

The Domestic Panopticon: Location Tracking in Families

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ABSTRACT

We present a qualitative study examining Location-Based Service (LBS) usage by families and how it is integrated into everyday life. We establish that LBS, when used for tracking purposes, affords a means of *digital nurturing*; that said, we discuss how LBS surveillance has the potential to undermine trust and serve as a detriment to nurturing.

Author Keywords

Location-Based Technologies, LBT, Location-Based Services, LBS, tracking family, home, privacy, security, gender.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Design, Experimentation, Human Factors, Security, Theory

INTRODUCTION

Location-Based Services (LBS) for tracking were once conceptual prototypes only, but they are now being used within mainstream society. In particular, use of applications such as Google Latitude, Follow-us (www.followus.co.uk), or Childlocate (www.childlocate.co.uk) within families of early adopters is starting to become integrated into the fabric of daily life and affecting domestic roles and responsibilities. We will show how Location-Based Services also have profound implications for the notion of personal and family privacy. While previous research studies have investigated how people engage with location-tracking technology in hypothetical scenarios [1,6], or when experimenting with prototypes for a short time [1,3,5], we sought to specifically understand how these technologies are used within the context of family life and how family life accommodates these new technologies. Consequently, we engaged closely and for an extended period of time with a small group of participants that had spontaneously adopted LBS and used it regularly as a tool to manage roles, relationships, and functions within their families. We investigated how these technologies were integrated in their

daily life and discovered that their use fulfilled a wide range of functions in response to waxing and waning affections, perceptions of marital fidelity or infidelity, and the sense of parental trust or distrust.

The domestic work of the home centers on nurturing and protecting family members, and this domestic work is adapted in response to new technologies [18]. In our study, we sought out how LBS was integrated into domestic work. This is highly gendered, and researchers have historically argued that the domestic sphere is considered inherently feminine and the role of wife and mother extends beyond housework to building moral character [4] and maintaining the emotional well-being of her family [14]. Rode [19] shows how roles and responsibilities surrounding nurturing and protection are negotiated in response to new technologies, and that existing gender roles in the home continue to be relevant to security practices. We wanted to understand how factors such as gender came into play with regard to LBS. Because key aspects of nurturing and well-being involve moral safety as well as physical safety within the family, we sought how to understand each of these issues were addressed in an LBS enabled-home.

This paper makes two contributions to the literature. Our first contribution is theoretical, but being ethnographic work, our goal is not to contribute specific generalizable findings about LBS usage. Rather, we hope to begin to explore the interaction between LBS and family dynamics, and thus contribute grounded theory. Specifically, Rode's prior work introduced the concept of *digital nurturing* [18] where technologies are integrated into practices of parenting and elder care, as well as into romantic and friendship-based relationships. Here we show how LBS is integrated into these practices and how LBS has potential to profoundly affect privacy in that it may be perceived as voyeuristic technology. In the context of domestic relationships and LBS, our title makes reference to Bentham's Panopticon, a circular prison which afforded constant monitoring of prisoners by guards while the guards remained invisible [2]. LBS allows the home to become a *domestic panopticon* as household members may become subject to unseen gaze. Second, we show that LBS, by allowing surveillance, may preempt the opportunity to do what we will call *trust work*. That is, just as Shklovski calls privacy, something that is "done" [22], so too is trust. Trust is enacted and maintained in the context of a domestic relationship, and it is critical to the sense of closeness and connectedness in domestic relationships. Petronio [17]

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UbiComp '10, September 26–29, 2010, Copenhagen, Denmark.
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discusses credibility and supportiveness as factors in helping us decide in whom to confide, and he argues trust in particular underlies relationships. Thus trust is fundamental to domestic relationships and *trust work* then is necessary to maintain them. If LBS permits a sort of domestic panopticon, it also prohibits the trust work necessary to create and maintain strong relationships. This suggests that for LBS users there is a tension between digital nurturing and trust work, and it is this tension which emerged as central in our analysis.

RELATED WORK

Location-Based Services for tracking have emerged as central to ubiquitous computing literature especially with regards to understanding their effects on users' privacy. Well known studies have investigated different aspects: for example, how people decide to disclose location information with their social relations under different conditions, in response to hypothetical requests [6]; how practices emerge in sharing location and status information within social groups [1]; and how privacy concerns over sharing location information decrease over time [25].

Additional research focused on how family dynamics are particularly affected by location tracking. Shapiro [21] looked at how technology restricts, enhances or blurs privacy boundaries within the home and between this and the wider community, with location-tracking technology creating a new virtual space in which these boundaries are redefined. Bentley and Metcalf [3] looked at how devices that allow family members and friends to monitor a person's movements allowing them to infer what they were doing affected their sense of closeness, safety, and social awareness. Similar findings emerged from Brown et al.'s [5] research on the Whereabouts Clock which displayed whether family members were at home, work, or an unspecified third location. However, this work is largely based either on hypothetical scenarios or on the experimental use of prototypes for short time periods.

