Online Everywhere: Evolving Mobile Instant Messaging Practices

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ABSTRACT
In this paper we report on the results of a large scale user survey investigating the status setting and interruption management behavior of *mobile* instant messaging (IM) users with *existing* systems. The motivation for this study was to inform the design of interface tools that support users by setting contextually appropriate awareness messages. Our results demonstrate that many desktop IM practices have been appropriated by mobile laptop users, but in the face of increasingly situated computer usage and an "always online" culture, several frictions are emerging between desktop and mobile practices. We find that common assumptions about IM users and the established awareness cues are failing and users are frequently embarrassed and interrupted with negative and sometimes threatening consequences.

Author Keywords
Instant Messaging, IM, Mobile Computing, Presence, Online Status, Awareness, Location Disclosure, Privacy

ACM Classification Keywords
H.4.3 Communications Applications, H.5.3 Group and Organization Interfaces, K.4.2 Social Issues

INTRODUCTION AND RELATED WORK

Instant Messaging (IM) systems support synchronous communication over technology-mediated channels. Users maintain a "buddy list" of other users with whom they can initiate a real-time text conversation by clicking on a buddy's name (or other representation). When users type a message, their buddy's computer displays pop-up windows containing the text of the messages and a place to respond. To support awareness of buddy status, buddy lists are often augmented with two types of real-time status cues. The first is a simple indication of whether the buddy is "offline", "away", "idle", "busy", or simply "online". The second type of cue is a short custom phrase that users can choose to broadcast to all of their buddies. Different implementations, extensions, and services often modify aspects of this basic framework.

IM is not the first example of a system that provides awareness cues. Similar systems have been providing insight into the physical context of distributed communities of practice [20] since at least 1971 [18]. Early examples include the Unix command, "who", which allowed users to see whether other users on the same mainframe computer were typing. As individuals began to work on smaller more personal networked computers, utilities like "finger" emerged to reveal remote U/I activity and custom "project status". Greater bandwidth and access to advanced peripherals enabled richer remote awareness through systems like MediaSpaces [1] and Portholes [4].

In the physical world a popular office awareness system is the "in/out" board. Such a bulletin board is maintained at a common location, like a reception area, to give people in small to medium sized office suites knowledge of where the inhabitants are. Some researchers have attempted to create a hybrid ecology around these boards so that the affordances of *digital* awareness, such as remote automatic updating can be coupled with the *physical* placement of the bulletin board itself [3, 8, 13].

More recently researchers have *custom built* special systems to explore the effects of awareness cues in a *mobile* context. The Awarenex system examined the user interface of mobile awareness cues [17]. Another system, PePe [12], examined how users described the locations that they visited. In the commercial arena micro-blogging services such as Twitter [19] and Jaiku [11] have been developed to support user entered status from mobile devices.

Other researchers have focused on *evaluating* the role of IM status cues in *existing* IM systems. They have used a number of perspectives including focussing on IM's social role among teens [6], how it functions in physically distributed workplace teams [7], and how it maintains social connections in the workplace [14].

In this paper, we focused on evaluating the role of status cues as they relate to mobility, the ensuing inappropriate interruptions that result and the resulting status management behavior of these users. Our motivation is to inform the design of Nomatic*IM [15] which has the goal of enabling users

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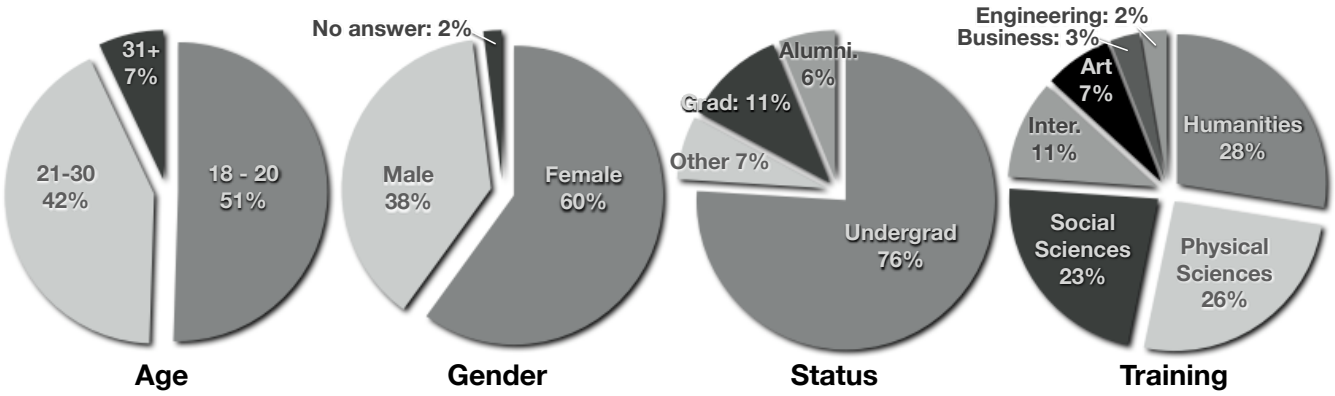

Figure 1. Demographics Of Survey Participants

to quickly and accurately enter appropriate contextual status messages in IM.

