

Anshimi: Women's Perceptions of Safety Data and the Efficacy of a Safety Application in Seoul

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In this paper we examine Anshimi, a mobile safety application that hosts women's safety services. We present a case study based on qualitative data gathered from semi-structured interviews and a participatory design workshop with women in Seoul, South Korea. We examine women's perceptions of various kinds of safety data that Anshimi provides and collects from its users, such as GPS data, security camera footage, messages, personal information, etc. Exploring how women negotiate the tension between feeling protected and surveilled, we account for the nuanced ways in which women understand, feel, and use safety data in their daily lives. We also present scenarios for engaging with women's safety data, in the hopes of developing a guiding framework for designing women's safety applications and safety data practices.

CCS Concepts: • Human-centered computing → Empirical studies in HCI; Empirical studies in collaborative and social computing; • Social and professional topics → Women.

Additional Key Words and Phrases: Data Narratives; Safety; Women

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1 INTRODUCTION

Violence against women is a widely studied issue all around the world [2, 14, 48, 53], and it takes many forms, ranging from extreme incidents to more mundane situations like street harassment, stalking and other kinds of surveillance. For example, in the Korean context, the epidemic of revenge pornography and spy cams has altered the experience of public space for women in a way that the Korean government has struggled to address [61]. Recent research has paid attention to the deleterious effects of the more mundane forms of harassment [2], and how they can be mitigated by digital safety technologies [2, 20, 55, 68].

But stopping violence against women requires a shared understanding of what constitutes it, and definitions of violence and harassment often vary. In South Korea, a context in which sex crimes are under-reported and under-sentenced, the definition of what constitutes violence against women is very much contested. The legal system is lenient toward offenders, who very often are given probation in lieu of incarceration [67]. This is especially true with regard to offenders of digital sex crimes, e.g. people who plant spy cams or who circulate spy cam footage online. For instance, only 9% of those who get arrested and charged for spy cams actually end up with a jail

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sentence [15]. As such, the public's estimation of women's safety oftentimes does not holistically take into account all of the factors impacting women's safety.

Even so, there is a push by civic government to take seriously and to mitigate violence against women. In May 2017, the Seoul Metropolitan Government released a mobile application that hosts safety services for women. Named Anshimi ('relieved'), the application provides navigation support and easy access to police reporting, and is meant primarily to deter street harassment. Anshimi relies heavily on real-time GPS and security camera tracking in order to facilitate these services. Anshimi reflects the city's understanding of safe urban navigation as something that requires the close monitoring of personal and geo-spatial data through mobile phone GPS trackers and security camera footage.

However, whether safety data motivates the public to critically engage with women's safety issues is unclear. Although prior work on location-based applications designed to prevent harassment has suggested that these applications might help secure women's safety [4, 9, 20], studies of the social functions of data [33, 51] have identified gaps between data-driven understanding and human experience, suggesting that "designers and policymakers often seek to make interventions for change...with little understanding of how people produce, experience, and engage with data." [51] Similarly, previous research on policies developed by the Seoul Metropolitan Government for women's safety have been shown not to correlate with a decrease in the rate of crimes against women [40].

What emerged in our study was a disjuncture between how data-driven safety applications like Anshimi collect and use data about women's safety on the one hand, and the everyday experiences of women who use Anshimi on the other. Whereas the safety application rather narrowly defined women's safety as an issue of location, navigation, and physical safety, that was not always the case with our participants. The women in our study tended to see safety in a more holistic way, as an issue of a variety of contextual factors. Taking into account the absence of privacy occasioned by digital sex crimes such as spy cams, and a legal culture of permissiveness toward offenders, the women in our study felt that Anshimi's model of safety fell short of their own sense of what safety would mean.

Along similar lines, previous research [2, 36] has focused on addressing what aspects of women's safety certain applications have not addressed in their design. What parts of a holistic picture of women's safety, in other words, are missing in any given application? These questions are quite pressing. The gap that we wanted to address, however, regards how women who use safety applications experience safety data as something they have to manage themselves. Women who used Anshimi undertook extra labor, both within and outside of the application itself, to translate safety data into a more holistic picture. Recognizing the gaps in Anshimi's model of safety, the women in our study imagined ways of appropriating safety data in their everyday lives. At the same time, this task of appropriation fatigued users, as it required labor on their part.

We interviewed 16 women in Seoul about their experiences with Anshimi, paying special attention to their understanding of Anshimi as a data system, their feelings about safety data, and how they managed their safety data across a web of relationships with friends and family. We also held a design workshop with 11 students from Soomyeong Women's University to discuss possible ways to tackle the limits of Anshimi. We offer more nuanced scenarios, created by participants, of countering violence against women through mobile applications. These scenarios consider values, device ecosystems, and accountability guidelines.

Our case study contributes to the literature on location-based safety applications for women by giving a detailed case study of how one particular application fared in the South Korean context. Specifically, we investigate the specific shortcomings of surveillance-based applications for women's safety, and how women take on extra labor to overcome those shortcomings to secure a more

holistic and contextual version of safety. We argue that discussions of safety data and technologies should move away from paternalistic conceptualizations of women's safety, or safety as something that is secured by the government simply through the accumulation and monitoring of data. Instead, the collection and usage of safety data should account for the tensions between surveillance and protection that women experience, and should acknowledge women's autonomy over how their own safety data is understood in everyday contexts.

2 RELATED WORK

2.1 Gender-Based Violence and Safety

Previous studies in CSCW and related venues on the intersection of technology and violence against women have taken a number of forms [53], exploring revenge porn [13], doxxing [10], sexual harassment [43], and cyberstalking [3].

Much of this research has been about how technologies developed to ameliorate such issues also sometimes carry the risk of exacerbating or reinforcing them. Even as they afford users new ways to feel safe, digital interventions can create new situations of danger, especially where they create new channels through which survivors are profiled, detected and monitored. Research concerning digital intervention into situations of intimate partner violence [28, 29, 47], and homelessness [65] has showed that, while technology can be a powerful tool for empowering vulnerable communities, it must be sensitive to context in order to deliver on that promise. Freed et al. thus advocate for "context-sensitive design" [29], which takes into account how violence functions specifically in intimate partner relationships.

