2004; Daminger 2019) – are also closely related to digital housekeeping. According to Pink, housework and home creativity are "decisive in the production of continuity and change in contemporary gender" (Pink 2004, 41). In line with Pink (2004), the present study shows how digital housekeeping both changes and reinforces gender roles. This study further illustrates how gender roles and technologies dynamically interact, reinforcing Mechlenborg and Gram-Hanssen's argument that "gender, home, and technology are not just formal features but are subjects of negotiation and positioning" (Mechlenborg and Gram-Hanssen 2020, 4).

The study has demonstrated how the gendered division of roles between digital and traditional housework can reinforce traditional gender roles as men spend more time on digital housekeeping and less time on other household tasks. This tendency is also highlighted in other SHT studies (Sadowski, Strengers, and Kennedy 2021; Strengers et al. 2019; Strengers and Kennedy 2020). However, the findings presented in this study add further nuance to this issue. They show that SHT can change the very meaning of housework and shift the way practices are gendered, an aspect of digital housekeeping that has received less attention in the literature. Such shifts were illustrated by the case of Adam who had become more engaged in traditional household practices, but at the same time, the meanings, materials, and competences related to these practices were changed. Further examples showed that when men engage in home decoration as part of the digital housekeeping, technologies can reconfigure how gendered practices are performed as well as the gendered meanings of those practices (Pink 2004). Thus, as this study has shown, home decoration does not necessarily involve putting flowers in a vase or hanging pictures on a wall but can also be performed through making settings in an app. These homemaking practices illustrate how "[d]ifferent masculinities are constructed, lived and represented uniquely in relation to the structural, spatial, material, visual, sensory and social elements of men's homes" (Pink 2004, 119).

As Daminger (2019) notes, the tendency of women more often performing cognitive labour than men at the household level can lead to gender inequality, however, the present study shows that digital housekeeping often involves (male) performance of cognitive labour as well, for instance, anticipating needs and providing care for the household. Important to discuss in this regard, is the nature of this form of care, and whether it for instance relieve household members from housework. As reflected in other research (Strengers and Nicholls 2018, 2018; Kennedy et al. 2015), this study shows that there are clear gendered differences in terms of the interest in SHT and whether it is considered "nice to have" rather than "need to have". Several female participants noted that although they had come to appreciate many of the smart solutions, if they lived alone, they would not install SHT in their homes. While the present study indicates that SHT does not always resolve traditional household tasks, the study's small, qualitative

scope does not allow to conclude on the actual time spent on manual housework and digital housekeeping among men and women respectively. To gain a better understanding of and ensure a just and gender inclusive development of future smart homes, the paper calls for further studies on the relation between digital and traditional housework, particularly in relation to time of use.

In some ways, SHT enables multitasking and more efficient housework – thus several participants noted that their robotic vacuum cleaners saved them time. However, this would also require that they cleaned up more since the frequent run of the robot vacuum cleaner requires a clear floor space. Like other domestic technologies, SHT contributes to heightened standards of comfort, cleanliness, and convenience (Shove 2003; Cowan 1985). This study of SHT indicates that such accelerating standards are highly gendered.

In line with existing research, the paper illustrates how digital housekeeping is central to the process of SHT implementation (Tolmie et al. 2007) and that practices associated with this field are most often performed by men (Kennedy et al. 2015; Strengers et al. 2019). As with the male participants in this study, when household members spend a considerable amount of time on digital housekeeping, they are likely to spend less time on traditional household tasks. This risks reinforcing existing gendered roles in the division of household labour (Sadowski, Strengers, and Kennedy 2021; Strengers et al. 2019; Strengers and Kennedy 2020). In the findings presented from this study, female participants were more reluctant to use SHT and often became reliant on their male partners in various SHT interactions. When (male) household members oversee the digital housekeeping, they simultaneously have access to a central point of control in the home. These aspects require further awareness and research if we wish to challenge not just digital inequality, but also general power imbalances within the home.

Notes

1. All participants received written and oral information on the research project and gave their written consent to participate. They did not receive any gifts or economic compensation for their participation. Names were pseudonymized and personal data were protected in accordance with the EU General Data Protection Regulation (GDPR). Interviews and home tours were conducted physically in participants' homes except one interview and home tour which was conducted virtually via Skype.

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Disclosure Statement

No potential conflict of interest was reported by the author(s).

Ethical Approval

Informed consent was obtained from all research subjects participating in the study. Personal data were anonymized. Research was performed in accordance with the Declaration of Helsinki and was approved by the author's research institution.

Data Availability

Interview transcripts will be made accessible after publication.

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