

# A Study of Mobile Mood Awareness and Communication through MobiMood

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## ABSTRACT

Recent research shows that there has been increased interest in investigating the role of mood and emotions in the HCI domain. Our moods, however, are complex. They are affected by many dynamic factors and can change multiple times throughout each day. Furthermore, our mood can have significant implications in terms of our experiences, our actions and most importantly on our interactions with other people. We have developed MobiMood, a proof-of-concept social mobile application that enables groups of friends to share their moods with each other. In this paper, we present the results of an exploratory field study of MobiMood, focusing on explicit mood sharing in-situ. Our results highlight that certain contextual factors had an effect on mood and the interpretation of moods. Furthermore, mood sharing and mood awareness appear to be good springboards for conversations and increased communication among users. These and other findings lead to a number of key implications in the design of mobile social awareness applications.

## Keywords

Moods, emotions, mobile computing, awareness, social context, location, mobile interaction, field study

## Categories and Subject Descriptors

H.5.2 [Information interfaces and presentation (e.g., HCI)]: User Interface - Evaluation/methodology

## General Terms

Design, Experimentation, Human Factors

## INTRODUCTION

Recent research shows that there has been increased interest in investigating the role of mood and emotions in the

\*This project was carried out while Eve Hoggan was an intern in Telefonica Research.

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HCI domain. Our moods, however, are complex. They are affected by many dynamic factors and can change multiple times throughout each day. Our mood can have significant implications in terms of our experiences, our actions and most importantly on our interactions with other people. For example, it has been shown that when we are happy we are more likely to communicate with others, while when we are sad we tend to distance ourselves from friends and family [16]. Furthermore, it's been shown previously that moods are often a common theme in conversations with friends, highlighting the extent to which mood plays an important role in our daily life [4].

There has been lots of research over the past decade which explores the detection, monitoring and communication of moods through physiological sensing [9, 17, 25], through automatic detection in online blogs<sup>1, 2</sup>, [8, 13], status updates<sup>3</sup> and online diaries[24]. Each approach offers a range of trade offs in terms of validity, accuracy and privacy[7]. More recently, a variety of mobile services and applications have surfaced designed to help users communicate presence information in the form of short textual messages which often convey their mood[14]. However, the majority of existing approaches to the presentation and detection of moods do not facilitate the sharing of mood information within one's social circle or within mobile environments.

Existing mobile devices allow us to sense a range of contextual factors such as location, time and activity of users. Mobile handsets provide a great opportunity to capture information in-situ and gather feedback from users while on-the-move. Given the increased popularity of social mobile awareness applications such as **Loopt**<sup>4</sup> and **BrightKite**<sup>5</sup>, mobile users may also be interested in sharing moods with each other and may actually be able to positively impact each other's moods. Furthermore, given their role as personal communication devices, mobile phones are a natural choice for sharing and communicating moods with others.

In an effort to address the gaps in existing literature and to answer a series of research questions related to explicit mood sharing, communication and mobile awareness, we present the results of a live field study of a mobile application called **MobiMood**. MobiMood is a social mobile awareness application which allows users to submit and share moods and their associated mobile contexts with friends and others

<sup>1</sup>See <http://nyti.ms/baswaG>, last retrieved Aug 2010

<sup>2</sup>See <http://www.wefeelfine.org>, last retrieved Aug 2010

<sup>3</sup>See <http://bit.ly/c4h64j>, last retrieved Aug 2010

<sup>4</sup>See <http://loopt.com>, last retrieved Aug 2010

<sup>5</sup>See <http://brightkite.com/>, last retrieved Aug 2010

while on-the-move. It supports mood sharing in a similar way to microblogging services such as twitter<sup>6</sup>, which allows status updates to be submitted and shared easily and quickly in the form of short snippets of text.

In this paper we describe the MobiMood application and present the results obtained from a 2-week field study involving 15 users, split across 5 social groups. The findings of our field study lead to a number of important implications in future mobile social awareness applications.

## RELATED WORK

MobiMood supports explicit mood sharing and awareness among groups of friends while on-the-go. Aside from mood, MobiMood also allows users to share other forms of context including location, time and social context (*i.e.* who I'm with). As such we have identified a number of related threads of research that belong to the general category of *mobile social presence* [3].

### Location awareness

While there has been several research projects that aim to connect electronic information to a physical location, *e.g.* **GeoNotes** [18], **ActiveCampus** [10], and **UrbanTapestries** [12]. In more recent times, focus has switched from tagging of locations to location sharing. For example, researchers working at Intel's **PlaceLab** project have explored explicit sharing of location information in social communication using a prototype called **Reno**[22]. The goal of the Reno prototype was to understand how people leverage social context in mobile environments to share location. The authors carried out a small-scale pilot study with 7 early adopters using Reno over a period of 5 days. Their preliminary results showed that Reno facilitated more effective communication using a simple approach to disclose place.

In [1], Barkhuus *et al.* described **Connecto**, a location-aware mobile application that allows location tagging and sharing among social groups. In a live field study the authors found that Connecto was used to express moods, lifestyle and events as well as location information. The authors highlight how the application allowed participants to 'tell a story' and express feelings relating to each others perceptions of each other.

The **WatchMe** prototype[15] is a watch-based mobile communications device designed to support awareness and initiate communication among users. WatchMe supports multiple communication modes (text messaging, voice, etc.) and uses the display of photographs as emotional references to show users that others are thinking about them. The prototype supports sharing of location and activity information.

In [2], Belloni *et al.* focused on mobile social awareness in the context of commuting. Through a web-based mobile interface users could explicitly self-report their current location, receive a list of train times in real time and find out which of their friends are in the same train as them. Through an informal study involving a group of 4 people, the authors found that users exhibited very different behaviours depending on their level of acquaintance with the person in question. For example, in some cases, users openly encouraged more interaction with their friends, in other cases, they avoided any form of interaction.

More recently, commercial applications have appeared on

the market. **Loopt**<sup>7</sup> or **BrightKite**<sup>8</sup> enable social serendipitous encounters and keeping track of what your friends are doing. Google and Yahoo also provide generic location sharing services (**Latitude**<sup>9</sup> or **Fireeagle**<sup>10</sup>), along with readily available APIs that support development of location-aware mobile applications.

