Report

Design and Evaluation of a mobile social awareness system

Master's thesis by
Berith Lundgaard Andersen
Martin Lindholdt Jørgensen
Ulrik Kold

Aalborg University
June, 2005

AALBORG UNIVERSITET

Aalborg University
Department of Computer Science
Fredrik Bajers Vej 7E
DK-9220 Aalborg Ø

Title:

Design and Evaluation of a mobile social awareness system

Project period:

From 01-feb-2005 to 09-jun-2005

Project group:

Berith Lundgaard Andersen

Martin Lindholdt Jørgensen

Ulrik Kold

Supervisor:

Mikael B. Skov

Number of copies:

7

Number of pages:

Report: 17

Abstract:

This master's thesis investigates the design and evaluation of a social awareness system. We do this by conducting two different activities. First we design a social awareness system, which involves several sub-activities: We survey a selection of previous study papers to discover how social awareness systems have previously been designed. We identify three characteristics that influence design: characteristics of technology, the context of social technologies and social relations between users. Based on our model of mediated social awareness and the survey we design a system, iSocialize, to exemplify social awareness. Our second activity, which is designing an evaluation method, is also constructed from several sub-activities: again we survey a selection of previous study papers, but this time to discover how social awareness systems have been evaluated. We identify the following two distinctions: the system's level of functionality and the purpose of the evaluation. From this survey we construct an evaluation method that focus on the social relations of evaluation participants. We construct an evaluation method and conduct 10 tests with pairs of acquainted participants or unacquainted participants. iSocialize serve as the case for this evaluation. We end the process by reporting the results of evaluating the concept of social awareness and on the applicability of our evaluation method for social awareness methods. The conclusion of this master's thesis is that we successfully implement the properties activity, status, vicinity and relation into iSocialize, and that acquainted as well as unacquainted users can be used for testing social awareness systems, but for different purposes.

Preface

This report of master's thesis is written during our 10th semester at Department of Computer Science, Aalborg University. The thesis at hand is based on our research work from the 9th semester.

Reader's Guide

This master's thesis consists of the available report and two papers named "iSocialize: Designing a Mobile System Supporting Social Awareness" respectively "Evaluating a Mobile Social Awareness System". The papers and the report can be read individually of each other. The report's focus is on the academic process of the study, and the overall conclusion of the master's thesis, which forms the base for this report. The first article's focus is on the design and will therefore contain an extensive description of the system and use less space on the describing the usability evaluation. This is reflected in the second article, which will contain only a small section on the design of the system and then focus on the evaluation setup. The intended order of reading the texts at hand is the report and then subsequently the papers in the given order.

Bibliographical References

All references in this master's thesis are enclosed in brackets. References are made on a numerical basis like this: [1, 6, 11]. The numbers refer to the entries in the *References* sections in each individual part of this thesis respectively.

Acknowledgements

This master's thesis would not have been possible had it not been for the useful guidance of our supervisor, associate professor Mikael B. Skov, Aalborg University. We would also like to give our regards to assistant professor Wijnand A. IJsselsteijn, Eindhoven University of Technology, for helping us out on the definition of Social Awareness from the ASTRA project. Ph. d. students Rune T. Høgh and Benedikte S. Als, Aalborg University, earns our thanks for technical support and constructive advice on the evaluation – and of course thanks a lot to our willing test participants. Last but most certainly not least: Thank you, Jolly!

Aalborg University, June, 2005

Berith Lundgaard Andersen

Martin Lindholdt Jørgensen

Ulrik Kold

Table of Contents

Introduction

Emerging technology that allows for connectivity 24 hours a day and 7 days a week offers different opportunities of being connected at all times, and the technology integrates with our social lives [9]. Examples of such opportunities are explored in studies e.g. by Berg et al. in their work on mobile device design for the future [4], and by Schmidt et al. who extend the mobile phonebook with context information [10]. Rich Ling also touches on this topic in his book The Mobile Connection from 2004 where the cell phone's impact on society is discussed [8].

The benefits of being connected to a network around the clock are not limited to the well-off parts of the world [7]. Rheingold says in an interview about his book Smart Mobs from 2002:

> *"One thing it means is that people who weren't in on the PC or the Internet, people who are barefoot in slums in South America or fishermen off the coast of India are participating in this technological revolution. You can get text messages to tell you which port to bring your fish to, or if you're in a small village in Africa where the spot labor market is requiring a couple of laborers within walking distance today. That moves the economic advantage of having access to information out of the realm of the relatively well-heeled elites of the world, out to a much larger population. And just like literacy, this is going to have emergent effects that are much larger than the effects of making technologies available to only the wealthy and highly educated."*
>
> - Howard Rheingold, interview on openp2p.com [7]

This means that everybody, not just rich, highly technological societies are able to benefit from the use of the new smaller, faster, more powerful technologies. But *always connected* is not a trivial situation.

Smaller, cheaper, faster, better hardware with accessible interfaces on multiple platforms has made mobile applications feasible. From the *laptop* to the *tablet PC* over *handhelds* to *hybrid mobile phones* with the abilities of a handheld computer, the processing power has increased and the price lowered similarly. This evolution has brought the applications from the desktop platform (and their laptop equivalents) to the handheld and hybrids. It means the applications we know from the laptop or desktop runs on smaller devices, but basically they are still the same: off-line applications such as office suites to write documents and create spreadsheets, or online application such as instant messaging programs to keep in contact with friends, relatives, and business partners. They have the same abilities as their stationary counterparts, and do not recognise the fact that they are mobile.

The next step – and a sign of a maturing domain as Howard Rheingold sees it [9] – is to start developing for and exploring the fact that mobile, handheld, pocket-size devices are not as powerful as desktop or laptop computers. This moves the focus to mobility and limited processing powers. Now that users are able to get connected to a network and thus stay in contact with network servers at all time, the heavy burden of processing data can be lifted by the servers. Thus the presentation of data, lightweight processing, and reporting the device's current location is left to the mobile devices.

The new focus on mobility aspects and the characteristics of the handheld technology leads to increased interest in how the technology affects our behaviour and social conventions. Now we are back at the social connectivity and tomorrow's social technology. This project sets off to explore how mobile systems that mediate social information and connect the users socially can be developed and evaluated. In other terms the focus is on mediating social awareness with mobile systems.

Social Awareness

Social connectivity has to do with people being connected and exchanging information of a social nature. It can take place in a work setting but the exchanged information is not work-related. One aspect of being socially connected is social awareness. We adopt a definition of social awareness from the ASTRA project [11]. In this work Van Baren et al. define social awareness as:

> *Social awareness concerns maintaining a peripheral awareness of the activities of and status of ones communication partners.*

This focus on social awareness is based on our former research [1,2,3]. This research focused on *understanding the literature* on mediated social awareness [1], *how and by which means* social awareness was maintained and supported [2], as well as *how to conceptualise* this mediation and support [3].

The ASTRA deliverables [11] do not give further attention to the definition of social awareness and what it concerns, so we will focus on this topic in the following.

First, *awareness* origins from the cognitive science, and describes the perception and cognitive reaction to an event or condition [12]. Awareness is a relative concept. The subject may be partially aware, subconsciously aware, or acutely aware. The difference between these awareness states is that it may be focused on an internal state, such as a "gut feeling" or on external events by way of sensory perception. The use of the word *maintaining* means the preservation of something already in existence. This is in contrast to creating something new – or removing something old.

Secondly, *peripheral* refers to the elements in our environment to which we are attuned but do not attend explicitly. For example when driving a car, the attention is usually focused on the road, on a passenger or on listening to the radio and not on the engine. Unusual noise from the engine is noticed right away and we immediately attend to it because it is in our periphery. These peripheral elements are not unimportant as they can be in the centre of our attention within an instant. [5]

The joint expression of *peripheral awareness* therefore denotes the concept of elements in the periphery demanding some degree of attention. People have an ability to selectively pay attention to information from their surroundings and thus obtain it in an unobtrusive way. They can pay more attention to this information if they choose to do so, but it is not demanded [5]. An example of peripheral information is the smell of warm bread that can be sensed and paid attention to or not, whereas a ringing phone is not peripheral since it demands attention.

Thirdly, as IJsselsteijn puts it [5], *activities* and *status* of communication partners refer to the kinds of information that is meaningful to attain about someone you are communicating with. *Activities* are the actions of the other person – what is the other person doing. *Status* covers the state of the partner – location, availability, interruptability, or emotional state.

The concept of *communication partners* is split up into two parts: The *communication* and the *partners*. This is not a discussion of the different parts of human communication (e.g. intrapersonal, interpersonal, nonverbal, verbal, paraverbal, or mass communication) nor the various technically related definitions of communication (e.g. computer science, engineering, journalism) – just an ascertainment of the fact that communication partners are two human beings exchanging meaningful information.

The particular interest of this master's thesis is in social awareness systems – a system mediating social awareness [1]:

> *Social awareness systems are computer mediated communication systems that aim to support connected parties to maintain a peripheral awareness of the activities and status of their communication partners.*

In our previous study we found the research area of social awareness systems to be rather intangible [1]. A set of different and overlapping terms is being used to describe the research and therefore we want to discover the subject in depth.

Research Questions

The objective of this master's thesis is to discover the concept of mediated social awareness and the possibilities of social awareness systems. In order to qualitatively discuss this objective, we present the following two questions:

1. How can a mobile system be designed to support social awareness?
2. How can a mobile social awareness system be evaluated?

The mobile setting of our questions is chosen since it adds new aspects to social awareness such as flexible location of users and the ability to stay online round the clock.

The focus is on the human aspects and the impact of social, mobile technology on the users' lives. Technologies related to mobile devices as well as the lower-level details of client-server communication and networking will not be considered nor discussed in this report.

The first question will focus on discovering what properties can be mediated in a social awareness system. The background of social awareness systems will be reviewed and categorised so as to learn from previous endeavours. The mobile system will be described in depth so as to give the reader an understanding of the properties of social awareness in the system. Eventually an evaluation focusing on these properties and their applicability will be executed, which will form the basis of making a contribution to the study of social awareness systems.

The second question will focus on the applicability of using traditional evaluation metrics of usability problems, effectiveness, efficiency, and satisfaction in the evaluation of a social awareness system. The hypothesis of asking this ques-

tion is that these work-related metrics are not very useful within the paradigm of social technologies. Previous work in the field of evaluating social awareness systems will supply the basis for establishing an overview. An evaluation based on distinctions constructed from the overview of previous work will form the basis for making a contribution to the study of social awareness systems.

The following chapter describes the research papers in which the two research questions have been examined.

Research Papers

This chapter presents the two individual research papers of this study, which are included in *Appendix 2 – Research Paper 1* and *Appendix 3 – Research Paper 2*. The papers are closely related because they both cover the same process of building an application to support social awareness and evaluating this software with regard to the concept. They each represent a different perspective on the process, as the first paper focus on the development of a system and the second focus on evaluation issues.

The basis of the two papers and this report is a single development cycle, as is illustrated in Figure 1. The papers each represent a different view on this process. The system, called iSocialize, implements the concept of social awareness, and by evaluating the system insight into the idea and the development process is gained. The two papers correspond to the research questions described in the previous chapter.

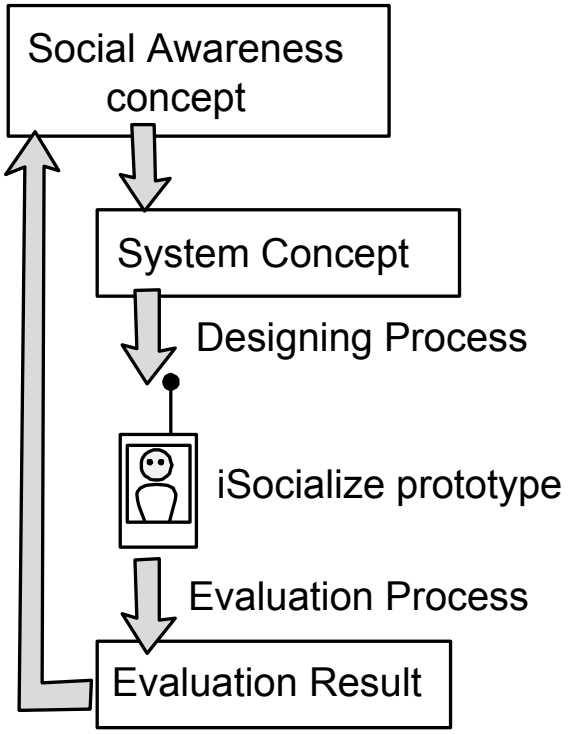

Figure 1: An overview of a social awareness system development process. The papers focus on different aspects of this process. The first paper focuses on the concept and design. The second paper focuses on the evaluation process.

Research Paper 1

iSocialize: Designing a Mobile System Supporting Social Awareness

The first research paper addresses the problem of how to design a mobile system supporting social awareness. Prior to designing a social awareness system, we set out to get a better understanding of the task at hand. First we surveyed the social awareness systems that other researchers have built, and secondly we illustrated the setting for social awareness and the aspects of social awareness to be mediated. Based on this, we designed a system that was able to support people in staying in contact with others, and related this design to a use scenario set up by us. The goal was to gain insight to important issues and challenges of designing mobile systems that mediates social awareness.

The first approach to addressing the objective of designing a social awareness system was to explore the designs of other researchers. By surveying papers on social awareness systems that other researchers have previously built we gained insight into some of the topics our design could deal with. These topics dealt with the characteristics of the technologies used, the type of contact they mediate, and the social relation between the users.

The second approach to the design of a mobile social awareness system was based on a previous study of our own where the setting for social awareness was investigated. The study described the nature and means of mediated social awareness in a family context and provided the definition of social awareness systems used in this paper. By building upon this understanding and the findings concerning other researchers' systems, we modelled the aspects of mediated social awareness. These aspects are activity and status that originates from the definition of social awareness and relation and vicinity that we have added in order to deal with the mobility of our system.

A scenario of social awareness was then created and the iSocialize system was designed to support this situation. iSocialize allowed friends to maintain social awareness of each other by monitoring the information about contacts in the system. The functionality and design of the system supposedly resembled the aspects of social awareness and therefore an evaluation of the system would provide insight into the user interest in such information. iSocialize was evaluated in a usability laboratory and the evaluation involved 20 evaluation participants using the system in pairs of two. Along with the traditional focus on usability problems the evaluations aimed to investigate the social awareness aspects of the prototype and thereby gain insight to the concept.

The result of the paper is the social awareness system called iSocialize that implements the following aspects of mobile social awareness: activity, availability status, status of mood, relation and vicinity of friends. The evaluation of the prototype provided some insight to the concept of mediated social awareness which is also discussed in the paper. Furthermore we consider our model of mediated social awareness a contribution that further research and system designs may build on or be inspired by.

Research Paper 2

Evaluating a Mobile Social Awareness System

The second paper explores how to evaluate a mobile social awareness system and in particular the social awareness aspects of a system. The underlying presupposition is that standard usability evaluations focus on effectiveness issues and interface problems and not on the social effects or values of a system. The iSocialize prototype was designed to mediate social awareness in a non-work-related context. The purpose of this paper is to explore how standard laboratory usability evaluations can be used to gain insight to the social awareness aspects of a system, using iSocialize as a case for this evaluation.

In order to be able to evaluate a social awareness system we did two things. First was to survey the evaluations other researchers had performed on systems mediating social awareness. This provided an overview of the different approaches applied and the choices of evaluation methods in relation to the functionality level of the systems and the purpose of the evaluations. Secondly we developed a mobile social awareness system called iSocialize that made information about activities, status, relation and vicinity available to friends in order to support social awareness. This system was used to explore how to evaluate a mobile social awareness system. A standard laboratory usability evaluation was conducted involving 20 evaluation participants. Due to the interpersonal nature of the iSocialize system each evaluation had to involve two participants using the system simultaneous. These evaluation pairs were distributed evenly on pairs of acquainted and unacquainted participants. This approach enabled us to gain insight into the effect of pre-existing relations when evaluating social awareness systems. Each usability evaluation consisted of two parts: One part where the participants performed tasks that had the purpose of introducing the participants to the functionality of the system, and another part where the participants solved a contextual task in order to create a realistic use situation. Furthermore semi-structured interviews were conducted with the participants after each test. The focus of the interviews was on the participants' experiences with the system and their attitude towards mediated social awareness. The interview allowed the participants to elaborate on their experience and comment on the system and the concept.

The results of the analysis showed that no major difference between the numbers of usability problems discovered by the two groups of participants. The differences showed up when distinguishing between the types of usability issues. We related these issues to the properties of social awareness and found a difference in favour of the unacquainted participants, who found 18 out of 30 different usability problems related to interpreting social awareness information in the system. We conclude that using unacquainted participants is useful when testing social awareness systems for usability issues. The acquainted participants did however appear to be better able to evaluate the concept of social awareness, as they had more meaningful interaction with both their test partner and other contacts. The two types of participants have each their qualities when evaluating social awareness systems.

Research Discussion

Topics of interest to this thesis will be discussed in this chapter. These topics relate to the concept of mediated social awareness and the issues and characteristics of social awareness systems. The topics will be examined, and discussed in order to create a better understanding of weaknesses and strengths of our results. This is our contribution to specifically the study of social awareness systems and generally the field of human-computer interaction.

The topics of discussion are: *Research Methods* and *Social Awareness Revisited*. In relation to researches methods we focus on the relation between method and purpose in our work, and with respect to revisiting the concept of social awareness we discuss the definition of social awareness, evaluation of social awareness, and mediating social awareness.

Research Methods

This section's focus is on how our choices of research methods have affected the work and the results we have come up with, and what we have done in order to deal with the weaknesses of these methods.

Wynekoop and Conger establishes a matrix of 8 methods (*case studies*, *field studies*, *action research*, *laboratory experiments*, *survey research*, *applied research*, *basic research* and *normative writings*) by 5 purposes (*understanding*, *engineering*, *re-engineering*, *evaluation*, and *description*) for conducting research [13]. Detailed descriptions of the purposes and the methods are given by Wynekoop and Conger. A discussion of how the methods and purposes relate to the study of social awareness systems can be found in Andersen et al [1].

	Research Paper 1	**Research Paper 2**
Research purpose	Engineering	Evaluating
Research method	Applied research	Lab experiment

Table 1: Research method and research purpose of our papers.

Table 1 gives an overview of the methods and purposes applied in our work. The table illustrates how the purpose of paper 1 was engineering by means of applied research, and the purpose of paper 2 was evaluation by means of lab experiment. The methods were chosen subsequent to the purpose of the two parts of this master's thesis, and they act as means to fulfil the purposes of the two parts.

Table 2 summarises the weaknesses, strengths, and the use of each of the appropriate research methods. In the below text, we will explain how we handle the strengths and weaknesses.

Method	Strengths	Weaknesses	Use
Applied research	The goal is a product, which may be evaluated	Solution may be constrained by goals. May need further design to make product general, adaptive, and context-free	Product development, testing hypotheses and Proof of Concept
Lab Experiment	High level of reliability, Greatest level of variable control, Replicable Precise measures	Limited realism, Unknown generalizability, assumes the real-world is not important	Controlled experiments, theory/product test

Table 2: This table is adapted from Wynekoop and Conger [13:133]. We show only the relevant rows of the original table of all the research methods.

Applied research is used for product development, and is also applicable for testing hypotheses and Proof of Concept, which is exactly what we are after. It does have the weakness that a developed prototype may be very limited in its usable functionality and needs further work to become generally applicable and free of the laboratory context.

The goal with iSocialize was to develop a system with functionality so as to test a hypothesis of social awareness systems. By means of applied research we believe this goal has been completed, as the properties of social awareness were integrated into the prototype of iSocialize. The prototype was then evaluated in a lab experiment to determine the applicability and appropriateness of the properties of social awareness in a mediated communication system.

The reason we chose the method of lab experiments for evaluation of our system was control of variables. In order to explore how to evaluate a mobile social awareness system we needed a replicable setup where we could change one parameter and still have control of the remaining variables. However the traditional *lab experiments* suffer from limited realism and unknown generalizability. According to Wynekoop and Conger, the assumption of laboratory experiments is that *the real world* is not important. Based on this, we ask: What role does the real world play in the evaluation of a social awareness system?

In the context of evaluating social awareness systems, we here focus on the following two interesting parts of the real world: the *communication partners* and the *context*. Both of which can be either *imitated* or *real*. Regarding communication partners, the imitated communication partners are the contacts invented by the research team for the evaluation of iSocialize. *Real communication partners* could be friends with similar systems. With a real context, we mean testing in the field - possibly through a longer study. An imitated context is what we create, when we ask the evaluators to concentrate on a contextual task while using iSocialize. Part of the imitated context is also the fact that the contacts are moved about by

the operator during the test. This distinction of the evaluation setup gives at least four different combinations, of which we have only explored the "least realistic". Table 3 shows how our evaluation is positioned in relation to these categories.

	Real	**Imitated**
Context		Both evaluations
Communication Partners	Acquainted evaluators	Unacquainted evaluators

Table 3: A matrix of the setup of evaluations.

As can be seen in our research, we have changed only one of the variables of the matrix, namely the *communication partners*. As is argued in our second paper, prototypes and systems with low functionality most frequently are evaluated through laboratory experiments. By distinguishing between acquainted participants and unacquainted participants we aimed to explore whether laboratory experiments are suitable for testing social awareness systems. Therefore we did not change the context parameter of the evaluation. We argue that conducting lab evaluations of prototypes of social awareness systems is a feasible solution as it gives some degree of insight into the properties of mediated social awareness. There is however still work to be done within a *real context*.

