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MyTeam: Availability Awareness through the use of Sensor Data

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Abstract: This paper reports on a four-week study of the usage of myTeam, a prototype that provides availability awareness for distributed work groups through the use of sensor data. Automatically detected information such as presence or absence in office, network connection, mouse and keyboard activity is conveyed along with optional user-added information such as "gone for the day", or "do not disturb". The information allows visualization of the availability of colleagues, and supports selection of the best mode for communication for the given context. The results of the study are reported to inform the design of future availability awareness systems.

Keywords: Availability awareness, sensor data, active badges, communication.

1 Introduction

Distributed teams are becoming increasingly commonplace. Trends such as telecommuting, mobile workforces, touch-down centers, and the globalization of business are creating workers that are geographically separated, but virtually connected. The connection may be only to their email and calendar through a modem, or workers may be linking into a virtual space that is continuously or intermittently connected to colleagues.

In some cases team members are separated by country borders and time zones, while in others, they are merely in adjacent buildings or floors. However, even when the distance is only from one floor to the next, co-workers lose the visual reminders of each other's presence, and they lose all the social information that is obtained through aural and visual contact with co-workers. They become disconnected from the actions of their colleagues and are not aware whether a person is in his office, on the phone, or hurrying to meet a deadline.

Working as part of a disconnected team is only one of the issues that workers face in today's workspaces. We studied several of these issues in a series of more than fifty on-site interviews with knowledge workers. We focused on open-plan offices where workers inhabit semi-walled areas commonly known as cubicles. The common requirements that emerged included the need for a sense of control of one's workspace, the ability to deter unwanted interruptions, and in-place support for dyadic interactions.

In order to accomplish quiet, heads-down work without interruptions, many knowledge workers reported that they either work from home, or work during off hours (late at night, or early in the morning). Since part of the value that knowledge workers provide their employer is by sharing their knowledge with others, it stands to reason that there is a negative impact when these workers telecommute and are unavailable for informal and serendipitous communications. Informal communications are defined as generally impromptu, brief, context-rich and dyadic exchanges (Kraut et al, 1993) that support joint problem solving, coordination, social bonding and learning (Whittaker et al, 1994).

Research has shown both the value and prevalence of informal communication in the workplace (Fish et al, 1993; Kraut et al, 1993; Whittaker et al, 1994; Whittaker et al, 1995). It has also shown that informal communication is mediated by physical proximity (Allen, 1984; Fish et al, 1993). People who are physically collocated are more likely to communicate frequently, and researchers are more likely to be familiar with and respect the work of colleagues that sit near to them (Whittaker, 1995). Opportunistic interactions are vital to the planning and definitional phases of projects (Whittaker, 1994). Thus, a key issue in workplace productivity for knowledge workers is to ensure a balance between their need to "cordon off" time for quiet uninterrupted work and the benefits of being accessible to others, working in an environment that is supportive of informal and opportunistic interactions.

The myTeam prototype is our attempt to address this issue. It is an availability awareness application that uses sensor data to report on a user's presence or absence in his workspace, as well provide indicators of the user's activity. It also provides support for making others aware that the user prefers not to be disturbed. This paper reports on myTeam and on the findings from a four-week user trial conducted with the prototype.

2 Prior Work

Understanding the impact of using technology to support communication and awareness among distributed team members is an important field of research in both the CHI and CSCW communities. Initial research into Media Spaces (Bly et al, 1993; Gaver et al, 1992; Mantei et al, 1991) explored the use of always-available video and audio connections between geographically separate locations. The goal was to support not only intentional information exchange such as video conferences, but also non-intentional communication such as those involved in social activities (Bly et al, 1993).

While media spaces are useful in providing general awareness of colleagues, there are several problems associated with the use of continuous-connection video links. Two of these are the cost of maintaining these links (especially when the locations are not on the same continent) and the technical feasibility of transmitting the data in a timely manner. The Portholes system (Dourish et al, 1992) also afforded passive awareness of distributed workgroups, but did so by displaying a matrix of video images. Thus colleagues that were 6,000 miles away could be viewed alongside co-workers in the same building. The images are periodically updated, and are easier to manage than a continuously open video link.

The Peepholes system (Greenburg, 1996) overcame many of the objections associated with video systems by using iconic presence indicators. Peepholes was inexpensive and also had the advantage that users did not feel self-conscious about the image of themselves broadcast (since it was only a drawing and all the drawings looked identical). However, Peepholes relied on computer activity to determine presence, thus a colleague who was working in his office, but not using his computer, would have been in an unknown state (portrayed with a question mark).