### Mood awareness

Microblogging services such as twitter provide insights into how and what people are doing. Although such services were not designed with *mood* in mind, recent results show that a high percentage of entries are in fact mood related, (*e.g.* in Twitter see: [5]).

There have also been some projects that support explicit mood sharing. For example, the **MoodJam** project<sup>11</sup> from the Human Computer Interaction Institute at Carnegie Mellon University provides a visualization of moods and other peoples moods based on colored strips and words. Users choose colours that feel most appropriate to them, thus creating a personalized mood representation. The website allows users to keep a record of their moods, to learn about mood trends and to share moods with others. The goal of the project is to increase mood awareness among users and groups, however, it should be noted that the project is desktop and no consideration has been given to mobile users.

Nokia developed the **Context Watcher** application [11] with the goal of making context tracking, storage and use easy for users. The application runs on series 60 phones and allows context sharing with family, friends, colleagues, etc. The application supports explicit mood input as one form of context (along with location, activities, body data, etc.).

The **eMoto** [23] prototype developed by Sundström *et al.* supports mobile emotional messaging and communication through a series of emotion related gestures which are then mapped to a series of shapes, colours and animations. The authors carried out a user study with 5 participants and 5 friends as spectators, in which users reported on their friendships, the social experience and reactions to the emotional messages they received. Their results showed that emotional communication was not simply transferring information plus emotion from one person to another, but that the system must provide support for the sometimes fragile communication pattern that occurs among friends. They also found that users wanted their own personal ways of expressing themselves to one-another.

Shirazi *et al.*[21] focused on sharing emotions through self-composed ringtones on mobile handsets. These melodies are used to share information about emotion in an easy and non-obtrusive manner. The authors carried out a preliminary user study involving 12 participants, the results of which highlight that these personal melodies have a stronger impact than pre-composed or downloaded melodies in terms of conveying mood or emotion. However, at the receiver end, users did express concerns regarding (1) misinterpretation of the melodies and the message it was trying to convey, (2) social embarrassment and (3) a lack of control.

There are also a number of commercial mobile applications that support manual mood input but the majority do not support sharing of moods among friends/groups, *e.g.*

<sup>7</sup>See <http://loopt.com>, last retrieved Aug 2010

<sup>8</sup>See <http://brightkite.com/>, last retrieved Aug 2010

<sup>9</sup>See [www.google.com/latitude](http://www.google.com/latitude), last retrieved Aug 2010

<sup>10</sup>See <http://fireeagle.yahoo.net/>, last retrieved Aug 2010

<sup>11</sup>See <http://moodjam.org/>, last retrieved Aug 2010

<sup>6</sup>See <http://www.twitter.com>

### Mood of the Nation<sup>12</sup>, My-Mood<sup>13</sup>, and MoodSense<sup>14</sup>.

Although there has been some work that explores mood sharing in mobile environments, work to date has been limited with little focus on the role that mood awareness plays on communication in dynamic mobile environments or the impact that explicit mood sharing in social groups has on increasing awareness among users. By creating an application solely for the purpose of sharing moods within social groups we can study: (1) the impact on awareness and (2) the role of explicit mood sharing has on communication and in particular whether communication is initiated based on knowing the mood of others. As such the *key contributions* of this paper are as follows:

1. An examination of how explicit disclosure of mood increases awareness and communication among groups of mobile users through a live field study in-the-wild.
2. A set of design implications for future social mobile awareness applications.

## MOBIMOOD

MobiMood is a proof-of-concept research prototype that enables groups of friends to share their moods with each other while on-the-move. The prototype consists of two components: (1) an iPhone application that allows users to record and share moods as well as comment on the moods of others; (2) a server that synchronizes and stores all mood details in the MobiMood database<sup>15</sup>. The server forwards an up-to-date list of all moods to the mobile application. The server also consists of an email and SMS notification facility that informs members of the appropriate social network about new moods and new mood comments from friends. In addition, the server logs all interactions between the user and the iPhone application for off-line analysis of behaviour.

### Mood Entry

When users launch the MobiMood application, they are presented with a *mood input screen*. The mood input screen shows six different coloured buttons at the bottom of the screen, each representing a different mood. Users can choose from one of five standard moods (*sad*, *energetic*, *tense*, *happy* and *angry*) or they can input their own *custom mood*, e.g. 'bored', 'very excited', etc. The standard moods are derived from a subset of moods found in Russell's Circumplex of Affect [19] and XMPP [20]. Russell's Circumplex is widely used in psychology and XMPP is a common standard used in Web based social applications. Both contain a similar set of moods<sup>16</sup>.

The Circumplex Model of Affect proposes that all affective states arise from two fundamental neurophysiological systems: one relates to valence (a pleasure - displeasure continuum) and the other relates to arousal or alertness. Each mood can be understood as a linear combination of these two dimensions, *i.e.* varying degrees of both valence and arousal. We chose a set of standard moods from each of these dimensions. By allowing users to set numerical values for each mood we could still capture opposing moods to

some degree. Each mood category is also associated with a different colour based on those established by Wexner: blue-sad, green-energetic, purple-tense, red-angry, yellow-happy [26]. We chose orange for the custom mood (see Figure 1b).

To input a mood, the user presses one of the buttons at the bottom of the screen and a bubble will begin to grow in the rounded box in middle of the screen (Figure 1a). The longer the user holds their finger on the button, the bigger the bubble will grow. The size of the resulting bubble is mapped to the intensity of the mood (1 to 10, where 1 is represents the lowest intensity and 10 represents the highest intensity). The intensity is also displayed on a progress bar so that more absolute feedback is provided. For example, if the yellow button is pressed and held until the bubble grows to its largest size, the participant's mood is considered to be 'happy' with an intensity of 10.

### Contexts

Once the user has selected a mood and intensity level, he/she clicks 'next' and is taken to the *context-input screen*. On the context-input screen users record their *situational* and *social* contexts. The *situational context* allows us to determine more about the location of the user and is given by selecting one of four options: *at home*, *at work*, *commuting*, *other*. The *social context*<sup>17</sup> allows us to determine more about who the user is in the presence of when submitting a new mood. The social context is introduced by selecting one of six pre-defined options: *friends*, *family*, *alone*, *partner*, *colleague*, *other*. In addition, we log the device ID, the date and time and the physical location (in latitude/longitude form) of each user. By logging the physical location of the user we can map meanings to the situational contexts.

