Status on Display: a Field Trial of Nomatic*Viz

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Abstract.

The use of personal status messages is becoming a part of popular culture through wide-spread instant messaging (IM) adoption, the growth of social networking websites and the increased connectivity provided by mobile phones. However, the implications of status broadcasting and people's behavior in the milieu of social life is still poorly understood. In this paper, we present the results of a field trial in which we examined how community members come to understand and appropriate a status broadcasting service into their daily use. We designed Nomatic*Viz, a situated large display showing people's location and status messages to complement an existing status message distribution tool called Nomatic*IM. Through a five month field study of its use we uncovered not only how it supports lightweight awareness of the community, but also how it participates in creating new spatial experiences and how people perform and negotiate self-representations through multiple simultaneous displays of personal status.

Introduction

As early as 1971, networked Unix computer users were using utilities to see the *status* of other mainframe users. By combining commands such as "who", "ps", and "finger" people had a way to describe their current workload, view other users' activities and account for the usage of shared computing resources. Gradually, a related idea was conceptualized, *presence*, to describe an indication that someone is in a digital or physical space (Fitzpatrick, 2003). This concept came about largely as the result of the increased availability of cameras, and other sensing peripherals.

Projects such as MediaSpaces (Bly et al., 1993) and Portholes (Dourish and Bly, 1992) both showed the value of this kind of awareness amongst remote collaborators.

As the internet has become more central to daily life, and as mobile computing has increasingly reduced the time when people are offline, these two concepts have become more intertwined (Patterson et al., 2008). Their hybridization has been seen in widespread distribution of personal status messages in popular culture, which is supported in social networking services such as Facebook[1], and Twitter[2]. While these services provide support for quick status message authoring and sharing, other services support cross-service aggregation and redistribution such as FriendFeed[3] and Ping.fm[4].

Despite the widespread use of status broadcasting services in popular culture, the behavior and implications of its use in the milieu of social group life is still poorly understood. Smale and Greenberg noticed that users adapt their ID field on IM to broadcast information to their buddy list, and through examining these messages, identified different thematic categories (Smale and Greenberg, 2005). However, more work needs to be done to gain in-depth understanding of how users experience and practice status messaging. At the same time, researchers have studied automatically reporting sensed data including raw video, audio (Bly et al., 1993; Dourish and Bly, 1992) and a variety of sensed contextual data such as location (Brown et al., 2007), activity (Rowan and Mynatt, 2005), and IM availability (Terrell and McCrickard, 2006; Guzman et al., 2004) for their ability to support group awareness in a variety of settings, and have shown their value for improving coordination and connections. What happens, then, as status messages are made available not just for sharing with one's own buddies, but are also employed for awareness of a community in a shared space?

In this paper we report the results from a long term field trial of a distinctive status broadcasting system called Nomatic which repurposes status broadcasting to enhance awareness for a community. Figure 1 shows a usage model of the system. The black Nomatic*Viz display on the right, shows status messages and sensor data, such as location, activity and mood information. It displays the information in an ambiguous, anonymous and abstract manner in hopes of giving insights into community behavior while preserving privacy and promoting active engagement through data interpretation. The source for the status information is a context-aware software tool called Nomatic*IM which is installed on personal computers (usually laptops). Nomatic*IM uses a wide variety of built-in sensors (e.g., WiFi access points, ambient light, battery charging status) to categorize a user's context, to remind users to update their status when their context changes and to suggest status messages. The combination of these techniques are designed to support keeping status messages up-to-date with minimal cognitive burden.

[1] www.facebook.com
[2] www.twitter.com
[3] www.friendfeed.com
[4] www.ping.fm

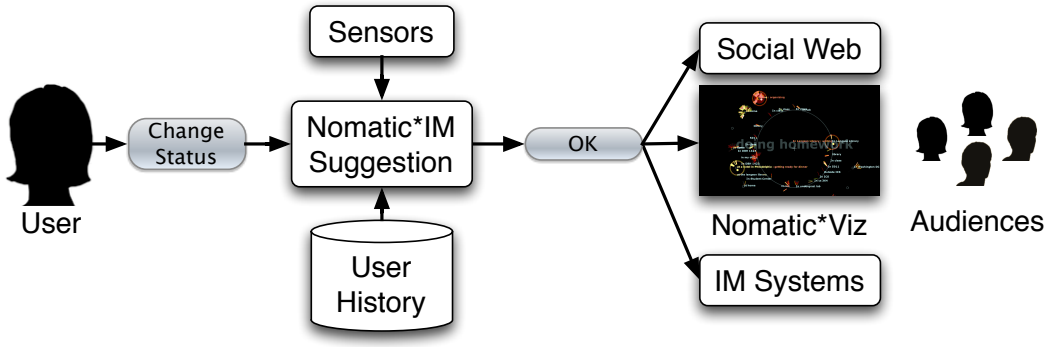

Figure 1. When a user wants to change status, possibly at the prompting of the system, Nomatic uses sensor data to provide suggested status messages. When a user selects a status message, it is sent to many different status broadcasting systems and Nomatic*Viz.

What displaying status messages in a community helps us to uncover is not just how it supports lightweight communal awareness, but more importantly, how the status display participates in producing new spatial experiences and how people perform with the display with simple text editing. We argue that the performative and performance aspects of awareness technologies, while often overlooked, play important roles in shaping people's experiences with status broadcasting systems and other awareness technologies.

