

Weiser's Dream in the Korean Home: Collaborative Study of Domestic Roles, Relationships, and Ideal Technologies

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ABSTRACT

Following Bell and Dourish's call for a "ubicom of the present," we visited 14 households in Korea, where Weiser's dreams come true, to study their social dynamics and domestic technologies as a part of these dynamics. We used a participatory research approach in which participants, acting as collaborative ethnographers and co-designers, chose how to describe their homes to us and which existing technologies to discuss. A qualitative analysis of the conversations identified two main themes. The first finding is the highly gendered nature of roles in the Korean home, influenced by traditional Confucian values and reinforced by contemporary neo-liberal norms. The second finding is that domestic technologies are used, adopted, and imagined in the context of these gendered social dynamics rather than just according to functional needs. In conclusion, we emphasize the need to attend to the social dynamics of the home in the design of politically sensitive domestic technologies, which will enable the inclusion of marginalized voices, such as women, in design.

Author Keywords

Home automation, collaborative ethnography, participatory design, social and cultural dynamics of household.

ACM Classification Keywords

H.5.2. User Interfaces: User centered design; H.5.3 Group and Organization Interfaces.

General Terms

Design, Human Factors.

INTRODUCTION

The vision of ubiquitous computing developed by Weiser in the 1980s defined the dominant research trend in the field as the design of technology prototypes to anticipate and meet the needs of a constantly advancing future [36].

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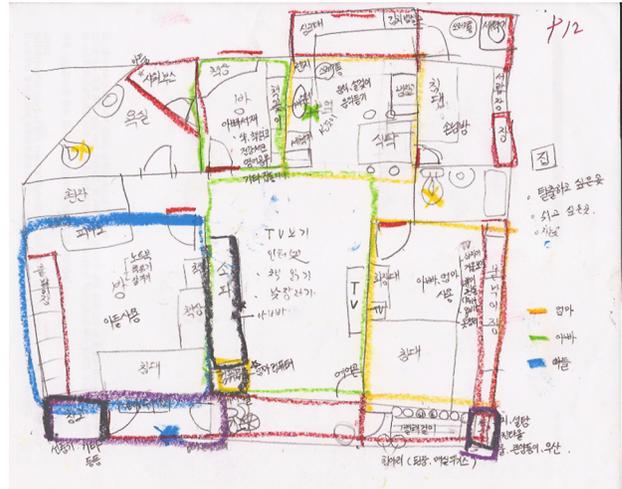


Figure 1. An example of field note written by the members of household #12 (a wife, a husband, and a son).

Reflecting on the current state of the field in 2007, Bell and Dourish[6] suggested that Weiser's proximate future has already arrived and called for a "ubicom of the present," emphasizing the importance of attending to current sociotechnical dynamics when designing and evaluating ubiquitous technologies. The research presented in this paper follows in the spirit of Bell and Dourish's critique and approaches technology use and design in the present tense [6], focusing particularly on automated technologies in the home. As computers have moved out of laboratories and workplaces, researchers have turned to developing not only new technologies, but also new approaches for exploring the unique social and cultural logic of domestic spaces [4; 5]. Our work seeks to contribute to this literature by focusing on the social dynamics of the home as they relate to technology use, and by bringing users into the research and design process as collaborators.

The results presented in this paper are based on interviews conducted with members of 14 households in Seoul, South Korea. Bell and Dourish cite South Korea as a place in which Weiser's dreams for ubiquitous computing have already come true [6], which makes it an apt location in which to develop our participatory approach to designing automated home technology grounded in current issues. We visited participants in their homes seeking to understand their social and cultural dynamics and domestic technologies as a part of these dynamics. Our findings

suggest gender as a focal factor affecting modes of technology adoption and use in the Korean home; we also identify a domestic social hierarchy influenced by traditional Confucian values and reinforced by contemporary neo-liberal norms. We describe how domestic technologies are used, adopted, and imagined in the context of gendered social dynamics. In conclusion, we emphasize the importance of designing home automation technologies based on their cultural meanings and place in the social dynamics of the home. We further suggest this attention to how social relationships and hierarchies are constructed can enable the inclusion of marginalized voices, in our study women, as more active participants in the design of automated domestic technologies.

RELATED WORK

The home has been widely explored in the Ubiquitous Computing (ubicom) literature (e.g. [10; 13; 35]). Research can be categorized into two main approaches. One approach explores smart home prototypes in the lab, while another investigates home automation in the wild, where researchers study householders interacting with technology in real homes. We review these approaches and address the importance of user empowerment in home technology design below.

