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- Virtual Espresso-Cafés and Semi-Located Communities

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Royal Institute of Technology
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Innehåll

ABSTRACT	7
Keywords.....	7
INTRODUCTION	7
RELATED WORK	9
THE REFLECTIVE DESIGN METHOD	11
Design of Public Mediaspaces.....	11
Evaluations of communications patterns.....	11
THE VIDEOCAFE SYSTEM.....	12
ROOM DESIGN.....	12
The combined lab - living room.....	13
The Corridor	14
The Cafébar.....	15
Using the media-room	15
Audio channel.....	15
Field of View.....	16
Using large screen projections	16
VIDEOCAFÉ AS A PART OF DAILY ACTIVITIES	17
Patterns of communication in the VideoCafé.....	17
Sociograms	18
Evaluation of the Cafébar setup	19
How has the VideoCafé affected the relationships between the two laboratories?	20
RESULTS.....	20
DISCUSSION	21

ACKNOWLEDGEMENTS22

REFERENCES22

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ABSTRACT

This paper describes our studies of public media spaces. The reasons for utilizing public social places can be derived from a hypothesis that individuals are empowered — even when working apart — by opportunities for light informal interaction. The re-use of social places for video-communication is examined through a set of full-scale prototypes that were used and assessed over extensive periods of time. The informal observations and reflection in design of these places have been supplemented by formal studies. We found that great care needs to be taken when designing these places from an architectural point of view. For some of the places, we would like to suggest using architectural features when altering the room rather than technology. In other settings, media altering might be more efficient.

Keywords

Video communication, Mediaspaces, Communities, Social places, Architecture, CSCW.

INTRODUCTION

The VideoCafé project started from an idea for virtually connected public places in two research labs that were about to initiate a collaborative research program. The idea of providing a public mediaspace was built on the assumption that such a space could facilitate informal community building. This will empowering the individuals with a sense of being able to take an active part in the discussion and hence also being able to make a difference to future plans and activities.

The incentive for the study came from a planned joint research project that was about to start in June 1996. In our study, we have set up a couple of prototypes of different social places, between two research labs, that have been augmented with a mediaspace installation. This environment is commonly referred to within the labs as the VideoCaféⁱ.

Before the VideoCafé project there was no formal collaboration between the groups and the contacts between the labs were not regular. However the groups work in similar areas and people in both groups hoped for more regular contacts and knowledge exchange through the VideoCafé. Today we closely cooperate in two major research projects – besides the continuous development of the VideoCafé environment.

ⁱ In this text will the term VideoCafé be used as a generic term for all our different kinds of public mediaspace installations.

A day in the VideoCafé might start when “Joe” is sitting at the computer in the lab next to the coffee corner and hears the rattling of keys when “Mike” at the other lab opens his door. “Joe” continues to work, but does not feel as lonely in the early morning when he knows that “Mike” has arrived. When he sits down later on to take a coffee, in the sofa by the TV, he sees someone he has never seen before looking around. Suddenly that person looks at the TV and asks “Joe” if he has seen “Mike” today.

Even if similar scenarios have been envisioned, and studied, in related projects at Xerox Parc, [4] as well as Bellcore [9], our ambition has been to focus particularly on how to reuse social places within a workplace to create new means and opportunities of communication.

The key point here is our experience from building a total of seven different locations and constellations of mediaspace installations integrated into public environments. Our main objective has been to develop the VideoCafé so it could connect people over distance at places that are suitable for social (and work) related conversations.

Technically the VideoCafé is a rather simple but (very) high quality videoconferencing system that continuously links the two labs with audio and video. The main push has been to make this advanced technology as transparent as possible.

Previous research has indicated that the most important workplace interactions are not formal group meetings. Informal workplace interactions support a wide number of different functions such as the execution of work-related tasks, the co-ordination of group activity, the transmission of office culture, and social functions such as team building [15][12][14][1]. These interactions occur spontaneously, as informal communication for short periods of time, most often at semi-public places within workplaces.