We will show that relevant work on mobile phone use in families illustrates key dynamics that LBS can amplify or distort. For example, Devitt and Roker [8] showed how the mobile phone is perceived by both parents and children as not only as a means of communication but also as a tool to keep the young safe. In a similar study Palen and Hughes [15] found that parents only relaxed their attachment to their mobile phones when in the presence of their children, the mobile phone being perceived as a means to enable 'remote' parenting and care-giving. Beyond this, there is work focused on teenage mobile phone use looking at privacy practices [13] or discussing the social stigma of not promptly replying to contact [10]. While this work is contextually rich, it predates mainstream LBS use.

Relevant to our research is also earlier work by Shklovski et al [22], which looks at the use of location-tracking devices with parolees in the US prison system. The dynamics of parole officers monitoring prisoners to ensure they do not

break laws or the condition of their parole are not dissimilar to parents monitoring young children who frequently get into trouble, or adults monitoring their spouse's marital infidelities. Consequently, there are many aspects of Shklovski et al's work which prove relevant to our analysis and to which we will return in the discussion.

Prior research has explored the connection between location tracking and privacy, both within society in general and within the family more specifically. Previous research has yet to explore how the protracted use of LBS may change behaviors, dynamics, and boundaries within the family. To investigate how family life is affected by LBS, we conducted a study of families for whom LBS was already integral part of everyday life.

STUDY DESIGN

Our research centered on four households that were already using LBS applications when we screened them, and who participated in a combination of interviews, diary study, and observation for an intensive two-week period.

Participants

Respondents to a series of online advertisements posted over a span of eight months were screened to ensure that they were: 1) experienced users of LBS; 2) tracking at least one family member; and 3) using location tracking at least once a week. We screened 242 respondents online and ultimately recruited four households. Seventy one of those 242 respondents met the above criteria, and we were able to reach 43 of them via telephone for secondary screening and to schedule interviews. We disqualified 13 participants because they believed that "location tracking" simply meant calling and asking where their loved ones were. Of the remaining 30, four were recruited; 25 qualified but did not have the time to participate; and the final household was too erratic in its use. Our recruiting experience suggests that while LBS is not yet widely known, there was a significant population of users in London where the study took place. Given the potential impact of this technology, our small, in-depth study of only four households with 14 associated individuals impacted by tracking is appropriate as well as in line with Tolmie's study [24] of three households.

Our four households included: two households in which the mother was tracking the children; one household in which a nephew was tracking an older and physically disabled uncle; and one household in which two cousins were tracking each other. All household members were invited to take part in the research whether they used the technology or not. The age range of the participants was between 10 and 74 years (see Table 1). These households were from working-class homes in London primarily. Reviewers of this paper have commented on the somewhat "dysfunctional nature" of some of these families, in that our data suggest that some of our families had marital and parenting issues. Reviewers also questioned the generalizability of results. As we have stated, however, our goal is to provide grounded theory. Second, we would like to stress an overemphasis to date on middle-class families

Table 1. The households and participation level of household members. *Interviewed, +Completed Diary, ^Observed.

	Name	Role	Age	Education	Occupation	Technology Used
HH1	Michelle	Mother*+	48	A-level (High School)	Legal PA	Follow-Ups for 10mths, Childlocate prior
HH1	Ryan	Partner	-	-	-	Follow-Ups (mostly via Michelle)
HH1	Zara	Ryan's Daughter*	14	Student	Student	(tracked, once tracked David with her mom)
HH1	David	Michelle's Son*	14	Student	Student	(tracked)
HH2	Simone	Mother*+^	27	MSc	Civil Servant	Google Latitude- 8mths
HH2	Andrew	Partner	31	-	Finance	(Simone claimed he was using tracking technology)
HH2	Angela	Grandmother	50	-	-	(none)
HH2	Sophie	Simone's Niece*^	11	Student	Student	(tracked)
HH2	Chris	Son*^	10	Student	Student	(tracked)
HH3	Sanjeev	Nephew*+	23	BA	Student	Google Latitude for 2 mths
HH3	Raveen	Uncle*	74	Some College	Retired	-
HH4	Paul	Cousin *+	29	BA	Asst. Office Mgr	Google Latitude for 1 mth
HH4	Stephen	Cousin	27	-	-	Google Latitude for 1 mth

in HCI research, which this work addresses [20]. Third, we would like to point to the work of Coontz, showing that families are far less idyllic than Western nostalgia surrounding family conveys [7]. We argue that the families we discuss are not “dysfunctional”; rather, our deep ethnographic work simply exposed tensions found in most homes, tensions that were further exacerbated by a technology that had profound trust and privacy implications.

Even though the relationships among the members of the different households varied, in each household one person took responsibility for keeping an eye on at least one other family member daily. This person was the one who initiated the use of LBS and responded to the advertisement (this key informant is shown in bold in Table 1). All the participants had used LBS for more than one month.

The Study

The study consisted of four phases. In **Phase 1**, we interviewed the key informant. The interview focused on why LBS had been adopted in the first place; what specific application had been chosen and why; who was doing the tracking and who was being tracked; and how individuals felt about tracking or being tracked. Finally, we examined their family’s reactions to location tracking. Based on the last question and the diary data, we hoped to garner information about changes in behavioral and communication patterns in the home without asking explicitly.

