

# Comparing 2 Mobile "Location Sharing Systems"

*Sharing one's geographical location with friends.*

**Final Report**

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# Introduction

Location Sharing Systems are burgeoning. While services such as Foursquare and Loopt have been growing rapidly in terms of number of users, others are joining in too. Not only a plethora of smaller tools have sprung up in recent times, but also the established brand names in the field of social communication and communication technologies such as Google and Facebook have adopted these services (Google Latitude and Facebook places respectively). Therefore, it is reasonable only to foresee a large scale penetration of Internet users by these services in a not too distant future.

A group of researchers at University of California, Irvine is examining the *adoption and usage of Location Tracking in Online Social Networking* with a particular focus on Google's adaptation of Location Sharing Systems – Google Latitude. The group performed an ethnographic study of people's attitudes towards and adoption of Google Latitude and to understand how they perceive Latitude as a part of their social networking and communication technologies experience. The participants comprised of the users and non-users of Latitude, and those whose Latitude usage has dropped off to understand the barriers to adoption. It is important to note that although there are earlier studies reporting privacy concerns with regard to location tracking, this study steps up to try and identify various salient pressures/tensions such as adoption trends, social conformance, audience management, and information filtering that are the entailed by the use of Google Latitude.

Additionally, in order to further establish the validity of the users' concerns identified in the above mentioned study, the research group designed a prototype location sharing system called Longitude. This prototype system is equipped with a set of features additional to the custom location sharing attributes that address the social pressures reported by the users.

Our research focuses on the comparative evaluation of Google Latitude with Longitude with regards to privacy, social pressures, appropriateness in the various social situations like friends, family, workplace etc. The ultimate goal of this study is to prepare the two applications for a formal usability test. Firstly, the existing test scenarios (handed over to us by the research group) for longitude were revised via brainstorming sessions and discussion. These revisions were synchronized with the corresponding user test script and the Longitude prototype was modified accordingly. Secondly, we synthesized the parallel user script and prototype for Google Latitude. This was followed by 2 rounds of Pilot studies and a detailed results analysis to congregate users' feedback for each system with respect to (a.) the privacy concerns, (b.) the perception of 'friends', (c.) the social pressures at play and (d.) the issue of reciprocation.

# Methodology

## Task 1: Conceptual Analysis

The first task for the group was a conceptual analysis. This included analyzing the user scenarios that were already in the script as well as those that were not, becoming familiar with the Longitude prototype, becoming familiar with the Longitude script (in addition to the scenarios), researching location-sharing systems in general, and becoming familiar with Google Latitude (the application that Longitude is based on).

The scenario analysis was the biggest part of this first task. We analyzed 121 scenarios spanning many topics, including habits, safety, and reciprocity, as well as 10 questionnaire items based on how well they addressed privacy and social concerns, how well they tested usability issues (which was a secondary concern), how realistic they were, and if they were logically sound. We also looked for repetition and ways to combine multiple scenarios into one.

This is one example of a scenario that we felt directly addressed social and privacy concerns. The scenarios are on the left and our comment is on the right.

<p>+B2: Hide location to avoid contact</p> <ul style="list-style-type: none"><li>● <b>I've been really busy lately and so I sign out of [latitude longitude] so that people know not to contact me.</b></li><li>● I told my friend that I didn't feel like going out, but ended up going out with some other friends. I temporarily blocked the first friend in [latitude longitude] so that he wouldn't see I had gone out.</li></ul>	<ul style="list-style-type: none"><li>● Both very practical and directly address privacy concerns and represent good features to include.</li><li>● Both are likely to come up often and reflects questions that users will be thinking in their minds. The system must work for the user to allow them to feel "safe" using location-sharing.</li></ul>
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We presented the analysis in the form of a qualitative evaluation, commenting beside each bulleted scenario or group of scenarios (see Appendix Section 1.1). This evaluation led to narrowing down the scenarios to 20 individual scenarios and fewer task domains (see Appendix Section 1.2).

We also analyzed the differences in functionality between Longitude and Latitude in order to ensure parallel functionality between the two prototypes, and parallel scenarios and processes in

the scripts. The user experiences had to be as close as possible in order to maintain consistency, and therefore, experimental validity. There was in fact certain functionality present in Longitude but not Latitude and vice-versa.

This is a list of functionality found in Longitude and not Latitude:

- Pauses location tracking
- Window shade drop down to see friends
- Highlighted city-level area
- More warnings about what kind of information you're sharing
- Frequent contacts shown on top
- Tells you number of friends in an area
- Organized list by frequency of contact
- Logging

This is a list of functionality found in Latitude and not Longitude:

- Random pauses
- Manually pausing in Longitude (Latitude's semi-parallel feature is hiding from someone, but it's asymmetrical)
- Longitude shows people in the current region in a list rather than on the map. Tells you how many in are there in the current area. These friends are listed in order of contact frequency. (Latitude just shows everyone on the map)
- Manually setting location (not supported in Longitude)
- Longitude warnings about what kind of info you're about to share
- Longitude logs when someone sees your location
- CONTINUOUS real-time location sharing is available in Latitude (Longitude does ON-DEMAND real-time location sharing)

## **Task 2: Creating and Modifying Scripts / Creating and Modifying Prototypes - Round 1**

The process of creating and refining scripts, and creating and refining prototypes, occurred simultaneously, with the exception of creating the Latitude script before creating the Latitude prototype since there was no existing script for Latitude like there was for Longitude. This process was also highly iterative. There were numerous incremental versions, going back and forth between script and prototype, eliminating errors and making content changes along the way.

Once our conceptual analysis was complete, we went to work on our first of two rounds of creation and revision. The majority of the changes made to the Longitude script were added questions, within the scenarios, to get more information along the way about how the user felt about social, interpersonal, and privacy issues. For example:

*<scenario C4> “Now you take a look at your Longitude log and see that Ben has clicked on you as well. How do you feel about that?”*

*[RECORD answer]*  
*“Why do you think he clicked on you?”*

To make a parallel experience in Latitude, this text was inserted:

*“Now suppose Ben had been tracking your location through Alpha, as you had been for him. How would you know that he was tracking you?”*

*[RECORD answer]*

*[IF CORRECT] “Right, you wouldn’t know that he was keeping track of your location.”*  
*[IF WRONG] “Actually, you wouldn’t know that he was keeping track of your location.”*

*“How do you feel about that?”*

*[RECORD answer]*

*“Why do you think he was tracking your location?”*

*[RECORD answer]*

There were also changes made to make the script flow a little bit better—like more of a story, such as changing this text:

*“Great. Now you can see Ben in this bar” [ACTION] researcher points to friend bar “which lists contacts who are currently in the area being displayed.” [ACTION] researcher points to Irvine area. “In this case, the city of Irvine is being displayed. Using Longitude, you are able to see Ben’s location on demand. Please find out where his is now.”*

