Supporting Social Awareness @Work
Design and Experience

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ABSTRACT
During the last year we have been designing and studying a computer based tool intended to strengthen social group awareness within a research laboratory.

While awareness has been a subject of previous research it is still unclear how it should be conceptualized and how it can be provided for a CSCW system. In order to investigate this, and hence to attempt to create a system that would gain acceptance in the user community, we have been using a mixture of user-centered and participatory design methods.

This paper presents the design process, the resulting system as well as users' comments on it. Based on all this, issues related to awareness are discussed and ideas for further studies are suggested.

Keywords
Computer supported cooperative work, awareness, user centered design, participatory design

INTRODUCTION
A-Lab is a multi-disciplinary research laboratory which is mainly focused on Human Computer Interaction (HCI). The lab consists of about 10 senior researchers and about 15 research students. It is responsible for research and education at Master level in Computer Science, mainly in HCI, CSCW, graphics and object-oriented programming, including supervision of about 20 Master's theses each year. The physical proximity of its members provides normally a natural way for spontaneous meetings, as well as for developing human relations. Nevertheless, even if physical proximity exists, it sometimes fails to yield these advantages. One reason can be the working habits of the people working in the lab.

The system described in this paper is intended to provide through computer support similar advantages as physical proximity, bridging the gaps between people, and strengthening awareness and group consciousness among the lab members. The goal of the project has been to provide a system to be used naturally and regularly by the group members to inform each other where they are, what they are doing and how they could be reached. By this we hope to encourage informal, spontaneous collaboration and support community building.

On certain mornings, when you arrive, the lab is full of activity and energy while on other days it is more or less empty. This could be confusing if you don't know the working habits of the A-lab people. Their work includes lecturing, so they could be in classes, as well as research, so they could be in the library or in a computer room. The lab also runs external research contracts that may keep the staff out of the lab's location. The working hours are not regulated, people work in the office or at home. Everything is fine as long as you show up at the meetings and lectures where your participation is expected. But it is not socially accepted to stay out of touch or to be unreachable for a long time. The 'non written law' states that you should regularly read your electronic mail and reply within the same day in most cases. The academic world that A-lab acts in is organized in networks and, even if A-lab sometimes seems to be empty, the activity within the virtual networks seldom stops.

Recognized within the CSCW community is that one of the most important components of collaborative work is the awareness of the activity within a group. We would like to stress the importance of social awareness. By social awareness we mean awareness about the social situation of the members, i.e., awareness about what they are doing, if they are talking to someone, if they can be disturbed etc. In our everyday work, social awareness is a key element. We gather continuously information about our colleagues and act accordingly. If they listen, we will talk, if they are not here, we might phone them or leave a note. If they are in the right mood, we start a discussion, if not, we postpone it.

A definition that catches the essence of awareness in a broad way is the one suggested by Dourish and Bellotti [9] where awareness is defined as "the understanding of the activity of the others, which provides a context of your own activity". Moran and Andersson [27] discuss the problem in terms of 'peripheral awareness'. They point out the importance of signalling the availability of information and people in a way that uses the human capability to peripherally process non-attended aspects. Kraut et al. [24] show that geographical proximity is fundamental for the development of personal relations and communication. This includes first of all the knowledge of persons' availability, both physical and

emotional. Gaver [15] uses J. J. Gibson's term 'affordance' to characterize those physical properties in a media space that provides such information.

Another aspect is understanding how members' knowledge is used in a group. Some studies [26] claim that groups tend to be organized in knowledge networks where people relate to the knowledge of others. Hence, providing information about that knowledge is important, as it will increase the potential of collaboration within a group, as observed in our earlier CSCW prototypes, e.g., the CoDesk system [32][33].

Accordingly, the focus of this work has been directed towards observing and understanding mechanisms for supporting social awareness within CSCW systems. Good communication tools will allow flexible working environments where hierarchy and strict regulated norms will be replaced by human centered and project oriented approaches. Although the flexible work style in a multi-disciplinary research lab like A-lab is somewhat extreme, it has been argued, e.g., by Kling [23], that this will become a more common work style in many settings. The need to handle "information overflow" is characterized as a change in the social paradigm of our society [25]. Information overload often seems to be handled by using other people as references rather than by excessive reading of several documents [21]. One of our informants put it like this:

"For my work I'm very dependent on good social relations... If I don't have good social relations I'll work slowly and I neither like my work situation nor myself... A person who is good in his work knows how to use knowledge he got at previous times and has a great net of contacts."

Notable from earlier experience with CSCW system is the difficulty to envision all dimensions of cooperative work. To explore this further, and in particular study the means and expressions of social awareness, one part of the project has been to try out what we will refer to as 'multi-domain methodology' by using different user-centered and participatory design techniques for CSCW.