In **Phase 2**, we invited the adult users to keep a diary detailing each time they tracked someone. This included whom they tracked, whether the person tracked was where they expected, and, if not, how they felt and what actions they took. If they had not tracked anybody during the day, they would explain why. We sent them regular text message reminders asking participants to fill out diaries. While we considered using an Experience Sampling Method [6], this was not possible with our participant’s mobile phones, and

allowing them to use their own equipment was critical to environmental validity.

In **Phase 3**, we conducted debriefing interviews with the participants, during which we asked them to comment on their diary entries. We also conducted additional interviews with other household members who were now more willing to be interviewed. In the case of HH2, our informant was not comfortable with our interviewing her children, but did so herself, transcribed the interview, and sent us the data.

In **Phase 4**, we intended to observe location tracking in daily use; only HH2 was willing to participate. We engaged in participant-observation at a major public event for six hours to gain understanding of LBS in an unfamiliar, crowded, and potentially dangerous environment.

Consistent with an ethnographic approach, interviews were carried out in the home whenever possible in order to gain insight in the lifestyle and personality of the participants and to see where the technology was used. Jottings [12] and audio recordings were taken during interviews. Fieldnotes were written later and were analyzed along with transcripts of key events in order to create grounded theory [23] regarding the tension between trust and relationships.

KEY FINDINGS

Participants varied substantially in how they used LBS. Next we will describe the household’s usage patterns at a high level to prepare the reader for a more detailed discussion later. HH1 had been using Follow-Ups for ten months, and had previously tried Childlocate. Michelle discussed the technology and the reasons for introducing it with her family before she started using it. She tracked her two children every other day during the study. Even though she told her children how the technology worked, they felt they did not really understand how to use it. HH2 had been using Google Latitude for eight months. Simone started using it without her family’s knowledge, and when her partner found out, he disagreed strongly on whether LBS was appropriate even when parties knew they were being

tracked. She tracked her children every few days, but they did not track her. In HH3, Sanjeev had been using Google Latitude for the last two months to track his disabled uncle several times a day. His uncle was aware that his nephew was tracking him, though he did not know how to track his nephew. Sanjeev and a cousin also occasionally tracked each other. Last, HH4 had been using Google Latitude for a month. Paul used it daily to track his friend and cousin with their knowledge. He publicly framed his motivation in terms of interest in the technology; however, he was also concerned about the safety of his cousin, who was new to London. Both his friend and cousin were also tracking him. Participants were using LBS differently which is reflected in the motivations which we examine next.

Table 2. Participant's Tracking Behavior during diary

	Name	Days Tracked	Times Tracked	Who they Tracked	Individual Times Tracked
HH1	Michelle	7/14	11	Zara	5
				David	6
HH2	Simone	5/14	10	Chris	7
				Zara	2
				Godmother	1
HH3	Sanjeev	14/14	37	Raveen	20
				Cousin	8
				Self	9
HH4	Paul	14/14	39	Stephen	23
				Friend	16

HOW LBS AFFECTS DOMESTIC LIFE

During the course of the study, four primary motivations arose for continuing to use LBS. First, and perhaps least interesting, the male participants reported an interest in trying the technology for its own sake (HH4); this is consistent with Livingstone's research that shows men's motivation to use technologies is often due to an interest in new features [11]. Second, there was a desire to monitor household members to ensure their safety—be it monitoring children or adults. This is closely related to a third key motivation: a desire to reassure oneself that one's family is safe. Finally it also satisfied a curiosity about family members' activities. Combined, these served to transform the nature of domestic work surrounding caretaking in the home. Not only does the work of caretaking change, but the technology facilitates new mechanisms for resolving conflict surrounding issues of trust. In the next section we will discuss the latter three of these topics.

Transformation of Domestic Work

Ensuring Children's Safety

First, we will discuss how children's safety is ensured using LBS. London is a large diverse urban environment and children often have to use the sprawling public transportation network unaccompanied, with all the risks that entails. In particular, there is concern about knife-crime and gang membership among teens [9]. Consequently,

safety also involves knowing how to avoid danger and navigate a potentially unsafe city. For instance, Simone's son attends martial arts classes in an area she believes can be unsafe,

[It] is always a problem with me because he is going twice a week and it is quite late in the evening, and it is also a part of the area which I don't consider to be safe, so I am more sort of on edge when he is out and I know he is there. But I can't stop him from going, because he enjoys going and I can't necessarily always be there to pick him up or drop him or stay with him whilst he is there, and there isn't always somebody else either.
Simone (HH2)

There are also a host of other concerns for parents, such as child abduction and pedophilia, and these threats were cited explicitly by Simone (HH2) as her reason for using LBS. Prior work by Palen [15] has shown that LBS can facilitate "remote parenting," and indeed, both mothers in our study were using LBS to help ensure their children's safety,

My reason for using it was to facilitate cases that were out there at the time child abduction, pedophilia, kidnapping etc. So it sort of raises a level of fear in you to say, well, ok look, I have got to be a bit more proactive in what I do and the responsibility that I have, making sure that they are ok.
Simone (HH2)

The access to LBS changed the nature of parenting responsibilities, as shown by Simone,

I think I was even more paranoid than I am now. I would be calling them constantly and being honest again there were times where I would actually bloody follow them... but I don't have to do that as much now.
Simone HH2.