In close relation to these insights, another line of work at CSCW and related venues has explored how safety data can be used to prevent violence against women. This work also tends to emphasize the need for contextual understanding. These studies argue that, whether through data mining or crowdsourcing [20, 34], safety data is produced, maintained, and enacted in specific social contexts that women occupy. In particular, studies on location-based mobile applications that are designed for women's safety in public spaces [2, 4, 9, 36] have shown that mobile technologies and location data alone cannot solve the problem, since the very concept of safety is a cultural problem embedded in a complex sociotechnical fabric. Theorizing safety requires considerations of a multitude of factors, including the "personal, social, and technological" [36].

Our case study adds to these scholarly discussions, by examining how women make do with the limitations of Anshimi's surveillance-based model of safety. Building on studies that take into account a broad range of sociocultural factors that impact safety (including perceptions of the police and faith in the criminal justice system) [36], our case study shows how women, who enact this more holistic picture of their own safety by appropriating Anshimi for their own purposes, are thereby burdened by the state to take responsibility for their own care. We explore how women interpreted the need to manage safety data through Anshimi as both a chance to articulate their safety more holistically, and at the same time a chance for the state to outsource its own duty to protect them as citizens.

2.2 Location-Tracking / GPS

Location tracking is a major area of concern for HCI scholars, with studies often focusing on error and accuracy [18, 58]. A good number of studies have specifically looked at the lexicons employed by designers and users to understand location-based systems [11, 32]. Some studies have more specifically analyzed how state institutions often rely on GPS data to track the safety of citizens [36]. In our study, the GPS data of Anshimi's users, triangulated with nearby security cameras and police stations, forms the basis of Anshimi's model of service delivery. As we addressed above, this

innately frames safety as an issue of location. Feminist geographers argue that such deterministic perceptions of certain places as safe or unsafe can lead to a mistaken assumption that “the physical areas that women fear are more important than the symbolic connotations of space” [49]. In truth, it is not simply location but “women’s perceptions of risk, of the actual risks they are exposed to, and of their behavioral responses” [49], in addition to how the public perceives women’s identities as fearful and endangered [17] that constitute women’s experience of violence in space.

Numerous studies in CSCW and related venues have explored institutional contexts where location-based technologies demand new kinds of adaptation from bureaucrats and the people they serve [57]. As Shklovski et al. show in their study of parole officers, the introduction of “real-time” location data into parole procedure demanded its adaptation by “transforming the work so that they actually spend less time, rather than more time, engaged with the community and the parolees themselves” [57]. Rendering a service primarily on the basis of GPS data tends to “commodify” location [57], thereby obscuring the social character of the service and precluding a more holistic picture of what its users are going through.

While our study builds on this literature with a supporting example, we also seek to show that users can appropriate such technologies, against the grain of how they commodify location, to generate more holistic versions of accountability with those in power and to more fully negotiate with the government’s perspective. This is to say that Anshimi users find ways of expanding the location-based surveillance model of safety in the application to encompass a broader and deeper version of women’s safety.

2.3 Surveillance and Privacy

Because Anshimi functions not only to connect women with resources, but also to collect data about them, a word on surveillance is apposite. Regardless of its role in national security, surveillance is often interpreted by citizens as potentially authoritarian and exploitative [26, 59, 66]. Surveillance inherently hampers public discourse [26], and this is equally true for digital surveillance. Scholars who research the impacts of dataveillance [5, 19] have argued that dataveillance means much more than simply monitoring individuals. Rather, it “penetrates every fiber of the social fabric” [5]. According to some, dataveillance inspires misplaced faith in government, business, and academia [19]. Other work within the SIGCHI community about state surveillance has attended to how dataveillance can, rather, erode trust in systems of public safety [1]. Without already-substantive faith in the existing public safety infrastructure, citizens tend to worry about what that infrastructure can do with their information. Perhaps a social security number, one’s fingerprint, one’s home address, or one’s location at any given moment will leak – and what then?

Other work in CSCW and in the broader SIGCHI community has problematized the idea of privacy, underscoring that such a discourse (as it is currently deployed) functions to reproduce particular notions of exchange and cost / benefit analysis [8, 25, 57, 62]. These studies often take up situations where privacy is not to be expected to begin with, as it is not between parolees and the parole officers [57, 62] that monitor them or between the state and criminals [54]. Because our study similarly takes up a situation where privacy is not even the norm for women in public space, such reflections are clearly relevant [61]. What Dourish and Anderson have deemed “the economic model” of privacy simply doesn’t work in such contexts. “The economic approach to privacy models collective action as the outcome of individual decision making by rational actors optimizing for individual benefit” [25]. Rather, it behooves us to think in terms of how privacy and security “are continual, ongoing accomplishments; they are constantly being produced and reproduced.” In other words, we must think of security (digital or otherwise) as something that is constantly up for negotiation, both on an individual level and collectively [25]. Similarly, Barkhuus

calls for scholars in HCI to rethink data privacy altogether, as something that is contingent upon shifting circumstances and the incentives of specific parties [8].

HCI research on "lived data," or "caring-through-data" as Kaziunas et al. put it in their study of parent-caregivers who monitor their children's diabetes [37], provides one way of thinking beyond the simplistic or economic understanding of privacy. Lived data acknowledges how technologies for health and safety tracking lead to new arrangements of accountability between parties. Sometimes these data-driven solutions will lend themselves to relations that empower users in various ways. At the same time, such "empowering" scenarios often also burden users by stacking them with more responsibility for managing their own care. Our study builds upon this, by attending to the ways in which women appropriate Anshimi to better fit the circumstances of their lives but also how they find that appropriation to be a burden in its own way.

3 METHODS

After receiving Institutional Review Board approval, we conducted our study in Seoul, South Korea. Four sources of qualitative data were used in our analysis: 16 semi-structured interviews with Anshimi users, scenarios created during the participatory design workshop, one unstructured interview with a policy researcher, and another unstructured interview with an Anshimi application developer.

We conducted semi-structured interviews with 16 women. We recruited interview participants in-person and by posting in online forums. Although we were aiming to find generative rather than statistically representative findings, all participants identified as women, and all were in their twenties or late teens. Our selection of participants was significant because the city government posits "young, unmarried woman who lives in a single-person household" [30] as the main beneficiaries of Anshimi. Although we could not guarantee that our sample of participants was representative of the entire user pool of Anshimi, our participants could specifically account for the experiences of young women who live in a metropolitan area.