This paper contributes to the state of the art by adding to our understanding of evolving practices of mobile communication management by surveying a large number ($N = 447$) of *mobile* IM users who are actively using *existing* systems in their daily lives. Through this approach we are able to avoid effects due to system novelty, and small numbers of participants.

METHODS

We conducted an anonymous online survey of targeted users, over 17 years of age, to inform our understanding of the way people currently interact with their IM client when physicality is a dominant force. Potential participants were recruited over the course of two months via email, blogs, flyers and word of mouth from the greater University of California, Irvine community. The first part of the survey informed participants of the scope of the study and asked 4 questions to determine eligibility. Eligible participants who completed the entire survey were compensated with a raffle ticket for one of three $50 gift certificates. The survey consisted of a total of 53 questions in 6 parts:

- Demographics: 6 questions
- General Mobile Platform Usage: 6 questions
- Instant Messaging Usage: 14 questions
- Instant Messaging Interruptions: 7 questions
- Managing Instant Messaging Interruptions: 12 questions
- Mobility: 8 questions

Mobility

For the purposes of screening for mobility, we only included those individuals who reported using instant messaging on a mobile platform at least once a week. We defined mobile platforms to include laptops, mobile phones, and PDAs, and explicitly excluded desktop computers. In the body of the survey our participants separately confirmed that they were mobile users, took their mobile platforms with them when they went places and felt like they used their computers while "on the go". However, since cell-phone mobility and laptop mobility look different in practice, we conducted a secondary analysis of our qualitative responses to look for evidence of specific mobile device types. We found many references to situations involving laptops (e.g., users explicitly mentioning laptop screens, sitting around a laptop in group settings, or not being "at their laptop"), but all references to cell-phones suggested our users were not using them for IM (e.g., "I IM'd because cell-phone was too expensive", "my status message said call my cell"). Because of this, our results should be interpreted with a particular perspective on mobility, that of nomadic workers who move from location to location with a mobile computer, but who are likely stationary when they are actually using their device.

A total of 604 people were screened. 447 individuals met the criteria for eligibility and started the survey. 384 individuals completed all questions which yielded an 86% completion rate. Average completion time was 23 minutes.

After collecting the data, we performed an initial statistic analysis on the results, and then two researchers examined the statistical results and the open-ended questions. Based on this review, a researcher was assigned to perform two pass coding on each question of interest. Finally χ^2 tests were performed by multiple researchers over some responses to identify and test trends.

Demographics

The majority of our survey population was between the ages of 18 and 30 with 51% between the ages of 18 and 20 (see Figure 1). 60% of our participants were female, 38% were male and 2% declined to respond. Although we didn't restrict our survey to being members of our university, our outreach methods primarily reached undergraduate students (76%), then graduate students (11%), alumni (6%) and finally a mix of staff, faculty and others (7%). The field of study/training for the participants was broadly distributed with most people training or trained in the Humanities (28%),

then the Physical Sciences (including computer science, 26%), Social Sciences (23%), interdisciplinary training (11%), art/ design (7%), Business/Finance (3%), and finally Engineering (2%).

RESULTS

Mobile Computing Platform Usage

We asked questions about overall mobile computing platform usage. We used the term "mobile platform" (MP) to create a category of mobile devices for which IM clients are available. MPs included laptops, PDAs and cell-phones, but excluded desktop computers. The participants in this study reported using their MPs anywhere from 1 to 40+ hours a week distributed uniformly, and showed a slight tendency toward reporting that they used their computer more for "personal" reasons than for "work" or "other", although this is difficult to interpret for student participants.

We asked several questions to understand the computer fluency of participants. We chose a task-oriented approach to these questions, opting to ask about ease in accomplishing a variety of tasks rather than directly asking the user if they were fluent on their MP. The questions asked about functional behavior (e.g., difficulty with printing, formatting, file manipulation), solution seeking (e.g., difficulty finding answers to questions, "Do you ask for help or provide help more?" etc), perceptions toward undertaking specific computing tasks (e.g., loading new software and learning about it) and experience with software development. Participants indicated high levels of confidence and computer proficiency. 86% reported finding computers easy to use and most tasks were rated as simple or very simple by over 90% of the participants. Proficiency with their MPs was largely limited to user level tasks, as only 8% had ever developed their own applications for their MP.

