

From Awareness to Repartee: Sharing Location within Social Groups

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ABSTRACT

This paper investigates emergent practices around ‘microblogging’, changing and sharing status within a social group. We present results from a trial of ‘Connecto’, a phone based status and location sharing application that allows a group to ‘tag’ areas and have individuals’ locations shared automatically on a mobile phone. In use the system moved beyond being an awareness tool to a way of continuing the ongoing ‘story’ of conversations within the group. Through sharing status and location the system supported each groups’ ongoing repartee - a site for social exchange, enjoyment and friendship.

Author Keywords

Mobile communication, location-awareness, user studies

ACM Classification Keywords

H.4.m Information Systems: Information Systems Applications: miscellaneous.

INTRODUCTION

A set of promising new technologies have emerged that help users co-ordinate and communicate status messages, usually in the form of a short text message, with friends, colleagues and family. Taking a lead from the ‘status’ field supported in most instant messaging systems, these systems allow users to view and update status messages while static and mobile, and have those message shared to an invited list of contacts - an emergent practice known as ‘microblogging’ (e.g. Jaiku and Twitter). Whilst these applications do support a range of interesting social interactions [16] they often impose considerable load, as users must manually change their status on a near continuous basis in order for it to remain current.

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In this paper we explore a distinct approach that draws on work on location-awareness and GSM positioning. ‘Connecto’ is an always on, location tagging and sharing application that allows groups of friends to ‘tag’ locations using a standard Windows Mobile phone. Using GSM cell towers to position each phone, Connecto reports each user’s status and location to the group, supplementing the standard contacts view. In this way Connecto supports the sharing of status and location in an unobtrusive manner, automatically communicating location and status without user involvement.

We tested Connecto in a field trial with two groups of peers. In this paper we describe how Connecto was used to express not only their whereabouts but also their moods, lifestyle and events. In use, Connecto moved beyond an awareness system, to an application that supported the ongoing ‘story’ of conversations between individuals and within the group. It supported a form of ongoing social repartee through status messages, as well as providing a resource of information for conversation in other forums (such as face to face). In addition, by allowing the group to build a set of tagged locations, Connecto formed a tangible representation of the locations the group frequented, and their names for them. We argue that these locations supported not only ‘social navigation’, but that the system became a site for social exchange, enjoyment and friendship.

BACKGROUND

A number of commercial location-based services have recently been launched, both as people finders and mobile ‘nannies’; such as loopt [25], Mologogo [26], and Disney Family Locator [9]. However, the spread of these commercial systems is still limited due to several practical restrictions, such as that most only work with one network provider [9; 25] or have restrictions on phone software and hardware [9; 26]. Some systems further restrict service to manual location requests, which are paid for individually [9]. These commercial services define usefulness in terms of serendipitous meetings or keeping a ‘leash’ on children.

Many factors have impacted the sporadic adoption of these systems; including privacy concerns, technical issues, lack of a user base, and more general usability issues with the technology. Whilst these systems have their advocates, the models of social interaction supported are not without their problems. Indeed, more broadly, location and user tracking continue to be prevalent areas of research in the Ubicomp and mobile computing literature. An early example is the Active Badges system, originally concerned with how the capture of real-time location information could support life within office buildings [12]. More recently, with the advent of wireless networks, many applications are increasingly focusing on providing context information to more mobile users; for example, for tourists [3]. Others are more properly called “tracking applications” in that they focus on the delivery of location information itself. Popular applications here include those supporting gaming, family co-ordination and social interaction [4; 32].

A range of online applications let users ‘microblog’ status messages on social networking websites, such as twitter and facebook. However, few studies have explored how this microblogging might be practiced, or indeed how typical it is as an activity. One exception is Java et al’s study that highlights how Twitter is used to exchange information about daily activities and connect to other users with similar interests [16].

Studies of Location-Based Applications

Researchers have studied a number of dedicated location-sharing applications that rely on location detection from user’s mobile devices, most often mobile phones. For example, ContextPhone shares a set of predefined friends’ locations and their phone’s ringing profile (silent, vibrate, normal, etc.) [29]. However, ContextPhone does not let users control when their location is shared to others, and instead continuously broadcasts the user’s actual location. Studies of ContextPhone report how the service was used to broadcast messages in a social group [27]. Another, more family oriented device, is the Whereabouts Clock [4]. This ‘clock’ reveals where family members are, using three identifiers: Home, School and Work. The clock’s use among families was studied and found to provide *reassurance* of family routines, rather than explicit co-ordination or awareness information.

