

Collaborative Map Making: A Reflexive Method for Understanding Matters of Concern in Design Research

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ABSTRACT

HCI researchers investigating the politics of technology design have recently focused on how design practice can tackle “Matters of Concern”—complex social issues perceived and experienced in multiple ways. These researchers suggest design research can generate *new* networks of human and non-human actors to express and act on these issues. Prior studies, however, tend to restrict their networks within traditional boundaries (e.g. existing organizations, local communities) and categories (e.g. human/nonhuman binary) without examining their significance for participants. We suggest collaborative map making as a reflexive method for understanding current Matters of Concern from the perspectives of diverse actors, not just researchers. As case studies of the method’s use, we present two studies of domestic computing technologies in the US and South Korea, which show how collaborative map making allows salient networks to expand beyond the individual actors in the home to local and global power issues outside of boundaries (e.g. physical house) and categories (e.g. private/public space) commonly recognized in HCI. Our methodology provides HCI researchers with a way to understand existing Matters of Concern, so they can position themselves to address and act on these issues.

Author Keywords

Actor Network; Matters of Concern; Situational Analysis; Reflexivity; Home; Collaborative Mapping

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

INTRODUCTION

Since 2011, more than 100 South Koreans, mostly pregnant women and infants, died after using a toxic disinfectant for humidifiers in their homes [1,4]. Figuring out the source of the problem took quite some time, as the individuals all

looked for personal causes of the deaths, and there was no attempt for the group of people affected to share their problems and concerns. Eventually the real cause of the deaths was revealed, and it was clear that the accidents were the result of the actions of several actors in and beyond South Korea: the sterilizers were from Reckitt Benckiser, a British multinational consumer goods company, its sales were made possibly through deregulation policies in South Korea and advertisements for the products, and the effects were compounded by dry winter weather. Understanding this incident and preventing similar future occurrences requires exploring relations and power dynamics among the diverse and widespread actors participating in the technology’s design and use.

In recent years, HCI researchers have studied the emergence of complicated sociopolitical issues (e.g. sustainability, immigration), and explored how design research can express and affect those issues [2,11,13,20]. Among these efforts, HCI researchers have been investigating Matters of Concern based on Actor Network Theory (ANT) [22], which has enabled researchers to study and design technology within broader social contexts (e.g. within the public sphere). Previous work in this vein has investigated the ability of computing technologies as nonhuman actors to bring together diverse human actors to share problematic situations and social issues in a *new* network. In this paper, we build on and also shift the focus of this research trajectory by suggesting *collaborative map making* as a participatory method to help HCI researchers scrutinize existing networks and Matters of Concern *before* constructing new networks around novel technical interventions. Collaborative map making involves three processes: 1) researchers select keywords related to the context and phenomenon being studied, 2) participants develop micro maps to express their everyday experiences and concerns related to the keywords, and 3) researchers make micro maps out of participants’ micro maps.

To describe our method for exploring the political valence of the design and research process for computing technologies, we first present Latour’s notion of Matters of Concern and ANT and describe how Matters of Concern and ANT have been studied in HCI. Secondly, we illustrate our proposed method—collaborative map making—by presenting two case studies of its use in US and South Korean homes. We focus on the home because it has not been a popular space in which to explore Matters of

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Concern in HCI, despite the political aspects of domestic technology use, as exemplified by the above incident. Finally, we explain the benefits of collaborative map making that enable HCI researchers to focus on exploring Matters of Concern beyond HCI's conventional categories (e.g. human/nonhuman) and boundaries (e.g. home/work) by actively engaging participants' perspectives. In conclusion, we propose HCI researchers can mediate between individuals' personal issues and policy by showing how they are closely tied in technology design and use.

RELATED WORK

Matters of Concern have been studied in HCI using ANT as the underlying theoretical framework. First, we discuss Matters of Concern and Actor Network Theory (ANT) as conceptualized by Latour, then explain how these concepts have been adopted within HCI, and finally explore how Participatory Design (PD) has been used as a methodology to study and address such sociopolitical issues.

Actor Network Theory (ANT) and Matters of Concern

In his book, "Reassembling the Social", Latour describes the concepts of ANT and Matters of Concern starting with a critique of how social scientists built their knowledge of society based on four uncertain beliefs [22]. The first uncertainty is about specific groups (e.g. family, organization) as the basic research units in social science. Although groups are not absolute but constructed based on social scientists' definitions and practices (e.g. groupings based on geographical location), social scientists investigate society mainly within group boundaries. Latour argued that researchers should not limit their investigations to predefined groups but seek to understand group formation, which can lead to the emergence of new types of groups. As the second and third uncertainty, Latour examined social scientists' overemphasis of the importance of (human) actions, at the expense of ignoring the agency of nonhumans as social actors.

Latour's final point of critique addresses the uncertainty of fact finding as the research goal of social science. In opposition to such Matters of Fact, he suggested a new research focus for social scientists: Matters of Concern. Latour proposed to flexibly *trace relations*, the network, of what matters to people as a humble cartographer, rather than to restrict knowledge of society within strong predefined boundaries (e.g. family) and categories (e.g. human/nonhuman) as an authoritative professional.

In our study, we describe a method for HCI researchers to explore Matters of Concern, without limiting their knowledge within existing boundaries or categories in HCI. As a case study, this paper particularly focuses on the home, which has been commonly defined by the physical boundaries of the house, and categorized as personal space in contrast to public space. Due to the boundaries and categories of the home within HCI [5,8,16,33,35], it has not been a popular context for studying Matters of Concern. We show how issues at home closely relate to more complex

sociopolitical dynamics in societies all over the world, and how householders could be promising members of a group that technological interventions can bring together as an active public.