Our aims with such a project have been to understand:

- How to use knowledge in architecture and interior design to integrate the virtual and physical spaces and places.
- How the high quality audio could be integrated and used in mediaspace installations.
- And finally, to evaluate how these perceptions influence informal and spontaneous interactions within this medium

Consequently, our approach has been to carry out both formal evaluations of users and informal observations of different settings. We provide in the following sections of this paper, design issues when creating mediaspaces in public places, results from the questionnaires and sociograms, patterns of communication within the medium, and suggestions for enhancing the usage of such a medium.

In this paper we will focus on the reflective development of these new social places with particular focus on combining experience from related areas, such as architecture and community building.

RELATED WORK

Within the area of CSCW research, the importance of a medium that could support informal communication has been debated for a long time. It has been suggested that face-to-face meetings give more opportunity to be more informal (spontaneous, non-planned or temporal) than any other form of communication. Kraut [15] concluded using observational methods that informal communication tends to be highly frequent, above 85% of all interactions, in an R&D environment. More than 50% of the conversations were also unplanned.

According to Morgan [20], one of the major opportunities to encourage this kind of interactions is to create informal networks that give the members influence over and preliminary information on critical matters. Katz [11] even suggests that informal communication is an essential form of human communication. Some companies have realised its benefits and advocate explicitly what Fish et al [10] define as the organisation's "instrument to handle flexibility in critical moments". Informal communication is used by organisations as an important method of accomplishing work as well as transmitting organisational culture and knowledge.

We would like to argue that one appropriate setting often exhibits the character of informal communication is the community [2]. One of the most important community properties is probably its rich variety. It has hence been suggested that one form of virtual community could be a mediaspace-mediated community, as this is an informal medium rich in interactions.

The term "community" has previously been used within the CSCW research area to label a group of people who have or share some common attributes - but who have broadened their range of activities gradually and informally into some other areas (e.g. CSCW'96 and ECSCW'97 community workshops). That is, communities offer a fairly robust set of opportunities for people to come together and be together, more than just a single topic or event. Communities could hence be seen as social mechanisms to bridge physical distance.

Mediaspace is the term coined by Robert Stults at Xerox Parc to label some electronic media, like video communication, that has the property of altering and augmenting physical space. The importance of the Palo Alto - Portland mediaspace was that it provided an opportunity for communication that would not otherwise be possible without being there and that the support extended beyond communication on the explicit content of work tasks. This is what made the mediaspace a sustainer of working relationships [4].

One of our basic assumptions is that telecommunications will not only decentralise services, this has and will continue to happen in several industries, but also increase interpersonal communication as well as centralising some of the most information-dense industries. Sassen [23] reported in her research on the high-density business centres in New York, Zurich and Sydney where almost every business that matters is located within a ten minute walking distance. Smart buildings, communication centres, laundry

services, espresso-cafes, diner-restaurants and cocktail-bars are a necessary component of this infrastructure. Here is the essence of the VideoCafé environment - cross connecting public places with R&D labs, public services, financial centres etc.

Naturally, it is a bit trickier than just providing some connected cameras and monitors between two remote places to obtain a usable mediaspace. In particular, like in any semi-public place such as company offices, there is the dilemma of where the private and public spaces meet. Paul Dourish reported at the CSCW'96 Community Workshop [6] on the continuous efforts to experimenting with different solutions to privacy issues in mediaspaces. Dourish pointed out the contradiction in the nature of mediaspaces as hybrid physical/virtual environments - "Many of the significant issues in differentiation arise from the physical environments from which we enter "virtual" spaces; the exigencies of particular, local situations lead to variations in virtual behaviour. The homogeneity of distributed communities is often illusory".

Nevertheless, the stories from Xerox, Toronto University, Bellcore [4] [10] [16] have fruitfully informed us that video has a profound impact on the communicational act and the way of utilising this medium can take many different forms equally successful. We can imagine at least three basic types of mediaspaces and envisage how physical metaphors are used to aid our interpretation of the systems. One is exemplified by the Xerox Portholes, Bellcore Cruiser and the Sun's Montage system [8] [5] [25] where glances enable a user to briefly "look into" the office of co-workers to assess their communication availability. A second category could be exemplified by Bellcore VideoWall systems [10], which provide open links through which persistent video/audio channels are maintained between public places. Finally worth mentioning are some awareness applications such as KTH's AtWork system [26] in which, in addition to other awareness mechanisms, a video image is periodically sampled and hence could indicate the presence or the absence of co-workers.

