

Living with a continuously produced presence – experiences from an extended office space

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Abstract. What is it actually like to share your office space - all day, every day - in realtime collaboration with your peer professionals, located in distributed geographical locations - in our case also involving multiple countries – yet interconnected with audiovisual technology. This empirical study aims to examine how telepresence affects various communication modes at the workplace; teamwork, reflective, leisure activities and so forth. The research team members have identified some key factors that together contribute to a sense of presence, each of them affecting the level of trust and co-existence between two or more parties. Secondly, the report attempts to address the overall notion of communication quality as such; what actually constitutes communication quality in a telepresence context, to what extent is this quality measurable in technical terms, how does the user's perceived sense of quality correlate to measurements, and how does communication quality affect the sense of presence, bonds of trust and feeling of togetherness for members of a virtually co-located, yet geographically separated, working group.

This study was carried out by a joint team of researchers at Høgskolen i Lillehammer, Høgskolen i Gjøvik, both in Norway and Kungliga Tekniska Högskolan in Stockholm, Sweden during 2004-2007.

On remote presence

Throughout the study, as well as in daily life in general, we speak of various types of presence. Physical presence is often the interpretation mentioned of the term, where a person's physical body is located at a given time. After the introduction of various forms of media, such as the telephone, wireless (radio), television, the term presence is often related to the willful suspension of disbelief that a person, although physically elsewhere, still through mediation can be perceived as present to a certain degree. This suspension had nothing to do with computers or video equipment at first. Rather, it was the theatre drama which through the "willing suspension of disbelief" by the actors and audience in mutual poetic faith made the playwrights story come to life, as argued by Samuel T Coleridge many years ago [Sinclair 1998].

One could naturally argue that someone remotely present through the use of videoconference equipment or similar easily could be perceived as more present than people actually on location. As would a participant, although physically present, who by intense daydreaming could pass as being far more absent than a group member connected to a meeting via a speakerphone. The latter of course, however interesting, is considered beyond the scope of this paper.

Traditionally, analysis of telepresence is mostly a study of the bidirectional and active use of audio and video in various combinations. In this study, there is also emphasis on audio and video usage, but sometimes the participants tried to stimulate or simulate other senses as well.

The basis for good communication is the existence of trust. The basis for trust in turn relies on a sense of presence. If the persons communicating are not physically present, the presence has to be produced through various forms of mediation anywhere from a single phone line to live casted high-definition, full-frame video. This production can either be established with the facilitation of a trained professional – a presence producer – or through the use of a well-defined so-called communication recipe, suitable for the situation at hand. These recipes can be made up as reference documentation, i.e. comprehensive how-tos on many aspects of “presence production” for the benefit of the mediated layman.

How can we understand and use the term communication quality? From a technological point of view there are things that can be measured. i.e. the communication quality is understood as technical performance of the system and its components. Image resolution, audio quality, roundtrip delay, real-time sync, bandwidth issues et cetera, are such technical aspects that quite easily can be measured.

Yet, from an ethnographic point of view the communication quality is rather something we perceive as individuals, as argued in [Enlund 2004]. Here the individual preconditions are important since different individuals can perceive different communication quality even though the communication has the same technical potential for any two given conversations in sequence. If the narrative and “story telling” along with the conversational subject at hand are immersive enough, the communication quality can be more independent of the technical performance of the communications tools used [Steuer 1992].

Presence tools

This paper does argue that many of the systems for distributing audio and video on the market are quite similar, and that for the overall sense of presence they are more or less interchangeable. In the study, the research team agreed to enjoy the use of constantly open connections, virtually whenever any party was physically present at any of the offices, which meant that any time restricted system was out of the question. The technology used was partly standard “video conferencing” equipment, sometimes superimposed with various IP-based systems (Marratech, Apple iChat, Google Video, VNC et cetera), e.g. for integration with shared whiteboard, synchronized slide shows and chat. For the morepart, the transmission protocol over the IP network was a standard H.323 using off-the-shelf Tandberg video conferencing equipment in full-duplex 2 megabit per second connections. Sometimes software-based codec systems were used in conjunction, such as the Marratech e-meeting system. The Marratech e-meeting system also features an on-board bridge to the H.232 systems, and therefore could be interconnected also with the Tandberg hardware-based systems, and also accessible for team members away from their office spaces. Also, when concurrent viewing of documents was required, the Marratech systems made it substantially easier to drag-and-drop these in the Marratech conferencing client.

Other tools were used for the visualization of test results, such as the concept mapping techniques by Ambjörn Naeve and the Knowledge Management Research group at KTH, Stockholm. In figure 1, an example overview on a context map on presence from a session in 2005 by researchers Naeve and Knudsen.