### Mood Lists

After submitting a mood, the user is presented with a list of the last thirty moods of their friends. The mood lists shows the name of the user who submitted the mood, the mood (in both textual and colour format), the date and time and the situational context. By using the tabs at the bottom of the screen, the user can also view their own previous moods (*My Moods* tab) or the moods of everyone else (*Everyone* tab) (see Figure 1c). Users can view the details of any of the listed moods by double-tapping on the mood in question.

### Supported Interactions

This mood detail screen (Figure 1d) provides more details about each mood. The detail screen lists the user's name, the mood, the date and time submitted, the intensity of that mood as well as any comments submitted by the users friends about the mood. This screen also includes 3 buttons that allow a user's friend to interact with the mood entry. These buttons include an 'add comment' button, a button which initiates a phone call to the user in question and a button which initiates an SMS. The inclusion of these buttons allowed us to assess if mood sharing increased awareness and communication via comments, SMS messages and phone calls within the application.

## USER STUDY

In this section, we describe the results of a live field study of the MobiMood prototype with a focus on designing social

<sup>17</sup>These labels were chosen based on informal pilot studies.

<sup>12</sup>See <http://www.moodofthenation.net/>, last retrieved Aug 2010

<sup>13</sup>See <http://bit.ly/dCFR1Q>, last retrieved Aug 2010

<sup>14</sup>See <http://bit.ly/9uKEVZ>, last retrieved Aug 2010

<sup>15</sup>We use Apache for the server requirements and all data is stored in a MySQL database.

<sup>16</sup>Related moods by Paul Ekman: [http://en.wikipedia.org/wiki/Paul\\_Ekman](http://en.wikipedia.org/wiki/Paul_Ekman), last retrieved Aug 2010



Figure 1: Screenshots of the MobiMood application.

mobile awareness applications. Before conducting the field study, several pilot tests took place in-house to evaluate the application design and the experimental methodology. The results of which led to several iterations of the MobiMood prototype with the final version shown in Figure 1. Note that in this study we were more focused on understanding the interesting and dynamic behaviours that emerged from using the MobiMood prototype in-the-wild rather than examining the usability/interface design of the prototype.

### Participants

To take part in the user study, participants needed to own an iPhone and be part of a group willing to participate in a 2-week study where they input and share their moods with friends. We chose to study the use of MobiMood in five close-knit groups who lived, worked and studied in different countries around the world. In total, 15 participants took part in the study (11 male and 4 female), ranging in age between 23 and 43 years (avg=28.6). The participants had a diverse set of occupations, including a journalist, a teacher, solicitors, IT professionals and students. The participants were given a small incentive of £20 for taking part and a £200 raffle was held at the end of the study and given to one participant.

Table 1 shows more details about each of the five groups: number of users per group, the ratio of males to females and the country of origin for each group. Group 1 consisted of three young professionals from Glasgow, UK, two of which knew each other after having been flatmates previously, and the other was the partner of one participant (and well acquainted with the other). Group 2 consisted of two computing science PhD students from Indiana, USA, who work together in the same lab and often socialise with each other. Group 3 consisted of three professionals from Rome, Italy. Two of these are married and the other is a family member. Group 4 was made up of two young professionals in a long-term relationship with each other from Glasgow, UK. Lastly, group 5 included five members all of whom are young profes-

sionals working and socialising together in Swansea, UK<sup>18</sup>.

Group	1	2	3	4	5
# Users	3	2	3	2	5
# Male	2	2	2	1	4
# Female	1	0	1	1	1
Country	Scotland	USA	Italy	Scotland	Wales

Table 1: Details on the MobiMood participants

### Procedure

Before the field study began, users completed a pre-study questionnaire and installed the MobiMood application. The pre-study questionnaire was used to gather basic demographic information, details about their use of online social network sites as well as information about their moods and the factors that contribute to their moods. The live field study took place over two weeks in August 2009. During the study, we collected a series of log data for post-task analysis which included: listings of the calls and SMS sent between participants<sup>19</sup>, the time, location, type and intensity of each submitted mood (participants could choose to omit their location data), what moods were viewed, comments on moods as well as whom the participants were with at the time of mood entry. Finally, participants were asked to complete a post-study survey to gather subjective information on their

<sup>18</sup>Although the groups in this study represent relatively small samples, we focused on groups of users with close friendships rather than larger sample groups with less intimate relationships. If such an application was integrated with larger online social networks such as Facebook, we might expect the interaction to increase, especially given that users of online social networks would be able to select only the peers they want to interact with within an application like MobiMood. See <http://bit.ly/awjxuu>, last retrieved Aug 2010

<sup>19</sup>Note that we could only count calls and SMS message initiated from within the MobiMood application

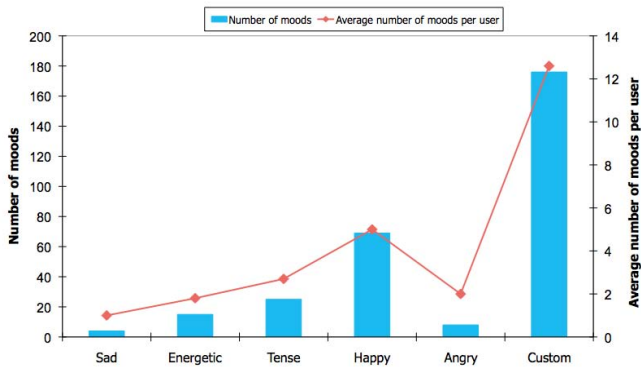


Figure 2: Distribution of moods and average number of moods per user across custom and standard mood entries.

experiences with the application<sup>20</sup>.

In an effort to maintain the motivation amongst participants, the ability to view moods was restricted. MobiMood only allowed users to view other moods and associated comments once they had submitted a mood. One of the issues with evaluating social applications is that often they need to reach some mass level of usage before the system can be useful to users. Our study was relatively short and we wanted to ensure that enough mood entries were collected and shared. Given the natural imbalance that exists between producers and consumers of content within social systems its unlikely that these behaviours could emerge so quickly/naturally in a short time-frame.

