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December 2005

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Abstract

Community support is currently gaining more and more importance in different areas where communication is important, e.g. in knowledge management. One important issue in community support is making the community and the activity of its members visible to the members – the provision of community awareness. This paper addresses the usage of non-desktop user interfaces, namely public shared displays, as an additional interface for community support applications to provide community awareness. By displaying information from within the community such "Community Mirrors" can help insiders and outsiders getting an understanding of the community, and thereby make more efficient communication possible. We present an overview of how such devices can be used for community support, and briefly describe three applications we have designed and implemented.

1.   Introduction

Starting from early studies on computer-supported collaborative work, the role and potential of community support is gaining more and more importance in the development of new applications for information and communication technologies.

One result that has been learnt in this field is that the success of community support applications depends on the active participation of a significant percentage of the community members. Hence, the availability and modality of access to the community support application can be considered a major issue. However, experience so far demonstrates that the common user base of community support applications is mainly composed of computer literate individuals, accessing the systems with desktop computers at home or at the workplace. In fact, community support applications are often based on bulletin board systems, and the main user interface usually is a Web browser.

Ubiquitous Computing and mobile computing, i.e. new user interfaces that are emerged in the real world, may address the boundaries of community support and offer possibilities for enlarging the reach of community support applications.

One field, where new user interfaces for community support might prove especially useful is awareness support, i.e. visualizing the activity in the community, the relationships and interaction among the community members, and presenting this information at locations and in situations where the community members meet.

We coined the term "*Community Mirrors*" for such awareness applications. Community Mirrors provide information about the community and its activities for community members to support interaction and matchmaking in the community.

In this paper we first discuss some basics on communities and community support to derive possible application areas for Community Mirrors, then summarize existing work, and finally present three Community Mirror applications we have developed in the past year.

2. Community Support and Community Mirrors

We began our project on Community Mirrors with revisiting basic work on community support (see (Koch, 2003) for a detailed discussion). The goal of the task was to answer the question, what communities are and in which tasks they can be supported, in order to derive possible application areas and requirements for the usage of public Community Mirror displays.

2.1 Communities

In general a community is a group of people who share some interest, identify with a common idea or more generally belong to a common context. Thus, a community can be seen as a descriptive identity for a set of people.

Early sociological work points out, that communities always need a locality and interaction (Hillery, 1955). While the demand for a common physical locality is no longer seen necessary, the demand for interaction is still valid. However, no active interaction among all community members is required but rather the possibility to interact with the rest of the community. In more practical terms this possibility to interact implies the existence of a common communication medium, of common protocols and awareness of the existence and of the membership in the community.

Other characterizations highlight the need for mutual collaboration in the community, e.g. the will to exchange knowledge or to help each other (Ishida, 1998). A community should not just be seen as a set of people who have something in common and who have the possibility to communicate, but as a set of people who are willing to help each other, who are collaborating to the advantage of all. See (Dyson, 1997; Mynatt et al., 1997; Rheingold, 1993; Schubert, 2000; Schuler, 1996; Wellman and Gulia, 2000) and (Wenger, 1996) for a more detailed discussion of (virtual) community.

Besides the collaboration among the members itself, the main activities in communities are communication and finding people to communicate with. Hence, community support can be characterized as "*communication and matchmaking/ awareness support*".

2.2   Community Support

The use of networked computers to support communities can be traced back to the beginnings of the Internet: The second service in the initial Internet, the file transfer service was soon "misused" to transfer messages from one person to another – email was invented (Hafner and Lyon, 1996). Quickly mailing lists followed and Bulletin Board services (BBS) were available – both on the Internet (Arpanet) and on alternative networks formed of loosely connected computers (e.g. the FidoNet). When computer connection improved further IRC (Internet Relay Chat) followed, a service allowing direct synchronous communication, which was followed by different forms of Multi-User Dungeons (MUDs). These first community support services of the Internet still exist. Additionally, different (Web-based) platforms emerged, that provide virtual places for communities. Such solutions are labeled as "platforms for community support" (often used synonyms for describing such platforms are "online community" and "community platform"). See (Rheingold, 1993) for a description of one of the first bulletin board and later Web based support platforms for a virtual community, „the Whole Earth 'Lectronic Link" or just „The WELL".