Homes without Householders

“Smart home” prototypes such as the Aware Home [22], Orange[17], and ETHOS [1] demonstrate various uses of sensors and network technologies in the home [34] and provide a context in which researchers can test prototypes of potential home technologies. Such “living labs” for designing and evaluating domestic technologies reduce yet conserve the gap between the ideal home environment for research and lived-in homes, in which technology is used in the context of the social dynamics and everyday practices of householders. The development and testing of technology prototypes in “smart homes” has also been critiqued for being a masculine vision of the home [8], since the research is mostly grounded in technological interests and challenges rather than in the experiences and needs of householders.

Householders as Users

To address the critiques of smart home prototypes, researchers also investigate home automation in the wild. These studies problematize the adoption failures of commercialized smart home devices such as programmable lighting which have been available since the 1970s but have not been widely adopted in homes [10]. Studies in the wild explore the needs and experiences of householders in the context of existing practices in the home, and explore actual, rather than ideal, routines of the home [13], currently available home automation technologies [10], home networks [16], and other domestic technologies. These studies have, however, mostly focus on so-called “brown goods,” such as TVs and VCRs or sensing and

network technologies, rather than “white goods” such as vacuums, washing machines, and refrigerators, displaying a bias towards technologically novel applications rather than more mundane yet necessary domestic functions [29].

We build on prior ubicom research by investigating the cultural and social logic of practices in the home, including how householders use currently available technologies as a part of their daily lives. This is similar to Bell’s study of the meaning of kitchens as a way to understand the experiences of people without reducing them to users [7], but we focus explicitly on revealing the underlying logic of social practices [14] and participant sense-making about daily routines and technologies in the home.

From Users to Collaborators

Although home automation studies have included householders, as users they are still subordinate to designers in the conduct of research. Users are in the position of providing information to designers as informants and appreciating the services designers can provide through their technical knowledge. Dourish compares this hierarchy between designers and users to the hierarchy between anthropologists and natives in Victorian times [14]. Viewed from a more participatory perspective, householders can be seen as experts in their home environment. Although they are often marginalized in home automation research, their knowledge about the domestic context is a valuable source of knowledge for the development of new technologies. With this in mind, we employ participatory design methods in our study, treating our research participants not just as informants, but as collaborative ethnographers and co-designers. Participants in our study initiated the design of technology by telling us their stories, defined their needs based on their home context, and also took field notes on their experiences acting as collaborative ethnographers.

METHOD AND PARTICIPANTS

The methodology used in this study is inspired by participatory design [27] and collaborative ethnography [23]. Survey research is less contextually rich and not suited to eliciting in-depth descriptions of participants’ feelings and experiences, but more structured for easy analysis; semi-structured interviews in turn are more closely controlled by the concerns and conceptualizations of researchers. In contrast, our method enables participants to guide the research process by their concerns, with minimal prompting from researchers. To be sensitive to the hierarchy between researchers and researched, we intentionally chose this method to distribute the authority of knowledge-making between the researchers and participants. The researchers relinquished some control over the research by leaving it to users to choose which experiences, technologies, practices and spaces they talk about, and which issues might provide opportunities for technological intervention. Furthermore, rather than inviting participants to our laboratory, a researcher visited

10 families in their homes (as Korean homes are considered very private [6] this was not allowed in every case), and met 4 families in a public space of their choosing. Conducting interviews in spaces familiar to users was meant to obviate some of the hierarchical dynamics between the researchers and participants.

Method

We performed open-ended interviews with participants as co-designers and collaborative ethnographers. Our conversations were organized around three big categories: the house, the social actors in their home, and their ideal automated technology. We audio- and video-recorded the interviews, and took some pictures of the home with the consent of participants. At the start of the interview, we explained to participants that we were there to learn from their everyday knowledge. We then asked them to draw their house, then to draw and describe all the relevant social actors with their roles in the home, and finally to describe the automated technologies that they would like to own. Letter size paper, pens, and crayons were given to all participants. Four participants over 50 years of age were worried about their drawing skills, so they wrote their thoughts down instead. Those participants asked the researcher to print out a floor plan from a real estate website and marked their furniture, appliances, and the meaning of each space on the plans.

After they had created visual representations or verbal descriptions of the homes and householders, we asked participants to explain their drawings or text in detail. We prompted them to tell us about their daily lives in the home by 1) drawing the floor plan with furniture, appliances, favorite and least favorite spaces, renovated spaces and the meaning of each space to show how they use their home, 2) drawing social actors in the home and describing what they do in the home, and finally 3) drawing their ideal automated technologies in the context of the physical and social dynamics of the home they had described previously. This task order was also meant to help them create designs with their specific home context in mind. We tried not to intrude on participants' meaning making by letting them explain what they visualized without specific instructions, so they could choose the aspects of their drawing to focus on.