In the sections to follow, we discuss the relevant literature, the design, the deployment and the evaluation methodology of Nomatic*Viz. We then go on to synthesize a series of themes that emerged out of our qualitative analysis of the data. While these issues are specific to our particular case, they suggest social patterns that will help to frame the usage of other status broadcasting and awareness systems.

Related Work

Remote awareness and remote presence have long been important topics in the CSCW and related communities. They are usually viewed as mechanisms that improve collaborations and connections, especially for distributed groups. As mentioned previously, continuous streaming of video and audio was shown to foster ambient awareness in the Media Spaces and Porthole projects (Bly et al., 1993; Dourish and Bly, 1992). Later research on awareness started employing IM availability as an information source for ambient displays, and attempted to extend the availability information off the desktop and into our everyday environments (Guzman et al., 2004; Terrell and McCrickard, 2006).

What these different systems often share is the automatic capture and collection of information to minimize user distraction. By automatically capturing or rebroadcasting otherwise freely-available information, these systems effectively reduce the overhead that would be required if users had to keep the information up-to-date manually. Similarly, work on automatic sensing combined with context model-

ing technologies explores automatic ways to go beyond just reporting raw sensor data and instead assists in choosing an appropriate time to interrupt (Hudson et al., 2003), or choosing when to have a face-to-face meeting (Moran et al., 1999). The negative side of automatic broadcasting is the potential for inadvertent disclosure of information, particularly as the size of the audience grows larger (Patil and Lai, 2005).

Recent work has combined sensing with manual labeling to provide light weight automatic interpretations of sensor data for applications that are not predetermined. For example, the Awarenex project examined the user interface of a mobile status sharing system that associated manually entered labels with device detected locations (Tang et al., 2001). Reno allowed users to associate labels to cell tower connections and then activate rules based on entering those zones (Smith et al., 2005). Using a very different user interface, but similar underlying technology, the Whereabouts Clock allows users to associate three labels (work, home, school) with cell phone towers for the purpose of communicating vague locations to family members (Brown et al., 2007).

Nomatic*IM is like the latter systems in that it attempts to map labels to sensor data and to communicate those labels on behalf of users (Patterson et al., 2006). But unlike these systems it treats labels less strictly as a single description of location and more flexibly as multiple descriptions of context composed of "places", "activities" and "moods". The difference lies in relaxing the one-to-one mapping of physical locations to labels so that a location can be a "classroom" in the morning and a "conference room" in the afternoon. Similarly you might "be eating" in the kitchen at lunch, but "doing homework" late at night. It employs sensing to *automatically* label a current context, and also detects changes in context which acts as a reminder for status updates. For this field trial, Nomatic*IM was adapted to report sensor *and* status message information to the Nomatic*Viz large display in addition to publishing *just* status messages to a variety of IM systems, Twitter and Facebook.

Because Nomatic*Viz is a large display, recent investigations into how large displays enhance interactive and collaborative experiences are also germane. Work by Huang and Mynatt (2003), Churchill et al. (2003), Greenberg and Rounding (2001) and McDonald et al. (2008) have demonstrated that large displays have unique affordances. Compared to laptop or mobile phone displays, they are physically persistent, situated, and often shared, and as a result support low overhead awareness and information exchange, creating opportunities for conversations and community engagement and are usually the subject of many short "glances" rather than prolonged interactions.

About the Nomatic System

The whole Nomatic system is composed of two components, a context-aware software tool called Nomatic*IM which is installed on individual laptops and Nomatic*Viz, a display of participant's contextual and status information located in

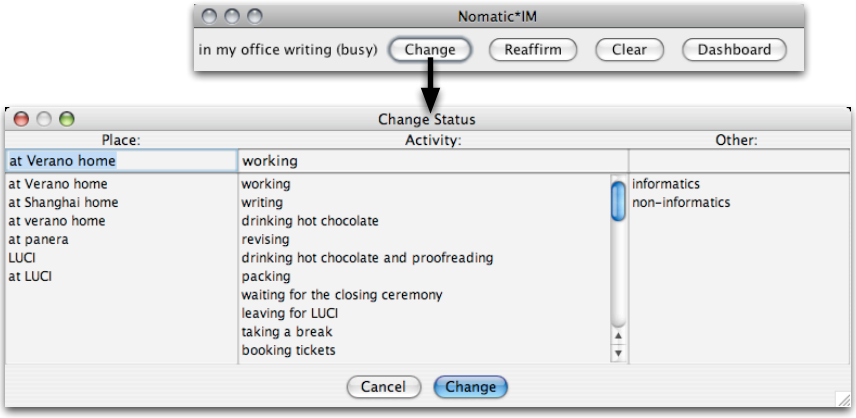

Figure 2. The primary Nomatic window shows the status that is currently being reported to IM systems and Nomatic*Viz. When a user wants to change his status, he is provided with a list of suggestions which are generated by a machine learning algorithm that matches current sensor readings to previously used status messages.

a shared community space. In this section, we will describe Nomatic*IM and Nomatic*Viz in details.

Nomatic*IM uses a wide variety of built-in sensors (e.g. ambient light, motion, network parameters, battery charging status) on a user's laptop to sense aspects of a user's context. Unlike IM presence cues, which are almost raw sensor data (e.g., "idle"), Nomatic*IM, whose interface is shown in figure 2, uses machine learning to present a list of predicted status descriptions from which the user may choose. The status messages are combinations of a user's place, activity and mood and are predicted based on current sensor readings and the user's history of status entries. Additionally when the system independently thinks that the context has changed or after a period of inactivity (two hours by default), it will remind users to update their status. The goal is to allow users the freedom to richly express their current context without requiring more than a couple of mouse clicks in the best case. The selected status entry is then broadcast to a wide variety of IM systems (e.g., Skype, AIM, Yahoo!, MSN etc.), social networking sites (e.g., Twitter, Facebook) and Nomatic*Viz.

