

# A time to glance: Studying the use of mobile ambient information

Frank Bentley<sup>1</sup>, Joe Tullio<sup>1</sup>, Crysta Metcalf<sup>1</sup>, Drew Harry<sup>2</sup>, Noel Massey<sup>1</sup>

<sup>1</sup>Applications Research Center  
Motorola Labs  
Schaumburg, IL 60196 USA  
{f.bentley, joe.tullio, crysta.metcalf,  
noel.massey} @motorola.com

<sup>2</sup>Sociable Media Group  
MIT Media Lab  
Cambridge, MA 02139  
dharry@media.mit.edu

## ABSTRACT

Recent work by our group at Motorola Labs has focused on applying the principles of ambient interfaces to the domain of mobile communications. Our methods incorporate both formative ethnographic studies and field evaluation of prototypes to investigate how people make use of ambient information in the course of everyday communication. Our goal is to enable applications that provide rich presence information for close friends and family that is appropriate to their particular tasks and social conventions. In this paper, we briefly summarize the results of two prior field studies of ambient awareness on mobile phones: shared motion presence and music listening history. We then discuss our current efforts in context-aware photo sharing on the phone. Together, these studies provide insights about how people understand, use, and contextualize presence information. We also show how this information helps people stay connected and strengthens relationships. We hope to use these insights to establish how contextual information can be gathered, synthesized and displayed to more effectively promote connectedness.

## Keywords

Ambient information, mobile devices, field studies, photo sharing, presence

## INTRODUCTION

To date, researchers have found some success in the development of ambient information tools for such environments as the home and office. These settings are characterized by situations where there is a high potential for users to be distracted from their primary activities by any number of environmental or social sources. Ambient interfaces allow these sources to communicate information in a lightweight, non-distracting manner and can be attended to selectively by users.

We see similar benefits gained by applying ambient interfaces to the mobile space. Whether in transit or a foreign environment, there is a need for users to maintain contact with friends and loved ones despite having limited attention or a limited ability to interact with their devices

(*e.g.*, while driving) [11]. For us, ambient mobile interfaces include additional information that is displayed in the context of normal use of the device that informs a user about the state of others or his/her environment.

We see ambient mobile communications as a means of maintaining connectedness with close friends and family with minimal interaction. By viewing small pieces of real-time contextual information about one another, people can feel a greater sense of presence despite hectic schedules or geographic distance. This information could include music listening history, location/motion, recent photos taken, or one's current mood. In addition, the lightweight interactions of viewing this information can enable more focused, opportunistic communications.

By studying how people make use of a diverse range of shared contextual information, we ultimately hope to build interfaces that will combine and display the information that is most relevant to the needs of friends and loved ones for managing and maintaining their relationships. To this end, we conduct field studies examining when and how often people check this information, how they interpret it, and whether they use it to strengthen relationships (*e.g.*, to initiate further communication with a phone call).

In this paper, we will review the results of some of our work on mobile ambient communications, reporting on field studies of both motion presence and music sharing prototype applications. We will also discuss our current work on ambient photo sharing, as well as some future directions we plan to explore in the coming months.

## RELATED WORK

Our work has been influenced by several existing systems. WatchMe [6] allows people to view the current location and mode of transportation of a contact and send him/her a lightweight "smile". The Socialight [7] suite of applications allows a user to remotely "tap" a contact by making his/her phone vibrate for some length of time. In addition, users can register for notifications when a friend is within some threshold of distance from them. Systems such as those developed by Vetere [11] and Kaye [4] allow



**Figure 1** A message inbox with Music Presence information.

intimate users to communicate in lightweight ways throughout the day.

While our focus is to support existing close relationships between people, other systems use context such as proximity to allow users to access information about less familiar others in their environment. DigiDress [8], allows users to browse public profiles of people in their vicinity providing for potential communication with strangers.

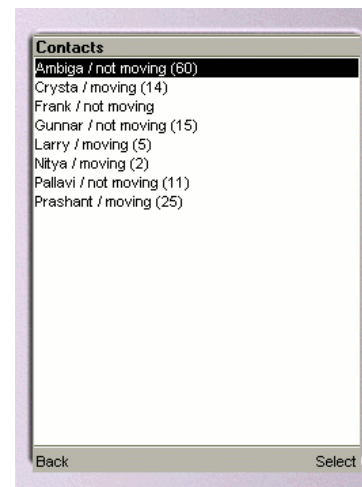
#### **PAST PROJECTS**

We believe that the best way to understand ambient mobile applications is to observe their use in real social situations. Over the past year and a half, we have been implementing and field testing ambient mobile presence applications. In this paper we will describe two of these applications, Music Presence and Motion Presence, and then discuss the situations in which they were used by our participants.

