Check out where I am!

Preferences and Behaviors in Location-Sharing as an Interactive Practice

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Aalto University & University of Helsinki
Interactive systems often engender privacy concerns.

Q1: Why do privacy concerns arise in interactive systems?

Q2: What is the nature of these concerns?

Q3: Which privacy management practices do people currently follow?

Q4: In what ways are current privacy management mechanisms in interactive systems lacking?

Q5: How can “privacy sensitivity” of interactive technologies be improved?
Location-sharing services (LSS) can help examine privacy attitudes and practices.

LSS emerged from Ubiquitous Computing and CSCW.

Initial LSS were geared toward finding nearby people and/or services.

Early LSS were expensive, cumbersome, and typically required specialized infrastructure.
LSS are gaining mainstream adoption…

…driven by increasing usage of smartphones & social media.
LSS offer “Check in” and/or “Always on” modes.

Checked in at the office.

Moving between home, office, and gym.
...but location information is sensitive.

Girls Around Me App Is a Reminder To Be Aware What You Share

As far as I can tell, the app “Girls Around Me” wasn’t violating any laws. But it was high on the creepy scale when, according to reports, women’s identity, photographs and location were being revealed to strangers, even though the women never opted into the service. Although the developer, Moscow-based I-Free, hardly deserves any awards, the app’s a good wake-up call for people to use the privacy settings of legitimate social networking and location services.

The app mashed together information people posted about themselves publicly on Foursquare and Facebook and created a map showing the location and photographs of nearby women. On its website, the company brags that the app can be used
...but location information is sensitive.

Privacy Concerns Remain for Location-Based Service Users

The FINANCIAL -- Consumers are taking to the use of location-based services on mobile devices because of the convenience such services offer.

A March 2012 poll of US mobile app users by global security association ISACA found that 58% of those who had smart devices had used location-based apps, compared with only 15% who had not. But users continue to have significant concerns regarding security and privacy issues when using portable devices.

According to eMarketer, more than half of those polled thought that there was a good balance between the benefits offered by location-based services, and the risks in using them. But more than one in five thought the risks outweighed any benefits—a sign that brands need to demonstrate that privacy concerns are being addressed, especially if they plan to ramp up mcommerce and geolocation efforts in the near future.

Tellingly, almost one-quarter of respondents said their greatest privacy concern was having their information used for marketing purposes. The same percentage of people named having strangers know too much about their activities as their top worry.

But these concerns are not yet deterring the use of location-based services. About one-third of respondents said they had increased their use of such services over the past year, while another third said their use had stayed about the same. Only 10% of those polled had reduced their use of geolocation apps or other products.

Privacy worries, if left unaddressed, have the potential to affect already substantial revenues from location-based apps. The Yankee Group in April estimated that location-based apps would generate $900 million in revenue by the end of 2012, with that figure reaching $1.7 billion in 2016.
...but location information is sensitive.

Privacy of Location-Based Services on FCC's Radar

BY MIKAL E. BELICOVE | July 5, 2012 | Comment

It was bound to happen. With approximately 30 percent of U.S. adults now using a location-based service via their mobile phone, tablet or automobile, it was only a matter of time before the Federal Communications Commission stepped in and began looking into the myriad of privacy issues raised by the use of such services.

From Foursquare, Twitter and Facebook to GPS-navigation systems in cars, location-based services are no longer talked about in the realm of "someday." They're already here and their use is expected to grow by leaps and bounds. The sale of geo-targeted advertising alone is expected to generate more than $100 billion by 2020, according to the McKinsey Global Institute.

The FCC's concern is that users of location-based services be allowed to reap the benefits, all the while being assured that their privacy is being protected. And while it recognizes that industry is moving toward minimizing privacy concerns, the government still intends to monitor the space closely.
...but location information is sensitive.

Class action against Apple for location tracking moves forward

*By Aaron Souppouris ([http://www.theverge.com/users/AaronSoup](http://www.theverge.com/users/AaronSoup)) on May 5, 2013 10:37 pm*

…but location information is sensitive.