Instant Messaging Usage

We asked several questions about the details of the systems that the participants were using for instant messaging and found that 81% were using at least AIM with the second highest usage being a tie between MSN and Google Talk, both at 35%. Smaller proportions were shown to use Yahoo!, Skype, or other systems. The actual clients that the users were using to connect to these systems were more varied. 64% were using native AIM client programs, and then over 10 other clients were mentioned, including those (like pidgin) that support multiple protocols and systems at once. Aside from AIM, none of these clients were used by over 20% of the users. Although technical problems were raised by participants, we didn't observed any responses that indicated that mobility specifically was influencing system or software choice.

Participant's median buddy list size was approximately 100 users. This represents an increase from the 22 reported by Nardi [14] for workplace IM usage. It is consistent with the size of teen buddy lists in 2002 [16] assuming that those teens are now in their twenties and taking this survey.

Participants used IM in over 14 languages, but the overwhelming language preference was English.

IM Incorporation Into Mobile Practice

70% of participants report using mobile IM the same or more than email, but for the 73% of participants who used mobile IM daily it was displacing email usage ($\chi^2 = 61.5, p < 0.001$). Similar effects were seen in land-line use ($\chi^2 = 54.8, p < 0.001$). For cell-phones, most people reported using cell-phones the same or more than IM, but the trend toward mobile IM displacing cell-phone use remained ($\chi^2 = 18.4, p < 0.001$). As Grinter [6] suggested and as we show in our data, displacement is not the real issue, instead mobile IM is being adopted as part of the communication infrastructure. For example one participant noted:

> "*It's difficult to gauge how much you use IMs or text messages in comparison to talking on the phone. IMs and texts can be done in various places while various things are being done - I typically use instant messaging or texts because I'm in class; busy with work; or watching the TV and can't talk on the phone. Not to mention the fact that a phone conversation may only be 10 minutes long; but it takes sometimes 30 minutes for the same things to be said via an electronical [sic] form of communication. Also; for "importance" of IM; it's hard to tell - I lived perfectly fine before IM; and I will certainly feel no sorrow or negative influence on my life should it go away - that said; it does play an important roll in quickly discussing school topics; checking in on more friends than you could had it been via phone; and easily deciding who's around and who isn't when you are contemplating grabbing something to eat or need a favor.*"

Mobile Instant Messaging Interruptions

We asked a series of questions about whether or not our participants had ever been in a situation in which they had been interrupted or seen someone else interrupted during a formal or informal presentation. We followed up asking specifically about whether the interruption had been inappropriate or not.

IM is, of course, designed to interrupt at some level in order to get the user's attention and as [10] points out not all interruption is bad. Not surprisingly, 92% of our participants indicated that they had had a task interrupted by IM. Specifically, 25% had been in a presentation in which the presenter had received an IM and 5% had found themselves as the presenter in that same situation. These numbers may reflect the relatively large numbers of students who are more likely to be *in* a presentation than to *give* one.

Of more interest were the results we obtained when we relaxed the presumption of a presentation and just asked our users if they had ever received an embarrassing or inappropriate IM because others were looking at their screen and what the situation was at the time. 78% indicated that they had. 80% indicated that they had seen an embarrassing message delivered to someone else. Figure 2 shows the proportion of different types of embarrassing messages categorized in the following ways: Inappropriate or sexual lan-

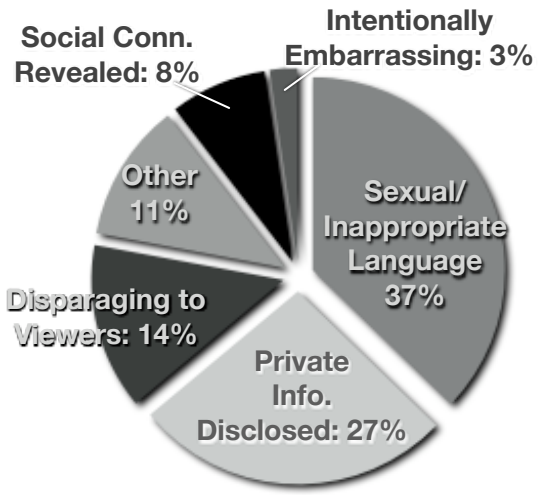

Figure 2. Types Of Embarrassing Interruptions.

guage (e.g., "Sitting in a theater with a friend messaging about her 'female' problems."); secret or private information being inadvertently disclosed (e.g., "a surprise birthday party invitation and the person whose birthday it was was standing right next to me"); disparaging comments made about people who could see the IM (e.g., "'are you still in the meeting with those losers' popped up on the screen while I was, in fact, still in the meeting with those losers."); too diverse to categorize (e.g., "This happens to me all the time :(I'd rather not talk about it."); an unknown social connection revealed (e.g., "someone was asking me out"); intentionally embarrassing (sent with the intent to embarrass because of their known context).