Finally, Intel Research studied the use of Reno, their location enhanced messaging service [15]. This service is based on location requests initiated by a user. If the receiver then permits, their location is returned to the request initiator. The limitation of the service is, naturally, that both parties have to perform an action before location information is shared, but the service was designed based on studies that found that always-on location trackers would compromise people’s privacy. Reno provides a level of automated location tracking by letting the user chose between a set of probable locations when

responding to a request. The delivered answer can therefore be tailored to the receiver. Intel report that the automatic messaging function was not used, as people did not like to disturb others unsolicited.

Location Tracking Technology

Most of these commercial and research based services use some form of location detection on mobile handsets. A number use the phones’ own communication system: GSM tracing has been shown to be adequately precise in locating a mobile phone, in particular in urban areas where cell phone towers are dense [15; 23]. A second technology for location tracking is GPS. However, although it is generally more precise than GSM, GPS does not work well indoors, consumes a relatively high amount of power and often has a long startup time between being powered up and delivering an accurate location. Wireless positioning using 802.11 is also possible on phones, and there are several commercial and research systems available [5; 10; 21]. Although 802.11 hardware is becoming far more common in small handsets [22], one obvious downside of these techniques is that they primarily rely on privately owned WiFi base stations; the locations of which are not known and can change (be moved or turned off) over time. Therefore, these techniques usually require ‘wardriving’ an area before this type of positioning can be employed within it.

Perhaps the strongest and most efficient location tracing methods are hybrid systems, which combine two or more of these technologies [22]. However, one key problem with hybrid systems is that the reliance on a number of subsystems requires more power, thereby decreasing the battery life of the mobile device. This, coupled with expensive hardware, is one of the main reasons that these technologies are not always available, even with the latest phones.

Studies of Privacy

A key – if not the key – issue with location tracking systems is privacy. There are obvious sensitivities with having one’s location shared. One crucial previous finding has highlighted the importance of *who* can access location information. Whilst individuals are often willing to share potentially sensitive context information to friends, they are far less likely to give out this same information to others (for example, their employer) [6; 18; 24]. Secondly, a privacy factor in sharing location information is how the information is going to be used [6]. Some of our previous work found that people have more privacy concerns about location-tracking services (‘friend finder’ services) than position-based services (such as, ‘find the nearest restaurant’ services), even though these frequently make use of similar technology and architecture [1]. However, users remain willing to use location-tracking services when they are found useful [ibid]. However, this and most other privacy studies were based around ‘wizard-of-oz’ type trials, probing people’s

concern for privacy in potential situations (an exception is the study of Reno; however, this system was based on location *requests*, not continuously broadcasting [14]). By probing participants about such issues they may have become more aware of these issues, and subsequently the results may show an increased level of concern. These indications might not hold in real situations. For example, research in Internet use showed that actual privacy practices do not necessarily correspond to survey responses about privacy concerns [17].

Indeed, the notion of privacy as an individual choice about information sharing, or alternatively a broad legislative feature of technology use, has been questioned. For example, Palen and Dourish argue that privacy is a dialectic embedded in social exchange, with disclosure as important as privacy [28]. Brown et al. explore this point in family, arguing that shared knowledge of location awareness is foundational to family life [4]. Location privacy must thus be understood in the context of continual communication and sharing between family members.

CONNECTO

Connecto is a mobile phone application that displays context and location information amongst small groups of friends. Our goal in designing and testing Connecto was to understand how location awareness would work within a peer-group of friends. While the system shares much with earlier location tracking systems, Connecto is distinctive in that it continually tracks and shares location. Thus, a user need only turn their phone on to have their location tracked and see their friends' locations.

The system currently supports sharing three main items of information: location (detected by the phone itself), the length of time a person has been at their current location (or when they last left a known location), and the current ringing profile. All three pieces of information are shown in the contact list screen, which appears on the main screen of the phone. The selection of a person in the list enables the user to either text or call the selected contact with one further key press. Friends' locations are shown as text labels on their list entries. Naturally, some generic locations are useful, such as home and work, but a user can name any location with whatever label he or she desires. The user can also re-define the location if it is not precise enough or if it needs adjustment.