Nomatic*Viz is designed to be situated in a shared community space. Through the design of Nomatic*Viz we sought to leverage ambiguity to address privacy concerns and more importantly to create a thought-provoking and reflective visualization of the entire community's sensor and status data. In the spirit of work by Gaver et al. (2003) we wanted to focus Nomatic*Viz's audience on the interpretation of the overall rhythm of the community and not on the specifics of the sensor data available. Our goal was not to engage viewers with the system *per se*, but rather to engage them with the community who is generating the data. By showing status information in an ambiguous way, we hope it will encourage users to relate their contextual social background to more actively interpret the display and experience the community in new ways.

Figure 3 shows a screenshot of the resulting design. All participants' status data

for the current week is aggregated on the display. On the top, a calendar-like bar indicates to viewers what days' data is currently being shown, the current time of the day is shown with a red arc, and a series of color boxes represents each participant whose data is on the display. Each user has a slightly different color that remains constant over time.

Across the display colorful "fans" are shown. Each cluster of fans corresponds to a unique WiFi access point from which statuses are reported. The arc sweep on the fan corresponds to the time at which the user was at the location (mirroring the clock at the top of the screen). Multiple days of reports from that access point are layered on top of each other. A text label with the most recently reported place name is shown next to the fan. If multiple WiFi access points share the same SSID label (for example many access points administratively managed by the same organization), they are clustered together on a gray ring. The size of the gray ring is determined by the number of unique access points associated with it and its position on the screen is based on the recency of the last status report from it. In the case of figure 3, the central ring represents a university campus. Overlaid across the display, large lines of text representing current activities sampled from all participants appear and disappear. The visualization highlights current real-time status reports with pulsing circles over the relevant fan.

Thus, the information presented in Nomatic*Viz is ambiguous at several levels. Instead of using a literal geographical map as its layout, it is dynamically constructed by users' collective interactions with the WiFi infrastructure. Instead of using icons to represent people, it uses different colors to subtly distinguish individuals. The mapping of colors to individuals is not specified, and is therefore unknown unless viewers have a knowledge of the community. The display does not associate activity text with an individual either. The fact that place descriptions are user generated allow for user control over the degree of accuracy over the location names. Finally, by layering historical traces of people's whereabouts over time details become obscured but frequency becomes more pronounced.

The Study

To understand how people live with Nomatic*Viz in a community setting, we deployed Nomatic*Viz in the authors' academic department, a shared public space, and conducted a five month field study.

The Setting

An entire academic department is located on the floor of the building where the deployment was conducted. To make the display more accessible and to facilitate sharing by the whole community, we placed the display at the entrance lobby to the floor, which was also the connecting point between two wings of offices and is close to many shared resources such as the kitchen, the bathrooms, the copy and mail rooms, etc. Notably, this was not the first spot that we tried. In early

