Social Radio – A Music-Based Approach to Emotional Awareness Mediation

Carsten Röcker, Richard Etter
Fraunhofer IPSI
E-mail: {roecker, etter}@ipsi.fraunhofer.de

ABSTRACT
This paper presents a novel approach for mediating awareness in small intimate groups. Instead of traditional communication media, music is used to inform users about the presence and mood of multiple remote peers. Based on this conceptual idea, an awareness system called 'Social Radio' was developed. The system consists of several smart artifacts and an underlying multi-user communication infrastructure.

Author Keywords
Emotional Awareness, Music, Smart Artifacts, Multi-User Communication, Intimate Group Communication, Tangible User Interfaces, Aesthetics Artifacts

ACM Classification Keywords
H.1.2 User/Machine Systems, H.3.4 Systems and Software, H.4.3 Communication Applications, H.5.2 User Interfaces, H.5.5 Sound and Music Computing

INTRODUCTION
Within the last decade, a multitude of applications for supporting awareness and informal information exchange between different groups and places emerged. Although the interfaces and interaction mechanisms might look fundamentally different at first sight, the underlying concepts are quite similar.

On the sender side, awareness information is either captured automatically via sensors, and continuously transmitted to the remote side, or users are required to provide manual input, whenever they want to transmit information. Although most existing applications use one of the two approaches, both interaction concepts have their drawbacks. The first group of systems uses environmental parameters to derive information about the current status of its users. In order to eliminate the required user input, an assortment of techniques have been tried to provide automatic status information [1]. But, when the data are largely generated automatically and potentially quite frequently, users have very few control over the information provided to other users, making it nearly impossible to ensure appropriate levels of privacy [2]. In addition, misinterpretations are likely, as sensor information can be ambiguous. In contrast to the concept of automatically capturing and presenting awareness information, the second group of systems relies on explicit user input about location, presence or activity. While this approach meets the essential requirements of awareness system, like transparency, trust and control over activity information [3], continuous user input leads to considerable behavioral costs, in terms of the amount of effort needed to provide and perceive information.

Once the information has been gathered, it is either visualized explicitly using traditional media or abstracted and presented via ambient presentation devices. Especially early awareness systems make use of explicit visualization techniques, like video, text or pictures. While those systems might provide very detailed awareness information, explicit information visualization brings several drawbacks. A number of those awareness systems have been tested in real-world situations. Although it was shown, that the installations had some success in getting people to communicate more easily, all systems were abandoned after the demonstration period [4]. The rejection of the systems was due to serious usability problems, caused through recurring interruptions and privacy violations. More recent approaches make use of ambient display technologies in order to facilitate lightweight, informal and emotional forms of communication. While ambient displays, by their nature, are not limited to certain kinds of data, most systems map presence information associated with other people to artifacts, situated or integrated in the environment. Using ambient displays to visualize awareness information, seems to be a promising approach, and several prototypes for the home domain have been developed. Although these systems proved to be successful in mediating awareness in peer-to-peer situations, they are not adequate to support awareness within groups, where multi-user communication is required. Restricted through the design of their interfaces, most systems only allow one parameter to be transmitted to a single remote device. In addition, the mapping of the input

parameter to the output device is often not very intuitive and usually the same for all users and situations.

DESIGN GOALS

The work presented in this paper was motivated by the shortcomings of existing awareness systems. It was aimed to develop a system that enables members of small intimate groups to stay in touch with each other. The focus of the conceptual design is on the following aspects.

Multi-Party Communication

Today, most awareness systems, and especially ambient and public systems, are developed to connect two remote locations. But dyadic communication is usually not sufficient [5], instead continuous multi-party communication is required in order to support awareness between distributed users [1]. The number of people, which should be linked, has a big impact on the design of the communication system, and especially on its interfaces [6]. Washington [7] addressed this topic in a focus group study and found, that most panelists wished to have close communication ties with 5 to 7 remote peers. To meet this requirement, the user interface must be designed to support communication between multiple users distributed over several locations.