To this:

*“Great. Now you can see Ben in this bar” [ACTION] researcher points to friend bar “which lists contacts who are currently in the area being displayed.” [ACTION] researcher points to Irvine area. “In this case, the city of Irvine is being displayed. Using Longitude, you are able to see Ben’s location on demand.*

*<C1a> Now, let’s say you’re moving some heavy furniture today and want to borrow Ben’s truck. However, you don’t know whether he’s left Irvine to go on vacation yet. Please use Longitude to figure out whether you should call Ben based on his current location.”*

We created the Latitude script from the Longitude script, modifying it to match the specific functionality of Latitude. We used Google’s actual Latitude application to go through the Longitude script to see what would need to change and how to change it, in addition to using the functionality comparison we had already done. We paid particular attention to the opportunities to highlight a social or privacy concern resulting from a difference in functionality. One example of this sort of change can be seen in Latitude <scenario C4>:

*“Now suppose Ben had been tracking your location through Alpha, as you had been for him. How would you know that he was tracking you?”*

*[RECORD answer]*

*[IF CORRECT] "Right, you wouldn't know that he was keeping track of your location."  
IF WRONG] "Actually, you wouldn't know that he was keeping track of your location."*

*"How do you feel about that?"*

*[RECORD answer]*

*"Why do you think he was tracking your location?"*

*[RECORD answer]*

Longitude has a contact log where the user can check to see who is tracking them and when. Latitude has no such functionality so we got the opportunity to ask the user how they would feel about not knowing that their friend is tracking them. The way this question was presented in Longitude instead asked about how the user felt knowing their friend clicked on them:

*"Now imagine you take a look at your Alpha log and see that Ben has clicked on you as well.[AK1] How do you feel about that?"*

*[RECORD answer]*

*"Why do you think he clicked on you?" [expected] Well in this case, Ben wanted to see how close you were to arriving at his house. Since you are still at home, he decides to call you and find out when you are planning to leave."*

*[RECORD answer]*

This is an example of a script change that pertained directly to a difference in functionality. In Longitude, you can only see city-level location information for contacts that you are infrequently in touch with. Then, if that contact wants to see your specific location, they must make a request each time. In this case, the user's mother-in-law, Isabella, was used:

*"After several lengthy trips out to see you and your spouse, Mother-in-law Isabella tells you that it would be easier to just know your exact location all the time, instead of sending these requests and waiting for a reply. However, based on what you now know about Alpha, you know that Isabella must continue to send location requests for one-time snapshots of your location. Even if you and Isabella interacted much more frequently, she could not have your location updating automatically and continuously displayed on her map - she would have to click on you each time which would be recorded in the log."*

*"What do you think about not being able to continuously disclose in this situation?"*

*[REPORT & RECORD ANSWER]*

The Latitude equivalent takes into account the functionality of being able to change which location information you share with each friend, as opposed to Longitude adjusting this information automatically, based on frequency of contact.

*"Isabella makes several lengthy trips out to see you and your spouse. Often, when you arrive home Isabella calls to let you know she's stopping by to say hi. What do you think about automatically disclosing your location in this situation?"*

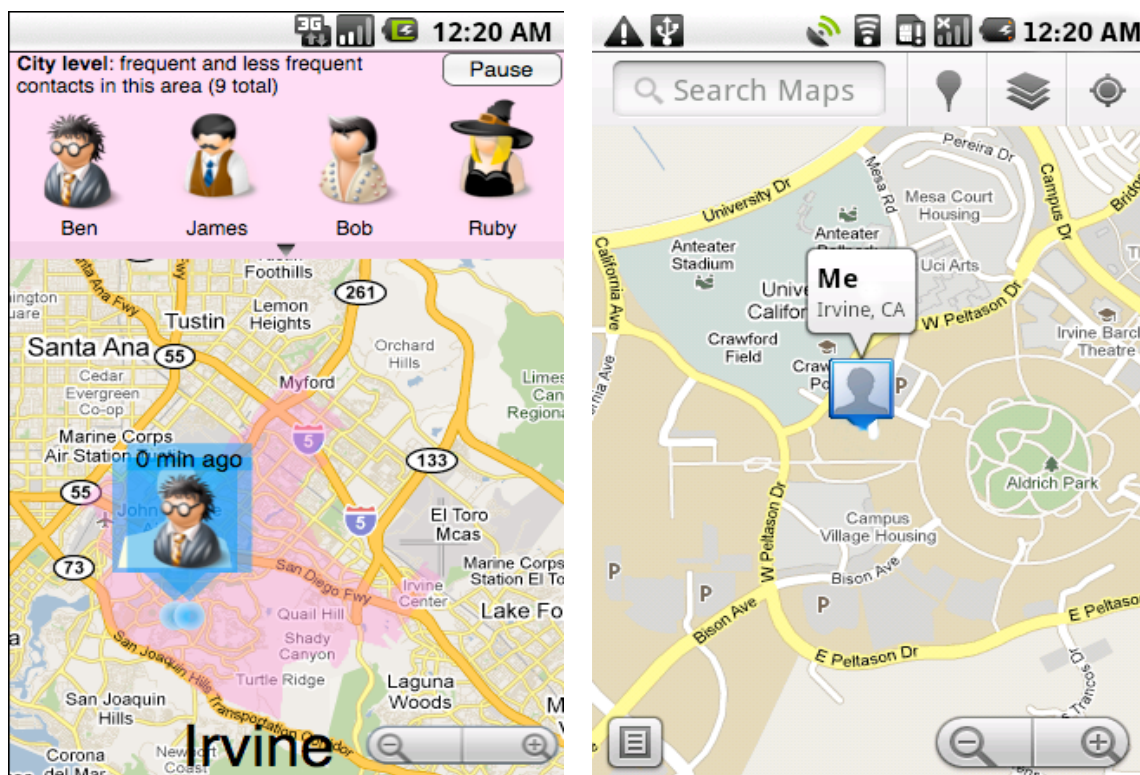
*[RECORD ANSWER]*

<scenario C1c>

*“What if you had previously agreed to chat on the phone with Isabella to help her coordinate some details of her trip. Would it be okay for her to automatically know when you get home so that she does not disturb you at work?”*

Once we began the creation of the Latitude prototype, we discovered even more differences in functionality between Latitude and Longitude. The process of creating the Latitude screens and checking each step of the way with the script to see if the script would lead the user in the correct way through the task was very revealing of many small changes to make in the Latitude script and prototype.