Past experience has shown that one of the major problems in assessing technologies such as video communication, is the difficulty of predicting second order effectsⁱⁱ and hence anticipating which data could be of interest to study. Whittaker [Wit] pointed out that it is also the case that subjective and objective data in video-communication studies is often not in accord, i.e., people reliably prefer video but it is hard to prove why. One possibility is that subjective preferences are an aspect of social cueing, and hence provide evidence for this hypothesis.

In addition, from an assessment point of view, it is definitely clear that technical limitations have blurred the results of several earlier studies of video-communication with proportions of uncertainty [26]. Until recently, it has only been possible to achieve high quality media in video-communication have in LAN or by analogue technology. In two, of the few, comparisons of low quality media and high quality media the type of conversation was notably different [21][19]. In low quality systems, the tone was more formal and lacked the use of quick interruptions, back-channels etc., while the high quality media system provided the opportunity to talk and act much more efficiently and informally.

ⁱⁱ E.g., if we live in X and predict Y – if then Y happen, what consequences Z due to Y are of interest to study in transition between X to Y?

In conclusion we could summarise that an integrated view of how to mix the virtual and physical space from a communicative as well as architectural perspective is still lacking. The discussion by Harrison and Dourish [11] reports some of differences that could be made between the two concepts place and space. The need of methods and experience in evaluation of such an effort leave a great opportunity for further research. Furthermore, if the purpose of the work is to create a mediaspace for informal interaction the use and development of high quality media seems to be an important strand to continue.

THE REFLECTIVE DESIGN METHOD

In our study, to date we have set up seven different prototypes of the VideoCafé environment. Each setting has been evaluated by being put into practical use for several months. As part of the iterative design, we continuously observed the daily usage of the VideoCafé and then reflected our observations in the next set-up. For the informal evaluation we have collected anecdotes and viewpoints about the system. These have often come up during informal group discussions. These informal evaluations have been supplemented by formal evaluations, asking how the VideoCafé has affected the pattern of relationships and communications among the people at both labs. The reflective design of the VideoCafé environment has given us the possibility to collect and store experience which we implemented later in our next generation of prototypes.

As mentioned in our introduction we have focused on three main areas. In this chapter, we will give an overview of what we have done and hence hopefully provide the reader with a context for the rest of the paper where the different aspects are discussed in more detail.

Design of Public Mediaspaces

Some basic needs and situations were identified as being common in everyday use. For example, in the very simple case, the VideoCafé benefited from being open any time and hence bridging the two public lounge areas with permanent accessibility.

Based on different kinds of situations, a couple of basic metaphors for social locations have then been deployed through the different prototypes of the VideoCafé installations. As illustrated above, the VideoCafé uses architectural metaphors in its manifestation - social places of different kinds.

To explore the feasibility of these metaphors we have designed new types of social places in workplaces that have incorporated mediaspace technology. In these places the integration of the physical social place and virtual mediaspace has been one of our main objectives. A more elaborate description of these places could be found in the following “room design” chapter.

Evaluations of communications patterns

From the set-up of the first prototype to the current ones, studies related to the usage of such a medium have been carried out. Techniques such as interviews, observations and

sociograms allowed us to collect a set of data including daily usage patterns between the two research labs and users' feedback and attitudes.

During the course of the project we have undertaken three formal studies, two of which have measured communication patterns and attitudes while the third study focused in more detail on UI aspects for new users of mediaspace technology. By comparing observations and interviews performed before and during the use of the system, we have been able to register communication patterns, and study behavior and attitudes. The outcomes from these studies are described in the following "The daily use of the VideoCafé" chapter.

THE VIDEOCAFE SYSTEM

The VideoCafé in its current setting connect one research lab at KTH-CID with a research group at Ericsson Media Lab. The VideoCafé always open and bridges two public lounge areas with a permanent open video and audio link. The two laboratories are approximately 15 km apart. The settings have been in operation since February 1996.

Whether video's most important benefit is to support non-verbal communication or not is a debate we will not enter into here [27]. However, the particular form of

communication that matters for the VideoCafé - informal communication is a rich form of communication by its very nature. It has hence been one of the VideoCafé assumptions that by seriously improving media quality, informal communication will be easier to initiate and the conversation will flow more smoothly.