ANT and Matters of Concern in HCI

ANT to Illustrate Material Power of Computing Technologies

A growing number of HCI researchers have been using Latour's "Matters of Concern" and Actor Network Theory (ANT) to explore the role of design research for addressing socio-political issues [11,20]. These studies investigated how ANT envisions technologies not just as tools within certain locations, but as political actors enabling democratic action by bringing people together to collectively visualize and discuss shared issues. These studies have focused on the power of computing technologies as nonhuman actor interventions; one example shows how a smart phone app for sharing bicycles not only brought local citizens together but also provided evidence to enable transportation policy changes, thereby figuring as a social actor [20]. The research shows how computing technologies (or the design process) can facilitate a newly networked "public" [10] that can collectively express and discuss Matters of Concerns in freshly constructed and networked groups.

As in these previous studies, we consider technologies as nonhuman actors, but do not emphasize their agency. As a step before investigating new technology and the emerging networks around it, collaborative map making shows current situations in actor network form. Our study particularly pays attention to the *relational* components of the network, including previously unrevealed associations among diverse actors. Current arguments in HCI intensify the power of computing technologies and build networks centered on them. This simplifies HCI researchers' view of sociotechnical networks. As a result, other actors within the network who are not directly connected with technology, and the relationships among them, become invisible in research. Groups in previous HCI studies are mostly geographically bound (e.g. local community), which is an arguably limited way to generate networks. In our study, we aim to explore the complexity and multiplicity of networks by performing a relational analysis through collaborative map making. In the collaborative process, individual participants develop their own networks—micro maps—expressing their personal concerns, and we, researchers, develop macro maps by associating individuals' networks. At the same time, while making maps, both researchers and participants critically examine their own values and understanding of the situation.

ANT as a new frame for Politics in Participatory Design

Since its inception in the 1970s, the political aspects of design have been of utmost importance to PD researchers, in particular as a more democratic perspective on the design and adoption of technology [28]. PD has included minority groups, such as workers who could previously not participate when automating factories, and more recently

other underrepresented users—such as homeless mothers and children [9], children within families [25]—in studies. Recent PD research has had a more limited expression of political issues within the design process, compared to the early days when PD practitioners aimed to democratize the work environment. Björgvinsson et al. found it difficult to express and affect power dynamics due to the situational complexity of computing technologies as computers entered into diverse parts of daily life [2]. When computers were mainly situated within the workplace, power dynamics were easier to figure out: workers were clearly the ones that PD researchers should support. However, current power issues do not reside within one context (e.g. the workplace) but fluidly tie into places across organizational and community boundaries (e.g. work and home). Thus, PD researchers have been developing different ways to act on politics in and through computing. One approach has been to design a “Thing,” a network of people and technologies that deals with Matters of Concern rather than to develop certain technologies for certain users (e.g. a living lab providing public space for people to gather and develop an agonistic public environment) [2].

Our study builds on these prior efforts to incorporate political issues into the design process. Specifically, we investigate a method for understanding existing networks in computing environments before building new ones through new computing technology. In previous studies, researchers determined the Matters of Concern from their assumptions and perspectives on what was important (e.g. air pollution [11], immigrants [2]). However, researchers are also actors who are part of the network and whose situated perspectives affect how they interpret the issues [32]. Socio-computational networks existed before researchers created new webs, and researchers enter into existing networks before making new ones. As researchers enter existing networks, they build relations to other actors. The researchers’ position in the network determines their roles and standpoint, which then affect how they represent other actors [31] and constitute the new network. In previous studies, researchers’ positions and their relations to other actors have rarely been inspected (e.g. researchers were facilitators but their positions were not thoroughly scrutinized) (see Figure 1 for differences between networks as expressed in previous studies and our current work.). Our proposed method, collaborative map making, will provide a way to understand the complexity of existing networks, and in turn allow researchers to take up suitable positions and relations with other actors in the networks.

COLLABORATIVE MAP MAKING INSPIRED BY SITUATIONAL ANALYSIS

Situational Analysis

Collaborative map making is inspired by Situational Analysis [6], a methodology that focuses on analyzing relations among actors developed by Clarke, a feminist STS scholar. Situational Analysis is a more reflexive version of Grounded Theory, originally developed by Strauss and

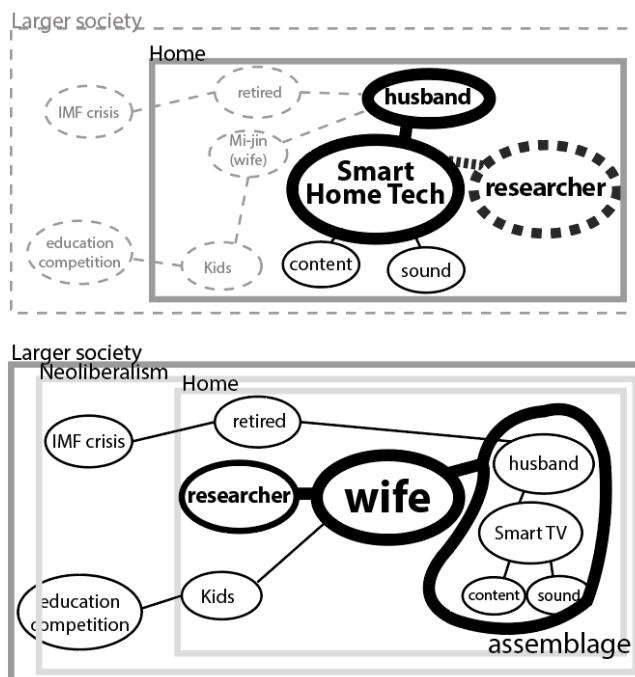


Figure 1 Top: A previous home study network where a researcher is focused on and closely tied to a certain technology, Bottom: Alternative home study network where a researcher positions themselves more closely to participants.