Being able to monitor her children remotely meant that she no longer had to call or follow them to ensure they were where they were meant to be.

The mothers in our study felt use of LBS to track their children was part of their maternal role, to the point that they were redefining the role of motherhood to include use of LBS. Michelle attributed her use of LBS to gender differences by saying she likes "to be on top of things."

I think tracking is more what a mother would do. Because women tend to have more perception of where the kids might stray, because I think, they themselves may have experienced circumstances where they have gone of a track or deviated ...

Table 3. Expected and Unexpected Locations for LBT

	Name	Total Times Tracked	Expected/ Unexpected Locations	# of times
HH1	Michelle (mom)	11	Expected	8
			Unexpected	3
			Unknown/ Failed	0
HH2	Simone (mom)	10	Expected	3
			Unexpected	5
			Unknown/ Failed	0
HH3	Sanjeev (nephew)	37	Expected	30
			Unexpected	7
			Unknown/ Failed	0
HH4	Paul (cousin)	39	Expected	14
			Unexpected	9
			Unknown/ Failed	14

with men... if they say they are going one place, they still invariably end up at that place. *Michelle (HH1)*

Michelle was in particular concerned that her daughter might stray. Similarly, Simone felt that LBS replaced some of the responsibility her partner used to have as a father, due in part, perhaps, to his resistance to the technology,

The way it has changed the way our family is living and communicating with him is that he has maybe become a bit more distant in the sense that he feels as a father he has lost that element of control in that he no longer has to be with them in order for me to know where they are. I can do it all by myself... *Simone (HH2)*

Rode has discussed how gender and technical identity are co-constructed in relation to new technologies [19]; here we see this occurring with LBS to afford *remote parenting* [15] and how it is being inscribed with a feminine gender in households where the mom took responsibility for LBS childcare. Of course, as Rode [19] discusses, in households with male *technology czars*, new home technologies were integrated into the role of the male head of the household. While we would have expected to find this in our study, we were unable to recruit fathers who were current active LBS users.

Remote Adult-Caretaking

Not only did we see examples of *remote parenting*, but we also saw examples of *remote adult-caretaking*. For instance, Sanjeev has, to a certain degree, been able to care for his uncle from a distance. He felt that the uncle could potentially be an easy target for criminals due to his obvious physical disability. Additionally, when running errands, his uncle is not always able to answer the phone; therefore, LBS lets Sanjeev keep an eye on his uncle without calling him. He explains how he used to go out and try to find his uncle if he was worried, but now he says,

I don't have to go and see where he is and I can do other things now. I can do my coursework and just track him on the computer. *Sanjeev (HH3)*

LBS helped Sanjeev feel less worried about his uncle, and both he and Paul (HH4) felt that it simplified the communication about people's whereabouts. One no longer needs to ask details about location and can instead focus on more meaningful aspects of maintaining the relationship. Thus, while remote parenting exists, LBS is part of a larger pattern of digital nurturing affecting many forms of domestic relationships.

Reassuring Oneself that Everyone is Safe

While use of LBS is a means of showing concern for another individual, it is self-serving as well. By monitoring, people can reassure themselves that their loved ones are safe. As Simone says,

I am usually a very strong person about everything else, but when it comes to the children, I am very emotional and I do get into a panic. It is a situation that I can't control. *Simone (HH2)*

LBS allowed people to relieve anxiety and focus attention more productively elsewhere, just as Sanjeev was better able to focus on his schoolwork. This suggests that technologies

such as Microsoft's Whereabouts Clock [5] are desirable to both afford easy monitoring and self-reassurance. However, our data suggest that it is particularly important for users to know when household members are in atypical locations.

All of our participants reported individuals were somewhere unexpected at some points during the study (see Table 3). For Sanjeev (HH3) and Paul (HH4), this was mainly attributed to inaccuracy of the technology or delays in receiving the location information. Michelle (HH2) had also experienced inaccuracy with the technology, though not during the course of the study. Simone (HH2) found the service could not load at a major event, most likely because of overload of the mobile phone towers. However, in some instances individuals were genuinely somewhere other than where they were meant to be. One unexpected event logged by Michelle was particularly interesting, because this was an example of a child breaking the house rules. David, her son, had stayed home from school because he had injured his knee, so when Michelle called the household phone from work and it was not answered, she tracked him and found that he had gone to his friend's house. She says,

I felt annoyed that he was too ill to go to school but well enough to go out and see his mate! ... It turned out he was at his friend but still within [area]. I felt relieved that I was able to track him before ringing him and it allayed my anxieties somewhat. When I was able to get hold of him and asked him why he was not at home resting his leg, he had no choice but to tell us the real reason why he had left the house against our wishes instead of resting his knee... *Michelle (HH1)*

Even though Michelle was disappointed that he had gone to his friend's house, she was relieved that he was safe. In this situation, Michelle was reassured because the technology accurately displayed her son's location, even though he was not where she expected him to be.