Furthermore, participants had to submit at least 15 moods before being able to see the submitted moods and comments of everyone in the study. Prior to this, participants could only view and comment on their own moods and those of their friends. At the end of study, we provided two visualizations of submitted moods to all users: one visualization at the group level and a second visualization showing the moods of all 15 participants over the 2-week period.

We used email and SMS notifications to keep users informed of the interactions of others within the study<sup>21</sup>. Whenever a participant submitted a new mood, all of the participant's friends received an email notification. When a comment was added to a particular mood, the participant who originally entered that mood received an SMS to inform her of the new comment.

## RESULTS

### Basic Usage Results

In total, participants submitted 311 moods over the 2-week period. 112 were standard moods (36%), while 176 were custom mood entries (56.6%)<sup>22</sup>. Figure 2 shows the

<sup>20</sup>Both pre and post-study surveys were carefully designed to include questions that would allow us assess participate reactions to an application such as MobiMood.

<sup>21</sup>Emails are a common notification mechanism used in many social applications e.g. Facebook informs its users when friends comment on status, tag photos, etc. Note the email did not include a link to the application so if users did access MobiMood after receiving an email it was to interact in other ways, e.g. to post comments.

<sup>22</sup>The type of the remaining 23 mood entries (i.e. standard or

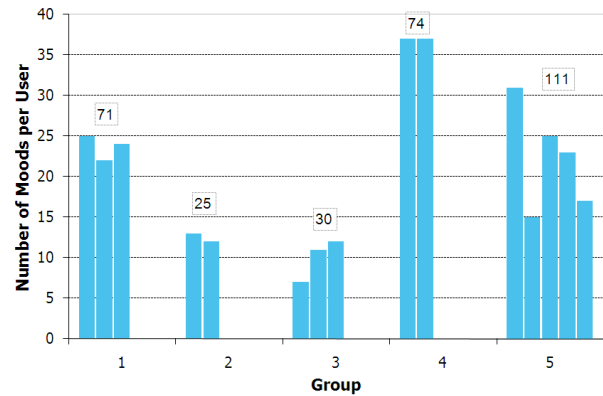


Figure 3: Moods submitted per user per group.

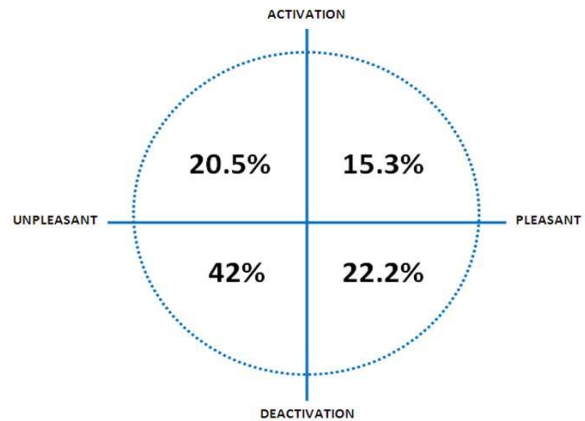


Figure 4: Custom moods classified according to Russell's Circumplex Model of Affect.

distribution of mood entries per type as well as the average number of moods per user. Of the custom moods, 103 (58.5%) were unique custom mood entries, indicating that diverse sets of custom moods were submitted by participants. The most common standard mood was "happy" and the least common was "sad", suggesting that users tend to share their positive emotions more easily than their negative emotions. We found an average of 20.1 submitted moods per participant (stdev=9.4) and an average of 62.2 moods per group (stdev=35.4). Figure 3 shows the number of moods submitted per user per group. We can see that even groups with only 2 participants (e.g. group 4) generate a high number of mood entries (> 70 moods submitted).

### Custom Moods

We found that 14 of the 15 participants submitted at least one custom mood, resulting in an average of 12.6 custom moods per user. When we looked more closely into the custom moods, we found 3 types of custom mood entries: (1) basic moods, e.g. "tired", "excited" and "rushed". 77% of custom moods fell into this category; (2) status or activity related moods (16% of the custom moods), e.g. "hating busy custom) is unknown. The type is unknown for mood entries where the user did not want the application to track their location. We will discuss this later in the paper.

hot slow bus in the rain” and “looking forward to yoga”; and (3) combination moods, made up of a combination of a basic mood followed by a description of why the participant was in a particular mood: e.g., “grumpy (about going back to work)”, “glad, Monday done”, and “bored (of big brother!)”. 7% of custom moods fell into this category.

In an attempt to better understand the custom mood entries, we manually classified all custom entries according to Russell’s Circumplex Model of Affect. Figure 4 shows the percentage of custom moods that fall into these dimensions. We find a total of 62.5% of the moods are actually unpleasant, and 62.2% fall into the deactivation dimension. Note that although we earlier found a very low occurrence of the explicit sad mood, we do find that users expressed more negative moods in their custom mood entries. In future work, we plan to investigate why and how users are ready – or not – to communicate these more negative moods with the goal of understanding how users might be persuaded to share their mood even when they are sad.

We also find 50 (almost 30%) of the custom mood entries (out of the 176 that could be classified according to Russell’s model) are related to tiredness, implying that there are some patterns in the custom moods submitted. This is an area we’d like to explore further as part of future work.

### Context and Mood

We explored two different types of context in the MobiMood study: (1) location and (2) social context<sup>23</sup>. The most popular location context chosen by participants was “home”, with 41.6% of all moods submitted at this location by 14 of the 15 users (average 9.3 moods submitted per user at this location). According to the answers from the post study questionnaire, users accessed the MobiMood application at home because there were often “at a loose end” and had more time to interact with their device.

It was difficult to assess fully the effect of location on the moods experience by users given the volume and diversity of “custom” moods, however, as shown in Figure 5, we did identify a number of trends and correlations. For example, when the majority of participants recorded their location as “at work”, energetic, sad and angry levels were considerably lower (1.6% of moods at work were energetic, sad and angry), while “tense” (9.8%) was chosen more often. Whereas when location was set to “home”, energetic levels were higher.