As collaborative ethnographers, participants took all the field notes, while the researchers did not take any. Participants created all the written and drawn documents through a process of consensus between participants and the researcher. Sometimes, participants just wrote information down without interruption by the researcher. If researchers had questions during the process, they asked participants to write down the answers in their language. As co-designers with knowledge of domestic technologies, participants decided which technologies and issues to talk about.

Participants

Recruitment of participants for the study was extremely difficult due to the home's conceptualization as a highly private space in Korea. We tried to recruit from a popular Korean websites, but only three contacted us and they chose not to do interviews because they did not want to open or explain their homes to strangers. We then changed our recruitment method to using word of mouth, which allowed us to recruit participants from 14 various types of homes. Two single households, one newly married couple, four households with parents and young children, five households with parents and adult children, and one older adult couple were included to see the overall socio-cultural dynamics in home. The participants were 8 males, 11 females, with a mean age of 43 years; 8 wives, 5 husbands, 3 daughters, 1 son, and 2 single males. All available householders were interviewed together. Only one working husband was available due to their busy schedules, so we got information about the absent men's activities from other householders. Five wives were interviewed without husbands. Wives were more vocal and critical about social dynamics in their home when their husbands were not present; one wife being interviewed with her husband kept checking his reactions throughout the interview, which likely influenced our results to some extent.

All participants except two live in Seoul, South Korea. Nine households earn \$50,000 ~ \$100,000 per year, which situates them in the middle class. Two households did not share their income, one earns more than \$100,000 per year, another earns \$10,000 ~ \$36,000 as a single man who also gets support from his middle class parents, and one was an undergraduate student who got support from his parents. The participants held a variety of occupations including analyst, nurse, teacher, designer, principal and journalist.

RESULT

The interviews were transcribed and analyzed using qualitative methods. The initial open coding of transcripts yielded 554 discrete codes. We grouped these codes using an affinity diagram technique, a form of inductive analysis that categorizes similar key points to identify overarching themes in a given context [9]. After the initial open coding, related codes were combined into a set of 38 themes (e.g. role in home, Kimchi refrigerator, favorite space in home), then into 15 themes (e.g., infrastructure of home, husbands, parenting technologies), and for presentation here these are organized into the 3 main themes the study was designed to address: the contemporary Korean home, the householders and their roles, and ideal home automation technologies.

In the discussion of our results below, we start from the meaning of the home as a whole and of each space in the home. Then we describe six types of householders, including husbands, wives, children, grandparents, helpers, and visitors, and their roles in and perceptions of the home. Finally, we describe the ideal home automation technologies designed by participants.

The Contemporary Korean Home

The average size of the participants' homes was 1254 ft². All the participants lived in apartments, the most common housing type in Seoul, Korea. As population density in Korea is high, with 1200 people per square mile [33], apartments are the most common habitation type. Participants lived in apartments with 15 floors on average, with newer buildings having more than 20 floors. The homes of our participants had three to four rooms, one to two bathrooms, a kitchen, and a living room. All homes usually have two balconies, one at the front and one at the back of the apartment, with big windows for ventilation. Every home had a shoe closet right next to the main door with indented areas for removing shoes, as the cultural hygiene standards prohibit wearing shoes indoors.

Infrastructure

In the 1990s, the South Korean government made a plan to develop a highly networked country with a high degree of Internet literacy [20]. Thanks to the structure of apartments, network infrastructure was easily installed, so currently 94 percent of the population has high speed Internet access. The broadband speed of Korea is four times faster than that of the US with lower cost (around 22 USD/month). All participants in our study have high-speed wireless Internet in their homes and use various computing devices including desktops, notebooks, tablets, and smart phones, as Weiser had envisioned people doing in the proximate future.

The meaning of the home

When asked about the meaning of "home," all except two participants called it a place to rest. Home was contrasted with work places such as the office. The home was also described as a place for family members to share and be together. In our previous study of Korean participants' perceptions of the home [24], they repeatedly used the terms "tender, friendly, and warm" (부드러운, 상냥한, 따뜻한) to describe the essential features of the domestic context. Participants also expected these features to be reflected in their domestic technologies and a number of participants referred to femininity (e.g., feminine voice, material, or color) to reflect such features.

In this study, we noted differences in the meaning of the home depending on one's lived experiences with it. A working mother H7w¹ described her home as "a place to rest after coming back from work and to spend time with my family" (teacher / 32). Two housewives saw their homes differently. For H2w, home was everything:

H2w: To me... home is... everything in my life. [Laughs] It does not mean I assign big value to the home. I mean home

is the one and only space. I rarely go out. My actual life is all done in the home. (housewife, 28)

For H12w, home is a place to escape from because of the amount of housework she has to do there, such as cleaning and cooking. The participant (housewife, 56) described tearfully that she is "free" when she is not at home, because "I don't need to do all the housework" which is heavily concentrated on her. While the home's meaning is similar for most participants, it is important to pay attention to such dissenting voices, which indicate possible conflicting meanings of the home due to work and gender dynamics.