Use of LBS to monitor children and adults and to reassure oneself of one's household safety demonstrates how LBS is changing the nature of domestic work when it comes to issues of nurturing and protection. LBS affords new opportunities with regards to monitoring, and new ways of responding to unexpected circumstances. Furthermore, it provides new mechanisms for providing reassurance about the well being of loved ones. However, as we will show next, LBS also provides new mechanisms for negotiating interpersonal trust.

Changing Nature of Trust in an LBS Enabled-World

In an ideal world, individuals would trust one another to honestly communicate information about their location, but as our data show, this is not always the case. Prior to using LBS, many of the children in our study had a history of giving parents incorrect or misleading information about their whereabouts, and some of the adults had suspicions of marital infidelity. These behaviors, in turn, foster lack of trust, which breeds suspicion. Trust as we said before always needs to be maintained, but LBS use was caught up in this cycle prompting additional trust work.

Trust and Parenting using LBS: Initial Use

Lack of trust was the initial motivator for participants with children to use LBS. For instance, Michelle (HH1) introduced LBS after her children had broken house rules; she would have to go find them and pick them up if they were not home on time. Michelle was disappointed with her children and felt that she could not trust them; therefore she wanted to try LBS. Michelle gave a specific example,

[They were] supposed to be at a friend's house and they ended up in a completely different, in sort of fun day in the park somewhere quite far. So obviously it had been pre-planned between them and that was one of the times we actually located them and then went and got them. *Michelle (HH1)*

In this instance, when she realized they had broken the rules, she called them to tell them she and her partner was going to pick them up. Simone had experienced a similar situation, which prompted her to follow her children on foot prior to using LBS. The particulars of these situations were the foundations for adoption patterns around LBS.

The introduction of LBS changed how similar incidents were resolved, as an example from Simone's family shows. During the study, her son went to an event without her permission. She was worried, because it was in an area that she considered dangerous. She tried to call him, and when he did not pick up, she used LBS. Simone commented,

That is when I become very irritated... if you are not being honest with me and I have to use these aids as a tracking device for you, you know, that is a problem for me. *Simone (HH2)*

LBS provided her with concrete information that her son was at the event. LBS in this instance removed ambiguity about whether the rules were being followed, making the children more accountable for their actions.

Trust and Parenting using LBS: Changing Behavior

The families reported that using LBS had resulted in a change in their children's behavior, and that over time, the mothers found themselves less dependent on the service. While both of them said they used it more initially, they also said they felt their children's behavior had improved,

Now that they know that I am watching they are more inclined to just go where they.. are supposed to be... because they know that if they are not doing it then I can see it. *Simone (HH2)*

They have definitely changed their behavior, mainly due to the fact that we can now locate them and go and get them, which they dislike. And also it has made them more responsible. *Michelle (HH1)*

Both of the parents felt that they could now trust the children more, but LBS has changed the balance of power in these relationships. With LBS these parents now know their children's location, giving them evidence of rule violations and better facilitating their being able to pick-up children if they are somewhere they are not meant to be. For children this is embarrassing, and acts as a significant incentive to comply with parents' rules.

We also asked about the introduction of LBS and parenting practices, and though Michelle had attempted to be straightforward with her children about how she was using it,

her daughter was both surprised and displeased when Michelle used LBS to track her down one weekend. Indeed, Michelle sometimes chose not to tell her children when she had tracked them,

For me to talk about it, you were at this particular place at a particular time, it sort of raises issues that I don't trust them. Instead I would sort of like ask them, did you enjoy the day and sort of drop in the conversation 'where was it again?' Because you know to keep saying I am tracking you can be quite off-putting. I feel less of a spy. *Michelle (HH1)*

Michelle carefully manages the information she garners through LBS and strategically engages with her children. In Michelle's household, LBS has changed the relationship with the children,

[The children] themselves have become more open with us and tell less [sic] lies. It has had a very positive experience on our family... Now we use our judgment because as they have gotten older, you can't be in the same place, as you say you are going to be. Eventualities happen. We are more lenient, provided the place they say they are or they have ended up at is a safe and reputable place. *Michelle (HH1)*

In this case Michelle feels her children are more honest due to LBS. At the same time, LBS has resulted in a dialog about why children are not where they were meant to be. Consequently, she and her partner have come to understand how plans and thereby location change in a teen's social life.

Similarly, Simone's parenting practices have become more relaxed, but she still worries about her children's behavior,

The kids can be very sneaky. They are very good kids, but under the influence of other children there is the potential to run riot. That's what I am trying to avoid... I have become a bit more relaxed in my approach... Physically I have done that, but mentally I haven't always because I always think, Oh god, say Google [Latitude] is wrong or say they for instance have left their phone where they said they were going to be anyway... So you can't be in control all the time... *Simone (HH2)*

Simone's comments indicate a lack of trust in her children, but she also recognizes gaps in the technology that might cause it to fail. LBS as it was integrated into the home has impacted patterns of interaction surrounding trust.