When we asked users if the location labels (i.e. at home, at work, commuting, etc.) attached to moods helped them to understand more about their friends’ moods, 11 users answered yes while the remaining 4 said no. Of the users who answered yes, their reasons included: “I can see how these effect my friends moods”, “they gave clues to what might be causing peoples moods”, and “if it was just angry it would be hard to know why they were angry without asking why but by adding commuting you would know that it was either delays/too many people etc.”. The users who reported no felt that not enough context was provided with just these labels, e.g. “too much variety of possible scenarios”.

In terms of the social context associated with mood entries, we found that users submitted most of their mood entries when they were alone (35.5%). We found that 13 of the 15 users submitted moods while alone, with an average 8.5 moods submitted per user in this social context. Fig-

<sup>23</sup>Social context in this regard refers to who the person is with when they submit their mood.

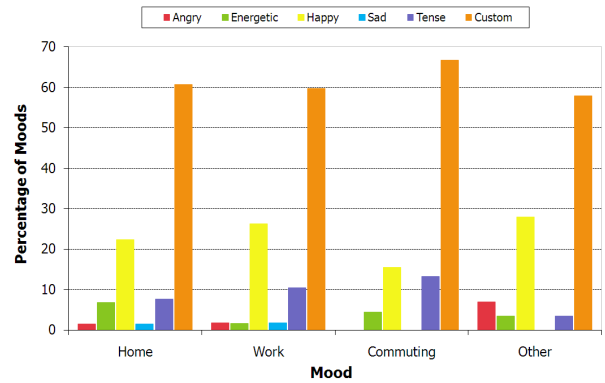


Figure 5: Percentage of mood types by location.

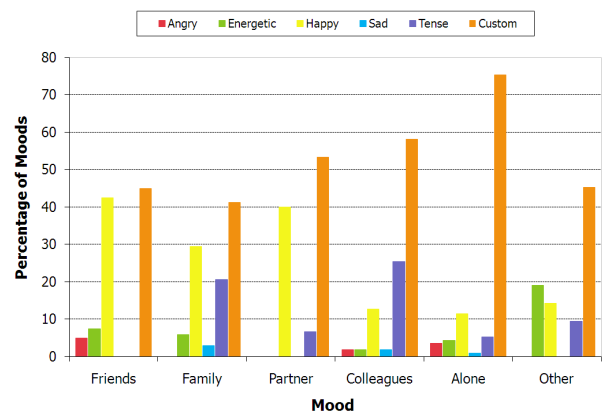


Figure 6: Percentage of mood types by social context.

ure 6 shows the social contexts associated with individual moods. Interestingly, there were absolutely no recorded sad moods when participants were with friends or their partners and no angry moods submitted with family or their partners. Furthermore, a considerably higher number of custom moods were submitted when participants were alone (49% of custom moods).

When we asked participants if the social context helped them understand more about their friends’ moods, only 7 (46.7%) answered yes. Of the users who said no, most felt that not enough additional detail was provided with these labels, e.g. “They did slightly but if at work i would assume they were with colleagues or at home it would usually be alone” while other users reported not noticing these labels as often, e.g. “didn’t really notice”. Based on initial user responses, it appears that the social context had less of an effect than location in terms of understanding why someone was in a particular mood. However, as mentioned previously, given the large volume of custom moods this is more difficult to assess. As part of future work we’d like to explore alternative interfaces for conveying such context to the end user which would enable us to assess fully the impact and effect of location and social context on mood sharing and mood awareness.

### Sharing and Viewing Moods

One of the core features of MobiMood is to allow users to share moods among friends. In the pre-study question-

naire we asked participants how they felt about the prospect of sharing their moods with others, while in the post-study questionnaire we gathered qualitative feedback about their experiences in sharing their moods during the study. Interestingly, we found differences in responses before and after using the MobiMood application.

In the pre-study questionnaire we found users more reluctant towards sharing mood information with others. For example, in the pre-study questionnaire we asked users if they would like their mobile phone to be able to track their mood. 7 of the participants responded yes for reasons such as curiosity and the ability to track changes over time; 1 participant said no, while the remaining 7 participants said that it would depend on factors such as privacy and accuracy of the mood captured.

When asked if they would like to be able to see their friend moods via their mobile phone, 10 participants said yes, mentioning curiosity again as a reason for it. One participant said, *“It would make me feel more connected to them”*; 3 participants said they would not like to track their friends’ moods with mobile phones, while 2 participants said that it would depend on the specific mood of their friend.

We also asked participants if they would like their friends to be able to see their moods. In this case, the responses were less positive: Only 5 participants said yes. One participant stated: *“I like talking about moods to people. There’s usually a story behind them!”*; 8 participants said it would depend on factors such as the particular mood they were in; while 2 participants said no indicating that they would not wish to reveal more negative moods to their friends. For example, one participant commented: *“sometimes hiding a bad mood is a good idea”*.

In the post-study questionnaire, users reactions to mood sharing were more positive. For example, in the post-study questionnaire, all 15 participants rated *“viewing their friends’ moods”* very highly (median=5<sup>24</sup>) and likewise participants rated *“liking the fact that friends could view their moods”* also highly (median=4). Furthermore, based on the usage statistics we found that each participant viewed an average of 10.6 specific mood entries submitted by their friends (min=1, max=31, stdev=7.8). These positive findings are strengthened further when we asked users to tell us about their experiences in using MobiMood. Overall, participants indicated that sharing their moods and viewing the moods of friends’ as a positive feature of the application. For example: *“I like being able to see how my friends are feeling.”* and *“Seeing how other people were doing was interesting, and is often lacking from other social networking apps”*.