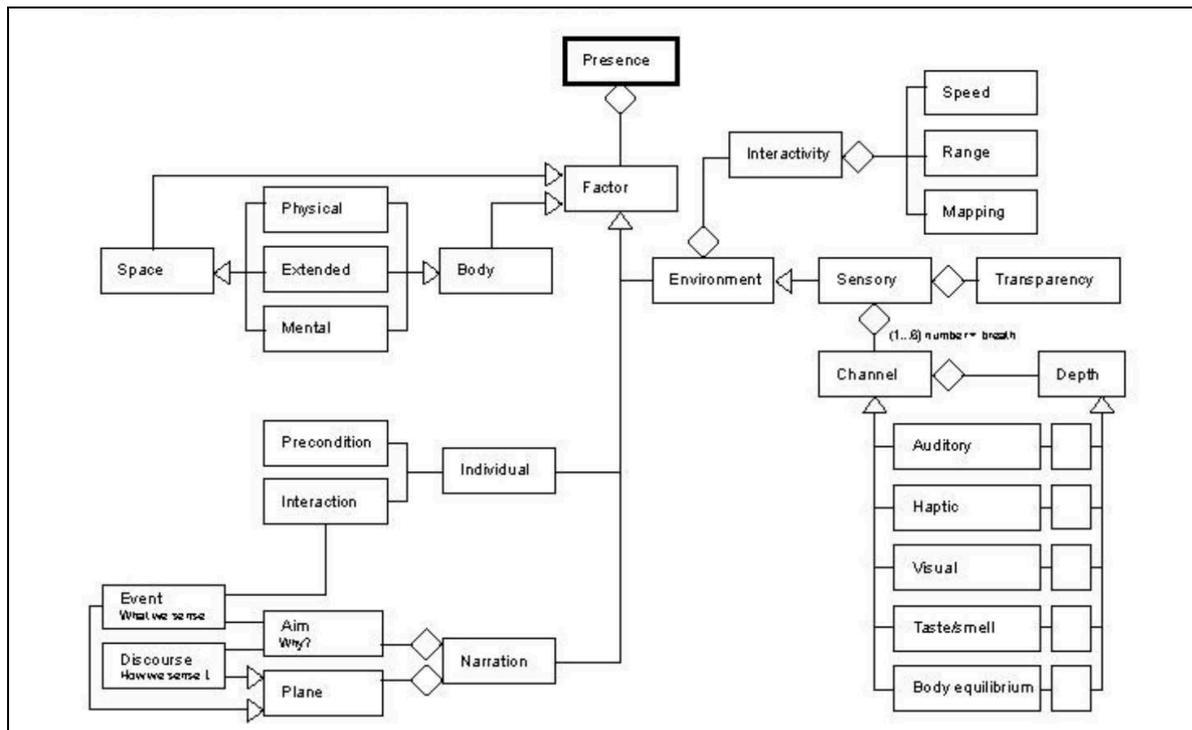


Figure 1. A context map on presence.

See how the concept map can be read for understanding relations and how things relate to one another, such that presence has three main factors that make up a sense of presence according to [Knudsen 2004], but also semantically by following any given route of connected boxes. such as “a persons individual preconditions is a presence influencing factor”.

Test population

As we for the morepart used ourselves in the research team as the test population, the everyday use of these technologies made the threshold for session initiation and usage very low. The participants got used to a range of tools that over time became a second nature to exploit to the furthest extent, much like when an experienced driver drives a car, completely integrated with the system, more using the car as an extension of the body.

The test population is not demographically correct for drawing any general conclusions, for any given large group of people. Rather to be regarded as a special case with highly trained professionals and their peers. From that perspective the technology was not an issue, as with tests when a new technology is introduced and studied. It was there, with its properties and limitations; its form factor, software bugs, camera functions, microphone characteristics, loudspeakers, screen glare and computer network malfunctions. Most of it was halfway through the study quite well known and thus easy to handle, even when technical problems occasionally occurred.

Interaction

The level of interaction differed a lot, both during the course of the working day and also depending on which parties were simultaneously 'present' over the network. The communication link was open most of the time during office hours, even if no "active" communication was taking place. Sometimes it provided more a sense of "awareness" – a sufficient feeling of being together with someone in the same organization, physical or virtual. This created a sense of reliability and comfort – you knew it was possible to speak out to your colleague if you wanted to, and to get an answer. The system provided more the possibility to interact than the interaction itself. Kind of the notion of not needing to call the others up, as they're already at the other end of the line all the time, much like someone present in the neighboring cubicle to your own in an office landscape.