Trust and Parenting using LBS: Kids Breaking the Rules

Limitations in technology were exploited to make someone appear where they are supposed to be even if they are not, allowing kids to break the rules. In one instance, a parent discovered that her child left her phone at her friend's house while she went to a party in order to stay out later than she was normally allowed. The parent only found out that her child had gone to the party because she overheard a conversation between her child and her friend afterwards. Her thinking her child was safely asleep when her child was actually somewhere else made her "very concerned." Another way children exploited the technology was to claim that the technology failed. For example, one child tried to convince her mother that he had been in a sports club all evening. However his mother was convinced he had not and instead was concerned that her son was trying "to pull a fast [one] saying that computers and technology, you know, can

fail.” She felt that her children were trying to take advantage of her being less technically savvy, thereby reversing the parent-child power relationship. However, this tactic became less effective as parents master technology.

In another household, the mother was not aware of instances when her children had tried to disguise their location, nor was she aware that there was a possible means of circumventing the technology. She felt it was an unlikely tactic because their phones were their “lifeline.” Her children, however, revealed that they had tried to disguise their location, or circumvent the technology. One turned off the phone, whereas the other had, on three occasions, left the phone at home before going to school,

I was at the park and me and my friends were just messing about, just listening to music and talking. That’s all we do. And I left it behind so they couldn’t come and get me and embarrass me, especially in front of my friends.

This suggests that the children weigh up the risks of not having a mobile phone and the benefits of their parents not being able to track them, an evolution of earlier privacy practices [13]. Furthermore, while Grinter and Palen [9] previously showed there was a significant social stigma if teens did not promptly return messages, our data suggest the need for privacy was greater than the social stigma potentially caused by not returning messages.

Interestingly, however, both of these children reported instances where they forgot they were being tracked, and thus forgot to disguise their location:

D: ...I went to a girl’s house. And then she [mom] called and it was really awkward. I said, mum why are you calling me. That’s all I said. It was really awkward. She said to me, you lied to me about where you were. She was angry and disappointed and I was in a shock. She told me to come home straight away, because she [girl] lives quite far away’

I: Did your mum not know about the girl?

D: ‘She knows about her now, but I just wanted to keep it a secret until I could actually introduce them’

I: What did your girlfriend say?

D: ‘She was actually shocked as well, because she didn’t think that I would be tracked. I had actually completely forgotten about it at the time.

Disguising locations or forgetting to do so is evidence of children demonstrating a need for privacy beyond what LBS easily allows. It also gives children power over their parents, reversing the typical power dynamic. Children are resolving this tension by exploiting the gaps in the technology, an undesirable situation from the parents’ perspective. This tension needs resolution.

Trust and Parenting using LBS: Who Tracks Whom

The power dynamic in these homes between parent and child was further emphasized by differences in how LBS was introduced and by children’s attitudes towards being tracked. Michelle, for example, explained the technology to her children and how it worked; despite this explanation, neither of her children knew exactly how to use it. Daughter Zara stated though that she did use it once with her mom to track her brother,

I was with her and he went to his friend’s house, so I tracked him. But I don’t know how to do it or anything, because she did it and I was just like looking. *Zara (HH1)*

Unlike Michelle, Simone introduced LBS without discussing it with her children or partner, and when they learned of it, her son did not see the point, “‘cause Mum is at work and Dad, he is just working wherever anyway.” In contrast, her daughter objected to the lack of reciprocity,

You can see me so why can’t I see you. It’s not fair. Not that it would be exciting, but it works both ways and should be an option, if we wanted it cause then we can both see each other and nobody is left out. *Sophie (HH2)*

Even though none of the children are particularly interested in tracking their parents, one child did express concern when his mother is out,

... if she goes to a party I wanna see who’s house it is. She sometimes tells me, but not when she’s like getting drunk. It is actually because sometimes when I am home alone, I actually worry about her and sometimes she is home late and I just want to know if she is alright.

This suggests that in some cases, for whatever reason, children will want and need to act as the caring “parent,” and the technology needs to allow for this role reversal.

Further, in a conversation with their mother Simone’s children strenuously objected to being tracked, which further exacerbated the lack of trust in their relationship. The children compared her behavior to the social norms for their friends and their father’s treatment of them. They were not meant to be out late, and were often asked socialize at home. Her son commented “I feel like I am a prisoner and I ain’t done nothing wrong.” Both children felt they were not trusted, though it was unclear the degree to which LBS antagonized an already contentious relationship.

Despite the children calling for more freedom, children in both households appear to like being tracked by their parents, at least some of the time. For instance,

I felt safe because if I was in trouble they would know where I am and they are just trying to keep me safe, but some times I don’t always want them to track me. I just want to have some privacy. *Sophie (HH2)*

This is in line with prior research [8], which found that children feel safer with a mobile phone, especially in case of emergencies.

In Michelle and Simone’s homes, LBS afforded a change in the power dynamic of parenting which allowed better enforcement of rules. This, in turn, encouraged compliance with the rules, and to some extent created a dialog that increased understanding of how teen social life changes. To some extent, this increased trust, but at the same time, reliance on a technology as opposed to the word of a family member removes an opportunity for trust-building encounters. Trustworthy actions occur under a surveillance system, and thus individual actions can no longer be attributed solely to good behavior; instead, the desirable behavior could be attributed to the simple fear of being found out. Realization of this paradox may in turn encourage

distrust between parent and child. Consequently, it could be argued that by limiting the opportunity for trust, LBS encourages distrust, thereby undermining the relationship it was meant to protect.