Glaser [14]. Early Grounded Theory was a systematic way of building sociological theories with qualitative data, in contrast to predominant quantitative methodologies. Situational Analysis enables researchers to be more self-reflexive: it helps researchers to avoid possible limitations of relating actors according to existing categories (e.g. human/nonhuman) or boundaries (e.g. conventional social hierarchy). Making situational maps is an essential analytical process in Situational Analysis, and the main point of map making is to understand the situation and concerns of actors involved in the situation. Situational maps are constructed based on matters that diverse social worlds or actors care about enough to fashion discourses and actions relating to them, similar to Latour’s Matters of Concern [22]. Situational maps focus on relations among actors and social worlds sharing concerns, focusing on the conceptual and qualitative ties between them.

Collaborative Map Making

In this paper, we adapt situational maps to find Matters of Concern, the complex networks of existing issues. We borrowed core idea of Situation Analysis to relate actors dynamically, regardless of existing categories or boundaries based on concepts and disciplines in HCI. While situational maps were tools meant for researchers, our approach is to make maps with and for participants as well. The focus of our analysis is therefore also on the collaborative map-making *process* and actively including participants’ perspectives into it. In this section, we explain 1) the main components of, 2) the essential materials for, and 3) the main features of the collaborative map making method.

Key components: keywords and micro/macro maps

Keywords: Keywords play the role of less obtrusive questions in interviews; they propose research directions to participants, but still give them enough room to lead the research. Researchers should carefully provide several keywords to participants that participants can use to develop their own micro maps. We do not recommend technical research terms as keywords, cultivated from the researchers' academic culture (e.g., Internet of Things (IoTs), assistive robots). Technical terms could forge a strong boundary between researchers and participants as those with and those without technical knowledge. This boundary could interfere with genuine collaborations between the two groups. For example, we found that traditionally marginalized groups within the technology design process, such as women, become passive in expressing their everyday issues when encountering technical terms [24]. Also, when participants perceive technology as a central concept, they tend to identify as users and talk about how they use technologies rather than their actual everyday issues.

Micro maps: Each participant makes a micro map. Micro maps reveal the participant's matters of concern in the form of a network. A micro map is composed of any words that participants think are related to the keywords; in our research they usually contained 15-20 words. Participants are asked to mark the words they find most important, to provide researchers with a guideline when interpreting micro maps from participants' perspectives. Each word is written on one post-it. Participants then categorize their words as they want, giving each group a title and defining relations to other groups. Importantly, participants should have as much control over the micro map making process as possible, flexibly changing their maps as they want.

Macro maps: Macro maps show interconnected matters of concern among participants. After finishing all micro map making, researchers build macro maps by connecting components of each participant's network. Researchers take the most important words from micro maps to the macro map and relate participants' issues. In some cases, researchers could triangulate the relations uncovered by their analysis with other literature (e.g. local news, anthropological scholarship). Although researchers develop macro maps, participants can make changes to macro maps if they want.

Research materials

Post-It note: The ubiquitous 1 3/8 in x 1 7/8 in Post-It is an essential material to facilitate flexibility in each map, as it allowed both participants and researchers to make changes to maps whenever and as they wanted.

Sketch pad: We used an 11 in x 14 in sketch pad to record micro maps. Participants categorized their Post-It notes on the sketch pad, wrote the names of each group, and explained relations among groups.

Photographic Camera: Since the process for map making is important, and maps could be flexibly updated, taking a photo of different map versions is useful for analysis.

Adobe Illustrator: When making macro maps, Adobe Illustrator software was useful for our research. Since we had many meaningful words (or statements) chosen by participants to work with, it was difficult to physically manage all the words. As Illustrator supports vector images, we could flexibly zoom in and out while building our maps throughout our analysis process. Any software based on vector graphics would work similarly to Illustrator.

Voice Recorder: The collaborative process and communications between researchers and participants are as, if not more, important than the physical maps themselves. Researchers recorded the process for analysis.

Etc: pen, markers, etc.

Essential features of collaborative map making

Reflexivity: Reflexivity is important in collaborative map making, as the map making process aims to help researchers to collaboratively explore participants' Matters of Concern. In our case studies, reflexivity about our relation to technology was essential, as we particularly wanted to understand participants' self-defined networks. When focusing on certain technologies, researchers could understand participants only as users. Technical components were therefore added into the research process after understanding participants' matters of concern from their perspectives first.

Flexibility: Although we propose collaborative map making as a method for understanding the interpretations, use, and consequences of technology related to broader Matters of Concern, the method also aims to explore ways to manage power dynamics between researchers and participants. Different researchers could develop or utilize micro and macro maps in diverse ways to examine their possible biases and understand participants' perspectives.

Multiplicity: Each map, either micro maps or macro maps, could be constructed in multiple ways, as the maps are contingent. For example, when utilizing micro maps for continuing sessions, we asked participants to alter their maps if needed. We assumed participants' issues might have changed as the follow-up session was performed a year after the first map making process.