Some awareness is provided through the use of Instant Messaging (IM) systems. These systems support the creation of lists and indicate whether a colleague/friend is running the client and active. While social use of systems such as AOL IM has seen explosive growth the past couple of years, introduction of IM in the workplace has been slower. Studies of IM use in the office (Nardi et al, 2000; Tang et al, 2001; Handel et al, 2002) has shown that IM is used to negotiate availability for other forms of interactions (e.g., phone call or meeting), broadcasting questions, as well as opportunistic communications. However, IM systems rely on activity data which does not always truly reflect the users' availability.

More recently, research in collaborative systems has been driven to account for worker's local mobility (Bellotti et al, 1996), such as visiting other offices or attendance at meetings. The Awarenex prototype (Tang et al, 2001) extends awareness functionality to a wireless handheld device. Sensor data was introduced with the use of Active Badge systems (Schilit et al, 1994) that allow the software to report on current location of the user. Such badges were successfully used by Want et al, (1992) in a system for telephone operators so that calls could reach users even if they were locally mobile.

3 MyTeam

MyTeam builds on prior research on awareness systems in several important ways. It differs from IM systems in that participants can get information about the availability of a colleague even if that person is not running the client. It also combines presence data with activity and network data in a novel way so that colleagues are portrayed as reachable even if they are not in the building. Lastly, it is unobtrusive and requires little to no active input from participants.

A critical factor in the success of communications is having prior knowledge about the *communication availability* of others before initiating contact. Lack of this information contributes to high rates of connection failure. This may explain why over 60% of business phone calls fail to reach the intended party (Whittaker, 1995). MyTeam communicates status and also acts as a visual reminder of the presence of co-workers who may be located elsewhere. MyTeam also conveys co-workers' communication availability at a glance.

4 Functional Overview

MyTeam runs in a 1" high browser window, which is constantly present on the screen. An active badge and badge reader automatically update a user's presence, thus precluding the need for the user to remember to change her status every time she steps in or out of the office. The first tile always contains the user (see Figure 1), with the remaining members following in alphabetical order. The participant is represented in the first tile so that he is aware of what his colleagues are seeing of him.

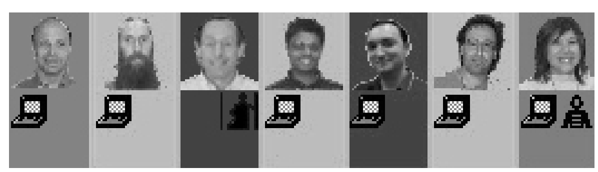

Figure 1: A subset of tiles from the myTeam client

Each team member's representation consists of a photograph for easy identification, a background status color, and an information area. The set of possible background colors can be seen in Table 1. The three colors indicating presence or absence (two blues and the green) are automatically set by the system based on the sensor data. The red or the white background can only be set by the user opting to change his status. While it is hard to perceive the background colors in Figure 1, the second, fourth and sixth participant are in their office and available. The first is not in the office but at a known location (light blue), the third and fifth participants are undetected by any badge reader (dark blue).

Background Color	Meaning
green	in the office and available
light blue	not in the office but at a known location (e.g. lab)
dark blue	location is unknown
red	do not disturb
white	user is hidden - status is unknown

Table 1: Status information from tile background colors.

Mouse clicking in the participant's own tile brings up a set of states that can be selected by the user. Many of these states elaborate on why the user is not in his or her office such as: "in a meeting", "at lunch", "having coffee" or "gone for the day." This information is displayed to other myTeam members by means of an icon below the picture. The third participant in Figure 1 is undetected and is displaying an icon for "gone for the day".

Since one of our goals in developing myTeam was to find a way for knowledge workers to work in their office without interruptions, another user-selectable state is "do not disturb". The last participant in Figure 1 is in a "do not disturb" state. The busy icon below her image and the red background reinforce her request not to be disturbed. Alternatively, participants can choose to remain hidden from others by selecting the "hidden" state, which prevents any sensor data from being broadcast in the system. Hidden users are not prevented from viewing information for their colleagues.