A Personal Computer Isn't A Private Computer Anymore

The high number of people who had received embarrassing IMs is notable and is consistent with the design probes of Eriksson [5]: Users are comfortable with public displays and private displays but have difficulty at the places where the two meet. Our analysis indicates that users make assumptions about the social context of their buddies based on an assumption of a dyadic connection, consistent with IM'ing someone at a private desk. In such a non-mobile situation, one has a reasonable expectation that a buddy's screen is visually private even when not being used. Desktop computers are physically protected and when they are unused, screen savers obscure the screen from casual view. The number of reports of embarrassing incidents that we collected suggests that there is not much broad exposure to communicating to MPs configured as public or semi-public displays (e.g., see [9]). But as the computer becomes mobile the screen is viewable by many people, those seated around you, those walking behind you, those collaborating with you and/or those watching you demonstrate or present.

We hypothesize that the results in Figure 2 are revealing a social friction that is developing around the movement of the personal private computer from the home or office into the public square. This is more relevant to mobile laptop usage than cell-phone usage as small screen form factors are easier to keep private in public spaces [5]. However, the interruptive, and unpredictable nature of IM interruptions, coupled with a lack of awareness of the visibility of the laptop screen on the part of the remote buddy combines to make mobile laptop IM more prone to embarrassment.

Managing Instant Message Interruptions

We inquired about IM status indicators and whether participants utilize them, and if so do their buddies change their behavior based on what they choose? We focused our questions particularly on behavior related to interruptions. Most participants (89%) indicated that they pay attention to their buddies' status and 90% are aware of their own away/idle/busy/available status. Fewer (50%) report using automatic methods for revealing their idle/away/available states but 60% report using custom status messages.

The Desktop Isn't A Place Anymore

Our data revealed a curious contradiction: Although 89% of users indicated that they paid attention to their buddies away/ idle/busy status, 93% said that they IM'd them even when they indicated that they were away/busy and 92% said that they received IM messages even though they were indicating away/ busy. Why are IM users paying attention but then disregarding the status cues of the recipient? Why are they choosing to interrupt buddies who are clearly indicating that they are "busy"? A detailed review of the open ended answers that our users provided revealed possible answers:

One user set his custom status to "*out for the day*" and explains that the reason is so "*if people want to leave an IM Message; they can*" another custom status message example was "*Not here right now; but leave a message and I'll respond when I come back*", a third explicitly clarified:

> "*As to question 11 ["Do you pay attention to the IM status (away/available, etc.) of people on your buddy list?"]; I'm not 100% sure what was being asked. I said 'no; I don't pay attention to IM status;' which isn't entirely true. I read people's status messages constantly. But I tend to ignore the actual status flag (away; available) when deciding whether or not to IM a person. If applicable; I may attend to the 'idle/active' flag; as it's a more reliable indicator of presence at the keyboard; but even then I often just leave a message to be read later.*"

So it appears that a good explanation for why up to 93% of users are IM'ing despite their buddy's unavailability, is that they are not interpreting "busy" and "away" as signals relating to *interruptibility*, instead they are being read as indicators of *expected response time*. When a user says they are busy, they aren't communicating that they shouldn't be IM'd, but rather that buddies shouldn't expect a response right away.

This is a pattern that is consistent with users assuming a mental model of desktop computing. Under this assumption a user's computer remains logged in at one physical loca-

Category	Examples
Social Reinforcement	"just catching up", "just wanted to say hi", "I hadn't spoken with them in a while"
Physical Coordination	"make dinner plans", "transportation discussion", "coordinating airport pickup"
Pass the Time	"just bored", "just felt like being silly", "I was encrypting files; which involves long gaps of waiting so I wanted a bit of a diversion"
Specific Information Need	"Let her know info about Mom", "discussing application", "To check if some mail of mine had arrived"
General Question	"question about class", "discussed implementation of Dijkstra's-Algorithm", "advice on fixing a laptop"
Prolonged Interaction	"giving feedback on his work", "Both of us needed to write papers but wanted to stay connected. We kept the IM on while we wrote."
Technical Compensation	"too expensive to use cell-phone", "SKYPE voice was not working"

Table 1. Categorizing Of Rationales For A User's Last IM

tion. When the user is truly busy and away, the computer remains online. In this case, sending an IM does not cause an interruption, the desktop computer wasn't going *with* the user after all.

Desktop use of IM in this case transforms from a synchronous mode of communication to an asynchronous mode. Users, knowing full well that their buddies are away, send them a message anyway, intending for these messages to stay on the screen until they return and can respond. In this mode, desktop IM works as an electronic pile of notes that buddies drop on the "virtual desktop" for later.

In a mobile context, particularly with a cell-phone, "away" makes far less sense as a status cue, and "busy" frequently doesn't suffice to describe the nuanced attentive capabilities of the user. On a laptop, "busy" more frequently indicates that the IM pop-ups themselves are problematic because of the semi-public nature of the screens, not just that response time is delayed.

