Designing new communication systems for the home

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INTRODUCTION

Although communication technologies have never been so prevalent in our daily lives, most of them still focus on short, synchronous, highly-engaged and one-to-one communications. For several years now, we have been exploring the design of new systems that would support more diverse forms of communication. Greatly inspired by previous works on mediaspaces [1, 7], we particularly focused on innovative uses of video in this context (e.g. [8]).

Mediaspace studies have long shown how different video services (e.g. long-term persistent connections, instantly accessible very short ones) can be combined to support activities ranging from casual awareness and informal talks to focused face-to-face communications. But most of these studies were conducted in professional settings, and the replication of these findings in domestic environments raises a number of challenges.

Home and office spaces are highly different. While office configurations and uses are relatively predictable, homes are highly dynamic places that host a wide range of activities, many of which the inhabitants might not want to expose. Office workers and home inhabitants differ in their age, physical condition, motivations and relationships. As a consequence, because they were initially developed in professional settings, traditional methods and paradigms used to design, implement and evaluate communication systems are often inadequate in domestic environments.

A few years ago, the EU-funded interLiving project[1] gave us the unique opportunity to work with a multidisciplinary team of researchers and six families to better understand the communication needs of these families and the challenges they posed. One of the desires repeatedly expressed by family members was to have more subtle, less intrusive forms of communication than email and the telephone. Looking for lightweight ways of staying in touch with each others, they were very open to new visual, auditory or tactile forms of communication. At the same time, they wanted selective and precise privacy control.

A more recent participatory workshop we organised reaffirmed these desires for peripheral awareness of others, subtle interaction techniques and precise privacy control for communications between and within households. Workshop participants also expressed the desire for a better integration of new communication systems into the decoration of their house. In the rest of this paper, we will briefly describe some of our past and ongoing efforts towards meeting these expectations.

[1] http://interliving.kth.se/

VIDEOPROBE, MIRRORSPACE AND PÊLE-MÊLE

VideoProbe [2] was our first attempt at adapting some of the mediaspace concepts to domestic environments. Designed as a *technology probe* [6] for the interLiving project, it allows a group of people to share their daily lives by exchanging pictures. One of the original goals for this system was to provide interLiving researchers with a non-obtrusive way to learn about a specific family's life while letting them control their privacy. Another goal was to let family members use and explore innovative communication technologies in their own homes to provide a foundation for subsequent activities.

Figure 1 **:** VideoProbe

VideoProbe physically consists in a screen equipped with two speakers and a camera and connected to a networked computer (Fig. 1). A specific software analyzes the images captured by the camera in real-time and automatically transmits a picture to similar systems in other households when it detects a persistent scene change (only pictures are exchanged, not video streams). The screen normally operates in mirror mode, showing the camera images, but can be switched – using a remote control – to a browsing mode that shows the pictures taken by all the connected systems.

VideoProbe was designed as a kind of portable mediaspace node: it had to be compact, non-intrusive, simple to handle and usable in a variety of spatial configurations. As a result, it can stand alone on any item of furniture or

be mounted onto a wall like a picture frame. The interaction with the system was also carefully designed to be as simple and direct as possible without imposing physical proximity. Motion-based scene change detection was chosen to allow users to interact with the device at a distance in order to trigger or prevent the transmission of a picture. Graphical and auditory feedback are also used to indicate transitions between the various states of the system (e.g. asleep, awake, about to take a picture, transmitting).

VideoProbe supports both explicit and implicit forms of communication. The explicit form takes place when the user is consciously using the system to transmit a particular image. The implicit form typically takes place when someone enters the room, stays there for some reason but doesn't pay attention to the device. This implicit form proved very useful for maintaining awareness between family members as it usually produces pictures showing day-to-day activities that users would not or could not take themselves.

But choosing the right place to install the VideoProbe proved to be quite difficult. The computer vision algorithms we used were somewhat sensitive to the light conditions, but most importantly, windows, doors and corridors made it difficult to limit the field of view of the camera to a unique room. This problem got us interested in the use of space in video-mediated communication and lead to the design of another system, *MirrorSpace* [9].

Figure 2 **:** MirrorSpace

As the name suggests, MirrorSpace relies on a mirror metaphor and looks like one (Fig. 2). Live video streams from the places connected through the system are superimposed on a single display at each site. In order to support intimate forms of communication, the camera has been placed right in the middle of the screen. This setup allows users to come very close to the camera while still being able to see the remote people and interact with them. MirrorSpace also includes a proximity sensor. A blur filter applied on the images visually expresses a distance computed from the local and remote sensor values.

Blurring distant objects and people allows one to perceive their movement or passing with minimum involvement. It also offers a simple way of initiating or avoiding a change to a more engaged form of communication by simply moving closer or further away. Users of both VideoProbe and MirrorSpace usually like the idea that the system is reacting to them and not just taking images from them, that they are in control and not only the subject. They also like the fact that this control does not require specific skills or devices but can be done at a distance, using simple body movements.

Building on our experiences with VideoProbe, MirrorSpace and our previous works in office settings, we recently proposed the concept of *multiscale communication* as a new approach for designing innovative communication systems [10]. Extending the ability provided by MirrorSpace to easily negotiate a common blur level, this approach aims at creating systems that support a variable degree of engagement, smooth transitions between degrees and integration with other media. A new system, Pêle-Mêle [4], illustrates this approach.