The information area below the member's image is used not only to convey user-selected states (e.g. "at lunch"), but also to display information about the member's computer activity. A keyboard and mouse activity monitoring application was installed on each participant's primary computer. When activity is detected, myTeam shows a computer icon under the member's picture. This information allows other myTeam members to determine if a colleague (who may not be in his office), is active on the network and thus likely to receive an instant message or email. This is true even if the colleague is connected into the network from home or another remote location. In Figure 1 we see that the fifth participant is not detected by any badge reader, yet is on the network and working at his computer.

When the mouse is positioned over any participant's tile, more detailed information appears in a pop-up window. This information includes the participant's name, office location, phone number, a textual interpretation of the member's current status, the date and time the status last changed, the member's current location (if known), and whether the member's computer is connected to the building network or a dial-up connection. For example: "*Tom Bridgman (08-134, x2417) 'Away from my desk' (since 3:30pm). Computer is on Hawthorne network.*"

MyTeam allows users to register themselves as "waiting" for a colleague who is currently unavailable. Clicking on the tile of the unavailable colleague (either away or busy) registers the user to be notified when that colleague becomes available. The notification is in the form of text message (e.g. "David is now available") that pops up silently on the requester's primary display. For the person who is in 'Do Not Disturb', the identity of the waiting individual is displayed through myTeam. This way, a worker can quickly check how many people (and who) are waiting to speak with her, and try to make herself available if possible.

5 Implementation

MyTeam relies on data automatically collected from sensors, which can optionally be augmented with information from the participants. The principle sensor is a low-cost active badge prototype system developed in our lab. Each participant was provided with a uniquely identifiable badge and reader, capable of detecting any badge within a hundred feet depending on interference from physical obstructions. The reader was installed in the participant's office, via a serial cable to a network-connected computer. Since many participants use laptops as their primary work machine, the reader was connected to a secondary workstation whenever one was available, since laptops tend to be carried around when the user is locally mobile. Additional readers were deployed in labs frequented by the participants.

Each badge reader sends frequent, periodic reports to the Sensor Data Server (SDS), enumerating the badges it detects. The SDS matches each badge identifier to its assigned owner and records the participant's probable geographic location, as determined by the known location of the reader. When the readers are deployed in close proximity multiple readers simultaneously detect the same badge, thus the SDS takes into account the relative signal strength detected.

The activity monitor simply watches for keyboard or mouse activity to determine whether the computer is currently in use. The monitor periodically sends the computer name, an activity flag, and the computer's current IP address to the SDS. The IP address is useful when the computer is a laptop, as it can provide further information as to the participant's probable current location. MyTeam distinguishes between remote (dial-up) connections and connections that are part of the campus networks, reporting this additional information through the interface.

The Context Server (CS) aggregates the sensor data with the user input using a hierarchical data store that supports data queries and subscriptions by the client. The CS periodically queries the SDS, retrieving the most recent data for all participants. The client runs in a browser environment and is setup to start automatically. Users are encouraged to leave the client running at all times; however, they are free to stop and start it at will.

6 Pilot

A four-week pilot was conducted to understand how myTeam would be used in a real work environment. The authors made use of the application to understand its value and what was missing. Additionally we recruited 13 fellow employees to use myTeam during the pilot. The authors' data is reported separately and used primarily for comparison purposes. We refer to these two groups henceforth as Main Group and Author Group.

6.1 Participants

The users selected for the pilot had several interesting characteristics that tested the utility of myTeam. The group was distributed between three locations: Hawthorne, Yorktown and Cambridge, Massachusetts. Hawthorne and Yorktown are both in New York, separated by a 12-minute drive. All participants have private, enclosed offices and are equipped with an 802.11b-enabled laptop. They also have a flexible work schedule, and divide their time between the various locations. While all 19 participants work for the same senior manager, they are associated with three different projects. People within the same project know each other and communicate with varying degrees of intensity, while communication between members of different projects can be sparse or non-existent.

Customizing or reordering the team list was not possible for the pilot. Thus every participant got all 19 participants as part of his myTeam. Some of the participants in the pilot had never met colleagues that were now part of their myTeam display.