These interviews were conducted in Korean around a topic guide, and they lasted from 40 minutes to an hour. The questions covered participants' conceptualizations of safety, experiences with the Anshimi application, and views regarding the model of safety that Anshimi offers. We did not observe women interacting with the Anshimi application over time. Rather, we were interested in unpacking what some have defined as "data narratives" [64], women's accounts of the application as a data system, their attitudes towards the data practices that the application affords, and the rationales for using the application in specific ways. We focused on revealing participants' own accounts of navigating the city with safety data, their feelings towards and personal interpretations of safety data, and their stories of creatively appropriating safety data.

The participatory design workshop was conducted by the first author in Korean. We recruited eleven design workshop participants in Sookmyeong Women's University through snowball sampling. The first author recruited a graduate student in Sookmyeong Women's University majoring in Mechanical Engineering who then referred other students who were interested in women's safety policies and technologies. Participants were asked to use Anshimi prior to the workshop. We implemented the participatory design workshop because we wanted not to make claims based solely on interview instruments that posit participants as passive entities that are disconnected from researchers. A growing body of work in feminist HCI [6, 7, 35] and design methodologies, such as adversarial design [21], point out that design interventions often occur alongside socio-cultural currents that run deeper than our research instruments. We wanted to invite this interventionist mode of research, characterized by participation and advocacy, into our study. We describe design suggestions proposed by women to not only imbricate Anshimi with a more holistic picture of

women's safety, but to give more of the responsibility of ensuring the safety of citizens back to the state.

The design workshop was an event where Sookmyeong Women's University students collaboratively brainstormed design modifications and policy reforms through heuristic analysis and card-sorting. First, the first author and participants came up with themes by collaboratively analyzing the Anshimi application. They were then prompted to share scenarios for application modification and policy reform for each theme elicited during the previous process. In this workshop, participants were encouraged to share their opinions freely, then record their ideas with simple tools like post-its, markers, and highlighters. Participants and the first author later collaboratively sorted these scenarios according to themes elicited in the previous process.

We also conducted face-to-face unstructured interviews in Korean with one policy-researcher and one developer. The unstructured interviews each lasted two hours. The interviewees were recruited through emailing the Seoul Foundation of Women and Family, and the Seoul Metropolitan Government. These interviews were primarily used to further contextualize our findings from the qualitative data we gathered from our interviews with the 16 women.

3.1 Participants

All 16 semi-structured interview participants were single women in their twenties or late teens. One was working as a store clerk. Four were women who held white-collar occupations, such as television writer, public relations specialist, and customer support representative. Other women were students who were enrolled in schools. The majority of participants were primarily residing in the city of Seoul. However, some participants were commuting to work from adjacent suburbs such as Yongin and Anyang. They used Anshimi less frequently, as Anshimi only worked within the boundary of the Seoul Metropolitan Area. Interview participants had used Anshimi for different lengths of time. Our participants mentioned that their patterns of usage were inconsistent from day to day, and week to week.

All 11 design workshop participants were young women in their twenties or late teens. All participants were enrolled in Sookmyeong Women's University. Nine were undergraduate students and two were graduate students. Many workshop participants resided in student dormitories near the university or with families in more distant parts or outside of the city. The participants did not have prior experience using Anshimi and were prompted to use the application before the design workshop. Students who were living in the vicinity of the university who had shorter commute-times were encouraged to use Anshimi when going to further areas of Seoul.

We note that our interview and workshop participants were all young, unmarried women who were educated and living in Seoul and adjacent suburbs. This segment of the population is more literate in smart phones and can easily access technical infrastructures than many other female populations, such as older or less educated women. Studying a relatively privileged population can be advantageous since it clarifies what problems the surveillance-based model of urban safety can have even in a best-case scenario [36]. Despite their privileges, our participants still faced pervasive safety concerns that they described as "exacerbated by the collection of personal data, location tracking, security cameras." (P7) Moreover, users talked about the extra labor they had to do in order to make do with Anshimi and to meet their desires for a more holistic safety model.

3.2 Analysis

All interviews were transcribed, translated, and coded. Translations, including all the quotes in this study, were made by the first author. The first author used coding for themes of interest and open coding to analyze the interview data.

The first theme, 'navigating with safety data,' was developed by consolidating participants' responses related to experiences of navigating the city while using the Anshimi application. Understanding women's experiences of safety requires that we take into account the symbolic connotations of space, in addition to how women themselves are socially constructed as fearful and endangered. In light of how mobile safety applications like Anshimi can inadvertently consolidate regimes of bio-power that regularize the economic and political governance of female bodies [27], we analyzed the interview data in a way that foregrounds how women are not simply dots occupying a space on a map. The first theme and its three sub-themes thus highlight the distinct contexts of how Anshimi shapes women's experiences of navigating the city.

The second theme, 'feelings about safety data,' was developed by collecting responses related to participants' feelings about Anshimi providing and collecting safety data from them. We wanted to understand how women perceived data, how they dealt with it, and so on. What invisible labor did they undertake to manage their safety data through Anshimi? We wished to understand this more clearly by using participants' own accounts of their affective experience. Previous studies on data and affect [38, 39, 45] investigate people's emotional engagements with data. These studies demonstrate that the question is not 'how does data represent reality' but 'how does data come to embody processes of knowledge production and construct sites of interaction.' Hence, the second theme considers emotional responses that were often neglected in discussions of women's safety applications.

The third theme emerged through an open coding process where the first author went through each responses and consolidated concepts that were often flagged by participants. Many of the responses were answers to questions without specific themes such as "How would you like to improve Anshimi?", and "What do you like most about Anshimi?". The first author coded two sub-themes, 'communicating with friends and family' and 'legal empowerment', and later combined them into a larger theme of 'building a community.' This theme maps out participants' labor to rework Anshimi's model of safety.

Even as women creatively appropriated Anshimi, they resisted the burden of doing this extra labor, and imagined ways that the government could redesign Anshimi to more holistically address women's safety. The design scenarios were consolidated during the participatory workshop. First, participants brainstormed and card-sorted their ideas into different threads. After the discussion, the first author and the participants collaborated on color-coding and analyzing ideas into three core design scenarios.