Social Awareness Revisited

In this section of the discussion we revisit the concept of social awareness. Based on our work we now revise and elaborate the topics of: *defining social awareness*, *mediating social awareness*, and *evaluating social awareness systems*.

Defining Social Awareness

Our work is based on a definition adopted from the ASTRA project [11] and other research on social awareness systems. We examined the concept and studied the natural context of social awareness in previous work [2] and the project has aimed to explore how to operationalise the concept and use it for development of new systems. Now that we have implemented a system mediating social awareness and evaluated the system it is time to review the definition of the fundamental concept.

The definition of social awareness implies that the information to share between the connected parties is *activity* and *status*. During this study we found that these were truly private properties by which a situation can roughly be described. They proved to be information that provide insight into a person's situation and thus are usable for maintaining awareness of that person. However, we also found the need to involve and define other aspects of the communication situation in order to mediate social awareness. These aspects we denote *relation* and *vicinity*.

Relation must be brought into focus because a social awareness system aims to maintain existing social relations between users, according to the definition. Hence the system must support these relations and the expectations that users have towards their communication partners. During the evaluation of iSocialize

we found that the relation between users was used when interpreting the information in the system. Vicinity becomes an interesting property of the communication situation due to the mobility aspect. Our evaluation showed that information about physical distance created a feeling of closeness between the users.

Thus we defined four properties of a mobile social awareness system in our work: *activity*, *status*, *vicinity*, and *relation*. It is important to note that they are all connected and influence each other. Therefore they are hard to separate and we did not feel that it was possible to design the iSocialize system without bringing all of them into play.

It is clear from the definition of *status* that it is an intangible concept because it involves several aspects of the social situation and these aspects are hard to clarify. The problem is not that the evaluation participants were unwilling to share information about their status, but to define the code of communicating the information. In the evaluation we found that it was not satisfactory to express mood or feelings as a matter of categories because human feelings are more complex.

However availability was considered much more useful by combining categories of information, e.g. by expressing *not available* and *tired* together, richer information can be constructed and interpreted. As an example it is complex to specify the availability of a person. First of all it is an individual threshold, and secondly it also depends on who is interrupting. However, combining information also poses the threat of gaining knowledge that transgresses the privacy of some people.

We argue that since the status of a person is not generalisable in the format we chose, it is important to allow different forms of interaction so the users can choose one that suits their social relation, for example allowing the users to leave a message that does not require immediate response.

We found that the value of a particular piece of social information decreases rapidly because the situation of a person changes often. It may for example be an inappropriate time to call a person rushing for work but five minutes later when the person is sitting at the desk the call may be more welcomed. The evaluation of the iSocialize prototype showed that users did not put much trust in information they gained through the system unless they were actually monitoring the changes. On the other hand they were clearly interested in following changes in the system and monitoring their contacts' activities in real time. The definition of social awareness systems lacks the aspect of time and change which seems to have great influence on how people feel aware. In our work we have treated awareness as a feeling of the moment but another perspective may be the effect of history and tracking changes over time.

Mediating Social Awareness

Earlier in this report, social awareness systems were defined as communication systems that support peripheral awareness of activities and status of communication partners. This means that the following subsections will take a critical look on the types of information, the accuracy of information, and the quality of information in relation to mediating social awareness.

Existing mobile technologies contains several ways of letting people interact and exchange information including social information. The iSocialize system exposed the evaluation participants to several types of information with variations in the exactness of meaning. For example the participants found that icons can have several meanings thus being subject of interpretation based on a common understanding of the sign. Text seems more precise at the level of interpreting signs though the content may not be any more exact at the level of meaning. On the other hand interaction through icons was found to be less socially satisfying than talking to one another.

The social information a sign can represent depends on both the mental associations of the receiver, the information context, and the social context of the interacting parties. As an example, an icon showing an aeroplane could mean different things such as *vacation* or *speed* depending on what the receiver thinks of. Together with an icon of a clock the aeroplane probably means *speed* more than *vacation*. Knowing that the sender is not likely to go on vacation right now but may be late for work at this time of the day reinforces the meaning of *speed*.

Hence the usefulness of symbols and icons as social messages depends on the communicators to create and reinforce the meaning through use of them. Unacquainted evaluation participants reported that they were missing a social relation with their communication partner in order to interpret symbols and the already acquainted reported that they were missing practise and a common understanding of how to interpret the symbols. This leads to the discussion of accuracy of social information.

Our evaluation showed that inaccurate information is no guarantee of privacy between friends. Existing social relations and knowledge of each other makes it possible to guess or register unusual activity. For example movement or the physical distance to someone can tell whether the person is where he or she ought to be, provided that the receiver of the information already knows where that is. If one does not prepossess the knowledge about the other person it seems that information about movement and physical distance is rather inaccurate information about an activity. More or less accurate means of communicating social information change their value due to the existing social relations between the communicators.

All participants stated that they would not want too accurate information, for example their exact location, to be broadcasted to their friends. It would violate their privacy, which is a well known issue when mediating personal information. Inaccurate information, such as *I am close to you* or *I am under transport* on the other hand seems to be acceptable to share. The evaluation participants all stated that they were willing to share some sort of private information with their friends if gaining the benefits of social contact. The challenge seems to be choosing information to share that does not violate the needs for privacy yet providing the feeling of closeness between people.

The *activity* is the main reason for the feeling of being monitored and the violation of privacy. When information about location is mentioned in this context it is because location in many cases can be interpreted into what activity a person is engaged in. The evaluation participants related differently to what sort of information on activity they would prefer. Some preferred precise information about others activity but others were more reluctant and did not desire the de-

tailed insight. The same goes for sharing one's own activity information: some dislike that their friends would know much about their activity and some did not mind.

Regarding the quality of mediated information, the proactive functionality with which the system makes a guess based on e.g. sensor input and calendar data makes the users fear that the system guesses incorrectly. The knowledge that a certain piece of information is not created or chosen by a person makes the information less trustworthy and less interesting. It creates a certain feeling of closeness towards the communication partner knowing that a message was manually created. The quality of a manually created message should not be overlooked when building systems that mediate social awareness since the overall purpose is to create a feeling of closeness among the users. The problem is that it is difficult to define this psychological value because it is created during the reception and interpretation of the information. We found that users want to validate social information to trust it. For example knowledge of the communication partner's habits is used to evaluate information.

Evaluating Social Awareness

In the introduction we present the question of how to evaluate social awareness systems. We then survey the area of HCI research for examples of evaluations of social awareness systems. This presented us with a selection of studies in which traditional methods and metrics have been used. These methods focus on measuring the system in various ways – that is, focusing on the human-computer interaction problems.

Introducing a second user as part of an evaluation changes the context: Now there is a third partaker in the evaluation situation - a communicational device and two human communicators. The device has been reduced to a mediator between two users instead of the one half of a use situation. It is obvious that the interaction between the user and the system is still important – a faulty system that keeps crashing on the user (regardless if there is one or two of them) is practically useless. But the interpersonal communication, which is to be assumed as the important reason for introducing another participant into the equation, is not evaluated with traditional HCI-related methods.

This aspect of evaluation could be covered by a method more focused on interpersonal communication. In relation to our data collection setup, we propose a camera setting more directed at the participants instead of the present focus on the mobile devices. This would also allow for a differently aimed analysis method – one more directed at interpersonal communication.

This setting still includes a controlled environment with e.g. cameras, test leaders, control rooms, video recordings, contextual tasks, artificial test data, and laboratory walls with one-way mirrors. With reference to the discussion of research methods, we argue that these are elements that can also be constructed or be part of a real-life context. Thus more thorough evaluations of the concept of mediated social awareness are to be conducted, where elements as the aforementioned can be the subjects of variation.

Conclusion

This is a master's thesis within the field of human-computer interaction. We focus on the research of existing social awareness systems, the design of a mobile social awareness systems and how to construct and conduct an evaluation of a social awareness system.

This conclusion sums up our master's thesis; repeat the research questions from the introduction, give the answers to these research questions, and point out the limitations of the results of this study. Finally various issues for further research are mentioned including the incentives to look into them.

Research Questions

Mobile, "always-online" technologies are emerging everywhere, and are getting increasingly smaller, more powerful, and cheaper by the minute. This means that the software applications known from the stationary computers are now moved to mobile platforms – including the socially related software such as instant messaging applications. The mobile software enables people all over the world to continuously stay in contact with their friends and business partners. Even though software applications are moved to a mobile platform it does not mean they exploit the full potential of being mobile.

Our previous work focused on defining social awareness and the conceptualisation of social awareness. This thesis is based on our previous work, and we therefore ask the first question:

Research Question 1: How can a mobile system be designed to support social awareness?

The answer to this question is addressed in the first research paper related to this report. Our work examines the social awareness systems developed by other researchers. This examination leads to identification of three characteristics that influences the design: characteristics of technology, the context of social technologies and social relations between users. This insight into prior research and our own previous work enables us to model the aspects a social awareness system should incorporate: *activity*, *status*, *relation* and *vicinity* between users. On this basis we build the system iSocialize that mediates social awareness between friends. The system is evaluated using laboratory-based usability testing with pairs of users. The results of the evaluation relate to the implementation of social awareness aspects of the system. The answer to the question is the combination of adding more properties to the definition of social awareness, the description of the design of iSocialize, and the results from the evaluation. This showed that unacquainted participants had problems interpreting the information in the system, whereas acquainted participants missed practice and a common understanding of the system. Participants preferred to use iSocialize for monitoring changes but missed audible feedback to alert them to these changes. Likewise many expressed privacy concerns.

The design and construction of a mobile social awareness system is assumed to be different from traditional work-related systems. We therefore ask the second

question:

Research Question 2: How can a mobile social awareness system be evaluated?

The answer to this question is addressed in the second research paper related to this report. Our work in this paper examines the evaluation of mobile social awareness systems. We examine how evaluations have been conducted of other such systems and categorise the results of this examination, in which we distinguish between the system's level of functionality as well as the purpose of the evaluation. We then set up a laboratory usability evaluation with 20 evaluation participants in 10 one-hour tests – 5 tests with acquainted and 5 with unacquainted pairs. In this evaluation we focus on iSocialize – our mobile system constructed to mediate social awareness in a non-work-related context. We analysed the results with respect to both usability and social awareness problems. The evaluation showed that both acquainted and unacquainted participants are useful when testing social awareness systems for usability issues in general. The acquainted participants did however appear to be able to provide a slightly more in-depth perspective on the concept of social awareness. We conclude that the two types of participants have each their qualities when evaluating social awareness systems. The answer to this question is the combination of the described evaluation method and the reflections on our evaluation of iSocialize as a case.

Limitations

This subsection describes the two larger limitations to our work, as we see them.

The first limitation of our work relates to our one-hour evaluation in a laboratory setting followed by an interview. Our survey of other researchers' evaluations of social awareness systems showed that only few evaluations touch on social awareness aspects. The few studies that did evaluate these aspects mainly used a combination of field evaluations and interviews. The purpose of the field evaluations was to introduce the users to the system, let them understand the purpose of the system and let them experience the system over a longer period of time without the watchful eyes of the researcher. The interviews then had the purpose of exploring the users' opinions of the system and to explore whether the incorporated aspects of social awareness had worked.

Compared to these evaluations a laboratory evaluation followed by interviews has its shortcomings. The artificial setting of the laboratory results in an unknown generalizability of our results. Clearly, this setting also influenced the behaviour of our participants. Several of them stated that they felt that the contextual task of the test had no other purpose than keeping them occupied. This was also clear from the fact that most participants had problems concentrating on the contextual task and kept asking whether they had to try solving it. Our experience with the laboratory evaluation indicates that this setting might not be appropriate for our evaluation purpose since the participants never seemed to feel comfortable and thus never got a believable experience of the use situation.

Our second limitation pertains to the cultural and demographic nature of our participants. As this study is based on Danish participants aged in the middle twenties, the generalizability of our results is limited. As we have argued in both

our papers and the introduction to this report, the subject of social awareness is still little explored and therefore every structured step is a contribution.

We believe this thesis is such a step.

References

1. Andersen, B.L., Jørgensen, M. L., and Kold, U. "Classifying and Defining Social Awareness Research". In *Supporting Social Awareness in a Family Context*. Department of Computer Science at Aalborg University, 2005.
2. Andersen, B.L., Jørgensen, M. L., and Kold, U. "Illustrating and Understanding Social Awareness in Family Contexts". In *Supporting Social Awareness in a Family Context*. Department of Computer Science at Aalborg University, 2005.
3. Andersen, B.L., Jørgensen, M. L., and Kold, U. "SocialBoard: A Socially Aware System Supporting Passive Interaction". In *Supporting Social Awareness in a Family Context*. Department of Computer Science at Aalborg University, 2005.
4. Berg, S., Taylor, A. S. and Harper, R. "Mobile phones for the next generation: device designs for teenagers". In *Proceedings of the conference on Human factors in computing systems, (CHI 2003)*. ACM Press, pages 433-440, ISBN: 1-58113-630-7, DOI: http://doi.acm.org/10.1145/642611.642687.
5. IJsselssteijn, W.A., *private e-mail correspondence of April 26th, 2005*.
6. Kjeldskov, J., Graham, C. "A Review of Mobile-HCI Research Methods". In *Lecture Notes in Computer Science – Human-Computer Interaction with Mobile Devices and Services, vol. 2795*, pages 317-335. Editor L. Chittaro. Springer-Verlag Heidelberg, 2003.
7. Koman, R. *The Next Revolution: Smart Mobs*, 13th March, 2003, http://www.openp2p.com/pub/a/p2p/2003/03/13/howard.html.
8. Ling, R. *The Mobile Connection: The Cell Phone's Impact On society*. Morgan Kaufmann Publishers 2004, ISBN: 1-55860-936-9.
9. Rheingold, H. *Smart Mobs*. Reading, Mass. Basic Books. 2002.
10. Schmidt, A., Stuhr, T. and Gellersen, H. "Context-Phonebook - Extending Mobile Phone Applications with Context". In *Proceedings of Mobile HCI 2001: Third International Workshop on Human Computer Interaction with Mobile Devices*. 1-6, http://www.cis.strath.ac.uk/~mdd/mobilehci01/procs/.
11. Van Baren, J., Romero, N., Markopoulos, P., Ijsselstein, W. Farschian, B. and de Ruyter, B. *Deliverable 1: ASTRA Scenario and Research Contribution*. November 2003, http://www.presence-research.org/Astra/deliverables-/Deliverable1.v3.pdf.
12. Wikipedia, *Awareness*, June 2005, http://en.wikipedia.org/wiki-/Awareness
13. Wynekoop, J.L., Conger, S.A. "A Review of Computer Aided Software Engingeering Research Methods". In Proceedings of the IFIP TC8 WG8.2 Working Conference on the Information Systems Research Arena of The 90's., Copenhagen, Denmark (1990)

Appendices

These are the appendices for the report *Design and Evaluation of a mobile social awareness system*.

1. English Summary
2. Research Paper 1 – iSocialize: Designing a Mobile Device Supporting Social Awareness
3. Research Paper 2 – Evaluating a Mobile Social Awareness System
4. Query Sheet for Participants (in Danish)
5. Evaluation (in Danish)

Appendix 1 – English Summary

This master's thesis investigates the design and evaluation of a social awareness system. Social awareness denotes maintaining a peripheral awareness of the activities and status of ones communication partners. We do this by conducting two different activities.

First we design a social awareness system, which involves several sub-activities: We survey a selection of previous study papers to discover how social awareness systems have previously been designed. We identify three characteristics that influence design: *characteristics of technology*, the *context of social technologies* and *social relations between users*. The technology characteristics concerned whether the systems were mobile or stationary. The context of social technologies concerned whether the systems were designed for workplaces or for domestic use. The social relations between users concerned whether the users of the systems had existing relations or whether the system made the users initiate contact.

Building upon our previous model of social awareness, which introduces the social awareness properties of *activity* and *status*, we add in the properties of relation and vicinity, which are added in order to deal with the mobility of our system. Based on our model of mediated social awareness and the survey we design a system, iSocialize, to exemplify social awareness. iSocialize allows friends to maintain social awareness of each other by monitoring the information about contacts in the system. The functionality and design of the system supposedly implemented the properties of social awareness and therefore an evaluation of the system would provide insight into the user interest in such information.

Our second activity is to design an evaluation method, which is also constructed from several sub-activities: again we survey a selection of previous study papers, but this time to discover how social awareness systems have been evaluated. We identify the following two distinctions: the system's level of functionality and the purpose of the evaluation. From this survey we construct an evaluation method that focus on the social relations of evaluation participants.

iSocialize was evaluated in a usability laboratory and the evaluation involved 20 evaluation participants using the system in pairs of two. Due to the interpersonal nature of the iSocialize system each evaluation had to involve two participants using the system simultaneously. These evaluation pairs were distributed evenly on pairs of acquainted and unacquainted participants. This approach enabled us to gain insight into the effect of pre-existing relations when evaluating social awareness systems. Each usability evaluation consisted of two parts: One part where the participants performed tasks that had the purpose of introducing the participants to the functionality of the system, and another part where the participants solved a contextual task in order to create a realistic use situation. Furthermore semi-structured interviews were conducted with the participants after each test. The focus of the interviews was on the participants' experiences with the system and their attitude towards mediated social awareness. The interview allowed the participants to elaborate on their experience and comment on the system and the concept. Along with the traditional focus on

usability problems the evaluations aimed to investigate the social awareness aspects of the prototype and thereby gain insight to the concept.

The results of the analysis showed that no major difference between the numbers of usability problems discovered by the two groups of participants. The differences showed up when distinguishing between the types of usability issues. We related these issues to the properties of social awareness and found a difference in favour of the unacquainted participants, who found 18 out of 30 different usability problems related to interpreting social awareness information in the system.

The evaluation showed that both acquainted and unacquainted participants are useful when testing social awareness systems for usability issues in general. The acquainted participants did however appear to be able to provide a slightly more in-depth perspective on the concept of social awareness. We found that unacquainted participants had problems interpreting the information in the system, whereas acquainted participants missed practice and a common understanding of the system. Our participants preferred to use iSocialize for monitoring changes but missed audible feedback to alert them to these changes. Likewise many expressed privacy concerns.

The conclusion of this master's thesis is that we successfully implement the properties activity, status, vicinity and relation into iSocialize. Results from our analysis indicate that acquainted as well as unacquainted users can be used for testing social awareness systems, but for different purposes. Furthermore we consider our model of mediated social awareness a contribution that further research and system designs may build upon or be inspired by.

Appendix 2 – Research Paper 1

iSocialize: Designing a Mobile System Supporting Social Awareness

iSocialize: Designing a Mobile System Supporting Social Awareness

Berith Lundgaard Andersen, Martin Lindholdt Jørgensen and Ulrik Kold
Aalborg University,
Department of Computer Science,
Fredrik Bajers Vej 7E,
DK-9220 Aalborg East.
{berith, martin, kold}@cs.aau.dk

ABSTRACT
This paper explores how a mobile system can be designed to support social awareness. Our work starts out by examining some social awareness systems developed be other researchers. This examination leads to identification of three characteristics that influences the design: characteristic of technology, the context of social technologies and social relations between users. This insight into prior research and our own previous work enables us to model the aspects a social awareness system should incorporate: activity, status, relation and vicinity between users. On this basis we build the system iSocialize that mediates social awareness between friends. The system is evaluated using laboratory-based usability testing with pairs of users. The results of the evaluation is discussed and related to the social awareness aspects of the system.

Keywords
Social awareness, mobile system, system design, evaluation.

INTRODUCTION
Information and communication technology is increasingly blending into our everyday life and new devices are constantly introduced to the market. [21] The technology has become available to common people and therefore a new aspect of use purpose emerges. While the traditional primary purpose of using technology is to increase efficiency or earnings, communication devices are increasingly used for social reasons. From an innovation perspective this raises the question of how communication technology can be designed to match this social use and purpose.

One perspective to this issue is the social interaction, which naturally happens between people. When people are in the same room they instinctively have an understanding of what each other are doing and feeling. We denote this type of interaction *social awareness* and people stay socially aware of other people all the time. They do not have to be actively communicating. A quick glance can tell the mood of others and their interruptability [16,17,19].

Sometimes it is not even required to look at each other. The continual sound of typing means someone is working at a computer and the sweet smell of warm bread might mean someone is baking. When people are together they spend little effort on gaining the information but they are nevertheless constantly aware of each other. The situation is different when people are separated. When separated people have to actively tell about their feelings, mood, activities, and interruptability.

Some devices built on emerging technologies support new ways of staying aware of each other. These devices can automatically collect and transmit information and some systems can even change behaviour according to the situation. A simple example is a mobile phone that switches into silent mode when it senses that the user is at a meeting. Designing technologies to match the needs of the users is nontrivial and when the focus is on social needs, it becomes increasingly complex.[4]

The interest of this paper is on social awareness systems – a system mediating social awareness. It is the premise that people wish to be aware of their friends and that mediating social awareness will support the social bonds between people. Thus, the purpose of this paper is to illuminate how social awareness can be supported in a mobile communication system. As a basis of investigating this we use the following understanding of social awareness systems:

Social awareness systems are computer mediated communication systems that aim to support connected parties to maintain a peripheral awareness of the activities of and status of their communication partners [1, 29].

In this paper we report on our work on designing and evaluating a mobile social awareness system called iSocialize. First the background of social awareness is treated drawing on experience from existing research and our own previous work. A case scenario explains the

motivation and challenges that the iSocialize system was constructed to meet. The system was evaluated in a laboratory usability evaluation and successive interviews, and the results are used to discuss the system we developed and the concept of mobile social awareness systems.