Facebook Pulls Location-Tracking Feature Dubbed ‘Stalker App’

Posted on: 11:03 am, June 26, 2012, by Dan Jovic

John D. Sutter, CNN, Reporting

Following a period of freak-out on the Internet on Monday, Facebook appears to have pulled a controversial feature that let the social network’s users get a digital list of other Facebookers nearby.

The “Find Friends Nearby” feature was not accessible in a CNN test on Tuesday morning, and other media outlets, including CNET, reported that Facebook had pulled the service.

In a statement e-mailed to CNN, a Facebook spokeswoman declined to elaborate.

“This wasn’t a formal release — this was something that a few engineers were testing,” the spokeswoman wrote. “With all tests, some get released as full products, others don’t. Nothing more to say on this for now — we’ll communicate to everyone when there is something to say.”
Two privacy management mechanisms…

… privacy policy of the service

and privacy preference settings.
Privacy policies are not user-friendly.

Written by lawyers for lawyers.

Largely unread by the typical user.

No negotiation or customization.
Privacy preference settings are useful...

...but constrained.

Written by system developers.

Can be hard to find and unintuitive.

Users find it burdensome to change defaults.
What if we removed the constraints of privacy policies and preference specification interfaces?
We let users write natural-language rules…

…and rate and rank the importance of seven typical contextual factors.

1. Recipient
2. Reason for access
3. Hour of the day
4. Day of the week
5. Current location
6. Specificity of disclosure
7. Access frequency
The study involved several steps.
Respondents were drawn from four Craigslist lists and one subject pool.

103 valid responses (41 male, 60 female)

18–61 years (median: 28, mean: 32, sd: 12)

70 owned smartphones.
Natural-language statements were coded by three independent coders.

Is it a rule or a guideline?

   When people know where I am and that place is not "at home" it makes my home less secure.

Does it refer to any of the seven common contextual factors?

   During my normal day e.g. while I am at work I would not care.

Does it refer to any other themes?

   Allow my location to be visible to emergency contacts and law enforcement whenever 911 is dialed.
Most respondents wrote just a few rules.

Average rules/respondent: 2.66 (sd: 2.12)

Only 18 wrote more than 3 rules.

15 (14.6%) didn’t write a single valid rule.
Four other themes identified in the rules.

Emergencies (11.1% rules)
Access to employer for emergency purposes only.

Manual control (10.3% rules)
I would like an application to pop up with a notification to ask me if I choose to grant access to anyone wishing to know my whereabouts.

Do not track (15.8% rules)
permanent (8.5%)
Block access to my location at all times.
temporary (7.3%)
Have the ability to disable the feature and any given time.

Current activity (6.4%)
When I'm running errands alone, I don't want people to try and find me. I don't always want to be social.
Family/friends and the government were mentioned frequently in the rules.

Rules created to...

**allow** access to family/friends

I prefer to only share my location with close friends and family. Any of my friends or family may know where I am unless otherwise noted.

**deny** access to the government

Government could NEVER know! I do think in terms of the Big brother and would not want government to know what I was doing.
Most contextual factors highly important, …but there is still some variation.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recipient</td>
<td>4.79</td>
</tr>
<tr>
<td>Current location</td>
<td>4.28</td>
</tr>
<tr>
<td>Specificity</td>
<td>4.18</td>
</tr>
<tr>
<td>Access frequency</td>
<td>4.06</td>
</tr>
<tr>
<td>Reason</td>
<td>4.53</td>
</tr>
<tr>
<td>Day of the week</td>
<td>3.36</td>
</tr>
<tr>
<td>Hour of the day</td>
<td>3.62</td>
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<tr>
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<td>Current location</td>
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<td>Access frequency</td>
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<tr>
<td>Reason</td>
<td>0.96</td>
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<tr>
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<td>1.31</td>
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<tr>
<td>Hour of the day</td>
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<tr>
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<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Most contextual factors highly important, …but there is still some variation.