During the project we have been able to show that it is possible to make large-scale improvements in the video and audio quality of videoconferencing systems. The basis of our system is a broadband (ATM) network, with high-performance (ATM-based) video-codecs and hence very high quality (HQ) media, such as multiple video streams and CD quality audio.

ROOM DESIGN

Maybe the most challenging aspects of the project has been to affect and involve a large-scale physical environment.

Our principal premise, though, is that most imitations of architectural and urban spaces and places that are used in today's electronic community building are too crude and superficial. We all know that clever architectural design is like a clever interface -

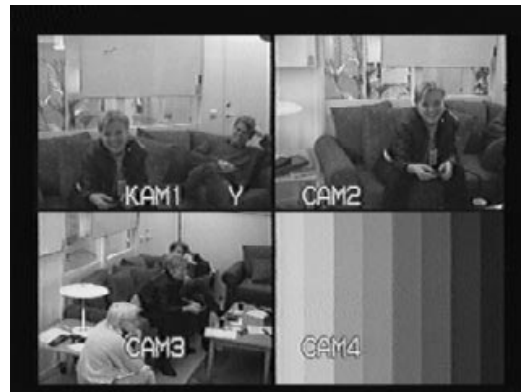


Figure 1: The use of multiple camera views in the first VideoCafe set-up.

intuitive, attractive and transparent in a subtle combination. In a physical space it is all these subtleties that shape or do not shape the communication within a building, office, public bar etc. Designers of today's electronic communication media unfortunately do not advocate and develop the architectural metaphors far enough. Fish et al reflects on difficulties in a self-critical analysis [10] of the Bellcore Cruiser system - "...the mechanisms that were supported in the Cruiser system were abrupt, intrusive, and lacking in subtlety."

In traditional, spatially defined, communities there are public places and buildings to use for these purposes, the piazza, the café etc. for socialising and conversations; town halls for political assembly; churches for religious assembly and theatres and museums for cultural purposes.

William Mitchell [18] draws a parallel between new electronic places and how urban public space was designed in the ancient Greek agora - "It was the possession of an agora that made a collection of buildings a city".

In addition to pure communication a place with these characteristics could provide the capability to foster a community. Ray Oldenburg in his book "The Great Good Place: Cafes, Coffee Shops, Community Centres, Beauty Parlours, General Stores, Bars, Hangouts, and How They Get You Through the Day" [22] made an analysis of the concept "third places". Third places around the world share common and essential features such as, they are leveller's - inclusive rather than exclusive and hence expand social possibilities. Physically, a third place is typically plain and the mood is playful.

For that purpose, we have designed new social environments in workplaces as well as new styles of interior design that could foster this kind of communication (see figure two and four):

- For a common living room,
- for shared laboratories,
- close to shared communication devices such as faxes and Xerox machines, and
- for public lunchrooms.

The combined lab - living room

The common living room was the first place to explore. It was furnished as an ordinary sitting room with sofas, bookshelves, stereo and TV. The corner had long been used for both relaxation and informal work. At the other end of the room were several workstations for shared use. There was at least one group member in the room most of the time.

A "regular" TV set (30"/16:9) and a specially composed directional sound reproduction system was used for the VideoCafé. Several cameras were installed in the room to make both sofas at the table comfortable visible, and a camera was mounted on the ceiling to make it possible to see parts of the room other than the VideoCafé corner (see figure 1). An IR-device was used to select the camera and control the cameras. These control devices could be used both locally and remotely from the other location. A small TV set provided feedback by showing the pictures as they were transmitted.

Naturally, inexperienced users found this a bit too complex. The microphones had no easily visible OFF button. To solve this problem the equipment was provided with labels indicating the OFF button, but the result was not acceptable. In critical situations, many users preferred to unplug the microphones to be sure that no speech was transmitted. This showed us that the threshold where the technology interferes with usage is very low in these kinds of environments.

A couple of the other lessons from the lab place were also related to privacy issues. For example it became



Figure 2: The last VideoCafé environment.

apparent that people working in the lab sometime, naturally, turned the speakers volume down so not to become disturbed in their work. Audio is possibly the most essential medium for peripheral awareness and the need to reduce the volume came into direct conflict with the informal and light interaction idea.