The living room: Togetherness and hierarchy

The participants considered their living rooms as spaces where all the householders could come together and socialize. Half of the families we interviewed renovated their houses by removing the balcony and extending their living rooms to enlarge the common space. Participants also placed shared products, including the TV, air conditioner, computer, and phone, in the living room.

While the living room is conceptualized as a place for all householders, children did not spend as much time there as their parents and it was not their favorite space. Parents, usually the fathers, had control over the TV, so children preferred to stay in their rooms watching TV with their smart phones. Two daughters, H3d and H4d, said they felt more comfortable staying in their room rather than arguing with their father about the TV channel selection.

I: Do householders gather in the living room on weekends?

H4d: On weekends? My dad watches TV on weekends in the living room. I watch TV during weekdays, but on weekends, my dad watches something boring. I prefer to stay in my room. (consultant, 29)

Parents with teenagers believed that TV and computers could negatively affect their children by interrupting their studying. H7w said she felt sorry when she watched TV in the living room since it would influence her son's homework. She placed the TV in the master bedroom to make the living room a more study-friendly space. Her 15 year-old and 13 year-old boys then mostly stayed in their rooms and used their smart phones. The householders living with H7w rarely gathered in the living room.

The kitchen as a "woman's issue"

The kitchen has traditionally been women's terrain in Korea and a taboo for men to enter [37]. Though social norms are no longer as strict, many participants still referred to kitchen work as the woman's job. One third of the participants, mostly women and two retired husbands, said the kitchen was their least favorite spaces in the home due to cooking and dishwashing chores. Two middle-aged housewives, H5w and H12w, reported that they spend most of their time in the kitchen, their least favorite space. The two retired husbands who participated in our study, H10h

¹ H7w refers Household #7, wife. H7d for a daughter of Household7, H7s for a son and H7h for a husband

and H12h, also mentioned kitchens as their least favorite spaces because they had to wash the dishes. Except for two retired husbands, other males rarely worked in the kitchen.

When describing their work in the kitchen, participants expressed dislike for household chores coupled with distrust in automated technologies such as dishwashers, washing machines, and dryers. Although four households had a dishwasher, only one household used it regularly. All participants regularly used the washing machine, but three homes also washed underwear and rags by hand. Only two householders who had been in the US for more than a year brought their dryers to Korea. However, H2w (housewife, 28) who had been in US about 8 months said she does not like the dryer because she sees it as unhygienic:

H2w: I know there is a dryer. I've used it when I was in US. But I don't like it. The air from a machine? I think natural power such as sun and wind would work better. I prefer to hang my clothes on my balcony.

While the participants treated automated cleaning technologies with some suspicion, they all owned and were very satisfied with their Kimchi fridge. A Kimchi fridge is made for storing Korean fermented vegetable dishes. Koreans traditionally used big jars buried in the ground to store fermented dishes and soy sauce; the Kimchi fridge is a modernized version of these jars. The general satisfaction with the Kimchi fridge shows that the distrust of automated cleaning technologies does not mean participants refuse to use modern appliances in general. Rather, participants were reluctant to automate human responsibilities in the home.

The Householders and Their Roles

Among the various types of households we interviewed, we found six main types of social actors: husbands, wives, children, grandparents, helpers, and visitors. Both working husbands and retired husbands participated, and we learned they had very different roles and social positions in the home. There were also both housewives and working wives in our study. Although housewives spent a lot more time at home, both types of wives had the same roles to fulfill, which made working wives feel strained by working both inside and outside the home. Children were also divided into two types: adult children who are over 18 years of age but are financially dependent on their parents, and younger children. Both types of children had similar roles in the home. Grandparents, especially grandmothers, and helpers were not regular householders, but took on important roles in the domestic division of labor. Visitors were rarely discussed as social actors due to the cultural practices around hosting in Korea, which see all visitors as needing to be “served” rather than as companions to socialize with.

The husbands

The main role of husbands was to work outside the home to earn money. Participants sometimes referred to them as “the head of family”. All husbands in our study, except for

the four retirees, spent an average of 14.3 hours outside of the home on weekdays, leaving the home at 7am and coming back home around 9:30pm. Three of the nine working fathers sometimes worked on weekends as well. Although the legally permissible work time is limited to 8 hours per day in Korea, most workers feel pressured to work beyond the legal limit [26]. We could only meet one working husband in person, so we had to rely on information from other householders to learn about their roles and practices.