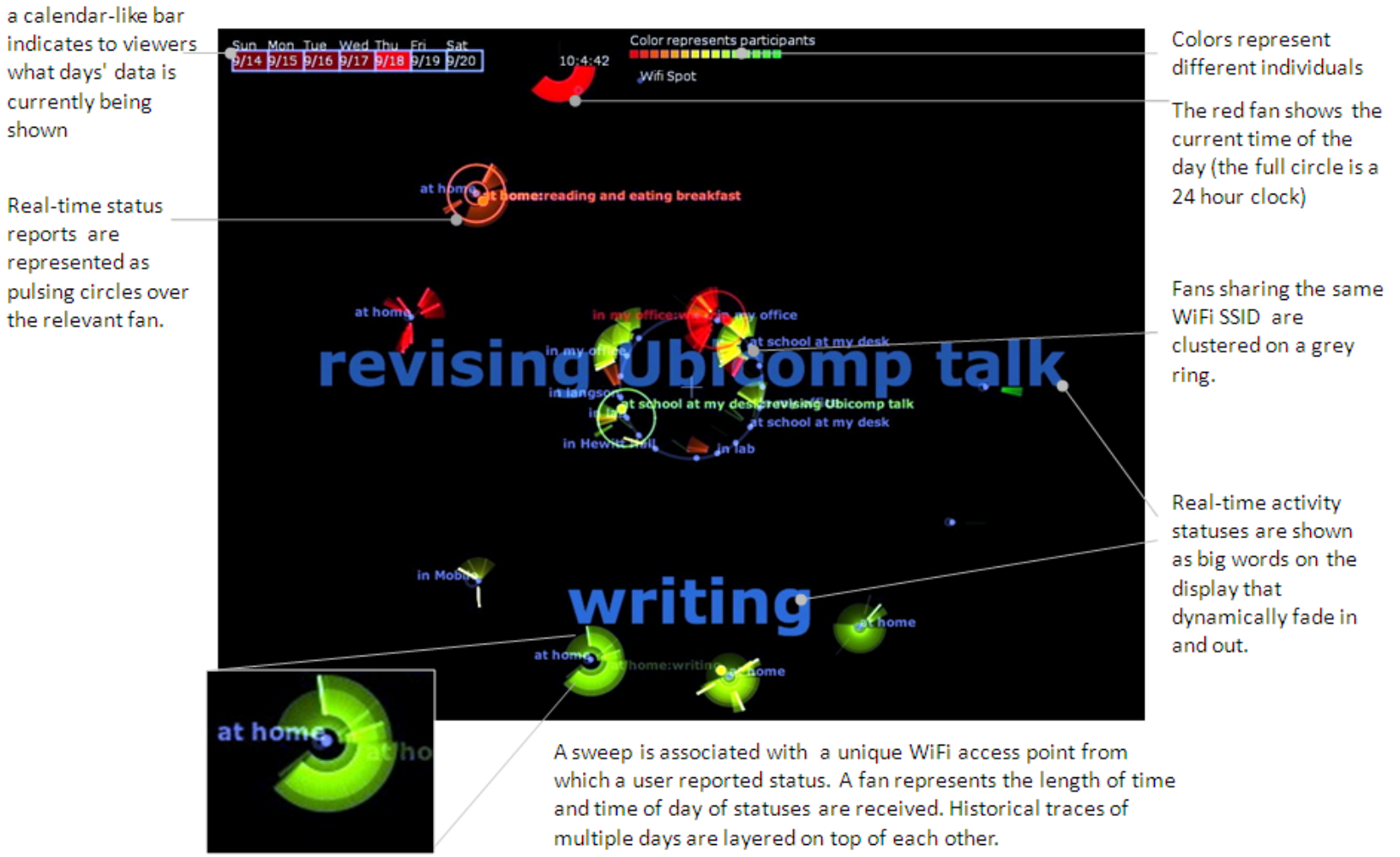

Figure 3. Screenshot of Nomatic*Viz display with four days of data.

iterations of this system the display had been deployed in the elevator waiting area, where, counterintuitively, we found people didn't have time to view the display. The studied display location instead had long sight lines which enabled the display to be viewed while people were in transit to other locations.

The display of the new visualization was mounted in the lobby from the end of March 2008 and remains in place as of the writing of this paper. The preliminary set of 7 participants consisted of researchers affiliated with the Nomatic project (one faculty member, four graduate students, and two undergraduate students). Over the next 10 weeks several other faculty members and graduate students were enrolled through personal invitations. During the summer quarter a new round of participants were recruited to replace participants who were no longer physically located in the building. By the end of the summer, there were 89 users of Nomatic*IM, 16 of which had opted-in to the display of their data on Nomatic*Viz. These 16 participants consisted of 3 faculty members, 1 research scientist, 10 graduate students and 2 undergraduate students.

Methods

After the display was deployed in the field for five months (crossing two quarters and a summer), we conducted semi-structured interviews and analyzed logs of status messages. The interview protocol covered four areas: *everyday schedules and mobile practices*; *interpretation of the visualization*; *encounters with the display* – probing for specific instances; and *disclosure practices*. When possible interviews were recorded and later transcribed. To jog memories and probe specific instances, most of the interviews were conducted by the display, with the interviewer providing a printed samples of past status messages to the informants. Out of the total 16 participants who broadcast status to the display, 8 were interviewed. One interview was with a member of the Nomatic research group, and the remaining 7 interviews were with participants not affiliated with the Nomatic project. Of the 8 participants, 3 were faculty members, 1 was a research scientist and 4 were graduate students. 5 were females and 3 were males. At the time of interviews, all informants had been using the display for at least a month, with several spanning the entire 5 month deployment. In addition to the interviews, logs of status messages were analyzed to gain insight into how they were shared.

Results

Over the period of 171 days, a total of 10772 updates were received from the 8 informants, with an average of 63 updates per day and 4 updates per day per person. Out of all of the updates 471 were unique messages. Figure 4 shows the number of status messages posted per day during the course of the study. A strong cyclical pattern is evident. Figure 5 shows the average number of updates per day-of-the-week. It reveals a strong tendency for people to update status more often early in the week, gradually declining through the week and then much less on

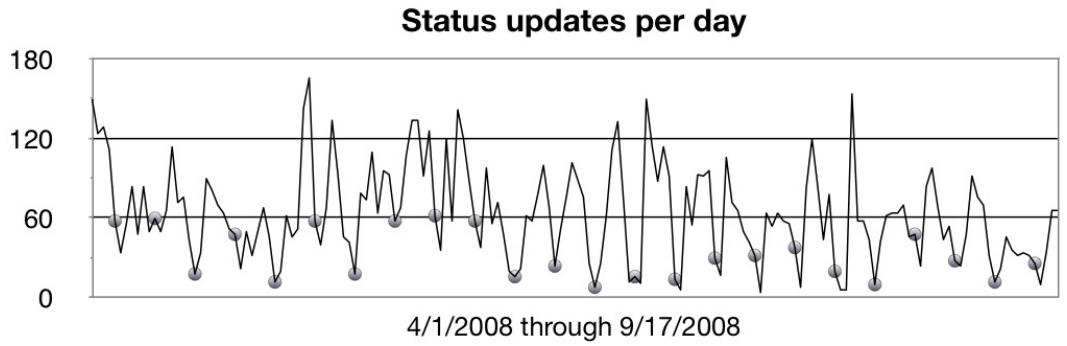

Figure 4. The total number of status updates per day during the duration of the study, with Saturdays identified.

weekends. This trend explains the cyclical update pattern in figure 4 with the low points corresponding to weekends.

