Location and Activity Sharing in Everyday Mobile Communication

Frank Bentley

Social Media Research Lab

Motorola Labs

1295 E. Algonquin Rd.

Schaumburg, IL 60196 USA

f.bentley@motorola.com

Crysta J. Metcalf

Social Media Research Lab

Motorola Labs

1295 E. Algonquin Rd.

Schaumburg, IL 60196 USA

crysta.metcalf@motorola.com

Abstract

We present a study on current, real-world communication of location and activity information based on analyzing context-sharing practices in recorded mobile phone calls. In 176 conversations, we found that over 70 percent contain disclosures of location or activity for one of eight main purposes. Based on our observations, we provide implications for the design of new systems for mobile social software.

Keywords

Location, mobile, presence, conversations,

ACM Classification Keywords

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

Introduction

The mobile phone has enabled changes to the ways that people can plan activities and meet with others. For example, much has been written about people feeling freer to be late and to change plans at the last minute because they have their phones with them [7, 13]. We believe these changes require a reexamination of how people use location in their everyday communication in order to better design applications that fit into people's current practices. We wanted to hear firsthand how location and activity disclosures fit into everyday communication, awareness and planning.

We designed this research to answer the following questions:
• During communications with others, what location and activity information is provided?
• How does context affect activity and location information disclosure?
• What are the purposes of disclosing location/activity information?
• How are disclosures of activity and location similar?

To answer our research questions, we performed a week-long study where we recorded the mobile telephone calls of seven diverse (age, occupation, gender, relationship status, etc.) participants from the Chicago area and analyzed the calls for instances of location and activity sharing. We found that over 70 percent of the calls had instances of location or activity disclosures and that in calls with disclosures an average of 2.8 disclosures were made. We analyzed the data which converged on eight main purposes for disclosure as discussed below. Following our analysis, we developed a set of design guidelines for new applications based on observed practices for planning to meet, negotiating availability, helping others, and keeping others informed of happenings in one's life.

Related Work
We were inspired by the techniques of several researchers who have analyzed conversations in order to learn about mobile location needs. Most of these studies focused on disclosures in a specific part of the conversation, for a specific purpose, or for a certain type of person (e.g. college student, mobile worker).

In a follow up study to [18], Weilenmann and Weuchovius [17] recorded four university students'

conversations for two weeks and looked specifically at the issue of location-tracking. They explored the use of location abstractions that are known to the other party on the phone call (e.g. "home," "school," "where we met last time") to help in micro-coordination tasks.

Laurier [9] studied the conversations of mobile workers (e.g. servicemen, field workers) in the UK who make many calls from their cars. He focuses on disclosures made for coordination in the openings of calls which worked well for his purposes of studying enterprise coordination. Arminen [2] also studied location disclosures in a smaller study of mobile calls and found five main purposes for location-telling, some of which overlap with the eight purposes we found in our study.

While not studying mobile calls, Schegloff [15] looked at location formulation in conversation. He analyzed the specific terms that people used to describe a place and the reasons for that choice in a particular situation. Consolvo et al. [3] studied a similar aspect when looking at what location information an individual would share with others in different contexts.

Another common area of research has been in studying the use of prototypes mobile applications for location sharing [6, 8, 10]. The Watch Me project [10] explored the use of destination predictions along with mode of transportation awareness in order to help people determine when it was socially appropriate to call someone and to maintain social awareness.

Other projects looked at creating systems for location sharing in a ubiquitous environment. The Reno project [6] looked at the issues of denial and deception as well as using activity as a proxy for location. They found

that disclosures of activity and place were fairly equal in number and that often people reply to a location request with an activity.

While the research on location sharing is well documented and widespread, we felt we needed additional detail about the mundane uses of location and activity sharing. We wanted to understand how the context of the conversation affected disclosure, something not widely addressed in the literature. We were also interested in requests for, and responses to, location and activity disclosure.