Intuitive Interaction Mechanisms

The willingness of users to provide and receive awareness information is a highly situated issue, depending upon the current activity, other users and the social environment [8]. As those parameters constantly and dynamically change, users should be able to easily adapt the 'connection settings' to their current context. Therefore, it is essential to provide users with easy and intuitive interaction metaphors as well as with lightweight mechanisms to individually provide and receive information.

Information for Small Intimate Groups

Evaluations [e.g., 9] showed that intimate groups have a strong desire to be informed about the 'mood' of their peers. An awareness system that aims at providing persons with emotional awareness should therefore consider the current mood of its users. However there are no sensors available to capture the mood of a person. A promising approach is to provide a user with information that reflects the current mood of a remote person. Since intimate friends know each other they are then able to conclude the mood of this person by themselves.

High Aesthetic Quality

Besides choosing information that is relevant for emotional awareness, it is equally important to present the information aesthetically to the user. In order to achieve the goal to enable users to stay in touch, the design of applications and artifacts must fulfill high aesthetic standards. The form factors of the artifacts must not only be tailored to the users' needs and abilities, but also be based on strong metaphors that are emotionally appealing.

USING MUSIC TO MEDIATE AWARENESS

The following section presents a concept for using music as a medium for emotional awareness mediation. In this concept, the individual music choice is used to inform users about the presence and mood of different remote peers.

Using music to mediate emotional awareness information brings several benefits over existing technologies. First, it significantly reduces the behavioral cost of using the system, as no additional effort is required in order to provide information. Second, music enables peripheral information perception, one of the main requirements of successful awareness systems. And third, music can be used as a highly emotional and rich communication medium, especially within small intimate groups.

Low Communication Costs

Recent evaluations showed, that the acceptance of awareness systems is strongly determined by the effort users have to undertake, to provide relevant information to their peers. According to Huang et al. [10], the required effort for the input action has to be comparable to the amount of effort the user is already exerting, to share information in real life. As the behavioral costs of accessing a communications system seem to be an important determinant of its usefulness [11], the interaction between the user and the application should be simple and lightweight, without requiring much effort from the user to minimize the costs associated with each instance of use [12]. Using the current music choice as an input parameter for the system reduces the behavioral costs to a minimum, as no additional effort is required from the user.

Ambient Information Representation

As receiving awareness information is not a primary activity, that a user frequently engages in, the presentation of the awareness information should not distract users from their focus [12]. Therefore, the presentation medium must enable recipients to attend to foreground tasks while maintaining peripheral knowledge of continuous awareness cues [3]. Experiences with existing systems showed, that peripheral information perception seems to be favorable over solution that appeal to main human perception [6]. Using background music and ambient light, as abstract forms of information visualization, are promising methods for presenting awareness information in an unobtrusive fashion.

Emotional Communication Medium

In contrast to traditional content-oriented communication, connectedness-oriented communication does not focus on the reproduction of message contents, but on the social relationships, expected to be formed as a result of communication activities [6]. Consequently, there is no need to transmit high-fidelity data. Instead a small amount of data might be sufficient, if it induces a sense of connectedness in the mind of the receiver [6]. In this context, IJsselsteijn et al. [13] argue, that it is better, to let

the receiver imagine the status of the other person, rather than interpret high-fidelity data. Especially in small groups, where the persons receiving the data are not strangers, interpreting properly abstracted awareness information is easy [14]. If we assume, that members of small intimate groups know the individual habits and behavioral patterns of their peers, music brings two major advantages over traditional communication media. Music does not only reflect the current mood of the information sender, but it is also likely to influence the mood of the information receiver.

SOCIAL RADIO

In order to validate this approach, a system called 'Social Radio' was designed and implemented. Social Radio enables an intimate group of persons to stay in touch with each other. The design of the system is based on the design goals defined above. Each user has several artifacts at home that represent a personal circle of friends. Each artifact represents one remote individual and displays awareness information about that person. The presence of a remote person is indicated using ambient light. In addition, an artifact communicates the mood of a remote user by replaying the music the person is currently listening to. Listening to the same song in synchrony can better enable people to feel like they are part of a community [15]. When several artifacts are placed next to each other, the artifacts take turns in playing music. This guarantees that only one artifact of the group plays music at the same time.

