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18 Supporting Social Presence Through Asynchronous Awareness Systems

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Abstract. This chapter discusses research conducted to understand the requirements of elderly for informal social telecommunication media that may be addressed through awareness technologies. It discusses the relation between the concept of social presence and the notion of awareness that the class of systems studied supports. Finally, we draw attention to the research method used which we feel is the most appropriate for gauging the social effects of technologies introduced to support social activities through ICT.

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18.1 Social Presence and Awareness Systems

Social presence as the "sense of being together" that may be created by telecommunication systems, captures very concisely a central vision for telecommunication research.

Arguably, in adopting this vision researchers adopt also the limitations of physical face-to-face encounters. In other words it is assumed that the immediacy and the relevance of the communicated information and the interactivity afforded to communication partners are predicated upon the synchronicity of the medium. This synchronicity is not always desirable. People are not always available to socialize or to answer a telephone at the same time.

This point has been elaborated in an essay by Hollan and Stornetta [12], who argued against building computer-mediated communications (CMC) that emulate physical proximity, since only second-best substitutes could then be created. Such substitutes may of course be of great value when actual proximity is not possible, e.g., see the studies by Heeter et al. (this volume) on Tele-windows. However, emulating physical proximity in face-to-face encounters overlooks the opportunity to identify human needs that are not served well by physical proximity and to develop mechanisms which leverage on the strengths of CMC to address those needs. As Hollan and Stornetta argue, such mechanisms may be preferred over physical proximity, as is the case with sending an e-mail to a colleague in the same office. Like e-mail, CMC can augment physical interaction channels, enhancing them instead of replacing them.

This research investigates how CMC can support the effortless, light-hearted interpersonal communication of people closely related to each other. In this context, social presence is an emergent (subjective) property of the communication medium that must be traded-off against other requirements and which may or may not deliver benefits to the user over the long term. The paper examines these trade-offs, the needs addressed through face-to-face encounters, focusing on elderly adults as a target group, and describes the design of a CMC system that supports them to stay in touch with their grandchildren.

More specifically we consider a class of CMC systems called *awareness systems,* which can be described as systems helping people to *effortlessly maintain* awareness of each other's whereabouts and activities. Emphasis is put upon 'effortlessly' and 'maintain' to differentiate from goal directed interactions that are typical of work situations and goal-directed communications that one might engage-in, say, over the telephone. Pioneering examples of awareness systems for the workplace have been developed at Xerox PARC, such as Media Spaces [3] and Portholes [6].

Whether people wish to maintain awareness of someone else's activities, why, and who this person might be are highly situated issues. The same holds for whom one would want to keep aware of one's own activities, how and why. The answers to such questions depend upon the activity, the person and the social environment. In a work environment, workers might just need to know who is in the building, who is in which room, or finer grain information such as, whether it is possible to phone colleague Jim at this moment, etc. On the other hand, non-work related social interactions, may simply aim to provide emotional support, to be reassured about the well-being of loved ones.

This paper discusses two exploratory studies addressing the research problem outlined above:

- A study of social visits, the procedural details of such visits and the needs that they support.
- The design of a prototypical awareness system for connecting elderly and their grandchildren.

18.2 Needs and requirements for social presence by the elderly

18.2.1 Overview of the study

In order to understand the benefits of CMC systems for informal social use, we examined social visits. Social visits are the primary form of socialising at home and the archetypal set-up that CMC systems might attempt to emulate. This study examined social visits and the surrounding use of telecommunications, aiming to understand the mechanisms that make them be valued but also their limitations.

18.2.2 Methodology

The study was of a qualitative nature. It did not aim to reach a generalized and complete account of a particular phenomenon. Rather, it aimed to provide contextually rich accounts of the social aspects of a visit and in this way sensitise us to the values and needs of the elderly, with respect to social visits and the surrounding use of telecommunication systems.

As argued by O'Brien et al. in [20] such studies can inform design and research agendas rather than closing them down in advance of an investigation in order to generate a range of formal analytical categories.

The field research itself lasted two months. The participants were twenty elderly and six younger adults. The younger adults were involved to create a contrast and so sensitise us to the special concerns of the elderly and to age related differences. They were however, not seen as some sort of control group, as we did not conduct a formal experiment. The elderly subjects were found from the subject pool maintained at the University of Eindhoven and most had participated in some study before. The elderly had a mean age of 71.3 years. Ten participants were female and 10 were male. The younger adults had a mean age of 24.3 years, 4 were female and 2 male. They were either students or employees of the technical university.

The objective set during the field research was to answer the question: 'What makes a visit a success?'. It was hoped that we could thus uncover what needs social visits address, what makes them of value, what are their practicalities and what are important issues to address by augmenting social interactions and existing telecommunications through CMC.

The survey was a combination of diaries and interviews. It has been inspired by works on ethnographic studies of families [20] and the "cultural probes" work [11]. O'Brien et al [20] and Dray [7] explain how it is hard for researchers to enter as participant-observers into households particularly for any prolonged period of time. In this study the interviewers could not reasonably participate in social visits without destroying their very fabric. For example, one interview had to be interrupted and postponed when an unexpected visitor arrived. On the other hand, interviewers were treated themselves as visitors and did experience different types of reception by the participants and could thus relate their descriptions to their actual experience of the visit. The diary method [22] was selected for this study as it helps capture information about phenomena soon after their occurrence, in their natural context and during the actual activities of interest. In the case where we are interested in the fit of technology to patterns of daily life, this sensitivity to context is ever more important. Information collected through completing diaries (the term journal is used below) is expanded and clarified during interview sessions.