Methods

In order to understand location and activity disclosure it is necessary to have access to accurate data about what, precisely, is disclosed and the context of the disclosure. Errors in recall would have a significant affect on the outcome of the study. Based on this need, we decided to gather recorded phone calls of our seven participants. They recorded their calls for one week, and we interviewed them about those calls twice during the study. We then engaged in rapid analysis using a team-based affinity version of grounded theory analysis in combination with statistics on abstracted analytical constructs from conversation analysis.

We used an outside recruiting agency to find seven people in the Chicago metro area who would be willing to record their phone calls for a period of one week. They recruited based on diversity along several demographic axes as well as regular cell-phone use. Participants ranged in age from 20 to 39, with four of the participants in their 20's.

Occupation	Gender	Age	Car
Office Manager	F	39	N
Finance	M	32	Y
Healthcare	M	26	Y
Student	F	20	N
Student	M	25	N
Event Planner	M	29	Y
Sales	F	38	Y

table 1. Study Participants.

Participants were given an A780 Motorola phone and asked to use this device as their primary phone for the entire week. These phones allow easy-to-use one-touch voice recording while in a phone call. We transferred the participants' SIM cards (the card containing the identity of a cell phone user) into the device and used the participants' own phone numbers and contacts. Conversations were stored to the SD cards and each participant was given instructions on how to use the features of the phone and how to record their calls.

We recognized the potentially controversial nature of this method and took steps to ensure the privacy of the participants and their friends and family. We required our participants to inform their friends and family that they were recording their phone calls, and our participants were given instructions not to record calls with anyone who asked not to be recorded. The participants also had to actively decide to record a call and press the record button, making recording a conscious choice. Furthermore, they could quit recording during the call without hanging up, allowing for spontaneous decisions to stop recording. We also gave the participants instructions for deleting recorded calls so they could retro-actively decide that a call was inappropriate to share. We collected recordings for 176 calls during the week-long period.

After three days of recording phone calls, the participants sent us the first SD card, and put the second SD card into their phones. We listened to the recorded calls, transcribed the portions of the calls that had activity or location disclosures, and interviewed the participants about their calls and disclosures over the phone. We used the recorded calls themselves, or transcripts of the disclosure to stimulate recall during

the interviews. The participants recorded the rest of the four days' calls on the second SD card, and we conducted the final interviews in-person.

Each instance of the 352 location or activity disclosures was transcribed and annotated with the following information that we collected either from the recording itself or the interviews:
• Participant Pseudonym
• Date/Time of call
• Location or activity disclosed
• Tense of location/activity disclosed (past, present, future)
• Disclosed by caller or callee
• Exact quote of the disclosure/request
• Relationship between caller/callee
• Physical distance between caller/callee
• Turns in conversation before/after disclosure
• Purpose of call
• Lead in to disclosure
• Response to disclosure
• Location of call

Annotation techniques were partially derived from constructs developed in conversation analysis. For example, in order to understand the placement of location and activity disclosures, we used concepts such as openings and closings of conversations, turns, and sequences (see [5, 12]). We used statistical analysis methods to find patterns in the data. We also used qualitative techniques to look for themes in the data (see [14]) and built an affinity diagram modeled on grounded theory and similar to those created in previous work in our lab.

Findings

High Level Patterns

Our seven participants made or received a total of 176 phone calls, an average of 25 per person. Participants were quite varied in the number of calls that they recorded (from 3 to 55). A large percentage of calls, 71 percent, had location or activity disclosures. In calls with disclosures, an average of 2.8 disclosures occurred, with participants about twice as likely (2.1x) to make disclosures about activity than about location.

Participants were about equally likely to respond to a request for their activity or location as they were to offer it up freely without request. Also, whether someone was the caller or the callee made no statistical difference in the likelihood to request or disclose or the types of information requested or disclosed. Likewise, whether a person was mobile or at home made no significant difference in their likelihood to request or disclose location or activity information. Relational distance did not have an effect nor did the physical distance between the caller and answer. Due to the many diverse reasons for sharing location and activity information, we found that it was a part of nearly all communication regardless of setting or recipient.