In the first part of the paper we present the different design methods that we applied. We discuss the awareness issues that came up and we present different prototypes that have been developed, as well as user comments on them. We end with some ideas for future studies.

MIXING DESIGN METHODS

Why do certain systems gain acceptance while others do not? Sharrock et. al. [30] argue that most CSCW "failure [is] often attributed to the inadequacy of existing methods" since traditional requirement specification pays insufficient attention to the social context of work. It is our belief that a broader perspective on work and environment needs to be considered. The design techniques that we applied are a fusion of different categories of design methods into, what we will call, a 'multi-domain methodology'. Encouraged by earlier successful use of interactive design and participatory design (PD) techniques [11] [5], we tried to blend some existing design methods rather than invent our own from scratch. In a series of design workshops members participated in the project and contributed to the design of the different prototypes that have been developed.

From a PD perspective, work is fundamentally social, involving cooperation and communication. Few work tasks are done in isolation. PD insists on shifting the perspective to group interaction within complex organizational contexts. Bannon [1] proposes that the design process should be directed towards an: "understanding [of] people as actors in situations, with a set of skills and shared practice based on work experience with others". He stresses the importance of going from user-centered to user-involved design by applying common design techniques such as prototyping and iterative design instead of requirements specification and traditional human factor analysis.

However, as Tom Ericsson [12] argues in his analysis of design activities, one of the basis for working with iterative design and interface metaphors is understanding "how the thing works". Obviously, cooperation and communication patterns are more complex than physical "things". In order to understand them better, and by this to offer a good basis for the iterative design, we started with what could be called a 'quick and dirty' ethnographical study of the communicational patterns within the lab.

During a two month period one of the co-authors made an ethnographical study of A-lab. This kind of study is assumed to provide a general but informed sense of the setting for the designers. It is debated, e.g., by Sharrock et. al. [30], that "field work methods involving ethnography are capable of providing rich material and analyses of the 'real world' character of the social organization of work". Even if the number of reported studies of the use of ethnography within CSCW design are few (e.g., Hughes et. al. [20] and Heath et. al. [19]), we believe that ethnography (and social anthropology) is a natural and useful basis for CSCW design because it is focused on the 'workday' activities of people in real settings.

The use of the design workshops could also be argued for by reflection on ethnographic analyses, which most often are textual stories and therefore provide only partial support for system design. Hence, we found a natural blend of iterative design with user involvement as an intriguing development of ethnographically informed design.

The Situation

A-Lab employs people with many different skills, e.g., computer science, linguistics, psychology, sociology and social anthropology. From time to time graphic designers, industrial designers and artists also work within the lab.

Working in a multi-disciplinary community sets high standards for the members. They are not only obliged to follow the discussion within their own field, but also within the filed of several other laboratory members. In order to find someone in the lab, people use a sign-in board (Figure 1). Placed at one of the two doors accessing the lab, it contains all staff members and blue magnetic stickers that should indicate whether you are 'in' or 'out'. But since most of the Ph.D. students enter the other door, they often forget to adjust their sticker. To use the computer to see if a colleague

is 'on' the computer network (e.g., the UNIX `finger` command) is seen by most as a more reliable way to check whether he/she is present or not. Still such systems offer only information regarding the use of computers, a rather limited concept of a person's 'presence'.

The group can also use other communication programs in the UNIX environment that make it possible to chat over the network. Those are mainly used by the master students and by some Ph.D. students, all with a computer science background, and only if they know each other well. A problem reported in the use of chat programs is the fact that these applications remove the normal social hierarchy, which can make users uncomfortable. This also prevents a wider usage since the risk to commit mistakes with a plausible negative social impact is felt to be high.

Many also feel unsure about when it is appropriate to use new media for communication with colleagues. An exaggerated care for a colleague's work load, especially for those who you don't know that well, is common. Meeting face-to-face is often desired for reasons such as the sensitivity of the subject or because you have not seen each other for a while.

The fact that, e.g., working hours are not regulated, clearly creates problems for the lab staff to reach and collaborate with each other. Several different strategies are used to overcome this. The preferred strategy is dependent on the employee's position in the lab. Master's students that only spend a short time in the lab and many Ph.D. students do not raise a question to a 'superior' through a phone call, not even during normal working hours. On the other hand, the senior researchers often prefer to use the phone. They rarely hesitate to call a colleague at home if it is not too late. This is out of the question for most research students.