4 WOMEN'S EXPERIENCES WITH SAFETY DATA

We present findings around three high-level themes to illustrate women's perceptions of and attitudes towards different types of safety data – GPS, safety facility hot-spots, security camera footage, video recordings, messages, and so on. Although participants acknowledged the value of location data, participants expressed how certain types of safety data might incite fear and complacency regarding their mobility and privacy. In addition, we present a finding on how women negotiated different degrees of credibility, fears, and values associated with different types of data. Going against the grain of Anshimi's original purpose as a preventative safety service, participants imagined and implemented their own creative tactics to use safety data. At the same time, doing so occasioned a certain level of fatigue with the technology. Before we present our findings, however, we briefly provide an overview of the application itself.

4.1 Application Overview

By 2019, Anshimi had been downloaded 20,349 times [12]. It continues to become more popular, with a ten fold increase in demand in its scouting service from 2013. [16] For navigation support,

Semi-Structured Interviews			Participatory Design Workshop	
Themes	Perceptions	Factors / Mechanisms	Scenarios	Suggestions
Navigating with Safety Data	<ul style="list-style-type: none"> Safe and Unsafe "Situations" The Efficacy of GPS Tracking Safety Data and City Infrastructures 	<ul style="list-style-type: none"> Time, lighting, crowd, working and living condition Acknowledging the value of location tracking for government institutions Limitations with navigation and hot-spots Considering preexisting infrastructures and technologies 	Safety Data with Values	<ul style="list-style-type: none"> Resist over-identification of women as victims Consider different types of violence (e.g. spy cams, revenge pornography) Prevent the sacrificial role of elderly women
Feelings about Safety Data	<ul style="list-style-type: none"> Fears of Restricted Mobility Privacy Concerns 	<ul style="list-style-type: none"> Anxiety towards limited service time Cross-checking crime data in order to calm oneself Hack or leak of personal information 	Safety Data Contextualized	<ul style="list-style-type: none"> Small-scale platforms over mega-platforms Develop distinct policies and technologies for digital, not just physical, violence against women Collaborate with existing safety databases and government institutions
Building a Community through Safety Data	<ul style="list-style-type: none"> Communicating with Other Women Legal Empowerment 	<ul style="list-style-type: none"> Desire to share stories with other women The 'ritual' of notifying safety Political potential of safety data and support for feminist activism Reforming the criminal justice system 	Safety Data for Accountability	<ul style="list-style-type: none"> Address the lack of guidelines to share and interpret metadata Present metadata in a contextualized way with other relevant datasets that are already open to the public Decrease the emphasis on video recordings

Fig. 1. A summary of consolidated themes from semi-structured interview findings and design scenarios from the participatory design workshop. The first two themes from the interview findings were coded according to themes in the topic guide. The third theme emerged through open coding. The design scenarios were created by the first author and workshop participants.

Anshimi provides "Safe Return Home Monitoring" and "Safe Return Home Scout Service." The monitoring service utilizes mobile phone GPS data and security camera tracking to provide rescue support for women in case of an emergency. The "Safe Return Home Scout Service" is a preexisting safety service that was integrated into the Anshimi application. The service provides "scouters" upon request to accompany women who would otherwise be commuting home alone from a bus or train station. For emergency police reporting, if a user sends an SOS signal either through clicking the emergency button on the screen or shaking the mobile phone, the district control tower locates the nearest security camera to the user and relays the situation to the police. Registering for Anshimi requires providing highly sensitive personal information, including users' name, address, age, gender, photograph, and the name and phone number of an emergency contact ("guardian").

4.2 Navigating with Safety Data

4.2.1 Safe and Unsafe "Situations". Participants shared their opinions about what characteristics of public space determine whether it is safe or unsafe. The geographical location of an area did not influence participants' opinions in determining whether that area is safe or unsafe. For instance, women associated places that are relatively close to their homes with more safety, but did not identify specific locations as safe. When asked why she considers locations that are commonly known to be safe, such as the affluent Gangnam district, P9 replied: *"It doesn't matter where you are. Even if you are walking along a wide road like Teheranno in the middle of Gangnam, when it's late at night and the lights are dim the sheer fact that you are walking becomes a source of fear."* In a similar vein, many participants preferred to describe narrative accounts of what experiences made them feel unsafe in public spaces instead of specific locations. Women utilized situational factors such as time, lighting, nearby crowds, method of transport, and so on, to determine whether a space is safe or unsafe. P3 explained how she is *"scared of situations when she notices unfriendly glances or hears footsteps that sound as if they're following her."* Other participants highlighted that

being intoxicated or walking on foot, as opposed to using public transit, increases the chance of feeling unsafe. When asked about when they actually wanted to use Anshimi, many shared general answers such as “*when living alone*” or “*after work*.” This reflected how women might feel unsafe regardless of location and time.

4.2.2 The Efficacy of GPS. The majority of participants expressed faith in GPS data. Although women did not perceive a marked difference in the level of safety in different geographical locations, they believed that GPS data was the most reliable point of reference for the police to locate them in case of an emergency. P1 explained: “*The victim's location is important for a police operation... there is a higher chance that you wouldn't be able to take proper video footage with Anshimi in case of an emergency, but GPS data doesn't lie about where you are.*” However, many women were also confused about the ways they had to interact with location data while using Anshimi. For instance, P14 said that she was “*too busy looking at my own location as I was moving to pay attention to my actual surroundings.*” They also expressed frustration at how the hot-spot page – showing locations of nearby police stations and women’s safety facilities – did not include a navigator function, leaving women to guess the coordinates of where these buildings were in relation to their own position. P10 criticized the hot-spot page as unrealistic in that “*a woman in a dangerous situation would not be able to constantly look at her phone and find her way to the nearest police station that is not guaranteed to be open.*” On the whole, women acknowledged the value of location data in expediting police operations but felt like they were not afforded helpful ways of using GPS data and coordinates on their own. This led them to believe that location data, while important for their safety, is most useful for the police and not themselves.