#### **Music Presence**

The music presence system allowed mobile phone users to see title and artist information for songs that their friends were playing at home. We conducted a preliminary field study with a group of four college-aged friends in the Chicago area to test the concept using a rough prototype implementation. All participants installed an Audioscrobbler<sup>1</sup> plug-in for their music-playing application of choice. A server would monitor the stream of songs played (as recorded by Audioscrobbler) by each participant and send SMS messages to each of their friends whenever they played a new song. At any time, participants could open the messaging application on their phones and see a list of the latest songs played (as seen in Figure 1). Messages started with the initials of the friend followed by the song title and artist name, allowing them to be seen at a glance from the messaging application. Many phones also display the most recent message on the external display, so in these cases, participants could see a part of the message without having to open the messaging application.

<sup>1</sup> Now named Last FM: <http://www.last.fm>



**Figure 2.** The Motion Presence Java Application

Participants used the service on their own phones for one week. In addition, they left voicemail diaries documenting their use of the system, and participated in two brief interviews during the study, with a longer final interview at the end of the study.

#### **Motion Presence**

The Motion Presence application (Figure 2) detected when a user was in motion between places (*e.g.*, driving home from work or walking to the grocery store), and conveyed this information to close family or friends through an augmented phone book application. Whenever a user entered this phonebook, they could see at a glance if their close family or friends were in one place or moving between places and the amount of time that they had been in that state. We used GSM cell ID information to determine when a participant was in motion, and these changes matched well with participants' own concepts of "moving."

We deployed this application to a total of 10 users from the Chicago area, three couples and one group of four friends. To understand use of the application and explore privacy concerns raised by sharing motion information, participants used the application for two weeks, left voice mail diaries, and participated in two interviews with researchers. The application and study are further explained in [3].

#### **WHEN PARTICIPANTS CHECKED PRESENCE**

Our work in mobile presence for music and motion has taught us a great deal about how presence information is used in a mobile setting. There are three types of occasions when users in both of our studies checked their presence applications: micro-moments, when bored, or when seeking interaction. Most use of both systems either occurred on weekdays when participants did not consider themselves to be "busy" or when they had a specific purpose for viewing the information.

### **Micro-moments**

We often found our users checking on the status of others in small breaks during the day, similar to the breaks that Anttila and Jung noticed in mobile media usage [1]. These micro-moments are characterized by short (~10 second) time periods when attention can be taken away from a current task. For two of the participants in the music study, this even occurred when short conversational breaks occurred in light conversations with others. Caroline<sup>2</sup> was spending Father's day with her family and "we were just casually talking...it's appropriate to check then." Dean also checked on the music playing of his friends. He told us that "when I wasn't doing anything, I might be with people but not actively engaged in conversation, then I could like go through [the messages]". In these cases, our participants were using idle time or pauses in social interaction to learn more about their friends' music tastes as well as to infer other information (e.g., whether they were home, their mood, etc.).

Abigail reported checking her phone during these micro-moments at her data entry job where "I stare at a computer all day, so I figure it's better to stare at my phone. So I'd constantly go to my purse and check [the music that my friends were playing on] my phone."

Likewise, in the Motion Presence study, Participants often needed a distraction from their current task and saw the Motion Presence application as an entertaining source of diversion. Harold reported looking at the application "at work when I don't feel like doing my actual work." Other users saw the application as a game and would try to catch each other moving or not moving throughout the day. Chris: "I looked at it mainly out of curiosity, mostly it was a game for me this afternoon to see if I could find a time when I could see her moving." George reported checking for his "own amusement."

These micro-moments provided an escape from current tasks, even if just for a second, and helped users get through tasks that challenged their concentration.

### **Boredom**

While checking presence information during micro-moments can be seen as offering a quick distraction from a current task, our participants also checked for longer periods of time when they considered themselves to be bored. These interactions typically involved a prolonged interaction with the application, looking into past history to try to learn more about the other participants.

In the music study, Bianca reported that "it was only when I was bored that I like went out of my way to see what they were listening to or like cared a lot" and "If I was like...doing anything more interesting then checking it, like eating or at work or watching a movie on TV. But if I

wasn't doing anything that exciting like on the computer checking my email, I would always check it."