"... I always use email when contacting my supervisor, I never use the phone..." [Ph.D student in social science]

For most, email is the tool that is easiest to use. It is a 'socially secure' way to raise a question because senders disturb as little as possible; it will be read when recipients give it time. The staff members with a higher position often use mailing lists to distribute knowledge. The old myth "the boss is the last one to know", is within A-Lab somewhat untrue since the lab leaders are those that have the contacts and the information. The different strategies to deal with mailing lists are strongly connected with the rank of the person and the social courage. Those that are talkative in the virtual media seem in most cases be the same that raise their voice during, for example, seminars.

The outcome of the first study has strengthened our belief that the work within the laboratory could primarily be described as a social phenomenon. Therefore we think it is very important to achieve a deep understanding of the nature of social activity in the lab. Without such knowledge a collaborative tool might work against social norms. Harper and Newman [18] state that social behaviour is always meaningful, and therefore the study of social behaviour is the study of meaning. Findings from their rich material of work

Figure 1: The A-lab's sign-in board.

practices and studies why certain systems fail, show that there is a causal link between system rejection and conflict with responsibilities. In the case of A-Lab the ethnographic study shows the importance of a socially secure collaborative tool. In order to succeed, such a tool needs to support both direct and indirect communication. The tool cannot only enforce direct communication since this would be uneasy for junior members. On the other hand, direct communication is reported as important and needed in some cases.

The second major finding from the ethnographic study is expressed difficulties in keeping in contact with colleagues and students outside the laboratory. The sign-in board is seldom used and there are many alternatives. This leads us to the conclusion that a computer based tool aimed at bridging those gaps and strengthening awareness and group consciousness among the lab's members also needs to take in consideration persons outside the lab. There seems to be a demand for providing a public interface such that, e.g., students could see if and when their teachers are reachable. This was not taken into consideration in the first prototype since we wanted to start by exploring different matters and see how things work within the group.

The First Prototype
The next step in our design was to develop and put a prototype in the hands of the members of A-lab. The system was named @Work, an acronym for being virtually at work.

Inspired by systems like, e.g, the Montage system [31], the Crusier system [13] and RAVE [15], we started using a video conference tool called `nv` developed by Ron Frederick at Xerox Parc. It provides thumbnail video images of all people that are using the system at one moment. The key idea is to be at all times aware of the presence of colleagues, thereby creating opportunities for spontaneous collaboration. However, as noted by Whittaker [35] in his review of real-time video for interpersonal communication, the kinds of glances made by video do not necessarily lead to better connection rates compared to phone calling when you have no clue about availability.
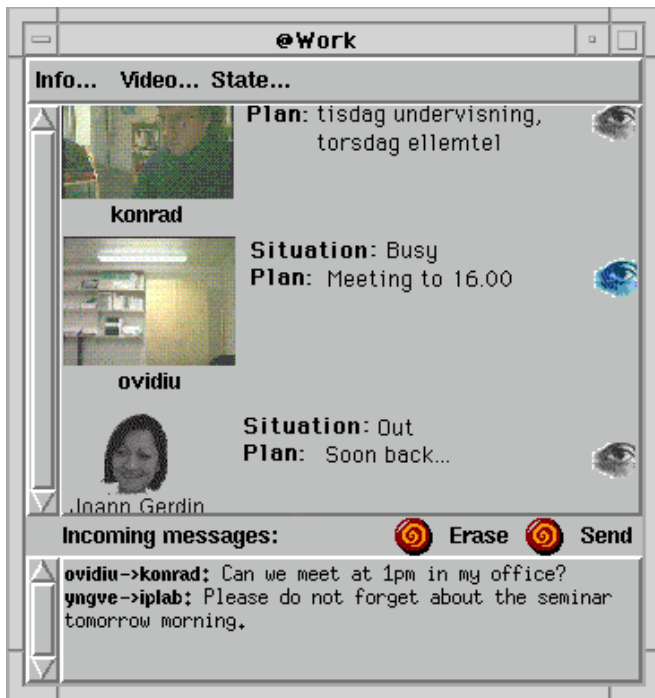
Figure 2: The first @Work prototype.

One version of the prototype was used by a small group of volunteers in the lab. The size of the group was limited by the fact that the system works only on Sun stations, requiring certain computer resources and a video camera. The experiment confirmed what previous studies, like Tang [31], showed. Even if people expressed concerns about privacy in the beginning, later on they did not refer to them any more. Having this kind of connection did not change the way people worked during the test period, but users got used to having it on screen and checked it out from time to time.

After a couple of weeks their interest for the system dropped and people stopped using it. We have found different reasons for that. First, the fact that the group was restricted (by access to technology at least). Second, the fact that the system was 'closed' in the sense that no one outside the group could access it (in any simple way). Third, it was clear that even if video images could offer some information about the availability of the others, some sort of complementary information was needed. For example, if someone is not logged in, where and how can I reach her/him, or when was he/she last at work?