Both the length of the study and the relative consistency of status updates throughout the duration of the study suggest that this study was able to mitigate novelty effects. Additionally the consistency of status updates suggest that Nomatic*IM was effective in promoting regular status updates. It was also consistent with findings from our interviews: our informants commented that Nomatic*IM was lightweight, and didn't involve much work to use and therefore made contributing to Nomatic*Viz easy as well. Several informants reported that they definitely started updating their status much more. It was especially true for those who didn't update at all through other social media. More specifically, the Nomatic*IM window popping up periodically was effective as a reminder for them to update their statuses.

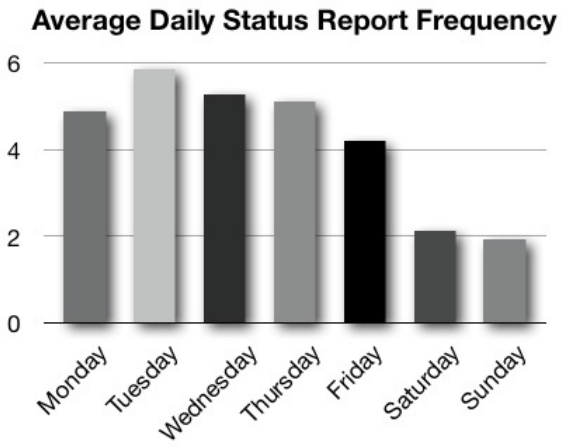

Figure 5. The average number of status updates per weekday.

To provide a framework for what status messages were broadcast by this group, we analyzed status message logs and identified five frequently used themes into which status messages could be loosely categorized:

- **Meeting Events**: Including talks, presentation, meetings. (e.g., "listening to XXX' talk", "attending a Ph.D. defense", "in XXX's advancement")
- **Work Activities**: Descriptions of tasks consistent with academic work. (e.g. "hacking", "coding", "working on dissertation", "reviewing papers", "storyboarding")

- **Non-work/Leisure activities**: Tasks not associated with the workplace (e.g., “cooking”, “making coffee”, “Watching TV”, “playing games with XXX”)
- **Social Banter**: Information, jokes, invitations, and greetings (e.g.,“not in an earthquack zone”, “Happy birthday XXX!”, “early lunch anyone?”)
- **Expressions of Mood**: Emotions, frustrations and reactions (e.g. “WHY DOES EMAIL HATE ME???????”, “punching my computer in the face”, “probably sleeping”, “exploding”)

As part of the evaluation of Nomatic*Viz we conducted semi-structured interviews with the 8 informants. At the highest level, our analysis demonstrated a very sophisticated and nuanced response to the introduction of these status tools into the informants’ daily practice. While a complete understanding of the details of the visual elements of the display was rarely displayed, our informants all developed deep social understandings of the implications of using the tools in various ways. In what follows, we will discuss some of the experiences with respect to the Nomatic*Viz display in particular.

Peripheral Awareness through Glancing

Figure 6. Glancing is the main form of interaction with Nomatic*Viz.

As expected based on prior findings on large displays in shared space (Greenberg and Rounding, 2001; Churchill et al., 2003), the situated context and people’s existing practices shaped how people encountered the display. A great deal of the impact of Nomatic*Viz was related to its location in a lobby that acts a hub connecting the various offices and that is near functional rooms. The lobby itself was not identified as a destination in and of itself and existed on the way to some other pursuit. As a result people were already engaged in an activity when the opportunity for viewing the display presented itself. Frances[5] noted that most of time when she was passing by, she was busy with other stuff, so she didn’t have the energy to change her actions on the way.

Indeed, in interviews, while our informants reported always “looking” at the display when they pass by, either when they come onto the floor in the morning, or when they visit the copy room, the kitchen, and other’s offices during the day, the majority of them reported that they just “glance” at it. Despite the presence of seating, very rarely would they stop, approach or carefully study it. An exception to this was mentioned by two informants who on occasion would study the display while using the adjacent kitchen to warm their lunch.

Despite just glancing, our data suggests that, although the same data was visible in participants’ IM buddy list status, Nomatic*Viz was still providing a more

[5] In this analysis we refer to participants by pseudonyms whose first letter indicates their role in the department: faculty names start with “F”, graduate students’ and research scientists’ names start with “G” and undergraduates names start with “U”.

lightweight and peripheral awareness. As Frank put it,

> "*I don't really look at my buddy list very often, unless it is just before I am about to make a connection with someone... but if I am walking by the display on my way to the mail room, I just kind of glance at it.*"

Fiona reported similar experiences,"*I used it as a lightweight thing to check, as I walk by anyway, while I think about what I'm going to do next.*". This supports previous results by Huang and Mynatt (2003) who point out that the large display, by making information persistent in a shared space, makes information more easily available and relieves the overhead required for people to retrieve it from other channels such as email or IM.

A Community Display

While more lightweight awareness seems to be the most obvious effect of a large display of social status, Nomatic*Viz is distinctive in that it conveys a sense of what is going on within *the community as a whole*, not just as a collection of individuals. This is primarily as a result of the juxtaposition of everyone's data together, somewhat anonymized and therefore individually obscured.