Regularly Communicate with:	Main Group
1 – 5 people	50.0%
6 – 10 people	41.7%
11 – 15 people	8.3%

Table 2: Communication characteristics of Main Group

Work Remotely:	Main Group
Yes – but no pattern	41.7%
> 8 days a month	16.7%
4 – 8 days a month	8.3 %
< 4 days a month	8.3%
Never	25%

Table 3: Work patterns of Main Group

Before the start of the pilot, we surveyed the participants of the Main Group about their communication and work patterns. We did this to understand how mobile the participants are, as well as how many people they communicate with regularly (more than 5 times a week). The results are shown in Table 2 and 3. Additionally, we queried them as to their preferred method of communication. In contrast to what actually seems to take place in the office, 75% reported that they prefer face-to-face communication, while none selected IM. Almost 9% claimed not to prefer any particular means, while the remainder was evenly split between email and the telephone. We also asked whether the respondents agreed with the statement "*I sometimes feel that there are too many interruptions at work for me to concentrate for an extended period of time,"* to which 83.4% responded affirmatively.

6.2 Measures

Three types of measurements were available for analysis at the completion of the pilot. The largest body of data was created through automatic system logs. These allowed us to determine how often participants manually selected to annotate an absence (e.g. "gone to lunch") or selected a user-defined state such as do not disturb. Logs also tracked which state changes were selected, as well as all the presence and activity data In addition to the logs, we asked participants in the Main group to complete exit surveys. These surveys collected subjective information on what participants liked best about myTeam, what they liked the least and what types of features they would like to see added. Finally, we asked the Main group to complete communication diaries both before the pilot started and during its final week. Participants were asked to record the names of all the people they interacted with for a two-day period, as well as the method by which they communicated (i.e. telephone, in person, IM, email). For telephone communications, we asked them to record whether they actually spoke with the person, or just left voicemail.

7 Findings

7.1 System Log Data

The log data showed that over the course of the pilot, the average number of user-selected states per user/per day (pu/pd) was 1.5 for the Main group and 2.2 for the Author group. A user-selected state is any state that is manually initiated by the user as opposed to reported by sensor data. A list of all the possible user selected states can be seen in Table 4. The average was impacted by the fact that after a period of initial experimentation, the number of user-selected changes (for both groups) declined towards the end of the pilot. This early burst of activity followed by a decline is not unusual with innovations introduced into organizations (Fish et al, 1993). Even though we did not include the first two days of data due to the high numbers introduced by user experimentation, the slope of declining usage is consistent with the pattern that we have seen with many prototypes introduced into the workplace. Figure 2 shows the average number of user-selected states pu/pd for the Main group from the start to the end of the pilot. After the first two weeks, it appears that participants seemed satisfied relying almost exclusively on the sensor data to report both their presence and activity to fellow team members.

When users did opt to manually supplement the sensor data, they were more inclined to so for longer absences than for the short ones such as "getting coffee". Table 4 shows the distribution of states that were selected by users on average, in each group. The three states most commonly selected by both groups were: 'gone for the day', 'in a meeting', and 'do not disturb'. Interestingly, the state "in a meeting" was added after the start of the pilot. Several users requested the state since they did not want their managers, (or presumably their colleagues) to think that they were merely away from their offices. They wanted it clear that even though they were not in their offices, they were still onsite and working.

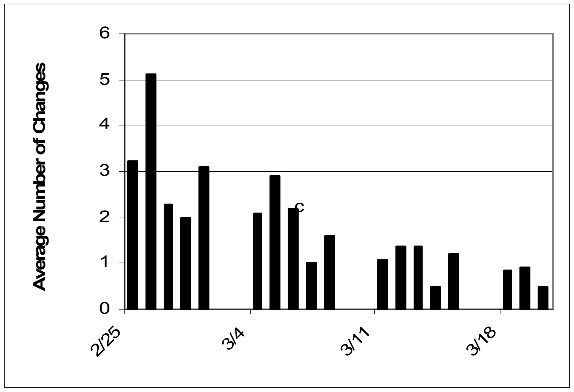

Figure 2: Average user-selected state changes per person by date for the Main group.

State	Main Group	Author Group
Hidden	4.7%	7.8%
Coffee	5.0%	2.5%
Be right back	9.1%	15.9%
Lunch	14.5%	7.2%
Do not disturb (dnd)	18.2%	21.6%
In a meeting	20.2%	24.4%
Gone for the day	28.2%	20.5%
Total	100 %	100%

Table 4: Distribution of user-selected states on average

An analysis of the logs further showed that some states were "contagious". In other words, once one user (or more) selected the state, others appeared more inclined to select the same state. This seems most true of the "meeting" state, where apparently participants in meetings were reminded to set their state to meeting when noticing that colleagues were also in a "meeting" state. This was true whether participants were in a meeting with other myTeam participants, or unrelated colleagues. The "do not disturb" state also seemed to have been selected more readily if another user had recently used the state. Figure 3 shows how these two state selections tended to cluster.