Hence, our approach become slightly different. The kernel in our system is still a number of thumbnail images (Figure 2) but, based on the ethnographic study, we added some explicit awareness information. First of all, the members are able to provide information about their current situation. The Situation makes it possible to set a state indicating your availability. We had to choose between a big set of predefined situations or a free form, where it would be up to the user to describe his/her situation. The advantage of the first system is that setting that information is simple (normally just choosing one option from a menu) while the second one is more flexible. Finally we chose a very small

set of states (Here, Away from the keyboard, Busy and Out), but at the same time we provided the user with the possibility to leave text information to others (a sort of 'plan' as in the finger utility). By this we combined the advantages, obtaining simplicity and flexibility.

We also wanted to provide support for easy, direct communication. We extended the video link with an audio one. We also provided a facility for sending and receiving small messages (a light form of email). The messages also create a kind of history of awareness information, as one of our informants put it: "it would be nice to have here [in the system] some gossip".

We also provided a 'watch' mechanism. By activating the 'eye' next to a person, the user will get notified (with a specific sound) when a change in the Situation information of that person appears. A typical scenario for using the 'watch' mechanism is when looking for a colleague. If you see that he/she is out or busy, you can activate the 'eye' and you will get notified when he/she resets the awareness information. Then you could call him/her through the video/audio link.

DESIGN WORKSHOPS

During a two month period we organized a series of design workshops within A-lab where we tried to apply different design methods. An aim of the workshops was to encourage discussions on what kind of problems are encountered today and what kind of cooperation and communication are desired. The PD methods in the design process tried to focus on how computers could be used in the context of the current work practice at A-Lab.

During the design workshops we displayed the outcome in A-lab's cafeteria to help people follow the process. People not able to participate in the workshops were encouraged in this way to continue discussing and contributing to the workshops. Also people who participated were reminded about the discussions.

We will focus on two of the methods used. The first one is Future Workshop [22], which is a participatory design technique that states a common problematic situation, generates visions about the future, and discusses how these visions can be realized.

The second method is Observation & Invention. The method is developed by Verplank et. al. [34] to design products with a broad audience, e.g., consumer products. Although the method is originally intended to be used only by the designers, we modified it by letting the end users participate in the design process. Hence, the design records became unique statements of the participants' understanding of their situation. In general our results followed earlier studies [3] which claim that this form of situated design has a strong impact on how a system will be anticipated and used. Thus, through the design workshops, several of A-Lab's members felt that they shared a responsibility for how the system would come to be used.

Future Workshop

The method was originally developed to support discussion among citizen groups with limited resources for decision making in public planning. The conduct of the method is fairly strictly regulated by two facilitators. The key idea is that you should never directly criticize a speaker. Statements are written down on sticky notes and posted on a white-board to be later argued over, grouped and eventually ranked.

In our case the method was highly appreciated. A shared problem understanding was genuinely established. During the workshop, the members realized that in order to find each other easier they have to pay greater attention to how they provide awareness information to others. Several valuable statements convinced the group and informed us that the kind of system that we envisioned is needed:

- People do not have regular working hours.
- People have several work places/offices.
- Teachers teach in class rooms away from their offices.
- Nobody has the specific responsibility for keeping track of people (like in the traditional secretary job).
- The lab members do not generally update the sign-in board.
- When someone is calling from outside, the lab member that answers cannot see the sign-in board.
- Even if email is largely used, the phone is the most used communication tool.
- People outside the lab often report problems in reaching lab members.

Observation & Invention

The key idea behind Observation & Invention is the use of different media to keep a record of the design process which ensures rich findings that engage the whole group. It is important to capture early *observations* of real users in real contexts. Based on these observations, future *characters and scenarios* are formed that will move the stage to a future use of a virtual system. This is also suggested to be very important in participatory design [4]. Finally, metaphoric exercises guide the *invention* of a conceptual model and artifact representations.

Observation: One of the observations concerned Lars, a senior researcher. "A day in the life" story-board of his morning activities (Figure 3) showed how he would pass the sign-in board, would observe, on the way to his office, who is really 'in', would read email, and after that would go for a cup of tea in the cafeteria. The story-board clarified for the participants that they, as a group, share a lot of the communication problems. It is not just they, as individuals, that have problems dealing with the variety of media and expressions that exists. Hence, observations are a bridge across individuals and groups.