BACKGROUND

It is difficult to get a clear view of which systems are social awareness systems because no well-defined terms have yet collectively been adopted. A lot of different, overlapping terms are being used or perhaps no terms are used at all. It is therefore still impossible to talk about a field of social awareness systems.

Most systems are being developed in a research context. Many vague terms are used for what they want to support – terms such as *social interaction* [14,15], *social practices* [7], *social networks* [7,11], *social computing* [8,9] or *social activities* [9,10]. We find that they all share the wish to support interaction with a social purpose between people using the system. However none actually discusses what influence the social aspect have on the design – how the attachment of *social* sets *social interaction* apart from merely *interaction*, and what are the goals of a social system? The use of vague and undefined terms makes these designs almost as hard to process as the designs that use defined terms [8,18,23,24,26]. The description of the design has to be closely inspected in these cases in order to determine if they are social awareness systems or not.

Counts and Fellheimer apply the concept *social presence* [12] to their work on lightweight photo sharing. They define it as: *the maintenance of a presence in the lives of friends and family*. This covers connectedness and group cohesion, and is largely driven through the sharing of life events. The sharing of life events and being present in each others life correlates to being aware of activities and status of communication partners in our definition of social awareness.

Exploring the work of others lets us identify the first challenges of designing a social awareness system. One challenge is to identify meaningful properties of the term *social* – what kind of information about activities and status is meaningful to receive about a communication partner in a given situation? Another challenge is to design a system that mediates this in a meaningful way – how to design it in such a way that the benefits outweigh any hassle of using it.

We have categorized the work of other researchers into three groups. First is *technology characteristics* that relates to how the properties of a technology can influence social awareness aspect of a system. Secondly is *the context of social technology* that discusses the context of different social awareness systems. Last is the *social relation between users* that discusses how the relation between users influences the design.

Technology Characteristics

A distinction made in relation to technology is whether or not a social awareness system is or should be mobile. The choice of making a system mobile or stationary influences what information is relevant to exchange to achieve awareness between the users. Next we will present an outline of social awareness systems based on stationary technologies and present a system in more details, secondly we do the same with systems based on mobile technology.

Social awareness systems can be stationary in different ways – some are based on traditional PC's [10,23], some use interactive screens set up in public places [9,11], and yet some are new types of stationary devices [18]. Common for all of these systems is that they can not be easily relocated. This means that users are fixed to the location of the device for the length of any interaction with the system. The Music Buddy prototype [10] was an example of this because it was an internet application, primarily meant to be used from stationary PC's. It supported users in discovering new music and making friends through music. It mediated social awareness by allowing users to gain information about the status of each other in the form of music taste. One could find new friends and explore new music by browsing the music collection of others with similar taste. In the future the system will also allow formation of groups and other communication options based on taste in music.

The mobile technologies are generally different from the stationary but the mobility can influence the use in different ways. Some systems actively utilize the fact that with mobile systems the location and activities of the communication partners can change during the communication [24,26]. For other systems the situation of usage is connected with the mobility, e.g. if the communication partners are occupied and the communication is asynchronous [14,15]. And yet for some systems the mobility makes the users able to communicate any time, anywhere [7,8,12].

The location-aware event planner [24] was a mobile prototype implemented on a PDA phone. The design aimed to support users in their goal of getting in contact with, and keeping up with friends to support informal event planning. The system contained a list of individual and groups of friends of the user, and connected these by providing information about planned events. The social awareness aspects of this system related to the mobility and event planning of the system. Since people were mobile and therefore could be anywhere while using the system, one could view the location of the individual people on a map. When selecting an event it was possible to view the location of people participating in this event, making it possible to assess when they would arrive.

In general the different characteristics of stationary and mobile technologies create different expectations between users. Users of stationary technologies can rely on

unchanging properties of the setting and location of the communication partner. The situation is different with mobile technologies where it is practically possible for users to be anywhere and do anything while communicating. They are not tied to a certain place and the location and setting can therefore change.

The Context of Social Technology

The intended use of social awareness systems varies a lot, but in most systems the goal is to support communication and the relationship between the communicating partners. In some designs the social purpose is combined with a work-related purpose which makes efficiency and effectiveness key values. Our work is focused on social awareness among friends in a private and not a work-related context but both settings involve people with social relations and can therefore be relevant. Here the overall influence of both private and work-related settings is outlined and examples of systems are described in more detail.

Systems, which mediate social awareness in a private setting, reflect their context differently. Some relate to interaction or settings where the system is not a natural element and they would loose much of their purpose if they were brought out of this context [9,23,24]. Many others have no distinct connection to outside interaction between the communication partners – examples of these are [7,8,10,12,15,18]. The Casablanca project [18] designed several simple device prototypes where social awareness was the goal and all other interaction played no role. The Intentional Presence Lamp and the ScanBoard were two of these prototypes. They allowed family and friends to be socially aware of each other from their homes. When people wanted to communicate their status (being at home and available) they activated the Intentional Presence Lamp that lit up at the communication partner's place. The ScanBoard implemented social awareness by allowing users to communicate their activities and status – notes, photos and clippings could be scanned and posted on remote ScanBoards. Berg et al. [7] also designed a social awareness system that did not relate to any other interaction between the communicating partners. The purpose of the prototype was to support teenagers' social practices through a novel multimedia messaging system and the augmentation of the mobile phone's address book. The system supported social awareness by visualizing the relation to communication partners by means of arranging the icons according to the frequency of communication, but also by allowing each contact to design their own avatar to express identity and mood – this was achieved by combining hairstyles, faces, moods, and simple animations.

The Plasma Poster Network [11] is the only work-related system in this study. It was a large-screen, digital, interactive, bulletin board located in public places at a research lab like in a corridor, in a foyer, and in the kitchen. Large plasma screens allowed people to view published information. The work setting called for the exchanged information to be mainly work-related, but it also allowed and encouraged social awareness between colleagues. Pictures, e.g. from travelling colleagues gave information about their activities and links to interesting material could give information about the interest and status of one's work.

A private or work-related context influences the design of a social awareness system in different ways. In a private setting social awareness has value in itself – it can be the sole purpose or be a contributing factor to other sorts of interaction. In a work setting the purpose of the system is primarily work-related – social awareness is utilized in order to promote the purpose of the work.

Social Relation between Users

As with all kinds of systems also social awareness systems target specific users. We have chosen to look at whether or not the users have already established social relations because we believe that this condition influence the way a system should mediate social awareness. In the following we first give an overview of the systems supporting acquainted users and give a few examples of these in more details, and then we will do the same for systems focusing on unacquainted and semi-acquainted users.

The systems that support already established relationships (e.g. in a family) have the advantage of being able to build on these relationships. This means that the users already have interest in communicating or interacting, and e.g. systems running on mobile phones can use the mapped relationships of the phonebook [7,26]. It also means that users are willing to share information of a more private nature than they would otherwise. Furthermore the systems can use information about location [24] and personal preferences [23] to aid meetings. Some systems combine both the interest in communicating and the willingness to share private information [12,18].

The Context-Phonebook [26] is an example of a system supporting already acquainted people. This was three different prototypical implementations of an augmentation of a mobile phonebook, though neither of them was functional. The implementations mediated social awareness by giving information about the people in the phonebook in three different ways. Two implementations gave information about the status of potential communication partners – respectively the connection state (how will a call be answered?) and the availability (is it a good time to call?). The last implementation gave information about the location or activity of people (are they at home, at work or on the way?). The purpose was to support people in deciding whether it was a good time to call, but after the decision was made the system did not support social awareness in other ways.

The Flipper photo sharing system [12] draws on both the interest in communication and willingness to share. The focus was on enhancing the sensation of social presence when not in face-to-face or verbal contact with each other. The system automatically shared the owner's photos with friends. Enhanced social presence was achieved by the photos passing information about the lives of friends and family. This concept complements our concept of social awareness where the passed information more explicitly covered the activities and status e.g. the mood of people.

Systems aiming at unacquainted users do not have the opportunity to build on an established relationship. Therefore part of the challenge of these systems is to create new social relations. In some cases this also includes creating the incentive to communicate. Some systems are based on users wanting to socialize with people with whom they share interests [10,14,15], some rely on the entertainment of the system itself [8,9], and yet some are based on the value of the available information in the system [11].

Hocman [14,15] is one of the systems supporting users that share an interest – motorcycles, in this case. It was an application designed to support mobile interaction among motorcyclists – acquainted as well as unacquainted. Meetings between motorcyclists are usually brief and with limited possibilities of communication. When two users of Hocman met, personal information was automatically exchanged between the systems. This made it possible during a later break to gain information about the motorcyclists one had met. The mediated social awareness covered exchange of e.g. names, model of the bike and favourite routes. This way, motorcyclists could share their joy of riding without stopping.

The Hocman users had an interest in common, whereas the i-ball system [8] created social relations through the entertainment of the system. i-ball was designed to support co-present community building inspired by the concept of folklore. i-balls (balls of information) required people to seek out other people following rules described for each individual i-ball and to connect one's i-ball unit with theirs. The rules could be to find someone who likes broccoli, plays tennis or to find someone whose work has been overlooked. The search led people to exchange knowledge about activities (e.g. what they do in their spare time) and status (e.g. likes and dislikes) of each other.

Some social awareness systems are found supporting already acquainted people such as friends or family members. These systems have the advantage of being able to build on these relations, where people are already interested in communicating and sharing information. Other systems focus on unacquainted or semi-acquainted people and try to establish new relationships or just to create a higher degree of social awareness towards ones' surroundings.

In the following section we further describe and elaborate on the concept of social awareness. We discuss the setting for social awareness, present a model of properties to mediate, describe a case and sum up the challenges of a social awareness system.

ILLUSTRATING SOCIAL AWARENESS

In order to design a social awareness system we further investigate the concept of social awareness and social awareness systems. First we will do it through our *previous work* on the subject. Secondly, this leads to *A Model of Mediated Social Awareness* that we present. Based on this knowledge the *Case: A Simple Scenario of Social Awareness* is described, and fourthly we sum up the *Challenges of Mediating Social Awareness* that have been identified from our previous study, our model and the scenario.

Previous Work

In a previous study, we explored the concept of mediating social awareness between already acquainted people [3]. The aim of the study was to understand the nature of social awareness in a family and how electronic communication technology as well as traditional means of communication supports social awareness. To address this objective, we used several qualitative techniques in collecting empirical data. Ten hours of semi-structured in-depth interviews with six family members were conducted over three weeks and the material was analysed using grounded analysis methods [28]. The study explored the context of social awareness and the influencing factors. Five concepts with relation to social awareness were identified: the *purpose for social awareness*, *situation, choice and use of media*, *forms of interaction* and finally *privacy concerns*. Their interrelation is illustrated by Figure 1.

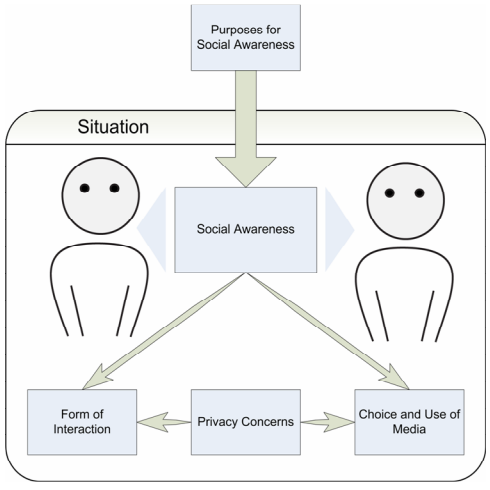

Figure 1. Concept map of social awareness – the concepts and their interrelation.

We identified three *purposes for social awareness*. Firstly, the purpose is to maintain an overview of group activities.

A large amount of common group activities where people rely on each other creates a need for coordination of activities and therefore an overview of group activities is needed. Secondly, the purpose can be entertainment. When bored, mediated contact with friends or family is used to entertain oneself – asking about the activities or status of others works as an initiation of contact and the conversation can evolve from there. Thirdly, the purpose can be cosiness. Social awareness often leads to a sensation of cosiness caused by the knowledge of being in contact with others and knowing they spend time thinking of you.

Acquainted people have knowledge of each other's lives and routines. When they want to communicate the *situation* of each of the communication partners impacts the need for social awareness. For instance it might not be appropriate to be contacted in the middle of a business meeting, or to talk about private issues in the bus. Also breaks from routines e.g. vacations or business trips can foster a need for social awareness.

The *choice and use of media* also plays a big role when mediating social awareness and it relates to the nature of the media and the content of the message. The choice of medium is primarily determined by three factors: time (how urgent is the message), place (where is the other person) and consequence (what are the consequences of the message). The use of medium also relates to three factors: confidence with the technology (is it used frequently), communication role in the group (are you e.g. the coordinator of the group or the communicator with people outside the group), and expectations towards the receiver (what is their situation and use of media).

In relation to social awareness we identified two *forms of interaction*: active and passive. Active interaction is when one person deliberately initiates and intends contacts with others. This can be one-way information pushing or pulling, dialogue or broadcasting. Passive interaction is when the interaction is not deliberately addressed for someone specific. This happens when someone puts up something on a public notice board - this way information is both passive information to others but also give the individual a sense of what others are doing.

Privacy concerns have much influence on how and when people choose to interact and therefore important in relation to mediating social awareness. The situation of all communication partners and the topic of communication are taken into consideration. The need for privacy differs according to what is communicated, in which situation and with whom. E.g. travel arrangements are acceptable to talk about on a mobile phone in a train station whereas more private issues can be inconvenient for both the communicating partners and the surroundings.

As shown on the concept map in Figure 1 all these concepts are interrelated and it is therefore hard if not impossible to work with only one without taking the others into consideration. We understand them as the context factors of social awareness and they are elements of the situation that a social awareness system should be part of.

A Model of Mediated Social Awareness

Our former exploration of social awareness [3] was based on the definition of social awareness as maintaining a peripheral awareness of the activities and status of communication partners and the understanding and so is this work. But whereas the earlier work was focused on social awareness in a natural context – both face-to-face and mediated – this paper aims to explore how the principles apply when the communicating parties are apart. Hence it becomes necessary to focus closely on the interaction between two people that are maintaining peripheral awareness of each other.

Mediated social awareness is characterized by the communicating partners existing in a social context of their own and gaining knowledge of each others' social context at the same time. The contact between the partners is peripheral in the attentional sense, referring to the amount of effort and attention the contact requires. Thus phoning one another is not social awareness because the communicated information is not provided and gathered effortless. To explore the concept of mediated social awareness we therefore strive to identify aspects that technology can mediate effortless and explore what sort of social information is desired by possible users.

Figure 2 illustrates two persons that are socially aware of each other via a communication device. They each have some properties that are part of their personal social context, e.g. what they are currently occupied with and how they are feeling. These properties are called *activity* and *status* in the model. The partners also share some properties that can only be understood as relations between them, e.g. the physical distance between two people. In the model they are called social *relation* and *vicinity*. These are the four properties of mediated social awareness when the communicating partners are apart.

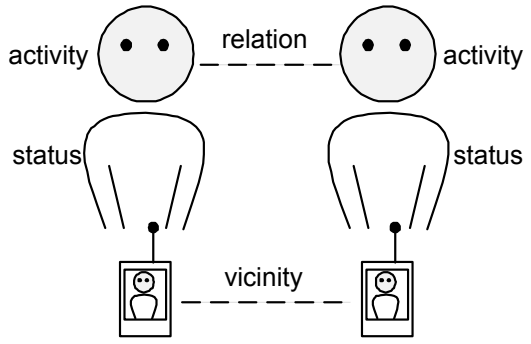

Figure 2: Illustration of social awareness properties meditated by information technology.

The property *activity* denotes the physical actions a communication partner is engaged in and thus an indication of what occupies her mind.

The property *status* denotes the state that the other party might be in. This could be properties such as availability or interruptability, which are particularly useful when deciding if and how to initiate communication. In our definition *status* also describes a person's emotional state and mood.

The property *relation* refers to the social relation between communication partners. How well do they know each other, what is acceptable within their friendship, and what is their relationship in terms of expectations towards each other? The relation with another person exists as social knowledge of that person and this knowledge is the basis of interpreting any social information.

The property *vicinity* refers to how much effort the contact requires. This can be expressed both in physical distance or the total time spent communicating with a related communication partner. In our definition vicinity is understood in terms of the physical distance as this is particularly interesting when people are mobile and not in immediate face-to-face contact.

This ends the description of our model of the properties social awareness. We use these properties as the fundamental elements of mediated social awareness and build on these when designing a system.

Case: A Simple Scenario of Social Awareness

The aim of our study is to design a system, which mediates social awareness. The following imaginative scenario is based on our former study and the above model.

It is early Friday afternoon and Ann is at the university. She and her friends have been talking about getting together this weekend but nothing definite has been decided. She wonders whether they can meet tonight and decides to give everybody a call. Some of her friends have jobs and are still at work at this hour, but she knows it is usually not a problem to call them at work.

Ann starts by calling her best friend Maria, but her phone is turned off. Ann wonders what Maria might be doing and when she will be able to talk, but she does not know and decides to try again later. Peter and Sarah are both working from home today and when Ann calls them. They pick up right away and are glad to have a break from work.

Once again Ann tries to call Maria but her phone is still turned off. She starts getting a bit worried because Maria seldom turns her phone off, so maybe something is wrong. Ann decides to call Simon next – he is both a good friend of Ann and Maria's boyfriend so maybe he knows something. Simon picks up right away but all he knows is that Maria should be studying. While they are talking they discover that they have been working practically door by door all day at the university and could have met face-to-face instead of talking on the phone.

Next in line to call is John. He picks up immediately but before Ann can ask her question John says he will call her back later because he is in a meeting and did not turn off his phone because he is expecting an important call. Ann hangs up and feels a bit embarrassed to have disturbed a meeting. Afterwards Ann decides to try Maria again and this time she picks up. She had gone to the library and turned the phone off since it was low on battery.

Challenges of Mediating Social Awareness

Based on the case story and the model of mediated social awareness, we identified several challenges of social awareness:

- *Friends have expectations of what each other are doing.* The scenario of Ann and her friends illustrates how friends have expectations of what each other are doing in relation to routines and behaviour. These expectations can be more or less detailed, but they influence how and when we choose to communicate. When expectations are not met, as shown with Maria who could not be contacted, confusions can arise. A system supporting social awareness should build on existing expectations and confirm or dismiss these.
- *Friends want to show consideration for when it is a good time to call each other*. Ann demonstrates how she wants to show consideration for others. E.g. she only phones friends at work, because she knows it is acceptable, and she feels bad when disturbing a business meeting. On the other hand people sometimes like to be disturbed in order to talk which is the case with Peter and Sarah. A system supporting social awareness should provide and mediate information without disturbing the users of the system. It should also provide information that enables a user to assess the availability of others and what sort of direct contact would be appropriate in the situation.
- *Friends might not want to share all information*. Our previous study showed that privacy concerns are an important issue in relation to social awareness. Although people are friends they might only want to share some information with each other. On the other hand some information needs to be shared in order to create the feeling of contact. It is important to select expedient information to share when designing systems that mediate support social awareness.

These challenges do not cover every possible aspect of supporting social awareness but they provided inspiration and basis for designing a system. In the creative process of inventing a social awareness system we used the case and the identified challenges to support decisions and as guidelines to creating a system that would provide insight to the concept of social awareness. We called the system concept *iSocialize* because the system purpose was to

provide social awareness between friends and support them in socializing with one another. The *i* in iSocialize is there to indicate that this is a personal system and that it is "I" who socialize.

The following section describes iSocialize. The system mediates the properties of social awareness, when acquainted communication partners are separated physically. It allows them to assess the social context of each other based on their previous knowledge and information transmitted by the communication device.

ISOCIALIZE: A MOBILE SOCIAL AWARENESS SYSTEM

Based on the insight we have gained on social awareness in general and social awareness system more specifically we will now present our social awareness system: iSocialize. In the following we will describe and illustrate it from four perspectives: first the architecture of the system, secondly the interface, thirdly the implementation of social awareness and fourthly minor additional features.

The description of iSocialize will be supplemented by examples and figures that illustrate the scenario of Ann and her friends.

iSocialize Architecture

iSocialize is built as a mobile client/server application. The intended hardware platform is a smartphone with all the capabilities of a mobile phone including calendar, address book, and messaging abilities. iSocialize was tested on two handheld *Hewlett-Packard iPAQ Pocket PC h1940* PDA's running *Microsoft Mobile 2003 for Pocket PC* connected to an IEEE 802.11b/g wireless TCP/IP network (WLAN). The PDA's were equipped with a Java-like application platform called *SuperWaba*, on which iSocialize was implemented. The WLAN connects to an Apache web server running PHP and MySQL.

iSocialize Interface

iSocialize is an application running on a personal mobile device. The overall purpose of the application is to enable users to stay socially aware of close friends. In the next subsections we will present the *main window*, the *personality window*, and the *contact window* of the system.

The Main Screen

Figure 3 shows the main screen of iSocialize. The main screen is a personal view of individual settings and friends. The main screen will be described in relations to the top, centre and bottom of the screen – cf. Figure 3.

At the top of the main screen is the owner bar. Here the *name* and the *current activity* of the user are written – in this case *Ann (At the university)*. The colour of the top is green which visualises the *availability* of the user. The colour green indicates that people are allowed to contact Ann without restrictions. The other colours representing availability is: yellow (*available if important*) and red (*not available*).