Working men did housework only on the weekends and otherwise relaxed when they were at home, usually by watching TV. They vacuumed, organized the garbage for recycling, and washed dishes once a week. Only one husband did the ironing every day; no other working husband did housework on a daily basis. The time spent on housework by men did not change even if their wives also worked. A 2009 survey in Korea confirms this trend, saying that husbands spend 30 min/day on housework regardless of the employment status of their wives [2]. H8w (housewife, 64) and H8h (retired, 70) explained they take care of their son's (CEO, 41) home and their grandson, while their son does nothing in the home. The older couple lived in another building in the same apartment complex.

H8w: What does he (the son of H8w and h) do in the home?

H8h: He slaps mosquitoes. That is the only thing.

While working men are generally exempt from housework, the social position and role of men in the home changes after their retirement. As their main identity is often that of a breadwinner whose role is to earn money for their family, being at home means they fail in performing their main role. Retirement increases the amount of time men spend in the home, so they are asked to actively participate in domestic work by their wives, something they had rarely done before. Domestic work has been taboo for most of them, since a man trying to share in ‘women's issues’ loses his social reputation at work [26]. Three among four retired husbands were the most active participants in domestic work among the male householders in our study. They were often embarrassed when they mentioned their active role in the home because of the social meaning of domestic work. H8m is reticent to describe what he is doing now:

H8h: I cannot frankly say all the work that I am doing now... (it is embarrassing to me) (retired officer, 70)

H8w: Be frank! You do all the dishwashing and managing garbage. (housewife, 64)

Overall, husbands rarely shared domestic work, which was normatively seen as the responsibility of wives; even when retired husbands took a more active part in housework it was something that they regarded with shame due to gender-based taboos regarding housework.

The wives

The wives were responsible for and managed the majority of the housework regardless of their employment status. Housewives and working women both had pretty much the same role in the home, which makes working women to feel role strains [25].

All housewives spent most of their time at home unless they had special events. They did almost all the housework alone with little help from other householders. H1w (housewife, 46) said she does the cleaning alone even when other householders are at home:

H1w: Nobody really cares when I clean. They just think mom is doing her work. Nobody tries to help.

H1w used honorific lexical items or suffixes [31] to her husband, although her husband never used the honorific to her and disparaged her opinion on ideal technologies during the interview. Another housewife underestimated her role in home by saying that she is doing nothing because she does not earn money, despite taking care of all the housework. H2w (retired office worker and current housewife, 28) said:

H2w: My role in the home... hmm... it makes me so gloomy and small to think about my role.

I: Why? You do all the work in home as a housewife.

H2w: That role is too small and trivial.

H2w also said she felt the need to apologize to her husband since she does not earn money:

H2w: (since I feel sorry) I sometimes ask my husband "do you feel fine (with me just being at home as a housewife)? He said "I am fine," but he forced me to invest on stock market online. [laugh] (housewife, 28)

The seven working wives spent an average of 11 hours a day at work on weekdays. They left home at 7:30 am and returned at 6:50pm. Except for three working wives who employed or asked for external help, they managed all the domestic work and did household chores on a daily basis. Three working wives also did housework on weekends. H3d (designer, 29) said the role of her mother is "teacher + housewife." H5w (teacher, 43) also referred to herself as a housewife although she works as a teacher. Working wives are considered as imperfect mothers according to a recent national survey in Korea [35]. Korean society expects mothers to devote themselves to their family, even when they work outside the home [32].

All three working wives with young children received external help from employed helpers, mother-in-laws, or their mothers. H7w (teacher, 32) got help from her mother and employed a helper from 2pm to 9pm from Monday through Friday. They helped her take care of her five and three year old daughters. When asked whether she is satisfied with getting help from her parents since that might interrupt the independence of her family, she answered:

H7w: I have no options. I really appreciate the help from my parents. My husband also appreciates it. My parents are now at a daycare instead of me since I told them I need to do this interview today.

H11w (singer, 33) also got help from her mother-in-law. When the couple was asked why they do not employ somebody or send their three year old daughter to a daycare, H11w and H11h said:

H11w: The employed person is not that responsible. I cannot trust that she sincerely takes care of my daughter when only the two are in home without any supervision. Since you know... the sitter must be a human... Even I sometimes just show her a DVD or TV... I cannot believe someone who is not my family.

H11h: Also, it is very difficult to find a good person.