4.2.3 Environment, Infrastructure, and Safety Data. Many participants were keenly aware of how Anshimi’s safety services rely on preexisting technical infrastructures in Seoul. They were cognizant of how location data becomes effective only when surrounding infrastructures, such as high-speed internet, security cameras, and safety facilities, are functional. P12’s comment on the absence of an underground GPS tracking system captures this awareness: “*The most surprising thing that you learn about the monitoring service is that it is unavailable when you are underground. More than 50% of my urban navigation happens in the subway system, and I'm pretty sure other people spend a great deal of time walking underground.*” In a similar vein, one of the developers at a software company outsourced by the Seoul Metropolitan Government to develop the Anshimi application, insisted that “*The Anshimi application will be meaningless without security cameras, safety facilities, and high-speed internet already installed in various parts of Seoul.*” Participants also expressed concerns regarding possible breakdowns of related safety infrastructures. P3 mentioned how she sometimes got worried about “*failures or damages to security cameras in old districts like Guro, thought to be crime-ridden.*” As aforementioned, participants did not bring up geographical locations as factors that impact their perceptions of safety. However, when discussing safety infrastructures related to Anshimi’s monitoring service, the majority of participants believed that districts popularly associated with crime, like Guro and Yeongdeungpo, are more likely to be impaired.

4.3 Feelings about Safety Data

In this section, we take the focus off of confirming the benefits of mobile safety applications [2, 4, 20, 34] not to deny these, but to contribute to a more balanced discussion, by drawing attention to women’s fears and the various ways in which women address their fears.

4.3.1 Fears of Restricted Mobility. Data narratives associated with feelings of restricted mobility were evident in participant accounts of what counts as safe time and space. Contrary to their assessment that geographical location alone does not determine the safety of an area, many

participants felt that certain districts or time frames might be more safe for women. The majority of participants felt higher levels of anxiety at a later hour, and these anxieties were calibrated alongside how the Scout Service operated only during a specific time frame, from 10PM to 1AM. Some participants felt that this time frame was not wide enough, while others felt that the time frame was established arbitrarily. For instance, P9 mentioned being "*confused about how this time frame was determined in the first place*" as she does "*roam around after midnight*." More importantly, the fact that Scout Service did not operate after 1AM prompted her to feel as if they were participating in a technologically-mediated "*curfew*" (P16). Despite the fact that they did not feel particularly motivated to use Anshimi at a later hour more than any other time of day, many participants felt as if the application was restricting their navigation of public spaces after the set time of operation.

Fears about mobility were also evident in how some participants investigated public data related to Scout Service usage. Released through the city's open government initiative in 2016, the report on Scout Service documents the total number of service requests made in 2016 and the number of scouters provided in each district. P4 described her emotional travails of feeling "*compelled*" to use Anshimi because she lives in Geumcheon, where "*service request rates were already high*." We found that participants also tried laboriously to dispel their own stereotypes about districts that are thought to be crime-ridden. As P15 described her decision to quit using the monitoring service, she explains how she consciously moved away from a feeling of obligation to choice: "*I live in Yeongdeungpo, and initially I felt as though I obviously needed to use Anshimi because, you know, people think about prostitution and sexual assault in relation to my neighborhood. But I learned through Korea Safety Map data that there's actually not a big difference in crime rates between affluent neighborhoods like Gangnam and Yeongdeungpo.*" We were surprised to find that the emotional labor that goes into calming oneself down, including looking up metadata and consciously cross-checking facts about their environment, was a prominent factor that contributes to participants' fatigue.

4.3.2 Personal Information and Privacy Concerns. Many participants were fearful of privacy invasions. Even though they explicitly acknowledged how the "*possibility of an actual hack or leak was low*," (P2) they still felt ambivalent about the application's ability to safeguard their data. We also found that women experienced different levels of anxiety for different modalities of safety data. Even though P14 expressed confusion around how she herself could effectively use GPS tracking, she described feeling as if they would be useful for the police or the district control center. In a similar vein, P4 and P7, who explained how they "*dislike connecting GPS and camera functions to other applications as well*," felt as though they could temporarily turn the GPS function on when using the monitoring service.

In contrast, participants expressed discomfort about the range of personal information obtained through the registration process. This information include user's name, age, date of birth, address, photograph, and a designated emergency contact number. Moreover, the majority of participants actively reflected on how they were negotiating two different types of safety risks. P7's comment on the irony of having to put privacy on the line for her navigational safety captures this trade-off: "*Think about a situation where all this information is hacked and leaked. I understand that Anshimi requires all this personal information because women are disproportionately targeted in violent crimes but we would be in much more danger when this application is hacked.*" Many felt that registration requirements were cumbersome, and cognizant of this trade-off between surveillance and protection that they were subjected to.

Participants were especially fearful of privacy invasions associated with visual data, such as security camera footage and video recordings. Many associated the visual data with feelings of shame, objectification, or "*becoming a spectacle*" (P11) for the public against their will. Participants often perceived security camera footage and video recordings, taken automatically when the

emergency button on the application is pushed, as data that "*documents but not necessarily prevents*" (P5) violence against women. This fear was exacerbated by participants' suspicion about how public officials, including the police and the court of law, might handle visual data collected from Anshimi. For instance, P11 explained why she would reluctant to use the emergency button: "*I'm ambivalent about whether I'd want a recording of an atrocity, if it happens to me.*"

4.4 Building a Community through Safety Data

Participants were utilizing Anshimi in ways that, perhaps, the city government could not expect. Our interviews showed how women were willing to use safety data to bolster a support community or establish a safety network. In this section, we describe the recuperative, not necessarily preventative, ways in which women used or were willing to use data to secure their safety in their daily lives.

4.4.1 Communicating with Friends and Family. Our interviewees spoke of Anshimi not simply as a safety application but as a tool of communication that might bolster their social network. When asked to describe their daily interactions with safety data, many participants expressed desires about wanting to share their "stories" of navigating the city with other people in their social circles. Some argued that Anshimi could evolve into a social platform "*where conversations between individual women or groups of women could take place through sharing useful data about public safety*" (P13). In a similar vein, some suggested linking Anshimi to popular social media platforms in South Korea, like KakaoTalk Plus Friend, to promote discussions about the application in social circles. Overall, participants wished to deploy Anshimi as a tool for connecting with other women who might be experiencing safety issues.