As mentioned previously, the MobiMood application also allows users to view the moods of everyone within the application, *i.e.* the moods of people who are not within their social circle. We found that the users’ reactions to this feature was quite negative both before and after the user study. Almost the same number of participants (13 vs. 12 in the pre and post-study questionnaires respectively) stated that they would not like strangers to be able to view their moods. In both cases, participants raised privacy as their main concern: *“because it’s something that is open to misinterpretation and abuse”*, *“mood its private or for close friends”* and *“it’s not really any of their business!”*. However, although participants did not wish strangers to see their own moods and indicated that they were indifferent in terms of *“lik-*

*ing that I could see everyone’s moods”*, the results of the study show that all participants frequently attempted to view the moods submitted by strangers. On average, each participant attempted to view the list of everyone’s moods 13 times (min=1, max=61, stdev=13.9). Of the users who accessed the list of everyone’s moods, we found that 7 participants clicked on individual mood entries to access further details. On average, these 7 participants viewed an average of 6 specific moods submitted by strangers (min=1, max=26, stdev=26). These results indicate that our participants were quite curious to know what other users where doing, despite not being in the same social group.

## Mood and Communication

As part of this research, we were interested in determining whether the expression and sharing of moods prompts communication between users. That is, if you know your friend is in a particular mood are you more inclined to contact them? Most of the participants indicated that they liked being able to associate comments with moods (median=4). However, despite very positive subjective reactions to the comments facility, at the end of the 2-week study, participants only entered a total of 28 comments on submitted moods – an average 1.9 comments per person. Some of the questionnaire responses indicated that an improved mechanism for commenting may have facilitated more comments: For example, *“I like being able to see how my friends are feeling. I also like the ability to comment on other people’s moods”*.

We found a similar trend in terms of the SMS/Call communication facility provided by Mobimood. For example, one user commented the following as what they liked most: *“The integrated SMS/commenting feature. It meant that when I saw someone in a sad or negative mood I could instantly send them a text to offer support. It made me feel closer to my friends”*. However in terms of actual communication, there were only 17 calls and 7 SMS messages<sup>25</sup> recorded between friends throughout the 2-weeks. This suggests that users did not use MobiMood to communicate with each other regarding their moods.

Given that we used email and SMS notifications informing participants when their friends submitted new moods and comments to existing moods, we hypothesized that users may carry out communication about their moods outside of the MobiMood application. In order to determine if this was the case, we asked participants in the post-study questionnaire if they initiated or experienced any communication about MobiMood outside of the application. Overall, 12 (80%) participants indicated that they utilised communication regarding their moods outside of the MobiMood application: 3 participants said they spoke about their moods via email, 3 participants phoned their friends, 4 sent SMS messages, 2 communicated through instant messaging systems and 1 participant engaged face-to-face conversations.

Therefore, it appears as though sharing moods was a successful facilitator for communication outside of the MobiMood application. One participant said, *“I liked being able to see my friends’ moods, and due to the fact that moods are generally one word (‘excited’, ‘happy’, ‘sad’, etc), it made me intrigued as to why they were feeling that way and what they were doing. It was a good catalyst for a conversation*

<sup>24</sup>Ratings were on a 5-point likert scale, where 1 indicates strongly disagree and 5 represents strongly agree.

<sup>25</sup>We did not log any communication (e.g. phone or SMS messages) that took place outside of the MobiMood application.

with a friend, to see how they were”. Another user commented: “one of my friends using mobimood was a colleague, so it kind of became a ‘back-channel’ form of office communication, with the moods (‘frustrated’, ‘accomplished’, ‘annoyed’ etc) having a shared meaning”. Also, “It made me think about their context. From my knowledge of what they were doing I was trying to guess why they applied a particular mood. From some mood messages we started conversations and this was nice”.

We also explored whether the users context impacted a users willingness to engage in communication. We found that location context does have some effect on the willingness to communicate with no calls or SMS messages sent when location was set to “work”. All communication occurred when users set their location to “home” or “other”. However, 11 participants (73%) indicated that the location of a user did not affect the type of communication they would use. If a user’s location was set to “work”, only 4 participants stated they would not call or SMS the person but they would choose a more subtle form of communication through comments or SMS. Conversely, if the location was set to “home”, participants felt comfortable calling their friend to discuss their mood. In the words of one participant, “if at work I would know not to call, a text or comment would be best or if at home would be fine to call”.

The effect of social context was less important: 13 users said that the social context would not alter their willingness to interact. In other words, they would still call or send an SMS to friends even if their friends were in the company of others. However, one participant mentioned that “if (friends were) alone I would prob(ably) call”.

Overall, participants found sharing moods to be a good springboard for conversation.

### Mood and Awareness

Over the past two years there has been explosive growth in status update and microblogging tools that provide users with the ability to share private information about their daily lives, their experiences, their interactions and their feelings. Recent work has look explicitly at whether we can discern “moods” or “feelings” from social awareness tools such as twitter. For example, researchers from the University of Vermont have looked at using twitter as a type of collective mood ring, by analyzing tweets and deciphering the general mood of the public<sup>26</sup>. Instead of focusing on implicit detection of moods in this manner, the goal of the MobiMood user study was to see how explicit mood sharing while on-the-go could increase awareness among groups of mobile users.

In the post-study questionnaire, we asked users to tell us in their own words about their experiences with other peoples’ moods. Interestingly, when asked this question, some users made explicit connections between mood sharing and increased awareness. For example, “It made me more aware of how my friends were feeling and more likely to drop them a text if need be.”, “It was in some cases insightful to know how someone was feeling” and “It added a bit of awareness. I think its nice to know when friends are happy or stressed”. These results indicate that explicit mood sharing in-situ appears to have impacted on awareness in a positive manner.

As well as attempting to increase awareness with the MobiMood tool, we also used external visualizations as an means for increasing awareness. At the end of the user study, par-

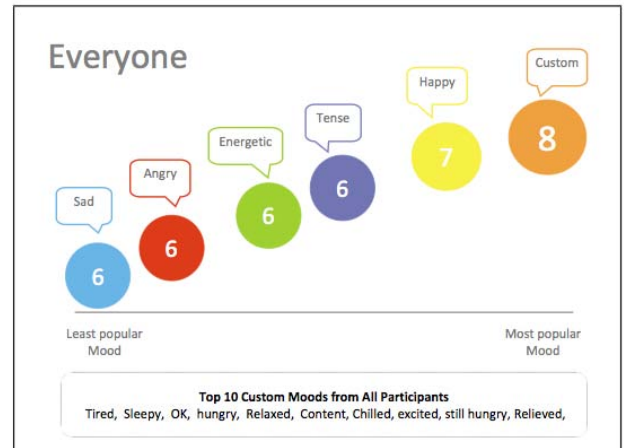


Figure 7: Sample visualization provided to participants at the end of the study.

ticipants were provided with two mood visualizations; one for their group and a second visualization for all users across the 2-week study period. Figure 7 shows the visualization for everyone, i.e. all participants averaged over the 2 weeks. When asked how participants felt about this visualization, 13 participants said it was useful and some of the explicit comments made by participants related to increased awareness. For example, “It was cool to compare it to the public one. Also interesting to see that we all used the custom mood the most”, “I liked the look of it, and it’s fun to see how you fit in.”, and “I seen that the moods most used was custom and that suggested me that everyone likes to tell precisely how they feel”. Thus the usage results combined with answers to the questionnaire suggest that not only did MobiMood help users to become more self aware of their moods; it also supported awareness among friends and family.