However, community support did not start with computers. Support for the building and the maintaining of communities can be classified in classical approaches like private letters, leaflets, magazines, paper whiteboards, specialized radio and TV programs, and approaches based on networked computers (bulletin board systems, IRC, MUDs, MOOs).

Both support types, the classical and the electronic ones, provide a medium that can be used for the interaction among the members. And both have their advantages and disadvantages. For classic media the advantages are availability, familiarity, and ease of use. For electronic media the advantages are dynamicity, speed, ease of replication, and distribution; disadvantages are barriers to usage, problems with access, and lack of availability.

Generalizing the functionalities of different electronic community support tools and matching them with the basic characterization of communities presented in the previous section one can identify the following basic concepts of community support applications:

- *Providing a medium for direct communication* and for indirect exchange of content and comments within the common scope of the community. This can be further subdivided into providing a communication medium with the whole community, with sub-communities, and with individual members.

- Providing awareness of other members and helping to discover relationships (medium for matchmaking) - this can help to find possible cooperation partners for direct interaction. The discovery also can be subdivided into discovery of the community as a whole, of individual members, of characteristics of individual members, of potential parties for interactions, and of sub-communities.

2.3   Awareness and Community Mirrors

Support of informal communication and awareness is important both for teams and communities as it helps people to establish common ground that is necessary for meaningful conversations and relationships. Common ground, as Clark defines it in his book "Using Language" (1996), is information that two parties share and are aware that they share. According to Clark, "*Everything we do is rooted in information we have about our surroundings, activities, perceptions, emotions, plans, interests. Everything we do jointly with others is also rooted in this information, but only in that part we think they*

share with us". For information on how the concept of common ground can be used to design technology for collaboration see (de Bruijn and Spence, 2001).

Closely related to the concept of common ground is the concept of awareness, which has already been researched intensively in the collaboration support domain (CSCW, Computer-Supported Cooperative Work). Dourish and Belotti define awareness as "*an understanding of the activities of others, which provides a context for your own activities*" (Dourish and Belotti, 1992). Context for the own activities can be different types of information, ranging from the availability of co-workers to notifications about people or information that might be relevant to your own work or leisure activities. Schlichter et al. regard providing awareness as the most common dominator in collaboration support (1998). They list contact facilitation and collaborative usage of knowledge as the main activities in communities to be supported by awareness. While groupware focuses on workspace awareness, community support focuses on people awareness (due to the lack of a common workspace).

Common ground and awareness suggest that providing a detailed and aggregated view of a community, a *Community Mirror*, can help community members in their activities. From the theories one can classify different types of information that can be useful for the individual community members: awareness of community members, information contributed by community members, and activities in the community information space.

Awareness of community members – Information about already known community members can help in coordinating activities. For unknown community members this information mainly serves contact facilitation. In addition to information about particular community members, aggregated information of community membership can be helpful for insiders and outsiders.

Information contributed by community members – Communities cluster people with similar interests. Hence, information contributed by community members in the context of the community is potentially interesting for other community members. This information also provides hints about the interests of the contributing users, and thereby supports contact facilitation. In this category again both the display of detailed and aggregated information is possible and useful.

Activities in the community space – A special type of information contributed by community members implicitly are activities they are performing in the community space. These events, again in detail or aggregated, can help other community members in identifying information or people that can help them in their activities.

2.4 Public Shared Displays for Community Mirrors

Following the ideas about availability and modality of access from the Introduction the displays we are envisioning for presenting this awareness information should be public, shared, interactive, and personalized:

- Public display: The display is in a public space, and can be used by all people that have access to the space.

- Shared display: The display can be viewed/used by more than one user at once.

- Interactive display: The users can interact with the display.

- Proactive/Personalized display: The display can react on the user (without the user directly interacting with the display, e.g. by recognizing users by radio frequency identification and adapting the displayed information to the users (McCarty et al., 2002)).

In our work we first concentrated on public shared displays – i.e. displays that are placed in a (semi-)public space and can be accessed by several users at once – and thereby constitute a social place where people can meet. This feature (social place) can further enhance the pure information distributing effect for the single user of the display. Interactivity and (automatic) personalization are considered as optional features in our designs (Koch, 2004; Koch et al., 2004).

