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a collaborative telepresence project 0101- 0106

Final report 011206

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Project groups

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## 1. Background

This project was initiated during my stay as visiting scholar at the Department of Conceptual Information Arts, San Francisco State University, in 2000. Prof. Steve Wilson, head of the department, and I discussed the possibility to set up a collaboration between his students and my colleagues at the Smart Studio upon my return to Stockholm. In using the physical separation between the two places we hoped to create an interesting setup to artistically explore the issues around telepresence.



[www.fourmilab.ch](http://www.fourmilab.ch)

When the sun is rising in one place, it is setting in another

I will present some questions and note fragments from the initial discussions on the following pages. First a definition of two terms around which the project evolved, telepresence:

"the ability to remotely manipulate physical reality in real time through its image" (representation). (Lev Manovich, "To Lie and To Act", p.175 The Robot in the Garden, ed. Ken Goldberg, 2000)

and

distance:

a measure of separation in space or time.

transmission time delay

real time difference

time over distance

geographical definition of here-there

indeterminate past-present-future

being in two places in two times

remote location - immediate location

space/time uncertainty

relationship between immediate and distant input/output

fictive or real space

illusion-imagination/reality

proportion/size

experience of a seamless w(hole)

# distance

multidimensional experience of space

notion of truth and knowledge is a convincing story a true story?

depth without perspective

trust

credibility/authenticity

informative - formative intent

**/measure of separation in space or time/**

body memory

subject-object relationship

presence/absence

detached relationship to the world through

representation/interface direct (basic) access to the world

distortion

intentional/unintentional

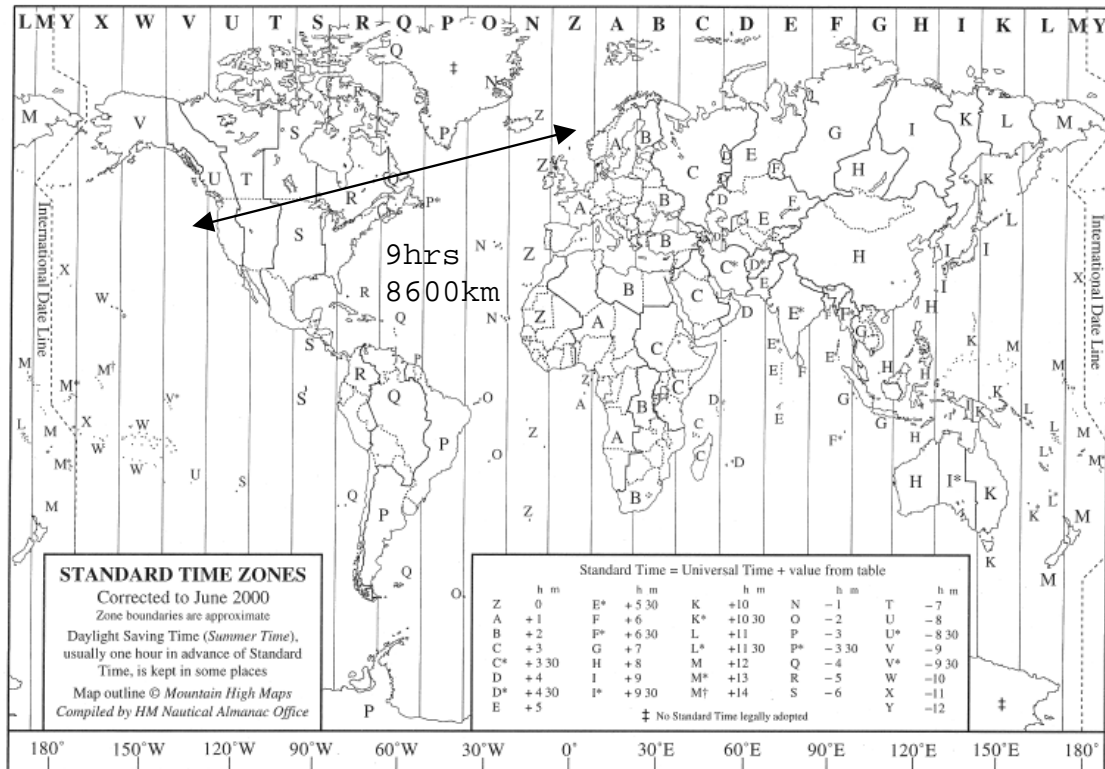
human senses - machine extension

diminishing bodily functions (as we know them),  
enhancing power of thought (imagination becomes reality)

legitimizing the imaginable through technology (western  
scientific reason)