Our diaries were 'instrumented' in the following ways:

- A journal where participants were encouraged to record their social visits and their thoughts about them.
- A disposable camera for half of the subjects (for keeping costs down)
- Pre-stamped postcards.

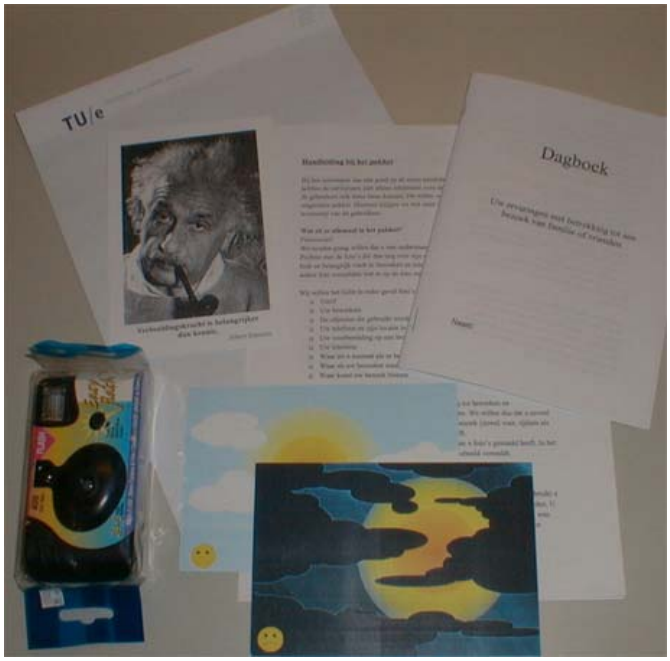

Figure 18.1 Materials given to participants of the study on social visits: Einstein postcard, good weather postcard, bad weather postcard, journal, instructions, disposable camera and pre-stamped return envelope

These are explained in detail below. Figure 18.1 shows the full content of a package given to participants. A short manual (1,5 pages) was given with the package.

The journal was a little booklet where participants were invited to record preparations before a planned visit, describe the visitor and the nature of their relationship, their expectations from the visit and, after the actual visit. Further, participants were invited to do the same for telephone calls in order to assess the way the combine and compare their most used telecommunications medium with actual physical visits. Participants who were given a camera were invited to also describe the pictures they took and when they took them. Directions were included and the first page was filled-in to provide an example of how it should be filled in.

Participants were given three pre-stamped postcards (see Figure 18.1): the 'good weather postcard' inviting comments on a successful visit or telephone call, the 'bad weather' postcard inviting comments about an unpleasant or unsuccessful visit, and finally, the 'Einstein' card, which was inviting them to send their ideas about the 'ideal communication medium' to support social interactions. The postcards were inspired by the Cultural Probes technique [11]. They were intended to create a playful mood and diminish expectations of austere scientific data reporting while being pleasurable and stimulating.

Compared to Cultural Probes, they were used less as an element of a dialogue and challenge between designers and participants and more as data collection instruments that encouraged the lightweight, the specific and the playful reporting of relevant data. As will be discussed later they had moderate success, but arguable contributed to setting the right tone for the interactions between the interviewers and the participants.

The participants who received a disposable camera were asked to photograph what they wanted to show to us and then send back the camera. They were requested to write in their diaries a description of each photograph and the reason why they took it. Indications of what would make interesting pictures were given: e.g., themselves, their visitors, objects

used during the visit, the telephone and its location in the house, preparations for a visit, where their visit is held and where visitors enter the house.

Two interviews were conducted with each participant. The first interview covered demographics, description of a recent or memorable visit and expectations from an upcoming visit. The materials for the diary study were given to the participants after the first interview. The second (shorter) interview was arranged soon after a planned visit had taken place. It concerned this specific visit.

Because of the personal and tacit nature of the information that was needed, the interviews consisted almost entirely of open questions combined with a laddering-method [21] to dig as deep as possible. This means that with each question the participants would repeatedly be asked why they give a particular answer, until they could not answer anymore. For example, one question in the interview is:

"Do you like it when this person comes to visit you?" - yes -
"Why do you like it?" - She is a nice person -
"Why do you think she is a nice person?", etc.

There were 4 multiple-choice questions in the first interview and 2 questions in the second concerning the topics of conversation during a visit. Since these questions would often need a personal answer, common issues were constructed from which they could choose.

These issues were: private issues (those things you would not share with everybody), everyday issues, issues about your past and that of your visitor, issues about things planned to be done in the future and, finally, business-like issues. By letting participants select one or more of these pre-selected topics, it was hoped that they would be more willing and at ease to answer questions about the personal content of their visits.

The first interview that took about one hour, covered general questions about the mobility of the participant, the people who visit the participant and the participant's use of telephone, letters and e-mail. Secondly, general questions were asked about a specific past visit that the participant had with a friend or family member (critical incident technique).

Finally, several questions were asked about a visit that would take place in the coming weeks. The participant could choose a visit that was already planned or a visit they expected to take place. Questions were asked about who the visitor is, the participant's relationship with the visitor, how often they visit each other, where the visitor lives, if the participant is going to make special preparations and if he has certain expectations of the visit.