Pêle-Mêle combines asynchronous and synchronous video services to support activities ranging from peripheral awareness to face-to-face interactions. It constantly monitors the activity of local users and classifies it using basic computer vision techniques according to a three-level scale: *away*, *available* and *engaged*. The activity observed at each place determines the nature of its on-screen representation, which potentially combines live images and pre-recorded ones that are filtered, delayed or displayed as-is. Shared among all instances, the screen layout follows a *focus-plus-context* approach: live images from people engaged in using the system are overlaid in the middle of the screen, while available people and images of past activity are shown on the periphery[2].

CURRENT WORK AND INTEREST IN THE WORKSHOP

A first part of our current work consists in refining our initial Pêle-Mêle design. As an example, we are exploring ways to integrate it with other communication devices already present in the home, such as mobile phones. We are also working on alternative screen layouts for specific interactions such as the visualization of past activities or synchronous communications with multiple people. These specific views might turn into new devices physically separated from Pêle-Mêle in the future, a logical link between devices being enough to comply with our multiscale approach.

A second part of our current work deals with the physical aspect of the systems we develop. The VideoProbe and MirrorSpace prototypes developed for interLiving required dedicated computers that were more-or-less hidden from users. As one can see in the upper-right corner of Fig. 1, these computers were Apple PowerMac Cubes chosen for their aesthetics and silence. Current Pêle-Mêle prototypes are based on Apple iMacs that provide the same characteristics and also include a video camera and an infrared remote control. But although these nicely-packaged hardware pieces make it easier to develop and

[2]Papers with more detailed descriptions of VideoProbe, MirrorSpace and Pêle-Mêle as well as videos illustrating them can be obtained from `http://insitu.lri.fr/~roussel/projects/`

test the system, the result looks too much like a computer and not like a single-purpose appliance dedicated to communication (Fig. 3).

Figure 3 **:** Pêle-Mêle running on an iMac

Although we have a somewhat precise idea of the kinds of communication services we want to create, the physical form of the associated systems is far less clear. Should we try to augment existing objects and metaphors, like we did for MirrorSpace? Should we instead try to design completely new objects like VideoProbe? Should the communication function of these objects be obvious, or should it only be revealed upon use? We have already started investigating some of these possibilities (Fig. 4 and 5) and discussing them with professional designers. But we would be really pleased to discuss the more general problems of information display and interaction in domestic settings with the workshop participants.

Figure 4 **:** Augmented cushions: both cushions measure the pressure applied to them and vibrate according to the pressure applied to the other one

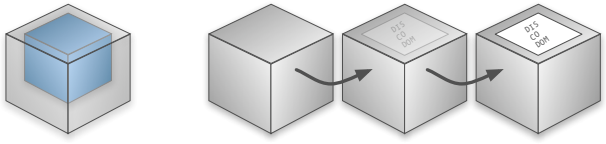

Figure 5 **:** Concept drawing of a screen integrated in a translucent glass table that would reveal its presence only when it is used

The last part of our current work deals with the evaluation of the systems we design. Communication systems for office settings are often evaluated using speed and efficiency criteria on specific tasks. Subjective measures have been proposed to evaluate one's awareness of others in the case of mediaspace-like technologies that support informal, spontaneous communications. Playfulness and aesthetics have been mentioned as important dimensions in the case of domestic environments [3, 5]. In the end, what are the appropriate methods and criteria for evaluating a communication system for the home, or any other interactive and adaptive furniture? We hope to be able to discuss that as well with the workshop participants.

REFERENCES

1. S. Bly, S. Harrison, and S. Irwin. Mediaspaces: Bringing people together in a video, audio and computing environment. *Communications of the ACM*, 36(1):28–47, Jan. 1993.

2. S. Conversy, W. Mackay, M. Beaudouin-Lafon, and N. Roussel. VideoProbe: Sharing Pictures of Everyday Life. Rapport de Recherche 1409, LRI, Université Paris-Sud, France, Apr. 2005. 8 pages.

3. B. Gaver. Designing for homo ludens. *i3 Magazine*, pages 2–5, June 2002.

4. S. Gueddana and N. Roussel. Pêle-mêle, a video communication system supporting a variable degree of engagement. In *Proceedings of ACM CSCW'06*, pages 423–426. ACM Press, Nov. 2006.

5. D. Hindus, S. D. Mainwaring, N. Leduc, A. E. Hagström, and O. Bayley. Casablanca: designing social communication devices for the home. In *Proceedings of CHI'01*, pages 325–332. ACM Press, 2001.

6. H. Hutchinson, W. Mackay, B. Westerlund, B. Bederson, A. Druin, C. Plaisant, M. Beaudouin-Lafon, S. Conversy, H. Evans, H. Hansen, N. Roussel, B. Eiderbäck, S. Lindquist, and Y. Sundblad. Technology probes: Inspiring design for and with families. In *Proceedings of ACM CHI 2003*, pages 17–24. ACM Press, Apr. 2003.

7. W. Mackay. Media Spaces: Environments for Informal Multimedia Interaction. In M. Beaudouin-Lafon, editor, *CSCW, Trends in Software Series*. John Wiley & Sons Ltd, 1999.

8. N. Roussel. Mediascape: a Web-based Mediaspace. *IEEE Multimedia*, 6(2):64–74, April-June 1999.

9. N. Roussel, H. Evans, and H. Hansen. Proximity as an interface for video communication. *IEEE Multimedia*, 11(3):12–16, July-September 2004.

10. N. Roussel and S. Gueddana. Beyond "Beyond being there": towards multiscale communication systems. In *Proceedings of ACM Multimedia 2007*, pages 238–246. ACM Press, Sept. 2007.