Trust and Tracking Adults using LBS

LBS's potential to foster distrust was readily apparent in the use of adults tracking one another. While it is difficult as an outsider to assign motivations for checking on another's location, a range of possibilities exist, from well-intended self-assurance of safety to voyeuristic behavior.

We have self-reports that help us characterize the nature of the motivation. Some appear harmless; Paul, for instance, mentions that he usually tracks because he is curious to see, where his cousin or his friend is located, while Sanjeev tracks his uncle to ensure his safety.

In other instances, the tracking is far less benign; one of the participants admits that she has tracked her partner covertly in the past which could have serious consequences,

He would probably see it as being a lack of trust on my part. It could potentially be damaging to our relationship for the fact that if you don't trust me then what are [is] our relationship based on. I am not necessarily using it as a tool because I don't trust him, but it is really sort of double-checking... more fun element 'oh he said he is going to be there, is he really there'. I would not be concerned about infidelity or anything like that, it is more sort of like oh does he really work, he said he is going to be there, is he actually there.

Interestingly, while she tracks her partner, she would resent him doing the same, saying she would be "quite irritated...I am a grown woman, and I think I should be allowed to go where I want when I want to." She rationalizes her behavior, by saying that her motivation is care and concern, thus justified, whereas his would be lack of trust,

I know his reason for using it and our reasons are different. His reason is with regards to 'is she being faithful', 'why is she saying she is going here and she is not there?' Mine are more 'are you ok?' and 'are you safe where you are?' so it is completely different, or to me it is.

At the same time other comments from her do indicate there may be an issue of trust,

I have never caught him doing anything wrong, but men are sneaky. He might be very good at hiding things. I don't want this to be seen as there is an element of distrust, but it is more sort of don't be naïve about what can happen.

Even as she remarks that "men are sneaky," she tries to defend her relationship and manage the perception of possible distrust. Here LBS norms are a source of conflict.

Participants who questioned themselves as to whether they were crossing a line and acting as voyeurs sometimes realized there was more to their motivation than seeking reassurance or ensuring the safety of others. For instance, if Paul finds his cousin to be somewhere unexpected, he avoids confronting him about it,

It did change the way that I approached the subject because obviously I knew the truth and I just tried to be innocent about it. Try not to appear as if you already knew where he was. It feels a

bit weird because obviously you are trying not to step on his boundary, like try not to push boundaries and want to keep communication at a normal level and not create situations where either of you would...feel awkward about it. *Paul (HH4)*

Paul's consideration stemmed from the possibility that LBS could potentially have a negative affect on relationships,

It made me feel like this tracking service can actually be a bit... How do you put it? I mean if you take it too seriously it can put a strain on relationships. I mean ... if I pressed him further, we could have entered into an argument. *Paul (HH4)*

Paul felt that tracking might be an intrusion on his cousin's privacy, and could damage their relationship if his cousin were to learn about it. Not being in the expected location could be a lie, or simply evidence that plans had changed. Despite Paul finding such situations awkward, he respects his cousin's privacy and feels no need to confront him. By pretending he does not know, Paul is able to demonstrate trust. Regardless of the reason, however, Stephen violated Paul's trust by not being where he said he would be.

Similarly, Simone justified her use saying that she may just be "more inclined now to see that is not just because I am concerned about where they are; I am just being too nosy." (*HH2*). Simone's need to justify her behavior may stem from her using LBS without her family's initial consent. Interestingly, for both Paul and Simone, the diary encouraged them to reflect on the appropriateness of their behavior. In Michelle's case, use of LBS prompted discussion with her partner about its appropriateness. Even though her husband supports her tracking the children, he does not think it is acceptable to be a voyeur,

He thinks it is a valuable tool for... locating our kids especially as they are teenagers and also for sort of peace of mind... I have to admit, he doesn't like me to track them just for the sake of tracking them or to be, you know, sort of checking up on them. He wants me to do it for a proper reason whether they are [sic], not just to give them a telling off. *Michelle (HH1)*

This suggests that appropriate use of LBS is being negotiated within households and that there is considerable debate by individuals about its appropriate use.

Participants repeatedly expressed concern about how their actions might be interpreted by others. To avoid giving the impression they were spying, they attempted to manage their presentation of self. For example, Michelle commented, "I don't like...that people are still very suspicious of it...They would think that, you know, we have a very distrustful relationship in our family that we have to use tracking." (*HH1*) Similarly, Simone commented, "What I dislike about it is the way in which I am being perceived...It can give you the sort of unnecessarily perceived spy image rather than a concerned parent. (*HH2*) Both felt their real motivations as a concerned parent might go unnoticed. Participants were concerned that their acts might be viewed as demonstrating a lack of trust.

This shows how LBS is not socially accepted yet, and its role is still being socially negotiated in homes. While in some homes, adults were able to agree on its use, it was the source

of conflict in others. We saw various forms of *trust work* enacted through LBS, as spouses struggled with the threat of infidelity, children engaged in obeying, parents managed their authority; all of these activities hinge on trust. Further, individuals expressed concern that others perceive them as concerned rather than as a voyeur. LBS are changing both trust norms and how they are enacted.