During the first interview participants' answers on questions could be somewhat distorted, because they were probably drawn from memories of visits that the participants had in the recent and not so recent past. The second interview, therefore, was done soon after the participants had received or paid a visit. This interview lasted approximately half to one hour and participants were asked about this specific visit. It included questions on how they had experienced this visit, whether expectations came true and what made it a success.

Twenty-six pairs of interviews were conducted. For one elderly participant, the first interview was never completed as it got interrupted by an unexpected visitor. Two more elderly did not receive any visits during the 2 months of the study and therefore the part of the 2nd interview dealing with describing a visit was skipped. Twenty journals and 10 films were returned.

In the remainder of this section we highlight some of the most interesting issues arising from the study, quoting our participants anonymously to illustrate their points. Quotes and extracts from diaries are all translated from Dutch.

18.2.3 Staying Aware

The need to stay aware of loved-ones was a recurring issue in reports on using telephone and brief visits. Conscious of their vulnerability more than younger adults are, the elderly feel the need to stay informed about the well being (or not) of their loved ones.

> '*I use it (the telephone) every morning to call my girlfriend and a few of my friends to see if they've woken up and if they're alright. We are getting older and we have agreed to call each other, because we don't want anyone to be found after lying dead in their house for three months. You read about that in the papers a lot lately. That's terrible.'*

Relying on the telephone or on physical visits as a way to sustain this awareness poses practical problems. An explicit communication act (phone or a visit) has to be executed in order to establish a basic level of awareness. This requires some effort and sometimes may be difficult to do or may simply be forgotten. In the case above, the arrangement to call every morning is a work-around for this obvious deficiency of the telephone as an awareness system. However, using the telephone has its advantages also:

> *'I got a telephone call from my daughter; she was in the Dolomites on an altitude of 2500 metres and was sitting in the sun after they skied down. It was a short telephone call and she said she was having a great holiday. Thank God, it was a good message!'*

In this case, making the telephone conveys also the message 'I am thinking of you' or 'I make the effort to communicate with you' which can itself be as valuable as the information conveyed. The daughter is in this way providing expressive support to her mother. Some participants reported paying visits to provide support to lonely or hospitalised friends. In some cases, visits were made out of a sense of duty or out of compassion, but in themselves were considered an unpleasant experience:

> *Interviewer: 'Can you describe the moment immediately after the visit. How did you feel?'*
> *'I felt relieved. I thought 'that's accomplished' and 'I'm through with that for a while.'*

For this informant concerns over the well being of her friend were more important than the differences in character and interests that set them apart. This sense of responsibility and the awareness of the importance of the visit to the other, seem to determine the behaviour of elderly more than that of younger adults.

> *'Today I went to visit a friend who has terminal cancer. Many people find it difficult to visit him, but I think it is something one has to do.'*

Similar to the telephone from the daughter on skiing holiday, simply establishing awareness is not the primary need. Another informant reports:

> *I really should pay a friend a visit, but she's not sympathetic. I know she's ill but I don't like to go there. It's too much of an obligation. Making a telephone call isn't enough when somebody's ill.*

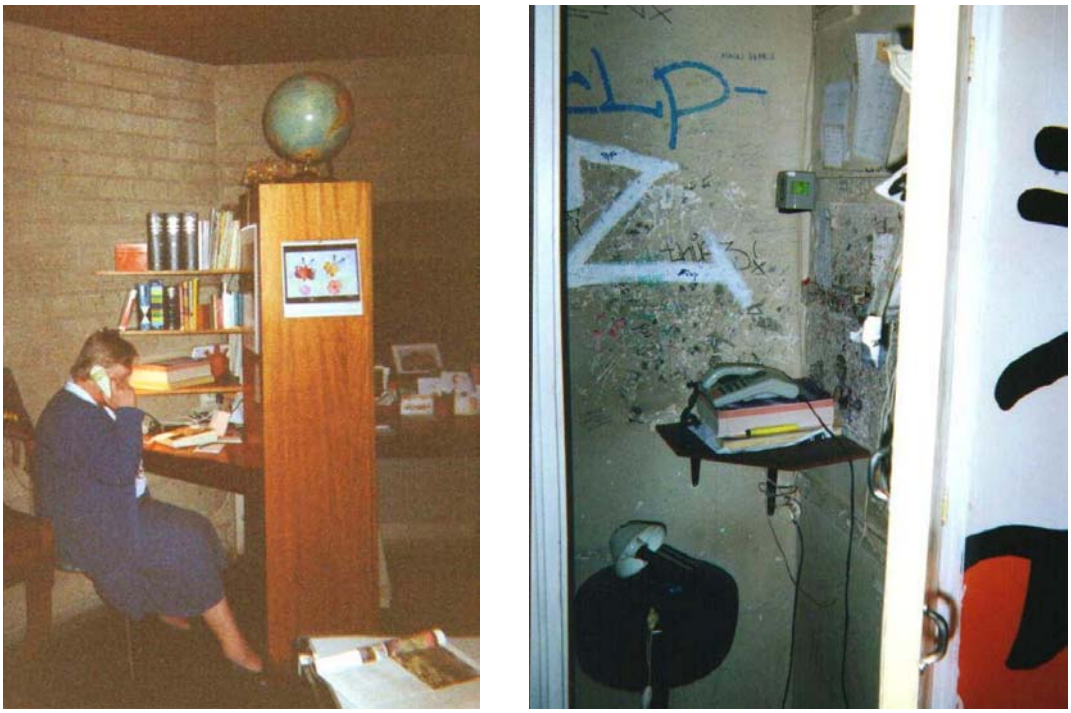

Figure 18.2 Contrast of private corner for making telephone calls for one of the elderly and one of the student houses.