Manual state changes as a whole seemed to follow a process of collective disclosure. When the majority of tiles showed either present (in the office) or had absences supplemented with user-selected state information, myTeam participants were more prone to annotate their own state. As usage dropped off, and colleagues noticed that others weren't taking the time to enhance the sensor data, (i.e. indicate through state information why they were not in their office) they seemed less inclined to add state information to their own tile.

We also looked at the logs to get a better understanding of how much time participants were spending in their offices in an effort to determine the value of automatically reporting absence from the office. Presumably, if a worker were seated in his or her office every day, all day, this type of software would be less useful, although still valuable for the ability to control unwanted. Participants in the Main group were logged as being in their office 7.17 hours a day, on average. This compares to the Author group, where the average was only 4.15 hours (see Table 5). While the amount of time spent in the office, versus in the lab or in a meeting is clearly tied to job function, the job functions between the two groups are very similar, if not identical. We believe the average presence numbers in the Main group were larger because participants occasionally forgot badges in their offices overnight, which caused them to sometimes be "present" 24 hours a day.

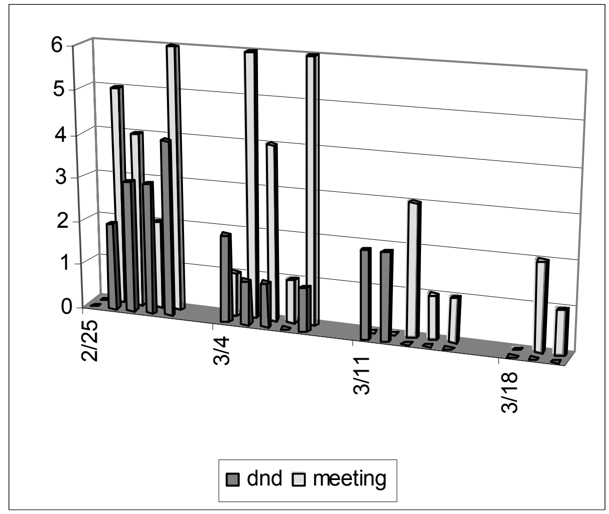

Figure 3: Total usage of two states that tended to cluster.

In addition to the time that participants were detected as present in their office, they were also reported as undetected but "active" on the network for 2.16 hours a day in the Main group and 2.93 for the author group. For that amount of time, colleagues knew that the best means to reach their fellow team members was via IM or email (rather than face-to-face or telephone call).

KB and Mouse	Presence	Main Group	Author Group
Active	In Office	4.82	2.33
	Known Loc.	0.58	0.84
	Not Detected	2.16	2.93
Idle	In Office	2.35	1.82
	Known Loc.	0.45	0.77
	Not Detected	13.64	15.34

Table 5: Average number of hours per day that users were detected as present

7.2 Communication Diaries

Our expectation was that the number of voicemail messages recorded would go down as a result of using myTeam, since one could tell if a person was in his office before calling (at least for calls within the team). We were also curious whether communications between myTeam members would increase as a result of having greater awareness of colleagues. However, in examining the communication diaries kept by participants in the Main group, it became clear to us that four days of logging communications (two before the start of the pilot and two at the end) was too little data to obtain clear results. There were wide variances from one day to the next, with some users having very active days interacting with others before the pilot with only quiet days towards the end of the pilot, while other users experienced the inverse.

While the numbers indicate a reduction in the number of voicemail messages (from 13 before to 2 during), a reduction in the number of telephone calls in general (from 59 to 35) and an increase in the number of face-to-face interactions (from 70 to 81), this could presumably be coincidental. Communication between myTeam members, as recorded by the diaries, actually went down from 105 incidents to 72. However, anecdotally there was at least one incident of a myTeam member passing a fellow myTeam member in the hall. The two had never met, and the participant reports that he stopped, recognized the colleague from his image on myTeam and introduced himself.

7.3 Exit Surveys

Based on the surveys conducted with participants of the Main group at the end of the pilot, the feature that users most preferred was the ability to know who was around at any given time, where someone could be located, and the best means to reach that person. Several users reported feeling more connected to others, and one user said: "*There is a sense of belonging that I get from seeing all of the myTeam images displayed*." Participants mentioned using myTeam to "*determine the best communication mode to use*" with a colleague.

