

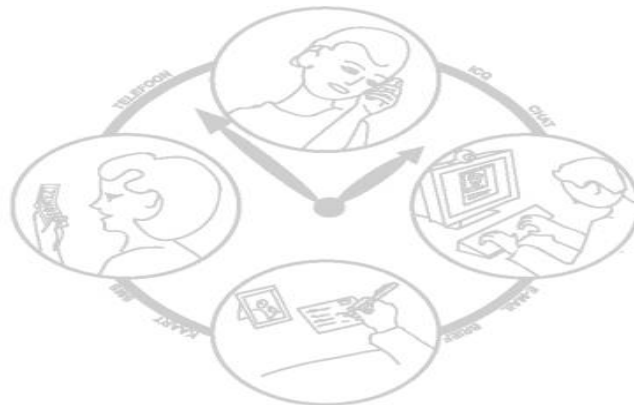
ASTRA project IST—2001-39270



Deliverable 1: **ASTRA Scenario and Research Contribution**

Version: 3 (final)

28 Nov 2003



WP : 1

Keywords: User requirements, diary study, interviews, baseline scenario

Abstract: This document describes the requirements study for the ASTRA project and the implications for the concept of staying in touch. It describes the scenario that will be designed and developed in the next phases of the project and that will be the test bed for the assessment activity.

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Project funded by the European Community under the "Information Society Technologies" Programme (01/01/2001 - 31/12/2003)

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ASTRA baseline scenario document

1. Introduction

Awareness systems are computer mediated communication (CMC) systems that aim to support connected parties to maintain a peripheral awareness of the activities and status of their communication partners. Awareness systems can serve both work-related and social interactions.

The aim of this short assessment project is to define an appropriate theoretical and technological framework for research in awareness systems, specifically those that are intended to support primary social relationships.

This project focuses on primary social relationships with a view to addressing realistic social problems, namely close family members living far apart due to emigration (e.g. elderly whose adult children emigrate to a distant location) or professionals travelling to distant locations regularly because of their job.

Currently, a theoretical account awareness systems usage is lacking. For example, the needs they serve, how to assess their use, etc., can only be hypothesised and the requirements from the supporting infrastructure, e.g., networking and interactive services are speculated.

The investigation aims to move beyond initial design conceptions and into a theoretically founded assessment of the affective benefits, tied with realisation of such an awareness prototype and a small scale but realistic assessment.

In this section, we outline the aims of ASTRA, the baseline scenario which we choose to support in our experimental prototype and we discuss how this scenario positions ASTRA with respect to the broader research field of social presence and awareness systems.

Objectives

In recent years, several concepts for awareness systems suitable for the home have been proposed. To date, these research concepts are introduced as envisionment scenarios, non-functional prototypes or, at best, partial prototypes which are evaluated within a laboratory setting, with correspondingly limited ecological validity. Empirical evidence upon which to base theoretical accounts of awareness systems use is still lacking.

The ASTRA project shall investigate awareness systems and services for social purposes (e.g., to help geographically separated but closely related people to stay in touch).

The objectives of the project are to:

- provide a proof of concept for an awareness service, connecting a homebound to a mobile user.
- test the appropriateness of mediated social presence¹ as a phenomenon for characterising long term and low-pace asynchronous communication activities, and
- **to verify that user social needs can be served by this class of systems to complement existing means of communication.**

¹ Social presence can be defined as the sensation of being together with a remote communication partner that is afforded by telecommunication systems. Social presence is an appropriate phenomenon for describing interaction with awareness services. To date, social presence research has mainly been limited to studying personal or group communications in professional settings (i.e. video conferencing, computer mediated communication), or studying online virtual communities. The personal, emotional dimension of telecommunication applications, has only recently started to attract the interest of researchers (Heeter, 2003; de Greef & IJsselstein, 2001).

The latter (shown in boldface) is the success criterion for the project. Up to now, the usefulness and value of such systems to people has only been hypothesised. The project success amounts to providing concrete evidence of people seeing value in awareness services and wanting to adopt them.

In ASTRA theory building and technological developments are tightly coupled. Both contributions are essential. Pursuing practical advances in this field without a theoretical understanding of the social practices we support can lead to expensive failures both in research and in development of awareness services and related technologies. The technological developments are necessary to avoid further basing theory development on the discussion of hypothetical scenarios without empirical evidence.

A positive outcome of this project would suggest that current social presence theory and measurement need to be extended to account for the background, low pace, long-term informal and asynchronous interactions envisaged.

ASTRA will develop a baseline implementation that will include dedicated applications for accessing a rudimentary awareness service from the home and from a mobile device. This activity will help define requirements for an open awareness platform that will support awareness through various media, devices and services that are appropriate for different contexts. This variability is necessary for building awareness systems that are used outside the laboratory and fit the daily activities of their users, which vary in location, context and purpose.

The awareness platform will consist of two main parts:

- A middleware part that is in charge of securing interoperation among the developed awareness applications. This part will provide transparent access to the services of the awareness platform. It is also in charge of providing basic technical services and mechanisms needed by parts of any distributed system, such as naming services, transactions on shared data, scalability and fault tolerance.
- A computation part that contains the awareness model used to exchange contextual awareness information. This part will optionally do some processing of captured awareness information, e.g. filtering, abstracting, finding distribution routes, etc.

Outline of this document

This document presents the ‘baseline scenario’ for the ASTRA project. This specifies how users will make use of a minimal awareness service and will hypothesize the benefits that users should obtain from the service. First we present extensively the requirements study carried out. Then we describe the scenario that will be implemented by the project. Finally, we relate this scenario to other research in order to position the ASTRA project.

2. User requirements study

Since ASTRA focuses upon informal communications for social and affective reasons, we first set out to learn about informal social communication within families the following:

- What makes these communications valued? Why?
- What communication media currently support this purpose?
- How do people experience them?
- What communication patterns currently support this purpose?

The aim has been throughout to rise above the detailed nuisances or benefits of a particular medium and to understand the interpersonal needs that ASTRA focuses upon and how they are served. In the section ‘Related Work’ we review related results literature and relate it to our own findings.

Process

The following data gathering activities were conducted.

- First an interview was conducted with each participant. This included a technology tour, aiming to inventorise the variety of current ways used to communicate and a discussion of future scenarios.

These aimed to uncover hopes, fears, scepticism, problems addressed of the concepts: staying in touch, awareness and social presence.

- Subjects were asked to participate in a diary study that focuses on their communication with other members of a family cluster. Diaries that aimed to capture both descriptive and quantitative data in the context of family environment: frequency, relevance, behaviour, preferences, etc. Subjects participating in the diary study were briefed about it during the first interview. The diaries aimed to capture motivations in context (social and environmental), initial effects and after effects when a contact is made between family members.
- Debriefing interviews, were designed to clarify the diaries and to uncover possible problems or difficulty with the use of diary and thus verify the reliability of the data collected with the diaries.

This combination of techniques was designed to focus upon informal, serendipitous communications that are interlaced with daily activities. The diary method offers the advantage of a prolonged data collection, that is close temporally to the phenomenon of interest (avoiding problems of recollection) and that is conducted in the context of the actual experience studied (see Rieman 1992).

On the other hand, diaries can easily degrade to dry factual collections of data, so they have been combined with interviews, to obtain a deeper insight into the emotional aspects of the communication studied. A disadvantage of the diary method is that participants have to write down contacts themselves. Thus, there is always a risk that data collected is not objective. A way to prevent this would be to gather recordings of the actual contacts, e.g., e-mail contents. However, this would become quite intrusive. There would be a new risk, namely that the knowledge that someone else would look at their e-mails would influence what participants wrote in them. In fact, one participant of our requirements study reported that the knowledge that she had to fill out the diary made her over-conscious during their communication activities and influenced her first contact for the diary study.

Participants

We decided early in the project to focus on *family clusters* in order to study ‘staying in touch’ over a distance. By family clusters we mean individuals related with family ties, but who live in more than one household. This reflects our ambition to focus on the potential of awareness technologies to address current social problems: elderly living alone, young adults migrating for carrier purposes, etc. Further it follows from earlier research that supporting communication within such family clusters provides valued affective benefits to the individuals (cf. Markopoulos et al 2003, Hindus et al 2001, Mynatt et al 2001).

The requirements study focused on 3 family clusters including 13 individuals. A further 4 individuals were interviewed outside the family clusters.

Participants were personal acquaintances of the researchers and acquaintances of colleagues from the TU/e. We settled for this less than ideal pool of participants to save time and because this is a preliminary activity; the validation of our hypothesis will be conducted with more rigour. Also a series of more rigorously conducted and extensive surveys of user needs have been conducted in the context of other projects. The present study was meant to focus on what is special about the particular design focus and to foster empathy and inspiration during the design process.

Family clusters of at least four were sought, at least one of which would consist of 3 generations: grandparents (GP), adult children (AC) and grandchildren (GC).

Families were approached by e-mail or by telephone. We most often started by calling/mailling one “contact person” in the family. During this first contact, the purpose of the study was explained and what would be required from them. If they were willing to cooperate, we proceeded with asking the other family members (sometimes directly, sometimes via the contact person).

In total, 8 families were approached. 3 families were willing to cooperate. From 2 families we never got a reply. 1 family did not want to cooperate because of personal reasons. 2 families were willing to cooperate, but it was not possible to plan meetings with all members in the short timeframe. From these families some individuals were interviewed. Of 1 family, the grandparents dropped out shortly before the start of the study, because of illness. It was impossible to replace the family therefore the remaining members of the family participated in the study as a cluster of three.

The Interviews

Structured interviews were conducted with 17 participants: 3 family clusters and 4 additional individuals. On average, an interview lasted about 1 hour. The same interviewer conducted all interviews. A memory recorder was used to capture the interviews and a digital camera to take pictures of the interviewees and their communication tools.

The questions of the interview are included in appendix 1. The interview consisted of 3 parts, following the approach of Blythe, M et al (2002):

1. **Communication with Family.** The first part consisted of questions about communication with family members in general, so with all possible means. Firstly, participants gave a short description of their family and were asked to estimate which percentage of all their contacts was with family members. Also, participants were asked if communication with their family was important to them and why. They also had to remember one recent contact (with a family member) that they liked very much and one contact that they did not like.
2. **Tech Tour.** In this part of the interview, participants showed which means they use to communicate with their family. About each medium, they were asked how often they use it, for what reasons they use it, how they feel when they use it, if they feel connected to the other person, how long this feeling lasts, what are main advantages and disadvantages of the medium and what they would like to change about it.
3. **Guided Speculation.** In the final part, the interviewer explained the concept of an awareness system and gave several examples. Participants were asked to react on the concept. They were also asked what kind of information they would like to send and for what purposes they would use an asynchronous system. They were also asked about the participation structure and whether the system should have a persistent memory of messages exchanged. Finally, they were asked whether they would like to send and/or receive automatically captured information.