Using on the phone for the purpose of staying aware of the well being of loved ones, is not always sufficient. For one informant seeing the facial expression seems to be an important mechanism afforded by physical visits:

> *... I rather visit people, because then I can look a person in the eyes and then you see how that person is feeling.*

In this case, being able to judge for oneself the well being of their friend is valued, to overcome the fact that the telephone lets the users keep information private. Clearly this contrasts with the intentions of the person whose state is being assessed. This asymmetry was also reported in [4] who report that people are interested to use the video phone for observing the others' personal space but were reluctant to divulge that type of information or image themselves. However, asymmetry has been found [8] to lead the CMC system to be perceived as a surveillance system. An important issue that arises is the need to become privy to information of loved ones in a socially acceptable manner.

18.2.4 Privacy

Social protocols and rituals surrounding the social visits and the use of the space at home, let people control and negotiate the private or public character of information, activities and the visit itself. Most subjects commented on how they would prepare their home for a visit, how they would display certain objects (souvenirs, photo-albums) as props for discussion and how they would allow different people different levels of access to the 'private' spaces of the house. Showing the home itself is an essential part of relating to other people. Crucially, the home is *private* but not *secret*. Showing private areas of your home, or life, to selected people seems to be an essential part of the social visit. The following participant lives at a designated block of apartments for the elderly where she

gets support services such as a canteen, home-care, etc. Normally she receives her friends at the institute-canteen, which her friends do not find sufficiently private.

> *...they wanted to know a little bit more about my private life. They invited me over to their rooms, but I never invited them back. ...just too much trouble for me to do, because of my hip deformity. I got some compunctions about it, so I invited them over. ...I think that you get to know somebody better when you see how he or she lives.*

An interesting commonality between social visits and telephone calls is the transition from private to public and vice versa. Some telephone calls are private and a special place is created for them in the house. Figure 18.2 shows the private places created by one of the elderly participating in the survey and in one student house. However, we should note that some telephone calls are also shared interactions, e.g., the husband listens to the wife talking on the phone in order to form a picture of how the child on the other end of the line is. The phone in this case adapts less easily to activity sharing than the house. The house is divided into private and public areas, that change dynamically, letting people simply choose the degree of participation in social interactions.

The informant below participates in some part of the proceedings of social visits of his wife's friends before he withdraws to leave the women to discuss what interests them and not him.

> *I was there for three hours for the cup of coffee, but then I retreated to my room, because she talks too much and the things she says, I've already heard a thousand times before. In this occasion she brought a clock that was broken, so I had an excuse to leave them to repair this clock.*

Controlling the availability for social interactions is not just an issue of space, but of time as well. As one participant (aged 68) reports envisioning a video-based communication system

> *Before 10 o'clock in the morning, I prefer not to be put "on screen", because I enjoy reading the newspaper, doing some domestic work and having my breakfast in my peignoir.*

On the other hand, the ability to conceal what you do while you speak on the phone is upsetting to this participant:

> *People are sometimes doing other things while they are on the phone with you. It gives the impression that they are preoccupied or not interested in the conversation. When you can see what they are doing while they are talking to you, then you can tell them to stop if necessary.*

Compared with face to face meetings, the telephone affords fewer mechanisms for controlling for socially acceptable behaviours, e.g., not to do other things while someone is talking to you. This is annoying for this informant but, evidently, is an advantage for the other person.

18.2.5 Activities and Silences

Several activities are often embedded in a social visit as an 'excuse' or because they offer the 'opportunity' to socialize.

They are not very good in playing bridge and sometimes I have to explain something just too many times. ..., but the social aspect of playing bridge together is more important. ...just having a nice time together.'

This informant likes playing bridge and likes teaching her friends how to become better bridge-players, but she is quite aware that the conversations she has with her friends are more important than the game. Several activities were mentioned by the informants in the study: playing cards, having dinner, drinking coffee and gossip, are all techniques to sustain the conversation and to keep the visit going:

Participant: '... I do not like silence during a visit'
Interviewer: 'Why not?'
Participant: 'Sometimes a silence can be pleasant. But often this is only when the visitor is a good friend. When you do not know somebody or the other person is too different, which was the case in this visit, silences can become annoying. When you do not know somebody well enough, asking them for dinner is a good way to deal with silences.' ... 'Silences while having dinner are normal and therefore less a nuisance.'

At least in the Dutch culture, silence during the visit is annoying and embarrassing for the persons involved. This point illustrates a limitation s of physical proximity and in general of synchronous interactions (such as through the phone): a lot of effort is committed through conversational 'props', rituals and social conventions to help prevent silence which can create an unpleasant feeling. The implication of this observation is that there is no reason for CMC to support such activities unless to overcome similar limitations of the setting, e.g., having dinner over a video-conference setting. A more promising use of CMC would be to circumvent the original problem all together. (We note however, that other activities, such as music-making, were experienced as the most valued aspect of the visit and not the socialising surrounding them).