Structure of Conversations

While we were surprised at the correlations that we did not find in the data, several significant correlations did appear. The opening of conversations, was strongly correlated with disclosures about *current* location or activity (t = 5.9). Often conversations start with questions of availability or icebreakers about location or activity as seen below.

We also observed a correlation between the middle of a call and disclosure of past locations (t = 3.33). This was especially true in longer conversations where participants would spend time "catching up" with others and talking about recent activities and the locations where these activities occurred.

Likewise, a correlation was evident between future activity disclosures and the end of conversations (t = 3.35). Many conversations ended with discussing plans to meet in person, to arrange for future communication, or by using a future activity as a way to end a conversation. In fact, 57% of all disclosures in the closing of conversations were about the future and participants were nearly three times more likely to disclose future activities and locations in the closing than in the opening of a call.

Uses of Location/Activity Sharing

As described above, our affinity analysis was aimed at discovering common purposes for activity and location requests and disclosures. The eight main purposes for sharing or requesting location or activity information are shown in Table 2.

Disclosures as a means of social awareness
The most prevalent disclosures came in the area of creating social awareness. By social awareness, we are referring to an idea similar to what Steinfield et al. described in [16]. Social awareness is a disclosure that allows people to be aware of other's activities in order to feel more connected and aware of their lives.

In keeping close social relations up to date, often participants talked about past activities and future plans. LA4 was telling a friend about a recent date he

had: "On Sunday I just went with a girl to the movies. I was in Highland, Indiana." Many participants also wanted to keep friends and family up to date even though they might live hundreds of miles away. "We're just getting ready to go to Meijer's and then pick [our daughter] up and then go get a Christmas tree." (LA7) These disclosures were a common part of everyday conversation for these participants and helped them feel connected to the rhythms of the lives of those that they cared about even when they were apart.

Many times, our participants were curious about the activities of others and asked to see if they had a correct idea of what someone was up to. LA5's mom asked her "Are you still at home?" to see if she had left for work yet. Likewise, LA4 asked a friend, "Have you made it home yet?" In almost all of these cases, the person asking the question was correct. We observed that people who are close often know each-other's general whereabouts, however are unsure of the exact transition times between activities or locations.

The final area of these disclosures was in trying to create shared experiences, thus creating a sense of physical co-presence similar to that described by Minsky [11]. While participants might have just seen this as sharing fine details of their exact current environment, the resulting experiences help to create a sense of presence between the participants and their close friends and family. While moving around on a call, participants would frequently update the other person on their current location or activity: "Now I'm on the train, I wasn't before" (LA5) or "I'm in the cab right now" (LA7) These disclosures helped place the participant in space while talking with them. LA7 was in a taxi and exclaimed, "Oh! Low flying plane!" in the

Reason for disclosure	Frequency
Social Awareness	27%
Availability	16%
Planning to meet	12%
Helping others	12%
To continue conversation	10%
To end the call	8%
Show Caring	8%
Process Awareness in Work	7%

table 2. Reasons for sharing location or activity.

middle of the call. Participants often asked for more detail. LA5, for example, wanted to know if anyone was smoking at a party her parent's were at. These clarifications represented information that was solely useful as context and was not to be used for any specific task.

Overall, the disclosures in the area of social awareness combined over time for our participants so that they could be better informed about the context of the lives of those close to them in their social networks. For our participants, a series of seemingly mundane disclosures built up to create a rich sense of social presence.

Availability
The second most common use of location and activity disclosure was for the purposes of managing availability. Many participants were quite up front about this type of request with openings like "Do you have a couple of minutes right now?" (LA4). These questions were used to set expectations for the length of the call and to make sure that the other party was available. Another group of requests were less direct, but approached the issue of availability by requesting current location or activity. In this group, participants requested information by saying things like "Are you sleepin'?" (LA5) or "Are you on the road or still in the office?" (LA1) These requests sought to ensure availability before continuing the conversation further.