TWO CASE STUDIES OF COLLABORATIVE MAP MAKING

We suggest *collaborative map making* as a method to help HCI researchers understand current situations participants face in the form of actor-networks. In particular, we chose domestic contexts in two countries to show how collaborative map making benefits HCI researchers to find Matters of Concern, without relying on existing categories and boundaries. We explain the detailed benefits—understanding Matters of Concern—of our proposed

methodology through these two collaborative map making case studies. The cases also show how collaborative map making can be flexibly employed in HCI projects. We will explain the map making process through four steps: 1) selecting keywords, 2) micro map making, and 3) macro map making, and 4) utilizing map making results. To retain participants' individuality, we use pseudonyms for them.

Case study 1: Older Adults' Networks in the US

Step 1: Selecting keywords

The first step for map making is selecting keywords. The US study is part of a larger PD project exploring assistive robots for older adults. The project was initiated in 2014 in Bloomington, Indiana—a small town with several retirement communities. We first interviewed older adults about how they are using existing technologies in their everyday lives [23], and map making was conducted as a follow-up study. We recruited Baby Boomers, who have an important place in the global phenomenon of population aging [27] which inspires assistive technology studies [21, 34]. In the first study, we found assistive technology design incorporated stereotypes and biases about older adults, which is why we employed collaborative map making.

In summer 2015, we employed collaborative map making as a second study to understand older adults' lives from their perspectives. We had six Baby Boomer participants including three participants from the first study. This study aimed to avoid framing older adults from our (researchers') perspectives, which is likely to bring in stereotypes. We intended not to negatively relate "older adults" and "aging", focusing on aging as a disability. We wanted to see how older adults relate "me," "home," and "aging" in their own ways and let participants construct networks related to the three keywords. Although assistive technology is our main academic interest as technology design researchers, we did not use "assistive technology" as a keyword so as not to frame older adults only in relation to technology, which could impact their map making process.

Step 2: Micro map making

Participants wrote about 15 words without restriction on Post-Its, and then developed their situational maps (micro maps) explaining the relations among the words. Among six participants, we illustrate Pam's map-making process to show how the map making helped us to redefine the relation between older adults and aging. We focus on one participant to provide a nuanced description of participants and their maps.

Pam's micro map: Pam (female, 58 years old) is a freelance editor and writer. She has been living independently in a rented house. She has a noticeable disability in her left leg and half of her body. Pam was interviewed at a café near her house. Pam was a continuing participant from our first study, which helped researchers to build trust with the participants over time.

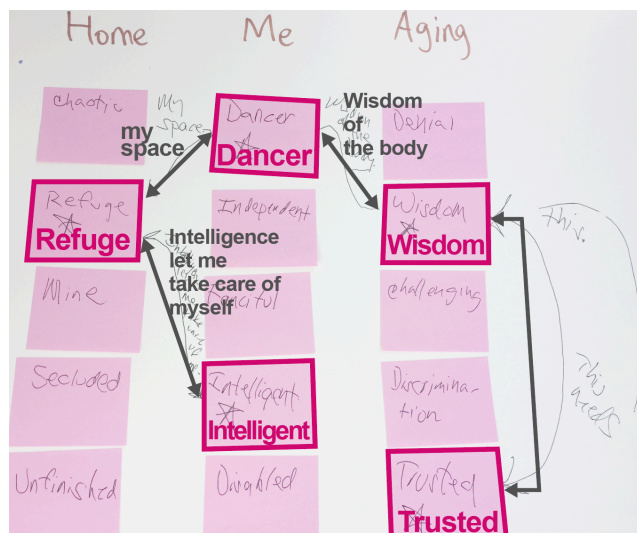


Figure 2 Pam's situational map (a micro map)

Pam wrote 15 words related to "home," "me," and "aging" (see Figure 2). In her map, she picked "refuge," "dancer," "intelligent," "wisdom," and "trusted" as the most important words. The five most important words illustrate how her ability is meaningful in her life. She explained her home as a *refuge*, since she can be herself at home, away from the pressures of the world and other people. As well as *refuge*, *dancer* was another important word, providing her own space. She has had prosthetics for about ten years and has difficulty controlling the left side of her body; however, she said "dancer" was the first word that came to mind when she thought about herself. "Intelligent" was also an important word for her, closely related to "refuge." Pam's intelligence let her take care of herself and keep her independence. Her identity as a dancer was closely tied to her "wisdom," which she attributed to her aging experience. Her wisdom comes together with being "trusted." She explained that the older she gets, the more people trust her. She said her friends let her take care of their children due to this trust. Pam said she has been a writing tutor and friend to the 10-year-old daughter of a friend.

Following Pam's interpretation of her map and her focus on those five words, we tried to understand other words in relation to the five. Pam also spent considerable time telling us about issue-related words, such as "discrimination." Pam's five most important keywords indicate her identity with abilities (e.g. someone who could be a "dancer," and "intelligent" enough to take care of herself) and her issues come from the factors that interfere with that identity. However, Pam's "disabled" body was not the main factor causing her problems, in contrast to the assumptions behind most assistive robotic technology designs [21,23]. Pam explained the word "disabled" as one of facts about her body. Her disabled body posed difficulties, but was not her biggest issue. "Discrimination," a word in her map, explains her actual issues, which includes complex network of people and the larger social structure.