As stated earlier, the myTeam member's telephone number and office location were visible by mouse-over, and several users listed this as one of the features they liked best. However, not all remembered to use it. In response to a survey question about using myTeam to quickly find telephone numbers of colleagues, only 45% of participants responded positively. Among those that indicated they did not use this feature, one participant stated that he was not even aware the information was available.

When we asked participants if they respected a colleague's request to not be disturbed, 63% indicated that they did, while 27% said that they did not (the balance did not answer the question). This inclination to disregard the "do not disturb" state was surprising to us, and we speculate that it might have been the same participants that reported distrusting the status information of colleagues. Since users could not override the sensor data in the pilot, if a participant forgot his badge at home, he was reported as being absent from his office, whereas in reality he could have actually been there. This caused one participant to report that he developed a mistrust of the system. Others reported frustration with the fact that people would put themselves into a "lunch" state, and still be in the same state hours later. However the sensor data would show that the user was actually in the office.

The greatest complaint that users had was the amount of real estate that the client took up on their screen. Even though the client could be minimized or closed, 72% of respondents reported running the client at all times. The two improvements that were most requested by users were the ability to personalize the list (selecting which colleagues to display and in what order), and the ability to initiate communication from the list. While we had hoped to have communication functions working for the pilot, we were not able to implement them in time.

There were some issues raised concerning the need to keep the badge on one's person. Survey data indicates that 54% of respondents in the Main group occasionally forgot their badge in the office, either overnight or for short absences. Additionally, 45% of survey respondents reported forgetting their badge at home occasionally during the pilot. Leaving the badge in the office all day would be an easy way to fool the system into reporting that one was in the office, toiling away (even though the activity monitor would show idle), if one wanted to do such a thing. We queried users whether they were ever tempted to "outsmart" the software. Only 18% replied that they were tempted. The funniest reply we got was from a colleague who stated he considered: "getting a dippy-bird to peck at my keyboard to make my manager think that I was working when I was not in my office"

8 Discussion

One of the greatest considerations for designers of awareness applications is the tradeoff between privacy and invasiveness. Users want to preserve privacy and not be disrupted too much. At the same time, they want as much information as available on colleagues in order to make informed decisions about communication channels. Privacy was a concern for our users at the start of the pilot. This issue has been reported by others piloting awareness applications (Greenburg, 1996; Lee et al, 1997). A couple of team member refused to install the client. One felt the badge readers were "creepy" and wondered how long it would be before software was reporting how much time she spent in the bathroom. She also believed that the activity monitor could be a precursor to having the corporation watch what she typed on her computer. Others were less adamant about their feelings, but expressed some reservations nonetheless. In study on the social aspects associated with wearing active badges, Harper (1996) found that people did, or did not, want to wear the badges depending on what organization in the company they worked for and what their resulting social identity was.

To help address some of the concerns associated with badges and privacy, we gave users the option to select the "hidden" state in which they could prevent the system from reporting their data. Users actually made very little use of this state. Timing analysis shows that while different users selected this state on five separate occasions, in two instances it appeared to be merely experimentation since they were in a hidden state only for a few minutes or less. In other cases the user selected the hidden state and remained so for about an hour, and then moved into a "do not disturb" state. While use of the hidden state violates the important principle of reciprocity, it did not create any grumbling from fellow myTeam members. This is most likely due to the fact that its usage was sparse and brief. However, it gave new users, especially wary users, time to get comfortable with the level of information that was being disclosed. In spite of some initial reservations about privacy, at the end of the pilot only one participant mentioned the issue of "big brother" when queried about myTeam drawbacks.

We were surprised that there was not greater use of the "do not disturb" (DND) state. Figure 3 shows that usage of this state fell off substantially in the second half of the pilot. What it does not show, since it only reports on number of events without the duration, is that many of the DND events were simply experimental. In the Main group, 9 of the events lasted less than a minute, 5 lasted about 30 minutes or less, and 2 lasted for 19 and 31 hours respectively, indicating that the user left this state on overnight. Of the remaining events, the average duration was 1 hour and 35 minutes. Thus users tended to use this state for short concentrated periods. We speculate that DND may have been less "socially acceptable" than other states. Because we wanted the DND to serve as a red stop light for colleagues considering initiating contact, we designed it in a way to maximize its visibility on the client. However, because it was so highly visible, it may have felt almost rude to make such a bold statement about one's lack of availability.

