# From analog to digital, from the office to the living room: why I happily worked in a media space but don't live in one

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## Introduction

CSCW researchers have long investigated the reasons for the failure of traditional videoconferencing (Egido, 1988) and proposed alternative uses of video for mediated communication. Media Spaces particularly showed the value of persistent connections to support activities ranging from casual awareness and informal talks to focused collaboration (Bly et al., 1993). This research somehow culminated in 1997 with the book *Video-mediated communication* edited by Finn, Sellen and Wilbur. Strangely, however, the interest for innovative uses of video and Media Spaces dropped off just as digital media and fast large area networks were becoming ubiquitous. As partly prophesied by Karam (Riesenbach et al., 1995), the information superhighways killed most of the existing projects, based on analog media, like the US interstate system killed Route 66:

> "People were not so likely to seek their fortune on the edge of a doomed road, and of those who were already there, fewer and fewer saw any value in upgrading or expanding or - sometimes - doing basic maintenance. After 1956, Route 66 remained important, but its importance was slowly moving away from the concrete toward the glorification of what the highway had been." S.C. Kelly in *Route 66 - The highway and its people*, cited in (Riesenbach et al., 1995)

Over the last ten years, I have myself designed, implemented and used several video communication systems inspired by early Media Spaces. I am personally convinced that Media Spaces remain an interesting research topic and that they deserve more than just a souvenir ceremony. In this chapter, I will briefly describe what I learned from these systems, how I built upon them and what I think remains to be done.

## From analog to digital

I first got interested in video-mediated communication in 1995. Michel Beaudouin-Lafon was then looking for someone to design the user interface of what would be the first french Media Space at Paris-Sud University. Michel had visited the Telepresence Project in Toronto and Rank Xerox EuroPARC. He had notably implemented *xcave*, a control interface for *Kasmer*, the system used at PARC. I had no particular experience in audiovisual communication but happily started reading papers, playing with the analog 8x8 crossbar switch and pulling wires through the building.

*Lascaux* (Roussel, 1997) was the first application I created to control our Media Space. It allowed to glance at other people or to connect with them for an undefined period of time. It provided a simple available/do-not-disturb switch for privacy protection. It also implemented a basic session model which supported multi-user conferences using a push-to-talk approach and the association of shared applications (e.g. a whiteboard) to the current session. Lascaux, however, was far from successful. It was hard to maintain and distribute. As we were all in the same building, people saw little interest in the multi-user conferences and the shared tools. Many of them often "forgot" to run the software. The only service that was really used was a Web gateway that captured snapshots from the nodes of our analog network and presented them on our group's Web page in a way similar to NYNEX Portholes (Lee et al., 1997).

A closer look at the early Media Space literature made me realize I had underestimated several essential aspects of these environments. Successful Media Spaces were designed to support existing practices and tools rather than impose new ones. They were designed to be flexible, making it possible for users to repurpose them with little effort. They provided sophisticated notification and control mechanisms. As the Web gateway was the only popular component of our Media Space, I decided to make the analog services also available through a Web-based interface. I implemented a custom HTTP server to control the crossbar switch. This server supported the old glance, connect and snapshot services as well as a new one that allowed users to leave messages on other people's computer screen. It also implemented more refined control mechanisms inspired by CAVECAT's door states (Riesenbach et al., 1995). The resulting system, named *Mediascape* (Roussel, 1999), made it possible to easily create interfaces to our Media Space by using simple HTML code such as:

```
<a href="http://mediascape/connect.michel">
      <img src="http://mediascape/grab.michel">
</a>
```

Duplicating these lines and replacing `michel` with other users' name was enough to create an HTML awareness view that could also be used to establish analog connections. The same code could also be used to integrate live snapshots into email messages (Figure 1, left) and existing or new HTML documents (Figure 1, right). An interesting use of this feature was to include a live snapshot of one's

office in one's email signature or in a Web page showing contact information so that people who wanted to reply to an email or talk with someone could see if that person was available for discussion.

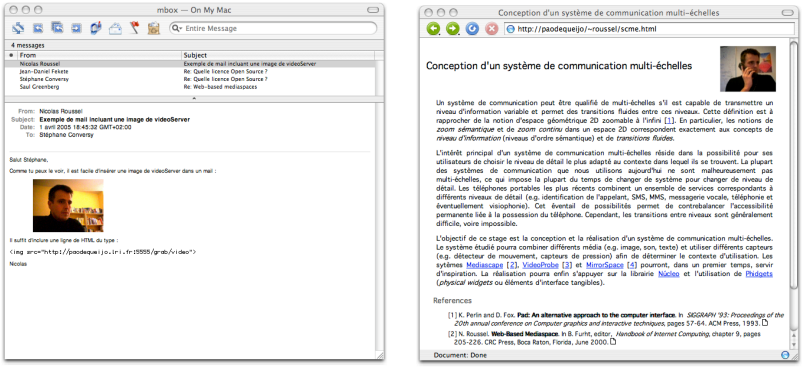


**Fig. 1.** Live snapshots displayed in an email message and a traditional HTML document. Images are captured and transmitted every time the message or document is rendered by the application.

The snapshot service of Mediascape made it possible to send live pictures from our offices to distant colleagues, friends or relatives. In order to share the Media Space experience with them, I designed and implemented *videoServer* (Roussel, 1999), a personal HTTP server that could make live images or video streams captured from a local digital camera accessible through simple URLs similar to the ones presented above. As webcams were becoming more common, we started adding videoServer images to the awareness views of our analog Media Space. At some point, the room hosting the analog equipment had to be cleared for maintenance. This equipment was never put back in order after that. But although we stopped using the Mediascape system, videoServer still runs on some machines around the world.