It became obvious that we needed to replace the direct audio with some ambient form of a less intrusive nature. This form of media-transformation is a complex matter where we have only begun by defining our needs and have so far only a rudimentary set of experience. This matter will be discussed later on in the paper.

The Corridor

The Corridor was another place of installation. The place was close to other communication infrastructure, it was also close to some of the staff members' offices. In general, it could be described as the place through which everybody had a reason to pass, several times per day.

Our basic idea was to enrich this place of encounters with the remote lab's presence, but since it literally affected everyone in the lab in a very direct way, several privacy considerations were taken into account to afford the place different communication zones. The place was hence divided into three different zones, (1) the inner zone where the user could be both seen and heard, (2) the background where the user could be seen but not heard and (3) a free zone where you are neither heard nor seen to be used, for example, by people passing through who would like to be left alone. It turned out to be difficult to strictly, but flexibly, control the technology in such a way that the different zones were clearly distinguished.

In addition, we found a problem in that public places tend to be owned by their neighbours. If people were engaged in a more intimate conversation it was hard to protect the privacy of that conversation, and the place could actually present a hostile character to visitors.

The Cafébar

One of the key problems that we observed during early prototypes was the difference between people sitting down, plausibly engaged in some conversation and people passing through. To work with this, and related issues, we decided to design and build our own tables and chairs according to our needs. The resulting solution became a raised table in the form of a bar. The basic idea was two-fold, firstly it lowered the threshold in the initiation of the conversation and secondly it provided a place for short, spontaneous interactions (see Fig. 2).

One of the problems in the early prototypes was that the space did not clearly suggest how many people it was designed for. One of the outcomes of this was that the distance between the participants and the camera, the microphones and the screen always varied. The shape of the table also ensured that most participants had a fixed distance between them. In addition, the recess in the middle of the table provided a natural separation between the social interaction area of the table and the technology in the form of remote controls, miles of cables, microphones etc.

Using the media-room

In our findings, feedback from the system was found to be crucial. For the visual channels, an active user must be able to control his/her visual field at the opposite site as well as monitor a visual back-channel. It is also necessary for users to be able to control the volume of the received audio and turn the audio transmission on and off. Therefore, it must be very clear if the audio channel is open or not.

To improve this interaction we designed a three-button switch with a small monitor (microphone, speakers and camera) that also provided the visual feedback (see figure 3).



Figure 3: Three button switch.

Audio channel

Our experiences with HQ audio have lead to some mixed results. In contrast, the audio quality has been assessed as extremely good compared to past experience of traditional videoconferencing systems - as well as the source of the most discomfort. The sometime intrusive audio made users often choose to turn off the audio channel to get more privacy, which can be seen as a way of establishing different levels of communication.

The second major problem concerned multi-threaded conversations. When a group consisting of two people at each site has a discussion, we are close to obtaining the same quality as if they were sitting in the same room due to the properties of the CD quality audio. But even if we support spatial audio most, specially non-experienced, users would still like have a microphone of their own - as proof of their participation - and this leads to problems, the users raise their voices and start to feel tense while they are following the discussion.

Field of View

Users like it when they can look around with the remote video camera at the other site. Displaying an object or showing the whiteboard are useful features. However, it still appears to be the case that they do not obtain a clear picture of what the other room looks like.

Instead, as far as we can see, the users use the room to control distance between each other by placing themselves in the room rather than



using the camera to zoom in on the person they are talking to. Often

Figure 4: Some additional places tested – a second lab place, the use of large screen projectors.

the camera stays in a wide-angle position to be able to view as much of the other site as possible. However, placing a number of cameras in the same room turned out to be a more reliable method of obtaining a feeling for the remote site through the multi-video streams. People seemed to prefer to select just that camera that showed the best field of view.

Using large screen projections

In one of the configurations we explored the use of large screen projectors. This system works simultaneously with 3 wall-mounted back-projection displays. Each display is 82 inches diagonal, with a resolution of 1.024 by 768 pixels. A number of factors led us to build a VideoCafé setting using large screen displays. Our key argument was that large displays are capable to simultaneously support communication which includes verbal communication, viewing and collaboratively manipulating work objects, and enabling mutual sharing of physical and informational contexts so that gestures and other body movements are understood by the participants.