When describing “discrimination,” Pam explained her experience during her job search. Pam said that she has given up trying to find a job due to discrimination she experienced. She thinks that it is from people’s stereotyped perspectives on her age. Several years ago, she found a job posting identical to her previous position, during which she had gotten to know the people in the company that posted the new job openings. Pam was glad to apply for the job. But, after a long wait, the company went dark. When Pam contacted them, they said she was not a good fit for the job. Pam asked why, because she had ample experience in that position, and they said they knew that but still did not want her. Pam thought this was a form of age discrimination. She filed an EEOC complaint against the company, but the manager lied to the officer, saying that Pam was late for an interview and did not answer correctly. The EEOC officer said she could sue personally, but the office could not help her anymore without evidence. Her voice as a potential employee was too small within the legal system, especially when she lacked the money to hire a lawyer. This experience made her stop applying for jobs, and she has had no regular income since. This explained how she sometimes wants to avoid the world and other people, as well as how her home became a “refuge” to her.

While explaining her map, Pam mentioned several technologies, such as the TV, a wheelchair, and a little electric car in a grocery store, in relation to her situation. Among them, she told us how her powered wheelchair caused issues relating to her discrimination experience and subsequently limited financial situation. Pam said:

I do have a powered wheelchair. The challenge with that is being able to afford having my home ramped so that I can take the wheelchair out, down the front step, and out. And then, I wouldn’t be able to use my powered wheelchair anywhere but in the neighborhood right now, because I don’t have a lift for the wheelchair. That’s expensive.

Pam’s micro map-making process showed us that her main issues originate from her relations to people and structures within society. To tackle her issues, she needs assistive technologies mediating between herself and the complex societal factors (e.g. legal systems) that relate to her issues, so that she can express her voice or show her frustration as a worker. In contrast, most assistive technologies mediate the relation between Pam and her body (e.g. a wheelchair letting her move around despite her disabled left leg). Without the map, we would never expect to hear that she identifies herself as a “dancer” and how the word relates to her issues. Without situational analysis, we might just think that she wants to focus on developing her abilities within the dichotomy between ability vs. disability and aim to design technologies equipped to tackle that, rather than her deeper issues.

As in this example, we started to construct networks from individuals and not from a certain community as the previous Matters of Concern studies in HCI. With a

different method, we identified the complex relations among various actors, from Pam to managers in the company that she applied to and to EEOC officers, which also related to workers’ rights and issues related to the legal system. Also, collaborative map making enabled us to find more users’ perspectives than traditional questions. If we investigated assistive technologies with targeted interview questions, we might have asked about possible technologies. Then, we would probably design assistive technologies to relieve the participant’s difficulties related to her mobility as her powered wheelchair. However, her Matters of Concern related to broader parts of society (e.g., legal systems for workers), which are not regularly part of HCI studies and interventions.

Step3: Macro map making

After the participants’ map making process, we developed a macro map (see Figure 3). As we did for Pam’s map, we tried to grasp each participant’s network and issues. Then, we moved the most important words from micro maps to the illustrator to make macro maps. As participants did, we made groups of words as shown in Figure 3. As a result, we found four groups: 1) older adults’ self-identities, 2) older adults’ interpretations of aging related to their identities, 3) the meaning of home, and 4) older adults’ frustrations. While exploring relations among the groups, we found that older adults’ issues were an important component in understanding relations among the groups. We went back to the transcripts and found how our participants discussed their problems. We constructed our macro maps using words defining the issues and related words from participants’ micro maps.

Throughout our process of exploring relations among the groups for macro map making, we recognized that issues often emerged when older adults had relations to actors and systems outside the home (or their aged bodies). Older adults were still themselves and viewing their aging as one of their life experiences. However, social systems outside the home do not interpret their aging as they do, which causes problems for them. As with Pam, other two female participants lamented people’s stereotyped perspectives on old ladies and how they limited their employment. Richard (male, 63, a retired doctor)’s issue emerged from his relationship to the national insurance system. He said that taking 20 pills a day is not fun, but tolerable. His real issue is that he cannot afford the 20 pills without Obamacare, which might be repealed. Participants were aware that their issues are closely related to actors and systems outside the home (or their bodies). However, they blamed themselves for their troubles, saying they should have tried harder to save their money when they were young. Macro map making revealed that not only Pam, but older adults in general, need help to handle their relationships with other parts of society as citizens as well as aged technology users.

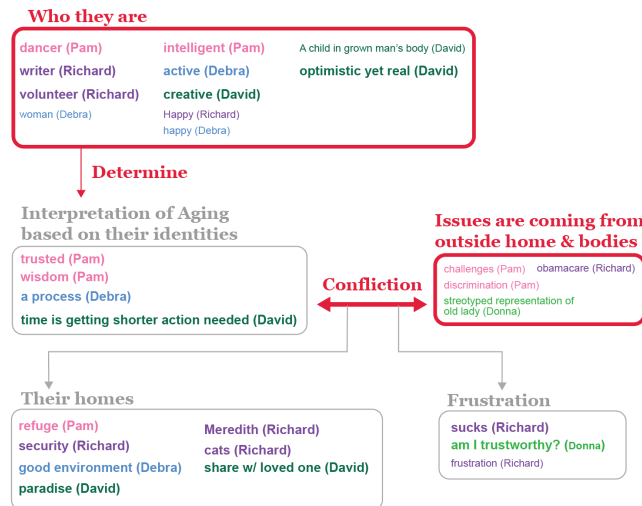


Figure 3 A macro map from the US study based on participants' individual maps

Step 4: Utilizing map-making results for design

Based on the findings of collaborative map making, HCI researchers could develop alternative types of technologies helping older adults to address their needs as citizens. Our participants acknowledged that their matters of concerns include not just themselves but other social actors. However, participants have limited ways to act on the social and welfare systems, which current technology design rarely takes into account.