For example, Longitude has a friends bar at the top of the screen that always displays your most frequently contacted friends (up to four) within the map area currently on screen and also tells you how many friends in total are in the current map area. The friends bar can be expanded to view the rest of your friends. Latitude doesn't display friends according to frequency of contact, nor does it have an “always on” friend's bar, but rather a friends list, which is accessible by a button-press from the main map screen and it displays friends in order of proximity to the user. We had to adjust the wording in the respective scripts to match the app-specific steps the user had to take, as well as explaining what the user saw on screen. For example, in the Latitude friend list, there is a timestamp for the last time the friend updated their location, the distance from the user, and the city/state for each user.

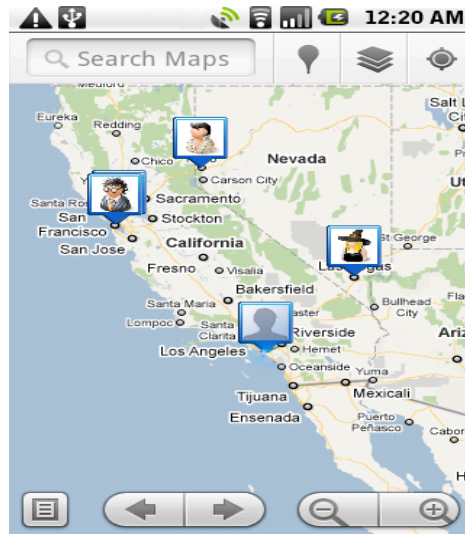


*(Longitude is on the left, Latitude is on the right. You can see the friends bar with the four friends in Longitude. The friend's list button for Latitude is the little icon in the bottom-left corner.)*



*(You can see the expanded Longitude friends list on the left and the Latitude friends list on the right)*

Another example of an issue that came up once we started building the Latitude prototype is that there was a new scenario created wherein the user has to count how many friends are in an area in order to determine where they should take a road trip to. In Latitude, there are three ways to tell how many people are in a certain area (for example CA and NV): 1) the people are spread out enough across the area that the eye can see how many icons are in the area. 2) you can press either the left or right arrow buttons to cycle through each icon, and in that way you can count the number of people you go through till you arrive at the one you started at (fairly confusing). 3) go to the friend list and read where each person is (the list tells you city/state for each friend). None of these are parallel to Longitude, so we chose to place the friends in areas spread around the map and have the user count as many as they could visibly see from a far-zoomed-out view.



Here, the user was asked:

*“Can you tell me how many friends you can see in either CA or NV?”*

Since the user can’t tell exactly how many friends are there, the answer was phrased as follows:

*[IF CORRECT] “That’s right, at least 4 of your friends are either in CA or NV.”*

*[IF WRONG] “Actually, at least 4 of your friends are in either CA or NV.”*

We also had to figure out a prototype usability issue in this scenario. The user must zoom-in on both San Francisco and Las Vegas to count the number of friends in each city. Panning would normally be involved in this sort of maps function, but we didn’t have a way to "fake" panning in a realistic way in the prototype. Instead, we implemented a double-tap to zoom-in on a particular location on the map, since this functionality is present in most maps applications anyway.

As has been illustrated already, the editing, refining, and creating of scripts and prototypes was highly iterative. Some of the changes we made ended up being cut from the final script. One such example was adding to both scripts a “serendipitous meet-up scenario”. We were given sample scenarios, and then we added the following (excerpt):

*“Now let us come to a situation where you are now on Longitude for a while and you want to explore its ability to allow friends to plan surprised visits or to have unplanned encounters.”*

*<Scenario A4a.>*

*“It is Saturday evening and you know that most of your friends are out of town for this weekend. So you plan to log on to longitude to explore whom could you hang out with. You see on the longitude screen that your good old friend Ben is back in town from his out of state job. You set up a meeting with him.”*

*“What do you think about being able to explore your options for meeting someone?”*  
*[REPORT & RECORD ANSWER]*

The Latitude prototype was created by taking screenshots from the actual Google Latitude application. We also used Photoshop to make some custom screens. The Android build was then put together using Eclipse, putting image maps on the screenshots.

The Longitude prototype was created before our group was involved, using Omnigraffle, so the Longitude prototype changes were made using Omnigraffle.

### **Task 3: Pilot Test - Round 1**

Once the scripts and prototypes had been created and revised to an acceptable level, we ran our first of two rounds of Pilot Tests. We tested two users each for Longitude and Latitude. Since this was only a pilot test and not the real usability study, we weren't under as stringent guidelines for having a totally diverse spectrum of test subjects. However, we did do our best to get subjects that were of different ages, different genders, lived in the US for at least five years, and had little experience with smart phones (as was requested by our client). Sending out emails to lists proved not to be useful in recruiting users, so all of our users were people we knew personally.

In order to collect data from the pilot tests, we did screen recording, audio recording, and note taking during the test. There were multiple prompts in the script to get user feedback, and we also asked them to think aloud as they performed the tasks. We created a template spreadsheet for the note taker to use to write directly into during the test, which made the process of analyzing the task completion success rate and user feedback much more efficient than taking prose notes and then transferring to a spreadsheet. We also used pre-and-post-test questionnaires, with our client providing the questions for us.

### **Task 4: Creating and Modifying Scripts / Creating and Modifying Prototypes - Round 2**

We went back to the iterative process of changing our scripts and prototypes based on the experiences of the first round of pilot tests. There were far fewer changes made in this second round of revision. The biggest changes we made were related to the formatting of the script itself, in terms of readability during the test. The test flowed very quickly, and the note taker had to record a lot of data, including time stamping when users responded to questions and start/end times for tasks. In order to follow the script smoothly and not fall behind the pace of the researcher, we re-formatted the scripts.

We implemented two types of re-formatting to see which would work better. One type, used on the Latitude script, followed a screenplay type of format; assigning different colors of highlighting to the various types of text to be spoken aloud, note taker actions, etc. (this is explained in detail in the Notation section of the script). We also changed bulleting, indentation, and section headers to be consistent and easier to read. Here is an example:


“To make this more concrete, let’s start the first task. Ben will send you a friend request to connect on Alpha. Accept his request so that you can share your locations with one another.”



[ACTION] researcher clicks on hidden button, which starts user at friend request screenshot

[START TIMER]

The other type, used on the Longitude script, was to place action icons beside the different types of text to speak aloud, note taker actions, etc. (this is explained in detail in the Notation section of the script). This method would not require color printing. Here is an example:

"To make this more concrete, let's start the first task. Ben will send you a friend request to connect on Alpha. Accept his request so that you can share your locations with one another."

[ACTION]  The first time the participant tries pinch to zoom inform them right away that the software does not support that.

- [ACTION]  Take the phone away from the user and click on the hidden button which starts user at friend request screenshot <T1A01> and hands over the phone over to the user
- [START TIMER] 

We made other small adjustments like removing all places from screens where the words “Longitude” or “Latitude” were visible and adding more opportunities for the user to reflect on their feelings about overall usability.