Despite the benefits, such a configuration introduced new problems for the individual. This configuration is a multi-user configuration, which imposes strong environmental constraint on the design of furniture and where the user sits. The configuration requires the careful placement of cameras. These cameras stay often in a wide-angle position when communication is taking place and hence increase rather than decreased the distance between people at the different sites.

Hence, and although the system can more efficiently support interaction at a distance, its use continuously requires the careful placement and setting of the viewing angle of cameras when used by individual. Furthermore, in a place of interaction that looks like a videoconferencing place, one major problem was that the 3 wall-mounted back projection displays made it difficult to establish private conversations.

VIDEOCAFÉ AS A PART OF DAILY ACTIVITIES

We mentioned earlier how the VideoCafé has been used in different situations. What remain is a more detailed analysis of the formal evaluations that took place during the first six months. We particularly focus on if and how the system has affected the relationships between the labs, and to what extent the system has been used and by whom. We used three different methods, to follow how the prototype is used daily between the two research labs. Interviews and, between the interviews, observations were made. Relationships and communication patterns were measured with sociograms.

The two groups exhibit similarities as well as differences in way of working. One of the groups is a small homogenous group of professional computer science engineers who work within a major telecom company while the other is highly multidisciplinary in terms of the members' backgrounds and divided into many subgroups doing research in slightly different areas.

The general experience from this study is that users were mostly willing to adapt their communication behaviour to the new media if they could see the overall benefits. The implication is that the most interesting results will appear after long-term use. This result is in line with other studies of long-term usage of new communication media [Dour2]. But we did also observe a pattern of short-term adaptation to the media. This gave the informal observations extra weight in the assessment of the technology.

Never-the-less, we would like to argue that empirical evaluation of media-spaces in longitudinal studies of usage among geographically distributed groups is a area that is still methodologically pre-mature. Our approach was to evaluate the VideoCafé with a mixture of formal evaluation and informal observation. In the previous section informal observations in connection to the use of rooms were discussed. In this section we will discuss how different users assessed and used the VideoCafé based on the formal evaluations.

Patterns of communication in the VideoCafé

During the first 6 months the use of the VideoCafé was extensively studied. Interviews where conducted with 10 members from the two laboratories, 5 people from each. The interviews where made when the VideoCafé was first installed and then after 6 months of use.

In the beginning, the contacts between the labs was naturally quite superficial. Only those who worked with the VideoCafé actually knew each other as they had begun to discuss the project a few months earlier. These people were also those who used the VideoCafé most frequently.

Even if the other researchers had not started to become acquainted, two of them established a "sporadic" working relationship with a member of the other laboratory.

One of them describes this relationship in the interview:

" .. I don't know if I have started to know them but I have had contact with very interesting people on the other side ... and what has happened is that a contact has been established where we continue to

work, maybe not only over the VideoCafé but also via other media like e-mail, exchange material and we will continue to do so”

One of the most obvious benefits has been that useful professional contacts have been established through the VideoCafé. A usual situation in which contact has been established between the two laboratories is when one side has visitors and they sit down by the VideoCafé. As one interviewee reports:

“ ... usually you sit in a meeting (with the visitor), then you think it would be nice to sit down there (at the VideoCafé) because you know that someone on the other side might show up, or maybe they too are having a meeting on the other side, and it has happened several times that a discussion have started between us while we were sitting there”

By asking the respondents about the different types of meetings that happen over the link we were also able to identify some other meeting forms. Often it is a mixture of these situations. The situations are the following:

- Coffebreak situations when some of the researchers from the two laboratories have a break together and sit and chat.
- A more passive form of usage but also the most frequently occurring is when the researchers monitor the activity of the other laboratory on their way to and from their rooms.

The majority of the researchers, however, reported that their expectations concerning social activities over the VideoCafé had not been fulfilled. They thought that there had been too little contact and exchange with the other laboratory. They stated several reasons why there was not more contact between the two sites. They are:

- The lack of a “real” context for informal contacts.
- Several members of one of the laboratories worked at the laboratory only part time.
- Problems with boundaries between private and public space, privacy issues and intrusiveness.