As noted in the figure, physical proximity is important to enable awareness of the lab members' presence. The physical proximity of a group can offer some important advantages with respect to group collaboration. First, the shared physical space affords spontaneous meetings. Such encounters prove to be a useful complements to scheduled meetings, allowing a more informal way of exchanging ideas and information. Second, physical proximity provides a natural way to develop human relations and build a real community. In the case of A-lab, the design process revealed that because of the working habits members often fail to meet physically. This observation informed the design about the importance of providing similar advantages as physical proximity through a computer system.

Figure 3: "A day in the life" story-board.

Characters & Scenarios: Scenarios help us look at changes in context and can be interpreted as prototypes for a range of users and preferences. In the scenarios, most people recognized a phenomenon earlier observed in the ethnographic study: the existence and importance of people outside A-lab. How those people could get access to awareness information was addressed and discussed. Among the characters we could find students who work partly as lab assistants but also family relatives who need, on a daily basis, to get in contact with lab members.

Invention: As argued earlier, metaphor design for CSCW is difficult in early phases of the design. Although neat ideas were discussed, most groups within the workshop reported difficulties in finding functional metaphors and artifacts.

Conclusions of the Workshops

The informants expressed a big lack of awareness of each other. The reasons seem to be two-fold: the variety of existing media creates a division and uncertainty of which media to use for a specific situation; and problems with the physical location.

The Observation & Invention method highlighted other aspects. Especially notable is the recognition of having a shared problem and that often people outside the lab are also involved. As stated earlier, the community around A-lab is organized in informal networks and obviously A-lab's problems are not only local. The members' need to communicate within their informal networks was in some scenarios described as even more important than maintaining relations within the lab.

This issue relates to another one reported during the design workshops. The idea is that people would like to provide group specific information accessible to group members but not to outsiders. Internal information could be sensitive and people would like to protect it from external access. Nevertheless, people would like to use the same system for informing people outside the lab about their availability. This leads to the idea that an awareness system must allow differentiated information to be provided under the full control of the user.

As reported from both the ethnographic study and the Future Workshop, the sign-in board is not used very often. Another key aspects of social awareness becomes how this kind of information is gathered. Basically a computer system can automatically trace user activity and can provide this information to other group members. As noted in previous studies of computer communication tools, like Clement [6] and Tang et. al. [31], such a way of gathering the information can make the user feel invaded in privacy. The opposite to this method is a user generated awareness information by means of an explicit action. In this way the user can decide what information should be accessible to the other group members. On the other hand this can lead to problems as the price of maintaining the others informed could be higher than the benefits of the system. As reported before [16] this is one of the major causes for rejecting CSCW systems.

If we compare this with real life awareness, we can identify the same ways of gathering information. If we are looking for a colleague and he/she is not in his/her room we might see that while passing by (implicit information). On the other hand if he/she is willing to inform us, he/she might leave a PostIt on the door with the phone number where to be reached or the time of return (explicit information).

The design workshops generated rather contradicting results, with some users asking for automatic information while others claiming privacy. It became obvious that we had to leave this problem under the control of the user, as actually other studies [8] also suggest.

At the other end, the receiver's, we have the problem of how to display the information. Normally, awareness information about a whole group will overwhelm the receiver. As pointed out by Gutwin and Greenberg [17] "a trade-off between being well informed about other's activities but being distracted by the information" must be made.

Awareness information can be presented to the receiver in a passive or active manner. In the first case it is the responsibility of the user to explicitly look for the information he/she needs. In the case of active systems, the user will be notified automatically about changes in the awareness information. The first approach has the advantage that the user is in control of when and what information is displayed, avoiding information overload by these means. Nevertheless, the disadvantage is the fact that in order to monitor the change in the state of a person, the user has to access that information repeatedly.

We suggest the use of a mixture of the two methods: a selective active information display. In such a system the user selects what informations is to be displayed actively while the rest will be displayed passively. The disadvantages of the two methods are removed and the user is in control of the information presented. The 'watch' mechanism in our first prototype is an example of this kind of 'subscription-based notification' services. The GroupDesk system [14] suggests a similar solutions using subscription in a generic local event mechanism.