Certainly a desktop user cannot always easily manage incoming IM messages, but with mobile IM, the situation is compounded. Mobile laptops have all the same concerns as desktop computing, but also share the burden of location-specific tasks such as giving presentations, dynamic network infrastructures, and limited time to accomplish tasks before a battery needs to be recharged. Further, if a cell-phone is actively being used for navigation, or for information searching while walking, users additionally do not have the cognitive resources to manage an IM client, nor to clear away incoming IM messages, nor the freedom to go offline. The assumption that the virtual desktop is an inbox of IM messages subsequently fails. This shift results in a second social friction as mobile IM users try and reappropriate the status cue "busy" to actually mean "don't IM me now".

"Please Stop Just IM'ing Me"

Further insights into the nature of mobile interruptions emerged when we asked people to describe the last IM they sent. Table 1 shows our categorization of the reasons and some examples of each category. Clearly many of these categories could be construed as overlapping, but we chose to base the analysis on the language that people used to describe the interaction in order to gain insight into the perceived role of the

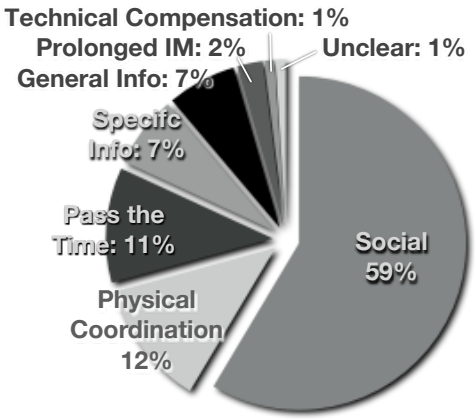

Figure 3. What Was The Rationale For Your Last IM?

interaction from the user's point of view. Figure 3 shows the aggregation of responses across users. A specific question was differentiated from a general question based on whether the recipient was likely to be the only person that could reasonably answer the question.

18% of respondents used the word "just" explicitly in their description of their last IM (e.g., "I was just chatting", "just checking up on a friend"). Even when "just" wasn't used directly, much of the language implied that users felt like being online meant you were temporally flexible and could accommodate a few minutes of discussion. Desktop computer usage isn't always temporally flexible, but mobile computing is even less so, because of the added overhead a user has in managing the reasons why they are mobile in the first place. If working on a computer means you are by yourself writing email, researching on the web, or reading news as one might be with a desktop computer then this assumption is appropriate. But if being online no longer means that you are by yourself, or that you are temporally flexible or that you have the manual dexterity to additionally manage an online interaction these "just" encounters cannot be supported as easily.

70% of recent IMs were categorized as social reinforcement and passing the time and not only require a *buddy* to be temporally flexible, but are themselves conversations that can be

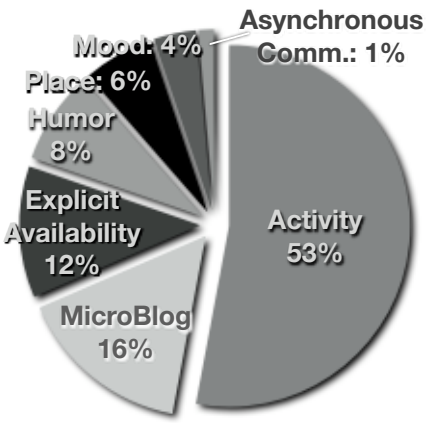

Figure 4. What Are Users Putting In Their Custom Status?

time-shifted easily. Physical coordination and gathering information needs are also tasks that could possibly be delayed to accommodate a temporally inflexible buddy.

Additionally passing the time, and gathering general information needs do not necessarily require a specific communication partner choice and are therefore "buddy-flexible".

These results expose a third friction in the adoption of mobile IM. In a mobile computing world, an assumption that a buddy has task flexibility is less appropriate. These results are also promising for the developers of context-aware IM tools, however, because by giving users appropriate knowledge about whether a buddy is temporally-flexible, our users could choose to reschedule or retarget up to 77% (the sum of Social Reinforcement, Pass the Time, and General Questions) of all of their IM's, greatly reducing the impact of interruptions when users have high cognitive load.

Custom Status In Mobile IM

We also asked users to give an example of a recent custom status message that they set (see Figure 4). 53% of the messages were descriptive of the user's activity (e.g., "cleaning my room"), 16% were micro-blogging (e.g., "study smart not hard"), 12% indicated explicit availability (e.g., "busy busy busy"), 8% were humorous (e.g., "the early bird catches the worm; but it's the late worm that lives."), 6% were describing place (e.g., "in the data center", "Starbuck's", "at work"), 4% revealed emotional state and 1% were asynchronous communication through status lines (e.g., a birthday message).