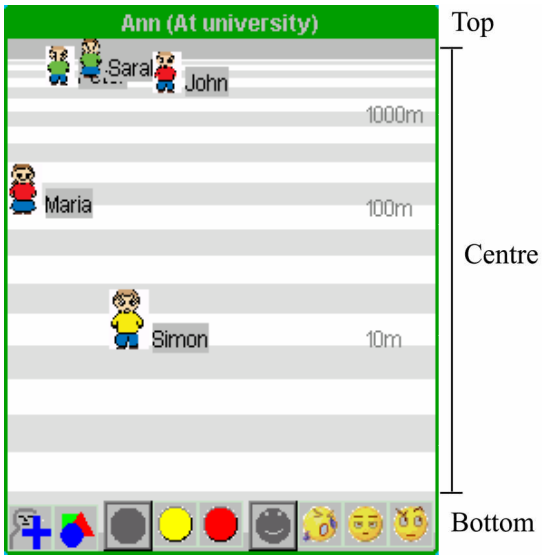

Figure 3. This is the main screen belonging to Ann. It provides a view of personal settings and friends.

The centre of the screen shows the *mood*, *availability* and *vicinity* of friends – we refer to them as *contacts*. Contacts are represented by avatars that express their mood and availability through changeable facial expressions and changeable colours on their shirts. The avatars are placed on a background of white and grey horizontal stripes. The position of the avatars on the background is used for visualising the distance between the user and each individual contact. The relative distance can be read from the measure indications on the right side of the background.

When the distance is beyond 1000 meters the position of an avatar is on a line in the back – or the top – of the screen. The avatar also expresses the sex of the contact by wearing a skirt or pants, and next to the avatar the name of the contact is visible.

In the scenario of Ann and her friends visualized in Figure 3 one can see that Ann has five contacts on her screen: Simon, Maria, Peter, Sarah and John. *Simon* is close by – approximately 10 meters away, which means he must also be at the university. From his facial expression and the colour of his shirt Ann knows that he is sad and can only be contacted if the message is important. *Maria* is around 100 meters away. She is tired and cannot be contacted. *Peter*, *Sarah* and *John* are more then 1 kilometre away and their facial expressions are difficult to read. Yet from the colours of their shirts, Ann can tell that Peter and Sarah are available for communication, whereas John is not available.

At the bottom of the main screen is a row of buttons. This is the main interactive area where the user changes her personal settings. First, from the left one sees the *add new*

contact button which will be explained under the subsection: *Additional Features*. Secondly, there is a button showing a circle, a triangle and a square. This is the button for choosing *personality icons*. This functionality will be explained further in the following subsection. Thirdly, there is a group of three round coloured buttons. These buttons express the *availability* of the user using the metaphor of a traffic light. The first button is grey instead of green which means it has been selected. The colour of the selected button also maps to the colour of the frame in the top of the main screen. Fourth and last is a group of four smiley buttons, which express the *mood* of the user. These buttons will be explained in more detail later. In the example of Figure 3 Ann has set herself to be available and happy. This shows that people can contact her no matter the topic.

The information about the user in the top and bottom of the main screen is also the information that contacts can access about the user. Information can be accessed either by viewing the avatars or opening the contact windows that will be explained later.

When the application is running, the main screen will always be visible. This means that when a window is opened it will position itself on top of the main screen and leave it partially visible in the background.

Personality Window

When selecting personal settings the user can also select *personality icons*. These icons can be selected on the personality window shown in Figure 4. This window opens when the user taps the second left button in the bottom of the main screen. The personality window will be explained relative to the top and bottom half.

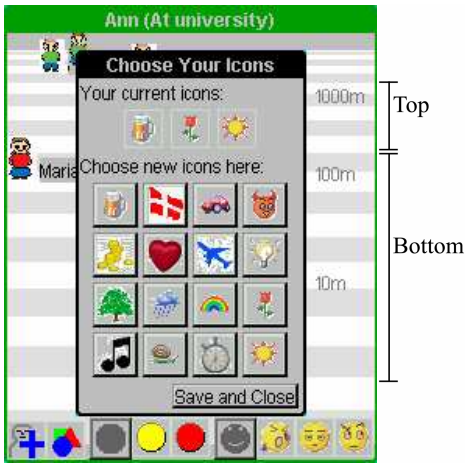

Figure 4. The window for choosing personality icons. Notice that the main screen is still visible in the background - though locked for changes.

The top of the personality window shows the three icons that the user has currently selected. These three icons are also visible to contacts just as the availability and mood icons are. The three selected icons are indirectly manipulated from the bottom half of the window.

The bottom half is interactive and this is where the user selects icons. 16 icons are available and the user can select any combination of them – even the same icons repeatedly. When an icon is tapped it is copied to the top left of the currently chosen icons. The previous three are then moved to the right and the oldest is dismissed.

Currently Ann has chosen a glass of beer, a rose and the sun. She has chosen these three icons because she is looking forward to a party tonight, she is feeling energetic and enjoys that the sun is shining.

Contact Windows

The user can access information about every contact. Some of the information such as availability, mood and physical vicinity is available on the main screen. Other information is only available at the contact window related to each contact. When tapping the avatar of a contact the *contact window* appears. Figure 5 shows the contact window referring to Maria.

At the top of each contact window one can read the activity of the contact. This is the only place in the system where this information is available.

At the centre of the window five icons are shown. The first three are grouped under the heading: *personality*. They correlate to the personality icons from the personality window shown in Figure 4. The two remaining icons correlate to the chosen availability and mood of the contact.

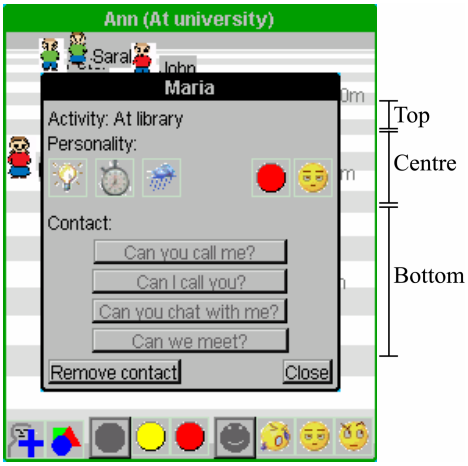

Figure 5. This is the contact window referring to the contact Maria.

The bottom of the contact window contains buttons that makes interaction possible. When one of the buttons is pressed the system sends a message to the contact asking the question of the button. When a contact is set to *not available* (the colour red) the buttons become inactive and ghosted since the contact does not want to be disturbed.

Figure 5 exemplifies the friend Maria from the scenario described earlier. By using iSocialize Ann is able to read that Maria is at the library, she is tired and can not be contacted. Ann can also see three personality icons – a light bulb, a clock and a rain cloud. From her knowledge of Maria Ann gather that Maria is studying at the library for an upcoming exam – Maria is learning a lot, but she is under time pressure because the exam is glooming in the horizon. Since Maria does not want to be contacted the interactive buttons are disabled, so Ann and Maria can not communicate right now.

Implementation of Social Awareness

iSocialize is a social awareness system and as such we have incorporated different elements to fulfil the definition: *Social awareness systems are computer mediated communication systems that aim to support connected parties to maintain a peripheral awareness of the activities of and status of their communication partners*.

In the following subsection we discuss how social awareness has been incorporated. Incorporation of different social awareness aspects has been done with relation to the challenge of what information friends want to share.

Activity

One of the key elements of social awareness is supporting people in being aware of each others *activities*.

Activities describe what the user is actively doing such as working, driving, eating or shopping. But these forms of activities might be difficult to detect, be too detailed and change quickly. Therefore activities can also be described in the form of being at a certain place that prescribes predictable behaviour. Such places can be: at work, at the doctor's or at the library.

Information about activity has been build into the system by displaying a short, simple and abstract text string revealing the activity of people. Displaying activities also deals with the challenge of friends having expectations of what each other are doing, and sometimes these expectations are not being met or they have little detail.

A user can view her activity in the top of the main screen. It is displayed after the user's name and is written inside parentheses. In the top of Figure 6 one can see that Ann is *(At University)*. The bottom half of Figure 6 illustrates how others see Ann's activity.

Users can also view the activities of their own contacts. This information is accessed by tapping the avatar relating to the particular contact and then reading the activity on the contact window – see the illustration in Figure 7.

In a fully functional system there would be different approaches to keeping the activity information up-to-date: one way would be to let the users enter their own activity, another way would be to automate the process and let the system take care of it, and the last way would be a hybrid of the two former. The pros and cons of all three are discussed below.

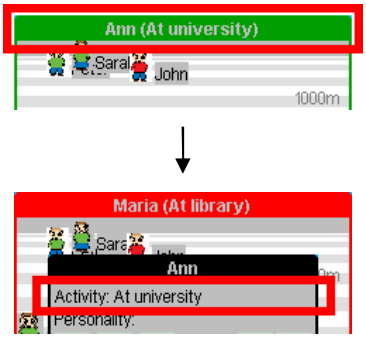

Figure 6. The top illustrates how Ann sees her own activity on her iSocialize device. The bottom picture shows how Ann's contact Maria views Ann's activity.

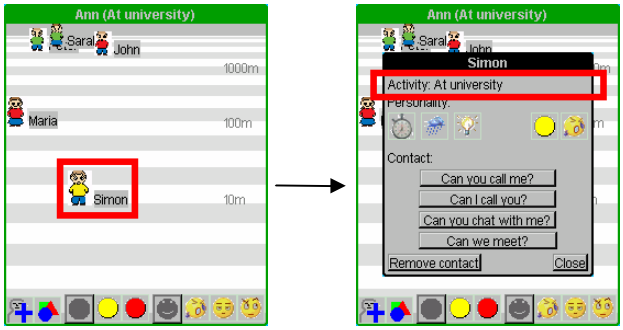

Figure 7. Illustration of how the contact window of Simon opens when tapping his avatar. In this window Ann can see his activity.

Letting the user enter her activity has several benefits. First is that the activity would be accurate since it comes directly from the user. Second is that the user will have total control of what information is passed on, so nothing too private is revealed without knowing it. The mayor disadvantage is that entering accurate information is very time consuming, since activities can change fast. Therefore there is the risk of the information being obsolete because the user either forgets or decides not to update it.

Automation of the process of updating the activity information relieves the user of the burden. The system can automatically determine the activity from different parameters: the user's calendar, current position, current time, whom the user is currently with, and items the user is bringing. The basic activities are rather abstract and thus easily recognizable. iSocialize has access to the electronic calendar belonging to the user. If an activity is scheduled in the calendar at a given time, then this activity will be displayed – e.g. *at the dentist*. Different positions can be labelled by the user – e.g. *at home* when the user is at her home address or *at the university* when she is generally within the area defined as university.

Detection of activities can be a lot more complex, for example if trying to combine position with time or if the system is able to detect the presence of a certain item. If the system combines position and time it can display *out for lunch* when the user is in the canteen around noon. But if the user is in the canteen outside opening hours the activity could be displayed as *in the canteen* or *out*. The system can also detect the presence of certain items. If the user brought her RFID-tagged coffee cup, which the system will then know is nearby, and entered the lunchroom, which is equipped with a coffee machine, the activity could be set to *getting coffee* [6]. The automated process has the disadvantage of the user needing to enter a lot of data to specify locations and combinations of data. There is also a lack of privacy if the system decides the activity at all times – privacy was of the important findings in our previous study – cf. *Previous Work*.

Combining the manual and automated approach to up-dating activity information is the one chosen for a fully implemented iSocialize. In the combination approach the system keeps the information updated but it allows the user to enter new activities and criteria for recognizing these activities. This ensures that the user maintains control over which information to share. This approach has the advantages of both the manual and the automated process, and eliminates both of the disadvantages.

For each user of iSocialize the system holds an individual list to determine what the user is doing based on the calendar, time, place and other conditions. The selection is based on a decision support system, which keeps learning from the user's interactions and corrections. The system lets the user add new activities and a set of factors to consider when deciding what activity the user is engaged in. Furthermore there is a filter to determine who can see what activities under which circumstances. This means that certain areas of the city could be selected as shopping areas, and given a certain time of day (say, between 10:00 and 16:00). The user's activity would then be *shopping* if these conditions were true – outside the opening hours, the activity might just be *walking outside* or *browsing*.

Status: Availability

We apply two different parts of the property status: *availability* and *mood*. In this section we discuss availability.

Availability modes in this system are analogue to indicators known from existing, non-mobile instant messaging programs such as not present, away or out for lunch. Since the iSocialize system is mobile and with the user at all times it makes no sense to speak of *not present* or *away*. Instead availability modes are related to whether a contact can be contacted at the given moment. The modes are called: *available*, *available if important*, and *not available*.

The availability indicator makes it possible for the user to signal whether or not it is acceptable to contact her. An example would be a business man at an important meeting. In this situation he does not want to be disturbed and might turn off the phone. But if his wife is pregnant and close to the date of the delivery, he might want the wife to call him if she goes into delivery. With iSocialize the man can signal that people should only contact him if it is important, and this way he can leave the phone turned on. Without the indicator the man would either have to keep the phone on and actively reject all calls, or turn it off and miss the joyous and important call from the wife. The availability indicator relieves some of the challenges of showing consideration for when it is acceptable to call.

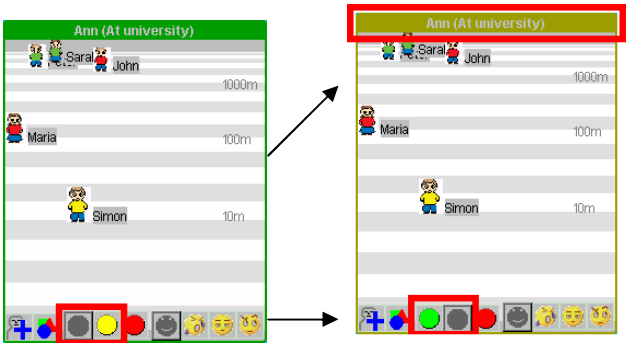

Figure 8. When a user changes her availability the change is visible in the colour of the frame and a different button becomes ghosted on the main screen.

The user can input her availability level using the three availability buttons in the bottom of the main screen. Availability is expressed by colours building on the metaphor of the traffic light: green is *available*, yellow is *available if important* and red is *not available*. The selected button becomes ghosted and inactive. The chosen availability level is reflected in the colour of the frame of the main screen – see the difference in Figure 8. The figure shows how Ann has changed her availability from available to available if important.

The availability of contacts is visible in two ways – from the colour of the shirt of the avatars and in contact windows – see Figure 9. The figure shows how Simon is *available if important* and John is not *available* for communication.

The level of availability influences the user's ability to contact friends. When contacts are *available* or *available if important* the user can contact them, but when they are not available she cannot do this. This difference can be seen from the contact buttons in the contact window. The buttons are ghosted and disabled when a contact is not available – see the difference in Figure 10.

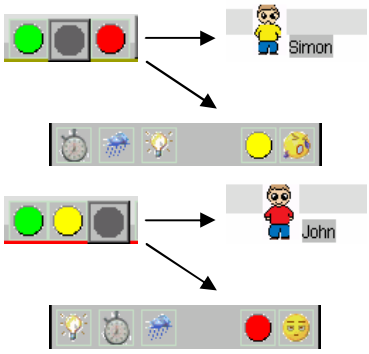

Figure 9. When a user changes his availability, other users see the changes. This is seen in the colour of the shirt on the avatar and the icon in the contact window.

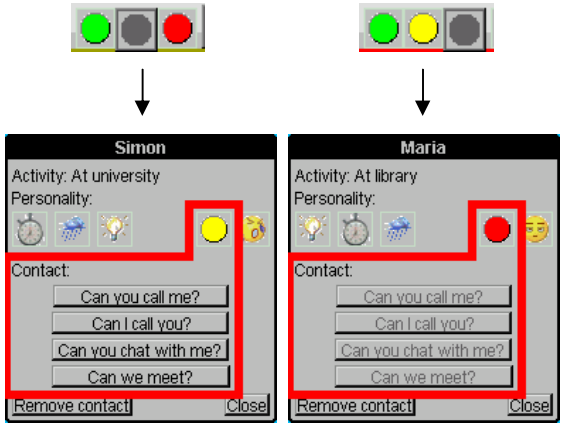

Figure 10. When a contact is available or available if important the user is able to contact them (picture to the left). If the contact is not available the user can not contact him and the buttons are ghosted and disabled (picture to the right).

A part of the aforementioned decision support system for deciding the activities is a filter for determining whether contacts are allowed to contact the user under the given circumstances. There are two approaches to this filtering strategy: A simple and a complex. The simple approach is to make the same decision for all contacts – the complex will be to make an individual decision for each contact. In the case of iSocialize we decided to give a lower priority to the advanced filtering features and thus give the same privileges to all contacts.

The user's availability is input by the user herself as a part of the indication of her status. But in overly busy situations the user might forget to change her availability. In these situations the system can make the decision when it decides the activity. When the user moves from her desk to the meeting room and forgets to change from available if important to not available, the system can be set up to change it automatically and save her the trouble.

Status: Mood

The second view we apply on status is *mood*. In the following we discuss why and how mood has been integrated into iSocialize.

Studies [e.g. 20,25] show that the use of smilies and other similar forms of meta-communication is widespread and useful in mediated communication. Information about a person's mood in iSocialize can be an indicator of how to behave towards a contact or it can be used as a conversation starter. The influence on behaviour could be not to disturb an angry contact if he is *available if important*, and a conversation starter could be: *Why are you so happy?* or *Tired today?* We chose four basic moods to be available in iSocialize. The selection of moods is: *happy*, *sad*, *tired* and *angry*. The moods or emotional states are inspired by the theatre form *Commedia dell'arte* [30] in which there is four basic emotions: *Fear*, *Anger*, *Sorrow*, and *Joy*. The substitution of *fear* for *tired* was based on the judgment that tired would be more frequent and therefore more useful. By introducing the concept of mood indicators the challenge of showing consideration for when it is a good time to initiate contact is further relieved.

The four moods can be chosen freely by the user to reflect her present mood. The automation of detecting a user's mood is not feasible, so mood must be selected by the user.

Using the smiley buttons on the bottom of the main screen makes it possible for the user to set her mood – see Figure 11. This is the only place in the system where the user can see her own mood setting. Figure 11 illustrates the mood of Ann. She is happy because it is the end of the week and she is going to see her friends.

Figure 11. The mood of a user is set using the smiley buttons from the bottom of the main screen.

Figure 12. Illustration of the mapping between the mood of the avatars and icons in the main screen and contact windows. The moods are (in reading direction) happy, sad, tired and angry.

Other users of iSocialize also input their mood. This information can be accessed in two places: from the expression of avatars on the main screen and from the individual contact windows. Figure 12 shows how the expressions of the smilies have affected the facial expression of avatars. Mood is expressed by different shapes and positions of mouth, eyes and eyebrows.

Relation

Whenever people are communicating a *relation* is created or reinforced. Although this relation is not explicitly a part of the definition of social awareness systems, we believe that it is implicit between any communication partners.

The relation between a user and her contact exists as social knowledge between the two of them. This knowledge is used when interpreting the information gained from the system. To support the relation a user can choose icons for the contacts to interpret. The goal is to reinforce and support the social knowledge that already exists. Inspired by existing instant messaging programs, the decision was made to equip the users with a collection of 16 icons to express their personality – see the personality window of Ann in Figure 4. The icons were chosen so as not to express activities as much as mental states. The idea was to let the users interpret the icons and let them fill the icons with meaning based on the prior knowledge they have of their friends.

When the user opens her personality window she can view and change her personality icons. This window is accessed by tapping the personality icon button on the main screen – see Figure 13. The personality window, and its meaning in the scenario for Ann, has already been described in the above section: *Personality Window*.

The icon set is static, a part of the application, and cannot be changed by the users. For the sake of simplicity – and due to the used SuperWaba platform – it was chosen not to let the user change the icon set.

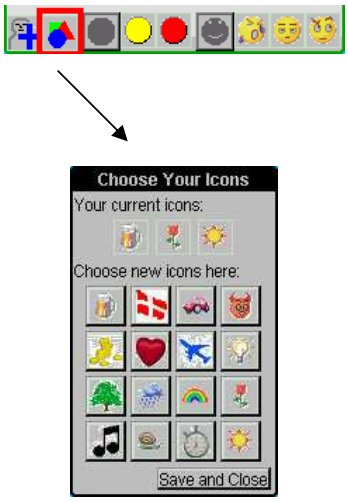

Figure 13. When tapping the personality icon on the main screen, the personality window opens and the user can view and change her icons.

Contacts can also view a user's personality icons by opening her contact window in their iSocialize application. This is shown Figure 14.

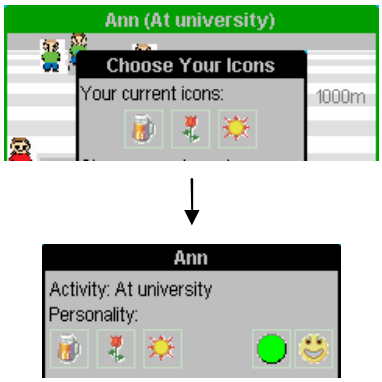

Figure 14. Contacts can view a user's personality icons by opening that user's contact window.

In Figure 14 there is an example of the personality icons of Ann. Her contact can see the same icons that she has currently selected.

Vicinity

The fact that iSocialize is a mobile system influences what information is relevant to have about communication partners. Mobility means that the communicating persons can be practically anywhere and do anything during the communication – they are not fixed on a stationary position. The location of a person can likewise influence the choice of communication media. If people are close by, they might want to meet face-to-face, whereas they might talk on the phone if they are in different cities.

Vicinity is indicated on the main screen by contacts' relative distances to the user. The system knows the exact position of the contacts, but will never convey this knowledge in full to the user due to privacy concerns. Only the distance between a user and her contacts is used. Figure 15 exemplifies the vicinity of contacts at different times.