Participants were also communicating with their family and friends through messages that automatically gets sent to three designated emergency contact numbers at the initiation and termination of the monitoring service. Many women felt that the guardian messaging system helped them expedite the "*ritual*" (P1) of notifying their family and friends of their whereabouts. Even before they started using Anshimi, participants were habitually notifying their friends and family of their location as a way of securing safety. Because this ritual usually happened through direct phone calls, text messages, or subsidiary functions of ride-hailing applications like Kakao Taxi, many participants were satisfied with Anshimi's hassle-free automatic messaging. P6 commented: "*I always send my parents safety message when I'm riding a taxi through applications like Kakao Taxi. It's really great that I can automatically send a similar quick message when I'm walking.*" In particular, teenagers found the guardian messaging system to be helpful in establishing trust with their parents with regards to curfew. P13 explained how automatic messaging decreased her everyday conflicts with her mother: "*My mother became more lenient towards curfew after she realized how messages were automatically sent after the start of the monitoring service.*"

4.4.2 Legal Empowerment. Participants also showed strong support for the political potential of safety data. They alluded to how safety data might be utilized in court to support female victims of crime. In contrast to the Seoul Metropolitan Government, participants thought of Anshimi as a safety application that "*documents*," not "*prevents*." In other words, participants perceived the utility of safety data as more pertinent to processing the aftermath of a crime, than to preventing it. Some argued that automatic mobile phone video recordings will provide victims concrete evidence in court that they might not otherwise have, if, for instance, the crime took place in a non-public setting. P5 explained: "*Anshimi seems like it would be more useful for expediting the investigation process in the aftermath of a crime. Video footage should be used to investigate and prosecute criminals even if they manage to get away.*" Most importantly, women were concerned that the criminal justice system was partial to perpetrators of sexual violence, and were reluctant to say that Anshimi could make a significant change in the near future. In the midst of these constraints and shortcomings,

women expressed a strong support for feminist activism and desire to communicate with the law through Anshimi.

4.5 Seeking Safety Beyond the Protection / Surveillance Dichotomy

Our interviewees were negotiating different degrees of credibility, fears, and values associated with various types of safety data. Participants in our study were actively balancing the conflicting imperatives to keep their data private and willingness to share data with the application. This tension embodied a balancing act to secure their safety, as well as the emotional and self-reflexive components of what may seem like technical decisions in using Anshimi. If the solution to securing women's safety is accumulating various kinds of safety data, such as GPS data, security camera footage, video recordings, and so on, then the fears that participants expressed were a breach to that collection of data.

However, women did not easily buy into a narrative of opposition, or the idea that there is an inherent trade-off between surveillance and protection. While this tension drove women to "come to terms with" the ways that safety data was collected or used by Anshimi, this does not mean that they passively accepted the city government's approach to their safety without resistance. Instead, our interviewees took on extra labor to affirm values in safety data. Although many women were feeling fatigued from these activities, many were willing to continue to use Anshimi along with these workarounds for their equity and empowerment.

First, our interviewees took on the emotional labor of calming themselves down due to heightened anxiety about the crime rate of their neighborhoods. The participants in our study were keenly aware of the broader disciplinary structures that location-based applications can create [57], even while they perceived GPS data as a "reliable" and "hard" type of data that could also expedite a rescue operation. This was especially apparent as our interviewees described how location-based safety services sometimes contribute to a higher level of apprehension about their own mobility. For instance, P15 spent a great deal of time cross-checking crime statistics and Scout Service request statistics in order to dissipate her anxiety.

Second, even as interviewees acknowledged the value of location data in emergency situations, many insisted on keeping their GPS and camera-access off on their mobile phones when they were not using Anshimi. This drove them to take on the extra labor of continuously checking the application status on their phones. These activities were often rendered alongside participants' understanding of the specific realities of violence against women in South Korea. Many participants externalized their fear in the form of "*voyeurism*," or "*stalking*" which they perceived as rampant social problems in South Korea. Although they expressed concerns about sensitive location or visual data getting "*hacked*," the breach itself was conceptualized as a socio-cultural problem of misogyny rather than a technical one. For instance, P7 mentioned how "*It's impossible for me to not think about the possibility of my personal location being leaked to a stalker or the very emergency video I recorded for my own safety being distributed through torrent as some kind of porn.*" The fact that she made reference to cyber stalking and non-consensual distribution of videos to explain her fear of hacking or leakage, alludes to the intricate ways in which women's physical safety is entangled in a broader socio-cultural context.

To seek a more holistic version of safety that does not rely on surveillance, some women appropriated the application to strengthen their social relationships with family and friends. Others imagined alternative ways of utilizing safety data as evidence in court to bolster women's equality before the law. Some interviewees mentioned that they only use the monitoring service to send automatic messages to their designated guardian, who are often family members or friends. Interviewees also perceived visual data as a useful form of retroactive or post-facto documentation that could be used for women's equity in court. Many participants expressed concerns about how

the criminal justice system in South Korea often works in favor of sexual offenders or those who commit violence against women. Even though participants were most fearful of privacy invasions on video-recordings or security camera footage, they also believed that visual data could aid women's empowerment in the law.

As such, women keenly aware of the ongoing trade-off between protection and surveillance and sought for a third way that allowed them to seek safety beyond this binary construction. These data narratives were established upon prioritizing women's equity and empowerment in the face of inevitable constraints and concessions. We should not forget, however, that the extra labor also points to the burden women undertook and the fatigue they experienced to achieve a more holistic version of women's safety.



Fig. 2. Design workshop. ©Chaeyoon Yoo.

5 PARTICIPATORY DESIGN WORKSHOP: SCENARIOS FOR DESIGNING WOMEN'S SAFETY DATA PRACTICES

We offer three suggestions for designing context-specific safety data practices. These design suggestions were collectively brainstormed by eleven Sookmyeong Women's University students in a design workshop (Fig.2). We do not aim to resolve the technical hurdles that workshop participants faced in using the application, nor do we pretend to envision a perfect safety application. Instead, we consider how our participants' suggestions were imbued with specific values, interests, and needs of women in Seoul.