Technology

Connecto was designed for Windows Smartphones and has been implemented in C# code, which executes on the .NET Compact Framework. Connecto uses GSM fingerprinting techniques to determine the location of the phone. It is able to detect the unique identifiers and signal strengths of up to seven GSM cell antennae. Every ten seconds Connecto compares the seven signals the phone is currently detecting to a database of cell fingerprints;

sets of cell identifiers and signal strengths mapped to a location name. A match is determined when at least 60% of the cell IDs and strengths currently detected align with one of the stored fingerprints. If there are multiple fingerprints that meet this requirement then the one with the greatest overlap with that currently detected is selected to be the location the user is currently in.

GSM fingerprinting techniques of this style have been shown to have an accuracy of 94 meters at best, and in poor circumstances this may drop to 277 meters or lower [5]. However, this technique was more than adequate for Connecto, as its intended use was with relatively low granularity locations, such as 'work', 'home', 'gym' or 'cinema'. We found this tolerance useful enough, and it contributed to the possible 'vagueness' of the location.

When Connecto is first installed on a phone there are no locations in the database. However, users are able to mark any location they desire with their own nametags, simply by selecting the 'Remember this location' command from the menu (figure 2). They are asked to label the location with a short (less than 20 characters) name that fits on one line (figure 3). Training then commences, over the next minute the application records all the cell antennae identifiers and signal strengths every five seconds. When the minute is up and the training is complete, the result is a mapping of the location name to the cell antennae identifiers and signal strengths for the location, which is added to the database for later use. If, in the future, the user notices that the application does not correctly recognize the location, and shows him or her either as being at another location or at an unknown location, the user can 'retrain' the location. This simply initiates an additional minute's training, merging the results with those from any previous training.

Connecto also records the current ringing profile the phone is set to. For example, profiles may be 'normal', in which the phone rings audibly; 'vibrate', in which the phone is silent but vibrates; or 'silent', in which the phone does not audibly ring or vibrate when a call is incoming. Connecto instantly detects whenever the user changes the phone's profile. If desired, the user can edit both the profile name and the behaviour of the ringing profile.

All the information Connecto collects—the location and phone profile—is uploaded to a central server every 7 minutes. At this time Connection also downloads updates from others who are on the current user's contact list. To perform these synchronizations, Connecto maintains a database locally, and synchronizes with an SQL Server database running on a server by exchanging compressed XML datasets over standard GPRS connections. This process allows Connecto to update the information it displays at least every 7 minutes, at minimal cost in terms of network traffic and battery life.



Figure 1: The main interface shows a list of friends, and location, profile and group for each.

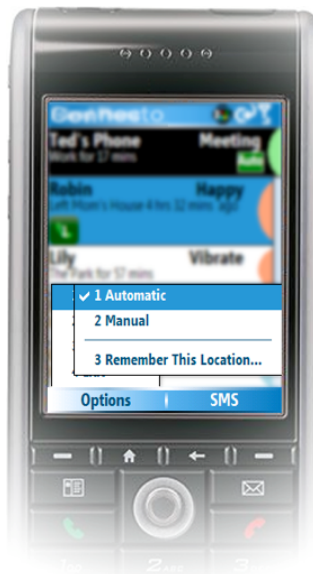


Figure 2: Users can switch between automatic and manual location modes, and train new locations.



Figure 3: A user can create a name for a location, or reuse one of his/her existing names

Functionality

The primary interface shows a list of contacts augmented with information displaying their location, ring profile, and time that elapsed since the last location change (see Figure 1). The current user's own information is also shown in his or her own entry, always the first and with a black background. The location status for a user can be one of several states. If a user is currently at a known location then the name of that location, along with the length of time he or she has been there are displayed. For example, the display might show that Sandra's location status as "Work for 40 minutes"; meaning that Sandra arrived at work 40 minutes ago. Similarly, if Sandra leaves a location and has not yet reached another known location her status will be shown as "Left work 24 minutes ago".

To help increase privacy, a function is provided to allow a user to override the automatic detection of location, and set the location manually. Users are able to enter any location name they desire, and have this reported as their current location regardless of whether it reflects their 'true' location. For example, James might use this function to mark that he is at 'work' when in reality he has taken an extended lunch break. The interface indicates which mode—manual or automatic positioning—is currently being used. This information is not shared to other participants, so they cannot tell from the interface whether or not another user is lying about their location. When automatic positioning is being used a green rectangle with the word 'Auto' is displayed on the user's own list entry, and when the user manually sets a position the rectangle changes to red and the word 'Manual' is

shown. This reminder is provided so users do not forget they have overridden automatic detection.