In contrast to existing solutions for awareness support that consist of single applications dealing with information gathering, storing and visualization, we follow the idea of connecting Community Mirrors to existing community support platforms (see Figure 1). Web-based community support platforms can be enhanced by additional shared displays or kiosks. This architectural consideration also suggest including mobile devices for information display and interaction. We do consider this in our projects, but do not address it further in this paper.

For implementing such hybrid systems different applications have to be integrated. Based on this need we have built Cobricks (Community Bricks – Bricks for building community support systems), an open source modular toolkit for building community platforms that easily can be accessed from other platforms or from external applications like Community Mirrors (see www.cobricks.org for more information).

One part of Cobricks is the Community Mirror application framework. Using this framework, Community Mirror applications can be built that display different information from a Cobricks platform. The framework provides all functionality for screen layout and for communicating with the community platform.
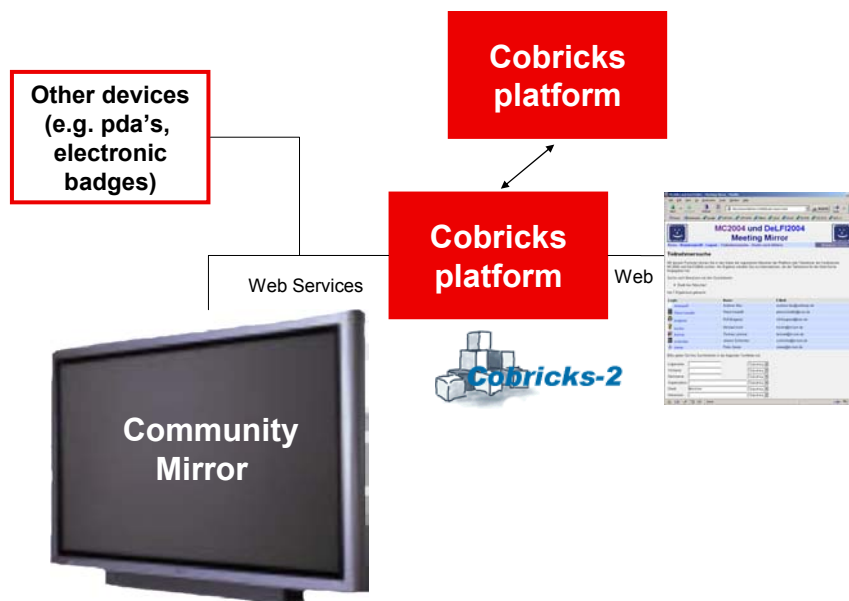

Figure 1: Community Mirror and (Cobricks) community platforms

3. Related Work

3.1 Community Awareness

There is a lot of work on awareness in general in the CSCW community. For examples of recent work and an overview on work about awareness in CSCW see for example (Hill and Gutwin, 2003) or (Schmidt, 2002). In addition to this work that focusses on work teams there is work on community awareness particularly. One concept that has been well studied in this context is the visibility issue of online communities. Erickson et al. (1999) introduced the concept of a "social proxy", a minimalist graphical representation of users that depicts their presence and their activities, an example of which consists of a circle and colored dots. In their field study, Millen et al. (2002) used as their version of a social proxy a visitor metric display of extremely low granularity showing the number of visitors to their studied community. Another extension of the social proxy is Apeer by Moraveji et al. (2004) with topic circles and activity circles indicating whether each user read the topic of left a comment on that topic. Perry and Donath (2004) created a new type of visual representation called anthropomorphs, which maps various historical data about a user to different parts of a body in a human form.

Another body of work that is closely related to community awareness is the visualization or exploitation of people networks in community support systems. Very well known examples for this are Web applications like Friendster (www.friendster.com) or Orkut (www.orkut.com) that allow people to discover potential communication and cooperation partners in different ways. Other applications like Referral Web (Kautz et al., 1997) focus on visualizing the relationship network of one particular user.

3.2 Large Screens in Community Support

Public shared large screen user interfaces are not a new concept, having been pioneered in the 1970's by Myron Krueger (1991). Recent work has mainly focused on supporting collaboration between co-located or distributed users. For the co-located support the central concepts are to provide an interface, which can be used simultaneously by more than one person, and to provide a large working area that can fill the field of view.

An example of usage of large screens to support collaboration is the DynaWall (Geissler, 1998). DynaWall, developed at GMD/Fraunhofer-IPSI, is a large screen display with an active area of 4.5 x 1.1 meters and a resolution of 3072 x 768 pixels It is formed by three networked, back-projected electronic whiteboards each which its own controlling PC. User interaction is by hand-gesture and pen input.