The Diaries

With the diaries, we aimed to get a closer look at when, how and why family members communicate with each other. Each of the 13 participants that constitute the 3 family clusters that we studied, filled in a diary for 1 week. They were instructed to write down each contact with family members and answer questions about the time, duration, communication means, location, the other person, initiative, reason, effect on themselves (feelings, connectedness and after-effect) and effect on the other person. The exact items of the diary are included in appendix 2.

For the children, we created a separate and simpler version of the diary. They had to write down, the time, describe what happened, who the other person was and how they were feeling. Also, they were asked to make a drawing of each contact.

For both the adult and children's diaries, we tried to use informal language and illustrated the diary with inspiring drawings.

3. Results from the Interviews

The answers to the interviews were analysed as followed. Answers from all participants were grouped per question and were compared for identifying interesting similarities and differences. In the conclusions and quotes listed in the paragraphs below we have tried to preserve the variety of the answers given. All answers are translated from Dutch.

Importance

Participants were asked which part of all their contacts was with family members. Answers ranged between 5 and 70 percent. The average was 52 percent.

All people said that communication with their family is important to them. As reasons for this, people said that it is important for them to know how their family members are doing and what is going on in their lives. They also want to tell things about their own life. Communication is especially important for people who don't see their family members very often. For them, it's the only way to keep in touch.

Especially the communication between parents and children is rated as very important. During the interviews, people concentrated on this.

"Communication with my parents is important to me because I value their opinion and judgment. They know me very well." (Vincent de Jong)

"I grew up with them. They still support me in everything I do." (Margot Nieuwenhuis).

Type of contacts

By clustering interview responses four categories of contacts have emerged:

- Practical contacts. These are aimed at the exchange of concrete information, e.g., asking each other questions or arranging a meeting.
- Social contacts. In these contacts, people tell each other about their lives or just chat about nothing in particular.
- Emotional contacts. Here the aim is to provide emotional support to each other.
- Occasional contacts. These happen at special occasions like birthdays, Christmas etc. They are quite obligatory.

Contacts in the second and third category appear to be handled by women more often than by men and are comparatively more important to them.

Reasons for contacts

People have varying reasons for contacting family members. If something important has happened, they often have the need to share this with one or more family members. The same happens in the other direction: if they know something important happened in someone else's life, they contact him/her to ask about it.

"I want to show that I am interested in them" (Arthur de Jong).

Contacts don't always have an obvious reason, sometimes people just feel like talking to each other. This seems to be especially true for women. Men indicated that they have a reason for calling most of the time.

"To share happy and sad things, to give each other support" (Renske Sanders)

Successful contacts

People were asked to recall a recent contact that they liked very much. Several people mentioned a contact in which they could tell that the other person was happy. People like contacts in which a piece of good news is communicated.

"My daughter called me on my mobile to tell me she got that job she wanted. It was very nice to hear. I also liked the fact that she called me first." (Paul Berends).

"Laura got her driver's license and told Selma about this on the phone. Selma told us and we drove over to Laura's place with our car and a bottle of champagne, to surprise her". (Margot Nieuwenhuis).

Another reason why people like contacts is when they perceive that the other person has made an effort to contact them and they get a feeling that "s/he thought about me".

"I received a Christmas card from my sister, which was very nice. There was a bird on it. I like birds, so I know that she especially selected it for me." (Anne Berends).

"On new year's eve, we came home and there was a voicemail from Laura, wishing us a happy new year. It was a nice idea that she thought of us. I had not expected it, because she was at a party." (Selma Nieuwenhuis).

Contacts that are unexpected can also be perceived as nice.

"My brother sent me a very long reply to my e-mail. Normally he isn't very communicative, he just sends a picture or one sentence. So I was pleasantly surprised." (Arthur de Jong).

Finally, contacts can be nice because they take an unusual form or something unexpected happens in them.

“My granddad phoned me and said “Hello, this is Sinterklaas”. It was very funny.” (Chantal Sanders).

“Grandmother sent me an e-mail that she had cleaned up the garden. She made a poem of it, about slugs.” (Nienke Sanders).

Unsuccessful contacts

Participants were also asked to recall a recent contact that was not pleasant. This proved to be much more difficult. Some people were not able to recall an unpleasant contact. Both the children said that contacts were always nice.

One reason why contacts can be unpleasant is an unpleasant topic: bad news.

“When Margot called me to announce that she had to stop working because of burn-out, I was shocked and worried.” (Selma Nieuwenhuis).

Apart from the content, the medium itself can also make a contact unpleasant. Especially the phone can be perceived as restrictive or lead to misunderstandings.

“My dad called and asked for help with filling out some forms. I wanted to help, but it wasn't possible because I could not see the forms.” (Vincent de Jong).

“Phone calls can sometimes lead to misunderstanding because you can't see each other's face.” (Anne Berends).

“Sometimes you can't say what you want on the phone because other people are present. The other party doesn't realize this and is confused. Then I have to call back later, to explain.” (Paul Berends).

Another reason why contacts may not be pleasant is if they come at an inconvenient time for the receiving party. Participants explicitly mentioned that they don't like to be called during dinner and during the news. People are afraid to offend the other by saying they don't want to talk right now. Managing reachability in a way that will be acceptable to both caller and callee seems problematic.

Some people have strong expectations about communication with their family members. If these expectations are not fulfilled, they can be disappointed or annoyed.

“I always call my mother on Wednesday morning, but sometimes I forget. If I call later, she acts a bit angry and disappointed.”

Expectations can also lead to a feeling of obligation with the other.

“My mum almost always calls me in the weekend. Most of the times it's nice, but sometimes I can tell that she only calls because she feels obliged to and then the conversation is a bit forced.” (Laura Nieuwenhuis).

If people try to contact their family members and they don't respond, they can feel hurt or annoyed.

“It is difficult to reach my brother. I often try to contact him through e-mail or MSN. I just know he is there, but he doesn't react. That is very frustrating.” (Anniek Sanders).

“I have not heard from my son for 2 weeks and I was worried about him. He did not reply to phone calls and e-mails. He finally replied by e-mail at 23.30 at night, but I didn't see it until the next morning. I was worried. It's such a small effort for him.” (Renske Sanders).

People don't know if they are expected to call back.

“We forgot to call Laura in return to her voicemail message on New Year's Eve. She finally called herself and I could tell she was a bit disappointed.” (Ed Nieuwenhuis).

Even when it's clear that the other doesn't ignore the contact but is simply not there, people can feel disappointed or even irritated.

“It's not nice to get an answering machine, especially when I'm calling my parents. Even though I know it's not really reasonable, I still think, “They're my parents, they should be there when I call!”” (Margot Nieuwenhuis).

Current Tools

This section summarises the current patterns of communication reported by our participants.

Telephone

- Frequency of use

Many people use the traditional phone: 15 out of 17 participants. They use it quite often for communication with family members, varying from 2-3 times per week to several times per day. There were two participants who did not use it: Arjan 23 and Marieke 24. Arjan does have a traditional phone, but never uses it for communication with his family. He prefers his mobile phone because he can use it while travelling. Marieke doesn't have a traditional phone because she finds the subscription too expensive.

The traditional phone is often used for practical conversations: to ask something, to arrange a meeting, to quickly pass on a message. The phone is used for these contacts because people want a direct reaction.

"I use it for practical questions that need a quick answer." (Paul Berends)

However, the phone is also frequently used for social/emotional contacts. Family members call each other to ask and to tell each other how they are doing. This can happen without a special reason, or because something important has happened.

"Sometimes I just call to hear how she is doing. But sometimes I know that she had an exam or a party and I call to ask her about it". (Selma Nieuwenhuis).

"I call my parents to tell them things about myself: what I have been doing, how I am feeling. And also to ask how they are." (Noortje Nieuwenhuis).

"I call my family to talk about everyday things. To share emotions: happiness, sadness, sometimes anger. If something happened, you call them. It's like a family code". (Arthur de Jong).

- Advantages

People say that in general, they like to use the traditional phone. It has many advantages. They like the fact that it's easily accessible; you can contact someone within seconds. The fact that a direct contact is established is convenient, because information can be exchanged without delay. The direct reaction is not only convenient for arranging practical things, but also for chatting about everyday things and giving emotional support. Many participants said they liked to hear each other's voice over the phone. Even if they don't see each other very often, it gives a feeling of being connected.

"I like the directness and that you can hear each other's voice. You can react directly on each other." (Ed Nieuwenhuis).

"You can't see them, but you can still talk to them."

Finally, people find the traditional phone a relaxing medium. This is mostly because they are very used to it and because it is in their home environment, where they feel at ease.

"I can use it in a comfortable place, for instance on the couch." (Anniek Sanders).

"I've used it all my life, so I'm very used to it. It can be so nice and relaxing." (Margot Nieuwenhuis).

- Disadvantages

However, the traditional phone also has some disadvantages. Even though you can hear each other's voice, it's not the same as really being with the other person.

"You can't see the other, so you can't tell how they look, how they are feeling." (Anniek Sanders).

"Because you have no face-to face contact, you have no knowledge of each other's environment." (Paul Berends).

The phone can be intrusive. People can be called at a moment when they don't have time or are not in the right mood. Also, calling or answering the phone can be felt as an obligation.

"You can feel obliged to call, which is not nice. If I call one family member to tell something, I have to call them all, otherwise they will feel disappointed." (Arthur de Jong).

"It can become such an obligation. I have a wireless one which I can take into the garden, so that's no longer a good excuse." (Renske Sanders).

"Sometimes I just don't feel like talking. You have to be in the mood for it" (Laura Nieuwenhuis).

- Changes

When asked what they would like to change about the traditional phone, six people wanted to add a screen where you can see a moving image of the other person, or see each other on TV during the contact. However, most of them said that you should also be able to turn it off. Other suggested changes were integration of mobile and traditional phones, picture-dialling (pressing on someone's picture instead of telephone number) and thought-dialling (thinking about a number).

- Feelings

People can feel very connected with each other while using the traditional phone.

"It's just like I'm sitting next to them." (Renske Sanders).

However, the occurrence of this feeling depends on:

- The topic of the conversation: should be social/emotional rather than practical.

"If someone has a strong emotion, happy or sad, you feel more connected than usual" (Laura Nieuwenhuis).
- The mood of both parties.
- Both parties should have enough time for the conversation and not be distracted or occupied by other things.
- The other person: people report that their feelings of connectedness vary per person. The strongest feelings seem to occur between parents and children.

"With my daughter and grandchildren I can feel very much connected. But not with my sons and other family members. They are less spontaneous and they don't allow the conversation to become too personal." (Simon Sanders).

"It depends on the person. With my children I have a feeling of being close. I don't feel that way about my other family members; with them I only talk about practical things." (Ed Nieuwenhuis).

For very emotional calls, people have a strong feeling of connectedness, but they also perceive the phone as too restrictive.