We also noticed our Motion Presence participants checking the application when they were bored. Several of our participants lived away from the city center and had to take busses or trains to get home. These participants frequently reported checking the application on public transportation as a way to pass the time. Individuals within our group of four friends often checked for when other members of the group were leaving work or going out to lunch. These interactions helped them to learn more about each other and in some cases led to topics for later communication.

### **Purposeful**

As we had hoped, many interactions with these systems served a greater purpose than curiosity. Often users had specific tasks that they wanted to accomplish, such as determining if a friend was at home or trying to coordinate arriving at a location at the same time. In these cases, participants would check the status of others to determine the best course of action.

Music context was commonly used as a proxy for location context. Since only participants' home computers could broadcast music context information, seeing that a friend was playing music meant that they were at home (or had left their audio player running). Early in the study, Bianca said "[I'm] bored because nobody could go out and do things this weekend, so there's nothing for me to do now. But maybe if someone is listening to music, I'll know they're home...I was thinking if maybe they played music, I could call them because I know they'd be home." Caroline reported looking at the application for this same purpose: "I did pay attention to [timing] because I did wonder 'oh, are they home right now?'"

Abigail knew that her friend Bianca was out for the night and "wanted to see what time Bianca got home, so I was looking at her messages then to see when she'd gotten back from going out."

Checking to see if a friend was home could be seen as a simple example of what Ling and Yttri call micro-coordination [5]. They describe micro-coordination as a set of coordination tasks that are required in daily life, such as deciding on a place or time to meet, determining transportation to a given location, or locating someone else in a busy park. Participants in the Motion Presence study used the application for many coordination tasks throughout the day.

We saw our participants use the application to give themselves more time to spend in their current location. Ebony would check the status of her partner towards the end of the day to see if she had left work yet. "If she didn't leave yet, that means I can go do whatever I'm doing, like at work stay later." James also described using the application in this way: "If you knew someone was going to go pick you up or if someone was going to go someplace

---

<sup>2</sup> All names in this paper are pseudonyms.

and you knew that and you know about what time, you could see if they were actually on their way or if they were running late. ... Kind of lets you know when you should be ready for things like that.”

Other participants used motion information to try to arrive at the same place at the same time. Harold and Ian were going to meet for lunch. Harold originally was going to call Ian when he was leaving, but then reconsidered: “I’ll call you, or I’ll just see that you’re moving!” Later that week when they were actually getting together, Harold reported using that information: “I could tell when he was leaving work by when he went off of ‘not moving.’ ... It was like, ok, I saw that he was already on his way and we’d get there about the same time.”

These purposeful uses show that much can be inferred from simple presence information. Oftentimes it is not necessary to share precise data like location that can lead to many privacy concerns. Something as simple as music playing or being stationary could be enough for a close friend of family member to be able to discern one’s location or activity while still allowing people to feel like they have not exposed information that could be misused by casual friends or strangers.

#### **Not for weekends**

We found our participants mainly used these applications during weekdays when their schedules were busier and were often trying to meet or communicate with friends or family. In fact, one participant in the Music Study said that she sort of forgot about the system over the weekend, but it became important when she “had rehearsals [Monday and Tuesday] and I was really bored so I took out my phone like every two minutes looking at it.”

In the Motion Presence study our participants also used the application less frequently on weekends. For participants that lived with their significant other, they often spent most of the weekend with them and therefore didn’t have a need to use the application. For friends, weekend time was either spent with family or scheduled in advance such that participants knew when their friends would be available and when they were all meeting to go out. Ian said that he “knew where my friends were going to be all day. So I had no reason to know where they were or what they were doing or to contact them.”

This data shows that mobile presence is most useful when a person’s time is scheduled, but prone to variations (*e.g.*, the exact time they leave work). On weekends, a participant would either be unavailable or have their plans made in advance. In either case, the application was not needed. When participants could not use the information for purposeful interaction, were not bored, or did not desire a distraction, they simply did not view the information presented on their phones.

#### **CURRENT WORK**

Currently, we are investigating the use of contextually relevant photographs displayed on the idle screen of the phone. Using the ZoneTag [2] system and friend/family relationships created on Flickr<sup>3</sup>, we display three types of photographs as rotating feeds on the idle screen. The first feed includes public photographs from Flickr taken in the zip code where the user is currently located. The second feed contains the recent photographs that their friends have taken while the final feed covers photos taken in a particular city, such as all photos taken in Chicago.