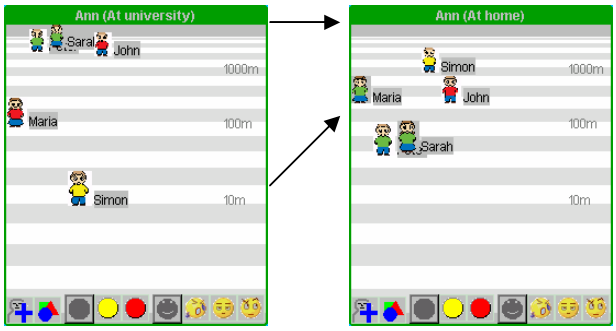

Figure 15. The position of contacts on the main screen changes when people move around - the vicinity is changed. On the left picture, Ann is at university – on the right she is at home.

The screen employs a series of light and dark stripes as well as scaling of the contacts' avatars to create an illusion of depth in the screen and thus convey the vicinity to the user. Notice how the contacts on the bottom part of the screen are bigger (and closer to the user) than the contacts in the top of

the screen. To support the user in estimating the distance to contacts measures of distance are inserted to the right – though not too detailed (see Figure 16).

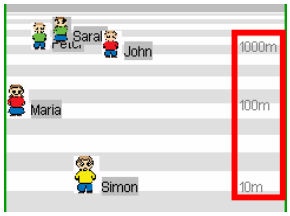

Figure 16. Measures of distance are inserted in the right side of the main screen.

The user's *position* is simply determined by GPS when outdoors. Indoors, the precise position is only available within certain structures where the system has knowledge of the position of wireless access points and thus is able to triangulate its position [4]. A more feasible solution was chosen: Letting the server simulate the localization and giving a set of X/Y coordinates every time it was asked for updates. The horizontal axis bears no significant information.

Vicinity influences, what forms of communication are available to the user. On the contact window for each contact the user have the possibility of initiating contact in different ways: *can you call me?*, *can I call you?* and *can you chat with me?* When a contact is within a certain threshold distance the choice of asking *can we meet?* is also available – see Figure 17. This difference illustrates the fact that meeting physically is only an option when within a certain distance of each other.

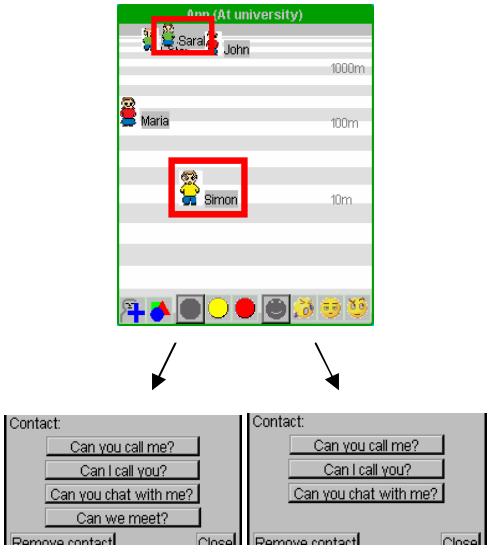

Figure 17. Whether or not a contact is within a threshold determines whether the user can ask to meet him.

The top picture of Figure 17 shows that Ann's contact Simon is close by and the contact Sarah is more than 1 kilometre away. This difference in vicinity means that Ann can choose to ask Simon to meet her, whereas she does not have this choice with Sarah.

Peripheral awareness

The definition of social awareness systems also includes the concept of peripheral awareness. Peripheral awareness means that the users can be aware of other people without spending a lot of mental energy.

Since iSocialize is a mobile system, the user must of course use some mental attention on the system when she wants to be aware of contacts. She cannot be aware of contact through the system without finding the device and looking at it.

The concept of peripheral awareness is implemented in iSocialize by making it simple and easily accessible. By easily accessible is meant that most information about contacts can be accessed by just a glance at the main screen. Without interacting with the system the user can know the distance to any contact, and the availability and mood of them. If the user wants more information about the personality of a contact or whish to communicate with them, she will have to access their contact window. Accessing a contact window does require more attention than glancing at the main screen. Though this was decided to be acceptable since understanding the personality icons and communicating with people also will require more mental attention.

Additional Features

iSocialize contains additional features that have not been introduced yet – including simple structured dialogs for sending messages between users, a login procedure when using a device for the first time, and functionality for adding new contacts.

Sending messages

As mentioned several times the contact window provides the user with the possibility of initiating contact with each contact. When the user taps one of the contact buttons in the contact window, a popup window shows the guiding text of that button, e.g. *Sending a request for a call from Simon*.

The sent request will be visible to the contact in a message window. The message text is determined by the message type – e.g. *call* or *meet* - and thus the user does not have to type in text when sending or answering a message. Depending on the message, there are a number of different buttons to be pressed. They are labelled *Yes*, *Later...* and *No*. When the user chooses either one of the three buttons, the window closes and returns to the main screen. If the user clicks the *Later...* button, a new window opens and lets the user select either one of three values: *10mins*, *30mins* and *2hrs*.

Login procedure
When the application is started for the first time on a new device the user is met by a login screen. From this screen the user can open a login window where the user can login using her 8-digit phone number as id. The window does initially not display a keyboard or any other means of input. One of the Pocket PC features is a pop-up keyboard, which shows up when the user taps the input field. When the user has logged in, the application loads the main window, which presents the information about the user and her contacts.

Adding a new contact
iSocialize lets the user add new contacts. This is especially important when using the system for the first time. The bottom left button of the main screen, which sports a torso profile with a large blue +, is used for opening the *add contact window*. Contacts are added by their 8-digit mobile phone number as id and then showed on the main window.

EVALUATION

The iSocialize system implements the concept of mediated social awareness among friends in a mobile communication device. Therefore an evaluation of the system not only concerns problems with the interface design but also has to provide insight into the concept of social awareness.

During the evaluation some functionality was simulated by an operator at a control centre. More specifically the systems assessment of the user's activity, sensing movement, and as well as the contacts' actions was simulated. This solution was chosen to allow focus on implementing the social awareness features of the system rather that technical features.

Method

The evaluation took place in a state-of-the-art usability evaluation laboratory at Department of Computer Science, Aalborg University, Denmark. It involved 20 evaluation participants, 13 men and 7 women, at an average age of 24 years. All except one were students or former students with background in humanities, arts, teaching, economy, social science, engineering, and computer science. We argue that these are possible users of a system such as the iSocialize and that the evaluation does not focus on the participants' skills in communicating or using computers but on how humans relate to mediated social awareness. Therefore we consider students and young academics part of the target group for the system.

Each evaluation test involved a pair of participants because they would have to engage in interaction with each other in order to examine the contact form. There were five tests with pairs of acquainted participants and five tests with pairs of unacquainted participants. The acquainted pairs were long term friends but neither family members nor colleagues, and none of the pairs were had a romantic relation with each other. The unacquainted participants had never met before, but were shortly introduced to each other just before the test. Thus, the evaluation of the iSocialize system should provide insight to both the form of contact and the influence of an existing social relation between the communicators.

The evaluation tests consisted of two parts where the participants were sitting in separate rooms only connected by the iSocialize system. In the first part of the test the participants were asked to perform some simple tasks using the system in order to familiarize themselves with the system. They were asked to think-aloud during the test. In the second part of the test they were asked to perform a contextual task using a stationary computer while using iSocialize for maintaining social awareness of each other. After the two parts the participants were brought together and a semis-structured interview was conducted covering their experiences with the system and the aspects of social awareness. For a more detailed description of the evaluation of iSocialize we refer to our other paper [2].

Data Collection and Analysis

The tests were recorded by four cameras and the signals were merged onto one video output. This enabled us to conduct a thorough review of the tests and allowed observation of the simultaneous interaction between the participants. 9 hours of video data was analysed from two perspectives: one was with respect to traditional usability problems and the other with respect to interaction and social awareness.

The study of usability problems was conducted in order to gain insight into the design of the system. The video track of each evaluation participant was watched thoroughly and all usability problems were identified and later categorized following the standard of usability testing [22, 13, 27].

Both the evaluation and the interviews were also analysed with respect to the interaction between the participants and the effects of mediated social awareness. All issues were noted and classified in order to structure meaning. The approach resembles a lightweight version of grounded analysis [28] with some of the elements that ensured in-depth understanding and structure of findings.

Findings

The result of the standard usability evaluation was a list of 68 different usability problems of varying severity. They primarily describe problems in the interface design and misinterpretations of the symbols and options. From the 68 problems we identified 30 problems (44%) that were in some sense related to aspects of social awareness.

We classified the 30 problems in two categories. There were 12 of the problems that obstructed social awareness because of problems in the interface, such as the system not announcing changes. The other 18 problems related to how the participants interpreted the information in the system.

These were problems such as misunderstanding the illustration of distance or not understanding the personality icons.

The usability problems is used to support the discussion and the findings from the interviews. Due to the qualitative nature of the interviews we will not report the analysis results here but instead use them in the discussion.

DISCUSSION

The results of the evaluation and the interviews form the foundation for the following discussion of iSocialize and the concept of mediated social awareness. The discussion takes the focus back to the initial concept of social awareness and addresses the purpose of the system. Therefore the following is structured from our definition of mediated social awareness focusing on the aspects of *maintaining a peripheral awareness of the activities and status of communication partners* and the new aspects of relation and vicinity of the communicating partners that we have added.

The first focal point is the expression *to maintain,* which indicates that some relation between communication partners already exists. Of course people in the same room will be socially aware of each other but not on a personal level and there is no point in mediating social awareness between people, whom are not connected by some common factor. Hence an interesting aspect of the iSocialize system is how friends feel connected by using the system.

In itself it is a contradiction to the purpose of a social awareness system to evaluate it using unacquainted pairs of test participants but by constructing the evaluation this way the problem can be illuminated. A standard usability evaluation does not dictate the social relation between test participants and naturally there is a higher cost in time and effort to recruit and execute evaluations with acquainted pairs of participants.

Unacquainted evaluation participants reported that they were missing a social relation with their communication partner in order to interpret the information in the system. The already acquainted reported that they missed practice in using the system and a common understanding of how to interpret the information. These statements are supported by the 18 usability problems concerning how to interpret information in the system. We find that an existing relationship between the test participants is one of the first steps in approaching a natural use setting in a laboratory evaluation. The participants would not engage in the social contact because they had no particular reason to be interested in the other evaluation participant apart from the test situation itself. Therefore they often gave up on interpreting the information in the system because they felt a lack of basis for the interpretation. There may be other problems preventing the participants from engaging in the interpretation of information, such as the lack of common understanding of the symbols, but the existing social relation appears to be the foundation of the contact. The evaluation showed that the users of a system needed the existing relation, or some other sort of context, to build their interpretations upon in order to begin reflection upon the information. 14 of the 18 usability problems concerning interpretation of information was found by unacquainted participants whereas 9 were found by acquainted participants. This suggests that unacquainted participants have more trouble relating to the social awareness information in the iSocialize system than acquainted participants.

The issue of how to represent and interpret information from the system is related to the issue of what information to mediate. We found that it was the changes in the system that the participants found interesting. From the evaluations and the interviews it transpired that the participants were not very interested in using the system to obtain information about a contact. Rather they showed interest in monitoring changes in the system because it indicated that something was happening to their contacts. If they were to assess the situation of a contact they preferred calling or meeting the contact because of the peripheral and superficial nature of the information in iSocialize. A problem with the system was that it did not indicate what had changed since last time the user looked at it. Several cases showed that the participants looked at the system and did not discover any changes even though there were some, which showed in two different usability problems. Clearly they did not remember the information in the system in between the glances at the screen. Therefore we suggest that systems mediating social awareness should focus on illustrating changes in the social context of the contacts rather than a history of situations or exhaustive information about a static situation.

The second part of the social awareness definition is the concept of *peripheral awareness* of communication partners. The evaluation of the iSocialize system proved that it is a challenge to design truly peripheral systems. The problem is that interaction in traditional sense is not peripheral and the information from the system should be presented to the user in an effortless way. As an example the iSocialize system did not implement use of audible feedback, which was a major problem for the evaluation participants. The lack of sound meant that they had to intentionally look at the system in order to be aware of their contacts and thereby the system became non peripheral. For the same reason there was a usability problem (experienced by 12 of the 20 participants) where events mediated by the system were not noticed. Social awareness of other people in a room is effortless because deliberate action is not required in order to stay aware of their activity and status. We found that systems mediating social awareness should focus on developing ways of serving information without requiring the user to shift attention. This is a challenge

because the information can easily become interrupting instead of peripheral, but it can be solved with appropriate use of different modalities – audible, tactile and visual.

The third part of our social awareness definition is the *activity, status, relation* and *vicinity* that is mediated. All evaluation participants state that they would not want information too accurate, e.g. their exact location, to be broadcasted to their friends. It would violate their privacy which is a well known issue when mediating personal information. Imprecise information, such as *I am close to you* or *I am under transport* on the other hand seems to be acceptable to share. The interview participants all stated that they were willing to share some kinds of private information with their friends if gaining the benefits of social contact. The challenge seems to be to choose information to share that does not violate the needs for privacy yet provides the feeling of closeness between people.

The evaluation also showed that imprecise information is no guarantee of privacy between friends. Existing social relations and knowledge of each other makes it possible to guess or register unusual activity. E.g. movement or the vicinity to someone can tell whether the person is where he or she ought to be or not. Without pre-existing knowledge of the other person it seems that information about movement and physical distance is rather imprecise information about an activity. The value of more or less precise means of communicating social information changes depending on the social relations between the communicators. When designing a system mediating social awareness it has to be carefully considered what the users can interpret from the information in the system because it is not obvious.

And now finally we will discuss the term *communication partners* in the definition of social awareness. During the evaluation, we found that the participants requested the ability to be able to distinguish between the recipients of particular bits of information about themselves – they wanted to filter the information they sent as well as received. Interestingly this only showed as one unique usability problem but it was stated in the majority of interviews. We had a hypothesis even before constructing iSocialize that this issue would show up during the evaluation, but we chose to construct the system with the least filtering in order to confront the evaluation participants with the issue. The evaluation thus confirmed our hypothesis and that usability evaluation is useful for confirming user needs rather than exploring their desires.

CONCLUSION

The primary purpose of this research paper has been to illuminate how social awareness can be supported in a mobile communication system. This has been done in four steps. First we surveyed papers on other researchers' social awareness systems in order to better understand the challenges of developing such systems. Secondly we constructed a model of mediating social awareness to illustrate the aspects a mobile social awareness system has to incorporate. Third, we design a system called iSocialize that mediates social awareness between friends, and fourth we conducted a usability evaluation in order to evaluate iSocialize. In this process we gained insight to the aspects of social awareness and design issues of such systems. In the following we summarize the result of each of these steps.

The social awareness systems developed by other researchers revealed three overall characteristics that influence the design of social awareness systems. First we discussed technology characteristics in relation to stationary and mobile technologies. The properties of the setting and location of communication partner are unchanging for users of social awareness systems build on stationary technologies, whereas users of mobile technologies can be anywhere and do anything. Mobility of users is therefore an issue in the design. Secondly we discussed the context of social technology. Social awareness systems can be situated in a private or a work-related context. In a private context social awareness can either be the sole purpose of a system or a contributing factor in other communication. In a work-related context the primary purpose is work-related and social awareness can be utilized to promote this purpose. Thirdly we discussed the social relation between users. Social awareness systems can either be aimed at acquainted users or unacquainted and semi-acquainted users. The social relation of the users determines whether the system can build on these relations where user have a prior interest in communicating or whether they need to create the enticement to communicate.

Based on our insight into the previous designs of social awareness systems we constructed a model of mediating social awareness which incorporated new aspects to the definition of social awareness systems. The original definition speaks of communication partners maintaining peripheral awareness of the activities and status of each other. However our design was situated in a mobile setting and therefore our model added the aspects of existing social relation and vicinity of communication partners alongside activity and status.

At this stage the mobile social awareness system iSocialize was developed. The aspects of mediated social awareness are closely related and can not be looked upon isolated, but roughly they were incorporated in the following way: Activity was conveyed as a text describing what the contact was doing or where she was. Status was incorporated in the shape of icons expressing the availability and mood of contacts. Relation to contacts was reinforced and supported by personality icons which could be interpreted based on the social knowledge that already existed. Vicinity was expressed as the physical distance between the user and each individual contact.

The evaluation showed that unacquainted users had problems interpreting the information in the system because they lack a social relation to their contacts. Acquainted users however missed practise in using the system and missed a common understanding of how to interpret the information. Users showed a tendency to use iSocialize for monitoring changes in the system rather than obtaining the information itself. To no surprise the evaluation also confirmed a need for audible feedback when changes occurred in the system. Without this feedback users needed to constantly look at the system to check for changes and thereby the peripheral aspect of social awareness was disturbed. A need for information not to be too accurate was also identified. Based on the social relation of each other, users could combine imprecise information into more precise knowledge that exceeded their wish for privacy.

REFERENCES

1. Andersen, B. L., Jørgensen, M. L. and Kold, U. "Classifying and Defining Social Awareness Research". In *Supporting Social Awareness in a Family Context*. Department of Computer Science at Aalborg University, January 2005.
2. Andersen, B. L., Jørgensen, M. L. and Kold, U. "Evaluating a Mobile Social Awareness System". In *Design and Evaluation of a Mobile Social Awareness System*. Department of Computer Science at Aalborg University, June 2005.
3. Andersen, B. L., Jørgensen, M. L. and Kold, U. "Illustrating and Understanding Social Awareness in Family Contexts". In *Supporting Social Awareness in a Family Context*. Department of Computer Science at Aalborg University, January 2005.
4. Andersen, B. L., Jørgensen, M. L. and Kold, U. "SocialBoard: A Socially Aware System Supporting Passive Interaction". In *Supporting Social Awareness in a Family Context*. Department of Computer Science at Aalborg University, January 2005.
5. Andreasen, M., Fredborg, A. and Pedersen, R. M. *Challenges in context-aware mobile information systems: A digital shopping assistant*. Department of Computer Science at Aalborg University, 2004.
6. Biegl, M., Gellersen, H-W., Schmidt, A. "MediaCups: Experience with Design and Use of Computer-Augmented Everyday Artefacts". In *Computer Networks, Special Issue on Pervasive Computing*, Elsevier, Vol. 35, No. 4, March 2001, Elsevier, p. 401-409.
7. Berg, S., Taylor, A. S. and Harper, R. "Mobile phones for the next generation: device designs for teenagers". In *Proceedings of the conference on Human factors in computing systems, (CHI 2003)*. ACM Press, 433-440, ISBN: 1-58113-630-7, DOI: http://doi.acm.org/10.1145-/642611.642687.
8. Borovoy, R., Silverman, B., Gorton, T., Notowidigdo, M., Knep, B., Resnick, M. and Klann J. "Folk computing: revisiting oral tradition as a scaffold for co-present communities". In *Proceedings of the SIGCHI conference on Human factors in computing systems, (CHI 2001)*. ACM Press, 466-473, ISBN: 1-58113-327-8, DOI: http://doi.acm.org/10.1145/365024.365316.
9. Brignull, H. and Yvonne Rogers, Y. "Enticing People to Interact with Large Public Displays in Public Spaces". In *Human-Computer Interaction, (INTERACT '03)*. IOS Press (IFIP), 599-606, ISBN: 1-58603-363-8.
10. Brown, B., Sellen, A. J. and Geelhoed, E. "Music Sharing as a Computer Supported Collaborative Application". In *Proceedings of the Seventh European Conference on Computer Supported Cooperative WorkProceedings, (ECSCW 2001)*. Kluwer Academic Publishers, 179-198.
11. Churchill, E. F., Nelson, L., Denoue, L. and Girgensohn, L. "The Plasma Poster Network: Posting Multimedia Content in Public Places". In *Human-Computer Interaction, (INTERACT '03)*. IOS Press (IFIP), 599-606, ISBN: 1-58603-363-8.
12. Counts, S. and Fellheimer, E. "Supporting social presence through lightweight photo sharing on and off the desktop". In *Proceedings of the 2004 conference on Human factors in computing systems, (CHI 2004)*. ACM Press, 599-606, ISBN: 1-58113-702-8, DOI: http://doi.acm.org/10.1145/985692.985768.
13. Dix, A., Finlay, J., Abowd, G. D. and Beatle, R. *Human-Computer Interaction*. Pearson 2004, Third edition, ISBN: 0130-461091.
14. Esbjörnsson, M., Juhlin, O. and Östergren, M. "Motorcyclists Using Hocman - Field Trials on Mobile Interaction". In *Human-Computer Interaction with Mobile Devices and Services, (MobileHCI 2003)*. Springer-Verlag Heidelberg, 32-44, ISBN: 3-540-40821-5, DOI: http://dx.doi.org/10.1007/b12029.
15. Esbjörnsson, M., Juhlin, O. and Östergren, M. "Traffic encounters and Hocman: Associating motorcycle ethnography with design". In *Personal and Ubiquitous Computing, Vol. 8, No. 2*. Springer-Verlag London Ltd 2004, 92-99, DOI: http://dx.doi.org/10.1007/s00779-004-0260-4.
16. Fogarty, J., Hudson, S.E., Lai, J. "Examining the robustness of sensor-based statistical models of human interruptibility". In *Proceedings of the SIGCHI Conference on Human factors in computing systems (CHI'04)*. 207-214. ACM Press, New York. ISBN: 1-58113-702-8. DOI: http://doi.acm.org/10.1145/985692.985719.
17. Fogarty, J., Hudson, S.E., Atkeson, C.G., Avrahami, D., Forlizzi, J., Kiesler, S., Lee, J.C., Yang, J. "Predicting human interruptibility with sensors". In *ACM*

Transactions on Human-Computer Interaction (TOCHI), Vol. 12, Issue 1, March 2005. 119-146. ACM Press, New York. ISSN: 1073-0516. DOI: http://doi-.acm.org/10.1145/1057237.1057243.