Frequency of Responses

- Recipient
- Reason
- Time of the day
- Day of the week
- One's current location
- Disclosure specificity
- Access frequency

Rated Importance (1 = Not at all important to 5 = Very important)
Non-temporal factors were positively correlated with Internet privacy concern. (p < 0.05)

Temporal factors were positively correlated with interpersonal privacy concerns with social relations. (p < 0.05)
Recipient and current location were the top ranked factors. \((\chi^2 = 395, \, df = 36, \, p < 0.001)\)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Ranking</th>
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<th>Mode</th>
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<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Current location</td>
<td>3.24</td>
<td>1.73</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Specificity</td>
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<td>1.79</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Access frequency</td>
<td>4.05</td>
<td>1.61</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Reason</td>
<td>4.31</td>
<td>1.70</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Day of the week</td>
<td>5.13</td>
<td>1.51</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Hour of the day</td>
<td>5.52</td>
<td>1.81</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

...Temporal factors ranked the lowest.
Rules often included recipient (75%) and reason (19.2%).

<table>
<thead>
<tr>
<th>Factor</th>
<th>Ranking</th>
<th></th>
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<th>Rules</th>
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</thead>
<tbody>
<tr>
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<td>SD</td>
<td>Median</td>
<td>Mode</td>
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<td>6</td>
<td>7</td>
<td>3.62</td>
</tr>
</tbody>
</table>
It is likely that the rules underspecified location-sharing preferences.

**Difficulty of recall**

**Inability or unwillingness to articulate**

**Lack of incentive**

We administered an online questionnaire to LSS users in the US.

Responses were analyzed to investigate:

Motivations for LSS use and
Preferences and Practices for LSS Privacy Management.
Respondents were sought via an ad posted to 10 Craigslist lists across the US.
Respondents were sought via an ad posted to 10 Craigslists across the US.

362 valid responses
152 male (42 %)
210 female (58 %)

18–67 years
(median: 30, mean: 33)

80% used LSS > 8 months.
90% used smartphones.
Users prefer the “Check in” mode of LSS.

Check in

Level of Comfort
1 (Very uncomfortable) to 7 (Very comfortable)
Users prefer the “Check in” mode of LSS.

Always on

- Level of Comfort: 1 (Very uncomfortable) to 7 (Very comfortable)
- Number of Respondents
Users prefer the “Check in” mode of LSS.

- **Check in**: 176 respondents prefer this mode.
- **Always on**: 42 respondents prefer this mode.

The chart shows the number of respondents for each level of comfort, ranging from 1 (Very uncomfortable) to 7 (Very comfortable).
Users prefer the “Check in” mode of LSS.

Differences are statistically significant. 
(p < 0.001)

The two levels are correlated with:

Each other 
(r = 0.2, p < 0.001)

Third party sharing 
(r = 0.35, p < 0.001)

Privacy concern (IUIPC) 
(r = -0.18, p < 0.001)
Users share location for individual, social, and economic reasons.

<table>
<thead>
<tr>
<th>Reasons for using LSS</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I wanted to tell my friends that I liked the place.</td>
<td>207</td>
<td>57.2%</td>
</tr>
<tr>
<td>I like to keep my social circle informed of where I am.</td>
<td>182</td>
<td>50.3%</td>
</tr>
<tr>
<td>I wanted to record and remember that I had visited this place.</td>
<td>154</td>
<td>42.5%</td>
</tr>
<tr>
<td>I was visiting a different city and wanted local friends to know that I was around.</td>
<td>152</td>
<td>42.0%</td>
</tr>
<tr>
<td>I wanted to appear cool and interesting by sharing where I was.</td>
<td>151</td>
<td>41.7%</td>
</tr>
<tr>
<td>I wanted people to join me at the location.</td>
<td>141</td>
<td>39.0%</td>
</tr>
<tr>
<td>I wanted geographically distant friends/family to feel that they were part of my day–to–day activities.</td>
<td>128</td>
<td>35.4%</td>
</tr>
<tr>
<td>I was at a political/social/artistic event &amp; wanted to promote it.</td>
<td>90</td>
<td>24.9%</td>
</tr>
<tr>
<td>I was offered a coupon or some other financial incentive.</td>
<td>72</td>
<td>19.9%</td>
</tr>
</tbody>
</table>
LSS usage is embedded in larger interactive practices.