## **Task 5: Pilot Testing - Round 2**

There were some issues with the users recruited in the first round of pilot testing, so we took extra effort to recruit certain types of users for round 2, specifically, people who were living in the US for at least five years (there are a lot of international students at UCI and we needed people who would not offset the cultural bias). We ended up overall, for both rounds, recruiting half male half female test subjects, in an age range of 22 - 38, and half did not have experience with smart phones, and only one user who has not lived in the US for five years.

We used the same testing methods as in the first round of pilot tests.

## **Surprises Along the Way**

We encountered some surprises during the process of script and prototype revisioning. One of them was that Google updated both Maps and Latitude and some functionality changed. We had to update our script and prototype for Latitude accordingly.

Another surprise (not exactly a surprise, but definitely something unexpected) was learning Omnigraffle. Omnigraffle is typically used to create information architecture diagrams, so learning how it was used in a graphic design capacity was difficult at first since the group was all accustomed to using Photoshop.

Our client also decided to change the name of the application used in the scripts from the actual application names to Alpha, in order to remove any bias that the name might create during the test.

## **Results and Observations**

There were 2 prime objectives of this project

1. To validate the effectiveness of
  - A restructured and updated Longitude script and prototype incorporating several new real life scenarios
  - A new Latitude script and prototype constructed on scenarios that paralleled those on the restructured Longitude script.
  - The usability test as a whole from the perspective of a participant and an interviewer/note-taker.
2. A comparative usability study based on cognitive walkthroughs of the the Latitude and Longitude prototypes to analyze and understand the pros and cons of each system under near identical real-life scenarios through 2 rounds of pilot testing.

Let us now delve deeper into the final results of these 2 objectives and analyze them in further detail.

### **Effectiveness of Usability test artifacts**

One of the most important objectives of this study was to investigate how effective the usability test artifacts; which comprised of the usability test script, prototype android applications

mimicking the actual application by manifesting real life scenarios through a sequential compilation of screen shots of the actual application (in case of Google Latitude) and mock-up screens (in case of Longitude), accompanying pre and post user survey questionnaires; and the overall usability study was from the perspective of a participant and also from the perspective of an interviewer and note-taker.

This assumes significance as we could undertake only 2 rounds of pilot testing due to unavoidable time constraints on the project and therefore understanding the effectiveness could sieve out issues in the script that would have been too costly if discovered during a future full fledged usability test.

The data acquired for this analysis were mostly qualitative and can be categorized as

1. Answers to open ended questions during the course of the study and after the study captured in the *Overall\_Survey\_Data.xlsx* spreadsheet and *Consolidated\_PilotTestResponses.xlsx* spreadsheet *in Appendix Section 1.4*.
2. Observations of the researchers in terms of behavioral changes of participants during the entire course of the study partially captured as notes in *Consolidated\_PilotTestResponses.xlsx* spreadsheet *in Appendix Section 1.4* and gathered during interactions of team members including the project lead in weekly team meetings.
3. Observations of the researchers in terms of the problems faced during execution of the study also captured partially as notes in *Consolidated\_PilotTestResponses.xlsx in Appendix Section 1.4* spreadsheet and gathered during interactions of team members including the project lead in weekly team meetings.

## **Observations and Analysis**

1. **Participant's perspective:** Overall the participants believed that both Latitude and Longitude prototype evaluations were carried out well. The researchers were lucid in their explanation of the tasks and in giving general guidance. However the following points are noteworthy
  - a. At least 3 participants felt that there was lot of time felt involved on the part of the researchers to explain the system functionality during the tasks and thereby there might have been a loss of continuity between tasks to a certain extent.
  - b. Also at least 2 participants directly felt the need to introduce a system guide or a tutorial at the beginning of the evaluation so that the participants could concentrate more on the tasks at hand rather than worry about the system during the tasks. Interestingly one of those participants was a non-smart phone user.
  - c. At least 3 participants indicated that the 1st post-test survey was a bit long, although 1 among them also made the point that once the participant understood the format of the survey one could proceed at a faster rate.

2. **Researchers (Interviewers and Note-takers) perspective:** One of the concerns that arose out of the 1st round of pilots for both Latitude and Longitude prototypes was the difficulty in navigating the script as there was no clear way of identifying when the interviewer had to spell out directions, click hidden buttons and where the note-taker had to be ready to record, start and stop timer. Although the scripts clearly demarcates such tasks it was a case of being able to visually distinguish such tasks under actual interviewing conditions with the added responsibility of not losing the flow of the interview. This concern was addressed in the 2nd round of pilots by introducing additional icons and visually identifiable styles like Bold and Italics at points of interest, a second approach to tackling this concern was to color code points of interest. The first option has the advantage of being printable in black and white and would be a cheaper alternative if multiple copies needed to be distributed across a number of interviewing teams for the final usability test. The second option is easily identifiable on a standard computer screen but would be costlier if printed copies need to be handed out to multiple interviewing teams.

A few other concerns were as noted during the course of Longitude prototype evaluations

Task Details	Problem encountered
Task Set 1 - Scenario A3/C3	All the users had a problem figuring out the zoom button easily and then had trouble using it which might have been as a result of the prototype inaccuracies.
Task Set 1c – Scenario C4	User did not know to click on a contact’s icon to get an update on their location. Same user noted that it would be useful to have more descriptive information on the application, or a help guide.
Task 2 – Scenario C1b	Two users have difficulty understanding the frequently contacted friend’s paradigm; another user notes that he’d like to have more control over who is displayed in the frequently contacted friends list.
Task 2b2 – Scenario A4b	Two users had difficulty understanding that one tap would focus in on a city (SF or LV), and subsequent zooms would require clicking on the zoom button. One user was eager to continue tapping to zoom, while the other was accustomed to clicking on zoom.

Similarly the Latitude prototype evaluations had the following specific concerns

Task Details	Problem encountered
Task Set 2 – Scenario A5a	One user mentioned incorporating a short-cut function in the map itself, creating an instant connection, rather than going to the friend list for all interactions with a contact.
Task set 2b – Scenario A4a	Two users had difficulty understanding the task; one tried to determine the exact number of friends in both cities by zooming in and counting, while the other tried to use different methods to find the number of friends. Clarify the need to <i>approximate</i> the number of friends.
Task Set 2b2 – Scenario A6/C5	One user required several clarifications before fully understanding the question.

### **Results of comparative cognitive walkthroughs of the 2 prototypes**

The cognitive walkthroughs (will be referred to as pilot testing as well) were conducted over 2 rounds for each prototype. Each round had 1 - 2 participants. The Longitude prototypes were evaluated across 3 participants over 2 rounds and the Latitude prototype was evaluated across 4 participants over 2 rounds.