The most common element noticed while glancing was the rapid appearance of big text. According to Greg, these big words are helpful for "*sampling what is going on*". George reported similar experiences, "*so when I walk off the elevator, the only thing that I glance at as I walk by are the big things that come up, like the task that people are doing.*" To Fiona, these big words are her favorite feature, "*the number one thing I look at it, which I really like it is the big things that sort of pop by...some sort of ambient knowledge about what is going on with my community of people.*"

Occasionally, the words together formed patterns which characterized particular community contexts such as the end of the quarter, during a conference or a paper deadline, etc. These visible patterns enhanced the feeling of the shared experience in the community. Fiona, being one of the longest members using the system experienced the "ebbs and flow" of community activities through the display,

> "*Another thing that is sort of amusing to me is the patterns you will see, so towards the end of the quarter, you will see "grading" up a lot, which is often me, Frank and Frances simultaneously, which sort of tickles me, because you get a sense of, OK, the end of the quarter, everyone is grading, or everyone is studying a lot, which is mostly undergraduate students. Similarly, when the [grant] stuff was going on, Frances and I were writing like crazy, so I saw "writing" flash up a lot.*"

Frances, another long term user, also noticed the different mix of activities that showed up between the quarter and the summer which was consistent with peoples' reports that their schedules were more complex during the quarter.

In addition to the big words, the display also more subtly conveys the sense of activity level through its graphical design in features such as "fan" density, the number and distribution of colored dots, the amount of animation, etc. all of which aggregate as status messages are reported during a week. Greg reported how he

perceived the visual cues in conjunction with the big words, "*Just walking by, I [notice] how many blurbs you can see ... high level status messages ... the radar dots that are animated ... how many people are online ... when they've been online*".

However, unless many people were updating on a given day, the sense of community was lost and the display was perceived not as the zeitgeist of a crowd, but simply as an ambiguous display of individuals. Fiona reported a case that was revealing,

> "*When it was just, for a while, in the early summer, where it is like me, Frank, Frances, that seems about the only people that were there, there were a few people on sometimes, from time to time, .. but most of time...it is sort of interesting, when I go by, I would always know that is going to be one of us... then when there are times, when there are more people, it is nice, it just changes the way that I see it, it just gives me more of the gestalt view of the department, but it is less like personal small group interaction*"

Members' Reflections

In the visual design of Nomatic*Viz, we hoped to create a view of status that provoked reflections on participants' roles as members of a community. Using ideas described by Sengers et al. (2005) we attempted to leverage user reflection as an important means for us to uncover unconscious values embedded in status broadcasting technologies and related practices. What we found was that the co-existence of multiple audiences (IM and Nomatic*Viz) did encourage reflections, particularly on the effects of the status on different audiences. Fiona described her audience management as follows,

> "*I used IM for people's birthday messages, I can imagine that it might be more useful for me to say happy birthday to someone on the display rather than go through my buddy list, and the other way around, there are cases, it makes sense to broadcast to my buddy list, but not to the display.*"

Similarly, Greg, who used to post frivolous messages "just to be silly" in social media, was taken aback by seeing his own presence on the Nomatic*Viz display. It made him reflect on the difference between the display and the IM buddy list,

> "*I posted my status message and then I saw it on the display, I would say, wow that is a personally identifying message, if you know me and what I've been up to, you can tell a lot, it makes me consciously aware, what kind of information I disclose.*"

Following his reflections, he concluded that "*the display lets the group know what the group is up to, but IM is better for crafting an identity for myself.*"

New Spatial Experiences

Most work on awareness has been based on informational accounts. That is, awareness technologies are presented as a means to inform activities and availability and thus support coordination and communication. Unexpectedly, in our field trial, we

found, many times, people had noteworthy and meaningful moments even when the display was showing information that they already knew. In fact, the display became meaningful when, in a serendipitous moment of shared knowledge, it showed information that they could easily interpret, or when it coincided with their perceptions of the real world space. Our informants described how they would "smirk", "crack a smile", "be amused", "be tickled" and "laugh" seeing some status messages on the display, and thought it was "interesting" and "funny." A particularly nice example of this was reported by Grace when recalling her experiences with seeing the status message,

> "*[her message] says, "in a meeting with students" or something like that, I was at the office next door, so I can hear, "oh yeah, she is meeting with students", so I thought it was interesting.*"

In this case, Grace was overhearing her colleague next door having a meeting with students, and at the same time seeing the status message on IM describing the meeting. Although the status message didn't provide anything new, yet the consistency of it with the real world experience seems to turn a mundane occurrence into something notable and reportable. The meaning of the status, then, is not just in its being descriptive, but rather, together with the space and setting, it participates in engaging sensations, and producing new meaningful spatial experiences.

Perhaps most explicitly, however, this was seen when users saw their own messages. In fact, Frank and Gladys reported one motivation for them to glance at the display was to view their own messages. George also commented that it was funny seeing his own status up there, or others' status which he can recognize,

> "*When I see my own status, I kind of smirk. It is just funny, to see. It is kind of fun. I also smirk when I see "making coffee" because I know it was Frank, no one else makes coffee, and I can guess its him.*"

Grace expressed similar feelings when encountering the display and seeing her own messages up there,

> "*Sometimes I laugh because I see my messages up there. Like one day, I had a kind of strange message. I guess it was a couple of days ago,"at work caffeinating". I put that message up before I went to go get coffee, and here I am at the elevator, it says in big letters "at work caffeinating" while I had a cup of coffee in my hand. I thought it was really funny. I was like, 'hey, that is mine'* "

On each of these occasions, the status message explicitly did not provide new information, but, our informants still seemed to be surprised seeing messages of their own. We hypothesize that our participants approached the display as a window into the lives of others. The resulting confusion and internal discord at seeing what was obviously their own near real-time experience was quickly understood and the experience was perceived as humorous. The display introduced a certain gap or suspense between authoring and seeing, ownership and appropriation, and consistency and inconsistency with the real world space. The gap and suspense opened new opportunities to be surprised, and to invoke a meaningful or at least entertaining

experience within space. The value of the display, in this case then, does not lie so much in providing something new, but rather, in its participation and creation of new dramatic and spatial experiences.