People who use custom status messages are more likely to be the same people who receive IM messages even when they indicate they are away/busy ($\chi^2 = 30.75, p < 0.001$) and are more likely to do the same to their friends ($\chi^2 = 9.65, p < 0.01$). Ironically these people are also more likely to be actively trying to manage their interruptions. This would be accounted for by the previously explained desktop notes model of IM. We hypothesize that people who put interesting status lines in their IM are unintentionally inviting their buddies to interrupt them with questions and comments about their status lines.

Status Prediction As Activity Recognition

The notable trend for mobile IM is the large number of status messages which are related to physicality. Activity and place together account for 59% of the information that people want to display on their custom status lines. If you consider explicit availability as an indicator of interruptibility, we see a remarkable result for the ubiquitous computing community: custom status lines are simultaneously doing the work of activity recognition, place recognition, and interruptibility disclosure, three developed fields of research in their own right.

Further it suggests that for the mobile IM community the lines that researchers have drawn to separate the recognition of place, activity and interruption, while convenient, may be misguided. The end user seems to require the ability to use all three interchangeably and simultaneously. All three type of data are necessary for a user to manage their mobile presence.

Construction Of Place Through Custom Status

We also asked participants general questions about the prospect of specifically revealing their places to their buddy lists. People were evenly split about whether or not it would be useful to them in general terms. To get more grounded answers, we then asked participants to assume that they were in a library studying and were going to write a custom status message describing their situation. We then asked them to give us their impression about how comfortable they would feel about using one of the following phrases:

- In seat 22, at Langson Library, UCI campus
- At Langson Library, UCI campus
- At UCI campus
- On campus
- In California
- At the library
- Researching Galileo for HIST 60
- Doing homework
- Working
- Working on campus
- Doing homework in the library

Our questions were phrased to allow people to indicate their comfort level, or to completely opt out of a given status line. For the people that rated it with a comfort level we normalized the responses and graphed them on the left of Figure 5 and put a bar chart on the right with the number of people who opted out.

The key message here strongly supports the work by Consolvo, *et.al.* [2], which suggested that people reveal the most

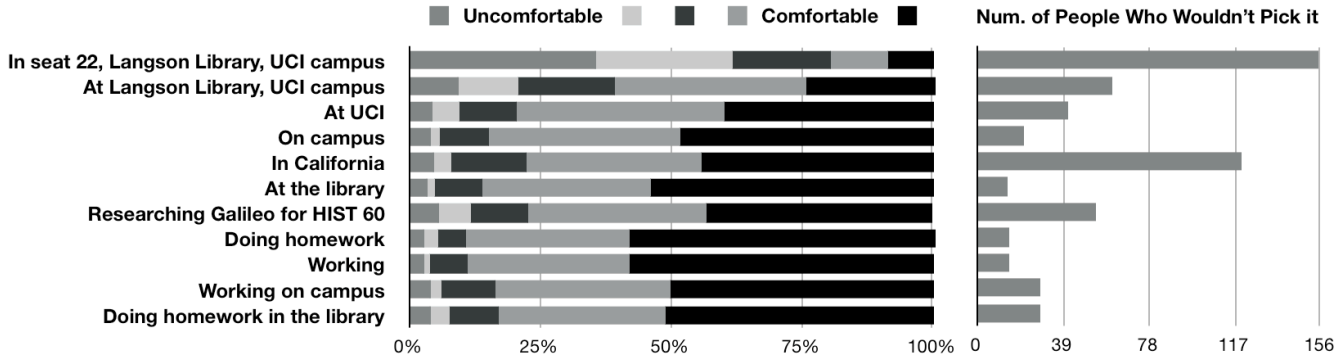

Figure 5. Comfort Levels: In this graph we show how comfortable people felt with a variety of different potential custom status lines shown on the left, all of which were hypothetically true for the same situation. If it was more applicable, we allowed people to instead indicate that they would just never pick that particular status line. The number of people who chose that option is shown on the bar graph on the right. We then normalized all of the remaining comfort level ratings to generate the graph to the left.

appropriate location information online, not the information that meets their privacy tolerance. If they aren't comfortable with a status they do not report anything. This phenomenon may explain why many people would never pick an extremely detailed location such as a seat number in a library. It may simply not be useful. Similarly given that more than 80% of the buddies of our participants were in California, indicating that they were in California would not be of any use.

The implication for mobile IM can be taken further, while raw sensor information like GPS or other sensors can be reported through custom status cues (e.g., [17]), we hypothesize that this isn't what users need. We believe that they want to communicate an *interpretation* of sensors that is appropriate for their current context.