METHOD

We studied Connecto in users' everyday lives. Employing similar methods to other studies of mobile technology, such as fill-in diaries [2] and interviews [15], we aimed to gain insight into usage patterns, behavior and feelings that the participants had in regards to Connecto. One challenge was to gain this insight without intruding or making constant inquiries that can influence behavior. Therefore, we used a dynamic diary tool, 'Flexifill', for daily inquiries. The diary automatically constructed questions based around the users' own activities with the phone, such as the incoming and outgoing calls they made that day, and text messages they may have sent. Participants were asked to fill in the diary every day, at their convenience. By using Flexifill we were also able to monitor the participants' use of Connecto throughout the study, and have questions based on individual users' actual use of the system automatically generated.

We chose to study the use of Connecto in two close-knit groups who lived, worked and studied in a large metropolitan area in the United Kingdom (Glasgow), some commuting from the suburbs. Group 1 consisted of six young professionals and graduate students in their early twenties, four of who knew each other from an activity club, and two who were partners of participants (the partners were well acquainted with the rest of the group). This group represented a range of occupations alongside two (non-computer science) students. In contrast, Group 2 was a set of five close colleagues in their early thirties who also socialized outside of their

work in a large technology company. They were employed within two different teams and had different roles, but worked in the same building. Two of these participants commuted together to and from work on most days.

Data Collection and Analysis

The study took place over two weeks. During the study we interviewed the participants twice: first after a week, then at the end of the study. We kept in touch with them throughout the study by sending them text messages to remind them about the fill-in diary as well as to make sure the application was running properly. We also collected log data for our own analysis: records of calls between the group members, text messages (stripped of content for anonymity), as well as the participants' profile and locations. In particular, we recorded if they set their location manually and, if so, for what duration. The participants had all been informed that we would be able to record this information, and were assured that we would be processing the data anonymously.

After gathering the data and transcribing the interviews, we analyzed it by dividing the subparts of the interviews into distinct themes. We focused particularly on how users managed their self-presentation through location and activity naming, and the social dynamics within the group. We also looked at how the participants used the manual location setting. We held these findings against our acquired understanding of their everyday life and social activities within the group. We first look at how they used the service in general, secondly we describe how they used the combination of profile and location naming to provide a larger context, and finally we describe how the awareness they experienced of each other also affected their own self-presentation.

CO-ORDINATION AND COMMUNICATION

An initial use of Connecto by participants was checking Connecto to co-ordinate their calls within their group. For example, some participants deliberately did not call a friend when noticing that their callee's profile was on silent. One participant described such a situation in his diary: "[I] wanted to call Colin and make sure he was aware we had a meeting. [I didn't want] to call him while he was at home so waited until he was on [the] road to work". Other times they would switch medium (e.g. send a text message instead) or simply delay the call.

The two types of shared information (location and profile) were also useful to the participant in terms of everyday activities and interaction. For example, one participant, who shared their home with another trial participant, was particularly enthused about being able to see when his friend was home. He could then send a text message asking the housemate to take tonight's dinner out of the freezer. Not only did the participants find it useful to know where their friends were, but on the basis of this

information they could also often infer what others were doing. For example, one participant explained that just by seeing that his friend was at the shooting club, he knew that he was taking care of picking up supplies for the upcoming weekend trip. Therefore he did not have to call and make sure the supplies had been picked up. Similar incidents happened with the two couples. They both reported episodes where one asked his/her partner to pick up something on the way home after seeing that the partner had just left the university or work.

In terms of coordinating meeting up, one set of participants reported that the application proved particularly valuable. The one participant who commuted to work in the morning with another reported that it was useful for him to be able to see when the colleague had left his house. He could then rely on him picking him up about twenty minutes later. He also reported in the interview that one morning he had seen the colleague still being at home when he should have left. Suspecting a problem, he called him up and, sure enough, the colleague had slept in.

Location and Profile Naming

Participants defined between six and twenty locations on the phone over the two weeks (on average ten locations each), with approximately twenty percent of the locations set manually. On average, they added three profiles each, in addition to the defaults (*normal*, *meeting*, *outdoor* and *silent*). When taking a closer look at the different location names we can see four different types of location labels: (1) labels of geographical reference, (2) place names that describe a location in terms of personal meaning, (3) names of locations that describe an activity, and finally (4) hybrids. See table 1 for overview and examples.