Performance

Our informants also considered how they were represented on the display through status message broadcasting. We draw on Goffman's performance framework in forming an understanding of the subsequent sophisticated control of our participants' self-representations.

Goffman uses the metaphor of theatric performance to examine mundane face-to-face social interactions (Goffman, 1959). In his framework, he used the notion of front, to refer to "that part of the individual's performance which regularly functions in a general and fixed fashion to define the situation for those who observe the performance" (p.22). He further distinguished it into different parts - setting, appearance and manner, and offered the insight that we often expect consistency and coherency among these front parts, and will focus on exceptions to expected consistency among them. In our field trial, we observed similar concerns in maintaining the consistency among different front parts. However, with the presence of digital elements, the front becomes more complex: requiring not just consistency among appearance, manner and setting, but also consistency among digital and physical presence, and consistency among various digital presences.

Maintaining a Coherent Front

As with face-to-face interactions, maintaining a coherent front is part of our informants' considerations when posting their messages through Nomatic*IM. Their desire was to conform to the expectations of the potential audiences' and to avoid unnecessary misunderstanding or wrong impressions. Various strategies were reported by our informants to cope with the complicated and faceted appearances they wanted to maintain. One strategy was to make sure the status message was correct, but not precise. Frank, for example, is explicit about this strategy,

> "*I don't want people to know specifically where I am, but I let people know I am on campus. If I am running personal errands on campus...I don't want people to think, because I am going down to the store, getting dinner for tonight, or something like that, I am not working on their project.*"

A second also commonly adopted strategy was for participants to shutdown the whole system, removing their digital presence and to lean on the resulting uncertainty that a complete lack of presence offers to give room for appropriate social interaction. Grace reported an occasion like this,

> "*There was one week I was sick. I was at home all the time. I kind of didn't want everyone knowing that I am at home all the time, so I didn't put things into Nomatic.*"

While being at home was not something that was necessarily problematic for this informant, its inconsistency with the usual situations may draw attention and lead to misinterpretations in the absence of further context. By shutting down the system, it saved Grace the trouble of explaining it.

Another common reason for inconsistency is due to a lack of updates or inattention to stale status. For instance, when Frances went on vacation she was more concerned about reporting inconsistent information between the digital and real presence due to inattention than she was about communicating the fact that she was on vacation through the system. As a result, she also shut down the system.

Same Message, Different Audiences

What adds to the complexity of maintaining a coherent front is when multiple audiences are present. It is certainly true with the Nomatic system, where the same status information is published to both the Nomatic*Viz display and IM and others. Fiona is a typical example, as a faculty member, her audience is very mixed, including peers, colleagues, friends, students, people at the distance as well as people that are local. As a response to this very mixed audience, statuses become less funny, and more vague, or innocuous as Fiona put it,

> "*I make things neutral for the most part. If I want to be funny, I try to make sure it is funny in a way that it is not going to be a problem for the mixed audience that I have.*"

To address the multiple audiences, status messages are, to some extent, "washed out". While managing different audiences separately may relieve some concerns, however, it may not be practical, as Greg points out,"*By dodging the problem, it may introduce new problems.*"

What is particularly striking here, is the sophisticated ways people crafted a single message for different audiences at the same time. One technique was to create *high context* and *low context* (Hall, 1976) messages to communicate different things and suggest different availability to multiple audiences. While the former says things that heavily rely on the shared context to understand what the speaker is saying, the latter incorporates more contextual information in their actual communications. Our data shows a common use of both high context messages and low context messages to say different things to different audiences.

Fiona's example was a case in point. During the period of the study, she was actively collaborating with a local hospital in another city. Originally, she put "hospital" as her location status. However, this message often invited some questions from her buddies who wanted to check in on her out of concern for her health. It made her change her status message to the city's name where the hospital is, so that the local people with appropriate context would be informed where and what she was up to, at the same time, it wouldn't create much concern from remote friends because the city name didn't make much sense to them without the contextual background. In this case, the city name is a relatively high context message, since it requires the right contextual background to interpret it appropriately.

In reverse, while a high context message is only informative when coupled with shared background knowledge, low context messages are commonly employed to suggest different availability to different people. Grace's example was representative,

> "*Sometimes, I am working pretty intensively on something. Like, this week, I was working on a NSF grant, and I put my status as "busy with NSF grant", then anyone who is working with me on the NSF grant knows that they can disturb me because they were also working on the same thing. Sometimes that is helpful in terms of gate keeping.*"

Indeed, our data shows that people respond to these messages accordingly. For example, people will decide whether it is appropriate to interrupt depending on whether the message shown is relevant to their work. In just a very few words Grace was able to rapidly and effectively shift the boundaries of her "groups" in such a way as to invite some contact while preemptively avoiding other types of contact.