DESIGN FOR MULTIPLICITY - OUR SECOND PROTOTYPE

One of the most important findings of the workshops was the fact that, in order to have a usable system, we had to provide all group members with easy access to it. The system has to be accessible in different circumstances (including working at home or in some remote location, or in situations where computer resources are limited). In order to accommodate all these particular requirements, we decided to provide three different interfaces to the system, each of which allowing access to the same information: an improved video conference version, a WWW interface and a simple, plain text UNIX command. All of these use the same data distribution and storage module, CoObjects [29], allowing them to work together as a single system.
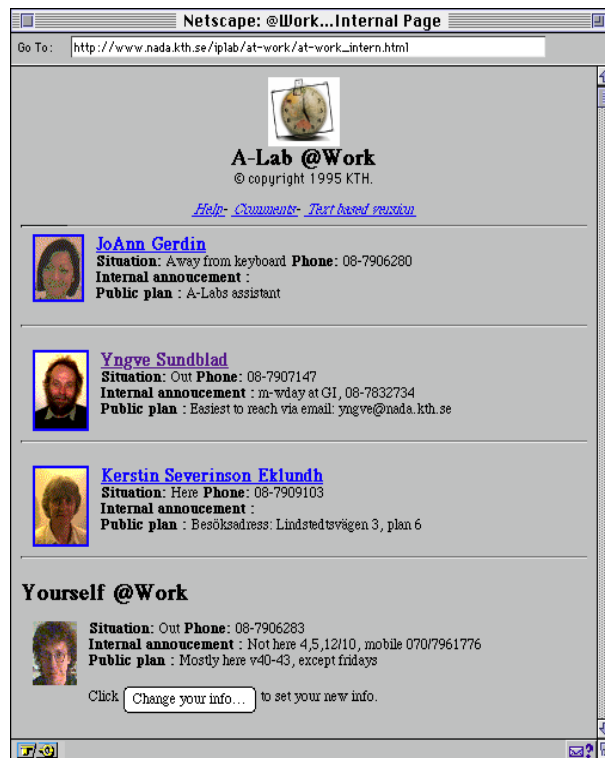

Figure 4: The WWW interface of @Work.

The goal of the WWW interface (Figure 4) is to offer the @Work functionality to all potential users. As WWW browsers are available on all existing platforms, this interface can be accessed by everybody within the group. In addition, this interface can be simply accessed by someone from outside the group, as no special program is needed.

The fact that WWW interface allows public access to the system raised again the issues of privacy. People would like to provide group specific information accessible only to group members but not to outsiders. The solution was to provide two versions of the information: one for group members (protected by individual passwords) and one for public access. The `Plan` information from the video interface is split into `Internal announcement` and `Public plan`. The first one is accessible to group members only, while the second one is visible to anyone.

The interface consists of a number of pages that allow viewing the group awareness information as well as updating your own information. The main page presents the group members in the form of a list. Figure 4 shows a snapshot of the private version of the main page (accessible to the group members only). In addition to the text-based interface this one uses the capabilities of HTML and the WWW, providing hyperlinks to home pages of the group members and to the communication tools within the browser (email). Other pages are available for viewing the public data (accessible to everyone), pages for setting your own information (by using a form), on-line manual, etc.

```
~@sbrehm> ipfinger -p ran
Name:   Ragnar Johnsson
Situation: Away from keyboard
Phone: 08-7906283, 070-7961776
Last seen: Oct. 10 09:45 on sbrehm
Internal announcement:
12/10 Ericsson, 13/10 SGN/Kista, 30-31/10 & 1/11
vacation, 7-11/11 conf: Doors in Amsterdam.
Public plan:
Mostly here v40-41, except w-days.
```

Figure 5: The UNIX text interface

Figure 5 illustrates the use of the plain text UNIX command. The accessed information is the same as in the other interfaces. The user can view the awareness information about any group member or can set his/her own information. Authentication will be performed if needed.

The third interface is an improved version of the video conference tool described earlier. The intention was to make it look like the Web pages, for example providing a picture of a person if a video image is not available. This interface is intended to be used only by group members. All the video/audio conference capabilities are still available while we removed the messages since those could not be naturally implemented in the WWW version.

We suggested earlier that gathering the awareness information must be done under the control of the user. In our system we decided to collect some of the data automatically (latest used computer, latest update to the information). More sensitive information (situation, private/public information) is not gathered automatically but we provide the user with a tool that, when used, can do it.

Actually the tool is the already described UNIX command. If used in the `.login` and `.logout` file with the appropriate parameters, it can set most of the awareness information properly, reducing the user's effort of keeping the information updated.

Usage and Feedback

The first real user test was pursued over a period of approximately four week. This was a hectic period for the lab, several of its members being engaged in the organization of a large conference. Naturally, there was a big need for informing each other about where they could be reached, when and how. The system became extensively used and we were able to gather many valuable comments.

The first conclusion was that the most used interface was the WWW one. We found that certain characteristics of the Web contributed to this. As we already mentioned, the fact that browsers are available for all platforms makes the system usable for all group members as well as for people outside it. Another remark was the fact that certain users have their browser open on their desktop all the time so it seemed natural to use it to get information about some colleague. This seems to follow the current trend of integrating a variety of information services into the WWW browser, so that it becomes *the* entry point to the Internet [7].