Geographical labels were most often used when participants were traveling, or in a place that was out of the ordinary for them. These labels were landmarks, larger areas, or street names. For example, this type of label was appropriated by one participant in order to display where he was each day during a holiday.

Place names were names that made sense mainly to the people in the group, but were not further defined. For example, one participant explained why she set one location to the very general term of 'restaurant' one Friday evening:

Well probably I put 'restaurant' thinking to myself, [my partner] knows I am in [town name]. So I put restaurant in. But if he did want to phone me and I didn't answer he would know it was because I was in a restaurant and I probably didn't go into much detail because I felt well, the only person that is gonna look at this in the interest [...] of wanting to phone me is gonna be [my partner]. He knows I'm in [town], he doesn't need to know which restaurant I am in.

Although Connecto is primarily a location service, our participants also named locations after activities. The strong link that often exists between activity and place made it sensible for the participants to use such labels in certain situations. One participant for example explained how he viewed ‘parking the car’ as a useful label:

I thought that if [my girlfriend] was actually in the flat she could see that I am parking the car. I have to park ten minutes from here, you know. ... [Then] I have left work for a start [...] then I am parking the car, then I am in Radnor Street, then I am home.

Finally, hybrids are the labels that use more than one type such as the augmented places, for example ‘home carlisle’, used by one participant who went home to her parents for a few days. It felt like home to her, but in order not to confuse her friends, she added the place name to express that it was ‘the other home’. Another example was places augmented with activity, for example ‘Tax lecture in j watt’ (‘James Watt Building’ being a building at his university). The participant wanted to express that not only was he in a certain building, he was also at a specific lecture.

Geographic labels	Place names	Activities	Hybrids/ expressions
M6	In-laws	Shopping	[City] stuck in traffic
Radnor Street	Sainsburys	Parking car	tax lecture in j watt
Blackpool	Gym	Car crash	Crap lecture
airport	Restaurant	Clays shooting	Johns car to work
Tormore	Library	Away for a run	M6 northbound
Amsterdam	Mums house	Drinking	Bed, sleeping, drunk
Charing cross	Shopping	On the job	Manchester Meeting
25	50	11	18

Table 1: Categories and examples of location labels used, total number of each type listed

Profile names were already set on the phone to general settings such as ‘silent’, ‘normal’, and ‘meeting’. However, it was simple to change the names and most participants were often expressive and playful with their labeling. Labels were either variations of the built-in names (e.g. ‘Shhhh...’), activities (e.g. as ‘Studying’) or just expressions (e.g. ‘Fine and Dandy’).

Automatic vs. Manual

Initially, we had expected participants to set their location manually when they did not wish to be found, or when they did not want to reveal what they were doing. In a pre-study questionnaire, participants told us that they could imagine using manual setting when at the doctor’s surgery or when arranging a surprise, e.g. buying birthday presents. However, in the post-trial interview none of the participants said that they used the manual setting for privacy protection. Instead, they found the manual setting

useful for ‘freezing’ a location. For example, three participants set their location to manual about once per day. One of them worked in a large area and found the automatically determined location imprecise, and so manually set the location to ‘work’ to overcome the limitations of the system. The second participant reported that she felt it was easier when she was on the road to just set it to ‘M6’ (a motorway through Britain). The third participant encountered the same problem when on a long drive; he explained in his diary “[...] because i was traveling like 400 miles down south, the best option was to leav[e] the phone and profi[le] onto a certain arrangement so people would know where i was”.

Although many studies show that people frequently lie and give incorrect information in social situations [7], we found little of this kind of deliberate deception. Our participants rather used vagueness and ambiguity in their location label to manage their location disclosure. The flexibility that the manual setting gave the participants was highly valued by about half of our participants. Six of the eleven participants used the manual setting during the two weeks of the study. For example, one female participant wrote in her diary on the second day of the study:

“[Yesterday] was the first day I’d used the phone and my initial reaction to the service was that it was a bit creepy knowing where people were, although today it was good fun to ‘play’ with the service [...] and decipher how it worked. The fact I knew I didn’t have to enter locations if I didn’t want to or could set it manually made me feel more in control.”