We found, sometimes, people customized the status with certain audiences in mind. One extreme example was provided by Fiona. During a stressful time, Nomatic*Viz was appropriated to create a little bit of entertainment,

> "*It must have been around some paper deadlines, that I can't remember, and we were joking around. I was listening to some silly music or something, Justin Timberlake's 'Bringing Sexy Back', so I switched it to my IM message, just to see whether it would show up on the display, to mess around and then Frank and Frances kept running back and forth past the display. They were going between offices. They were often coming in here, and they were writing together, and so I was amused to see whether they would run past the display and happen to notice that that was on there.*"

By putting a humorous message up Fiona changed the nature of the boundaries of her buddies, rapidly shifting into a mode of inviting contact where previously incidental contact was unwanted.

As an example of a low context message style, Frances mentioned that she liked to craft her messages to communicate, in a way that made sense to the remote audience. For example, when she traveled, she intentionally used the hotel name, instead of the city name as her location status, because to her, that was more indicative of her being in a conference than using the city name.

Discussion

We began our investigation by assuming the messages on the large displays were more public than IM. The framing of large displays in the literature is often that they are the "public" because they present no technical mechanism for restricting viewing. In contrast the laptop is framed as the "private" place where information is kept and carefully managed. In our study however, these categories did not align. Many of our participants had buddy lists that contained hundreds of people. For

our faculty participants the heterogeneous nature of the buddy list was plainly evident. There might be colleagues, family members, former students, administrators, bosses, and children all reading the same status message on IM, Facebook and/or Twitter. Yet in contrast the very fact that the large display was a situated artifact forced it to have a somewhat higher level of privacy. It was extremely unlikely that hundreds of people would see a status message that was put on the display. Many of our participants were comfortable with joking around or even making disparaging comments on the "public" display, but were concerned when they realized that the same message was being broadcast to their "private" IM list. So in what sense then is the large-screen display more public?

Our experiences with Nomatic*Viz and Nomatic*IM in a shared community space suggest that "public" and "private" might not be the best concepts to understand these displays and their use, instead, the idea of different audiences might provide a more useful organizing frame. Our five month field trial revealed that, even with just very simple status editing, our informants put considerable thought into how to present themselves with certain audiences in mind. Our informants all demonstrated sophisticated negotiation processes in terms of revealing more general or more specific status, high context or low context messages, and a digital presence or absence. Each of these choices was based on the sensitivity of the message, a need to invite some interruptions while preventing others, and the need to maintain consistency among different fronts. These observations show that managing status and awareness information is more complex than just concerns about awareness and privacy. It resonates more with the performance framework developed by Goffman who was making sense of everyday social interactions. While Goffman only considered face to face interactions in closed settings, the introduction of presence and awareness technologies into our social milieu creates complications for maintaining coherency and consistency among multiple new digital fronts.

Further, another surprising finding was the observation that our informants found meaning in the display not just in its descriptive nature, but also in the way that it created new spatial experiences. Many times people used words like "laugh", "smirk", "crack a joke", "have fun", and "interesting" while describing their experiences with their *own* status messages or the status messages whose authors they recognized. These effects could be explained in the way that the display created two distinctive spaces described by Mcgrath in examining surveillance technologies: the space where actions are taking place, and the second space or the "watched space" which does not exist prior to watching and is created by the act of watching itself (Mcgrath, 2003). The existence of the"watched space" introduces aspects of suspense, and a certain open-endedness, which, according to McGrath, creates new ways that space can be experienced and understood. Similarly, the existence of a status display also creates a momentary gap between performance and awareness, and between describing and responding. These moments of suspense and the gaps in the consistency of the digital and physical spaces, allow new ways that space can be experienced. Rather than leaving the awareness messages as self-evident descriptions of events, the display causes the viewers to reformulate their represen-

tation of the circumstances of its authorship and consequentially of the meaning of the spatial environment .

Conclusions

In this paper, we have reported on how people perceive, respond and live with a status broadcasting system, called Nomatic, in an academic community. Nomatic is composed of a context-aware software component, Nomatic*IM, which supports status broadcasting, and a large display, Nomatic*Viz, which shows aggregate status information in a community space. A long term field trial of the system suggests that Nomatic*IM is effective in promoting status updates. It also shows that Nomatic*Viz provides more lightweight and peripheral awareness of community activities than IM or other social software. However, interestingly, whether it represents a "community" or just personal relationships is determined by the number of participants updating in real-time, not just by the design of the display itself. Further, what is particularly striking is how the value of the display does not just lie in simply being informative but also in that it participates and creates new dramatic and spatial experiences. Finally, the study also uncovers how members carefully manage the presentation of their status messages and coordinate this presentation across different broadcast venues: a behavior that resonates well with Goffman's performance framework.

Awareness technologies have occupied much discussion in CSCW, and as sensors, displays and mobile technologies become increasingly pervasive, we believe more awareness technologies will occupy the space we inhabit, and continually play important roles in enhancing collaboration and connections for distributed as well as collocated groups. Our traditional focus has been on how to automatically sense, reason about and display activity and other contextual information, while at the same time providing enough controls for users to address privacy issues. However, as we can see from our data with Nomatic*Viz, this perspective does not address the complexity of how these displays function in a social environment. Instead, we have seen that people engage with awareness displays with contextual knowledge of the community and the space, and how people actively negotiate self-presentations and maintain coherent fronts to multiple audiences simultaneously. Rather than considering a tradeoff between awareness and privacy, we argue that we should consider the spaces that our awareness displays create and how people perform to different audiences in the presence of the display. Computer-mediated awareness is not simply a given; it is an active process of construction and interpretation, within a social and physical setting and set against a contextual background.

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