The data gathered for this analysis is a mixture of quantitative and qualitative and have been categorized as below:

1. Structured pre-study questionnaire which captured user perspectives on different real-life scenarios. These scenarios are the ones which are actually modeled into the prototypes. The answers had to be rated on Likert scale ranging from 1(Not important at all) to 7(Extremely important). (*Refer Pre Survey sheet in Overall\_Survey\_Data.xlsx in Appendix Section 1.4*)
2. Semi-structured post-study questionnaire which captured user perspectives on the same real-life scenarios as that of the pre-questionnaire but where formulated in the context of the tasks assigned. The answers had to be rated on a Likert scale ranging from -

3(Completely disagree) to 3(Completely agree).(*Refer Post Survey 1 sheet in Overall\_Survey\_Data.xlsx in Appendix Section 1.3*)

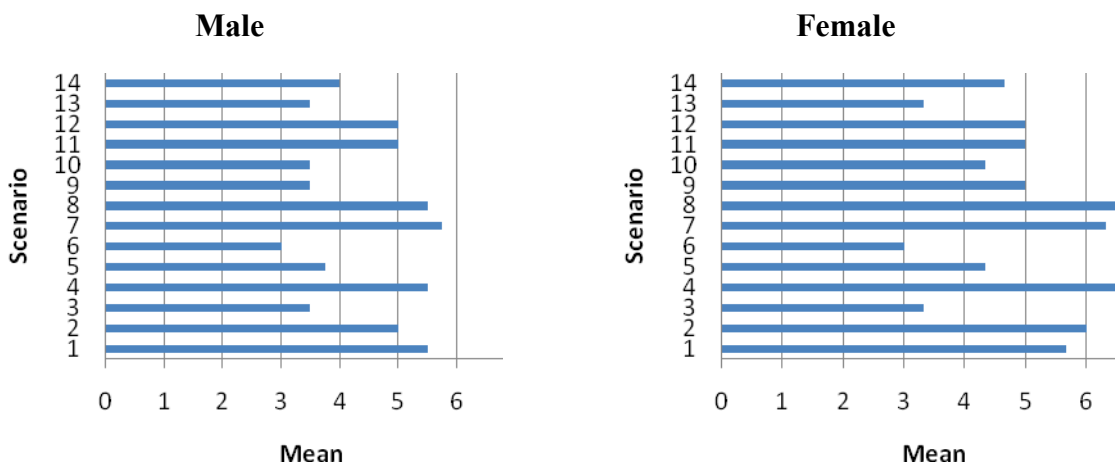
3. A second semi-structured post-study questionnaire which captured the participants demographics in terms of age, gender, type of mobile phone and its usage, social networking habits, current occupation, level of education and last but not the least the amount of Internet usage. (*Refer Post Survey 2 sheet in Overall\_Survey\_Data.xlsx in Appendix Section 1.4*)
4. Time taken to successfully complete tasks, open ended questions captured as user responses during the course of the study and researcher observations captured as notes during the course of the evaluation. (*Refer Consolidated\_PilotTestResponses.xlsx and Overall\_Survey\_Data.xlsx in Appendix Section 1.4*)

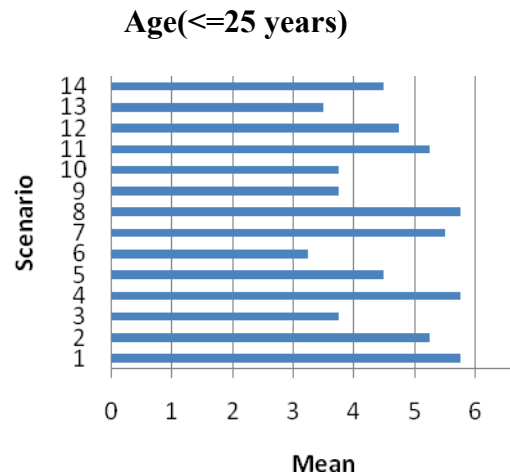
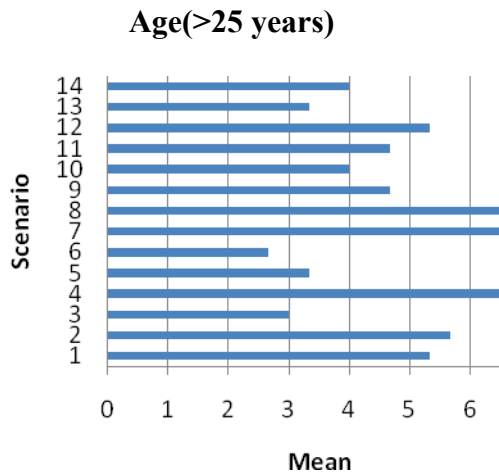
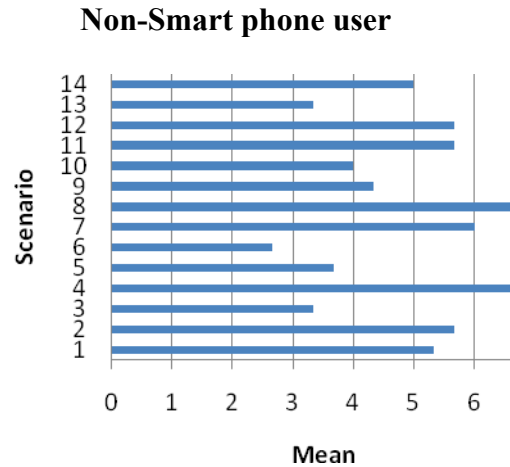
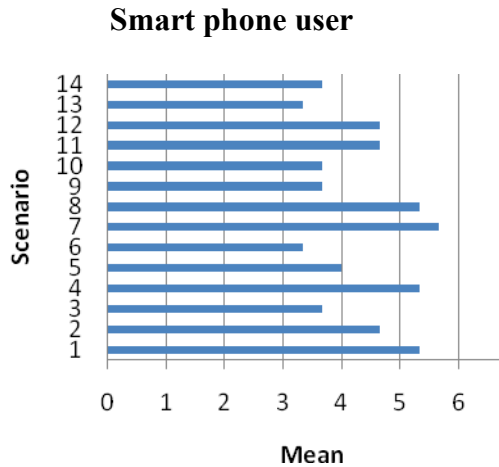
## Results and Observations

All analysis done is a on a very small set of users hence the results may not reflect the true picture and therefore should be treated only as a pointer to the actual results. The first 3 results and observations are based on the quantitative data of the surveys; the last one is based on the qualitative data.

**Pre-study questionnaire Result:** This questionnaire surveys the user on 14 scenarios. The following graphical results show the mean of user responses for all 14 scenarios, here users have been categorized as

1. Male and Female
2. Smart phone users and Non-smart phone users
3. Age > 25 years and Age <=25 years.





**Observations:**

In the purview of gender comparison females seemed to consider meeting back with people from whom they have been separated more important than males (Scenarios 4 and 8). Also females on an average considered more important the scenario of finding opportunities to meet-up with a specific person based on their location than males.