"Phone calls with my father and mother are difficult, very emotional, because their health is not good. I feel very connected but the phone just isn't enough. I also want to see and touch them." (Marloes de Jong).

"The feeling of connectedness takes longer to build up than in a face-to-face meeting, because you miss the cues of seeing and touching each other." (Margot Nieuwenhuis).

"I sometimes feel unsatisfied after a phone call. I sometimes feel the need to strengthen my bond with someone, but it just doesn't work over the phone." (Anne Berends).

- After-effects

Phone calls can have strong after-effects, that is, if people felt connected to each other during the conversation. People describe that the feeling of connectedness lingers for minutes, hours or even days.

The after-effect depends on who the other person was, the content of the conversation (especially happy/sad topics) and the context in which the contact takes place (are people distracted afterwards). Several people say that they keep thinking about an emotional conversation until their partner (wife, husband, boyfriend, girlfriend) comes home and they tell them about it. People also describe how a feeling of connectedness can disappear because they have to concentrate on some other task, but comes back later when they have time for it.

“It depends on what I do afterwards. If I am distracted it goes away. But then it often comes back when I am in bed or the next day.” (Simon Sanders).

“For practical matters it’s only a minute. But when it was a very happy or sad conversation it can stay for hours, or the rest of the day...Until my boyfriend comes home and I tell him about it.” (Laura Nieuwenhuis).

“If the other person makes me feel better, I keep that feeling with me for a long time. We live very isolated, you know.” (Anne Berends).

Mobile phone

- Frequency of use

The use of a mobile phone is much more varied in this group. Out of 15 people, only 7 use it regularly (varying from once per 2 weeks to 3-4 times per week) for contact with their family. 4 people explained that they have a mobile phone, but they use it only for very urgent matters. The other 4 people don’t have a mobile phone.

- Reasons

Reasons for using the mobile phone are much more practical than for the traditional phone. People use them for urgent things that can’t wait until they or the other person is at home, to coordinate their actions while travelling, or to save money (calling to another mobile is cheaper than using the traditional phone). Only 3 people said that they use their mobile phone for purely social or emotional contacts.

- Advantages & Disadvantages

The main advantages of the mobile phone is that it can be used anywhere. This is particularly useful for the coordination of activities when travelling. One participant also mentioned that you can easily seek out isolation if you need more privacy.

As the main disadvantage, people mentioned the costs of the mobile phone. Other disadvantages were the fact that you can be called at inconvenient times, having it with you and answering it can become an obligation and you can disturb others with it.

- Feelings

Only the participants who use their mobile phone for social and emotional contacts said that they sometimes have a feeling of connectedness. The feelings and after-effect of such contacts are comparable to the traditional phone.

“I can tell how the other person feels, by their voice. This creates an emotional bond” (Arjan).

Other participants said they never have this feeling, because they use it only for practical contacts. Several people mentioned that they can only feel connected to the other person when the contact takes place in their home or another quiet environment where they feel relaxed.

For contextual reasons (being on the move or with others) the mobile phone can be disruptive. The mobile user is currently out of touch, but opportunities exist for the person to start communications while travelling and to seek private locations for holding a phone conversation.

SMS

- Frequency of use

Only 4 participants use SMS to communicate with their family members. Reasons for sending an SMS can be practical, like questions or reminders. SMS is also used for short emotional messages and special occasions (e.g. birthdays, happy new year).

- Advantages & Disadvantages

Participants liked SMS because it has a surprise-effect on the receiver. Other advantages are that you don't disturb your environment, e.g., during lectures, you can use it when you don't feel like talking and it's relatively cheap.

A clear disadvantage of SMS is that the message has to be short. Participants also find it impersonal.

- Feelings

Only one participant indicated that she can feel a little bit connected when using SMS.

"My sister is living in England and I don't often talk to her. When I send her an SMS to surprise her or to let her know I'm thinking about her, I feel a bit connected to her." (Marieke).

Other participants said they never feel connected while sending or receiving SMS, because the messages are too short and impersonal.

E-mail

- Frequency of use

12 participants indicated that they regularly use e-mail to contact their family members (at least once per week). 4 participants use it infrequently, only if there is some special reason, e.g., to organize something. One participant doesn't use e-mail at all for family.

- Reasons

E-mail is used most often for practical things that are not urgent. The exchange of data (addresses, numbers, wish lists) and the coordination of activities (meeting, birthday parties) are named most often as reasons for sending an e-mail. These e-mails are often sent to several family members at once.

Several participants also use e-mail for social and emotional contacts: informal chats about everyday things, sharing emotions.

"If mum is working on the computer and I feel like it, I ask if I can send an e-mail, if I have something nice to tell to my grandmother." (Chantal Sanders).

Two participants mentioned that e-mails increase around real meetings.

"I send more e-mails after I saw someone. We talked, so I know more about the other person and can ask him questions about events that I know are going to happen." (Arthur de Jong).

- Advantages

People find e-mail very practical because they can send it to several people at once. Another advantage which almost everyone mentioned is that they can do it in their own time. They can read and answer their e-mail when they have time and are in the mood for it. And, more important, they have time to think about what they want to say and to formulate it in the right words.

"If I want to explain something in my own words, I use e-mail. I have time to think about it and I'm not distracted by the reaction of the other." (Anniek Sanders).

"You can read an e-mail, take some time to think about it and react on it in your own time." (Renske Sanders).

"With e-mail, everything is on your own conditions." (Margot Nieuwenhuis).

When people send an e-mail, they don't have to worry about whether they disturb the other, or the other is at home. Also, the free format of e-mail is appreciated: you can send 3 pages of text or just one sentence and it's ok to make errors.

- Disadvantages

One of the main perceived disadvantages of e-mail is that, if people want to use it in their home environment, they often have to perform many actions (start up pc, connect, log in) before they can use it. Another problem is that not all people check their e-mail regularly. This can lead to uncertainty on the part of the sender, because s/he doesn't know when the message will be read.

A different kind of disadvantage is that e-mail is prone to misinterpretations. Since there is no direct reaction, the sender cannot explain the meaning. This can lead to misunderstandings.

"On paper, things sometimes look different than I intended." (Laura Nieuwenhuis).

- Changes

Participants proposed several changes to e-mail. First of all, it should become more easily accessible and free from spam. Secondly, people would like to have a confirmation when their e-mail has been read. Finally, one participant would like to make e-mail more personal. She would like to add drawings to it and replace typed text by her own handwriting.

- Feelings & After-effects

Participant's feelings while writing or reading e-mail vary. Several people report that they don't feel connected at all, because they use e-mail only for practical contacts. Others say that they can feel a bit connected if the topic is funny or emotional. For some people this feeling is stronger when writing, for others it's stronger when reading e-mail. However, it never reaches the level of connectedness they have when using the phone.

"Even for serious e-mails it's much less than the phone...because there is no voice, no touch. It's a very cold medium. I only like it because I know the other person well, so I can imagine them." (Margot Nieuwenhuis).

A third group of participants explained that for them, the feeling of connectedness is the strongest of all media.

"It can be even stronger than the phone, because I take the time to formulate my thoughts and emotions and get a similar reaction." (Renske Sanders).

"I feel more connected than on the phone, because I concentrate on the other person much more." (Anniek Sanders).

For this last group, e-mails also have strong after-effects. They say this is because it is open-ended, they don't get a direct reaction and therefore they keep thinking about it for a longer time (up to one day).

Voicemail

- Frequency of use

Most participants (15 out of 17) make regular use of voicemail or answering machines, varying from 1-2 per month to daily use.

The reason for using voicemail is quite obvious: to leave a message when someone doesn't pick up the phone. This can be either to pass on a piece of information, or just to let the other person know that you tried to reach him/her. There are also some other motives:

"Even if I can't reach them, I still want to let them know that I'm thinking about them." (Laura Nieuwenhuis).

"If I don't want to talk to people but I have to tell them something, I call when I know they are not at home, so I can leave a message on the voicemail." (Margot Nieuwenhuis).

- Advantages, Disadvantages & Changes

Most participants think voicemail is very efficient, because they can pass on practical information if the other is not available. This way, they don't have to remember that they should call again later, or they can ask the other person to call them back.

However, drawbacks are that they can't be sure when the other hears the message. Also, some people don't like speaking to an answering machine.

"I'm very bad at it, I always say stupid things!" (Laura Nieuwenhuis).

"I always feel a bit awkward talking to a machine." (Arjan).

As changes, people proposed a notification when the other hears a message and an option to indicate the urgency of a message.

- Feelings

Voicemails don't seem to be able to give rise to feelings of connectedness. People report that messages are too short and practical and talking to a machine feels too artificial. People can be amused by funny voicemails, but they don't feel connected to the other person.

Postcards

- Frequency of use

Postcards are not used very regularly. One participant said she sends 3-4 postcards each month; for the other participants it varies from 1-2 per month to 3 per year. Several participants don't use them at all.

- Reasons

Postcards are often sent for special occasions like birthdays, Christmas or holidays. They are also used to wish people good luck (e.g. for exams) or thank them for something. Several people told that sometimes they send a postcard because they see one that is very suitable for a specific person.

"If I see a card that I think someone will really like, or if I have an association with that person." (Marloes de Jong).

"If a card is very suitable for someone. Or if I am in a place where I was before with that person." (Margot Nieuwenhuis).

In these cases, the postcard itself can be more relevant than the text on it.

"I just write something sweet, often only one sentence." (Noortje Nieuwenhuis).

- Advantages

People seem to like postcards very much. As an advantage, almost all participants said that it's very nice to receive them. They are perceived as something very personal, because they are handwritten and can be specifically chosen for a person. They also have a surprise-effect. People like the fact that they can keep them. A postcard is highly appreciated, because someone else took the effort to choose one, write it and post it.

"It's so nice to receive them. You can make the other feel good, it's a way of supporting someone." (Renske Sanders).

"The card itself can be very nice. And it's permanent, you can keep it." (Selma Nieuwenhuis).

"It feels like a small present. And sometimes you can see it was specifically chosen for you." (Margot Nieuwenhuis).

"You can choose it for someone, or you can make it yourself. It's a surprise, it makes you happy." (Noortje Nieuwenhuis).

- Disadvantages

Participants don't think postcards have real disadvantages. The mail isn't perfectly reliable, so they can't be sure when it will be delivered. Also, two people said that they don't like it if there's a standard sentence on it.

"Sometimes the message is boring, only greetings and a name. It's nicer if there is a story."
(Nienke Sanders).

- Feelings and After-effects

Some people can feel connected with each other because of postcards. They say this is because they specifically choose the card and the message for someone and concentrate on that person. They say it's a different feeling than they have on the phone, because they don't have a direct contact.

"It can touch you emotionally. The combination of a selected card and one sentence can be very powerful." (Noortje Nieuwenhuis).