Design of the Artifacts

Throughout the development process, the focus was on three aspects: an elementary design, an aesthetic sculptural appearance, and an individual character of each artifact.

The notion 'elementary design' refers to the fact that each remote person is represented by an individual artifact (see Figure 1). Since Social Radio is intended for small intimate groups, this approach is feasible. The idea is borrowed from a 'family' or 'circle of friends' that consist of its single members. As each artifact represents an individual remote person, user can easily form groups. Even in small intimate group, like, e.g., a family, the group members usually have different relations to each other and therefore want to communicate individually. The elementary design of Social Radio enables users to communicate differently with all members of the group. The different interaction and communication possibilities will be explained in greater detail in the next section.

An awareness system that communicates peripheral information should be seamlessly integrated into the environment. Therefore, the metaphor of a sculpture was chosen. Sculptures are common and accepted aesthetic elements, in office spaces as well as in home environments. The art works are aesthetically pleasing and part of the environment. The individual artifacts of Social Radio can be combined seamlessly and thereby form a sculpture.

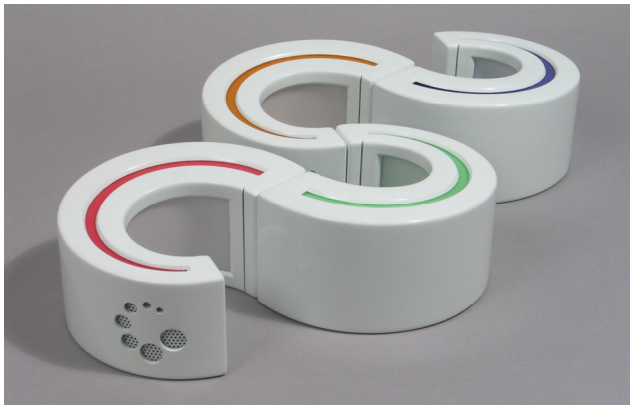

Figure 1: Social Radio artifacts representing an intimate group of friends.

Since each Social Radio artifact represents an individual remote person, it is important that the artifacts can be distinguished and that each one has its own character. Social Radio offers the user three ways to personalize the artifacts. Firstly by choosing the color of the illuminated surface, secondly by choosing a symbol for the speaker part, and thirdly by attaching an individual picture (see Figure 2). This image can be handwritten, a photo of the person, or a shared piece of memory. When the artifact is active the image is illuminated.

Interaction Design

In order to provide users with lightweight interaction mechanisms the artifacts are controlled via a tangible user interface. Depending on the position, an artifact is switched off or in different operating modes. For an intuitive and coherent interaction design, it is important, that the positions and interactions are based on strong natural metaphors.

An artifact can be placed in four different positions. If the artifact is placed upside down, sound and light are switched off. This position means that the user is not connected to the remote person. He does neither receive data from the remote person, nor does he submit data. The remaining three positions are different active modes. In all these positions, the user is connected to the remote person. If an artifact is placed in a moon-like position (see figure 2), light indicates the presence of remote persons. The light illuminates the personal image and projects the outline of the image on a wall. If an artifact is placed like a bridge, it plays the music the remote person is currently listening to or has recently listened to. Light indicates the presence of the remote person. The metaphor of a bridge stands for connecting two remote locations. In addition, this position slightly reminds of a speaker. Artifacts that are placed next to each other take turns in playing music and never play at the same time.

Figure 2: Social Radio artifacts in different active modes.

TECHNICAL REALIZATION

Social Radio has been fully implemented. In each location, e.g., home, the system consists of several smart artifacts and a server. The server communicates wirelessly with the artifacts and manages them. Additionally, the server retrieves information from servers in remote locations and provides information for remote locations. The server uses the public API of iTunes [16] in order to retrieve what a user listens to. The webserver provides playlists, audio data and presence information in standard XML via internet. This decentralized approach with multiple webservers was chosen, since it enables the system to support multiple locations and potentially several intimate groups without storing all data on one server.