From a perspective of owning a smart phone versus not, owners considered more important the scenarios of co-ordinate the timing and location of meeting a specific person with whom they had agreed to meet, meeting back with people with whom they had separated and others to be able to know when to contact me based on their location (Scenarios 2, 4, 8, 14) as against non-owners.

When we observe the data on an age scale it was observed that whereas participants under 25 years considered the scenarios of **others** meeting up with them when previously agreed or when being specifically looked for or when separated as more important (Scenario 5, 7, 8), participants over 25 years considered meeting back with a person with whom they got separated with in other

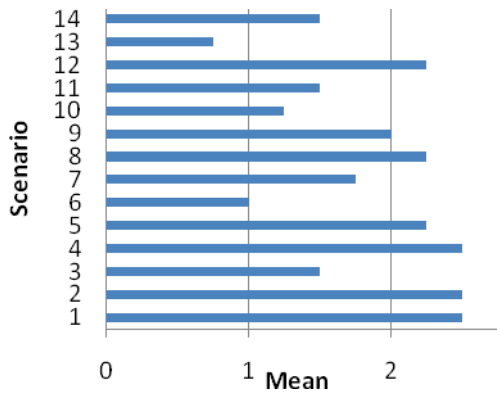
words they consider it more important to meet up with someone with whom they have been separated from their side.

**Post-study questionnaire 1 Result (1st Part):** The 1st part of this post-study questionnaire had 14 scenarios each of which had to be answered in the context of

1. Usefulness
2. Ease of Use
3. Level of Comfort
4. Zeal
5. Bother others
6. Will use it
7. Often use it

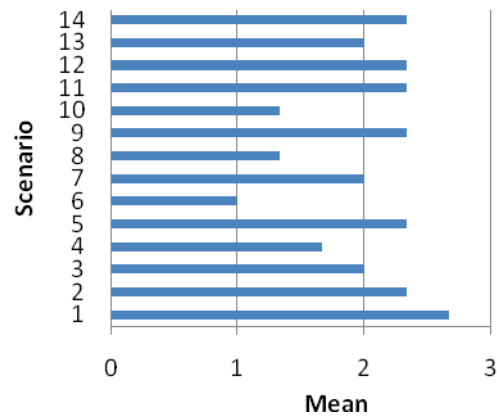
The following is a comparative graphical listing of the results obtained. The X-axis is the mean calculated for the values reported by the participant for either Longitude or Latitude and the Y-axis represents the scenario number (*Refer Appendix Section 1.3 for the Scenario No to Description mapping*)

**Latitude prototype**

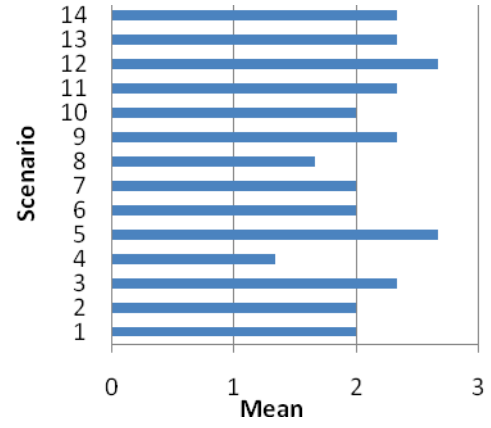
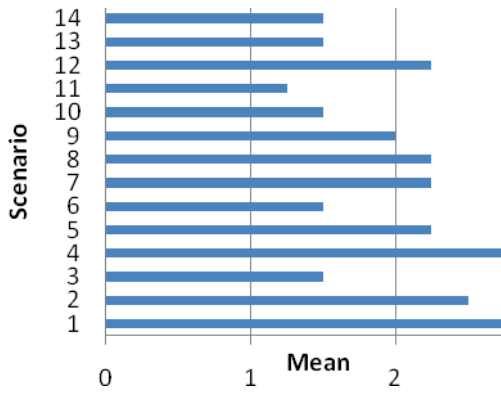


**Longitude prototype**

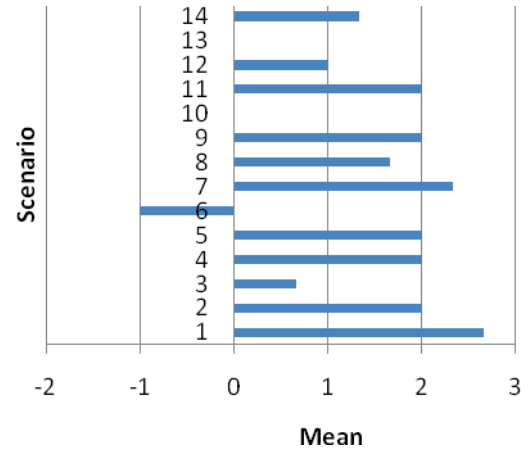
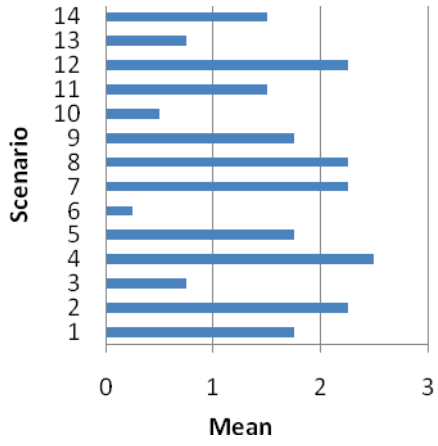
**Usefulness**



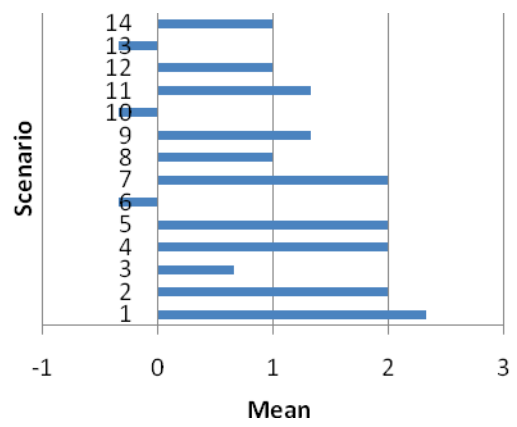
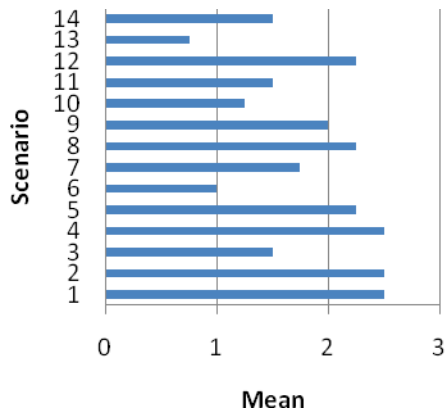
### Ease of Use