Unsurprisingly, another main use of availability requests and disclosures was in planning future conversation. Our participants often arranged for future conversation at the end of their calls. Often, this planning was a check to make sure that the other person would be available when called back.

One rather surprising area of availability involved getting the context of third parties, assumed to be with one of the people on the call. We heard people ask the other party on the call what others who were with them were currently doing. In these cases there doesn't appear to be an intent to talk to them, just to know their location/activities. This can be seen when LA2's mom called her to see if LA2's sister had gotten up yet: "Did [your sister] get up?" In these cases the disclosure of activity provides a sense of social awareness to a party not involved in the communication.

Planning to meet
Disclosures about future activity and location were also quite common when participants were making plans to get together. There are several ways that our participants made plans. A common approach was to share some information about one's current location: "Why don't we have coffee someplace downtown?" (LA2) or "Are you gonna come this way?" (LA5). A subset of this category involved making plans to meet the next time that both people would be in the same location such as when LA4 was going to be in the neighborhood of a: "I'm going to stop by later on then because I'm going to be up there taking my mom to get, uh, a root canal … I'm dropping her off at 1, so by like 1:30." In this case, LA4 is taking advantage of the fact that he'll be in the neighborhood of the answerer to take time to get together.

A final use of disclosure around plan-making was in micro-coordination to meet in person: giving precise details of one's location in order for people to find each other. [17] LA5 was trying to meet her fiancé and gave her exact location: "Hey, can you meet me walking down Touhy towards Clark?" LA1 was trying to meet up with

his brother who told him "I'm right in front of La Strada." In these cases landmarks or exact places were given to orient the other party in finding the person that they were meeting. Another case of micro-coordination involved finding out how far someone was away from the caller, often when they were running late. LA5 was trying to meet up with a friend and asked "Where are you at? / I'm walking down Milwaukee"

Disclosures to help others
Another common use of location or activity disclosures was in helping others or seeking help from others who were not present with the caller. Twelve percent of all disclosures sought to seek help from others based on the location of the caller or answerer. For couples who lived together, often calls would be placed from the grocery store to see if the other person needed anything or to develop a plan for what to cook for dinner. These disclosures helped to provide coordination for common tasks of food buying and allowed people to take advantage of the locations of their partners to get any last minute items.

Participants also commonly used location disclosures to help in arranging for transportation or getting help in their current location. Several of our participants did not have cars or shared cars with others and often called to arrange rides for themselves or others. Other participants would call from outside of a person's building to have them come down to help with groceries or other large items: "I'm right downstairs, why don't you come down with the basket?" (LA1)

Furthermore, we saw people calling others to look up information on the Internet for them. Five of our seven users did this and were looking up everything from

directions to weather to getting general information from websites. Sometimes participants who were mobile were also in need of directions. They often had to disclose their precise location or precise destination in order to receive the best directions. After previously telling LA4 that he was on Cumberland Ave. but didn't know exactly where, his friend started yelling out street signs of cross streets as he moved along in his car: "Here's Touhy!" (LA4)

Disclosures as mechanisms to continue the call
Previous research (e.g. [9]) has investigated the role of location or activity disclosures in the opening of phone calls. When not used as a query for availability, in the openings of calls requests of activity or location are often made as a way to find a conversation topic. We noticed that these same sorts of "What's up?" or "Whatcha doin'?" requests are often also used in the middle of conversations. The purpose of these disclosures appears to be as a mechanism to keep conversation flowing and generate further topics to discuss.

In the openings of calls, requests of activity or location are often made as an ice-breaker, especially with those who talk often and call without specific purposes in mind. These disclosures often lead to discussion about these topics and serve as conversation starters. This is how we distinguished "ice-breakers" from availability checks in call openings. In these cases the subsequent conversation revolved around the activity disclosed.

When used in the middle of calls, requests such as these can serve a slightly different purpose - acting to stimulate conversation and introduce new topics to discuss. Responses to these requests follow very similar patterns to the ones above. "What you doin'? / At work"

(LA5) The following discussion then revolves around that activity or location. These disclosures are most commonly seen in long, catching up conversations where participants wanted to prolong the call.