18. Hindus, D., Mainwaring, S. D., Leduc, N., Hagström, A. E. and Bayley, O. "Casablanca: designing social communication devices for the home". In *Proceedings of the SIGCHI conference on Human factors in computing systems, (CHI 2001)*. ACM Press, 325-332, ISBN: 1-58113-327-8, DOI: http://doi.acm.org/-10.1145/365024.383749.

19. Hudson, S., Fogerty, J, Atkeson, C., Avrahami, D., Forlizzi, J., Kiesler, S., Lee, J., Yang, J. "Modeling User Behavior: Predicting Human Interruptibility with Sensors: A Wizard of Oz feasibility study". In *Proceedings of the SIGCHI conference on Human factors in computing systems (CHI'03),* 257-264. ACM Press, New York. ISBN: 1-58113-630-7. DOI: http://doi.acm.org/10.1145/642611.642657

20. Kaliouby, R.E, Robinson, P., "FAIM: integrating automated facial affect analysis in instant messaging". In *Proceedings of the 9th international conference on Intelligent user interface (IUI'04)*. ACM Press, 244-246.

21. Ling, R. *The Mobile Connection: The Cell Phone's Impact On society*. Morgan Kaufmann Publishers 2004, ISBN: 1-55860-936-9.

22. Molich, R. *Brugervenlige edb-systemer*. Ingeniøren | bøger, 2. edition, 2000, ISBN: 87-571-1647-4.

23. O'Connor, M., Cosley, D., Konstan, J. A. and Riedl, J. "PolyLens: A Recommender System for Groups of Users". In *Proceedings of the Seventh European Conference on Computer Supported Cooperative WorkProceedings, (ECSCW 2001)*. Kluwer Academic Publishers, 199-218.

24. Pousman, Z., Iachello, G., Fithian, R., Moghazy, J. and Stasko, J. "Design iterations for a location-aware event planner". In *Personal and Ubiquitous Computing, Vol. 8, No. 2*. Springer-Verlag London Ltd 2004, 117-125, DOI: http://dx.doi.org/10.1007/s00779-004-0266-y.

25. Rivera, K., Cooke, N.J., Bauhs, J.A., "The Effects of Emotional Icons on Remote Communication". In *Conference companion on Human factors in computing systems: common ground (CHI '96)*. ACM Press, 99-100.

26. Schmidt, A., Stuhr, T. and Gellersen, H. "Context-Phonebook - Extending Mobile Phone Applications with Context". In *Proceedings of Mobile HCI 2001: Third International Workshop on Human Computer Interaction with Mobile Devices*. 1-6, http://www.cis-.strath.ac.uk/~mdd/mobilehci01/procs/.

27. Shneiderman, B. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. 1998, Addison Wesley, ISBN: 0-201-69497-2.

28. Strauss, A. and Corbin, J. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 2nd edition, Sage Publications 1998, ISBN: 0-8039-5940-0.

29. Van Baren, J., Romero, N., Markopoulos, P., Ijsselstein, W. Farschian, B. and de Ruyter, B. *Deliverable 1: ASTRA Scenario and Research Contribution*. November 2003, http://www.presence-research.org/Astra/deliver-ables/Deliverable1.v3.pdf.

30. Wikipedia, *Commedia dell'arte*, June 2005, http://en.wikipedia.org/wiki/Commedia_dell%27arte.

Appendix 3 – Research Paper 2

Evaluating a Mobile Social Awareness System

Evaluating a Mobile Social Awareness System

Berith Lundgaard Andersen, Martin Lindholdt Jørgensen and Ulrik Kold
Aalborg University,
Department of Computer Science,
Fredrik Bajers Vej 7E,
DK-9220 Aalborg Ø.
{berith, martin, kold}@cs.aau.dk

ABSTRACT
This paper examines evaluation of mobile social awareness systems. We do this by evaluating iSocialize – a mobile system constructed to mediate social awareness in a non-work-related context. We examine how evaluations of similar systems have been conducted and categorise the results of this examination. We distinguish between the system's level of functionality as well as the purpose of the evaluation. To evaluate the prototype we set up a laboratory usability evaluation with 20 evaluation participants with acquainted and unacquainted pairs of participants. Each test involved two participants interacting by using the system which allowed insight to their awareness of each other. We then analysed the results with respect to both usability problems and social awareness issues. The evaluation showed that standard usability problems influence the level of social awareness. Unacquainted participants tend to find other types of problems than acquainted but they do not differ in numbers. We conclude that the two types of participants have each their qualities when evaluating social awareness systems.

Keywords
Social awareness, mobile systems, evaluation, usability study, comparison study.

INTRODUCTION

The primary purpose of this paper concerns how a mobile social awareness system can be evaluated. Social awareness systems are computer mediated communication systems that aim to support connected parties to maintain a peripheral awareness of the activities of and status of their communication partners [1], and social awareness concerns maintaining a peripheral awareness of the activities and status of communication partners [1].

The emerging of socially related technologies e.g. [16,20, 27] requires the HCI community to search for appropriate methods for testing these systems, because they are different from work-related systems. We therefore find it essential to explore how laboratory settings that facilitate evaluation of social awareness in mobile communication systems can be created.

The social awareness system used in our evaluation mediates contact between communication partners and therefore relies on existing relations between the communication partners. This raises the question of how existing personal relations among the evaluation participants affect the produced results.

We address the above issues by exploring ways of creating laboratory evaluations of a mobile communication system prototype build to mediate social awareness. Section 2 outlines the background for the study drawing on examples from existing research on evaluation of social awareness applications. In this sections are also the challenges we see in evaluating social awareness systems. Section 3 presents the method behind the study describing how evaluations were set up and carried out. The section also contains a description of the case we use for evaluation. Section 4 highlights the key results of the study, and finally section 5 discusses the results and their potential implications and limitations for the HCI-community.

BACKGROUND

Before presenting our evaluation method, we discuss issues related to evaluating social software. First, how software systems traditionally have been evaluated and what the challenges from different types of systems are to these methods. Secondly, how evaluations of social awareness systems have been conducted. Thirdly, what the challenges of evaluating social awareness systems are.

Software Evaluation Metrics

When evaluating software systems we traditionally speak of laboratory-based evaluations[13,28], which are measured either in accordance to ISO standards e.g. [17,19] or usability problems e.g. [23].

The ISO standard use three different metrics: *Effectiveness,* which relates to the accuracy and completeness with which users achieve certain goals. Measures of effectiveness are quality of solution and error rates. Secondly, the *efficiency* is the relation between effectiveness and resources spend to achieve them. Measures of efficiency can be completion time and learning time. And finally *satisfaction* relates to

the users' positive attitude towards the system. This can be measured by attitude rating scales.

Usability problems are identified by users performing meaningful tasks using the system. After identifying the problems the researchers categorize them in accordance to their severity: *critical*, *serious* or *cosmetic*. Critical problems are so severe that they need to be fixed before release of the system. Serious problems should be fixed before next release and cosmetic ones should be fixed when convenient.

The abovementioned metrics are of great use when evaluating systems that have clear cut productive goals and are designed to make work processes more efficient and effective. The metrics are challenged when evaluating systems such as *mobile systems*, *games* and *social awareness systems*. We can still talk about ISO standards or usability problems, but it is not adequate when evaluating such systems. Mobile systems, games and social awareness systems each pose their own challenges for these evaluation methods. In the following we will present these challenges and what is done to meet them.

As the name states, mobile systems adds the challenge of mobility to the evaluation. Use of mobile systems is typically closely related to activities in their physical surroundings and they often have highly specialized use contexts [22]. The evaluation of mobile systems and which methods to use, is continually being discussed. Many researchers are inclined to believe that mobility requires evaluations in the field, whereas others argue for the use of laboratory-based evaluations. A fact is that research into this question shows that most evaluations are laboratory-based [21].

Game evaluation is another area where ISO standards and usability problems are inadequate measures. The challenge here is that the goal of games is not to aid productivity but to entertain. If a game is successful, it leads to a loss of time, rather than a gain [16] - and instead of being easy to learn, use and master, games should be easy to learn, and difficult to master [12]. Usability testing can be relevant for evaluating the interface, but not for evaluation of the core purpose of the game. Such evaluations must be based in investigating the entertainment value of a game. Some researchers suggest that heuristic evaluations and heuristic walkthroughs can be used for evaluation of games [12,16].

Evaluations of social awareness systems also possess a challenge to ISO standards and usability evaluations because these systems deal with non-work-related success criteria, which the ISO metrics and usability problem severity scale do not consider. Social awareness systems are related to maintaining or creating relations between people, and to the user's context.

Evaluating Social Awareness Systems

As the users of social awareness systems already have prior knowledge and established relations, one problem of evaluating these systems, is how the relations and the knowledge influence the users' ability to understand the information in the systems. Another problem is whether that information is interesting – does it make any sense to the users. How the challenge of evaluating social awareness systems is met will be presented and discussed in this section.

We identified two approaches when we categorised how other researchers have met the challenge of evaluating their social awareness systems: by *level of functionality* and by *purpose of evaluation*.

The first approach, relates to how the level of functionality influences the choice of evaluation method. Whereas the second approach to evaluation of social awareness systems examines the evaluations that have the purpose of evaluating aspects of social awareness.

Level of Functionality

The functionality level of a system plays an important role in the choice of evaluation method and metrics. Although different evaluations try to evaluate the same things, the level of functionality sets limits to which methods and metrics can be used – the higher degree of functionality the less control is needed. In the following we will give an overview and then exemplify in more details evaluations of social awareness systems with different levels of functionality.

Concerning the level of functionality we can generally say that the need for control strongly influences the choice of evaluation method. Systems that are still early prototypes or concepts are evaluated in a controlled setting because there is a need for guidance and control of boundaries. These evaluations mainly relate to the validation of concepts and design ideas. Partially functional systems can be and often are evaluated in the field but there is still need for some control. These evaluations relates to both the qualities and shortcomings of the system, and to usability issues. Fully functional systems are evaluated through deployment in the field. They can be evaluated in relations to long-term impact and attitudes towards the system or in relation to verification of a concept.

First we discuss evaluations in the early stages of development. When evaluating a system still at this stage, there is limited choice of evaluation method and metrics. Since the system might still only be on paper – in the form of a description or a paper prototype – it can not be deployed for use in the field. Instead interviews and focus groups are often used for evaluating concepts and design ideas [20,27] and this may be supplemented with interaction trials with simple prototypes [6].

The Casablanca project [20] is an example of early designs where focus groups were used to evaluate and to compare different design ideas. Based on the research team's own experiences and a study of consumers, homes and communications they came up with four design ideas for systems for homes. Two ideas were awareness-related concepts, one explored audio based on the limits of telephony, and the other was to ease communication. The focus groups rated and gave feedback on the ideas based on descriptions and sketches. The feedback was in the form of design suggestions for and uses of the systems, but also privacy and control issues were raised. Based on the evaluation, the researchers were able to select and redesign two ideas, but more importantly they were able to formulate a set of guidelines to be considered when designing for homes.

Secondly we discuss systems that are partially functional. The evaluations often have a double purpose: On one hand evaluating the qualities and shortcomings of the concept and design and on the other hand evaluating the design with respect to the ISO and usability metrics. The Hocman system [14,15] and the location-aware event planner [30] are examples of such evaluations. Both systems were evaluated first in a controlled field study since this is the closest to a natural setting and secondly through interviews. The results of the Hocman evaluation were improvements and suggestions for new designs, attitude towards the system, use situations and relevant information to be displayed in the system. Based in the results of the evaluation of the location-aware event planner the researchers were able to assess the efficiency, understandability and end-user satisfaction with the application.

To be discussed last are systems that are fully functional. Evaluations of such systems usually take the form of field studies. These are expensive because they take time and manpower, but they can be used for evaluation of issues which can not or are difficult to evaluate otherwise. They can evaluate the impact of or the attitude towards the system over time [10,25] or evaluate the concept that the system is designed to support or explore [8,9,11]. PolyLens [25] was evaluated on the impact of and the attitude towards the system over time. The evaluation was conducted over a period of nine months, where the researchers logged the user, group, and time when users created groups, joined groups, and made recommendation requests. Based on the logs the researchers gained insight into how groups were formed and used, how groups affected the way users used the system, user satisfaction and privacy concerns. The Opinionizer system [9] explored how people socialize around large displays, and how to entice people to interact with these displays. The evaluation consisted of two short studies in the field where users were observed, and sometimes interviewed and filmed. The researchers gained data on how people move around and interact with public displays. Based on this data they made a framework from which to draw implication for designing interactive public displays.

Purpose of Evaluation

The purpose of an evaluation of any kind of system naturally influences the choice of evaluation method - hence we have different methods. Likewise with social awareness systems. Most evaluation methods and metrics are aimed at work-related aspects such as efficiency, effectiveness, easy-to-remember, easy-to-master and the likes. As we have argued in our introduction these are not appropriate metrics when dealing with social systems.

Many social awareness systems are not evaluated in relation to social awareness, or social awareness is only of little interest. Yet in some evaluations it has significant influence on the system. Most of these evaluations use qualitative techniques and only few uses quantitative to evaluate social awareness.

Common for all the evaluations that relates to the definition of social awareness systems is, that there are few of them, and that they are conducted with systems that are partially or fully functional. The latter is probably due to the fact that the participants in the evaluation needs insight into the use of the system in order to evaluated aspects of social awareness.

In the following we will outline the similarities of the evaluations that deal with aspects of social awareness and give examples of different approaches.

First we discuss the evaluations that use qualitative techniques – e.g. [10,11,14,15]. These evaluations use some kind of interview technique to evaluate on social awareness aspects of the systems. The systems are aimed at both acquainted [11], semi-acquainted [10] and unacquainted users [14,15]. First the participants in the evaluation have conducted a field trial of a partially [14,15] or fully functional system [10,11] to understand its purpose. Then they are interviewed to gain insight into whether they got to know more about the other participants by using the system. The Flipper system [11] was evaluated in relations to whether acquainted people would share more pictures and feel more present in each other lives when using this system. Groups of four friends or family members tested Flipper during a two-week exercise. Prior to the evaluation and after each week the participants filled out questionnaires concerning their relationship to the other group members. The first week the groups used Flipper and the following week the groups shared photos in their usual fashion – through e-mail or mms. The evaluation was then closed by a roundtable discussion on the system and the impact of it. Through this evaluation the researcher found that people shared more pictures and through this felt they knew more about each others lives.

Secondly, evaluations that use quantitative techniques for evaluating social awareness aspects of the system are discussed. We have only identified one study, where quantitative methods were used for this purpose, namely the evaluation of i-ball [8]. This system tried to support co-present community building and was evaluated through a three week trial in a public school. Although informal talks and observation were used, the primary means of evaluation was logging of the spreading and mutation patterns of i-balls between people. The i-balls were designed to entice people to interact with people they didn't know, in order to find people they could pass them on to. The logs made it possible for the researchers to gain insight into how fast and between whom the i-balls were passed. The evaluation could not reveal whether the exchange of information between people had lasting effects on community building. But it showed that the system had the ability to make unacquainted people interact.

The analysis of how social awareness systems have been evaluated is concluded here by pointing out, that in general the need for control strongly influences the choice of evaluation method. Furthermore the majority of the evaluations that deals with social awareness aspects use qualitative techniques.

Challenges of Evaluating Social Awareness Systems

Based on the evaluations of social awareness systems conducted by other researchers and question in relations to the design of our case we have identified three challenges for our evaluation of a social awareness system.

- *Do people want to be socially aware?* Any social awareness system is designed in order for the user to be socially aware in a certain way. The question is whether users want to share the incorporated kind of information.
- *Can social awareness be evaluated during a one-hour evaluation session?* Previous evaluations of social awareness studies primarily use field evaluation and interviews for evaluating the aspects of social awareness. Can we use a laboratory-based evaluation to evaluate social awareness?
- *Do the existing social relations of acquainted evaluation participants play a role when evaluating social awareness systems?* Is it worth the hassle to find acquainted evaluation participants to test social awareness systems or is it just as useful to use random, unacquainted participants?

These challenges are the basis for constructing a method of evaluating a social awareness system. This method will be described in the following along with the social awareness system to be evaluated.

EXPERIMENTAL METHOD

As mentioned in the background section there is several challenges to evaluating a mobile system that mediates social awareness. There is a need for more information than merely usability problems and ISO standards because the use of this kind of systems is not driven by efficiency concerns. The use experience must be taken into account in order to gain insight to the usefulness of technology mediating social awareness.

Rating user satisfaction as a part of a usability evaluation may provide valuable insight but there are uncertainties that make the results questionable. Do the users have a realistic understanding of how the system would be used in the daily life based on a usability evaluation? Are the users able to evaluate mediated social awareness of a friend in a simulation? And what influence do the existing relations have on an evaluation?

To address the abovementioned issues we started out by developing a social awareness system called iSocialize that mediates social awareness between friends. iSocialize then served as a case for the evaluation of a social awareness system. We conducted two different evaluations of iSocialize. The focus of the evaluations was to enrich the traditional laboratory usability evaluation and to gain insight into how a system can mediate social awareness.

The iSocialize system will be described in the following section and hereafter the two evaluations will be presented.

Case: iSocialize – a Mobile Social Awareness System

We built a mobile social awareness system called iSocialize that allowed friends to maintain social awareness of each other by monitoring the information about contacts in the system. The system was constructed to raise questions about the means and form of contact and to let the evaluation participants discuss their attitude towards mediated social awareness. iSocialize will be described briefly in the following. For a more thorough description of iSocialize, please refer to Andersen et al. [4].

Platform

iSocialize is built as a mobile client/server application. The intended hardware platform is a smartphone with all the capabilities of a mobile phone including calendar, address book, and messaging abilities. The prototype was tested on two handheld *Hewlett-Packard iPAQ Pocket PC h1940* PDA's running *Microsoft Mobile 2003 for Pocket PC* connected to an IEEE 802.11b/g wireless TCP/IP network. The PDA's were equipped with a Java-like application platform called *SuperWaba*, on which iSocialize was implemented.

Interface Design

iSocialize implements a series of windows to let the user interact with her friends - called *contacts*. Information about each user is available through the system – some information is manually set by each user, other information is automatically set by the system. The user manually selects her current *mood* and *availability* status as well as a

set of icons to represent her present mental state denoted *personality*. iSocialize is able to automatically determine the user's current activity and *position,* and this along with the manually set information is conveyed to herself and her contacts. Herein lays the social awareness aspect of the system.

The left picture of Figure 1 shows the primary screen of iSocialize: the *main screen*. It gives a quick overview of the contacts, their availability, mood and *vicinity* (distance to the user calculated using their positions).

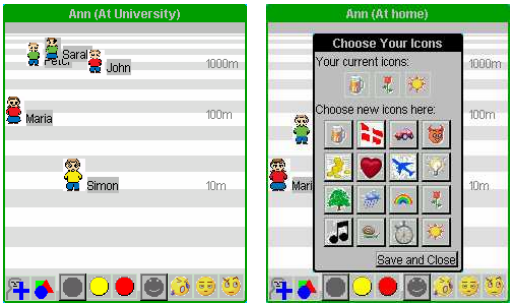

Figure 1. To the left is shown Ann's main screen containing five contacts. To the right is her personality window.

The user's availability and the distance to her contacts influence the system's interface. When contacts are farther away than a certain threshold value, only a selection of the contact buttons are shown, and likewise are the avatars scaled down and placed closer to the top of the screen. To select her availability or mood the user can click the icons in the lower icon bar. The user can see the currently chosen personality icons in the window shown in Figure 1 to the right.

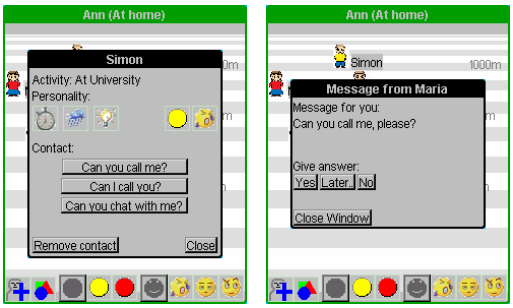

Figure 2. The left picture shows the contact window containing Simon's details. The right picture shows a message for Ann from Maria.

The main screen does not show the contacts' personality icons and their activity. To see them the user has to click one of the avatars on the main screen. The *contact window* will then show more details of the selected contact. The contact window can be seen in the left picture of Figure 2. The contact Simon has chosen to be *available*, *if it's important* and therefore the contact buttons in the bottom of the window are active and enabled, to let his contacts initiate contact with him.

The users have the possibility of sending each other small, pre-determined messages in order to figure out more details about the availability of each other and to initiate contact. For this, they can use the buttons presented above in the left picture of Figure 2. The buttons send a message to another user's PDA, which will then show up as seen in the right picture of Figure 2. The receiving user then has a chance to take action accordingly.

Laboratory experiments

When comparing usability evaluation methods, it is important to ensure comparability of the results [18] – not only to be able to compare the methods to each other but also to compare the methods to reality, meaning the actual amount of usability problems in a system. The purpose of our work is not to compare usability evaluation methods, but to investigate how to gain qualitative insight to mediation of social awareness by using a standard usability evaluation method. Therefore it is of less importance to standardize the found usability problems or calculate comparison values such as *validity*, *thoroughness*, and *efficiency* of the methods. What we learned from comparison studies of usability evaluation methods is that some conditions apply to the evaluations in order to derive valid conclusions. The evaluations must fundamentally build on the exact same conditions and only differ in one aspect. This way we attempted to isolate the effect of that particular aspect which enabled us to investigate it with regards to evaluation of mediated social awareness.