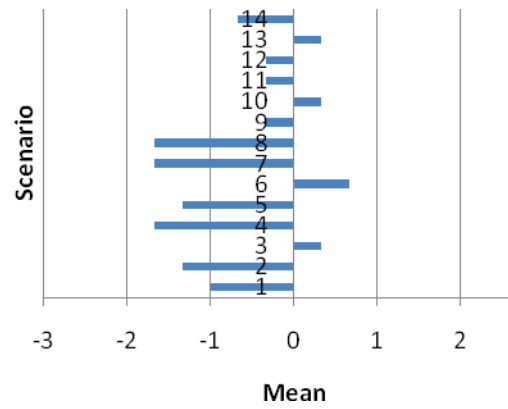
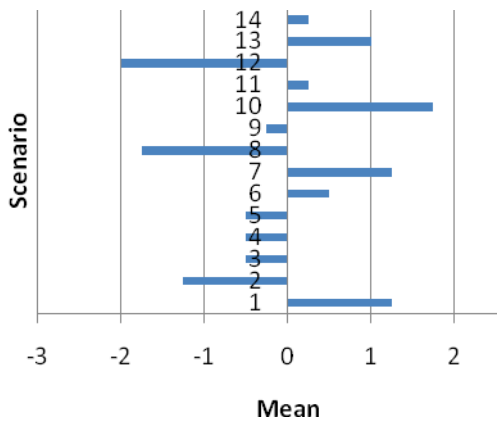
### Level of Comfort



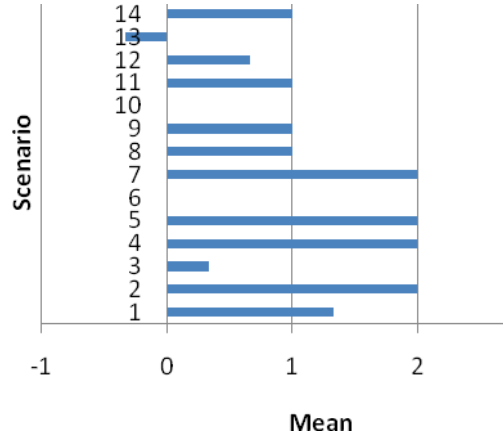
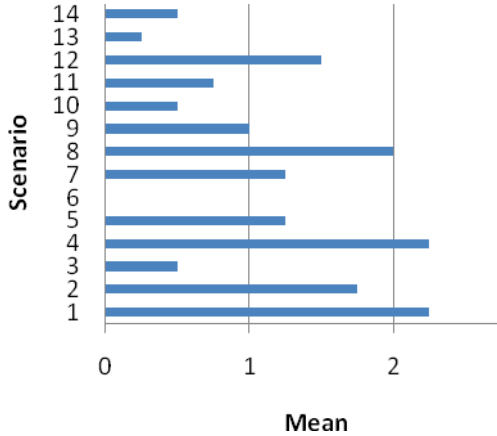
### Zeal



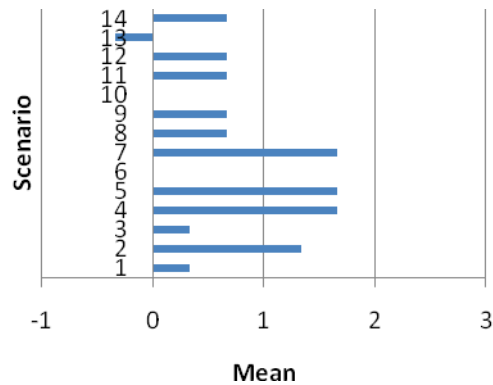
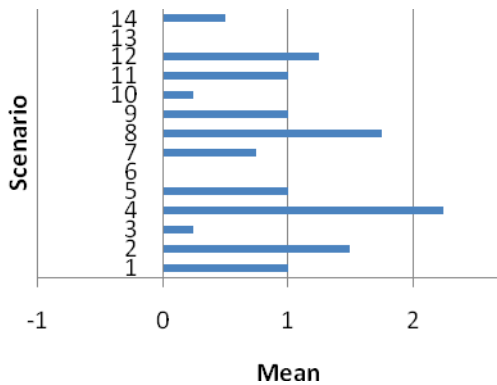
### Bother others



### Will use it



### Often use

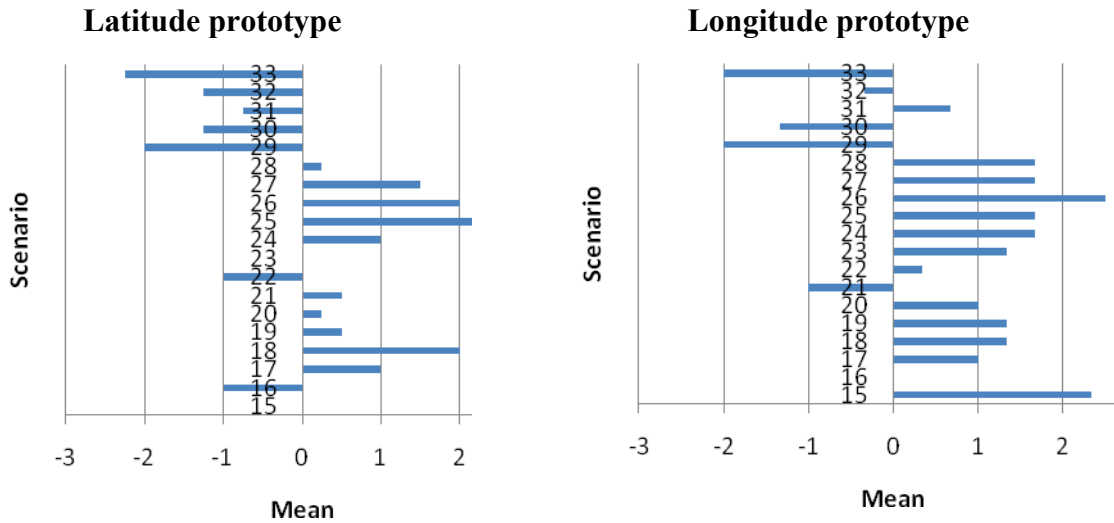


### Observations:

1. On the **Usefulness** scale the Longitude prototype scores higher on an average on all the scenarios except for the meet back with scenarios (Scenario 4 and 8).
2. Longitude again scores higher on an average in the **Ease of use** scale, but Latitude again scores higher on the meet back with scenarios and scenarios of meeting with a specific person and the coordinating the timing and location of meeting a specific with a previous appointment (Scenario 1, 2, 4, 8).
3. In terms of **Level of comfort** and **Zeal** the Latitude responses have a greater positive average over Longitude; especially noteworthy are differences in responses for Scenarios 6, 10 and 13. Longitude users averaged either a zero or negative value.
4. When questioned whether the use of either Longitude or Latitude in each of the scenarios would **bother others** Longitude achieves a better negative average indicating that users didn't agree as much to this aspect.
5. On the question of **Will use it** and **Often use it** Latitude seems to have a better average on the degree of agreeability over all the scenarios. Special note should be taken on

Scenarios 4,8, 13 and 10 where the scenario in which others are able to find opportunities to contact the user based on the location even though they are not specifically looking for the user (Scenario) produces negative averages for Longitude for both conditions.