Case study 2: Householders' Networks in South Korea

Step 1: Selecting keywords

The first step of map-making is selecting three keywords for micro map-making. In our previous studies at home in South Korea, we found that the use of smart home technologies was entangled with social dynamics at home [24]. Based on these findings, this project explores domestic technologies' possibilities as social interventions. Collaborative map making was performed during the project's first session in order to understand the existing network of householders reflecting their Matters of Concern from participants' perspectives. 7 families, including 11 householders, participated in the project.

As we were interested in social dynamics at home, our keywords were "me," "home," and "family." In the previous study, we found that focusing on certain technologies could distort the presentation of social dynamics at home, and we excluded smart home technologies as keywords. For example, female participants were not interviewed within recent smart home studies since researchers could not find females directly using the smart home technologies in which researchers were interested [5,33,35]. When researchers focus on technologies, people who do not have strong relationships with the technologies were excluded from study. In contrast, we investigate how participants' perspectives on their matters of concern through collaborative map making.

Step 2: Micro map making

We asked each participant to make their own maps as shown in Figure 4. we asked participants to write any 15 words related to our keywords, "me," "home," and "family"; then, we asked them to make maps by grouping and relating those words as they liked. Among our participants, we discuss Daewon's map as an example of micro map-making process.

Daewon's map: Daewon (male, 35 years old) is an apprentice at an Italian restaurant, which he started a year ago after quitting his job as a financial analyst at a large company. Daewon lives in a suburb of Seoul, the capital of South Korea, with his wife and daughter. His family moved from Seoul when the rent on their apartment increased. He worked for 10 hours every day as an apprentice with a 2-hour commute. There are no official weekends or holidays at this job, though he has four days off per month.

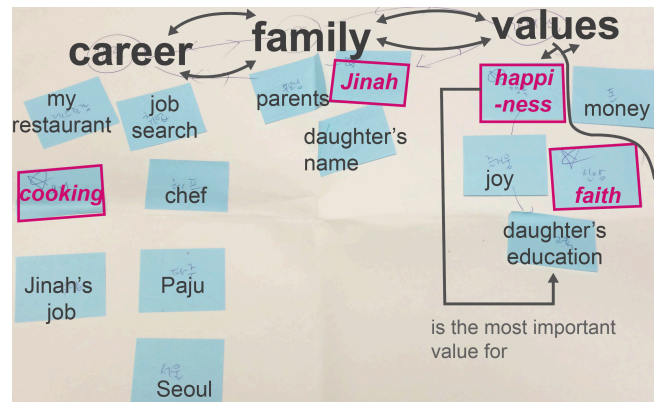


Figure 4 Daewon's situational map (a micro map)

Daewon wrote 15 words related to the three suggested keywords, "me," "home," and "family." In his map, he picked "cooking," "Jinah (wife)," "happiness," and "faith" as the most important words. The five most important words explain his issues relating to his recent career path change. He said that "happiness" is the most important word among the four, and all the words are closely interrelated. He said he decided to change his career path because of "happiness." He described his life as an analyst as not very pleasant. Being an analyst could guarantee economic status and social position. However, the job was stressful, and he knew he would be forced to retire around the age of 45 like all other white-collar workers in South Korea. Considering that average life expectancy is heading toward 100 and South Korea has a limited pension system, he worried about his future years as the breadwinner for his family. His speculation about "happiness" led him to explore "cooking" as an alternative career direction, one in which he has been interested. Due to the career change, "Jinah," his wife, should start her new full time job. He felt very sorry for his family, especially for Jinah, because of his limited income, but he could not find other ways to keep himself happy and his family economically stable in the

long term. He said his “*faith*” in religion helps him greatly persevere through his currently rough and unstable situation.

Daewon’s map-making process revealed how his issue includes various societal factors, including his status as a father, a worker in the flexible labor market, and the unstable pension system in Korea. Daewon chose early retirement, as companies can no longer guarantee lifelong employment. The labor market of South Korea became flexible after IMF economic crisis in 1997 (e.g., early retirement system, sharply increased numbers of non-regular workers [25]), and the South Korean national pension system is not stable [6]. His status as an unstable breadwinner saddens him because he sees providing for his family as his duty according to traditional Confucian gender roles [39]. The economic instability makes him lonely and stressed. As the head of his family, it is difficult for him to complain or share his difficulties with other family members.

We did not constrain our participants in thinking about their issues, especially with technical terms. Thus, Daewon could pay the most attention to issues not related to technologies, and at the same time, relate his issues to his experience with technologies. While explaining the map, he mentioned his internet TV as his least favorite object. Daewon usually watches TV alone in his living room after coming back from work around 1 AM. At that time, no one else in his family is awake. Silence makes his home seem cold, and the TV is the only thing that can talk. He often loses his sense of time, watching TV until 2 or 3 AM. He needs to leave for work at 7 AM. He wants to stop watching TV, but continues as it is the easiest way of relieving his stress.