Stalkers

While the subject of dangerous people who follow unsuspecting targets around is common material in the popular news, it is unclear if stalkers are a serious enough issue that they should be considered as more than a hypothetical in ubiquitous computing design. We specifically asked participants if they had ever had a "bad" experience with revealing their locations online. 5% indicated that they had. The majority of them were awkward social situations:

> " *somehow I forgot to tell my mom that I was leaving [a city in the Americas] to travel to a small village in the Atacama desert for a week. When I came online she was not exactly thrilled with where I was.* "

> "*My wife was upset when she knew I was at home instead of at school*"

> "*Studying at a location and friends came over and was distracting me [sic]*"

However, 1.0% of our participants reported experiencing situations that were physically threatening. One female related an experience of being threatened through mobile IM and then afterward realized that she had been broadcasting her location. One female and one male both described situations in which they had been stalked and it had caused them to change their mobile IM status setting behavior.

Mobile IM Means IM Interruptions Are Mobile Too

To confirm our assumption that interruptions need controlling, we asked how many people had strategies for managing IM interruptions. 43% indicated that they had specific strategies for managing interruption.

40% use a fake status and indicate that they are either away or offline (i.e."invisible") when in fact they weren't (see Figure 6). This technique manages interruptions by giving users the social freedom to ignore incoming messages. It did not function to stop the visual interruption of the pop-up window from appearing when sent. 39% have so much trouble with interruptions that they choose to shut down their clients entirely. Smaller percentages indicated that they create sensory corrals for IM to support ignoring interruptions by either turning off sounds or pop-up windows or both. Some try to mitigate interruptions with detailed custom status lines, and others find that simply ignoring interruptions or setting their status to busy is sufficient.

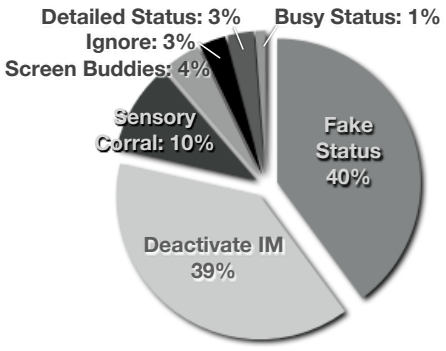

Figure 6. How Do Users Manage IM Interruptions?

15% of respondents indicated that they had stopped using

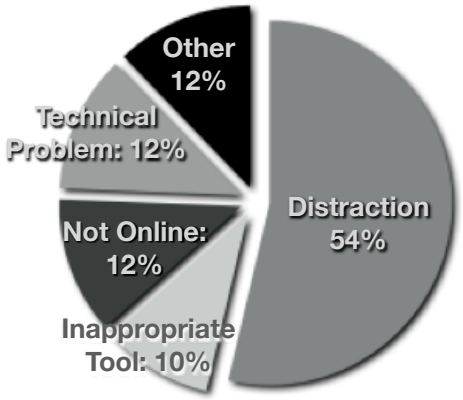

Figure 7. Why Have 15% Of Respondents Recently Stopped Using IM?

IM on their mobile platforms for a period of time, providing more insight into the difficulty that mobile IM users have in maintaining focus while using their MP (see Figure 7).

Some of the user's comments referred to the distracting nature of IMs: "*I didn't feel like going on IM because I just wanted to get my work done.*", "*Stopped to get work done. Sometimes buddies would IM even if status is away/busy.*"

Some indicated that it was an inappropriate tool: "*IM'ing wastes time when I can easily communicate by telephone and get the answers quickly instead of typing and waiting for the typed response.*"

Some were disconnecting from the network: "*On vacation or busy doing other outside activities*"

Some had technical problems: "*Forgot my password. So I could not log on to my IM client for several days*"

As mobile laptop and cell-phone usage increasingly means being online continuously the potential for IM to be "distracting" increases in the same way that receiving a voice call at any moment is distracting. Providing users tools to communicate their context could reduce the inappropriateness of mobile interruptions.

Obligation And Mobile IM

Although interruptions for some could be managed by shutting down mobile IM. Some participants did not have that option and did not see the whole enterprise as a purely positive communication medium. 14% of participants indicated that they felt "obligated" to use IM. There were many correlates to obligation in the data: People in more committed personal relationships felt more obligated to use IM on their mobile platform ($\chi^2 = 5.1, p < 0.08$) although not necessarily as a result of the relationship. Weekly IM users were disproportionately more likely to feel obligated to use IM than daily IM users ($\chi^2 = 2.77, p < 0.10$). Men were more likely to feel obligated to use IM than women ($\chi^2 = 6.9, p < 0.01$).