Disclosures as a means to end a call
While disclosures can serve as icebreakers and as a means to stimulate conversation, they can also serve as excuses to end conversations. Participants often used location or activity information in order to terminate a call. Changing location or activity provided the most common reasons, with activities in their environment also providing several reasons for termination.

When participants were about to go to a new location or begin a new activity, they commonly found it a good time to end their conversations and gave their new location or activity as a reason for ending the call. For example, LA3's friend was about to enter a restaurant and wanted to end the call, "I think we're going to go inside, so let me give you a ring back in a little bit." (LA3) Likewise, when LA5 was about to get off the el, she said to her fiancé, "I'm about to get off the train so I'll call you later." (LA5)

Activities that required high cognitive load also were common reasons for ending a call. For example, LA6's coworker was trying to parallel park her car in the snow and just couldn't talk anymore: "The other one, if you give me, actually I'm trying to park my car here, I don't know what the hell I'm doing. Actually let me call you right back."

For these participants, the changing state was a good reason to move on with other tasks. While in some situations it seems clear that the state change was just a convenient excuse to end the call, in cases of cognitive overload or change in environment bringing the call to an end was often required.

Disclosures to show caring
Twenty-eight disclosures revolved around caring about other people. Similar to the helping set of disclosures, these statements are used to show a sense of awareness of others' actions and a desire to make sure that someone is ok.

Often participants were worried about the health or well-being of others and phoned to check on their activity or location. LA5's fiancé was diabetic and she often checked in with him to ask "Did you eat?" LA5 was also concerned about her mom one night when she found out that she was in a bar where a fight was about to break out just outside. LA4 called his girlfriend to make sure she arrived home safely after a rough drive home in the snow: "Just wanted to make sure you actually made it home ok last night and how everything went with the parking."

Disclosures as process awareness in work
We found many instances when participants shared location or activity information in order to perform joint work tasks, similar to the concept of process awareness in [16]. In these instances often the current state of a task is shared or disclosures are made in planning future shared work tasks. For example, LA4's boss asked for the status of some work he was expecting: "Can you give him a call and just ask him to call me when he sends it? … I'm out running around and I'll make a special trip to go home if it's there but if not I'll just wait until later today." LA4 also informed his coworkers of his current state in his tasks: "So I'm gonna send them an

email and I'm gonna work on the [powerpoint] deck this afternoon." In these cases, sharing work activity state helps the other party understand where the work stands and can make more informed decisions about their own work processes.

Implications

While we were surprised at the lack of correlations found between different contexts, people, and disclosures, our data shows that our participants are quite willing to share their context in a wide variety of circumstances and for many purposes. Through our analysis, we have identified several key implications for the design of mobile social software. We believe that systems that take advantage of these implications will help people feel more connected to others while still empowering users to feel that they are not controlled by the information that they share.

Utilize the context people already know
People already know quite a bit about the routines and activities of those close to them. Instead of assuming that users only have the information presented in a given application, designers should realize that people have a wealth of information based on previous interactions and communications.

This finding brings into question the need for many of the context-aware presence applications that have been created that contain complex algorithms to compute inferred context such as destination or mode of transportation. In almost all examples in our study, when participants asked to confirm where someone was or what they were doing, they turned out to be correct. Simpler information that can confirm one's guess at context might be enough for people to infer other rich

information such as location or activity while still providing a great deal of plausible deniability (see [1]) and control.

Environmental cues create rich social presence
Ambient information like street traffic, bus stop announcements as well as explicit information like disclosure of current activities let users infer one's location from small amounts of seemingly ambiguous data given past knowledge about that person's interactions with the world. Systems that exploit information like this do not reveal rich information like absolute location that users are most often concerned about conveying, yet allow those "in the know" to make sense of this data.