Based on previous work [3] and experiences from existing research on evaluating social awareness this paper focuses on the social relations of the evaluation participants. The iSocialize system was meant to be used for communication among friends that know each other, hence having existing social relations. We denote this that the users are *acquainted* or *unacquainted* depending on whether a prior social relation exists. The two evaluations focused on how acquaintedness among the users affected the insight to the aspects of mediated social awareness. Therefore both evaluations were standard laboratory usability evaluations involving the same set of tasks and involved interaction between two evaluation participants. The difference between the evaluations was the existing relationship between the participants in each test. As a consequence of this, the authenticity of the information mediated by the prototype would differ as well.

The following text describes first the specific setup of the two different methods (*test participants* and *procedure*) and then the general setup that concerns both methods (*procedure*, *laboratory setting, data collection,* and *technical setup*) before the data analysis is explained.

Method 1: Acquainted Participants

When two people use a communication device the relationship between the users has great influence on the form of interaction. Therefore we argue that it is appropriate to evaluate a social awareness system with users that are acquainted using information in the system that reflects their reality. We conducted 5 tests using this method.

Test Participants

The participants of these five tests were all pairs of people that knew each other well. Their relationship was required to be a long-term personal friendship but not professional nor romantic. During the evaluation they were asked to act as themselves. In this evaluation participated 5 males and 5 females at an average age of 24 years. They were all students or possessed an academic degree with background in humanities, arts, teaching, social science, engineering, and computer science. Four of them stated their prior experience with handheld computers to be above average as they owned or had owned such a device. The rest had little experience. They all used electronic devices daily for keeping in touch with their friends and all except one were regular users of instant messaging systems. Two of them stated that they were always online in this regard.

Procedure

Since the tests simulated contact with actual friends of the participants the information in the prototype had to resemble a natural situation. Therefore the participants were asked to answer a series of questions about three of their close personal friends before the actual test. These questions can be viewed in the Appendix of [2][1]. This information was used to set the preferences of the contacts in the prototype and make the information in the prototype resemble their real life. This way the participants might recognize and relate the information to their existing knowledge of their friends, thus better simulating natural use the iSocialize system.

Method 2: Unacquainted Participants

Since it time-consuming to locate acquainted participants for a evaluation study and to interview them to get authentic data we conducted five test using unacquainted participants. This method was chosen in order to illuminate the possibilities and limits of unacquainted participants.

Test Participants

In each test a pair of participants participated at the same time but in these five tests the participants were unacquainted. They did not know each other before the test and the pairs were chosen randomly. They were introduced to each other before the evaluation and asked to act as themselves during the session. In the setup for this method the participants had to imagine knowing each other and the other contacts in the system. 8 males and two females at an average age of 24 years participated. All, but one, were students or academics with background in humanities, social science, economy, engineering, and computer science. Only one rated himself to be an experienced user of handheld computers, the rest were new to the technology. They all used electronic devices daily for keeping in touch with their friends and all except two were regular users of instant messaging systems. One of them stated to be online as much as possible.

Procedure

As a consequence of picking random evaluations participants the information accessible in the prototype were fictional and created by the research team. There had to be a certain amount of contacts in the system and the settings and preferences of these were simulated by an operator during the test. These data were prepared before the individual tests.

General Setup

This part describes the generic setup that applies to both methods.

Procedure

Each test consisted of two parts. After a short oral introduction to iSocialize and the test situation, the participants were given a written set of tasks to carry out with the system. This was the first part of the test and allowed the participant to explore the prototype. The purpose was to introduce the prototype to the participant and uncover basic usability problems. A task could for example be: *the system shows the mood of the user, try to set your mood to sad, then tired and finally happy* or *use the system to decide whether it is okay to call one of your friends right now*.

After this first part of the test and before the second the participants were asked to describe a contact in the system with and without support from the system.

The second part attempted to create a natural situation setting for using the prototype, thereby allowing the participant to get a feeling of natural use. During this part of the evaluation, the participants were asked to perform a contextual task on the present stationary computer while using the prototype for maintaining social awareness of the contacts in the system. During this part of the test the operator would simulate a few events in the system for the participants to experience, e.g. a contact going home from work and another changing availability. One of the participants would during the test be asked to get a cop of coffee in a nearby lunch room while the prototype would allow the other participant to monitor this actions.

[1] The Appendix of [2] is written in Danish since this was the language of the evaluation.

After the test, the participants were brought together and a semi-structured interview was conducted. The focus of the interview was on the participants' experiences with the system and their attitude towards mediated social awareness. The interview allowed the participants to elaborate on their experience and comment on the system and the concept.

The material produced in relation to the activities described here can be viewed in the Appendix of [2].

Laboratory Setting

The evaluations took place in a state-of-the-art usability evaluation laboratory at Department of Computer Science, Aalborg University. The laboratory is built as two evaluation rooms and a control room (see Figure 3). From the control room both evluation rooms could be surveyed through one-way mirrors and by means of remotely controlled cameras mounted in the ceiling. From each evaluation room, it was not possible to look into any other room. For the evaluations each room was equipped with a stationary computer connected to the Internet and a PDA on which iSocialize was installed.

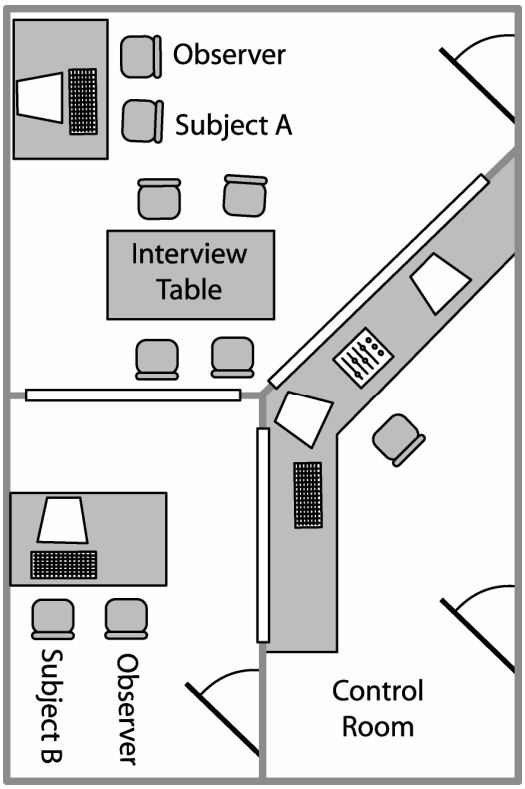

Figure 3: An overview of the usability lab.

Each test involved five people at the time: two evaluation participants, two researchers acting as observers and one researcher in the control room. The participants were seated in each their evaluation room, accompanied by each their observer who asked clarifying questions and encouraged the participants to think-aloud. The third researcher was operating the control room and the simulation of actions in the prototype.

Data Collection

High quality audio and video from two cameras in each evaluation room was recorded digitally. The signals were merged into one picture (see Figure 4), but the sounds from the two rooms were separated in order to allow focus on one participant at the time during the analysis. After each test the participants were interviewed together in the larger evaluation room while being recorded on video.

Figure 4: Screenshot of the video data.

Technical Setup

The technical setup for the experiment included an Apache web server to serve the PDA applications with the requested data, and a wireless access point to allow the PDA's to connect to the WLAN on which the server was setup. iSocialize ran sequentially on two PDA's to allow test participants to interact with each other. The contextual sensing functionalities were implemented through a control centre. This centre was operated by a member of the research team. From here, the user's movement and activities could be triggered, and interaction with other contacts could be simulated. This was chosen to allow the research team to focus on evaluation and social awareness aspects rather than technical issues. For discussions on how to give mobile applications a contextual sense see [5,7,26].

Data Analysis

A total of 9 hours video recordings were analysed during two sessions with different focal points. One was to create a list of usability problems based on the two experimental settings and the other compared the insight to mediation of social awareness provided by the two methods.

The order in which the tests were analyzed was randomly chosen. The video data from the tests was analyzed using

pairs reviewing and listing the problems and findings. Both failures and successes was noted and treated in the analysis because the aim was not only efficiency and problem correction but also insight to the concept of mediated social awareness.

The tests were also reviewed with focus on cooperation issues and mediation of *actions*, *status*, *relations* and *vicinity*. The interviews were reviewed and all issues were noted and classified in order to structure the meaning. This approach resembles a lightweight version of grounded analysis [29]. The notes were then revised, sorted, merged, and categorised into more general categories or descriptions of problems or situations. This process was repeated until a qualitatively meaningful ordering and categorisation was reached. The arguments from the participants were used for motivating the results and in the discussion.

To facilitate the overview and insight to the results of the two evaluations, the notes and findings from the video reviews were plotted into spreadsheets. This way calculations and comparisons could be made.

FINDINGS

This section presents the findings of the evaluation of iSocialize – they will be discussed in the next section. The findings are split in relations to usability and social awareness issues. The findings are also distributed on the relations of acquainted respectively the unacquainted evaluation participants as this is the distinction we made in the methods.

Usability Problems

The usability evaluation revealed a total of 68 different problems. The distribution of these problems in relation to severity can be seen in Figure 5. The distribution of severity over the 68 different usability problems shows, that there were 3 different critical problems (4.41%), 19 different serious problems (27.94%), and 46 different cosmetic problems (67.64%). Each of these problems was reported by at least one of the evaluation participants.

Figure 5 and Table 1 show the distribution of usability problems related to the relation of the evaluation participants. The figures show a completely even distribution of critical problems (2 and 2 critical problems), an almost even distribution of cosmetic problems (31 and 30 cosmetic problems), and the biggest inequality in the distribution of serious problems (14 and 17 serious problems).

	Acquainted	Unacquainted
Critical	2	2
Serious	14	17
Cosmetic	31	30

Table 1: The distribution of usability problems shown in relation to their severity and the relation between participants.

What Figure 5 and Table 1 do not show is that 31 of the 68 identified problems were unique – meaning only one participant experienced this problem. Compared to the fact the 28 problems were identified by both acquainted and unacquainted participants leave 9 problems that were found by either acquainted or unacquainted participants.

Among the unique problems were two critical. One occurred when the researchers had set up the system wrongly and a participant therefore did not have any contacts. The other occurred when a participant had a contact bearing the same name as the participant. This lead the participant to believe she saw herself.

Among the 68 different problems we identified 30 problems that had influence on a participant's experience of being socially aware with the contacts. 12 of these problems were problems with the interface that somehow obstructed the experience of social awareness. Examples of this are that some participants were frustrated that they had to click on a user avatar to read the activity or that the face of the avatar was hard to read when the contact was far away. The other 18 problems were related to the interpretation of symbols or information in the system. Examples of these problems are that the participant did not understand what an icon chosen by a contact meant or that the participant did not relate the setting of availability with the colour of the avatar. Thus 44% of the usability problems found were related to or had influence on the mediation of social awareness.

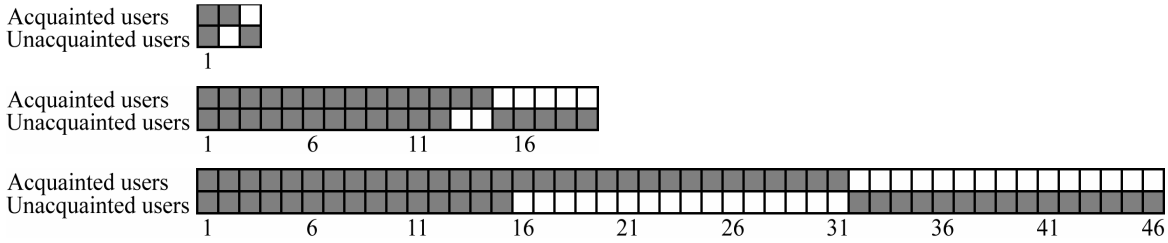

Figure 5: The distribution of usability problems. The top bar describes distribution of critical problems (a total of 3). The middle bar describes the serious problems (a total of 19), and the bottom bar describes the cosmetic problems (a total of 46).

Of these 30 (44%) usability problems 13 were found by both acquainted and unacquainted participants. 5 of the

problems were only found by the acquainted participants and 12 of the problems were only identified by the unacquainted pairs.

Interaction Issues

Some results of the qualitative analysis of the interaction between the evaluation participants are described in the following. Table 2 shows the distribution of successive, neutral, and failed interactions between acquainted or unacquainted participants and the operator or the other participant. A success was noted when a test clearly involved social awareness of contacts based on the statements of the participants during the test. A failure was noted when they stated that they could not understand what was happening and neutral means that no comments were made.

	Acq.			Unacq.		
	Succ.	Neut.	Fail.	Succ.	Neut.	Fail.
Interact w/ partner	9	1	0	5	1	4
Interact w/ operator	9	1	0	10	0	0

Table 2: The distribution of interaction between test participants, including the operator stand-in for contacts.

The majority of the evaluations (19 out of 20) resulted in some form of meaningful interaction between the evaluation operator and the evaluation participants. 9 out of 10 tests with acquainted participants contained meaningful interaction between acquainted communication partners, and 5 out of 10 unacquainted partners had successful interaction. This category also showed the biggest failures of interaction between communication partners with 4 out of 10 cases.

This was a summary of the quantifiable findings of the evaluations of iSocialize. The result from the analysis of the interviews is used in the following section where we discuss the findings and the method of evaluating social awareness systems.

DISCUSSION

This discussion has 2 points: First discussing the impact of participants' social relations on finding usability problems and second finding problems related to the concept of social awareness.

When it comes to general identification and classification of usability problems, no major differences were found between acquainted and unacquainted participants. Practically the same number of problems was found by acquainted and unacquainted participants and the severity distribution was also similar (see Table 1). We could not conclude that either acquainted or unacquainted participants were better at finding usability problems in the system from an overall perspective. Therefore it might not be worth the effort recruiting acquainted pairs of participants if the focus is merely on the usability aspects.

However, we also identified a group of 30 usability problems that related to aspects of social awareness. 25 of these were found by unacquainted pairs of participants and 18 were found by acquainted pairs. This suggests that the unacquainted participants find it harder to interpret and use the system for maintaining social awareness with each other and therefore experience more problems. This would imply that unacquainted evaluation participants find some problems that are false in the sense that they would not occur if they had existing social relation to their contacts. We argue that a possible explanation for this is that the participants who have no preceding relation to the information in the system have a stronger incentive to verbally express their confusion about the presented information. This argument is supported by various previous research into the think-aloud evaluation [e.g. 24], which states that there is a difference between what participants say and what they are thinking.

Furthermore we found indication of other advantages of acquainted participants. When it comes to design elements such as personality icons, the analysis of acquainted participants were able to dig deeper into conceptual problems. With personality icons both acquainted and unacquainted participants had problems understanding their meaning and purpose. When unacquainted participants explained their difficulties they argued that they did not know their contacts and therefore did not know what they meant by using specific icons. However when acquainted participants, who knew their contacts, met the same problem, we found that they argued that they needed to create and adopt a general consensus concerning the meaning of different icons. Thus we argue that using solely unacquainted participants would leave the evaluation with the question of whether e.g. personality icons were generally difficult to understand or whether they just presuppose a prior relation between participants. Acquainted participants could peel off another layer of the problems in the system because their comments reach a little further beyond not knowing their communication partner.

The results of our qualitative analysis of the video recordings also showed that unacquainted participants had more difficulties remembering information about contacts than acquainted participants had. Unacquainted participants interchange the position, activity, availability and mood of different contacts. We found that acquainted participants did not show the same difficulties distinguishing between information about different contacts. This indicates that acquainted participants rely on their prior knowledge of contacts when remembering their information. E.g. if one contact was at the university and only one of their contacts study at university they needed to spend little mental energy

on remembering which one it was. This supports the element of maintaining social awareness in a peripheral manner.

Some acquainted participants showed that they were able to read information from small changes in the system without interacting with it. For instance one participant saw a contact move away from her and without accessing the contact window of the contact and seeing her activity, she was convinced that the contact moved because she was picking up her child. In this case the participant relied on her prior knowledge of the contact and combined this with the fact that she had told us that the contact have a child. This observation indicates that acquainted participants with prior knowledge of their contacts are able to read more information from the system than unacquainted participants are. This way they also come close to using the systems as was intended. However we cannot definitely conclude this based on our study. The participants showed varying ability to read information of the system and more investigation into this question will be needed to give a clearer picture of any differences.

CONCLUSION

The primary purpose of this research paper has been to explore how social awareness systems can be evaluated. This has been done in five steps. First we surveyed previous research papers in order to better understand how the evaluations of social awareness systems have been conducted. Secondly, as an outcome of both the review of other research and our own previous work, we presented a series of challenges that needs to be covered by an evaluation of social awareness systems. Thirdly, two methods differing on the parameter of participant relations were described including a descriptive case of our social awareness system iSocialize. Fourthly, we presented the findings of our evaluation and discussed these. In the following we summarize the results of each of these steps.

The survey of evaluations of social awareness systems revealed two distinctions of interest to our study: the level of functionality and the purpose of the evaluation. First we accounted for how the level of functionality in the evaluated system affects the method of evaluation. The more functionality, the less control of variables appeared to be needed. This means that systems with a low level of functionality were mostly evaluated through paper prototypes with respect to the validation of concept and design ideas. Partially functional prototypes were evaluated both in the field and in the laboratory with respect to usability issues, the qualities, and the shortcomings of the system. Fully functional systems were evaluated in long-term field studies with respect to the impact and attitudes towards the system as well as verification of concepts. Secondly the survey of previous research showed that the purpose of an evaluation affects the selection of evaluation method. We reported that most social awareness systems are not evaluated with respect to social awareness but primarily concerned with usability problems. Of the evaluations that actually deal with social awareness, most use qualitative techniques. These included individual interviews as well as roundtable discussions. We found only one example of evaluating social awareness with a quantitative technique: gathering log data through long-term field studies.

The next step was to construct a laboratory evaluation method for evaluating social awareness systems. We constructed two setups: One with acquainted participants, who were presented with self-reported data in the system, and one with unacquainted participants who were presented with artificial data in the system. During the tests some of the information in the system was simulated by a member of the research team.

The evaluation was conducted on a social awareness system called iSocialize, we designed and implemented. iSocialize is made up of a series of screens through which the user can stay socially aware of his friends. The social awareness properties activity, status, vicinity, and relation can be viewed for every contact in the system.

We conducted 10 tests each including 2 participants: 5 tests with acquainted participants and 5 tests with unacquainted participants. The test was made up of two parts followed by a semi-structured interview. The first part allowed the participants to get to know iSocialize and to find usability problems. The second part asked the participants to solve a contextual task while still using iSocialize and thus give them a feeling of “natural use”. The individual tests of the evaluation were recorded on digital video and analysed both quantitatively with respect to usability problems and qualitatively with respect to social awareness problems by the research team.

The analysis of evaluation data led to a discussion of the results. Overall the results showed no major difference between the numbers of usability problems discovered by the two groups of participants. The differences showed when distinguishing between the types of usability issues. We related these issues to the properties of social awareness and found a difference in favour of the unacquainted participants, who found 18 out of 30 different usability problems related to interpreting social awareness information in the system. The acquainted users found 12 different usability problems related to the interpreting this information.

We suggest that unacquainted participants are useful when testing social awareness systems for usability issues. The acquainted participants did however appear to be slightly better at evaluating the concept of social awareness. Not because they found more problems, but because they had more meaningful interaction with both their test partner and the operator via the system during the tests.