<table>
<thead>
<tr>
<th>Motivations for Sharing Location</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social interaction with friends.</td>
<td>228</td>
<td>64.8%</td>
</tr>
<tr>
<td>Finding/seeking others nearby in one’s home/work area.</td>
<td>77</td>
<td>21.9%</td>
</tr>
<tr>
<td>Social interaction with family.</td>
<td>59</td>
<td>16.8%</td>
</tr>
<tr>
<td>Recommending a location to others.</td>
<td>38</td>
<td>10.8%</td>
</tr>
<tr>
<td>Journaling one’s experiences for future recollection.</td>
<td>30</td>
<td>8.5%</td>
</tr>
<tr>
<td>Projecting a positive and interesting impression of oneself.</td>
<td>25</td>
<td>7.1%</td>
</tr>
<tr>
<td>Attending/taking part in an event taking place at the location.</td>
<td>24</td>
<td>6.8%</td>
</tr>
<tr>
<td>Visiting an unusual/non-routine location.</td>
<td>20</td>
<td>5.7%</td>
</tr>
<tr>
<td>Coordinating and collaborating with (work/school) colleagues.</td>
<td>17</td>
<td>4.8%</td>
</tr>
<tr>
<td>Sharing location with a provider of a location–based service.</td>
<td>16</td>
<td>4.55%</td>
</tr>
</tbody>
</table>

36
Location-sharing helped maintain and strengthen bonds with family & friends.

“[I use LSS] to make others a part of my day when they cannot be physically present.”

“I have family all over so I like keeping them informed of where I am and my news.”

“I do it just to incite commentary and participation of friends with whom I may not have spoken in a while.”

“It is a way of starting a conversation with friends. It lets people into my life and I learn new things from their comments.”
Location-sharing was used to present an interesting impression of one’s identity and personality.

“I like to share with my family and friends where I am if it is something out of the ordinary, say a concert, show, or event.”

“[I use LSS] to let friends and family know where I am and how much I am enjoying myself. I like others to know about my happiness and travel destinations.”

“I share location to look cool and brag about the fancy places where I go.”

“I like using location-sharing services because it helps express my personality online.”
Sameer Patil is at Kjeragbolten, Norway.
At 2:36:17 pm CEDT on Sunday, May 23, 2010.
Nearly 39% respondents shared location to receive a reward.

<table>
<thead>
<tr>
<th>Rewards Received for Sharing Location</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>49</td>
<td>36.3%</td>
</tr>
<tr>
<td>Discount</td>
<td>44</td>
<td>32.6%</td>
</tr>
<tr>
<td>Coupon</td>
<td>31</td>
<td>23.0%</td>
</tr>
<tr>
<td>Drink</td>
<td>21</td>
<td>15.6%</td>
</tr>
<tr>
<td>Gift certificate</td>
<td>12</td>
<td>8.9%</td>
</tr>
<tr>
<td>Clothing</td>
<td>9</td>
<td>6.7%</td>
</tr>
<tr>
<td>Points of virtual objects in games</td>
<td>9</td>
<td>6.7%</td>
</tr>
<tr>
<td>Raffle, lottery, or contest</td>
<td>8</td>
<td>5.9%</td>
</tr>
<tr>
<td>Tickets or entry to a place or events</td>
<td>4</td>
<td>3.0%</td>
</tr>
</tbody>
</table>
More than 25% of the respondents experienced regret.

<table>
<thead>
<tr>
<th>Reason for Regret over Sharing Location</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disclosing location to an audience broader than intended.</td>
<td>32</td>
<td>30.8%</td>
</tr>
<tr>
<td>Being caught lying.</td>
<td>21</td>
<td>20.2%</td>
</tr>
<tr>
<td>Dealing with an encounter with an unwanted party.</td>
<td>18</td>
<td>17.3%</td>
</tr>
<tr>
<td>Hurting feeling of others.</td>
<td>10</td>
<td>9.6%</td>
</tr>
<tr>
<td>Dealing with an encounter with an ex.</td>
<td>9</td>
<td>8.7%</td>
</tr>
<tr>
<td>Being stalked.</td>
<td>8</td>
<td>7.7%</td>
</tr>
<tr>
<td>Being judged negatively by others based on visited location(s).</td>
<td>8</td>
<td>7.7%</td>
</tr>
<tr>
<td>Leakage of secondary information (beyond just the location).</td>
<td>7</td>
<td>6.7%</td>
</tr>
<tr>
<td>Experiencing romantic repercussions.</td>
<td>4</td>
<td>3.9%</td>
</tr>
</tbody>
</table>
Regrettable disclosures were often tied to undesired social consequences…

“My boss saw where I was when I told her I was sick and I got fired.”