18.2.6 Conclusions

From the investigation discussed in this section several interesting issues arise:

- Difficulties arise out of the synchronous nature of social visits and telecommunication activities: these pertain to the timing of the visit which must be negotiated and managed for both parties, silences can be very upsetting to people.
- Neither social visits not the telephone are most appropriate for staying aware of each other.
- A low effort communication medium will never be a substitute for a visit, because it cannot show to the other person how much you value their company and that you are prepared to invest effort to maintain the social relationship.
- People are keen to protect their privacy, but equally keen to be privy to somebody else's private life. Letting people into private spaces or private information is a way of displaying intimacy or friendship. On the other people need to manage privacy very explicitly and dynamically as they do with the spaces in their home.

Looking back at this study, it seems that while very detailed and context specific discussions took place, we get broad-brush results out of it concerning issues that must be taken into account during the design of CMC systems. The second interviews turned out to be much more informative than the first. This may be because a rapport had now been

established by then between the interviewers and the participants, or because the second interviews were more firmly grounded upon an actual visit. The post-cards were perhaps the least rewarding instrument of data collection. As this study did not include a design component, we missed perhaps the best use of this material, which would have been as sources of inspiration rather than to capture data. On the other hand, we believe they did play a part in setting the tone of the relationship with the subjects, an issue that cannot be separated out. The usefulness of the diaries varied: some were kept meticulously but provided no interesting clues, others were brief and messy and full of nuggets of information. Photographs were less interesting, perhaps because most of us already have a good idea of what to expect to see in someone's home, particularly where they receive guests.

Assessing this study, we note that it produced clear indications for design opportunities. To gain a larger leverage upon the use of CMC to support social relationships through social presence, a significant design component is required in the study. Technology can then act as a probe to better understand social visits. The next section discusses such a design-oriented approach.

18.3 A cross-generational communication device

While awareness system vary widely, the general design issues arising seem to repeat themselves across domains and activities. The study reported in section 18.2 illustrates several needs and benefits that must be balanced when CMC systems are designed:

1. Social Presence: to what extent is experiencing the 'other' as co-present conducive to the success of the system.
2. Privacy: Whom do you want to show what information and for what purpose? Privacy concerns the content or even the location devoted to the meeting in the household. As we saw in section 18.2, sharing private information may itself be the purpose of inviting people, as a token of friendship.
3. Awareness Need: Who wants to find out what information about what and for what purpose? Sometimes people need to be aware of the well being of their loved ones, or want to be let into some private information.
4. Synchronicity: in some contexts the synchronous nature of the medium is desirable, e.g., to immediately convey good news, to share an experience or to show to someone you want to spend some time for them. In other contexts synchronicity is problematic, e.g., receiving visits at strange times, answering the telephone at inconvenient circumstances, etc.
5. Frequency: How often does a person engage in such an interaction? Clearly, e-mails can be more frequent than postcards, but within the domain of CMC distinctions are much harder to make.

Melenhorst et al. in their study of perceived costs and benefits of various current communication media by the elderly [17], discuss how frequency is a function of (at least) the effort needed to engage in an interaction versus the perceived benefit. One of the perceived benefits of e-mail that they discuss is that it affords a higher frequency of communications and this is considered valuable for distances requiring more than 30 minutes travel. We note that this finding also depends on the assumed connection to the Internet: with dial-up connections, the costs (financial and other) of hooking up to the internet and sending a mail can be higher than that of the phone call. So while specific to the current technological context and their subjects' perceptions of technology, the findings

of [17] indicate that, in general, people wish to manage and optimise (according to social and technological context) the frequency of their social interactions, whether face-to-face or over telecommunications media. Arguably then, frequent and lightweight communications can provide very high perceived benefits to people. The precedents of e-mail and SMS suggests to us the promise offered by asynchronous, lightweight communications. Bouwhuis [4] and Melenhorst et al. [17] state that elderly adults value most communication with close family. Grandchildren are high on their preferences. This section presents a design case study that attempted to identify whether grandparents and grandchildren can benefit from a CMC system to support lightweight and frequent interactions between them.

18.3.1 Conceptual Design

In formulating a design concept to meet the requirements described two main issues have to be resolved. First, how should information be input, managed and used? Secondly, should engaging in a communication require explicit effort by the user and demand the focus of their attention? For example, a video conference requires significant effort by the user, while a postcard pinned on the wall demands none. This issue pertains to the notion of calm technology [26] an essential aspect of the vision of ubiquitous computing [27].

The envisioned concept is that the system will support exchanging data and pictures in an *asynchronous* manner upon a shared display – a collage. When a new message or picture is opened the facial expression of the viewer is captured and sent back to the sender. Pictures, video and messages can be captured *serendipitously* through the day by using a mobile capture device (a handheld camera and audio recorder). The collage stays in the *periphery* of the users' attention and should not demand full attention. The communication medium must be *symmetric* and must give equal power to all interactors [8].

The rationale for this concept is as follows. Section 18.2 discussed how photographs are valued as a conversation prop and as an important component of social visits. Liechti and Ichikawa [16] pointed out that sharing pictures is a very powerful artifact to strengthen emotional relationships. Asynchronous communication solves the problems of obtrusiveness, and capitalizes on one of the strengths of computers as a medium of communication [12].