VideoServer has no support for audio communication. But it allows people to see live images from a distant camera by simply pointing a standard, unmodified Web browser to the appropriate URL. As a group communication tool, it quickly became an invaluable add-on to the telephone, as a way of checking the availability of someone before making a call and seeing that person while talking to her. Obviously, digital video makes it possible to communicate with people much farther away. But it also allows more dynamic forms of communication. A few lines of JavaScript, for example, can simply turn a snapshot into a medium frame-rate video when the mouse moves over it and pop up a new window displaying a high frame-rate and resizable stream when one clicks on it (Figure 2). These three levels of details proved very useful to resolve ambiguities related to the small size of awareness views and accompany the transition between the moment when a user checks for the availability of another person, picks up the phone and start calling that person.

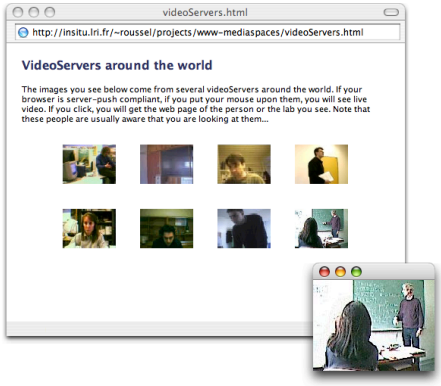


**Fig. 2.** Gradual engagement: from a low resolution snapshot in a Portholes-like awareness view to a high frame rate independent video that the user can freely move and resize.

As most Media Spaces, and unlike webcam software, videoServer provides users with customizable notification and access control mechanisms. For every request it receives, it executes a control script with arguments indicating the name of the remote machine, possibly the remote user's login name, the resource that led to the server (the HTTP referrer) and a description of the requested service. The script uses this contextual information to generate auditory or on-screen notifications and sends back to the server a description of the service to be executed. This description can be inferred from a set of pre-defined rules or negotiated with the user through some interactive dialog. An important feature is that the script is not limited to a binary accept/refuse choice but can freely redefine the service to be executed, supporting selective accessibility. It might request that a spatial filter be applied on the images, which the remote person will probably notice. It might redirect the client to another server. But it might also substitute a pre-recorded sequence to the live stream, supporting the creation of ambiguities and stories (Aoki and Woodruff, 2005).

I lived in a Media Space constantly accessible from the Internet for about five years and this was great. But to be more precise, I should probably say ``I worked in a Media Space'', since I only had access to it in my office. To be even more precise, I might even say that I worked in a Media Space, which was nice, and that I took advantage of this situation to keep in touch with my girlfriend and other close friends during office hours, which made it great. This might sound anecdotal but I somehow suspect that every successful Media Space built on similar close relationships, although they're rarely mentioned in scientific papers.

## From the office to the living room

Domestic environments pose a number of interesting challenges for Media Space designers. While most Media Space studies probably dealt with relatively predictable office configurations and uses, homes are highly dynamic places that host a wide range of activities, many of which the inhabitants might not want to expose. In the context of the *interLiving* project, I participated in an effort to adapt some of the Media Space concepts to support communication among distributed, multigenerational families. Together with other colleagues, I designed and implemented *videoProbe*, a *technology probe* that allows a group of people to share their daily lives by exchanging pictures (Hutchinson et al., 2003; Conversy et al., 2003).

The system physically consists in a screen, two speakers and a camera connected to a networked computer. 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 Media Space node: it had to be compact, non-intrusive, simple to handle and usable in a variety of spatial configurations (Figure 3). 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).

**Fig. 3.** VideoProbe.

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 group awareness 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 in a home (or any other communication device) is quite difficult. Lightweight wireless devices that people could move around might partially solve this problem. Yet, my experience with wireless phones indicates that these devices seem to always be in the wrong place when they're needed, no matter how many you have got... Another problem, in the case of videoProbe, is that windows, doors and corridors make it difficult to limit the field of view to a unique room.

This problem got me interested in the use of space in video-mediated communication and lead to the design of *MirrorSpace* (Roussel et al., 2004). As the name suggests, this system relies on a mirror metaphor (Figure 4). 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. A recent study showed that blur filtration fails at providing an obfuscation level that could balance privacy and awareness for home situations (Neustaedter et al., 2006). Yet, I strongly believe that this type of filtering is still valuable. Not because of what it tries to remove, but because of what it adds: the filter shows the remote person that we don't want them to observe. The fact that it does not necessarily enforce this leaves room for negotiation and social regulation, two concepts traditionally associated with Media Spaces.

**Fig. 4.** MirrorSpace.

## What remains to be done

A lot! As I said in the introduction, I believe that the concepts that originated from early Media Space studies still offer many opportunities for research.

As I hope to have illustrated, I think that digital technologies can provide ways of enriching or impoverishing audio and video communications to create a wider range of services corresponding to more degrees of engagement. I believe that a key aspect of future Media Space research will be to find ways to ease transitions both ways between low levels of engagement (i.e. awareness services) and higher ones (e.g. synchronous chat, telephony, videoconferencing). The general idea is to move towards the notion of *multiscale communication*, a concept I am currently investigating (Gueddana and Roussel, 2006; Roussel and Gueddana, 2007).

I would love to see more work done on the adaptation of Media Space concepts to domestic environments. One aspect that seems particularly interesting to me is the use of Media Space technologies for in-house communication. Asynchronous communication, for example. Domestic environments also pose the problem of shared always-on communication resources, a problem that already existed but wasn't really solved in office settings.

Finally, Media Spaces in mobile contexts also seems an interesting topic. One of the reasons why I don't run videoServer on my laptop anymore is that I skip from one network to another with long periods of unreachability. Again, simple, unobtrusive asynchronous communication services (other than text-based) would be greatly appreciated...

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