Only recently a trend investigating large screen displays for publishing and matchmaking in communities has started to emerge, specifically addressing settings like conferences and exhibitions. Some public displays have been created that attempt to address the issue of providing common ground to inspire conversation. McCarthy's Groupcast is a peripheral display that recognizes passers-by and posts content of interest to at least one of the users (McCarthy et al., 2001). The Silhouettell system (Okamoto et al., 1998) also uses large screens to project information of common interest to people meeting in front of the shared display.

More examples for current systems supporting communities can be found in (Ohara et al., 2003), e.g. the Plasma Poster from Fuji Xerox Palo Alto Laboratory (Churchill et al., 2003, 2004), the Magic Wall from Accenture Research, and the CWall from Xerox Research Lab Europe (Agostine et al., 2000; Snowdon and Grasso, 2002). In most projects the development was for done office environments, i.e. communities sharing the

same physical work location. The Plasma Poster is intended for knowledge sharing at the workspace and has also been extend to conference usage in CHIplace and CSCWplace by Churchill et. al. (Churchill et al., 2004).

In addition to the research projects there are some examples for the use of large, interactive shared displays in practice. BBCi has built street-level window displays that allow passersby to not only see and hear interviews in progress, but also to submit their own questions using SMS text messaging. Likewise, the Vodafone Lisbon office contains a giant cube display on which passersby can request news, short animations, and games, again using SMS text messaging. See (Scanlon, 2003) for more information on these examples.

The main shortcut of existing large screen applications is that they usually are self-contained. The full potential of Community Mirrors however can only be made available when connecting large screen displays to existing (community) platforms. Additionally, it would be ideal if existing large screen displays could be used for more than one community platform.

4.   Application Areas and Prototypes

Based on the theoretical considerations and possible functionalities we have started to build Community Mirror applications for several application areas. In this section we will briefly describe three projects that are nicely covering the different possibilities for Community Mirrors. We will also report about some qualitative results from watching and interviewing the users of the application – more detailed evaluations are not available yet.

4.1   Library Mirror / Engramm

For identifying interesting topics or people to contact it is useful to have peripheral awareness of what other people (in the community) are working on or looking for. Sadly, the introduction of electronic information systems often destroys the possibilities to get this peripheral awareness.

We have taken up this idea for the main library of our university, and have implemented a Community Mirror application that anonymously visualizes what library users (both in the physical library and via the Internet search engines) are searching for. This visualization is displayed on a large screen projection in the entrance area of the library and optionally on mobile devices.

The design of the library mirror includes the real-time visualization of queries, the visualization of aggregated query information (Figure 2), and the display of announcements of the library. We also address how users can interact with the visualization to obtain additional information. See (Ngo, 2004) for more details on this application.

Figure 2: Library Mirror

As we have learnt in earlier projects, an appealing presentation of the information is important to draw the attention of potential users to it. So, we have worked with designers from the Academy of Fine Arts in Munich in planning the visualization. As a result the application became an eye catcher, and it was possible to budget the costs of the application to the budget for art installations – which can be a major point for raising budgets for such tools.

The Library Mirror installation is in constant use now for half a year and we have seen people been very attracted by the installation. First comments from users indicated that the awareness information provided by the installation is indeed seen valuable. We already heard about users having got ideas for own work by seeing what other users were searching for, and about users trying to find other users of which existence they have learnt through the display. The latter proved to be difficult since we did not provide links from user input to the users identities due to privacy considerations – however, knowing that there is somebody out there interested in a particular topic can already help finding this person (which shows in fact that real anonymisation is hard to do – see the section on privacy below for more discussion of this issue).

4.2   Meeting Mirror

An important activity in communities of practice is attending (physical) community meetings, i.e. events during which members of the community come together for communication and for exchanging information.

While much effort has gone into creating online spaces for people to meet, network, share, and organize, relatively little effort has gone into creating awareness of online social activities in physical community places (Churchill et al., 2004). Support for awareness and matchmaking during such physical events currently is limited to simple badges and printed participant lists. These tools usually cannot be influenced a lot by the community members whose information is distributed through them.