It was already mentioned in section 18.2 how facial expressions can be a very important element for face-to-face meetings. Note that a social context is not a prerequisite for spontaneous facial expressions (see for example [10]). Not only do people seem to be well equipped to encode emotions through facial expressions, there are also neural mechanisms that enable them to decode these expressions rapidly and reliably [23]. Thus by sending across facial expressions the system may give insight into the emotional state of the users quite accurately. By capturing facial expressions while viewing the pictures the immediacy is at the highest possible level. A concomitant advantage of this method is that it does not require any additional user input to convey emotions. The quality of the conveying medium is high due to the wide range of different expressions [9] and the strong link between expressions and emotions.

Serendipitous capture of information means that content for the communication is created through frequent and lightweight acts. Asynchronous communication means that disruption is minimized for both parties, since capture is independent from engaging in a communication session. This type of interaction helps sustain awareness for the viewer but still leaves control of information capture to the sender. At this stage, we felt it was premature to experiment with automatic capture as the privacy issues that would need to be addressed were quite challenging.

The whole system should stay in the periphery and be decorative. The idea of not demanding and monopolizing user attention pertains to the vision of ubiquitous computing [27] and ambient displays [15].

The concept described is closely related to the concepts for affective communication resulting from the AROMA project [24] and, more recently, the Casablanca project [13].

As a concept it represents but a rational hypothesis about what should serve the communication needs of our target user group. An extensive prototyping and user evaluation was conducted to test whether indeed elderly and their grandchildren have an inclination to use such a system, whether they like the idea of serendipitous capture of data and whether capturing facial expressions (which is a central element of our design concept) is appreciated or considered threatening for privacy reasons.

18.3.2 Field Study

First an orientation visit was conducted to elderly homes. Several informal interviews were conducted to get an initial feeling about their contacts with their grandchildren and to act as informants for the study. These helped formulate the concept described above and guide the main requirements study.

Subsequently, adhering to standard user centered design practices we decided to prototype the concept and test it with users. In doing so we were quite conscious of the limitations of laboratory testing for obtaining realistic and veracious input from users. Out of their home environment and outside the context of their daily activities it is hard for subjects to imagine how and whether they would use the technology we proposed.

To get answers to our questions about the acceptability of our design and how to improve it we tried to simulate as close as possible the experience of using the system.

This idea is very close in philosophy to Experience Prototyping [5]. However, we did not contend with artificial situations and role-playing, but tried through repeated visits to their homes to embed the testing of the prototype in a contextual observation of the use of the simulated prototype. This approach is consistent with the approaches of rapid ethnography described in [14].

Participants for this analysis were 3 grandparents (with an average age of 68) and their grandchildren (4 in total) of ages 12,14, 7 and 9 respectively. The elderly participants live in their own home, i.e. not in an institution or elderly house. Two of the elderly live alone (their partner has died) and one subject lives with her husband. The elderly subjects are all users of the standard house phone; they do not have a mobile phone. The subject of 57 years is acquainted with working with a personal computer, however, she is not a regular Internet user. The other elderly have no experience with the Internet nor with personal computers in general.

The most important criterion for recruiting the subjects was whether we would also be able to recruit their grandchildren as participants. Clearly, this biased our small sample to pairs of elderly and grandchildren with the desire and the opportunity (time and abilities) to stay in touch with each other. For the children it was important that they would at least be able to express their needs, opinions and desires regarding the activities to share, etc.

Also, they had to be able to interact with the capturing devices (digital cameras), to come up with ideas of what to send to the grandparents themselves, so the children had to be old enough to do this.

For the investigation it was necessary to visit grandparents and grandchildren simultaneously in order to simulate a fully operational system and to get maximum mileage out of a few visits, thus not disturbing their lives too much.

Figure 18.3 The diary covers (above) for the children and for the elderly, aimed to set a relaxed and playful tone in the communication with the informants. Below, the page filled by the twelve year old subject, showing the prompts in the margins. In her text she describes a football game with her friends and the picture she took to send to her grandparents.

When the grandparent and grandchildren pairs (trio in one case) had been recruited, 2 of the authors conducted a sequence of four visits to each participant. The intention was to let them experience the use of the prototype over time and in the context of their daily life.

During each visit, they were interviewed and debriefed and the non-functional parts of the prototypes would be simulated by the researchers present at each end of the communication.

In the first visit a structured interview was conducted and the subjects were given a journal, where they were asked to record instances when they wanted to send something to their counterpart, why they wanted to send it and exactly what they wanted to convey, and a camera to take pictures that they would like to post on the collage of their counterpart (grandparent or grandchild). In the subsequent visits designers would effect the communication 'manually', by uploading the pictures and making them available to the collage of the counterpart. They would then conduct a debriefing interview discussing the contents of the journals.

The design of the diaries was done in a careful manner. It was important that the diaries wouldn't look too professional, because of the open atmosphere that was preferred. We asked the subjects to share personal feelings and experiences. The diaries looked rather informal, playful, and colourful in order to reduce the distance between the participants and the experimenters. The diaries for the grandchildren were different from the diaries the grandparents received. Different pictures were used (see the covers of the diaries in Figure 18.3). The wording of texts was adapted for the children where necessary.