Sociograms

One technique used for the study was sociograms to measure the number of relationships between the labs members and see if this was affected by the new system. The first sociograms measurement took place before the system was installed and the second after the system had been in use for several months. Five members at each lab participated in this part of the study. The maximum number of relationships between people in the labs was hence limited to 50 (five each).

Before the system was installed 26 relationships were already established, 11 of these were categorized as only professional and three (3) were categorized as purely social. Sixteen of the 26 relationships were within the group and 10 spanned outside the group to other lab members not included in this study. One third of the relationships within the group were only mono-directional, meaning that only one party have recognized the existence of the relationship when asked. In the rest of the cases the relationship was recognized by both parties but in many cases given a different rank.

The second sociogram measurements took place after the system was used for six (6) months. During that period 13 new relationships were added, now totaling 39. Eight (8) of these were new relationships not part of the 5+5 people interviewed in the study. Two relationships changed from being mono-directional to become bi-directional. One relationship changed the other way around and became mono-directional. Generally speaking there are 21 relationships now existing between the 5+5 informants and hence everybody had now some relationship towards all of the others.

Evaluation of the Cafébar setup

After we had installed the VideoCafé in its current setting, we were able to perform an evaluation of a more mature usage of the system. By this time, the cooperation between the labs was established and besides the VideoCafé project, two other projects were being shared between the labs.

In a paper-based questionnaire related to VideoCafé, the list of questions allowed us to measure the following criteria:

- type of people using the system,
- duration and frequency of the communication,
- subjective user satisfaction,
- needs of user.

An analysis of the questionnaires revealed that interactions over the link occurred for short periods of time (1 minute to less than 5 minutes), and frequently between people who knew each other (several times a week).

People who do not share any project with others from the remote location (the vast majority within the labs) also use VideoCafé, generally several times per month. Unlike people sharing a project over the link, people have a relationship with only one (and the same) person at the remote location. The duration of their communication is quite variable, i.e., from 1 minute to 30 minutes.

People sharing a project with people from the remote location use the medium more frequently (once to several times a week). They have interactions with several people from the other location (sometimes several times a day).

The vast majority of respondents considered the system useful for spontaneous conversation. They stated that VideoCafé had succeeded in providing such an open link to facilitate connection for unplanned interactions, that opportunistic communications could be started with minimal effort between connected participants.

However, the study also found that only a few of the respondents found that their expectations about the system had been met. They found that it was actually quite hard to initiate conversations over the link “with recipients you don’t know”, and that the medium can’t solve this difficulty. They would like to increase the spontaneity and frequency of communication and would like the medium to support more social relationships. When recipients are unavailable, people would like to be able to have a means of setting up future contact, most notably to leave a note in a prominent place.

Finally, they finally thought that the video would be more effective if combined with other interaction tools.

Users need tools to support the transition from spontaneous communication to group discussion: shared artifacts such as documents or drawings over the link could have a crucial role in the frequency and duration of the VideoCafé usage. Once people successfully initiate an interaction, they need support for it. We noticed that many informal conversations included references to paper and on-line documents. Unfortunately, we have found that existing collaboration tools for PC are still too complex and too immature for ordinary office workers.

How has the VideoCafé affected the relationships between the two laboratories?

The general conclusion drawn after the formal study is that the main ambition to initiate and maintain relationships between the labs has only partially been fulfilled. It is also not possible to claim that a more permanent community of interests has been developed during this study. No regular routines were developed around the VideoCafé, such as common coffee breaks between the laboratories. The usage of the VideoCafé has instead been sporadic and has occurred in different kinds of situations. It is clear that several of the contacts were found to be rather superficial. Almost half of the respondents thought that “get to know” was too strong an expression for the relationships they had with the other laboratories’ members. One of them said:

“Yes I have had contact with them ... a lot of contact actually, that is had contact with them but I haven’t got to know them, we have said hello to each other and talked a bit ...”

On the contrary, the communication between the labs has indeed improved in the sense that more people know about each other and some work-related contacts have arisen. From the analysis of the sociograms, we could see that as many as 10 new relationships evolved and 5 old relationships changed from a formal business relationship to a richer social one.

We could also see from the informal observations several (both expected and unexpected) situations that clearly emphasize the VideoCafe’s communicative strength, in particular, its support of informal communication. One of the most prominent examples took place when the link between the labs stopped working for almost two weeks. During that period, several users spontaneously said that they missed the communication.