Several people said that the after-effect of postcards can be quite long, even days. This is mostly because if they receive a postcard, they keep it in a visible place so they are reminded of it.

Guided Speculation

During the guided speculation we probed the participants for reactions on certain issues that earlier research on awareness systems has shown to be critical (see Markopoulos et al 2003). These are:

- **Asynchronicity:** CMC communication has the advantage that it can be buffered, i.e. asynchronous. It does not require both parties to be busy at the same time with the communication, thus liberating them from constraints of availability.
- **Type of Information:** The nature of the information exchanged and the medium of the message can affect significantly what benefits can the users reap from an awareness service. For example, simple instructions may be delivered in text or pictorially, facial expressions can convey emotions very effectively, etc.
- **Participation Structure.** While our earlier studies have focused on one-to-one communications, more realistic scenarios involve sharing information with more people. Even with telephones, it is very common to use telephones with loudspeakers, so that more people can listen in the conversation (such a practice might be relevant for tele-conferencing at work situations, but much more relevant for social calls for 'keeping in touch' between parents and an adult child who lives far away).
- **Memory (History).** CMC brings about the ability to store communications indefinitely, e.g., e-mail messages can be stored and archived. Combining this with informal social communications may bring advantages, e.g., keeping nice messages like some people do with post-cards. On the other hand, it may also bring problems: the system becomes an information system with the corresponding bonus of organising and retrieving archives of messages. The extent to which a history of communications is appreciated or is threatening to privacy is an issue open for investigation.
- **Automatic Capture.** One of the advantages afforded by recent developments in technology is the ability to automatically capture context information that may be used for awareness purposes. E.g., it may be possible to detect that at one's home it is dinner-time or that father is now passing through the local railway station. This capability extends earlier experiments, like the Portholes project at Xerox PARC, where co-workers are presented with automatically maintained awareness information.

Reactions of participants to these issues are discussed in the following paragraphs.

- Asynchronicity

Participant's reactions to the concept of asynchronicity fall into three categories. Firstly, there were people who thought that a new asynchronous tool would not have added value for them.

"It wouldn't really add a lot, because there is so much already. And you can do so much with e-mail" (Renske Nieuwenhuis).

“I think it would be too much. There are so many devices already and I’m afraid it would become just another obligation.” (Ed Nieuwenhuis).

Then, there were participants who liked some aspects of the idea, but didn’t think it was really necessary. They found it quite difficult to imagine how they would use it.

“I would have to get used to it. It’s nice that you can do everything at your own terms.” (Arthur de Jong).

“It’s nice that you can use it when it’s convenient for you. But it’s not really necessary, there is so much already.” (Selma Nieuwenhuis).

“It could be nice if you have a busy job and you don’t have time to communicate or see each other. In my current situation I would only use it for my sister in England.” (Marieke).

Finally, there was a group of participants who were really enthusiastic about the idea. Things they liked about it were:

- It would help them to stay in touch with their family and be more involved in each other’s lives.
 - “It would help me to have more contact with them. Every day, there are many moments that I would like to share, but I don’t have the time or the possibility.” (Anniek Sanders).
 - “It would be possible to involve my family more in my personal experience, things that I normally don’t share.” (Arjan).
- The sense of connectedness would be stronger.
 - “The feeling of connectedness would be stronger, because you consciously select the moment for it, so you have time and are in the right mood. It has a different value than current tools” (Noortje Nieuwenhuis).
- They could communicate in their own time, at their own terms.
- They could send messages without disturbing the other.
 - “They are not disturbed if they don’t want to.” (Paul Berends).
 - “You can send something when you feel like it, the other doesn’t have to be available.” (Arjan).
- It would be useful for situations where direct communication is not possible/desirable.
 - “Sometimes you just don’t feel like talking, but you still want or need to have some contact.” (Laura Nieuwenhuis).
 - “In some environments or occasions it’s not possible to have interaction. You could still send each other something.” (Margot Nieuwenhuis).
- It could enhance real meetings.
 - “If I would for instance make pictures at work, they would have more context and become more interested in my working situation. This would also have a positive effect on our real meetings: we would have more to talk about.” (Arjan).

Although they liked the concept, several people remarked that it should not be a replacement for telephone. Also, they said it should be easy to send each other things, if many actions were required they would go back to other tools.

- Usage of Asynchronous system

Several participants had concrete ideas about what they would use an asynchronous device for. Most people would use it for social and emotional contacts and not for practical things.

“I would like to create a shared information channel for the whole family: to exchange information and show them things.” (Paul Berends).

“To share things that are important or funny. Especially with my grandchildren.” (Simon Sanders).

“For very personal, emotional messages.” (Noortje Nieuwenhuis).

“To show my family nice or unusual things that I do. For instance, if I was in a nice restaurant. Then my brother would come home from work and he would see me sitting there, eating pancakes.” (Arthur de Jong).

“For special, happy occasions. For example if I was very happy about a new job.” (Margot Nieuwenhuis).

“For practical things. To send a message to the whole family if I want to arrange something.” (Laura Nieuwenhuis).

“As an addition to verbal contacts over the phone, to show each other things.” (Anne Berends).

“To get more involved in each other’s lives.” (Arjan).

“To show grandma my horse riding lesson.” (Chantal Sanders).

“To record things like swimming lessons, or funny things that happen in our house.” (Nienke Sanders).

- Type of information

Almost all participants focused on the sharing of visual information, that is, pictures or moving images. They say that this is what they miss most in current tools. Some of them would like to add their own comments (voice or handwriting). Most participants said they prefer concrete information to abstract information. This could also be because it was difficult for them to imagine a system with abstract information.

“I want concrete information. Just the knowledge that someone is there or is thinking about you is not enough for me.” (Simon Sanders).

“I don’t think abstract information would be sufficient. I want to see what someone is doing, how they are looking.” (Margot Nieuwenhuis).

Two people thought it would be nice to share smell and touch, or find some metaphor for it.

“To give someone a hug when they are feeling bad. But it should not be too abstract, they should be able to understand what I mean.” (Anne Berends).

One participant wanted to share all different types of information.

“Everything! Moving images, so you can show things that happen. Sounds that you both recognize...also drawings and pictures or pieces from films or music. I would like to make a collage that stimulates all the senses.” (Noortje Nieuwenhuis).

- Participation structure

Most participants would like to be able to send messages to their whole family at once, but also to specific persons or a selection of people.

“Sometimes to a group of people. But some things are only understandable for one person, or are too personal.” (Noortje Nieuwenhuis).

- History

Almost all participants indicated that they would like to save (a selection of) each other’s messages for at least some time. Only practical messages should not be saved. Some people want to keep messages for a short time and only keep the most special ones permanently.

“Only some very special things. Normally, your own memories and emotions also fade away.” (Anne Berends).

Other people would like to store messages permanently, for instance in the form of a photo-album. A print function was also requested by several people.

“I would definitely keep them. Now, I also keep all my letters and postcards.” (Noortje Nieuwenhuis).

“Things should be saved automatically and once in a while you should make a selection of what you want to save longer.” (Paul Berends).

- Automatic Capturing

None of the adults liked the idea of automatic capturing and broadcasting of information about themselves. Reactions varied from shock and disgust to mild disinterest. The main perceived disadvantages were privacy issues, loss of control and overload of information.

“It would be much too intrusive. You don’t have to know everything about each other.” (Selma Nieuwenhuis).

“No, you have to be able to do your own things, without having to share everything.” (Renske Sanders).

“I don’t use MSN because I don’t want other people to know when I am online. This goes much further.” (Laura Nieuwenhuis).

“I like the fact that it’s effortless, but people should not be flooded with irrelevant information. So the system should recognize important events and I don’t think that is possible.” (Paul Berends).

The option to have automatic capturing, but make your own selection before it is sent also didn’t appeal to most people: Only three people liked it. They thought it would be nice that the system records information, so you don’t have to think about it yourself.

Several people also mentioned that the automatic capturing and broadcasting would be useful for special situation, e.g. on special occasions that not all family members can attend, or when someone is ill or in the hospital.

The children both liked the idea; they thought it would be fun. Their only objection was that they would no longer be able to steal candies.

There was a bit more enthusiasm about receiving automatically captured and sent information about other family members: seven people (including the children) said that they would like it. However, it should only be possible with the consent of the sender. Also, people would not want to receive information continually. It should be focused on special occasions; things that the other knows are interesting for others. Another idea was to have a “summary” in the evening of someone else’s activities that day.

“It would be fun, but not if grandma is vacuum-cleaning or doing other boring things.” (Chantal Sanders).

“I would like that. Especially for my brother, because I don’t see him very often.”

However, there were also many people that didn’t like the idea. They were afraid of information overload and concerned about privacy of the other. Also, information that is not consciously selected by the other person has limited value to them.

“I don’t want to see everything about their lives, even if they are very close to me. However, if I get grandchildren I would love it!” (Anne Berends).

“It’s less personal if it is automatic. They should want to show it themselves, that has much more value.” (Arjan).

“The sender should take the initiative and choose the moment. Otherwise it’s not personal, you are communicating with a machine.” (Paul Berends).

4. Results from the Diaries

A total of 103 contacts were recorded in the diaries. Of these, 22 were excluded from further analysis, because they were between members of the same household, who see each other every day, so these communications were out of the scope of this study.

A debriefing interview was conducted, to get more information about the use of diaries by participants. Most participants said they wrote down contacts right after they happened, or otherwise at the end of the day. Three participants said that they sometimes did it the next day. One participant “confessed” he forgot to write down a contact and copied it from his wife’s diary two days later.

Almost all participants reported that they liked filling in the diary. The number of contacts they had had in a week surprised many of them, it was much more than they expected.

One participant mentioned that she did not like the feeling she had during her first contact after starting with the diary. The knowledge that she had to write something about it made her very self-conscious. Fortunately, the feeling disappeared with later contacts.

Several participants mentioned that they found the diary quite lot of work sometimes. Especially the people with a busy job, or who had many contacts had this experience. This is also visible in some of the diaries themselves: they start with extensive sentences, but towards the end of the week people tend to write more and more in keywords.

Some participants found it very difficult to write about their feelings. One of them never answered these questions, because he just didn’t know what to write.

Because the family clusters filled out the diaries in the same time period, it was possible to compare matching entries. There were only 5 contacts of which we could not find a matching entry. This shows that people wrote down their contacts quite faithfully.

We started the analysis by grouping the entries into categories, according to different principles:

- Categorising by medium: mobile phone, normal phone, normal voicemail, mobile voicemail, postcard, e-mail and SMS.
- Categorising by motivation: special occasions, specific, general, asking for help or advice, reaction, special coordination and general coordination.
- Categorising by feelings: very positive, positive, neutral and bad.
- Categorising by gender: male and female
- Categorising by time: morning, afternoon, evening and night.