We became aware of several usability problems while running the pilot. Most notably, we probably did not do a good enough job of exposing the features since two users requested features in the exit survey that already existed. The requested functions were the ability to be notified when someone in DND becomes available, and the ability to determine if a user who is not detected by a badge reader is actually in either the Yorktown or Hawthorne buildings (visible in the flyover information).

The last issue we will discuss is the use of sound. In a collocated environment, we maintain awareness of our colleagues through both visual and aural contact. In the tradeoff between disruption and awareness, we decided not to use audio feedback in myTeam. Several of the systems mentioned earlier (Gaver et al, 1992; Lee et al, 1997) used sound (e.g. footsteps, door opening) to indicate when an activity was taking place. In myTeam status changes occur silently in the background unless the user has registered an interest in being notified of an event. We believe that system sounds can easily become disruptive when users are trying to concentrate. Our design goal was to have information available to users when they wanted it, but not interrupt them with the information.

9 Design Implications from Findings

Finding: For the most part users were content to rely on the automatically reported sensor data. When users did opt to manually add to the sensor data they primarily did so for states of longer duration.
Design Suggestion: States of short duration such as "getting coffee", or "lunch" are not necessary. Sensor data alone should be sufficient to convey short absences.

Finding: The "do not disturb" (DND) state was not as commonly used as expected (only 19.9% of all state selections) possibly because it was perceived as less "socially acceptable" than other states.
Design Suggestion: All states should be visually equal.

Finding: The most useful feature reported on the surveys was the ability to know who was around and how they could be contacted.
Design Suggestion: If users are mobile, keyboard activity and network data is needed to supplement the badge information.

Finding: The most common complaint was the amount of real estate that the client took up on their screen.
Design Suggestion: Availability awareness client should have an auto-hide feature, or some other method, for easy viewing and hiding.

Finding: Forgotten badges caused sensor data to be incorrect for presence/absence information.
Design Suggestion: Users should have a way to override the sensor data, or at least annotate it.

Finding: Users in the study only selected the hidden state five times, and these occurred early in the study.
Design Suggestion: Give new, wary users a way to observe the interactions before being required to reveal their own data.

Finding: The most requested improvement was the ability to initiate communication from the awareness client.
Design Suggestion: Availability awareness helps workers determine the best mode of communication (e.g., IM if colleague is online but not visible to any badge reader, telephone if available in office) and communication capabilities should be integrated for convenience.

10 Future Work

The user feedback we received revealed a number of areas for enhancement. The most requested missing feature was a complete set of integrated communication capabilities. To that end, we would like to provide what we call "one-touch" communication, where the best communication method is selected based on the recipient's current state. For example, clicking on a participant who is in the office and not busy would initiate an IP phone call. If the participant was not in the office, myTeam would start an IM session if the recipient was detected on the network; otherwise it would open an email window. Integration with the telephony system would have the additional benefit of allowing us to show when users are in their office but currently on the phone.

A second finding was that several participants grew to question the data reported by myTeam due to forgotten badges, or outdated user-selected states. We would like to add additional intelligence to detect and adjust for conditions such as users forgetting to reset their state (e.g., at lunch) or not wearing their badge. For example, if a participant has indicated that she is away and the system detects that she is active, it might prompt her to verify her state. Similarly, if a user has not changed location for a long period and does not appear to be active on the computer, the system could ask him to confirm his presence. If no reply is received, the system can assume the badge has been forgotten and adjust the data accordingly. Additionally, participants should be allowed to optionally annotate their state, providing information as to their whereabouts or indicating that they are present but have forgotten their badge at home.

We would also like to address the customization issues that were raised by participants, including the ability to remove or reorder members of myTeam as well as experiment with providing information in a smaller screen footprint.

Finally, we are interested in pursuing new designs for the MyTeam display that better integrate the various information components. One possible direction is shown in Figure 4, where expressive, full-length images of the participants convey information about identity, presence, availability, and relevant activities. The only information not contained in the images is online status, which is conveyed by text color and boldness (a convention familiar to users of Lotus Sametime and other IM applications). Such a unified approach might enhance usability by eliminating the need to memorize the meaning of colors and icons.

Figure 4: New directions for myTeam

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