Obligation also seemed to have a strong correlation with bad experiences using IM. In several different ways the data showed that there are people whose experience with mobile IM has been negative, but continue to use it because of obligation. For example, participants who felt obligated to use IM:

- Had a higher than expected experience with receiving inappropriate IMs during presentations. ($\chi^2 = 31.0, p < 0.001$)
- Have a higher than expected experience with being in a presentation in which inappropriate IMs were received. ($\chi^2 = 32, p < 0.001$)
- Have a higher than expected experience with receiving embarrassing IMs while others were nearby. ($\chi^2 = 11.7, p < 0.001$)
- Have a higher than expected experience with having bad outcomes from revealing location status information. ($\chi^2 = 5.3, p < .03$)
- Were less comfortable with the more detailed hypothetical status messages in the library example whose results are shown in Figure 5. ($\chi^2 = 10.1, p < .08$)

Weekly IM users who tended to be more obligated than expected were also less likely to talk with friends on IM than daily IM users who often talked to friends ($\chi^2 = 131.2, p < 0.01$) , less likely to use custom status messages ($\chi^2 = 9.5, p < 0.01$), less likely to check custom status message ($\chi^2 = 8.2, p < 0.005$), and more likely to ignore away and offline messages and send an IM anyway ($\chi^2 = 16.26, p < 0.001$).

Obligation was not correlated with number of buddies, amount of time spent online, or whether the MP was used primarily for work.

All together this appears to paint a picture of two different types of mobile IM users. On the one hand there are users who are daily sending messages, often to their friends, and crafting custom status messages. Generally these people appear to be using IM to craft a social space that they are actively engaged in. A second set of the participants however seem to be a set which, all other things begin equal, might like to stop using IM. This set has had bad experiences of various types with IM, doesn't use it as frequently, and doesn't talk to friends nearly as often. So in this case there is a design friction between meeting the needs of the active shapers of the mobile communication sphere and people who are reluctant but obligated participants in the mobile IM experience.

CONCLUSIONS

We conducted a user study and subsequent analysis of 447 individuals that use instant messaging on mobile computing platforms (predominantly laptops) in order to inform the design of a context-aware status line prediction tool. From this study we are able to observe how IM is changing as computing becomes more situated in a wider variety of places in the

real world. Users that are adopting the new usage patterns associated with mobile IM are experiencing several frictions.

First, users are finding that their personal computers aren't as private as they used to be. The semi-public nature of laptop and cell-phone screens in the wild is breaking the assumption that a communication buddy can discretely receive an IM from a user. The result is that a large proportion of our participants had been involved in an embarrassing incident while using IM in a semi-public circumstance. The implication for tool design is that revealing information about the public or private nature of a user's current context could alleviate some of this friction.

Next, users are treating their buddy's virtual desktop in a way that is consistent with a mental model of a private stationary physical desktop computer. The practice of leaving IM's for a buddy on their screen, which they will attend to when they return, is no longer an appropriate model. Instead these messages are distracting enough that users are being forced to turn off IM entirely in order to accomplish their goals. The implication for context-setting is that the status lines must be believed to be accurate by buddies in order for them to mitigate interruptions. It is probably not sufficient for a tool to "take a best guess" at a user's current context and report it for them automatically. If the tool is ever wrong and the buddies discover that the status is not accurate, they are likely to continue with old practices and IM their buddy regardless of what they are reporting on their status line.

Thirdly, mobile IM users do not have the same degree of attention to devote to incoming IMs. They are actively using their computers for presentations and group work, moving around and physically engaged in other tasks. Fortunately however, many of the IMs being sent to our participants were flexible such that a well crafted context-aware status line could help provide information for users to time-shift their communication to a more appropriate moment.

Custom status prediction for mobile users is largely about activity, place and interruption recognition combined. In order for an automatic context tool to successfully mirror current user behavior it needs to incorporate aspects of all three of these types of active research problems. It is unlikely that a tool will ever successfully be able to capture all the nuances of place, activity or interruptibility that a user would like, but by addressing all three and attempting to communicate them to a buddy list, it is more likely that there will be sufficient information that buddies can make a good decision about how, when and with whom to initiate an IM communication.

Next, the ways in which mobile users are supported in setting their custom status lines must give them the flexibility to describe space in a number of semi-structured ways. It is not sufficient to pick one ontology of space descriptions and force the user to describe their place in those terms. Users must be supported in being able to describe their location in a way that is most appropriate for their current position and the composition of their buddy list.

Custom status line tools must support the reality that not everything about mobile IM is positive. A non-trivial portion of users are affected by physical threats which are associated with the disclosure of their location. Furthermore some users are obligated to use IM and have less patience for carefully controlling and crafting their online presence. Both of these types of sensitive users need to have the ability to use IM without impacting their safety or requiring even more of a obligatory burden.

In conclusion mobile IM users are experiencing frictions as they evolve their practice from a desktop model. The growing situated use of computers and the "always online" nature of modern computing is creating new opportunities for context-aware tools to support user needs. Through this study we have illuminated where research can be applied toward relieving some of these emerging tensions.

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