In Figure 1, we show how three diary-entries were characterised along the dimensions listed above. The left column is a code, e.g., JoArGCFtN06 assigned to the entry, describing the family (here Jo), the person filling-in the diary (here Ar), the motivation (here GC for general coordination), the medium (here Ft for Fixed Telephone), the feeling after the communication (here N for ‘neutral’) and a numerical suffix indicating the diary entry. This classification was mapped to the information under the columns corresponding to these categories, so that the Microsoft Excel spreadsheet software could be used for analysis.

	MEDIUM						MOTIVATION				FEELING	SEX	TIME																			
	fixed phone	mobile	msn	e-mail	fixed voicemail	mob voicemail	card	sf special occasions	sf specific	sf general	ask help/advice	reaction	special coord	gral coord	very positive	positive	neutral	bad	female	male	morning	afternoon	evening	night	Initiative		FROM		TO		WHERE	DURATION
JoArGCFtN06	1													1			1		1					1	1	PARIL	SONIL		HOUSE		3M	
JoArGCFtVP01	1													1	1		1				1	1			1	SON	MOT		HOUSE		1M	
JoArSCFtN05	1												1				1		1		1				1	BRO	SIS		HOUSE		2M	

Figure 1: Extract of the coding scheme to characterised the diary entries.

Factors that we also took into account were the relations between parties (e.g., contact between mother and daughter), the direction (indicating the person who took the initiative) and the location. The next step was to enter all this information into a spreadsheet. So for each contact, it was directly visible what medium was used, what the motivation was, etc. By applying different filters we could determine relationships between variables. An important disclaimer should be noted: even though numeric, the data presented here is shown as indicative and provisional results from qualitative research. No claim about statistical significance of the sample can be made and the numbers /percentages shown are simply descriptive of the communication activity of our informants during the short period of this requirements study. The exposition below pulls out some potential observations, which we shall relate to other research to help formulate our hypothesis for the ASTRA prototype. A more rigorous quantitative evaluation study will follow the implementation of the ASTRA prototype (as part of work package 3).

- Type of contacts

As can be seen in Figure 2, the majority of recorded contacts were of a practical nature (59%). However, there were also quite some social contacts (26%). There were not many contacts that were purely emotional (4%). A substantial amount of contacts were related to a special occasion (11%); this can be attributed to a birthday that occurred in one of the family clusters.

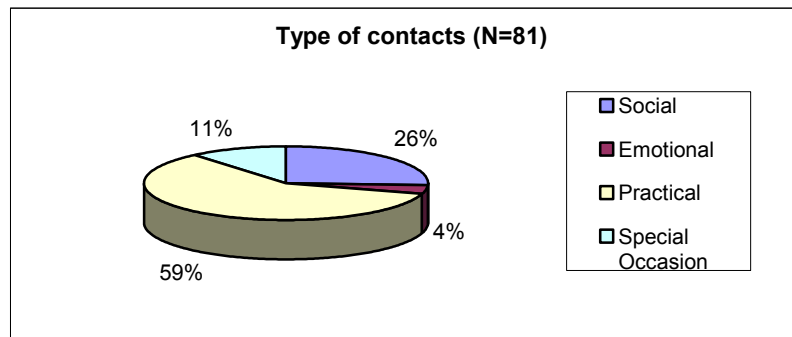


Figure 2: Classification of the recorded contacts by Purpose

“She wanted to share with me that her friends in New Zealand sent her a great package. I had to provide a “listening ear” for her” (emotional contact).

“Nice chat and news” (social contact)

“It was her birthday. I was happy that I allowed myself to call her so early to congratulate her.” (Occasional contact).

- Feelings

According to the diaries, contacts can give rise to varying feelings. The feelings after most contacts were rated as neutral (38%); these were often practical contacts. However, many contacts also give rise to positive (26%) or even very positive (30%) feelings. In a minority of cases, feelings during and after a contact were rated as negative (6%).

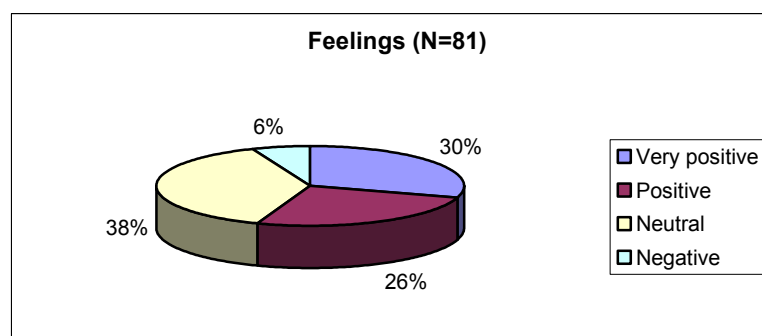


Figure 3: Classification of the recorded contacts by Feelings

To find out more about what makes a contact positive or negative, we studied the content of the positive, very positive and negative contacts. We found that contacts were rated as positive when the participant could tell the other person was happy, when emotional support was given/received during a contact, when participants planned a meeting or when a contact involved a person that was normally difficult to reach.

“She wanted to tell me that her friends in New Zealand sent her a great package. When she is emotional, I can always tell it right away and I feel very connected with her” (Selma Nieuwenhuis).

“I am happy that I can contact him in this way (MSN). He only has a telephone at work, so I don’t call him that often.” (Renske Sanders).

“Happy. Grandpa should bring his skates because the skating rink is open. Grandma too, so we can go skating.” (Nienke Sanders).

Contacts were rated as negative when they came at an inconvenient moment (wrong time / wrong mood) for the receiver, or when expectations about a contact were not met.

“I was rather tired and did not have the energy to talk for a long time.” (Selma Nieuwenhuis).

“Irritation and after some time slight worry.” (Laura Nieuwenhuis; she tried to call her parents but they were not in).

The contacts that participants felt positive or very positive about were mainly social or practical (Figure 4). Most practical contacts, however, gave rise to neutral feelings. Participants only experienced negative feelings in social and practical contacts and not in emotional or occasion contacts.

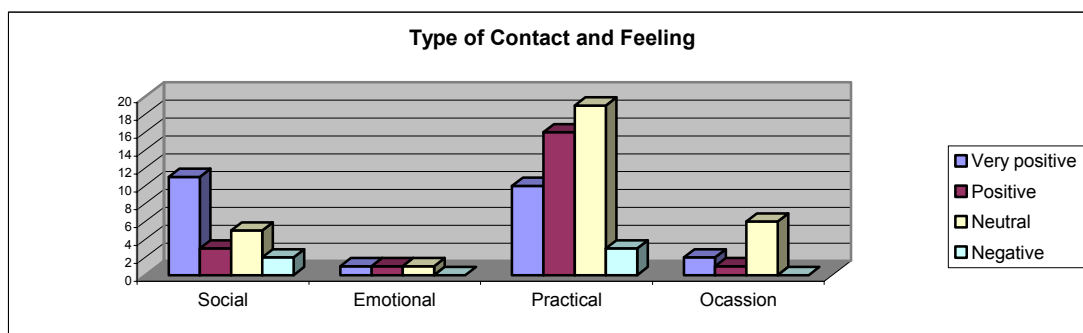


Figure 4: Classification of Feelings based on Type of Contact

- Synchronous vs. Asynchronous Contacts

More contacts were made by synchronous communication means (60%) than by asynchronous means (40%). The difference, however, was smaller than we expected. Therefore we looked at the recorded asynchronous contacts and noticed that in many cases participants wanted to communicate in a synchronous way but had to revert to asynchronous means (most often voicemail) due to the unavailability of the other person.

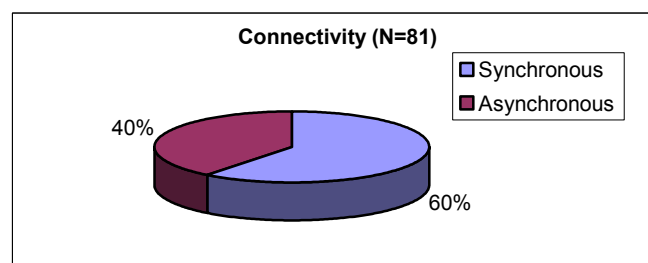


Figure 5: Usage of Connectivity

As can be seen in Figure 6, social and emotional contacts were made with asynchronous means almost as often as with synchronous means. With practical contacts, there is a strong preference for synchronous means; an explanation for this is that people want a direct answer. The special occasion-contacts were also conducted by synchronous means more often.

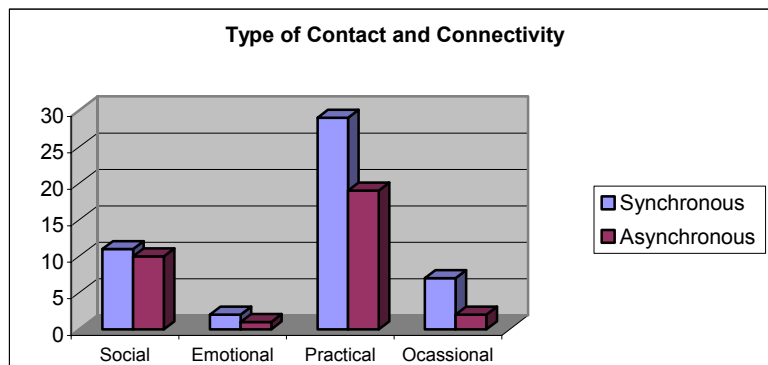


Figure 6: Classification of Contacts based on type of Connectivity

Figure 7 shows that contacts that participants felt very positive about, were made by synchronous communication means much more often than by asynchronous means. For the positive contacts, this difference was much smaller. Neutral contacts were conducted by asynchronous means slightly more often than by synchronous means. Finally, people had negative feelings about contacts with synchronous means more often than about contacts with asynchronous means.

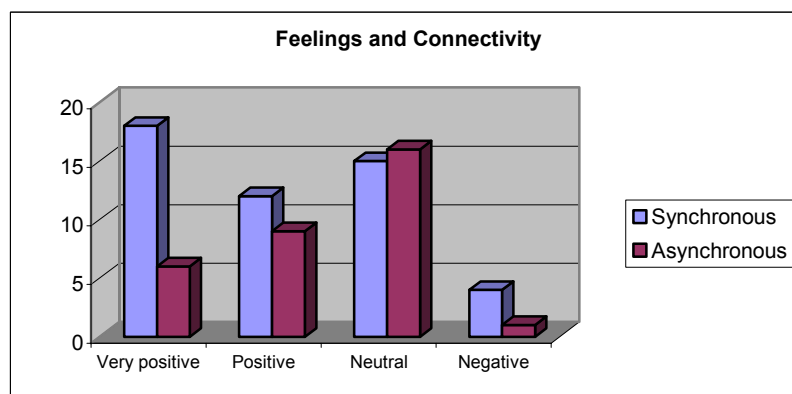


Figure 7: Classification of Feelings based on type of Connectivity

- Different Media

Figure 8 shows the different media that were used by participants. It is clear that the traditional phone is used for most contacts (60%). E-mail is the second most used medium (20%). The voicemail of the traditional phone is also used quite often (9%), due to the frequent use of the phone. Quite some contacts through MSN were recorded (6%); these were all within one family. Mobile phone and mobile voicemail were not used often (respectively 2% and 1%). Three postcards were recorded (2%).