It is interesting that ambient noise, often seen as a nuisance to be filtered out, serves this rich function of grounding the other party in the context of the mobile participant. Perhaps systems could be created to share the more interesting or telling ambient noises that one encounters throughout a day in order to provide a rich sense of presence similar to Frohlich's work [4] into combining ambient sounds into photographs.

Create systems that help others and build trust
Our participants often shared contextual information in order to help others or to request help. We believe that there is a widely untapped area for this class of applications. Instead of focusing on ways to allow people to be deceitful with context-sharing, we see a large potential for applications that help people build trust and help each other with daily tasks.

We observed many participants using mobile communication to help others. From getting groceries

and planning dinner to helping with directions in a place where one is familiar, our participants often utilized the context of others to provide help. We believe that there is an opportunity here that is largely unexplored to connect people with those they know who can help. Even close friends might not know all the places that they have visited or have knowledge about and systems like these would provide not only help in context but potentially also spur future communication.

References

[1] Aoki, P. M. and Woodruff, A. 2005. Making space for stories: ambiguity in the design of personal communication systems. In Proceedings of CHI 2005,.

[2] Arminen, I. (2003) Location: a Socially Dynamic Property - A Study of Location Telling in Mobile Phone Calls. In L. Proceedings of The Good, the Bad and the Irrelevant: The User and the Future of Information and Communication Technologies.

[3] Consolvo, S., Smith, I. E., Matthews, T., LaMarca, A., Tabert, J., and Powledge, P. 2005. Location disclosure to social relations: why, when, & what people want to share. In Proceedings of CHI '05, 81-90.

[4] Frohlich, D.M. (2004) Audiophotography: Bringing photos to life with sounds. Kluwer Academic Publishers.

[5] Hutchby, I. and Wooffitt, R. (1992) Conversation Analysis: Principles, Practices, and Applications. Polity Press.

[6] Iachello, G., Smith, I., Consolvo, S., Abowd, G., Hughes, G., Howard, J., Potter, F., Scott, J., Sohn, T., Hightower, J., and LaMarca, A. Control, Deception, and Communication: Evaluating the Deployment of a Location-Enhanced Messaging Service. In Proceedings of Ubicomp 2005, Tokyo, Japan. September 2005.

[7] Ito, M. and Okabe, D. 2005. Technosocial Situations: Emergent Structuring of Mobile E-mail Use. In Personal, Portable, Pedestrian, MIT Press.

[8] Jung, Y., Persson, P. and Blom, J. (2005). DeDe: Design and Evaluation of a Context-Enhanced Mobile Messaging System. In the Proceedings of CHI 2005.

[9] Laurier, E. (2001) Why people say where they are during mobile phone calls. In Environment and Planning D: Society & Space, pp. 485--504.

[10] Marmasse, N., Schmandt, C. and Spectre, D. (2004). WatchMe: communication and awareness between members of a closely-knit group. In the Proceedings of Ubicomp 2004.

[11] Minsky, M. Telepresence. Omni, June 1980.

[12] Psathas, G. (1995) Conversation Analysis : The Study of Talk-in-Interaction. Sage Publications.

[13] Rheingold, H. 2002. Smart Mobs: the Next Social Revolution. Perseus Publishing.

[14] Ryan, G.W., Bernard, H.R. (2003) Techniques to Identify Themes. Field Methods 15(1), pp 85-109.

[15] Schegloff, E. (1971) Notes on a Conversational Practice: Formulating Place. In Studies in Social Interaction (Ed.) D. Sudnow, Free Press.

[16] Steinfield, C., Jang, C., and Pfaff, B. 1999. In Proceedings CSCW '99, 81-90

[17] Weilenmann, A. H. and Leuchovius, P. 2004. "I'm waiting where we met last time": exploring everyday positioning practices to inform design. In Proceedings of NordiCHI '04, vol. 82. ACM Press, 33-42.

[18] Weilenmann, A. (2003) "I can't talk now, I'm in a fitting room": Availability and Location in Mobile Phone Conversations. In Environment and Planning A volume 35, (9), pp. 1589 - 1605.