### KEY IMPLICATIONS

Designing social applications is a difficult task[6] and when social applications are deployed in a mobile setting the environment becomes even more challenging. The live field study of MobiMood has led to a number of key implications in the design of mobile social awareness applications.

#### Self-expression is important

In order to increase awareness within mobile groups, users must first feel like they can express themselves fully within their group and within the application. It’s important to remember that in social applications, *people are the content*<sup>27</sup>, and users of social services like to control how they express themselves and how that expression is interpreted by others. As mentioned earlier, a large proportion of mood entries were “custom” moods (almost 60%). The participants’ tendency to express their moods through the “custom” option suggests a need to express more information. In terms of expressing moods, the post study questionnaire revealed that participants would have liked to have more control over mood categories. One approach in future version of MobiMood could be to allow users to submit a combination of moods or to include a description with each mood to enable users to explain their choice of mood. Although this find-

<sup>26</sup>See <http://nyti.ms/110Ern>, last retrieved Aug 2010

<sup>27</sup>“A social interaction design primer”, See: <http://bit.ly/Y0yC>, last checked Aug 2010

ing is relevant to many social systems, providing innovative approaches to self-expression is particularly important when sharing information such as mood due to the intimate and complex nature of the information behind shared.

One of the key challenge in providing rich self-expression capabilities in mobile environments relates to interface and interaction limitations. Touch-based interaction is a very personal modality and as such may be ideal for communicating certain moods or emotions. Another form of enriching the self-expression experience would be to incorporate sounds, haptics and images so users really feel like they have control over what they to reveal and to who.

## The Need to Highlight Context

MobiMood supports two explicit forms of context to go alongside the mood entries; (1) location and (2) social context. The location context in particular provided users more information so they could interpret or understand more about their friends' moods. However, it was clear from some user comments that even with these contextual labels, not enough detail/clarification was provided and in some cases the labels were not explicit enough. Once again, although this finding is relevant to many context-aware applications, providing rich contextual information is even important when sharing moods among users due to the complex nature of moods and emotions. Users expressed a need and desire to know more about the context of their friends moods so they could better interpret and empathize with the moods expressed by their peers.

The goal behind awareness applications is to provide users with a deeper understanding of a remote persons actions, activities or in the case of MobiMood, feelings. One of the key challenges is how to provide novel, rich and fun interfaces/interaction modalities to enable users to convey contextual information to their friends. There is room for improving the interface and input mechanism for conveying such context in the MobiMood prototype which would in turn enable us to assess fully the impact and effect of location and social context on mood sharing and mood awareness. As mentioned earlier haptics, gestures and persuasive UIs could all be explored to highlight context and help users interpret the moods fully thus improving awareness.

## Interactions & Social Visibility

One of the key findings of the MobiMood user study is that curiosity about our peers' whereabouts and activities seems to be part of human nature. Participants were not only interested in their friends mood; they were also interested in the moods of strangers. MobiMood relied on users updating or sharing their moods with one another. Some users commented on forgetting to update their moods while busy. These users explicitly indicated that it was not that they didn't want to update, they just forgot until an email reminder appeared. For example, *"I did have trouble remembering to update it while being busy. If I saw more updates from my friends in my email I would have been reminded to update more often I think. I think in the future if you have larger groups so that more updates are sent people will remember to update more often."* To overcome the typical cold-start problem associated with social applications, there must be some social purpose (in our case mood sharing), there must be interaction and there should be social visibility. Mobile social awareness applications must *engage users*. Users need to be able to easily interact with the application,

easily find the content of interest and easily act upon that content. And providing *notifications* in social applications of this nature is important because it helps to keep users informed of the interactions of other users.

We used visualizations at the end of the user study to help users reflect upon the mood of others within the study. Ideally, the MobiMood application would have included support for provide end-users with real-time, interactive visualizations of their moods and the moods of their group. Although this feature is not implemented in the current prototype, such visualizations could potentially increase awareness and self-reflection.

## Enhancing communication

Given that mobile phones are used primarily as a communications device, social mobile awareness applications provide a unique opportunity to provide end users with an arena to collaborate and communicate with friends and other users while on-the-move. Perhaps the most interesting results from our user study arose from the use of MobiMood as a communication facilitator.

We found that MobiMood generated a lot of conversations between users, with 12 users communicating even outside the application through email, SMS, phone calls, face-to-face conversations and instant messages. Furthermore, by providing users with a range of communication options we're bridging the gap between these virtual and real worlds, between indirect communications like commenting towards direct communication and increased interaction. An important point to consider when facilitating communications within social mobile awareness applications is that the choice of communication channel used by end users tends to reflect *intent* and the type of awareness desired. This is especially true when communicating more intimate and personal information such as ones mood.

For example, email is considered a good form of communication that supports one-to-one and one-to-many communications where the recipient can respond at their own convenience. SMS is mostly one-to-one, quick and easy to use and tends to be less invasive than phone calls. SMS supports a type of *"I want to let the other person know I'm here but I don't want to bother them"*. Although phone calls can be invasive to the receiver they support more social dynamics of face-to-face type conversations and tend to be used in situations where an immediate responses is desired or needed or in situations that are more personal in nature. As such when designing social mobile services, designers should clearly identify the communications channel they wish to support, taking into account the intent of end users, the intimacy of the information being shared, as well as the advantages and disadvantages of that choice of communications channel.