Pages of the journal were not structured as forms for recording very specific information, as for example described in [22]. We wanted to let our informants free to record through the day all the instances where they would have an impulse to write a message or take a picture for their grandparent/grandchild counterpart and to send it.

Therefore, the pages provided an empty space and the border of the page contained several terms (e.g. facial expressions, experience, emotion) that were intended as prompts

to indicate what kind of information we were after. The first two pages were used for instructing the subjects; the first page consisted of written instructions mainly related to the content of the diaries, an example was given on the second page. Several focus points were given on the first instruction page:

- What do you want to share?
- Why do you want to share *this* in particular?
- What kind of effect do you hope to achieve?
- In what kind of mood were you when you wanted to share something?
- When did you want to share this?
- Where were you when you wanted to share this?

The example given was a story-like description that addressed these aspects. On each page short keywords were printed around the margins as a reminder of the instructions given earlier in the diary.

Participants recorded several issues in their journals. The grandparents were keen to share things (e.g. pictures, stories) that they thought would interest their grandchildren. In general they want to share their activities and visits, to take care of their grandchildren and to keep in touch with them. With their messages and pictures they wanted to give their grandchildren a good feeling,

> *I want to share this because I hope that my grandchild will remain a happy kid, despite all the trouble in the world.*

For one subject it was very important that her grandchildren were proud of her. She was very proud of the fact that she is still working and very interested that her grandchildren were aware of that and that she is still active and useful to others.

Few subjects addressed all the instructions in their descriptions. It was difficult to explain their feelings in words. Most of the subjects made a description in the format of a few lines. One grandmother structured her record more; she answered the focus points separately on each page.

> *what: have a nice dinner together,*
> *why: it is a wonderful feeling when my grandchildren love the things I cooked for them,*
> *effect: that he tells that his grandma cooks nice (proud?),*
> *mood: good (but sensitive),*
> *when: at this moment (but other times as well),*
> *where: at our place of course".*

In general the grandparents are interested in topics like hobbies of their grandchildren, sports, activities they engage in, music, school. The grandchildren like to share the things they did during the day, e.g., soccer game, working in garden, music lesson, going to school, making homework with a friend. They want to keep their grandparents aware of their lives, e.g., school, hobbies, parents, friends.

Participants made pictures during the day. These pictures were sent across when the designers visited the subjects. As designers were present simultaneously at both ends of the communication, they would use e-mail to transfer the pictures and show them to the participants. In the second visit, a picture was taken of the participant recording their facial expression when they first glanced at the pictures received. This picture was then sent back to the other party in order to gauge whether this feature would be valued. In subsequent

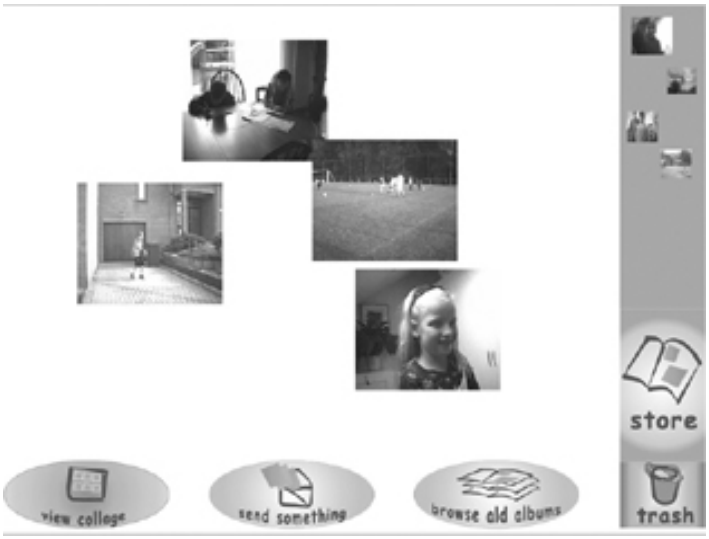

Figure 18.4 The "pin-board" interface, showing pictures and captured reactions to the pictures

visits (3rd and 4th) the same was done, but this time the informants were aware of being photographed.

Results can be summarized as follows. Both user groups liked the concept of sending and receiving pictures or text messages. Moreover, they appreciated to see the reaction of the other; facial expressions were thought of as helpful to strengthen the emotional relationship. They wanted to share their daily activities with each other. The capturing of the pictures was experienced as a nice activity as well.

The main requirements that were derived from these studies were:

- The system should not resemble a computer, the system should not be obtrusive.
- The device should be decorative (preferred context of use is the living room),
- The interaction should be simple and not time consuming.

The results from this study were very encouraging for the initial concept. Informants did not hypothesize about taking pictures and sending them across, they experienced it directly including the quite challenging (technically) component of having their facial expression captured when they would see the messages and pictures from their counterparts. Their reactions and recommendations can be therefore more sound than what focus group or evaluations in the laboratory might render. Of course we are talking of a small user sample here, but it is an interesting trade-off. More effort was spent on each informant than in the traditional requirements study or usability test, and this effort was invested on getting a realistic impression of the use of the designed artefact over time and in context.

18.3.3 Detailed design and prototyping

A working prototype was built following a client-server architecture. On the client side, a small application was written in Visual Basic in order to access the digital camera and store the captured pictures into the file system in a transparent way. The main application was developed using Macromedia Director 8.5 Shockwave Studio. The Server Side involved the Macromedia Multiuser Server (MUS) and a normal FTP server. The MUS distributes messages across the two clients and synchronizes them, while the FTP server transfers the different media types.