Even if A-lab members expressed the importance of the concept of separating public and internal information, several of them indicated problems in doing this separation in practice. As a result, several members provided information either in the internal or in the public field, leaving the other one blank. As Okamura [28] found in her study of news-systems, there is a need for setting the social conventions in using this kind of tools. We took the design decision earlier not to clutter the interface with options, but rather leave a couple of open text fields to be used freely. In practice, members felt uncertain on how to use those open text fields but later they were influenced by early users that tried to set up norms during the trial period.

In some cases the users reported that even if information was available about some colleague, they could not rely on it as they had no guarantee about the consistency of that information. Messages like "I will be here tomorrow…" could be seen both on the physical check-in board as well as in the @Work system. Does "tomorrow" mean really tomorrow in such a case? Or it means today or the day before? Hence, an awareness system must provide clues about the consistency of the data. We decided to add the time and date of the last update in the awareness information. By this, the user of the system can validate the data presented to her/him.

Some people commented that the awareness information was rather formal and it could not express emotional states. During the design, some ideas popped up about how this information could be provided over distance. We would like to share two of them. The first idea is that of representing the user by a 'smiley'. The user can control the degree of smile or sadness on the face of the smiley. By this simple operation he/she can pass over complex information about emotions
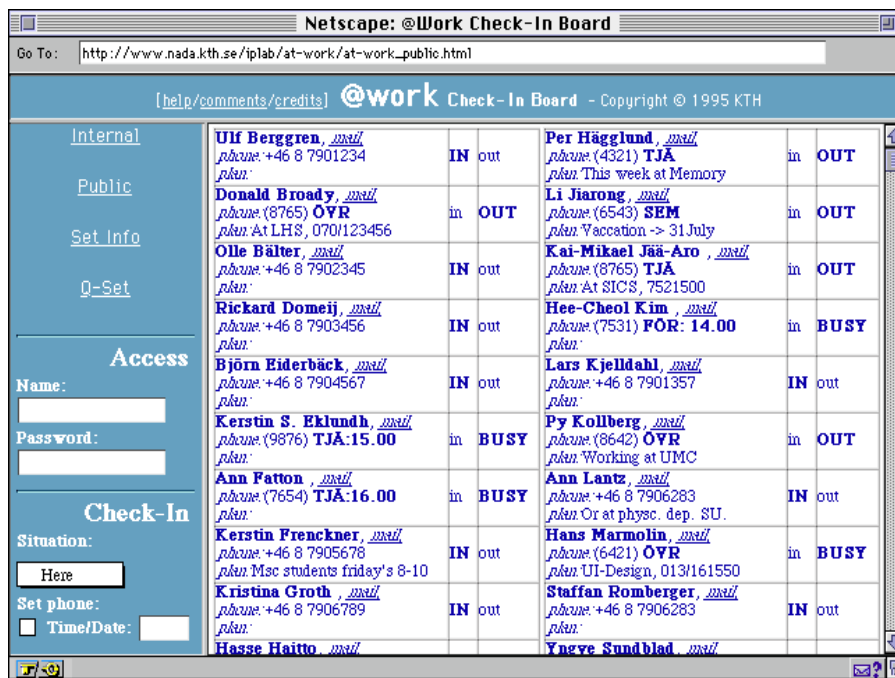
Figure 6: The redesigned WWW interface.

Netscape: @Work Check-In Board

Go To: http://www.nada.kth.se/iplab/at-work/at-work_public.html

[help/comments/credits] @work Check-In Board - Copyright © 1995 KTH

Internal
Public
Set Info
Q-Set

Access
Name:
Password:

Check-In
Situation:
Here
Set phone:
Time/Date:

Ulf Berggren, *mail* / phone:+46 8 7901234 / plan:	IN	out	Per Hägglund, *mail* / phone:(4321) TJÄ / plan:This week at Memory	in	OUT
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and/or availability. The second idea uses the metaphor of weather for the same purpose; sun, clouds, rain and storm could be used as a simple, but expressive, vocabulary.

The public interface provided the required awareness information for people outside the lab. However, some of these persons mainly use the phone for reaching lab members. To overcome this problem, it was suggested to connect the @Work system to the telephone exchange (PDE, Public Data Exchange) of the university. This would make an important improvement by providing a public interface towards people without network access.

REDESIGN - PDE INTEGRATION
As the Web interface was the most popular, we decided to focus on its redesign. The goals where to provide the PDE connection within @Work, to improve the way information is displayed, and to simplify operations for maintaining up to date information in the system.