Figure 3: Meeting Mirror

We took these observations as a starting point to look closer into possibilities to support community meetings and designed a Community Mirror application for supporting matchmaking during such community meetings (Koch et al., 2004). The Meeting Mirror application provides an interactive visualization of the participant list of the meeting. In addition to the visualization this application also addresses issues of identity management for managing the access rights to a user's personal information. We envision the Meeting Mirror in the form of a pillar (see Figure 3), the current implementation however uses flat screens only.

The Meeting Mirror has been used for two events already, and we have got very good feedback about the usefulness. Again, we have included designers (this time from the University of Art and Design in Helsinki) into our project to get a "non-technical" presentation and interaction with the display.

4.3   Announcement Mirror

The third application we are evaluating is the Announcement Mirror, i.e. an application that visualizes the content, community members are publishing on a community platform for other members.

We have implemented such an Announcement Mirror displaying selected contents from the community platform of a university department on a large screen display in the lobby of the department building. Another project, we are currently working on is to use the Announcement Mirror idea to make employees aware of improvement proposals by other employees to support peripheral communication in companies.

5.   Privacy

Whenever information that can be linked to people (personal information) is collected and used (e.g. by being displayed to other people), the question of how privacy is handled is raised. We cannot provide a full discussion of all privacy issues of our Community

Mirror applications here. However we will contribute some thoughts around privacy and Communtiy Mirrors in the next few paragraphs.

Definitions for the term privacy say that it is „*the interest that individuals have in sustaining a ‚personal space', free from interference by other people or organizations*" (Clarke, 2005) or „*the ability of a person to control the availability of information about and exposure of him- or herself*" (Wikipedia, 2005). From these definition one can derive the requests for „minimalizm" (collect, show and use as little information as possible) and for „control" (give the user control over the information collected and used). See the excellent collection of information on dataveillance and privacy at (Clarke, 2005) for a more detailed discussion of the topic.

In designing and implementing the Metting Mirror application (see Section 4.2) we have particularly addressed the „control" issue by giving users the possibility to explicitly select the visibility of their information on the Web- and Large-Screen interfaces (also see our work on Identities Management, Koch & Möslein, 2005). When looking into the actions taken by users and informally interviewing users during the conference we learned, that they used this feature to restrict the visability of their data on the Web, but did not restrict the visablity on the large screen application. The users even provided more information about themselves for being displayed to their peers during the conference. One reason for this given by the users was that the Meeting Mirror is not a public display (as everything that is posted on the Internet), but a display only available to a closed group of people they want to be known to.

When presenting the Library Mirror application in Section 4.1 we already commented that even with the data anonymized (or more precisely: not directly linked to identity information) it was possible to use this information as a trigger or starting point for people search. On the one side this shows the sensibility of such „Mirror"-applications to privacy issues, on the other side in our opinion this should not be a reason for completely stopping work on Community Mirrors. Our experience was, that people often want to be found – especially in restricted, semi-public environments. It still is a big difference if some information is pulished on the Internet or made available for being viewed only on a screen in a particular environment. This distinction has to be maintained by not making the data for the Community Mirrors available to the public. Additionally, there clearly should be an opt-out option – i.e. a way for users to say that the data they are producing should not be included in the display – or even better an opt-in option so that everybody explicitly has to agree on his or her (anonymized) data being displayed on the screen.

6.   Conclusions

In this paper we have presented the general idea of Community Mirrors, have discussed some possibilities for their application, and have presented three applications of such community awareness visualizations. These examples offer both applicable solutions for different community support scenarios, and provide inspiration for new developments in the area of Community Mirrors.

The most important message of this paper is that different user interfaces should be used to provide access to existing and new community support platforms. Large screen displays are especially effective for providing an overview of what is going on in the community – i.e. for supporting community awareness. Mobile devices might be added to the setup for interaction with the platform – this is something we are also planning to address in the future. However, integration of the new user interfaces with existing platforms is needed. Experience has shown that isolated applications for presenting community awareness information will fail due to problems getting up to date

information to display. New user interfaces as extensions to existing (Web-based) systems can solve this problem.

Another important message from our implementation experience is that for attracting users it is most important to involve artists and (interaction) designers in the process of designing such an application. Not the number of features is important for the success of the application, but how easy the information can be grasped peripherally, and how intuitively users can interact with it or integrate the interaction in their normal activity.

Acknowledgments

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