Step 3: Macro map making

After each of our 11 participants in South Korea made their maps, we developed a macro map (see Figure 5). We first went through each participant’s map as we did for Daewon. Then, we constructed a few statements explaining each participant’s Matters of Concern. From the statements, we found a pattern among participants in the same gender and age groups (e.g. 30-something male participants suffer from flexible labor market policies). For example, as Daewon can’t stop watching his TV, another participant Ji-eun (P3, female, 39, full time mother) explained her husband constantly watches TV in the home. Ji-eun said her husband suffered from long working hours and stressful working conditions in a large technology company. The stress made her husband keep watching TV when he is at home, decreasing communication between him and other family members. Also, we found different age groups with same gender were related to each other. For example, Eunja (P4w, female, 60, housewife)’ complained her husband watches TV all day long, which started in his 30s. When he was in his 30s, he watched TV after work. Even after his retirement, watching TV is his main occupation. The limited time with family members due to long working hours limited husbands’ communication ability with their

families. Consequently, the 50 and 60-something husbands watched TV most of the time. Based on the groups that emerged, we searched through local South Korean anthropology, sociology, and gender studies’ literature. The process was for triangulating our interpretations of the relationships among gender, age, and family dynamics in contemporary South Korea. The triangulation process helped us identify that Neoliberalism was a crucial theme to understand contemporary South Korea, especially after the IMF crisis in 1997, and to use that knowledge in our identification of main Matters of Concern.

The macro map making process in South Korea showed participants’ seemingly personal issues in the homes were closely related to the South Korean socio-economic system. However, participants blamed themselves, saying that they failed to perform their roles efficiently. Based on the common patterns, we came up with the macro maps as below. The macro map clarified that our householders’ issues stem from the Neoliberal system overemphasizing the importance of individual efforts. The macro map-making process visualized the notion that householders need help to perceive their issues as community’s issues and as citizens in relation to actors outside the home.

Endless competition from Neoliberalism

Men	Women
30s - 40s (p1h, p3h) - Need to work hard and late to support families - Have little time to communicate with families - Have stress from a company	30s - 40s - Need to choose either work or children as a woman (p1w, p2w, p6w) - either ways, need to perform the role of a mother (all mothers) - taking care of children and finding a way to make more competitive children) - expect responsibility of a mother will end after 20s of their children (p6w, p7w)
50s - 60s (p4h, p5h) - Forget how to communicate with families - keep watching TVs	50s - 60s (p4w, p5w) - children would still need economical or physical help from - their parents to keep their competitiveness

Figure 5 A macro map from South Korean study based on participants’ individual maps (household 1 husband: p1h, household 2 wife: p2w)

Step 4: Utilizing map-making results for design

After the map making process, we added technical components into our research gradually so that we could construct alternative domestic technologies based on participants’ network. For example, as a second step, we provided the participants with basic sensors so they could explore how technologies could affect their Matters of Concerns. While collaboratively designing technologies, we tried to visualize how participants’ issues are not just personal but related to systemic issues. To raise participants’ critical awareness, we showed participants our macro maps and how their concerns are interrelated with those of other participants. Also, we collaboratively developed Internet of Things (IoTs) prototypes with participants to share narratives of different participants’ issues.

What we learned from the two case studies

Throughout the map-making process, we found that the entanglement of concerns connected participants' individual issues to local and global politics—the Matters of Concern. Homes were not just a private space separated from outside power dynamics, despite their framing as such in HCI [8,16,36]; also see [7,26] for a critique. The most interesting finding to us was that participants' ways of perceiving their issues were closely related to a Neoliberal ethos [12,29]: endorsing individualized selves and self-governing. When discussing their issues, participants believed that they could be in a better situation with more individual effort. If older adults tried harder to save money in their early years, they would be fine now; if fathers had better jobs and earned more money, the whole family situation will be better off; if mothers managed their children better, the children will be competitive and win the education race. Participants were most critical of their own inefficiency and individualized their issues; however, those issues were not only interconnected, but also strongly tied to systemic problems in society. Neoliberalism overemphasizes individuals' roles and minimizes the role of the government [3]. The US government, ever since the Reagan administration [18], and the South Korean government after the IMF in 1997 [29], have pursued Neoliberal deregulation policies encouraging individuals' self-governance. To counter this individualization, grouping people's issues and providing a technological platform for them to voice their societal concerns (e.g. education policy) is an essential step towards technology that can deal with Matters of Concern.

DISCUSSION

We have shown how collaborative map making can help us explore current situations in the context of existing Matters of Concern. Subsequently, we are going to discuss the advantages of employing our suggested methodology: 1) collaborative map making reflexively situates researchers within a network, 2) collaborative map making enables researchers to constitute the “public” from an individual's experiences from the private space of the home, 3) collaborative map making helps researchers focus on Matters of Concern, regardless of pre-existing categories such as human/nonhuman binary, and finally 4) collaborative map making deepens the current meaning of “situation” and context in HCI.

Collaborative map making raises the issue of perspectives when studying Matters of Concern. In our study, participants played essential roles in defining Matters of Concern; participants determined important actors (or actants) and their relations to each other that constitute Matters of Concern. Then, we as researchers created further ties by finding associations among participant's issues while keeping and valuing the original relations among actors. When we were making macro maps, we kept checking whether the original issues in the micro map reflected back to the macro map correctly to conserve participants'

perspectives. Also, when we reported our results, participants' narratives were used to explain their primary concerns from their perspectives. In previous HCI studies, researchers have paid little attention to whose perspectives gain the most power when making networks. Researchers, as actors with power in the network, decided what are Matters of Concern from their perspectives, and researchers defined each actor in the network based on their own concerns. Although researchers extend their informants' contexts from a lab to an organization (or a home) and finally to the public sphere, power dynamics between researchers and the researched still exist.