5.1 Safety Data with Values

Our workshop participants defined themselves in a variety of ways. Some of these self-descriptions included: a possible victim, citizen of Seoul, adolescent, graduate student, minority facing adversity, and so on. Despite the diversity of identities among them, workshop participants defined safety data as something that could represent women's subjectivities. Thus, participants held a strong belief that data administered for women's safety should embody feminist values. While agreeing that safety applications can be provided for the public in general, many participants were motivated to re-design Anshimi so that it addresses the broader social justice concerns of women.

There were feminist values that emerged throughout the workshop. First, participants discussed the need to re-conceptualize "women's safety" as "women's rights to safety." They emphasized how the ultimate goal of safety applications and policies is not to protect victims but to create a just social condition that secures women's equity and empowerment. Workshop participants understood the

development and implementation of women's safety applications such as Anshimi as concrete evidence of gender inequality in South Korea. They strongly opposed the over-identification of women as victims or beneficiaries of safety applications and policies, and made clear how women should be able to freely navigate urban spaces without the help of an safety application. Secondly, workshop participants emphasized that different types of safety data and solutions are required to counter different types of violence to which women are subjected. For instance, participants identified spy cams, dating abuse, and revenge pornography as prominent types of violence against women in South Korea. Arguing that these crimes cannot be fully dealt with navigation apps like Anshimi, participants suggested framing women's safety as an issue that is entangled in a broader socio-cultural context.

Workshop participants also raised concerns over whether the scouters, who get off work after midnight and have to return home. Participants perceived this as a substantial dilemma that Anshimi faces, as the city government mainly recruits middle-aged women as volunteer scouters. It would seem that the safety infrastructure is exerting unitary forces [24, 60] on two seemingly identical but different communities, creating situations where a 'problematic system requires another problematic system to be resolved.' Many participants believed that Anshimi is perpetuating the very problem that it is trying to solve by mobilizing middle-aged women, and they emphasized that feminist values should encompass not only the perspectives of young, cis-gender women, but those of women who occupy more marginalized positions too.

5.2 Safety Data Contextualized

An announcement made by the mayor of Seoul explores ways of applying the Anshimi system to the safety issues of other marginalized communities such as senior citizens and children [50]. According to one of the developers of Anshimi, "*the final goal of this project is to create a mega-platform that integrates various civic data applications that the government has so far developed.*" When discussing the city's plan to develop a bigger, more comprehensive platform that delivers civic data and services to the public, many workshop participants suspected that the project could cause inconveniences for people who are looking for specific kinds of data and services. Arguing against this plan, participants suggested the development of separate smaller-scale platforms with specific services that match the user's needs.

Participants argued that promoting small-scale interactions with specific safety platforms or services can decrease the risk of privacy invasions. For instance, they believed that distinct policies and technologies should be implemented apart from mobile safety platforms to detect spy cams in public spaces, which they identified as the most urgent threat to young women in Seoul. Highlighting how mega-platforms are built upon the premise of accumulating more data from citizens, participants argued that such attempts might only escalate women's anxieties towards privacy invasions without mitigating the imminent problem of spy cams.

The workshop participants also believed that related data platforms can complement each other's data capacities. The participants suggested three strategies that could connect various types of safety data across preexisting safety infrastructures. First, data gathered from Anshimi can be used to enrich preexisting safety databases. For instance, the GPS data that Anshimi collects could be used to calibrate the information presented on the Daily Safety-Map, a GIS service that indicates streets where crime against women occur often. Second, the city government can collaborate with public transit companies to incorporate transit data into Anshimi. This can strengthen the guardian messaging system by enabling automatic messaging when women get on and off public transit as well. In particular, workshop participants emphasized how this improvement should go hand in hand with developing an underground GPS tracking system for subways, where "*most of urban navigation in Seoul happens.*" As such, workshop participants provided suggestions on how the

city might productively leverage preexisting data gathered via related safety infrastructures. They believed that this will support policy-makers in making nuanced decisions about where to allocate resources and how to prevent further risks associated with accumulating more data.

5.3 Safety Data for Accountability

The civic need for an accountable practice of safety data analysis and sharing emerged as an important theme during the workshop. Participants engaged in extensive discussions around how the city might store Anshimi data, such as log files and service request rates, and how "*it will start to reference these data for developing women's safety policies once the dataset becomes sizable enough*," as one of the developers of Anshimi mentioned during an unstructured interview. The discussions reflected a need for cultivating data analysis practices that prioritize citizen interpretations of safety data. Participants suggested scenarios about how safety data analysis and sharing could properly reflect the conditions from which the data was captured, and cultivate public knowledge on women's safety without inciting fear or putting an emotional burden on women.

The lack of guidelines to interpret safety data emerged as a point of concern. One participant mentioned how currently there are no concrete statistical indicators that can link the data gathered from the monitoring service and the scout service to their impact on crime rates. While research on the effects of Seoul's women's safety program on crime rates [40] concludes that the city's safety services did not have a concrete positive correlation with a reduction in rates of crime targeting women, our workshop participants were more concerned about the ways in which some scout service request rates were presented as if they existed in a vacuum, without a direct link to datasets (e.g. the number of single-female households) that likely would have impacted the level of request rates. Participants believed that scout service usage-rates did not necessarily correlate with high rates of crime targeting women. Thus, they argued that Anshimi's metadata should be presented to the public in a manner that is contextualized alongside other relevant datasets, such as rates of crime and female population. Participants emphasized how this modification would decrease unnecessary fear among women who live in districts where usage rates are high, and encourage policy-makers to deploy safety resources in areas of pressing need.

Participants also proposed referencing different modalities of safety data in order to mitigate women's fears related to spy cams and privacy invasions. For instance, participants suggested replacing the automatic video recording function with an audio recording function, arguing that audio data can be more easily captured by the user in case of an emergency. Various types of situational data managed by Anshimi, such as guardian messages, can also be used for describing the emergency situation for swift rescue operations. Workshop participants recognized that some data can become a potential source of fear for women who are currently suffering from the socio-cultural, rather than a technical, problem of violence against women. They also insisted that safety data needs to be situated and accountable without being unnecessarily provocative.

6 DISCUSSION

We have argued that discussions of safety data and technologies should move away from paternalistic conceptualizations of women's safety, or safety as something that is secured by the government simply through the accumulation and application of data. We have described the nuanced ways in which women take on additional labor to overcome the constraints of safety data and technologies, while creating and imagining ways to assert autonomy over their own safety data in their daily lives.