The participants did not express any concern in the interviews, even when asked specifically if they worried about their privacy. The practical use and participants’ awareness of its reciprocity seemed to outweigh any possible concern.

SHARING INFORMATION AS STORY TELLING

Although the initial system design focused primarily on location, participants used the combination of the two types of information to communicate their context in detail. Often the location would be a place name and the profile would indicate an activity. One example was a male participant who set his location to ‘the lane’ and his profile to ‘drinking’. The lane was a small street close to a university with bars, restaurants and shops. By personalizing his profile he indicated that his friends were welcome to come along. Indeed, another participant reported that he had joined him later after seeing this status. Other combinations were less dependent on each other, such as ‘work’ (location) and ‘boring meeting’ (profile) and ‘home’ (location) and ‘sick’ (profile). When asked why they set such a combination of indicators, one female participant said: “It is like telling a tale, using both”. This ‘story telling’ was strongly supported by the system’s flexibility in terms of location and profile

naming and we suggest that the openness to interpretation was one of the keys to the success of Connecto. For example, participants overwhelmingly used generic terms such as 'gym' rather than saying exactly which gym. These vague place names as well as the combination with profile naming were the essential glue for socialization around the application. Not only were geographical names less relevant, they were most often not telling enough of 'the story'.

Sometimes the stories would be 'broken' by problems in the technology. For example, one participant reported noticing another's profile shifting between 'the pub' and 'economics lecture' most of one evening. He knew that the pub was very close to one of the lecture halls and was, therefore, able to interpret that this was simply a matter of the phone being 'confused'. They both reported joking that the participant had been at a lecture that late at night the next day. Another participant who car-pooled to work with a colleague reported having set the location to 'Johns car to work', only realising later that the phone would show the same location on the way back from work. He said in the interview that he thought it was fun and, although no one had commented on it, he did not change it on purpose as he expected his friends would know he was going back from work when it was the afternoon.

These examples illustrate that the stories are not necessarily free-standing and that most often need interpretation in a social context, mainly by the friends themselves. If the friend had not known that the pub was close to the lecture room he might have thought the participant was (inexplicably) in a lecture at 11pm. Similarly, the other participant's friends would have thought he was working late. Since Connecto was designed for close friends they seemed relaxed about the 'correctness' of the status. In fact, they quickly started using Connecto to express all kinds of situations, moods and experiences, which we now report on.

Expressiveness and Repartee

The participants' eagerness to express how they were 'stuck in traffic', rather than driving, or at a 'boring accounting lecture', again reveals their need to tell a story rather than providing facts. They often responded to each other's location labels, sometimes by trying to make their own label more extreme, other times by texting comments back. For example, one participant responded to his friend setting his profile to 'Horny': "I sent him a text message to say I can't believe you put that". When asked why they enjoyed reciprocating each other's 'extreme' location or profile labels, another participant explained: "So I guess once one person started doing it, everybody else thought they would follow suit, changing their profile from saying, 'normal' to 'abnormal' etc.". We repeatedly observed participants' need to express more than just location through Connecto, not only as a more elaborate

description of a situation but also as a way of expressing opinions or calling for attention.

For example, one participant brought the phone to Amsterdam; walking around in the red-light district he set his profile to 'on the job' (a euphemism for having sex). When asked why in the interview he explained that he wanted to see what kind of reaction he would get. Surely enough, his friend had shown the phone to their classmates. The location label he had set had been clearly designed for his friends, who knew where he was and what Amsterdam was to them.

We witnessed many varieties as expression, mainly based on meaningful experiences. One participant set his location manually to the local football stadium on an afternoon where 'his' team was playing. He told us in the interview that he had planned to go, but got home too late and was instead watching the football on television. Since he had told the others he was going, he still wanted them to think he was at the game and set his location to 'the stadium'. When his team later lost, he put his location to 'down in the dumps' to express his frustration. His friend then texted 'well I would think so' so as to respond to the loss. The participant then teased the friend the next morning about how he had 'fooled' him into thinking he was actually at the game.

Thus, Connecto was used to 'tell a story' and express views and feelings that related to the general perception that participants had of each other. We now turn to how this continual awareness was experienced.