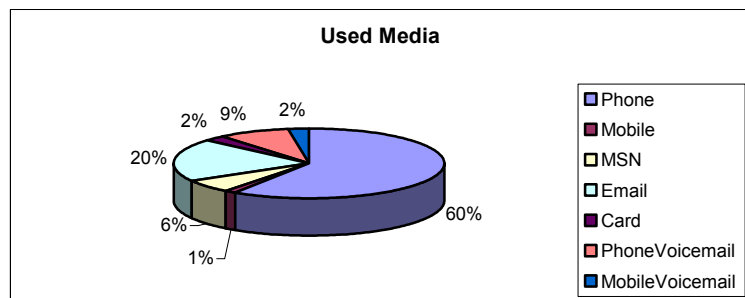


Figure 8: Usage of current Medias

Contacts that participants felt positive or very positive about were mainly made by normal phone, MSN, or e-mail (Figure 9). Only a limited number of contacts were made by mobile phone, but all of them gave rise to negative feelings. Participants also did not like contacts with voicemail very much. Contacts with normal voicemail mostly resulted in neutral feelings, contacts with mobile voicemail in neutral or negative feelings.

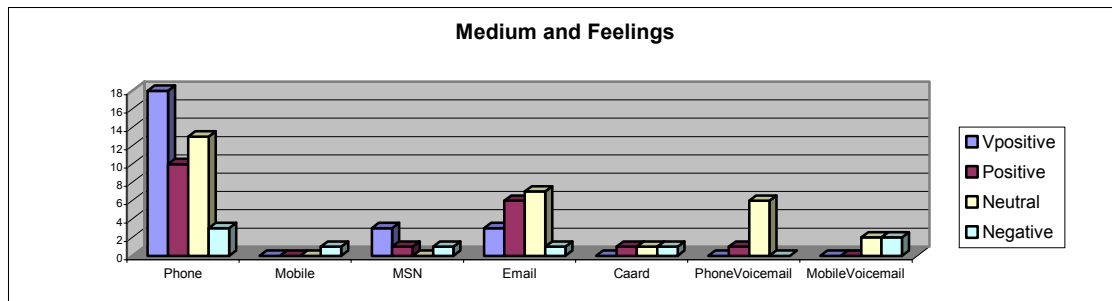


Figure 9: Classification of most used current Medias based on type of Feeling

Figure 10 shows that social contacts were mainly conducted by normal phone, MSN and e-mail. For emotional contacts, only normal phone and e-mail were used. Practical contacts mostly involved normal phone, e-mail and voicemail. For occasion contacts, the normal phone was used most often.

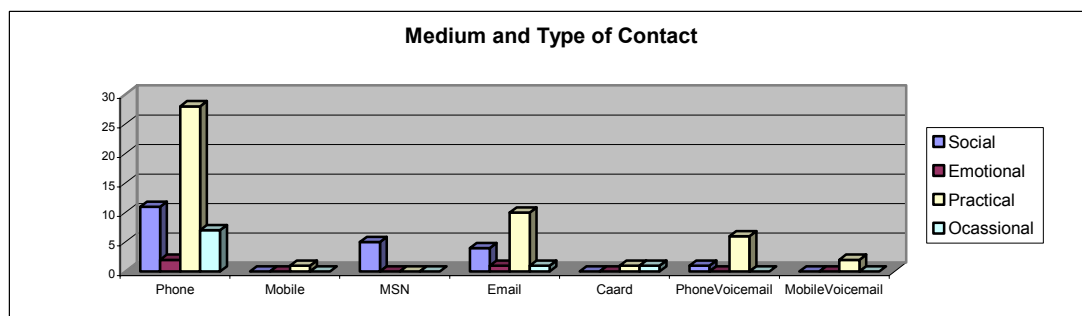


Figure 10: Classification of most used

- Gender Differences

There was a marked difference between men and women regarding the amount of contacts (Figure 11). The vast majority of contacts (81%) were made and recorded by women. One should keep in mind here that the sample contained 4 men (31%) and 9 women (69%), but even if this is taken into account the difference is still larger than expected.

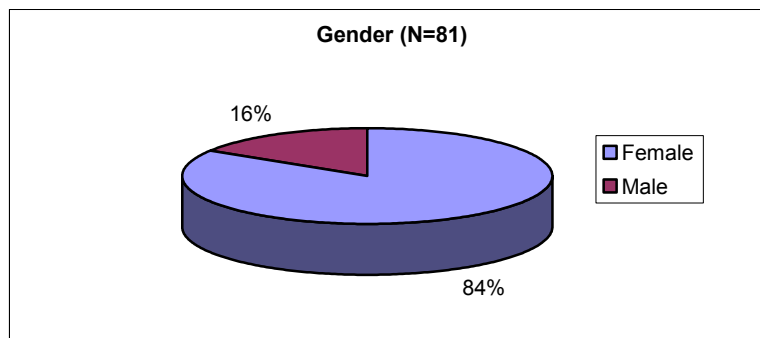


Figure 11: Classification by Gender

There is also a difference in the type of contacts that men and women are involved in. Whereas women take part in all types of contacts, men only take part in practical contacts (Figure 12).

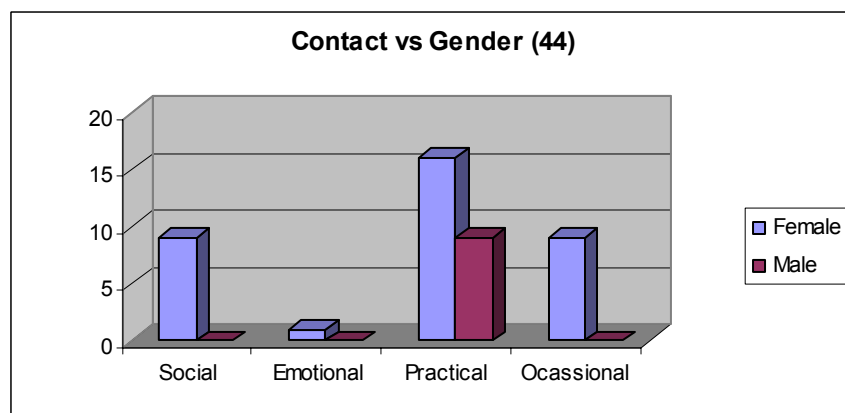


Figure 12: Classification of type of Contact based on Gender

There does not seem to be a large difference in the feelings that men and women have about contacts. However, only women had negative feelings about contacts.

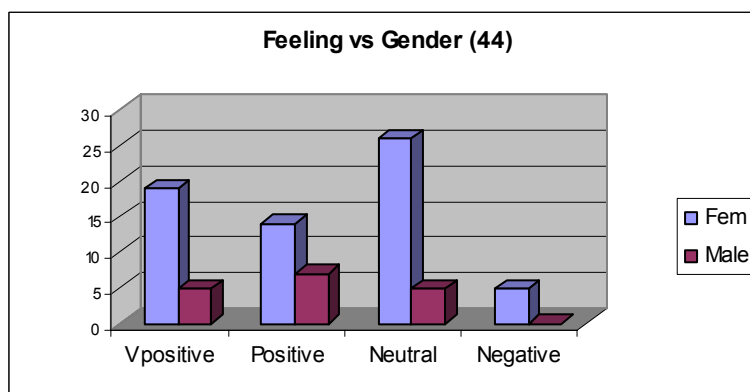


Figure 13: Classification of type of Feelings based on Gender

Relationships

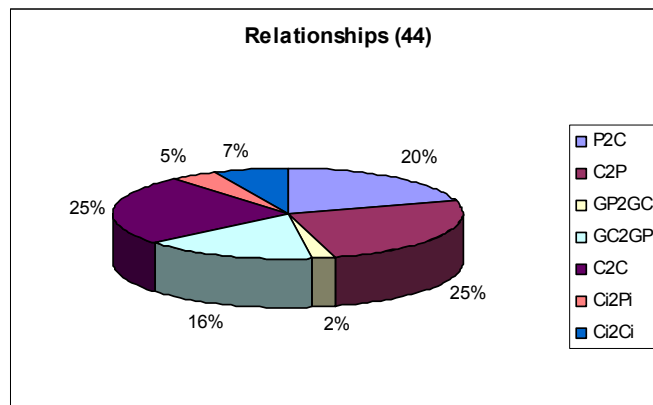


Figure 14: Type of Relationships

We also looked into the relationship existing between people who contacted each other (Figure 14). Most contacts were between parents and children (45%). Also, many contacts between brothers and sisters were recorded (25%). There were many contacts between grandparents and grandchildren (18%), especially considering the fact that we had only one family cluster containing grandparents and grandchildren.

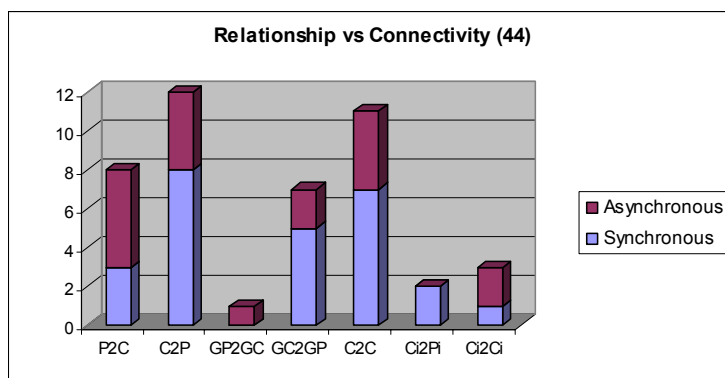


Figure 15: Classification of type of Relationship based on type of Connectivity

For most relationships, we observed a preference for synchronous communication means (Figure 15). However, parents contacted their children by asynchronous means more often than by synchronous means. This could be attributed to the fact that many of the children were difficult to reach, so parents had to revert to voicemail or e-mail. It is also quite remarkable that grandparents contacted their grandchildren by asynchronous means only.

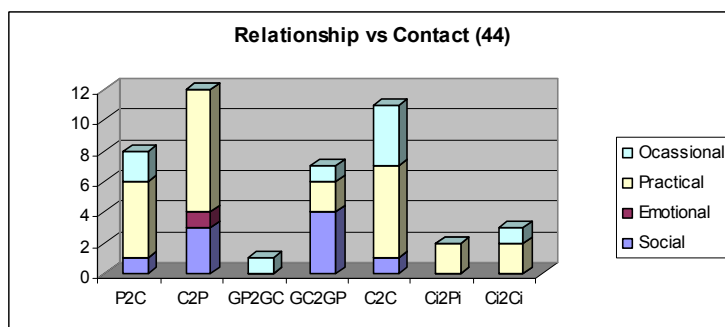


Figure 16: Classification of type of Relationship based on type of Contact

Finally, we looked at the type of contacts for the different relationships. The most important finding here was that all emotional contacts involved children contacting their parents.