Firstly, we interpreted women's additional labor to manage safety data through Anshimi as both a chance to articulate their safety more holistically, and at the same time a means of the state to outsource its own duty to protect them. Previous research on gender-based violence and safety do

point out how digital interventions can create new channels through which survivors are profiled and monitored [28, 29]. However, these studies largely focused on intimate partner violence and did not take into account the role of government agencies such as district control centers and the police. Indeed, dataveillance “penetrates every fiber of the social fabric” [5]. Scholarly work on mobile applications designed for women’s safety in public spaces [2, 4, 36] point out how women’s safety is a problem embedded in a complex sociotechnical fabric, but did not offer specific ways to address the limitations of these applications from the perspective of women. Our case study showed specific activities through which women sought safety beyond the dichotomy of surveillance and protection, and shared design scenarios brainstormed by women who experienced fatigue from these activities and desired a change in safety technologies developed by the government.

We also emphasized how Anshimi not only simplifies the process of requesting safety services, but also functions as a platform for collecting and using data about women’s safety. Anshimi reflects a broader trend in using data analytics to deliver a public service and re-configuring public service as a data practice. Previous research on civic data have focused on government data initiatives and data-driven decision making [23, 56, 69]. These studies investigate the notion of data fetishism, or a process of some data’s value being over-determined by its context of exchange [57], and the ways in which data comes to “stand in for and obscure the social relationships that initially gave it meaning in its context of production” [63]. While they reveal how data fetishization can negatively impact policy-making, they do not attend to the everyday lives of citizens who consume and produce civic data. Our cases study reveals the specificities of women’s engagements with safety data and Anshimi.

Scholars of feminist data studies have argued for a view of data that goes beyond the empirical and representational, showing the social, cultural, and political dimensions of data work [39, 41, 44]. As narrative accounts of how women actually understand, feel, and use safety data have often been obscured in previous research on mobile safety applications [2, 4, 9], this framework can provide a new analytic lens for designers and policy-makers. Following scholars of feminist data studies, we suggest that designers and policy-makers be particularly careful about how they structure data within a safety application. This includes consciously articulating classification categories [46], paying attention to meaning-making [41, 44], and highlighting often ignored modalities of data such as affect [39].

Our study also offered design scenarios on how safety data might be utilized in a way that foregrounds a holistic version of women’s safety. Previous research on data and civics developed the notion of “data-in-place” to describe how data systems can deepen civic engagements, and vice versa, by enabling the renovation of social values and structures [60]. Acknowledging the importance of civic engagement, we hosted a participatory design workshop with women in Seoul. As demonstrated in the design scenarios, paying attention to the ways in which Anshimi produces and shares data makes it possible for the public to reflect on the relationship between protection and surveillance as well as autonomy and disciplinary power. It also challenges policy-makers, researchers, designers, and users to think about ways of reclaiming the power of data for feminist purposes [42].

Secondly, this framework raises perhaps the most fundamental question of whether feminism as a form of governance can come without damaging its aspiration as an emancipatory project. Our case study expands the debate on whether the discourse of feminism can function within civic technologies developed by government agencies. Our case study demonstrated how women are often forced to accept the trade-offs between government surveillance and protection as well as the additional physical and emotional labor they have to take on to achieve a more holistic version of safety. Combined with the spy cam epidemic, the ways in which district control centers and the police can access personal information, location data, as well as video recordings, are

in some sense coercing women to accept privacy is not expected to begin with [25, 54, 57] for women in public space. Research on police brutality and women have often emerged from the U.S context and focused on issues of physical violence against women of color [52]. The ways in which women's safety is both protected and surveilled by the city and the police in Seoul allude to complex impacts of datafication and policing beyond issues of physical violence. It shows how administrative procedures built into the institution and technology can be a real concern to many women, and how it can reproduce the very problem that it is trying to address.

Our study also showed how bringing feminist values into the realm of governance can preclude intra-feminist politics [31]. The governing body often consolidates a particularistic identity-based project, ignoring the fact that women all benefit differentially from different policies. The ways in which Anshimi makes "victimization and identity the prerequisites for legal intelligibility" [31] through a rigid registration process resonates strongly with such critique. For instance, trans women and immigrant women who might not be able to provide gender or photographs during the registration process will face more hardships than cis-gender women. In addition, the sacrificial role that middle-aged women undertook as scouting volunteers denotes how the government overrepresents the victimization of younger women. It also describes how the state outsources its own duty to female citizens for their own safety. The extra labor of women to volunteer to safeguard each other is a good alternative to relying only on surveillance and policing for safety, but it does burden women with additional physical and emotional labor.

On the whole, policy-makers and designers alike should reflect on their dependencies and temptations when engaging with safety data [44]. This includes rejecting an over-identification of women as beneficiaries of public safety policies and acknowledging that women have autonomy over data.

7 LIMITATIONS

The participants in our study recruited for interviews and the design workshop were young cis-gender women in their twenties or late teens. Further research on how middle-aged, elderly women, or trans women engage with safety data may broaden the understanding of women's experiences with Anshimi. Our findings are specific to the socio-cultural context of Seoul, and so may not fully align with the experiences of women who use safety applications and safety data in other countries and in non-urban contexts.

8 CONCLUSION

Public design should strive to orient "artifacts, systems, and events" to "expose and re-imagine constraints and parameters surrounding issues and problematic situations" [22]. Our study provided a case study of Anshimi in Seoul as a mobile application that offers women's safety services. We examined the specific ways through which women understood, felt, and used the safety data that Anshimi administers while negotiating the conflicting imperatives to keep their data private and to share data with the city government. Our findings demonstrate how women do not passively consume safety data as a fixed representation of reality but as a site of interaction that may shape how women's safety is conceptualized. Women create new data ontologies that sometimes legitimize and at other times challenge the administration of data by the safety application. We also suggested three scenarios for developing and facilitating safety data practices. First, safety data is only meaningful when in interaction with people who have the power to give meaning to these data. Secondly, safety data should be presented in a context-specific manner for users, not in a vacuum. Thirdly, safety data should be analyzed and shared according to accountable guidelines. On the whole, our case study offers an understanding of women's experiences with safety data and contributes to discussions about safety technologies and governance.

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