DISCUSSION

Use of LBS featured both costs and benefits for our users. Here we have demonstrated how LBS is being used to enact various forms of *digital nurturing*. Parents, primarily mothers in our sample, were engaged in *digital parenting*, a finding consistent with Rode's [19] observations that women became responsible for digital parenting if they had the technological expertise. At the same time, we saw *digital adult-caretaking* take place among adults with and without power relationships related to one another's safety. While our users' primary motivations were to ensure one another's safety, our data shows how issues of trust cut across usage practices, potentially undermining the effectiveness of the nurturing.

This results in what we call *trust work*, drawing on Shklovski et al's notion of privacy work [22], and trust as something that is "done", enacted and maintained. While LBS afforded new forms of *digital nurturing*, it also created new forms of *trust work*. In particular, we argue LBS limits the opportunities to maintain and display trust, where daily socially-based trusting interactions are potentially replaced by technologically mediated interactions. It would be irresponsible to speculate as to the long-term social consequences of these interactions, or their likelihood. Instead, we offer the theoretical juxtaposition of digital nurturing and trust work as explanatory concepts, and the domestic panopticon as a provocative possible social outcome.

Good interface design practices through privacy preferences offer a measure of protection. Additionally, prior work has recommended the ability to turn off LBS to preserve privacy [1,6]. Our data supports both of these, but currently the only privacy management technique we observed was turning the phone off or leaving it behind. Palen and Dourish called for the importance of *recipient design* to ensure privacy by allowing one to tailor how one's actions will be perceived [16]; we extend this by arguing that recipient design could also promote or limit trust. Thus recipient design for LBS must be considered.

In particular, recipient design must be considered in the context of the power relationships within the home. Privacy is something that is being done, further it is enacted in the context of power relationships and among a range of social accountabilities and responsibilities [22]. When power relationships factor into domestic LBS—be it parents tracking children, adults tracking their own parents, or even children tracking their parents when they are sick or acting irresponsibly—lack of access to location can represent a

potential safety threat to the people being tracked. Consequently, privacy settings need to account for the undemocratic nature of interpersonal relationships but also account for the situational nature of privacy work. Additionally, as illustrated by the example of the child's concern about the whereabouts of a possibly intoxicated parent, there will be instances where children need to be able to act as the responsible party. This demonstrates that, unlike Shklovski et al's correctional setting, sometimes the prisoner needs to take control, and technologies must address this dichotomy to ensure the wellness of the entire household. Furthermore, the privacy rights of children, elderly people, and people with disabilities must be addressed before such systems can be implemented successfully. LBS needs to allow for richer forms of privacy that do not undermine the trust that serves as the backbone of relationships, as well as forms of *recipient design* which encourage trust.

LBS is a technology that provides power to individuals in that technology failures aside, it can provide evidence of an individual's whereabouts. It can cut across various existing power dynamics in the home—be that of parents and children or elders and adult-caretakers. Based on how it is used and implemented, LBS changes the interpersonal dynamics. Here, children were seemingly brought into line with LBS; at the same time, some found new ways of misbehaving. This bad behavior was masked by lack of knowledge of the technology. The tensions of couples with strained relationships were amplified by LBS. Even in instances with mutual consent and trust, evidence of evasion about one's whereabouts introduced new tensions into relationships, such as fear of voyeurism and the need to justify why one wanted to use LBS in the first place. Appropriate dynamics for how and when LBS are being used are being actively negotiated.

A key factor in negotiating the proper use of LBS is trust. While LBS brings with it the possibility of ensuring compliance with rules and honesty within relationships, it limits the opportunity to display trust. At the same time, one needs to carefully manage the perception of its use so as not to be perceived as lacking trust. LBS in the context of the home creates a sort of domestic pantopticon [2], where inhabitants are potentially warden and prisoner both. As such, accountability and parenting are based on surveillance rather than trust. Consequently, LBS brings with it the genuine possibility of eroding domestic trust and undermining trust-based relationships. The technologies themselves and the norms surrounding them are still being redefined to help ensure this does not happen.

CONCLUSIONS AND FUTURE WORK

In this research, we have begun to explore the ways in which LBS are changing domestic relationships. Here we have shown the complex and cyclical relationships between knowledge of location and use of that knowledge. We have shown that practices surrounding being tracked are extremely varied and arguably unique to the qualities of trust in participant relationships. A close study of a small number of participants does not allow us to generalize about the

likelihood of specific behaviors; however, it does allow us to draw out and create grounded theory. In particular, we have shown how LBS changes the nature of trust work and how it is being incorporated into practices of digital nurturing. To ensure that the domestic panopticon remains only a possibility, mechanisms for protecting and maintaining trust must be a focus of future LBS research.

ACKNOWLEDGMENTS

We thank the PriMMA team: Blaine Price, Bashar Nusebeh, Yvonne Rogers, and Keerthi Thomas. We also thank Sunny Consolvo for sharing her study method; Patrick Oliver and our reviewers; and finally, our informants for sharing their lives with us. We were funded by the EPSRC PRiMMA project (EP/F024037/1), and by Google.

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