“It made my girlfriend jealous because I checked into a local restaurant with my female co-worker.”

“My wife saw that I was at the mall buying a gift when I stated I was somewhere else. It ruined the surprise.”

“I was supposed to be putting in more time with someone else rather than going to a bar.”
“Friendship” connections contributed to regrets.

Leakage via mutual friends:
“An ex-boyfriend showed up at the club I was at because a friend of his had access to my Facebook information.”

Exposing location/activities of friends:
“I checked in at a friend's party and it started an argument between the person hosting the party and someone who was not invited.”

Disclosure due to friends’ location-sharing:
“I lied to some friend that I was sick because I promised another friend to hang out. Then the friend who was hanging out with me tagged me. My other friend found out and stopped talking to me for a few weeks.”
LSS are increasingly embedded in larger interactive systems.

This integration comes with privacy costs...

Accidental disclosures and leakages,
Richer and nuanced inferences,
Violating other people’s privacy,

etc.
Majority of regrets stemmed from a misaligned audiences & context collapse.
Results point to privacy-enhancing design suggestions.

Automatic detection of potential conflicts

“I RSVPed no to a birthday party and then checked in somewhere when I said I was somewhere else.”

Calendar indicates that you should be meeting with Bob. Still disclose location?

Alice is in Wonderland.

At 1:13:17 pm EDT
Thursday, July 12, 2012.
Results point to privacy-enhancing design suggestions.

Alice was in Wonderland last week.

Delayed disclosure

“I share my location to recommend to friends or to review the place.”
Results point to privacy-enhancing design suggestions.

Special-handling of purpose-driven sharing

“I can look back someday and remember where I was.”
Results point to privacy-enhancing design suggestions.

Automatic detection of potential conflicts
Delayed disclosure
Special-handling of purpose-driven sharing


These are attitudinal questionnaire studies of a sample from the US.

Sample has biases (self-selection, gender imbalance, etc.).

A larger sample can enable additional statistical analyses.

Interviews could provide additional data.

The match between reported and actual practices needs to be verified.

Other cultures need to be studied.
These insights are being extended via ongoing and upcoming research...

Experience-sampling study of LSS.

Online experiment on tradeoffs in sharing of location information.

Development of enhanced privacy management interfaces.

Experiment on online self-presentation.
We designed an avatar-based interface for managing location exposure.

Level of Exposure
Lightness and formality of clothing

Low exposure
Medium exposure
High exposure

I wish to thank:

Apu Kapadia, Adam J. Lee, Greg Norcie

- Kristy Caster
- Yann Le Gall
- Tijana Gonja
- Matthew Holfelner
- Sara E. Justinger
- Mihir Mahajan
- John McCurley
- Joel Ossher
- Roman Schlegel
- Rick Wash

National Science Foundation (NSF)
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In summary…

1. People use LSS for individual, social, and economic reasons. 
   *Privacy management mechanisms need to focus on the broader interactive context and intentions.*

2. Consumer rewards and offers nudge people toward sharing location. 
   *Interfaces could provide information and interactive functionalities that facilitates informed privacy choices.*

3. Inappropriate location disclosures could lead to regret and negative social consequences. 
   *Appropriate protective mechanisms could help avoid potentially regrettable disclosures.*
Disclaimer

This material is based upon work supported by the U.S. Department of Homeland Security under Grant Award Number 2006-CS-001-000001 under the auspices of the Institute for Information Infrastructure Protection (I3P), and the National Science Foundation (NSF) under grants CNS-1016603 and CNS-1017229.

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