Conclusions from the requirements study

By combining the interview with the diary results we conclude the following issues:

- Participants indicated that they appreciated it if a medium (e.g. the phone) allowed them to contact others in a quick and easy way and disliked it if many actions were necessary to make contact (as is currently the case with e-mail).

We note how this relates to the research of Melenhorst (2002) who studied how elderly adults perceive the value of communication media. While such costs (in terms of effort to use) are important to elderly, they affect their decision to use a communication medium less than the perceived benefits. In other words, the priority of ASTRA should not be ease of use or learning, but on delivering added value in terms of emotional benefits.

- The timing of the communication is crucial. Participants indicated that they would like to share events of their everyday life with their relatives, right at the moment when they happen. At the same time, timing for receiving a communication should be negotiated with the receivers so as not to disrupt them.
- Almost all participants said that abstract information (e.g., symbolic icons or text labels) regarding the availability, status or activities of their family members would not be sufficient for them. (Abstract information is for example adopted in the AROMA project, the Family Portrait of Georgia Tech and the Home Radio by Philips Research). Therefore, the system should enable users to share concrete information with each other, e.g., pictures or messages. An awareness system should provide concrete and visual information.
- Effort put by the sender is appreciated and is valued, but only when it is meaningful with respect to the communication. For example, the effort taken to start up a PC, log in and send a message is not valued compared to the message of choosing a postcard to fit the personal taste of the receiver. Note, that receivers of communications do not perceive extra value for the financial costs incurred by the sender, (in agreement with the findings of Kraut et al. 2002).
- There is reticence by participants to adopt communication media that will create new obligations. Communications for social purposes create obligations but also are valued less when they seem to be obligatory.
- Communication with images was required by participants, perhaps as an aid to phone conversations.
- Keeping favourite items (messages, pictures) would be valued.
- The surprise factor is valued: routine communications are not, whether it concerns timing or content.
- Using an awareness service at home should not be disruptive to relaxation. Participants want to keep strict control of reachability to different people.
- Feeling connected relates to social presence and intimacy, but can be seen as a feeling that lingers on after the communication. We need to seek ways to assess this lingering feeling and help create it. It also relates to some notion of engagement, i.e., focusing on the communication itself in its duration.
- Participants saw value in enhancing the existing media rather than replacing them: talking about an item/message of an asynchronous service during a phone conversation, or using it as a reminder for calling someone.
- An awareness system could serve the role of a family information channel. This idea has been explored in the Home Radio project at Philips Research, see Eggen et. al. (2003).
- Use in a comfortable and relaxing environment is valued (this was mentioned as a benefit of a telephone or a mobile phone that you can take to a place of your choice to phone from).
- Primary beneficiaries for awareness systems are geographically distributed families, for cross-generational communication (parent to child and grandparent to grandchild).

5. Technological framework

Currently, requirements from the awareness platform are only hypothesised. ASTRA will help validate and refine some of these requirements:

- **Interoperability.** The awareness platform should support a variety of user-configurable services, ranging from lightweight services on small mobile devices to more advanced multimedia services based on video/audio and VR. A common denominator for all the services will ensure interoperability among different types of services.
- **The ability to integrate with existing and near-future telecommunication infrastructures.** This will ensure ubiquitous access to the services offered by the platform without the need to invest in proprietary technologies. This property requires us to adhere to existing and emerging standards within presence and related middleware specifications.
- **Scalability.** The platform should constitute a building block in a larger context-aware computing environment: The platform should be interoperable with other services that are required for context-aware computing, e.g. directory servers, user profile servers, location servers, context servers, etc.
- **Security and Reliability.** The platform should preserve users' privacy and deliver dependable services.
- **Manageable and easy to deploy.** The platform should support easy management, e.g., defining new services, defining billing policies, defining Quality of Service, etc. and easy deployment (e.g., through client libraries and support for multiple client platforms).

6. The Scenario Definition

As an indication of the scope of the system we provide a user-goal list.

User Role	Goal
Home User	Check latest to tell items for group (focus attention)
	Check latest items for individual (identify yourself)
	Check status of other person or home (select partner)
	Insert to-tell item for person or home (create item, select partner(S))
	Look back in time
	Start communication
Mobile User	Insert to tell item for person or home
	Check status of home
	Start a phone conversation

The baseline scenario of ASTRA that will support these goals will be described as follows. A global scenario will indicate the participation structure and the canonical use of the device. Task level scenarios will focus on how users on a particular role, can achieve their goals as listed above.

Global Scenario

Bob, 72, lives alone in Eindhoven. He uses the ASTRA system to stay in touch with his daughter Emma's family and his single son Tim. Emma lives with her husband and her 2 children in Amsterdam. They access ASTRA from their shared home device but they also each have their own mobile ASTRA device. They use several other communication media like phone calls, SMS, emails and instant messaging. They use ASTRA to involve each other in their daily lives. With the mobile device they capture and share aspects of daily events, which they wish to talk about later. Such records of daily life are accessed through ASTRA to trigger communications and to be reminded of each other. Sometimes they use ASTRA while phoning or messaging, as something to talk about.

Sharing part of daily life

Laura, 11, has just lost the local judo championship final. She is disappointed but proud of her 2nd prize. She knows that Bob, her grandfather, would like to hear about it and she plans to call him later to tell him all the details. She makes a snapshot of the prize with her mobile device, writes a note at the back, “the referee is a cheat” and designates it as something to tell to Grandpa. An ASTRA message is now sent to and shown in Bob’s home device. Next time she accesses her own home device, she will also see this as a ‘sent’ item.

Talking about an item: Telling him/her about it

Friday afternoon, almost a week after the judo championship, Laura consults her ASTRA home device, which seems to be very busy. She looks at her personal space and notices the item for grandfather she had entered the week before. She checks his reachability and sees he is accessible. She decides to see only granddad-related items and sees that she could also ask him about the new roses that he bought which he has sent her an item about. She pushes on the phone icon and gets through to him.

Talking about an item: Asking about a message

Tim has just had a late breakfast on Saturday morning. He remembers that his father, Bob, sent him some messages during the week. One of them includes a picture showing an old friend of Bob that he had lost contact with years ago. Tim is curious about how they came to meet again. He decides to call Bob to see how he is doing and to ask him all about his friend.

Checking reachability

Tim hasn’t talked to his sister Emma for some time; they both have a busy job and personal life. Today is Sunday and Tim hopes that Emma will be at home and available for contact. He checks the reachability information on his homebound device and sees that she is indeed reachable by home telephone. He calls her.

Checking the well-being of someone

Emma realises she hasn’t talked to Bob for some time and wants to check that he is ok. She activates ASTRA and looks at the messages in her personal space. She checks only the items relating to her father. She sees he has entered several items recently, but none of them this morning. She notices however, that he has just read the message she sent this morning. So she guesses he is fine.

Finding out what’s new

Bob has spent the day with an old friend. When he comes home, he sees that he received two new messages. He clicks on them to see them on the full screen. One is a drawing from his granddaughter Sheila. The other one is from his son Tim, showing Tim and his colleagues in the pub. Bob sees that there is a message on the back, so he flips the picture. Tim has written, “Finally, the weekend has started!”

Interest of homebound person: calm technology

Tim is spending a quiet evening at home, reading. He has put his homebound device in the slideshow mode. In this mode, it acts like a decorative picture frame, showing the 5 last received messages in a slide show. Tim glances at it now and then. There is a small indicator, which shows whether there are new messages.

Viewing older messages

Emma is visiting her brother Tim. They talk about their father, Bob. Tim tells Emma that Bob met an old friend some time ago. Emma is curious about this and Tim remembers that Bob sent him a picture of his friend. He goes to his homebound device and selects only Bob’s messages. The screen shows only the last seven pictures, so Tim has to go back to past pictures before he can find the right one. He shows it to Emma.

7. Implementation Considerations

Mobile client

The user of the ASTRA mobile client (AMC) will be able to keep in touch with a group of other users through the communication mechanisms provided by the ASTRA presence platform (APP). APP will take as much advantage as possible of the functionality provided in Sony-Ericsson P800 mobile phone/PDA to enrich the communication experience of the user. AMC will support the following functionality:

The user will be able to compose a multimedia message and send it to a friend or a group of friends/family members, who can then view them on their homebound device. The composed message can contain images taken using P800's built-in camera, hand-written annotations, and ASCII text. The message will be sent as a normal email message, using the built-in email functionality of P800. These email messages will be posted to a predefined email address for a shared digital space provided by APP. The email addresses of the shared digital spaces used by each user will be registered in the address book of the user's mobile phone to make message composition as easy as possible (though this is not necessary for the functioning of the scenario). An arbitrary number of shared digital spaces can be set up for a family or a group of friends. For instance, a family can have one such space for each family member, one for summer vacations, one for Christmas vacations, etc. Once a message is posted to a shared digital space, it is disassembled by APP and its contents (e.g. snapshots, ASCII text) are stored in the corresponding space. This information is immediately available for viewing on the homebound device.

Realtime access to other users' status.

The user will have access to a special-purpose client on the P800 mobile phone. This client resembles a conventional buddy list found on desktop PCs, but has some additional features. The user can set up a buddy list or family member list (this list can also be predefined by the researcher to eliminate the overhead for the user during the experiment). The list will show the online status of other APP users. APP users can be other mobile users, or residential users who log on to a homebound device. In this way, a mobile user can see whether a home user is "at home" (and a home user can see whether a mobile user is available.) Real-time communication: Instead of sending asynchronous email messages, a mobile user can also send instant textual messages to a homebound user.

9. Related Research

The interest in informal communication between family members or between people with close emotional ties is shared by several recent research projects. The project is innovative in the following ways:

- Studies of awareness systems have concerned largely the workplace rather than private life.
- Investigations so far have focused on interaction concepts and have not lead to a theoretical framework for understanding this technology mediated human activity.
- Social presence research has been largely confined in short-term studies in the laboratory. The relevance of social presence to serving interpersonal communication needs has not been directly questioned or supported. ASTRA shall base its study on medium to long term user testing through the day and in the most part in the field, instead of the laboratory.
- Concepts of awareness systems to date have focused on devices that are positioned at the point where the user is present or not. Traditionally these have been studied apart from mobile telephony services pertaining to availability for communication. The proposed technological developments address the more realistic scenario where numerous personalised awareness services are mixed and are accessed via different devices relevant to different contexts.