The issue of perspectives within the network has been discussed as power flows among actors, where the ones with the most power can decide all other actors' representations [30]. HCI Researchers need to reflexively acknowledge their position and relations to other actors, and their existing pre-assumptions and biases while identifying old and making new networks. After all our efforts to collaborate with research participants, inevitably we as the researchers were the ones to finalize the macro maps, and decided whose narratives should be included in this paper. However, we hope our study opens the discussion of perspectives issues within studies exploring Matters of Concern in HCI.

Collaborative map making facilitates finding Matters of Concern, regardless of existing geographic boundaries.

Previous studies have explained that Matters of Concern or the “public”—sharing the concerns and taking action—are not necessarily bound by geographical locations; however, most studies are performed in local communities [2], or with governments [11] who are geographically selected at the community level. In our study, we expand possible actors within the public not based on existing local organizations but from individuals who are seemingly unrelated to each other. Collaborative map making visualizes how an individual's experience with technology or issues at home—the private space—are entangled with state-level policies and globalized power dynamics. Although our participants in the US and in South Korea are geographically far from each other, their Matters of Concern are closely related to state-level (or national-level) policies; also, their seemingly personal concerns were public concerns which could be reflected in the policy making process. Thus, a future project could involve developing a Thing to detect those personal and individual issues, aggregate the issues, and reflect the issues back to participants and into the policy making process.

The strength of collaborative map making is analyzing Matters of Concern regardless of geographical locations, derived from Clarke's cartography used to make situational maps [6]. Clarke does not follow geographical space hierarchies (e.g., defining Chicago by the Chicago loop < Chicago city < Illinois < the US < Americas). Rather, depending on the issues, a home could be linked to

national-level issues rather than at city level. Collaborative map making would help HCI researchers to find existing Matters of Concern by following research subjects' perspectives and by associating the concerns dynamically.

Collaborative map making sensitizes HCI researchers to the power of technologies beyond the category of human/nonhuman. Understanding the power of nonhuman actors is an important point of ANT, which is also important in HCI. However, ANT is also a critique on sociologists' research practices and categories, which limits their knowledge making. Thus, when HCI researchers adopt ANT, we could be reflexive and examine our existing research practices to be aware of how they limit us.

One of the common research features in HCI is that HCI researchers value computing technologies above other actors, due to the field's origins in Computer Science. Although HCI researchers have rarely analyzed computing technologies as meaningful actors as humans, computing technologies have been at the center of HCI studies. For example, in recent "in-the-wild" smart home studies, women became invisible actors because they were not the primary users of computing technologies [5,33,35]. The computing technologies researchers were interested in were granted power and the agency to define who should be in the studies or not. Considering the position of computing technologies at the heart of HCI research, HCI researchers need to be careful when focusing primarily on its power. Computing technologies, in the HCI context, have been not the ignored nonhuman actors of sociology, but special actors with significant power. Considering the power of technology in HCI, HCI researchers should carefully examine what relations computing technologies have to other actors and the power dynamics among them; collaborative map making can support such relational analysis.

Collaborative map making stimulates HCI researchers and participants to deeply situate their knowledge and issues. Situatedness has been an important issue in HCI ever since Suchman explained how the action of using technologies is different depending on the situations; she explained actions are mutually shaped between an actor and her environment. To situate the use of technologies, HCI researchers have investigated context; they employed various methodologies (e.g. ethnography, in-the-wild studies, participatory design) to reflect contextual knowledge into technology design and evaluation. Collaborative map making expands the meaning of situatedness by adding power issues between the researcher, as an action observer, and the research participant as an actor (who performs the action), to the analysis. Although a researcher observes how a user acts, the researchers' findings through observation are not enough to explain their situatedness; that is because a researcher has her own perspectives, and she cannot say she thoroughly understands her subject's situations just with observation.

Situatedness in collaborative map making is connected to Haraway's notion of situated knowledge [15], which HCI has discussed as an alternative epistemology [17]. As knowledge comes from researchers, who are located within a certain society, culture, and history, every piece of knowledge is derived from a certain perspective. Thus, knowledge cannot be seen as a universal truth or fact, but exists in multiple forms depending on the perspectives that constitute it. Research participants are also located within a certain society, culture, and history. When researchers study them, researchers cannot know them without understanding the complex relations that research participants have with other diverse actors within the network, which can be explored through collaborative map making. The map making process benefits participants as well; they can reflexively analyze their concerns and increase critical awareness related to systemic issues. After the micro map making in our two studies, participants said they had not known their issues are this complex, and some took pictures of their maps to share with other householders. When two householders participated in the session together, they liked to share their maps to understand each other's concerns. In addition, when we shared our macro map, participants were sometimes relieved that their issues were not entirely their fault, as their seemingly personal issues were closely tied to systemic issues; some participants then wanted to act on the systemic issues and policies if there is a way.

CONCLUSION

We introduced collaborative map making as a reflexive way to understand participants' in-depth situation with Matters of Concern. The method revealed complex connections of the homes to sociopolitical dynamics in the broader society. These connections showed a public can be constructed regardless of conventional boundaries defining social groups by characteristics like geography, kinship, etc. Also, in our two case studies, we found both US and South Korean participants live and interpret their experiences in the context of Neoliberal policies, which overemphasize the importance of individuals' efforts in society. Following the Neoliberal ethos, participants individualized their issues, believing increased efficiency of their lives will create desired improvements. A promising direction for HCI research could be enabling individualized people to collectively address their issues, despite their separation due to Neoliberal beliefs and individualism. The suggested method could also provide a way for HCI researchers to relate their design process to policy issues, which are of increasing importance and interest to HCI [19,37].

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