## SUMMARY AND FUTURE WORK

We have presented MobiMood, a proof-of-concept research prototype which supports sharing of moods among groups of friends while on-the-move. We carried out a 2-week live field study (involving 15 participants split across 5 groups) that focused on explicit mood sharing and it's impact on increasing awareness and communication among users. Our results highlight that mobile users enjoyed the ability to share moods with friends and that this sharing process facilitated a number of interesting conversations outside of the application. We also found that certain contextual factors

had an effect on mood, willingness to interact and the interpretation of mood. Based on our results we highlighted a number of important implications in the design of future social mobile awareness applications.

We are currently investigating a number of avenues of future work related to the MobiMood prototype. We believe there is more interesting work to be done in the area of mood awareness and its affect on our social interactions. We are developing an improved version which incorporates some of the lessons we have learned. We plan to carry out a longitudinal field study involving more participants and more social groups. We would like to explore the social context of moods in more detail, to investigate how to facilitate more fruitful communications and conversations among users and how improving self-expression can impact on awareness within social circles.

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## REFERENCES

1. L. Barkhuus, B. Brown, M. Bell, S. Sherwood, M. Hall, and M. Chalmers. From awareness to repartee: sharing location within social groups. In *Proceedings of CHI'08*, pages 497–506. ACM, 2008.
2. N. Belloni, L. E. Holmquist, and J. Tholander. See you on the subway: exploring mobile social software. In *Proceedings of CHI'09 Extended Abstracts*, pages 4543–4548. ACM, 2009.
3. F. Bentley and C. J. Metcalf. The use of mobile social presence. *IEEE Pervasive Computing*, 8(4):35–41, 2009.
4. K. Boehner, M. Chen, and Z. Liu. Reflector: An emergent impression of collective experience. In *Proceedings of the CHI Workshop on Providing Elegant Peripheral Awareness*. ACM Press, 2003.
5. J. Bollen and A. P. H. Mao. Modeling public mood and emotion: Twitter sentiment and socio-economic phenomena. In *Proceedings of WWW '10*, pages 1–3. ACM, 2009. *to appear*.
6. C. Crumlish and E. Malone. *Designing Social Interfaces: Principles, Patterns, and Practices for Improving the User Experience*. O'Reilly, 2009.
7. A. Geven, M. Tscheligi, and L. Noldus. Measuring mobile emotions: Measuring the impossible? In *Proceedings of MobileHCI'09*, pages 1–3. ACM, 2009.
8. A. J. Gill, D. Gergle, R. M. French, and J. Oberlander. Emotion rating from short blog texts. In *CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*, pages 1121–1124. ACM, 2008.
9. A. Gluhak, M. Presser, L. Zhu, and S. Esfandiari. Towards mood based mobile services and applications. In *Smart Sensing and Context*, 4793/2007:159–174, 2007.
10. W. Griswold, P. Shanahan, S. Brown, and R. Boyer. Activecampus: Experiments in community-oriented ubiquitous computing. *IEEE Computer*, 37(10), 2003.
11. J. Koolwaaij, A. Tarlano, M. Luther, and P. Nurmi. Context watcher - sharing context information in everyday life. In *Proceedings of Web Technologies, Applications and Services*, 2006.
12. G. Lane, S. Thelwall, A. Angus, V. Peckett, N., and West. Urban tapestries: Public authoring, place and mobility, 2005. Project final report, Proboscis, UK, London, UK, 2005.
13. G. Leshed and J. J. Kaye. Understanding how bloggers feel: recognizing affect in blog posts. In *CHI '06: CHI '06 extended abstracts on Human factors in computing systems*, pages 1019–1024. ACM, 2006.
14. M. Luther, S. Bohm, M. Wagner, and J. Koolwaaij. Enhanced presence tracking for mobile applications. In *ISWC '05: Proceedings of the International Semantic Web Conference*, 2005.
15. N. Marmasse, C. Schmandt, and D. Spectre. Watchme: Communication and awareness between members of a closely-knit group. In *Ubicomp*, volume 3205 of *Lecture Notes in Computer Science*, pages 214–231. Springer, 2004.
16. C. McIntyre, L. Clark, and S. Cross. The effect of induced social interaction on positive and negatives affect. *Bulletin of the Psychonomic Society*, 29:67–70, 1991.
17. M. Morris. Technologies for heart and mind: New directions in embedded assessment. *Intel Technology Journal*, 11(1), 2007.
18. P. Persson and P. Fagerberg. Geonotes: a real-use study of a public location-aware community system, 2002. Technical Report SICS-T-2002/27-SE, SICS, University of Göteborg, Sweden, 2002.
19. J. Russell. A circumplex model of affect. *Journal of Personality and Social Psychology*, 39:1161, 1980.
20. P. Saint-Andre. Extensible messaging and presence protocol (xmpp): Instant messaging and presence, 2004. IETF RFC 3291.
21. A. S. Shirazi, F. Alt, A. Schmidt, A.-H. Sarjanoja, L. Hynninen, J. Häkkinä, and P. Holleis. Emotion sharing via self-composed melodies on mobile phones. In *Proceedings of MobileHCI'08*, pages 1–4. ACM, 2009.
22. I. Smith, S. Consolvo, A. Lamarca, J. Hightower, J. Scott, T. Sohn, J. Hughes, G. Iachello, and G. D. Abowd. Social disclosure of place: From location technology to communication practices. *IEEE Pervasive Computing*, 3468:134–151, 2005.
23. P. Sundström, A. Ståhl, and K. Höök. In situ informants exploring an emotional mobile messaging system in their everyday practice. *International Journal of Human-Computer Studies*, 65(4):388–403, 2007.
24. J. R. Vittengl and C. S. Holt. A time-series diary study of mood and social interaction. *Motivation and Emotion*, 22(3):255–275, 1998.
25. H. Wang, H. Prendinger, and T. Igarashi. Communicating emotions in online chat using physiological sensors and animated text. In *Proceedings of CHI '04 extended abstracts*, pages 1171–1174. ACM, 2004.
26. L. Wexner. The degree to which color (hues) are associated with mood-tones. *The Journal of Applied Psychology*, 38(6):432–435, 1954.