RESULTS

We used HQ media to afford a better sense of the physical space in the remote place. The audio channels provided sound localisation so that the speaker’s voice appears to originate from the location of the speaker’s image. The same applied to the field of view, which was done mainly to obtain a better feeling for the physical environment of the remote place. The user could select from multiple camera views and remotely control the cameras. From our experience, we would like to argue that it is possible to

design this kind of high performance arrangement without being too enveloping and hence disturbing the local social qualities that are needed to make these places attractive. In our findings, the increased proximity between the places has been the key to the success or failure in supporting informal communication.

We would like finally to argue here for the importance of bringing in competence and experience from architecture and interior design to create physical and virtual spaces and places for distributed community-building. The architecture and interior design of these places should reflect the type of communication they are intended for. It is these subtleties in the integration that will shape or not shape the media space between offices, lunchrooms, lobbies and public bars.

DISCUSSION

It has recently been debated if, and how, media spaces are truly useful in the support of informal communication. One of the conclusions could be that media spaces are difficult to learn and use in appropriate ways. It has been argued that it is easy to find the system useful for peers who know each other well, but it has also been observed that creating new contacts seems unusual in this context — it is hard to meet new people in a media space. If so, only one dimension of informal communication is supported through a media space.

We initiated the project believing that the VideoCafé would promote informal personal contacts between people at both the labs and in time could foster a community of interest. After the study, we can see that there have been a lot of new contacts on a personal as well as on a more superficial level. However, these contacts have developed through a need for such contacts and by personal links. The VideoCafé has been used as a tool for some of these new contacts but it is still unclear how many would have occurred even without the VideoCafé. What is unquestionable is that almost everyone liked the VideoCafé setting, in the sense that it was a highly appreciated component of the social, as well as the communicational, environment.

The study presented in this paper has been performed in a rather typical R&D environment. In our forthcoming work, we will set-up VideoCafé look-alike installations in rather different settings. Two projects that also involve artists will be established between airports as well as between high schools in Sweden. In another ongoing project, we are looking at how a VideoCafé could be designed for domestic environments. In this project, we are building an experimental showcase of the future apartment for a major northern European telecoms operator [jt98]. As a part of this project, we are re-designing the table mentioned earlier to become a natural component of the family kitchen. The opportunities and challenges in these settings are naturally tremendously different. Nevertheless, it will be a lot of fun to test out some of the experience we have gained from this project in these alternative environments.

Finally we would like to mention some new developments that arose from the daily usage of the VideoCafé environment. During the use of the medium, we found rather soon that the obstacles to overcome were control of the technology and the conversation

flow. We still need to pay close attention to the human factors of the system. Again, connecting two locations is not enough. People also asked for a set of tools to support the automatic configuration of equipment in response to the human activity. The underlying design principle was to reduce the cognitive load of the user by allowing the system to make context-sensitive responses to the user's conscious actions: users should interact with the room using existing skills acquired through a lifetime in the everyday world. Tools designed to supplement a video conferencing system should be accessible and usable even by those who have no experience with the technology. The user interface should be as transparent and unobtrusive as possible.

Our general guidelines are to build the interface as transparently as possible. Ideally you will be able to use your body in the room as the main interaction device, not just one or two fingers on your hand. These "smart" or "reactive" artefacts will use information from devices including motion detectors, processed video, and contact sensors to control the equipment of the meeting room. An important issue for instance will be the inappropriate positioning of cameras (e.g. participants watching an empty seat when a recipient has forgotten to check his remote image).

Furthermore, formal evaluations identified those areas where improvements can be made and highlighted issues which are of concern to users. Users need tools for supporting the transition from spontaneous communication to group design: shared artefacts such as documents or drawings over the link could have a crucial role in the frequency and duration of VideoCafé usage.

To end with, it is also clear from our experience that places like VideoCafé would benefit greatly from more subtle communication qualities. The goal is to replace the ambient communication that is obviously lost between remote places but might be replaced by some artificial means. One example might be the following: Imagine a lamp connected to a remote sensor that is toggled on/off depending on a remote presence. Our working hypothesis is that restrictions, for example, due to privacy concerns, in direct media could be replaced by incorporating this kind of ambient media.

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