As in all mediated communication, the notion of space and embodiment are important. Physical spaces are extended by mediation when you pick up the receiver on your telephone. You're still left in the physical space together with others in that room, commuter bus or café; but you and the remote party have through the initiation of the telephone call, also created a shared space which is neither here nor there, but somewhere in between. In the case of the phone call, in this instance the technology becomes transparent to a certain degree – we no longer care how the sound waves are transported from my mouth to your ear as long as the voices don't break up or distort too much – something which our research has shown is a very important factor when it comes to the willful suspension of disbelief, which in sense creates that virtual room mentioned as a central factor of the makings of mediated presence in this study. [Bolter 1999] takes this even a step further, referring to this phenomenon – the [shared] virtual space – as an apparently unmediated perception of another world.

Preparing for mediation

By establishing awareness about how you look to others in your own environment; i.e. how your own body is represented and experienced in the mediated virtual space, how does your physical space look, how do your slides, charts and other shared information look to others through a compressed video channel. Several studies show how a more experienced mediated participant can catalyze and enhance the experience for a less experienced user. [Lombard 1997][Knudsen 2004]. Whereas in a physical space, people in general have at least a rough estimate on what you look like and some also quite a good idea how others perceive you. In a mediated space, this is increasingly difficult, especially when we don't see our own outgoing image, or without sound feedback.

To make it even harder to prepare for events to come, we added the fact that the connection between our offices and our countries too for that matter was constantly open, providing the makings of an extended office space, even at times when the person in "the other space" was not physically present. Secondly, rather than being in control of your own camera, the remote party was allowed access to the camera controls, and choice of video sources, allowing the mediated participant to look around, look out of the window, zoom in on various objects et cetera.

Through continuous for thousands of hours, the individual preconditions for each participant in the remote presence exercises, evolved to become less important after some time than they were in the beginning. As for us test subjects, we slowly began

acting more alike, both in salutation gestures, method for reporting events, preferred camera angles, documentation methods of the conversations made, screen dumping and sharing worthy whiteboard notations, slowly forging a tacit code for extended office behavior.

For instance, our dress code over time adapted through avoiding clothes that either would create disturbing patterns on screen, e.g various moiré patterns when wearing a narrow-patterned checkered shirt, or colors that would interact unfavorably with chroma key, written words or phrases on clothing that would reveal that the image in fact was reversed (mirrored) as they become in some applications.

To further enhance the notion of shared spaces, much effort over time was spent on hiding cameras, speakers, microphones and bulky computer monitors in the spaces. Semi-transparent mirrors proved most convenient for aligning angles of view for cameras and monitors respectively.

The formal and informal blurred

Just like when sharing a physical space, the boundaries between the formal and informal blurred to the extent that it was difficult to account for what had been said in the physical vs. the extended office space. Children and spouses calling during office hours allowed the remote team members to get a unique insight in each of the others' lives. Also, a code-of-silence tacitly evolved, kind of "what is said through cyberspace, stays in cyberspace", meaning that many of the conversations overheard couldn't be questioned nor quoted to third parties. In conclusions, many aspects made the extended (mediated) office very much alike, as if the team had been in the same office and not distributed.



Figure 2. Presence of space can be achieved, even when one node is unpopulated.

Even when persons in the research team was not present in the office it was possible to have social contact with "the other space", such as in this case with the monkey avatar shown in figure 2.

Conclusions

It is proved to be quite difficult to conclude the experiences of a long-term ever present experiment such as this. Since we at this point feel truly interconnected with our remote nodes of our extended office, the study has proven successful for our working lives. The decision to allow the systems to be on-line during all office hours, despite the depletion of several monitor screens and computers (not to mention the impact on the environment), was a success factor for sure. Lowering the threshold by no longer needing to establish connections on demand contributed heavily to the vividness of the interaction between the physical offices.

Allowing others to connect, via Marratech and other tools, thereby not limiting the conversations to but a small group, was also one of the corner stones in creating a living virtual space between us and beyond. However, sharing office spaces in the virtual isn't more glamorous or inspirational after a short sensation of novelty as such, the mutual interests have to be present too to distinguish it from riding the bus together.

One main question remains: Where does the transition from seeing someone in a screen window on a monitor to actually sharing an extended space? This study doesn't give a complete answer, but much in the eyes and perception of the beholder, whether a shared space exists or not, and if it can prove to be persistent enough to prevail as a acceptable alternative to travel and physical meetings. Much more can be learned from the extensive knowledge of the film & broadcast media industry, where narration, lighting, sound and visual techniques help the viewer to create that poetic faith required to extend the physical world to others. For the task of seamlessly merging these two disparate industry sectors with the ultimate goal of totally transparently mediated presence, telecom and media respectively, we are only in the beginning.

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