Even in this difficult situation, some participants were reluctant to use automated technologies such as washing machines, dishwashers and robotic vacuums. H3d (designer, 29) said her mother (teacher, 57) boils underwear although their washing machine has a boiling function:

H3d: The washing machine in my home has all the special functions for boiling and washing sweaters. But my mom never uses the function. She boils our underwear on the stove since she does not trust the machine. (designer, 29)

The penetration rate of dishwashers in Korea is low compared to other domestic technologies since it does not meet the cleanness standards of Koreans [3]. Because of this, dishwasher companies advertise their machines not in relation to their ease-of-use and convenience but in relation to hygiene and health, similarly to Switzerland, where housewives are very conscious of their responsibility for the health of their families [18]. The advertisement for LG dishwashers in Korea claims "I promise, I will take good care of your health since I love you."

The combination of work and home responsibilities of working wives and the lack of support from society (e.g. respecting the regulation of working hours, childcare) lack of help from other householders, and the emphasis on women's responsibility for the family's hygiene and health often cause women to leave their paid work. The ratio of dual-earning families in Korea is relatively low compared to other OECD countries [26]. Thus, teaching, which has relatively short working hours with paid vacations, is seen as an appropriate job for women [19]. A number of our participants were teachers, and they represent middle class working women who are in a relatively prestigious position.

The children

We did not have IRB permission to include children under 18 years of age in our study, so we got information about their practices from their parents. Children under 18 years of age spent 7.5 hours outside of the home on an average day. They went to schools or daycare, leaving home around

8am and coming back around 3:30pm. Adult children spent an average of 14 hours a day outside the home. They left around 7:30 am and came back around 10pm in weekdays. The main role of children was studying, sleeping, eating, watching TV, and playing. Children over 10 years of age, including adult children, helped parents with the housework. The role of children was gendered. Sometimes, children of different genders argued about their division of labor in the home. H3d (designer, 29) described the arguments with her brother when she was young:

H3d: He (her brother) rarely worked in home. We argued a lot when in a middle school. I forced him to wash dishes. But now... usually the chores are done by the one (herself or other sisters) used to doing the work.

Adult children earn money but they save it for their future marriage, spending most of their time outside the home to keep their independence and privacy. In Korea, especially in Seoul, housing is very expensive so unmarried adult children cannot afford to live on their own. The two single men in our study got support for their housing from their parents. Parents also want adult children to save their money instead of paying for home expenses.

H4d: My mom has never asked me to pay for the home expenditure. She always says "save your money for your marriage" ... I do not know the monthly income and expenditure in my home (consultant, 29)

The grandparents

The grandparents play an important role in the structure of labor of the dual working family although their children have already made their own nuclear families in different homes. Grandparents, especially grandmothers, spend most of their time in their children's homes taking care of grandchildren and doing housework. Some grandparents get monetary rewards for their labor.

All three families who have young kids with working wives lived near their grandparents to get help. Two of three lived in the same apartment complex in different buildings. H8s, the mosquito-slapper, intentionally bought a house close to his parents so they could take care of their child and the housework. We interviewed H8's parents in his house rather than their own. H11h's mother regularly visited H11's home two or three times a week from 8am to 9pm to take care of her 3-year-old granddaughter. She had a room in H11's home since she sometimes sleeps there. H11w said she paid her mother-in-law a thousand dollars per month, which was a big part of their expenditure, and was quite satisfied with this relationship since she can trust her mother-in-law with her daughter. She almost considered her mother-in-law as a main householder in the home.

The helpers

The working wives especially with young kids had difficulties managing their two roles as a mother and as a worker with insufficient help from husbands and the state.

YWCA Korea educates and introduces domestic helpers as part of their plan for empowering women. The helpers, who were total strangers but took a big part of labor in one's private home, sometimes argue on how to manage the home and children with wives and on their responsibility for the work [21]. These issues made it easier for our participants to rely on their parents even after marriage.

The visitors

All participants except one household said they had not had visitors as far as they remember. Participants believed inviting somebody meant the wives committing to cooking with heart and soul and cleaning the house until it is spotless. The use of disposable dishes is seen as a very rude way of serving others. Potluck style parties are also not popular in Korea, which makes socializing very difficult.

H12w: If I invited somebody and ordered catering? I would feel very sorry about the catering. (housewife, 56)

For this reason, three families expressed they cannot invite our researchers to their home and met us in a public space.

Ideal Home Automation Technologies

After discussing the social dynamics in the home in detail, the last section of our study involved asking participants to design their ideal home automation technologies. We did not limit the types of home automation technologies, so participants designed everything from smart appliances to robots. Participants expected automated technologies in the home to do a variety of tasks from cleaning to mopping, parenting, and organizing. Environmental control and security, which get major attention in ubicomp, was rarely mentioned. In addition to a list of functions, participants reported clear ideas on how these technologies should be socially situated in their homes. Participants expected automated technologies (e.g., domestic education robot, smart refrigerator) to perform tasks to reinforce the existing authority structure and relationships among family members (e.g., parents – children, father – other family members, wife – mother in law). Also, participants wanted to control their ideal technology so as not to disturb the existing family hierarchy. Some participants mentioned their continued distrust of technologies.