**Post-study questionnaire 1 Result (2nd Part) :** The 2nd part of the post-study questionnaire surveys the user on their usage experience with either Latitude or Longitude. There are a total of 19 scenarios (*Listed out in the Appendix*) numbered from 15 through 33. The X-axis again is the mean calculated for the values reported by the participants either for Latitude or Longitude and the Y-axis contains all the scenarios.



**Observations:**

The Longitude prototype on average scores higher in all scenarios than that of the Latitude prototype and especially the positive scenarios from 22 to 28 that ask the participant whether the application was useful in making a better impression, staying in touch, being more in control etc. Also the participants disagreed to a greater extent on issues of bothering contacts on the user’s list and spending too much time to manage it in case of Longitude.

**Qualitative data and observations**

Another goal of this study was to address the social concerns and privacy issues connected with using location sharing applications. In testing the scripts, we were also able to obtain data from users about their reaction to location sharing devices. These results are presented below, and reference *Consolidated\_PilotTestResponses.xlsx (Appendix Section 1.4)*

Longitude and Latitude both have different features that address different social and privacy issues users may be concerned about. To better understand the pros and cons of each system, user responses to the pilot test were consolidated into a single file to allow for simpler comparisons between users of the same prototype (Longitude or Latitude), and across prototypes as well.

These pilot tests show areas in which users are very concerned about privacy. In Latitude, users' locations are automatically disclosed; in this case, users voiced concerns about their contacts (specifically in this scenario, the mother-in-law) randomly stopping by and surprising the user. One participant noted that it would be considered "intrusive," while another noted that it would create challenges for families, who feel like they have a right to know each other's locations. This sentiment was echoed in Longitude users. In Longitude, user's locations are not automatically disclosed; participants thought positively about this feature, especially when faced with the possibility of a mother-in-law keeping track of one's location.

### **Differences in User Task Completion**

There were some areas in which multiple users from either Longitude or Latitude failed to accomplish a task, while users in the other application were able to successfully accomplish the task. These highlight the functional differences between the two location sharing systems, are useful in determining areas in which either application is lacking. For example, users in both Longitude and Latitude were asked to count the number of friends within the California-Nevada area. Users in Longitude could zoom out, take one look at their friends list and quickly see the exact number of friends within that area. Latitude users, on the other hand, had to zoom out and manually count the approximate number of friends in these two states. This example, while not specifically addressing a social or privacy concern, does point to some usability issues or functionality that could be improved.

In Task 2D, users were asked to give mother-in-law "Isabella's specific location, without contacting her." All Latitude users accomplished this task successfully; they clicked on Isabella's icon, then zoomed in and reported that they could not tell her specific location, only city-level. In a stark contrast to this, two of the three Longitude users failed to accomplish this task. The users were expected to click on Isabella's icon, to which a pop-up dialogue stated that the user could not access Isabella's specific location because they did not frequently contact each other [[insert screenshot](#)]. From this, they were to report that they could not access Isabella's specific location, only her state-level location.

The only difference between the two scenarios was the pop-up notification; they are otherwise conceptually similar. In this case, it may be that Longitude users do not fully understand the concept of knowing someone's specific location only if they are in frequent contact with each other. Because they were using a prototype version of Longitude, there was one correct path users could take to successfully accomplish the task; some users clicked around the Android screen and received no feedback, which contributed to their unsuccessful task. In this scenario, there was nothing the user could do after acknowledging the pop-up notification. It may also be that the users skim over the pop-up notification; one user confessed that she clicked the 'OK' button without reading the dialogue.

### **Similarities in User Responses**

While it is interesting to note the differences between Longitude and Latitude users, it is also interesting to note areas in which users across Longitude and Latitude reported similar results. In the Wrap Up section of Task 2, users were given a number of people whom they might share

their location with: mother-in-law, boss, close friend, old friend, and spouse. Users share the sentiment that there should be more control over who sees what, and how detailed they see the user's location. Most users agreed that sharing locations with close friends was acceptable (except for one user who was vehemently against location sharing except in emergencies), but sharing locations with their bosses was a definite no. Users would like a high level of control over which of their contacts has access to their location.

It is also interesting to note that, while in Longitude, some users wanted Latitude functionality (i.e., being able to constantly share location for a short period of time, like when the cousins are following the user in Ben's truck), and vice versa (Latitude users wanted to have one-time location sharing requests, like for a mother-in-law). Users reported this without knowing about the existence of the other system.

## Future Recommendations

### Script Development

- Although the current study tried to make the scripts a lot more legible (as noted above) this is an area where further improvement could be made.
- It could be beneficial to borrow the format from a theatrical script for more clarity.
- The surveys are too lengthy and can be shortened. Although the reason for their length is that they cater to a wide variety of concerns, but the extraneous text can reduce the size and prevent the subject from losing interest.

### Pilot Test

- Addition of a mini-tutorial prior to user test would be a useful step to avoid device related issues and the focus would remain entirely on the actual test scenarios
- Both Latitude and Longitude prototype can be improved in terms of touch sensitivity.
- Further, the expected response for standard features like pan, zoom etc should remain functional throughout.
- The test could be made more precise while still covering all the scenarios.

## Conclusions

As established earlier, this study was taken up as a subset task of the overall in-depth research to examining the *adoption and usage of Location Tracking in Online Social Networking* with a particular focus on Google Latitude. The goal of our group was to steer this examination up to the state where it is ready for a formal usability test of Google Latitude and Longitude and in the process, gather user feedback through the pilot tests and survey fill ups. The final task was to perform quantitative and qualitative analysis upon this feedback to record users' opinion on the various social pressures with respect to these two applications.

It was observed that the Location sharing systems as a whole are not a widely accepted addition to the extant social networking and communication technologies experience. The various social pressures as noted by the in-depth research were also evident in the users' responses in the pilot tests and surveys. On the other hand, it was clearly noted that the features added to Longitude to neutralize the social pressures associated with location tracking were happily embraced by the users. For example all the test subjects pointed out that the feature of logging adds a sense of control and reciprocity which is essential for these applications.

While privacy remains an important topic of concern and deserves the attention it receives, it is also important for the researchers to devote considerable amount of time and resources to appreciate the enormity of social pressures and tensions which emerge while using these applications.

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