FUTURE WORK

After receiving promising results in a first series of informal evaluations, the system will now be test under real-world conditions. The main goal of the study is to obtain feedback on the implemented interaction mechanisms and current mappings of light and sound. The feedback gained during the evaluation will then be used to tailor the infrastructure to the individual needs and abilities of different target groups.

ACKNOWLEDGMENTS

We would like to thank our colleague Jennifer Heier for designing the Social Radio artifacts as well as the European Commission for supporting this activity as part of the project (Amigo - Ambient Intelligence for the Networked Home Environment[1] (contract IST-004182).

REFERENCES

1. Milewski, A., Smith, T. (2000) Providing Presence Cues to Telephone Users. In: *Proceedings of CSCW*, pp. 89 – 96.
2. Godefroid, P., Herbsleb, J. D., Jagadeesan, L. J., Li, D. (2000). Ensuring Privacy in Presence Awareness Systems: An Automated Verification Approach. In: *Proceedings of CSCW*, pp. 59 – 68.
3. Sawhney, N., Schmandt, C. (2000) Nomadic Radio: Speech and Audio Interaction for Contextual Messaging in Nomadic Environments. In: *ACM Transactions on Computer-Human Interaction with Mobile Systems* (TOCHI), 7(3), pp. 353-383.
4. Olson, G. M., Olson, J. S. (2000). Distance Matters. In: *Human-Computer Interaction*, 15(2-3), pp. 139 – 178.
5. Konradt, U., Hertel, G. (2002) *Management virtueller Teams - Von der Telearbeit zum virtuellen Unternehmen.* Beltz Verlag, Weinheim, Germany.
6. Kuwabara, K., Watanabe, T., Ohguro, T., Itoh, Y., Maeda, Y. (2002) Connectedness Oriented Communication: Fostering a Sense of Connectedness to Augment Social Relationships. In: *IPSJ Journal*, 43(11), pp. 3270 – 3279.
7. Washington, W. (2001) *Exploring Ambient Media Presence Awareness.* Masters Degree Project Report. Department of Technical Communication, University of Washington, Seattle, Washington, USA.
8. Markopoulos, P., IJsselsteijn, W.A., Huijnen, C., Romijn, O., Philopoulos, A. (2003). Supporting Social Presence through Asynchronous Awareness Systems. In: G. Riva, F. Davide, W. A. IJsselsteijn (Eds.) *Being There - Concepts, Effects and Measurements of User Presence in Synthetic Environments*. IOS Press, Amsterdam, pp. 261 – 278.
9. Valdes, L. (2005) C*onnecting Remote Homes.* Diploma Thesis. Media System Design Institute, University of Applied Science, Darmstadt, Germany.
10. Huang, E. M., Tullio, J., Costa, T. J., McCarthy, J. F. (2002) Promoting Awareness of Work Activities through Peripheral Displays. In: *Extended Abstracts of CHI*, pp. 648 – 649.
11. Kraut, R. E., Fish, R. S., Root, R. W., Chalfonte, B. L (1990) Informal Communication in Organizations: Form, Function, and Technology. In: S. Oskamp, S. Spacapan (Eds.) *Human Reactions to Technology: The Claremont Symposium on Applied Social Psychology*. Sage Publications, Beverly Hills, CA, pp. 145 – 199.
12. Zhao, Q. A. (2001) *Opportunistic Interfaces for Promoting Community Awareness*. PhD Thesis, Georgia Institute of Technology, Atlanta, GA, USA.
13. IJsselsteijn, W. A., van Baren, J., Romero, N., Markopoulos, P. (2003) The Unbearable Lightness of Being There: Contrasting Approaches to Presence Engineering. In: *Proceedings of SPIE*, pp. 61 – 68
14. Marmasse, N., Schmandt, C., Spectre, D. (2004) WatchMe: Communication and Awareness between Members of a Closely-Knit Group. In: *Proceedings of UbiComp,* pp. 214 – 231.
15. Bassoli, A., Moore, J., Agamanolis, S. (2004) tunA: Synchronized Music-Sharing on Handheld Devices. In: *Adjunct Proceedings of UbiComp,* pp 171– 172.
16. www.itunes.com