We hypothesize that we will see our participants using these photographs to learn more about their surroundings. In addition, they will use them to initiate conversation topics with their friends about not only the photos that their friends have shared, but also about photos taken in their vicinity. We predict the same types of use from our previous system will be evident in this new application. These uses may include employing the presence display as a distraction while engaged in long tasks, as a relief from boredom, and as a means to determine where a friend is or what they are doing based on their shared photos.

#### **DISCUSSION**

We believe that ambient mobile presence applications have several affordances that allow for interactions different from more traditional in-home ambient applications. Since mobile devices are nearly always in their owner’s possession, mobile applications can provide continuous updates to presence states throughout the day and allow users to receive the most recent information available about others. As a result, no matter where a person is, they can check the current status of others and make real-time decisions about availability, activity, or location based on the information provided.

This indirectness of data used in our studies allows for a larger variety of information to be sent with fewer privacy concerns since there is still a large amount of plausible deniability. By contrast, most home presence applications have provided direct information such as physical presence in a room [10] or explicit messages left for others [9, 4].

Also, because mobile applications are always available, they allow for increased interaction opportunities when one is bored or looking for a distraction throughout the day. While moving from one location to another, people often have little else to keep them occupied. Mobile presence applications provide a constructive way to feel connected to others as well as coordinate while on the go.

Finally, mobile phones are unique in being able to provide a large amount of rich context that can be shared with others. Many phones today are able to determine their location through GSM cell ID or GPS, capture rich media such as photos and videos, and are aware of the media that a user is

---

<sup>3</sup> <http://www.flickr.com>

playing. This rich context provides many opportunities to share this information and allow for a greater sense of awareness as well as increased availability management. Having this information is increasingly important as people lead more hectic lives while maintaining a strong desire to feel connected to others.

### QUESTION

For us, a question we continually face is “How ambient is ambient in a mobile setting?” Is information that appears in the course of a normal phone interaction (e.g. an augmented phone book) enough to be considered ambient? What about information that is always visible on the idle screen or the external display? This leads us to a larger question of “What types of ambient affordances should a phone provide?” We hope that through this workshop we can explore some of these questions with others as well as explore the differences between mobile and home-based ambient applications.

### REFERENCES

1. Anttila, A. and Jung, Y. 2006. Discovering design drivers for mobile media solutions. In *CHI '06 Extended Abstracts on Human Factors in Computing Systems* (Montréal, Québec, Canada, April 22 - 27, 2006). CHI '06. ACM Press, New York, NY, 219-224.
2. Ames, M., and Naaman, M. Why We Tag: Motivations for Annotation in Mobile and Online Media. *To appear*, Proceedings of the SIGCHI conference on Human Factors in computing systems ([CHI 2007](#)), San Jose, CA, USA, 2007.
3. Bentley, F. and Metcalf, C. Sharing Motion Information with Close Family and Friends. *To appear*, Proceedings of the SIGCHI conference on Human Factors in computing systems ([CHI 2007](#)), San Jose, CA, USA, 2007.
4. Kaye, J., Levitt, M. K., Nevins, J., Golden, J., and Schmidt, V. 2005. Communicating intimacy one bit at a time. In *CHI '05 Extended Abstracts on Human Factors in Computing Systems* (Portland, OR, USA, April 02 - 07, 2005). CHI '05. ACM Press, New York, NY, 1529-1532.
5. Ling, R. and Yttri, B. (1999): Nobody sits at home and waits for the telephone to ring: Micro and hyper-coordination through the use of the mobile phone. Report No. 30/99, Telenor Research and Development, Oslo.
6. Marmasse, N., Schmandt, C., and Spectre, D. (2004). Watchme: Communication and Awareness between Members of a Closely-Knit Group. In Proceedings of UbiComp, Nottingham, UK.
7. Melinger, D., Bonna, K., Sharon, M., SantRam, M. Socialight: A mobile social networking system. In Proc. UbiComp 2004.
8. Persson, P., Blom, J. & Jung, Y. 2005. DigiDress: A Field Trial of an Expressive Social Proximity Application. UbiComp 2005, pp. 195-212.
9. Sellen, A., Harper, R., Eardley, R., Izadi, S., Regan, T., Taylor, A. S., and Wood, K. R. 2006. HomeNote: supporting situated messaging in the home. In *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work* (Banff, Alberta, Canada, November 04 - 08, 2006). CSCW '06. ACM Press, New York, NY, 383-392.
10. Tollmar, K. and Persson, J. 2002. Understanding remote presence. NordiCHI '02, vol. 31.
11. Vetere, F., et al. 2005. Mediating intimacy: designing technologies to support strong-tie relationships. CHI '05.