Ideal technology situated in family hierarchy

Participants expected that automated technology would reinforce their expected role in family hierarchy. Parents wanted automated technology to support their authority as parents against their children. H7w (teacher, 32), with 5 and 3 year old daughters, worried that her children might be influenced if technology communicated with her without using the honorific (e.g., calling her name without sir or ma'am – 님 in Korean, or speaking without the honorific suffix in each sentence), and imitate its communication style. A father, H11 (analyst, 33), was explicitly opposed to technology that could recognize and react to his emotions, especially if he was in a bad mood. As a breadwinner and a

head of family, he wanted to be able to control how others perceive him so that his family would not have to worry about him, which would make him feel worse. H2w (housewife, 28) wanted automated technology to help her maintain the hierarchy between her and her mother-in-law by performing her monthly telephone call to her mother-in-law instead of her with her voice. As a daughter-in-law, she has been expected to call her mother in law to show her respect; as a new bride, she found it difficult to talk with her mother-in-law. She said in Korean culture, a wife is expected to serve the parents-in-law although a husband is less expected to serve the parents-in-law than a wife.

Expected level of autonomy to be in family hierarchy

Participants avoided designing technologies with full autonomy because they worried it would intrude on the authority of the family members. Participants tried to maintain the family hierarchy by keeping strict control over the technology. Participants wanted the technology to turn off and on only with their command. They also designed various interfaces – cell phones, small screens, remote controls – that would allow them to control and know the performance of the technology. Participants also wanted the technology to follow their decisions and demands without any questions or any reasoning. H2w (28, housewife) said she would feel bothered if her technology has a high level of autonomy and performs tasks without her request.

Continued distrust automated technologies

The distrust of technology continued when discussing ideal automated technologies. Cleaning technologies were considered unreliable even though cleaning was mentioned frequently as the most needed function. Both men and women thought a human should clean, particularly women who are either helpers or wives. H7w (teacher, 32) worried about automated cleaning technology and preferred to employ helpers. H11h (analyst, 33) also said cleaning should be done by a human, though not himself – his wife will clean.

H11h: I cannot trust the level of cleanliness. Also, cleaning is not that important in my life. Cleaning bothers me a bit but it ends up being done by somebody.

I: So, you'd better do that by yourself?

H11h: [laugh]. I don't. But I expect more productive work from technology. Cleaning can be done by my wife.

Participants also doubted education/parenting technologies, although they said they needed them, due to worries about technology addiction. H11h (analyst, 33) expressed his needs for parenting technology along with some worries.

H11h: Parents these days are too busy to pay enough attention to children. My daughter asks me to read a book all the time, which I can't. I think interactive technologies can meet my needs but the technology is meaningful only with the participation of parents.

DISCUSSION

Based on our results, we identify three points that can inform further research in ubicomp. First, we found reference to gendered domestic roles and space as a pervasive theme in the lives of householders. Secondly, we found that existing technologies are used and given meaning based on how social norms and roles in the home are constructed. Lastly, we found the adoption of automated technologies was not simply based on user needs but on the way householders related social roles to automation.

Firstly, our study shows that gender is an important organizing factor in the Korean home. As gender is always constructed through cultural discourse and practice [11], design research should attend to how householders define and perform gender in the home. Our participants constructed gender roles following traditional Confucian values [37] (e.g., a wife should obey her husband and not get ahead of him economically and socially, women are responsible for the state of the house and the performance of housework [12]) and contemporary Neo-liberal [33] norms of Korean society. Scholars have historically investigated Confucianism as the main factor [33; 37] and explored Neo-liberalism [32; 33] as a more contemporary factor related to the definition of gendered domestic roles.

The traditional Confucian notion that only husbands can work outside and are as high as the sky and on the other hand, wives should stay at home and are as low as earth, has vanished [37]. However, the notion that husbands should contribute to the larger community by working outside the home and wives should support the contribution of their husbands by working in the home is still there. Wives, regardless of their employment status, are construed as managers of the home and husbands rarely participate in housework before retirement. Unlike the majority of middle class American families [30], working women in Korea ask for help not from their husbands but from other women, such as their mothers, mother-in-laws or female domestic helpers. The work of husbands outside the home is seen as contributing to the nation, so home means subsidiary place to rest and recharge for work. Women's primary need to take care of children and the home makes it difficult for them to work outside the home as much as men. The Neo-liberal social ethos that asks individuals to be productive and self-sufficient therefore defines women as lesser workers, causing them in turn to devalue their own contributions. The same cultural logic makes retired men see themselves as worthless and housework as an embarrassment. We saw our participants reproducing these gendered hierarchies in the home through their practices and sense-making of social roles and relationships.