CONSTANT CONNECT

Participants were initially very observant of other people's status. They reported checking the phone 'constantly', both in relation to their own status and others. When asked if she liked Connecto, one female participant said in the first interview: "I always check everyone! Cause I wanna see what they are all up to. I'm just nosy [laugh]". Although the frequency of checking others' status slowly went down through the study, according to most participants they continuously enjoyed the awareness of their friends' activities the application provided them with throughout the day. However, this awareness showed to be two-fold; Connecto provided an awareness of other people's activities and whereabouts, but it also meant that participants were aware that others were aware of them. We describe each factor in turn.

Awareness of Others' Activities

Participants used the awareness of others' activities for both practical issues as described above and social navigation, such as serendipitous meetings. For example, one participant used Connecto specifically to show others that he was at the shooting club. In the interview he explained that he had hoped the others would come up and join him, and indeed two of them then did. Another

participant explained that he enjoyed observing that others were getting home later than him.

More frequently, however, the past days' labels would be used when friends and colleagues were together. Several participants mentioned how they would comment on previous locations and certain 'colorful' profile names:

It does kind of make you chat more about what you are doing and that sort of things. Seeing that you were at [restaurant name] on the weekend. Where as other times you might just never really, well you might just be like 'how was your weekend?' and then not really say nothing. Whereas when you've seen they were at a certain location then that kind of gets you chatting.

In this role, Connecto contributes to the ongoing thread of conversation between friends and the ways in which, in Sacks' phrase, 'friends show that 'my mind is with you'' [30] – that they are paying attention to each others' lives and activity. Here, mutual monitoring acts as a part of friendship relations by adding to the ongoing 'relationship state' between participants. This was not just that participants would draw upon others' past locations in conversation, but that they would be expected to have seen each others' location or else risk falling 'out of touch' with the group. Just as we remember whom we have told what stories to, and mistakes can cause embarrassment, Connecto helped support knowing who was where, and when. This was the background knowledge of the routines and activities of the group (see also [4]).

Composing Location

A subtle but interesting characteristic of our participants was how they actively became aware of how others could now also see their location and profile. Previous literature on positioning systems has generally focused on the reading of place labels, but our trial participants also put effort into authoring their labels too. This reflected their concerns for presenting themselves in certain ways. For example, one participant described how she wanted to demonstrate how active she was to her boyfriend:

When I was travelling in the car I think I went to the extent of saying M6 southbound to Manchester or Northbound so... I went into further detail of which direction I was going, [...] to tell [my boyfriend] if I was going to a meeting or coming from a meeting. I think [...] it was probably because [he] would know my location as such... To know that I wasn't just sitting at home twiddling my thumbs so to speak [laugh].

Another participant explains how he made sure to update his locations one day when he was out shopping:

Saturday I put in very specific [location] I just kind of thought, well you can put in shopping, shopping is very generic you know. You could be absolutely anywhere shopping. So I started put in more specific, I put in 'Next [High Street]', you know in brackets [...] I just

put wherever I was in. Ehm, 'Topman' as well. [...] It's a bit like just letting everybody know where you were'.

Controlled self-presentation of course is not unique to virtual systems, we all make sure we present ourselves in certain ways and adapt our behaviour to both situation and surrounding people [11]. What is perhaps unusual is that in Connecto participants were self-conscious about what their profile and location was set to, even though they could never be sure anyone was actively watching. They chose the labels carefully rather than randomly, and in a way they were sure would be understood by exactly their group of friends.

DISCUSSION

Our study of Connecto explored issues in terms of new mobile social applications and their effects on users' behaviour and relationships. This system distinguishes itself from others by focusing on an open and continuous information sharing system, a type of application that has previously been overlooked in user studies. This kind of application is open to a number of social and cultural interpretations and appropriations, which only surface through actual use of the application. We discuss four issues in particular that contribute to a better understanding of potential future uses of location-based social applications.

Firstly, the tagging *features* of the system supported users collecting a set of shared names for the places that members of the trial groups frequented. Recent research has discussed what was termed the 'private geographies' that groups (in their case families) hold together [4]. Private geographies are the mutual sense of different places that a social group share and which differentiate that group from others. The private geography allows members of a group to draw upon 'shared in-common' senses of different places, and what those places mean for the group. The ability to use custom labels differentiated this system from earlier work, which has only used fixed labels. The tags acted as a concrete collection of labels that the group could regularly see in each other's statuses on the phone. In this way the system supported, in a very tangible way, the 'private geographies' of the groups.