One of the recurring observations was that it took too much time to set your own information: the user had to scroll down the list (as he/she is presented as the last one), had to click on a link, had to complete the information in the form that appeared, send it, get a confirmation and return to the main page. In the new interface (Figure 6), by using frames, we have a small form with the essential awareness/PDE information always on the screen. In this way we not only make the task of setting your own information simple, easy and direct, but we also emphasize the need for frequent updates.

In order to avoid information overload we provide a view that contains only the most important data. The layout is intended to copy the physical check-in board, to offer an effective group overview, and, at the same time, to suggest the way in which the system should be used. To make the

visibility and accessibility of the new system even greater, we placed a public terminal close to the physical sign-in board, in the lab. It gives a handy access to the system for people visiting the lab.

To get another perspective we asked a group of students to design a sign-in board that allows students to search for each other as well as for teachers and other employees.

We provided them with background material and gave them the possibility to interview a couple of the lab members. Their conclusions had a lot in common with our ideas. The rare use of the current sign-in board is due to location and, even more important in their perspective, group members have no real need for it. In their opinion the lab members can find their colleagues rather easily.

The discussion after the trial period and the students' redesign revealed the importance of improving both the internal and public view of the system. For the latter, the integration of our system with the PDE proved to be a promising idea.

As with most modern PDE, you can leave and retrieve messages using your phone, but many find the interface (different codes entered by pressing the phone's keys) non-intuitive and hard to use.

To understand better the way in which people use phone programming, we interviewed some of the PDE operators. They handle well over 2500 people and 3500 phone lines. They confirmed that most people do not 'program' their phones due to the tricky interface. Based on earlier positive experience when email was introduced to communicate with the operators, they really liked our prototype with the PDE integration and thought it had the potential of relaxing their work load. From their routines we also learned that, e.g., the

office 'neighbours' of an unreachable person were called for information.

DISCUSSION AND FUTURE WORK

Most systems that intend to provide computer supported awareness use a model of physical proximity. An interesting question is if computer supported awareness could, in some way, extend proximity awareness with new elements, impossible to obtain in real life.

A nice example of this is mentioned by Dourish and Bly [10] where, by means of a video-based awareness system, an American user "had watched the sun rise in England". Even if this example is not really related to a work situation, it still shows the potential of extending the notion of awareness by means of computer systems.

It is also worth comparing text-based virtual reality system, or Multi-User Dungeons (MUD) to the systems we have been developing. Both social phenomena and interface problems have a lot of similarities to our work. Lately, several interesting room based MUD, have been used to model real settings, like social communities and work environments [2]. We think it would be an interesting challenge to integrate a MUD system as one further type of interface. In such MUD systems, computer supported awareness can differ from proximity awareness. For example, in some MUD a character can 'ignore' some other person, by this filtering out the awareness information and communication channels to and from that person.

Opposite to this is the idea of providing a more physical sense of the lab, especially for the people outside it, for example, by providing a media-space that would allow the user to 'walk around' the lab. As a brief experiment we have put together a WWW prototype where snapshots from the lab's corridors and offices are shown. The user can 'navigate' through the lab by clicking different areas of the image (as in some adventure game). Entering an office is equivalent to visiting that person. Links to peoples' home pages as well as to different other information (like projects, courses) could be added in the future. For example, the snapshots could be populated with temporary objects (people - if they are logged in, projects, personal objects, events, etc.).

In order to investigate further these issues, we are planning a long term user study. We will focus our attention on understanding question like:

- Does such a system change the communication patterns in use today? Will this change the way people work?
- How do people provide awareness information in the long run?
- How available people are in real life compared to how available they present themselves in such a system?
- Are people willing to build virtual communities accessible to others?

CONCLUSIONS

From our study we conclude that social awareness is an essential prerequisite for good collaboration. We would like to stress that social awareness is not limited to physical availability but also includes emotional state and group members' knowledge. We recommend that CSCW systems should provide this kind of information, considering work practice and social norms, as well as issues like information gathering, displaying and privacy.

We suggest that an interesting direction for further study would be to shift the focus of awareness systems from cloning proximity awareness towards finding new and innovative awareness clues that could enrich group activity and collaboration.

One of the important findings in our study is that building a system like @Work is not only about designing for the future but is also about improving current work practices. From that we formulate what we will call the dual-purpose design in our work: For usability and acceptance you should design for both solving a current problem in work practice (like we did with the graphical user-interface to program the phone) and simultaneously offering solutions to enable new forums and new media for computer based communication (like we extended the ability to keep colleagues aware of your presence). We would like to argue that the dual-purpose design could be a helpful guideline in the design of CSCW system.

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