Secondly, we found that the use and meaning of technologies are determined by the way in which householders construct their social norms and roles in the home. Various screen devices seamlessly connecting through the wireless Internet, as in Wieser's dreams, were

not just efficient technologies to our participants. Control over the TV signified the strong authority of fathers as breadwinners, and parents' elevated place in the home hierarchy compared to their children. More individualized tablets and smart phones gave children their independence and privacy by allowing them to watch TV in their rooms. The use of smart phones was especially important for adult children who have to live with their parents due to the Korean heterosexual marriage-centered housing and loan-lending structure [33]. Dishwashers were not represented as a convenience, but as hygienic tools for Korean mothers to guarantee the health and good care of all householders. Our findings suggest technology is not evaluated by itself, but as an integral part of existing social dynamics and cultural values, similarly to Rode's finding that families reflect their roles through digital housekeeping [28]. UbiComp has agonized over the low acceptance rate of commercialized automated technologies in the home. Understanding social roles and cultural meanings in the home as they pertain to technology could improve their adoption.

Thirdly, technologies were adopted not merely because their functions met the needs of users but because of their suitability to domestic social dynamics. Participants expressed various difficulties in home management and suggested ideal technologies to ease their challenges. Cleaning and parenting technologies ranked highly in terms of need, but were considered undependable compared to humans due to the socially charged meaning of these tasks. Cleaning is not just physical labor, but a part of the wife's responsibility to take care of the family. Also, parenting is not just guiding or educating children by delivering information, but also affective interaction between children and parents by giving them love and support. In contrast, a Kimchi fridge, whose function does not relate to the social roles of householders, is widely adopted. These examples suggest we need to focus on the current interpretations of the roles of householders in relation to technology design rather than just on expected abstract future needs.

Based on our three findings, we have two design recommendations for domestic home automation. The first is to attend to the way in which salient social roles are defined and performed among potential users of new technologies to recognize social hierarchies and marginalized voices and include them in the design of home technologies. In our study, women in the home emerged not only as important users, but as a group whose participation needed to be more specifically encouraged and included in technology design. Second, home automation design should not only build on the social and cultural meaning of domestic practices, but also engage with them critically to question existing assumptions and values. These suggestions will enable us to co-construct domestic technologies and the social organizations in which they will be used in ways that can empower a wider group of users.

Previous studies exploring home automation focus on male participants as early adopters [10], without recognizing the importance of women's roles in the home not only in Korea, but in even in Scandinavian countries. It is important not only to address women as technology users in the home, but to reflect on women's current roles in home automation design more critically. Our collected data represents more female rather than male voices to counterbalance the greater representation of male voices in existing home automation discourses, which makes women's perspective more novel to report. To empower women as domestic technology users and designers, we need to acknowledge not only the epistemological hierarchies in ubiComp, which gives more value to the knowledge of technologists than that of users, but also to the social hierarchies in the home and broader culture which obfuscate the importance of certain groups of users, such as women, and cause them to doubt their own expertise. We suggest some of the barriers related to technology design can be removed by allowing users to talk about technology in their own language and in the context of their own lives and concerns.

Attention to the social dynamics of the home brings up questions about the politics of design and social dynamics, such as "should we reinforce current role divisions with technology design?" or "can we make changes in gendered work by understanding social dynamics and affecting them through design?" Research shows that new technologies introduced in the home can change gendered roles; the Roomba vacuum cleaner got men and teenagers more involved in cleaning [15]. Such possibilities for changing social roles and meanings surrounding technology can enable designers and users to reflect on existing social dynamics and technology's place in them.

CONCLUSION

Following Bell and Dourish's claim that "UbiComp is here", we explored the Korean home and automated technologies in a space where infrastructure has enabled Weiser's dreams to come true. To be sensitive to the hierarchy between researchers and researched, we tried to relinquish our control over the research and design process by not emphasizing specific technologies or spaces and by positioning participants as collaborative ethnographers and co-designers. This allowed us to gain a better understanding of the cultural and social meanings of technologies within the context of the home, rather than focusing on specific technologies or its uses based on technological interest. The method we used might not be optimal for actual technology building process, since users do not have skills to implement products. This method is helpful for the early stage of design and exploratory studies, particularly for including users early on in the design process.

By exploring home automation technologies as socio-technical artifacts, we found highly gendered roles as a dominant theme in home, originating from Confucian

values and reinforced by Neo-liberalism, and identified how domestic technologies are currently used and what is expected of them as cultural products. As a result, we call attention to gender as an important but often ignored component of home technology design and women as co-designers of ubicomp technologies, and suggest the management of the politics of home automation design as a new research opportunity in ubicomp.

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