In a related manner, a misperception is to view location sharing applications as mainly *navigational* or *coordination* tools. Spatial navigation is quite different from social navigation, an aspect Dourish and Chalmers described already in 1994 [8]. Indeed in our study, the geographical awareness within the system became part of the participants' ongoing sociable interactions [31]. In essence the awareness became part of the ongoing social repartee between friends and colleagues, quite unlike spatial navigation.

Our third point of discussion concerns privacy on the part of users and in terms of our design. Among our

participants, we observed remarkably little concern or action towards tightly preserving privacy over location. However, a large volume of the literature points to the sensitive nature of localisation applications, and the Wizard-of-Oz studies reviewed in the beginning clearly warn developers of users' sensitivity to localisation. Despite this, it was clear that our trial participants showed little concern about privacy.

Clearly, our sample here was relatively small and distinct (in that the participants initially had agreed to take part of the study and were, therefore, not necessarily representative of the general public). However, they were also young adults who were used to mobile phones being an integrated part of their everyday life. None of them had owned a mobile phone for less than six years, and all sent text messages on a daily basis. It is worth noting that much of the privacy related literature was conducted in the United States where mobile phone uptake lagged behind Europe (and Japan for that matter). Therefore, we find it telling that our participants had much fewer concerns in terms of using a mobile location application.

One feature that seems to have greatly put participants at ease was the manual setting. Although they did not use it to 'hide' when it came to actual behaviour, it meant that they initially accepted the application (alongside not expressing any concerns when probed in interview). They realized the value of Connecto through the study, as well as developing practices to 'shield' their privacy (such as naming locations generically and giving large geographical references). In the end, the minor sensitivity issues of the start of the trial were countered by users' desires to express and share experiences, mood and activities. Privacy is a dynamic and continuously negotiated process [28]; put into practice, this means that simply because potential users are hesitant about agreeing to share their location (such as in wizard-of-oz studies), when put in an actual situation they negotiate and appropriate the service for optimal use.

Finally, we point to how location-sharing applications often focus excessively on utility. As we saw in our study, the participants found Connecto assisted in many everyday tasks, but when interviewing them it turned out that this was not central to their experiences. This is not to say that the application was not useful for many everyday tasks, and naturally this is one of the application's strengths. More importantly, in the social group the application provided joy and amusement alongside social glue for further face-to-face experiences.

In essence, it would be heedless not to acknowledge the hedonic aspects of such application. Technologies are developed and used within a rich social world that is frequently only presented in anodyne form in academic discourse [19]. In this regard this system is not only capable of adding utility to already present social practices but becomes part of social interaction and

contributes to social awareness and communication. It assists in maintaining friendships alongside practical use. By viewing it as an information tool we diminish the influence that social technology can have on behaviour.

An analogy to this could be text messaging; when SMS was implemented into the GSM standard, most providers did not believe it would be used much [13]. However, as mobile phone users 'discovered' it, text messaging took off to unforeseen levels [20]. Texting facilitates social interaction and social networks, which contribute to the otherwise limited communication method's popularity. Practices came out of and developed from pre-texting practices, reacting to needs and opportunities in different cultures. Technologies become part of these very practices, not something 'layered on top', but constitutive of the many practices of friendship, companionship and social life.

CONCLUSIONS

We have presented one location tracking application, Connecto, which we have developed as a probe for investigating emergent social practices in groups of individuals who share their real-time location through mobile phones. Our aim was not just to find if users are ready to accept such applications, but instead to gain insight into how the different types of functionality would be used by people, as well as how the application influenced social experiences. Our friend finder application was not an entirely new 'invention'; several resembling applications have been studied, although in different settings. Yet we point to a gap in studies of real-life use of these applications in terms of open location sharing, as well as exploring the social interaction around the application.

In particular, in designing and studying friend finder applications, we underline the importance of understanding the larger surroundings of these applications. When solely considering 'general' situations such as the privacy exploring studies we reviewed in the beginning, we miss out on the more 'thick' social mesh of everyday life. As we emphasised in our findings, the friend finder is a tool for interaction, rather than an information provider. In thinking about technologies this way, our goal is to open up the research agenda to a more encompassing set of technologies.

Finally, we plan to continue studying these social applications, exploring how much information can be shared and in which type of social group. Our own research program takes us into further development of Connecto, by adding different functionality and conduct further studies, both for comparison and further insights.

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