REFERENCES

1. Andersen, B. L., Jørgensen, M. L. and Kold, U. "Classifying and Defining Social Awareness Research". In *Supporting Social Awareness in a Family Context*. Department of Computer Science at Aalborg University, 2005.
2. Andersen, B. L., Jørgensen, M. L. and Kold, U. *Design and Evaluation of a Mobile Social Awareness System*. Department of Computer Science, Aalborg University, 2005.
3. Andersen, B. L., Jørgensen, M. L. and Kold, U. "Illustrating and Understanding Social Awareness in Family Contexts". In *Supporting Social Awareness in a Family Context*. Department of Computer Science at Aalborg University, 2005.
4. Andersen, B. L., Jørgensen, M. L. and Kold, U. "iSocialize: Designing a Mobile System Supporting Social Awareness". In *Design and Evaluation of a Mobile Social Awareness System*. Department of Computer Science, Aalborg University, 2005.
5. Andreasen, M., Fredborg, A. and Pedersen, R. M. *Challenges in context-aware mobile information systems: A digital shopping assistant*. Department of Computer Science at Aalborg University, 2004.
6. Berg, S., Taylor, A. S., and Harper, R. "Mobile phones for the next generation: device designs for teenagers". In *Proceedings of the conference on Human factors in computing systems, (CHI 2003)*. ACM Press, 433-440, ISBN: 1-58113-630-7, DOI: http://doi.acm.org/10.1145/642611.642687.
7. Bohnenberger, T., Jameson, A., Krüger, A., and Butz, A. "Location-Aware Shopping Assiatnce: Evaluation of a Decision-Theoretic Approach". In *Proceedings of the fourth Conference of Mobile Human-Computer Interaction, (MobileHCI 2002)*, Springer-Verlag, 155-169.
8. Borovoy, R., Silverman, B., Gorton, T., Notowidigdo, M., Knep, B., Resnick, M. and Klann J. "Folk computing: revisiting oral tradition as a scaffold for co-present communities". In *Proceedings of the SIGCHI conference on Human factors in computing systems, (CHI 2001)*. ACM Press, 466-473, ISBN: 1-58113-327-8, DOI: http://doi.acm.org/10.1145/365024.365316.
9. Brignull, H. and Yvonne Rogers, Y. "Enticing People to Interact with Large Public Displays in Public Spaces". In *Human-Computer Interaction, (INTERACT '03)*. IOS Press (IFIP), 599-606, ISBN: 1-58603-363-8.
10. Churchill, E. F., Nelson, L., Denoue, L. and Girgensohn, L. "The Plasma Poster Network: Posting Multimedia Content in Public Places". In *Human-Computer Interaction, (INTERACT '03)*. IOS Press (IFIP), 599-606, ISBN: 1-58603-363-8.
11. Counts, S. and Fellheimer, E. "Supporting social presence through lightweight photo sharing on and off the desktop". In *Proceedings of the 2004 conference on Human factors in computing systems, (CHI 2004)*. ACM Press, 599-606, ISBN: 1-58113-702-8, DOI: http://doi.acm.org/10.1145/985692.985768.
12. Desurvire, H., Caplan, M. and Toth, J. A. "Using heuristics to evaluate the playability of games". In *CHI '04: CHI '04 extended abstracts on Human factors in computing systems*. ACM Press, 1509-1512, ISBN: 1-58113-703-6, DOI: http://doi.acm.org/-10.1145/985921.986102.
13. Dix, A., Finlay, J., Abowd, G. D. and Beatle, R. *Human-Computer Interaction*. Pearson 2004, Third edition, ISBN: 0130-461091.
14. Esbjörnsson, M., Juhlin, O. and Östergren, M. "Motorcyclists Using Hocman - Field Trials on Mobile Interaction". In *Human-Computer Interaction with Mobile Devices and Services, (MobileHCI 2003)*. Springer-Verlag, 32-44, ISBN: 3-540-40821-5, DOI: http://dx.doi.org/10.1007/b12029.
15. Esbjörnsson, M., Juhlin, O. and Östergren, M. "Traffic encounters and Hocman: Associating motorcycle ethnography with design". In *Personal and Ubiquitous Computing, Vol. 8, No. 2*. Springer-Verlag 2004, 92-99, DOI: http://dx.doi.org/10.1007/s00779-004-0260-4.
16. Federoff, M. *Heuristics and Usability Guidelines for the Creation and Evaluation of FUN in Video Games*. Thesis at the University Graduate School of Indiana University, 2002, http://melissafederoff.com/heuristics_usability_games.pdf
17. Frøkjær, E., Hertzum, M. and Hornbæk, K. "Measuring usability: are effectiveness, efficiency, and satisfaction really correlated?". In *CHI '00: Proceedings of the SIGCHI conference on Human factors in computing systems*. ACM Press, 345-352, ISBN: 1-58113-216-6, DOI: http://doi.acm.org/10.1145/332040.332455.
18. Hartson, H., Andre, T., and Williges, R. "Criteria For Evaluating Usability Evaluation Methods". In *International Journal Of Human-Computer Interaction*, Vol. 15, No. 1, 2003. Lawrence Erlbaum Associate, 145-181, DOI: http://www.leaonline.com/doi/abs-/10.1207/S15327590IJHC1501_13
19. ISO 9241-11. "Ergonomic requirements for office work with visual display terminals (VDTs)" In *Part 11: Guidance on usability (1998)*.
20. Hindus, D., Mainwaring, S. D., Leduc, N., Hagström, A. E. and Bayley, O. "Casablanca: designing social communication devices for the home". In *Proceedings of the SIGCHI conference on Human factors in computing systems, (CHI 2001)*. ACM Press, 325-332,

ISBN: 1-58113-327-8, DOI: http://doi.acm.org/10.1145-/365024.383749.

21. Kjeldskov, J. and Graham, C. A "Review of Mobile HCI Research Methods". In *Human-Computer Interaction with Mobile Devices and Services, (MobileHCI 2003)*. Springer-Verlag, 317-335, ISBN: 3-540-40821-5, DOI: http://dx.doi.org/10.1007/b12029.

22. Kjeldskov, J. and Skov, M. B. "Creating Realistic Laboratory Settings: Comparative Studies of Three Think-Aloud Usability Evaluations of a Mobile System". In *Proceedings of the 9th IFIP TC13 International Conference on Human-Computer Interaction (Interact2003)*, IOS Press, 663 – 670, ISBN: 1-58603-363-8.

23. Molich, R., *Brugervenlige edb-systemer*. Ingeniøren | bøger, 2. edition, 2000, ISBN: 87-571-1647-4.

24. Nielsen, J., Clemmensen, T., Yssing, C. "Getting access to what goes on in people's heads?: reflections on the think-aloud technique". In *Proceedings of the second Nordic conference on Human-computer interaction (NordiCHI 2002)*. 101-110. ISBN: 1-58113-616-1. DOI: http://doi.acm.org/10.1145/572020.572033

25. O'Connor, M., Cosley, D., Konstan, J. A. and Riedl, J. "PolyLens: A Recommender System for Groups of Users". In *Proceedings of the Seventh European Conference on Computer Supported Cooperative WorkProceedings, (ECSCW 2001)*. Kluwer Academic Publishers, 199-218.

26. Schilit, B. N. and Theimer, M. M. "Disseminating Active Map information to Mobile Hosts". In *IEEE Network, Vol. 8(5)*, 1994, 22-32, DOI: http://dx.doi.org/10.1109/65.313011.

27. Schmidt, A., Stuhr, T. and Gellersen, H. "Context-Phonebook - Extending Mobile Phone Applications with Context". In *Proceedings of Mobile HCI 2001: Third International Workshop on Human Computer Interaction with Mobile Devices*. 1-6, http://www.cis.strath.ac.uk/~mdd/mobilehci01/procs/.

28. Shneiderman, B. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. 1998, Addison Wesley, ISBN: 0-201-69497-2.

29. Strauss, A. and Corbin, J. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 2nd edition, Sage Publications 1998, ISBN: 0-8039-5940-0.

30. Pousman, Z., Iachello, G., Fithian, R., Moghazy, J. and Stasko, J. "Design iterations for a location-aware event planner". In *Personal and Ubiquitous Computing, Vol. 8, No. 2*. Springer-Verlag, 117-125, DOI: http://dx.doi-.org/10.1007/s00779-004-0266

Appendix 4 – Query Sheet for Participants

The first page of this two-page query sheet is for personal information for each of the two participants in a single test. The last page was duplicated in three copies and filled out for both the participants. The query sheets were filled out by the researchers by posing the questions in a structured interview with the acquainted participants.

Spørgeskema

Før vi går i gang med selve testen bedes du besvare dette spørgeskema. Formålet er at indsamle realistiske data, og oplysningerne vil udelukkende blive benyttet i forbindelse med testen og den efterfølgende rapport i anonymiseret form. For at sikre gyldigheden af testen er det vigtigt at du udfylder dette spørgeskema med virkelige oplysninger.

Hvad er dit navn? _____

Hvad er dit køn? ❑ Kvinde ❑ Mand

Hvad er din alder? _____

Hvad er dit telefonnummer? _____

Hvor stor er din erfaring med PDA'er (mobil computer, der kan være i hånden)?

❑ Ingen (har hørt eller læst lidt dem)

❑ Tilskuer (har set over skulderen på andre, som har brugt en PDA)

❑ Begynder (har prøvet at bruge én en enkelt gang eller to)

❑ Bruger (har eller har haft én og bruger de basale funktioner f.eks. kalender)

❑ Erfaren bruger (har eller har haft en, bruger mange funktioner og installerer nye programmer på den)

Hvilke teknologier bruger du til at holde forbindelse med dine venner? Og hvor ofte?

❑ Brev	gange om måneden:
❑ Telefon	gange om ugen:
❑ Mobiltelefon	gange om dagen:
❑ SMS	gange om dagen:
❑ Chat-program (ex Messenger)	gange om dagen:
❑ E-mails	gange om dagen:
❑ Andet:_____	gange om dagen:

Det efterfølgende drejer sig om nogle af dine venner fordi vi skal bruge noget information til at bruge i vores system. Du skal vælge tre af dine gode venner, som du i forvejen er vant til at holde kontakt med. Det må ikke være den ven, der også medvirker i denne test, og det skal helst ikke udelukkende være familie, kolleger eller gruppemedlemmer. Nu snakker vi om dem én ad gangen.

Hvad er din vens fornavn? Alder?

Navn: _____ alder: ____ Telefon nr. _____

Hvad er vedkommendes beskæftigelse? (arbejde / studie)

_____

Nævn mindst en fritidsinteresse din ven går op i.

_____ _____

Hvor tror du vedkommende befinder sig i dag / nu? (bopæl, arbejde / skole)

_____

Hvad tror du vedkommende foretager sig nu?

_____

Hvad tror du er den seneste store begivenhed i vedkommendes liv? Det kan selvfølgelig være alt muligt stort eller småt, men vi gerne vil vide, hvad der mon optager din ven for tiden?

_____

Nævn to ord der beskriver din vens personlighed.

_____ _____

Nævn to ting, du tror, betyder meget for vedkommende.

_____ _____

På en skala fra et til fem, hvor fem er højest, hvor stor føler du, at jeres fortrolighed er? (sæt en ring)

1 2 3 4 5

På en skala fra et til fem (hvor fem er højest) hvor godt føler du at jeres humor passer sammen?

1 2 3 4 5

På en skala fra et til fem (hvor fem er højest) hvor meget føler du at du ved om vedkommendes hverdag?

1 2 3 4 5

Appendix 5 – Evaluation

This appendix contains – in the presented order – the instructions to read for the participant before the test, the tasks we asked the participants to solve during the test, and the interview we conducted after the test. The tasks were filled out with the relevant, test-dependent information. Included in this appendix is also the overview of the test for internal reference during the tests.

For obvious reasons the text is in Danish.

Instruktion før testen

Jeg vil gerne takke dig for, at du vil hjælpe os med at gennemføre denne test, og jeg vil gøre opmærksom på, at det naturligvis er systemet, vi ønsker at teste og ikke dig. Før testen skal jeg fortælle dig et par ting. For at være sikker på, at jeg husker det hele og får det sagt på samme måde til alle deltagere, vil jeg læse det op.

Formålet med denne test er, at vi gerne vil vide mere om, hvilke fejl der er i vores system, og hvordan en bruger kunne tænke sig at bruge sådan et system. Det handler altså IKKE om, hvor god du er til at bruge en PDA, eller om du kan finde ud af at bruge systemet. Derfor kan du heller ikke lave nogen fejl. Og de opgaver, vi stiller, handler ikke om, at du skal regne svaret ud, men om at sørge for at du får prøvet at bruge systemet på forskellige måder.

Inden vi begynder selve testen vil jeg fortælle dig lidt om systemet. Systemet er et kontakt-system mellem venner – lidt ligesom MSN Messenger som du måske kender, men med nogle lidt anderledes funktioner. Meningen er, at du på din PDA kan se dine kontaktpersoner. Du skal forestille dig, at de har en lignende PDA med det samme program, hvor de kan se deres kontaktpersoner, deriblandt dig. For hver person afspejler systemet, hvor langt væk de er, hvad de foretager sig lige nu, hvordan de har det, og om de har tid til at blive kontaktet. Systemet er en prototype, derfor virker telefon-delen ikke – det vil sige, at du ikke kan ringe op eller sende sms'er. Systemet kan automatisk regne ud helt præcist, hvor du befinder dig i verden, og det gætter på, hvad du foretager dig lige nu. Til gengæld kan det ikke regne dine følelser ud, eller hvordan du har det. Der må du selv hjælpe systemet – lidt på samme måde som du kan sætte din status i Messenger.

Da systemet er en prototype, vil du opleve, at det i nogle situationer reagerer langsomt på dine handlinger. Derfor beder vi dig have tålmodighed, når du trykker på knapperne.

Meningen med systemet er ikke, at man skal sidde og bruge det intensivt, men at det skal være noget, man har ved siden af og kan kigge på en gang imellem.

Testen består af to dele, som du vil få udleveret enkeltvis. Under testen får du et ark med opgaver, som vi gerne vil have, at du udfører. Det drejer sig som sagt om at sørge for, at du får prøvet, hvordan det ville være at bruge systemet. Prøv at lade som om det er et system, du bruger til daglig, og at det bare er sådan en ting, du har med over det hele - ligesom en mobiltelefon. Du må gerne spørge, hvis der er noget, du bliver i tvivl om, men det er ikke sikkert, at jeg vil svare.

For at få det optimale ud af testen er det vigtigt, at du selv gør dig dine erfaringer og afprøver systemet. Jeg vil være der under hele testen for at spørge dig om, hvad du oplever, sådan at vi kan få et indblik i, hvorfor du gør, som du gør. Men jeg er ikke en del af den situation, som vi lader som om, du befinder dig i.

Efter testen vil vi gerne lave et kort interview, om hvordan det var at bruge systemet.

Så kan vi gå i gang med opgaverne.

Opgaver – del 1

Opgaverne i del 1 bedes du løse på følgende måde:

Først læser du hele teksten til den enkelte opgave højt. Derefter fortæller du forsøgslederen, hvordan du forestiller dig, at den kan løses. Så går du i gang med selve løsningen af opgaven. Når du mener opgaven er løst, siger du til og går i gang med at læse den næste.

Mens du arbejde med opgaverne, vil vi gerne have, at du tænker højt. Det betyder, at du skal sige, hvad du har tænkt dig at gøre, hvad der overrasker dig, og hvad du ellers tænker på under brugen. Vi ved godt, at det ikke er naturligt at sidde og snakke højt, så hvis du glemmer det, vil forsøgslederen minde dig om det.

Læs venligst højt herfra:

Det du ser, er systemets startskærm. Du er allerede oprettet som bruger i systemet, men du er ikke logget ind på denne PDA. Det er din første opgave at logge dig selv ind. Brug dit telefonnummer til at identificere dig selv.

I systemet kan du angive dit eget humør. Prøv først at sætte dit humør til "ked af det". Sæt det derefter til at være "træt". Indstil til sidst til systemet til at vise hvordan du har det nu.

I systemet kan du angive, om du må forstyrres. Prøv først at sætte dig selv til at være "optaget". Sæt dig selv til at være "tilgængelig hvis det er vigtigt". Sæt til sidst dig selv til at være "tilgængelig" fordi det bliver en kedelig test ellers.

I systemet kan man vælge nogle ikoner, som ens kontaktpersoner kan se. Prøv at vælge ikoner som du føler passer på dig lige nu.

Prøv at bruge systemet til at finde ud af, om du må ringe til <kontakt 2> nu.

Tilføj din ven <kontakt 3's navn> til din oversigt over kontakter.

Brug telefonnummeret: <kontakt 3's nummer>

Check hvordan din nye kontakt har det.

Opgaver, del 2

I denne del af testen vil vi bede dig om at leve dig ind i en fiktiv situation, hvor systemet indgår. Du bliver bedt om at løse en opgave på den stationære computer. Denne opgave har først og fremmest til formål at hjælpe dig til at leve dig ind i en naturlig brugssituation.

Samtidig med at du løser opgaven, vil vi bede dig om at holde øje med PDA'en. Undervejs vil der ske ændringer i systemet, som du selvfølgelig skal reagere på, som du ville gøre i en naturlig situation. Du bedes fortælle, hvilke ændringer du ser. Det kan også være at testlederen beder dig om at forklare noget eller om at gøre noget bestemt.

Ligesom ved den tidligere del af testen vil vi gerne have dig til at tænke højt, mens du arbejder med opgaverne.

Situation, du skal forestille dig at være i, er (Læs venligst højt herfra):

Du er ejer af denne PDA, hvor systemet kører på. Du bruger den normalt til at holde lidt øje med dine venner og til at beslutte, hvordan du skal kontakte dem, hvis du får lyst. Det er kun nogle af dine nærmeste venner, du har som kontakter i systemet.

På grund af dit studie / arbejde har du tænkt dig at flytte til Århus inden for den nærmeste fremtid. Derfor har du nu besluttet dig for at undersøge boligmarkedet via Internettet. Du vil gerne finde boliger, som du realistisk set har råd og lyst til at bo i ud fra din nuværende situation. Find gerne flere alternative, så du kan sammenligne dem. Du må gøre det, som du har lyst, men hvis du mangler et sted at starte, kunne det være på:

http://www.aarhusbolig.dk

http://www.husvild.dk

http://www.bolig-guide.dk/boligforeninger

Interview

Med dine egne ord, hvad er så meningen med systemet?

Med dine egne ord, hvad er det så systemet skal fortælle dig om de kontaktpersoner du har i systemet?

Syntes du at der er nogen åbenlyse problemer eller fejl i systemet?

Hvad ville fordelen være ved at have sådan et system i dagligdagen?

Aktivitet

Hvor godt følte du at du fik indblik i dine kontaktpersoners aktivitet?

Hvordan havde du det med at systemet kunne aflæse din aktivitet og sende den videre til andre?

På en skala hvor godt var dit indblik i [den anden test persons] aktivitet?

Var oplysningerne i om dine kontaktpersoner realistiske?

Status

Hvor godt følte du at du fik indblik i hvordan dine kontaktpersoner gik og havde det?

Kunne du aflæse deres humør i systemet?

På en skala (1-5) hvor godt fik du så indblik i deres personlige tilstand?

Relation

Hjalp dit kendskab til [testpersonen] dig til at fortolke oplysningerne?

Hvordan passede oplysningerne om [testpersonen] med det du ville forestille dig at han / hun havde tastet ind?

Hvad tror du at [testpersonen] kunne udlede af det du indtastede?

Nærhed

Kunne du afgøre hvor langt dine kontakter var væk fra dig?

Hvordan passede det med det du havde forventet?

Brugergrænsefladen

Fungerer brugergrænsefladen godt?

Forstår du de anvendte ikoner og begreber? Kunne de have en anden og bedre repræsentation?

Kunne du finde rundt i systemet?

Har du selv nogle kommentarer til systemet?

Hvad ville du kalde sådan et system hvis du skulle give det et navn?

Hvor meget syntes du at systemet forstyrrede den opgave du arbejdede med på computeren?

Intern guide

Husk: Forsøgsleder A skal have sin telefon på lydløs.

Forsøgsperson A	**Forsøgsperson B**	**Operatør**
Spørgeskema, hvis vennepar	Spørgeskema, hvis vennepar	
Underskrive samtykkeerklæring	Underskrive samtykkeerklæring	Indtast personoplysninger og relationer i systemet
		Skriv navne og id på opgaveark til A og B. Skriv navn på testledernes replikark
Starter på **del 1**	Starter på **del 1**	
		v. opgave 5: svare *nej*.
Forsøgslederen lægger hånden over pda'en. *Nu lægger jeg hånden hen over displayet. Så vil jeg gerne have dig til at fortælle hvad du forventer at _____(ven 2) foretager sig nu og hvordan han har det. Tror du at det er et godt tidspunkt at forstyrre ham med en mindre vigtig besked?*	Forsøgslederen lægger hånden over pda'en. *Nu lægger jeg hånden hen over displayet. Så vil jeg gerne have dig til at fortælle hvad du forventer at _____(ven 2) foretager sig nu og hvordan han har det. Tror du at det er et godt tidspunkt at forstyrre ham med en mindre vigtig besked?*	
Nu vil jeg gerne have at du bruger systemet og fortæller mig det samme om _____ (ven2) *ud fra de oplysninger du får af systemet.*	*Nu vil jeg gerne have at du bruger systemet og fortæller mig det samme om _____* (ven2) *ud fra de oplysninger du får af systemet.*	
Starter **del 2**	Starter **del 2**	

Hold øje med om testpersonen opdager aktiviteten.	Hold øje med om testpersonen opdager aktiviteten.	**Ven 3**: sæt til rød, aktivitet = transport, bevæge sig væk
		Vente til begge er klar
Besked fra Ven 1. Vent til der er svaret og A vender tilbage til opgaven før i går i kaffestuen.	Besked fra Ven 1. Vent til der er svaret og B vender tilbage til opgaven. Hold øje med pda'en derefter.	Sende besked fra **Ven 1**: "call me"
Nu afbryder jeg dig lige for at bede dig om at gøre noget. Vi lader som om at du nu har fået lyst til at gå ned i kaffestuen for at hente en kop kaffe eller hvad du nu har lyst til. Vær venlig at tage PDA'en med.		Ændre tilstand for A: ("*walking in hall-way*", "*coffee room*", etc.) + afstand for både A og B
Modtag opkald når du går ud af døren.		Ring op til forsøgs-leder A når de går ud af døren.
Husk at sørge for at få A til at kigge på pda'en en gang imel-lem.	Når A er i kaffestuen: *Nu vil jeg godt bede dig om at beskrive ud fra systemet hvad du tror A foretager sig?* *Er dette et godt tidspunkt at kon-takte A på?* *Hvordan aflæser du det i syste-met?*	
Når A er tilbage igen: *Ville det være et godt tidspunkt, mens du var nede at hente kaffe, at blive kontaktet på gennem systemet?* *Hvordan viser systemet det?*		
Modtage besked om at mødes fra B. *Systemet er, som du ved, en pro-totype, så derfor kan det ikke ringe op så i kan snakke sammen. Vi si-ger at I aftaler på telefonen at B kommer ind til dig.*	*Nu afbryder jeg dig for at bede dig om at gøre noget. Vi siger at du har fået lyst til at mødes med A. Prøv at arrangere det.*	
	Systemet er, som du ved en pro-totype, så derfor kan det ikke ringe op. Vi siger, at I aftaler i telefonen at du skal komme over til A. Kom, lad os gå ind til A.	
Interview	**Interview**	