The first prototype was evaluated with 2 children and their grandmother at their homes.

The interface was shown and the main tasks were simulated. Afterwards they were prompted by the designers to indicate whether the main requirements were met.

Preliminary results indicate that the interface is fairly easy to use for both user groups. The use of the "pin board" metaphor (see Figure 18.4) for the shared display was clear to them. After seeing the screens for a couple of times, it was clear how to operate the system.

However, for the 7-year old participant, the amount of text on some of the buttons was excessive: by the time she read the text of one button, she had already forgotten the previous one. The buttons have been redesigned accordingly. For the 9-year old subject text on buttons was not excessive. He mentioned that one screen was a bit confusing since the general organization of the buttons was not clear.

Some questions that are still open for this study are:

- How should facial expressions be conveyed: as a single image, a few frames or a video sequence?
- Would users like to control the capturing and sending of facial expressions? Our informants suggested that they did not mind their expression being captured. Will that be so in actual use?
- Would users like to annotate the items they send?

Future work shall try to answer these questions, improve the quality of the prototypes and experiment with automatic capture mechanisms. Further, we recognise the urgency of user testing in the field, to test if our results hold in actual usage of the system.

18.4 Conclusions

The paper presented two case studies concerning the communication needs of the elderly.

We started from the premise that understanding the needs and mechanisms of social visits would shed light into what are the requirements from CMC that could support the sense of 'being together'. A range of needs and mechanisms for optimising the visits and negotiating their evolution with the visitors were revealed. The requirements arising from this investigation helped inform the design of CMC that will not act as a poor substitute to physical presence, but that could support social interactions by offering an alternative and pleasurable communication medium.

The second study extended the analysis of the first by designing a communication system to support the rapport between grandparents and grandchildren. Analysis and testing of the design concept was embedded in the daily life of the informants and was highly realistic, lending much credibility to the findings. The prototype is still raw and further work is planned to continue this research, particularly using the prototype as a probe to understand daily communication needs of people. The conclusions that can be drawn are that the awareness systems of the type described have a valuable role to play for children and grandparents and potentially other closely related people. Awareness systems can provide some of the benefits of social presence, through low bandwidth, asynchronous and unobtrusive communications that remain very immediate, relevant and pleasurable.

We have learned some more general lessons from these studies. First and foremost, activities and rituals of social visits should not be copied sheepishly in CMC systems.

Their purpose may be to overcome limitations of the physical proximity that can be circumvented by appropriate use of the CMC medium. For example, rather than supporting sharing dinner over a video connection, which has been touted as a possible daily use of video-communication technology, research should find out how synchronous video

connections can be less disruptive through the day (also during dinner time), or how the asynchronous CMC that can solve the limitations of physical proximity can be made as engaging and rewarding.

With regard to communication needs of the elderly our research complements that of Melenhorst et al [17] cited above. Melenhorst et al. based their study of benefits and problems of communication media on focus group discussions of nine hypothetical scenarios. By counting the references subjects made to benefits or problems of communication media Melenhorst et al. inferred their relative importance. Their approach offers the benefit of quantified data and a relatively more objective analysis that the type of study presented here. On the other hand, the two studies presented in this chapter reflect actual experiences of visits and communication systems, situated in the actual context of interest (the home). Despite the methodological differences and different scope these studies agree in some of their main findings: Keeping in touch is a very important communication need for the elderly. Melenhorst et al. suggest that this benefit of the telephone is valued more by the adults than its use for making practical arrangements.

Correspondingly, the social presence afforded by the medium (Melenhorst et al. refer to intimacy) is valued more than interactivity (which relates to the notion of synchronicity above). Intimacy was mentioned also as a benefit of a social visit in her study, but one that is not desirable at all times and contexts.

Compared to mainstream work on social presence, and most especially that of Heeter (this volume) who focuses on long term communication sessions for informal social interactions, we aimed to complement rather than replace physical visits. As such, the communication setup designed and prototyped offers the potential to be used alongside real face-to-face meetings or video based communications such as those studied by Heeter.

Future research should gauge the extent to which social presence is experienced when interactions are asynchronous, i.e., capture and display are removed in time. Such work could involve formal measurement of social presence for such a context of use and should also address the more fundamental issue of whether we are indeed measuring the same psychological phenomenon. We hypothesize that for both asynchrnous and asynchronous communications social presence remains a useful yardstick of the user experience.

However, as a property of CMC usage, social presence should be traded off at least against the 4 additional requirements identified in this paper: awareness, privacy, immediacy and frequency optimisation.

With regards to the emerging interest in awareness systems that is evident from our discussion of related work, the present study is the first to look at the user issues arising from the use of a functioning prototype of such a system used daily for informal social interaction. Related works have mostly produced non-functional prototypes and focus-group evaluations.

Finally, an important lesson we have learnt from this study is the research method used, that combines ethnography with prototyping. It is a natural extension from ethnography, comparable in philosophy to contextual design practices [2] that incorporates field-testing for the purposes of understanding the potential of future technologies as part of the daily life of our target users. The contrast to [17] discussed, illustrates the added benefits that this approach can bring to the arsenal of research methods in this field.

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18.6 References

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