The closest to our ideas is the Interliving project (see <http://interliving.kth.se>), where 3 'Technology Probes' have been designed and implemented in order to provide interactive experiences with users, so that they can be equipped to become involved in participatory design. Of the 3 probes made by the Interliving project, one concerns messaging applications. This is similar to our earlier Fridge prototype (Vroubel, Markopoulos and Bekker, 2001) and can play a similar role to the prototype we discuss here. However, the ASTRA prototype starts from a need to integrate and complement existing communication media and the whole design (and the assessment that will follow) is based on this principle. Relating to

the Interliving research, we use ASTRA as a tool for theory development regarding social presence and in understanding the concept of staying in touch or of connectivity.

The Home Radio project by Philips Research (Eggen, Rozendal and Schimmel 2003), explores the idea of a communication channel for the whole family that will rely on ambient and abstract displays. Our approach is of concrete information exchanges to support current communication patterns rather than simply enhance peripheral awareness. Peripheral awareness is also interesting to this project but we focus much more on the active participation of users. Further Home Radio relies on the concept of automatic capture of information, something that the ASTRA prototype will not explore.

The CASABLANCA project, by Hindus et al. (2001), also aimed to support informal intra-family communication. Two different types of concepts were explored: The awareness light and a message board similar to that of the Interliving project. These prototypes were not tested in realistic contexts.

The i3 research project PRESENCE has exercised significant influence on much of this field. First in that it aspired to uncover and satisfy affective needs of people for serendipitous informal communication, second in the approach it used for understanding the target users of the system. Contrary to what the name of the project suggests, the design concepts proposed have not been related to research on the topic of Presence or Social Presence.

The aim of connecting elderly to their communities at times when they are isolated was explored with the Telewindows reported by Heeter (2003). While the phenomenon of social presence is very likely to be relevant in this domain, a formal assessment has not been carried out. However, as Heeter reports the value of such a system to support mutual awareness by the lone elderly and his/her communities is not in that it can simulate or substitute physical presence, but in that the person stays aware and involved in the group activities. This distinction between the two concepts is an important one we wish to preserve and emphasize in ASTRA: social presence and connectedness are distinct but correlated experiences for users. We wish to assess the actual link between the two.

An awareness system for mobile devices is the Awarenex system by Tang et al. (2001). The prototype they proposed was offering the information normally offered by Instant Messaging tools, on a mobile device with wireless capabilities. ASTRA aims to support much more than informing about the reachability through a PC, and is designed to enrich the use of other communication media.

10. Relation of ASTRA Presence Platform to current technological developments

The ASTRA awareness platform demonstrates functionality from a number of related research areas. ASTRA will build on lessons learned from earlier research in these areas, and will extend the technology state-of-the-art in a number of ways. Research areas that are of interest to ASTRA are the following:

- Shared digital spaces: ASTRA baseline scenario envisions a system where the users can easily keep personal information and artefacts, and share these with friends and members of family. Shared digital spaces, also called shared workspaces, do much of the following.
- Internet-based community tools: Easy-to-use tools that are used to foster Internet-based communities support many aspects of the ASTRA scenario, e.g. email communication, support for real-time availability information, sharing of information, and pervasive access through WWW interfaces.
- Mobile presence and availability management: A number of recent initiatives, both Internet and telecommunication related, try to standardize a number of basic presence and communication services that are of importance to ASTRA.

The following sections will discuss these three research areas in more details

Shared digital spaces

Shared digital workspaces have been a cornerstone of groupware technology for years. Numerous prototypes of shared workspaces have been developed, supporting different aspects of cooperation or serving as generic sharing tools with generic mechanisms for supporting social interaction. The majority of shared workspace applications originating from CSCW research, (Bentley et al. 1997), TeamRooms (Roseman et al. 1996), Orbit (Mansfield et al. 1999), and lately Groove (Groove Inc. 2003) are different in at least two aspects from the ASTRA prototype:

- First, most of these applications are desktop-based.
- Second, they are exclusively developed to support knowledge workers in their professional activities. APP takes a different approach and treats mobile users as first class users.

Internet Based Community Tools

Tools for developing and fostering informal Internet communities have major similarities with the ASTRA prototype. Internet community portals often include suites of tools to support informal groups such as families. For example, Yahoo! (www.yahoo.com) provides email and instant messaging tools, mailing lists, digital photo albums, and file sharing. Most of these tools are desktop-based. Dedicated clients for mobile phones and PDA's are beginning to appear (e.g. Yahoo! users can now send SMS to each other). These mobile versions have a number of limitations that are being addressed by the ASTRA prototype:

- They often implement only a limited subset of the functionalities of the desktop tools (often limited to SMS).
- They are not genuinely developed for mobile users, but are adaptations of the desktop versions developed as a quick answer to market demands.
- They often don't support real-time or multimedia communication on mobile phones.

A specific group of Internet applications, called buddy lists, demonstrate a desired ASTRA functionality. Buddy lists have existed for almost a decade as desktop clients. A number of these applications have been recently available for PDAs (e.g. Microsoft Messenger, ICQ). The only buddy list available for mobile phones is to our knowledge TipicMe (www.tipic.com). Compared to these buddy list applications, ASTRA prototype provides a wide range of additional functionality, such as sharing of content and interoperation between desktop, mobile phone and PDA clients.

Presence and Availability Management initiatives

A recent development that is important for ASTRA, and that will be monitored closely during the project, is presence and availability management standards emerging in the telecommunication market sector. PAM (Presence and Availability Management) is an initiative that is being implemented by 3GPP as part of the next generation open service platform for mobile networks. PAM supports simple presence (in form of status indicators) and advanced personalization of message routing. Once a standard, PAM functionality will be available on any mobile phone. This will result in low-cost availability of presence-related functionality on mobile devices. Another initiative is OMA's Wireless Village. Wireless Village is a combined protocol for presence, instant messaging, group chat and content sharing. Wireless Village is specifically developed for mobile devices, and first mobile phones (from Nokia) were demonstrated at the CeBIT exhibition in Hanouwer this year. Wireless Village provides the basis for implementing a number of the features offered by APP. Although these initiatives look very promising with respect to implementing low-cost presence mechanisms for mobile users, they are not suited for ASTRA because of a number of reasons:

- They are emerging initiatives. They are not in widespread use and are not available as commercially provided interfaces for service development.
- Seamless use of these standards across telecom operators and country boundaries will most probably not happen within the timeframe of ASTRA.
- Developing services based on these standards will require access to operators, expensive products, and administrative overhead beyond the resources available to ASTRA. Most of these initiatives are targeting commercial service development for a large customer base, justifying the expenses.

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Appendix

A.1. Interview questions

Communication with family members

If you look at all your communication activities (phone, SMS, e-mail, chatting, faxing, letter-writing, voicemail, etc.), which part (percentage) is with close family members?

How important is communication with family members to you? Why?

What are reasons to start a contact with family members?

Can you tell me about a recent contact (with a family member) that you liked very much?

Can you tell me about a recent contact (with a family member) that you didn't like at all?

House Tour

What communication tools do you use? Can you show them to me?

For each tool:

How often do you use this? For contact with whom?

For what reasons do you use it?

Can you describe how you feel when you are using it? Do you feel connected to the other person?

How long does this feeling last, after the contact?

What do you like about it (advantages)?

What don't you like about it (disadvantages)?

What would you like to change about it?

Guided Speculation about future systems

Finally, I would like to talk to you about possibilities for the future, for new communication tools. We want to make a new system that helps family members to keep in touch with each other.

Maybe the new system will be "asynchronous". This means that people who use it don't have a direct contact with each other. One person can send a message (this can be anything) to a family member, who can read/watch/listen to the message and react on it whenever he/she feels like it or has time for it.

Three examples to illustrate this:

1. SMS: sending each other small text messages
2. Sending each other pictures of daily activities, that show up on a "painting" in the living room of family members
3. Interactive picture frames that light up when a family member touches it (to indicate that you are thinking of someone)

What do you think of this "asynchrony"? Do you think it would have added value above the things you already use? Would it help you to keep in touch with your family?

If all types of information were equally easy to send, what would you like to send most (e.g. photo's, video clips sounds, drawings, text, touch, smell, etc.)?

Would you like to make contact with several family members at the same time?

Should messages that you receive disappear or would you like them to stay available for some time?

Imagine that it is possible to automatically send information (e.g. pictures, sounds, info about place) to others.

- Would you like it if such information about you was sent to other people? To whom and what kind of information?
- Would you like to receive such information about other people? Of whom and what kind of information?
- How often would you like to send/receive such information?

A.2. Diary contents for adults

Instructions

By means of this diary, we would like to find out more about how you communicate with your close family members. We ask you to fill out this diary every day for one week. Every time that you have had contact with a family member, you can write this down in the diary. Examples of contact are a conversation with a traditional or mobile phone, sending a letter, fax, e-mail, or SMS, chatting, and leaving a message on someone's voicemail/answering machine. Please, also describe unsuccessful contacts, e.g. you tried to phone someone but they didn't pick up.

For each contact, try to answer these questions in the diary:

- Time: at what time did the contact start?
- Duration: how long did the contact last?
- How: what medium did you use?
- Place: at what location did the contact take place?
- Who: with whom did you have contact?
- Initiative: who started the contact?
- Reason: why did you make contact with this person / why do you think this person contacted you?
- Effect on yourself:
 - Feelings: how did you feel during the contact?
 - Connectedness: did you feel connected to the other person?
 - After-effect: how long did this feeling last?
- Effect on other: How do you think the contact influenced / will influence the other person?
- You can also write down other things that you think are important.
- Finally, on the last page of the diary there is a wish list. Here you can write down things that you would like to have for making the contact with your family members better, nicer or more efficient. You can also write down things that are not yet available or possible. You can write down anything that occurs to you!

Example 1.

Saturday, 4 December

Time: 10.20

Duration: 20 minutes

How: normal telephone

Where: my living room

Who: Evelien, (my sister)

Initiative: her

Reason: She wanted to ask how I was; we call each other each weekend

Effect on yourself:

- Feelings: I felt relaxed during the conversation, it was fun
- Connectedness: I felt very connected to her
- After-effect: 2 hours

Effect on other: I think she liked it too

Example 2.

Saturday, 4 December

Time: 19.30

Duration: 2 minutes

How: SMS

Where: the bus stop

Who: My son Maarten

Initiative: me

Reason: to tell him at what time I would arrive

Effect on yourself:

- Feelings: no special feeling, just passing on information
- Connectedness: I hardly felt connected
- After-effect: none

Effect on other: No special effect, now he knows when I will be there.

A.3. Contents of diary for children

Instructions

Did you talk to your grandma or granddad on the phone today? Did you send a postcard to a niece or nephew? Or maybe you received an e-mail from an aunt or uncle.

Every time you have contact with you family members, you can write it down in this diary. Try to write down these things:

- What time was it?
- What happened?
- Who was the other person?
- How did you feel?
- You can also write down other things that you think are important. Also try to make a drawing!