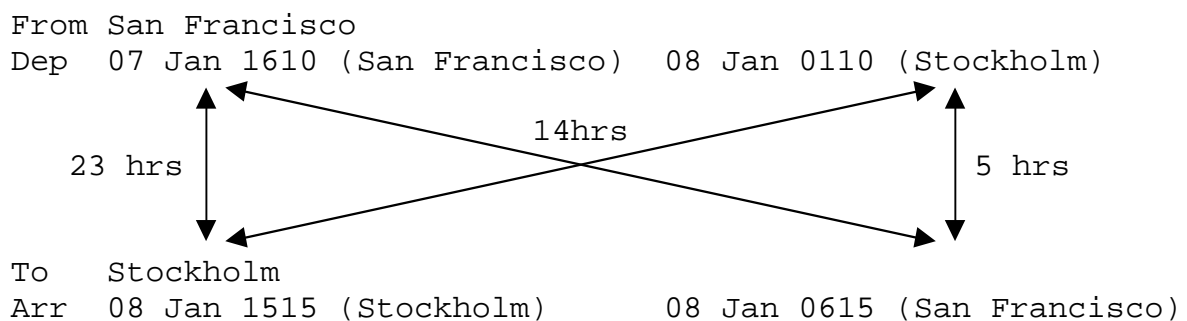
body - mind dichotomy or transformation of human existence as  
a whole

Considering time over distance:

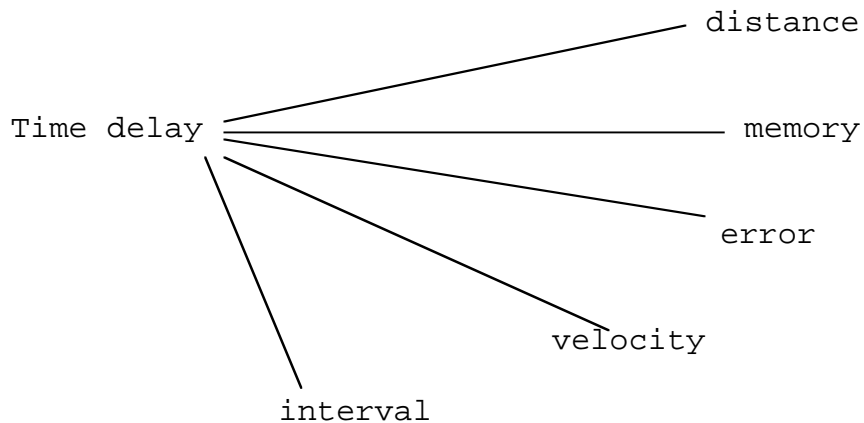


How many zones of time can we pass between two distant places if we consider both the real time difference and the imaginary time/space gap?

Anybody on an overseas flight must have considered this relative loss/gain in time, as an example:



"In information-only interactions, a certain amount of delay is natural. For example, when we ask someone a question, we expect to wait a short time before we receive a reply. Similarly when we click on an internet link, we wait a while for that page to display. In contrast, in energetic interactions, we expect instantaneous response. If we touch a wall, we feel the resistance immediately." (Blake Hannaford, "Feeling Is Believing", p.252 The Robot in the Garden, ed.Ken Goldberg, 2000)



The time delay was seen as an important factor in exposing and sensing the physical distance. The highest resolution is not always the best solution and simultaneity will not necessarily enhance the experience of remote action.

"Different kinds of teleaction require different temporal and spatial resolution"(Lev Manovich p.177) and we were interested in using the deficiencies caused by distance.

The mechanical aspect of remote interaction was also questioned.

For example, the limitations in a master-slave (machine extension) relationship or a manipulation which presumes that the manipulator wants to control the outcome of an operation 'when I do A, B happens (should happen) and how this implies a predetermined expectation.

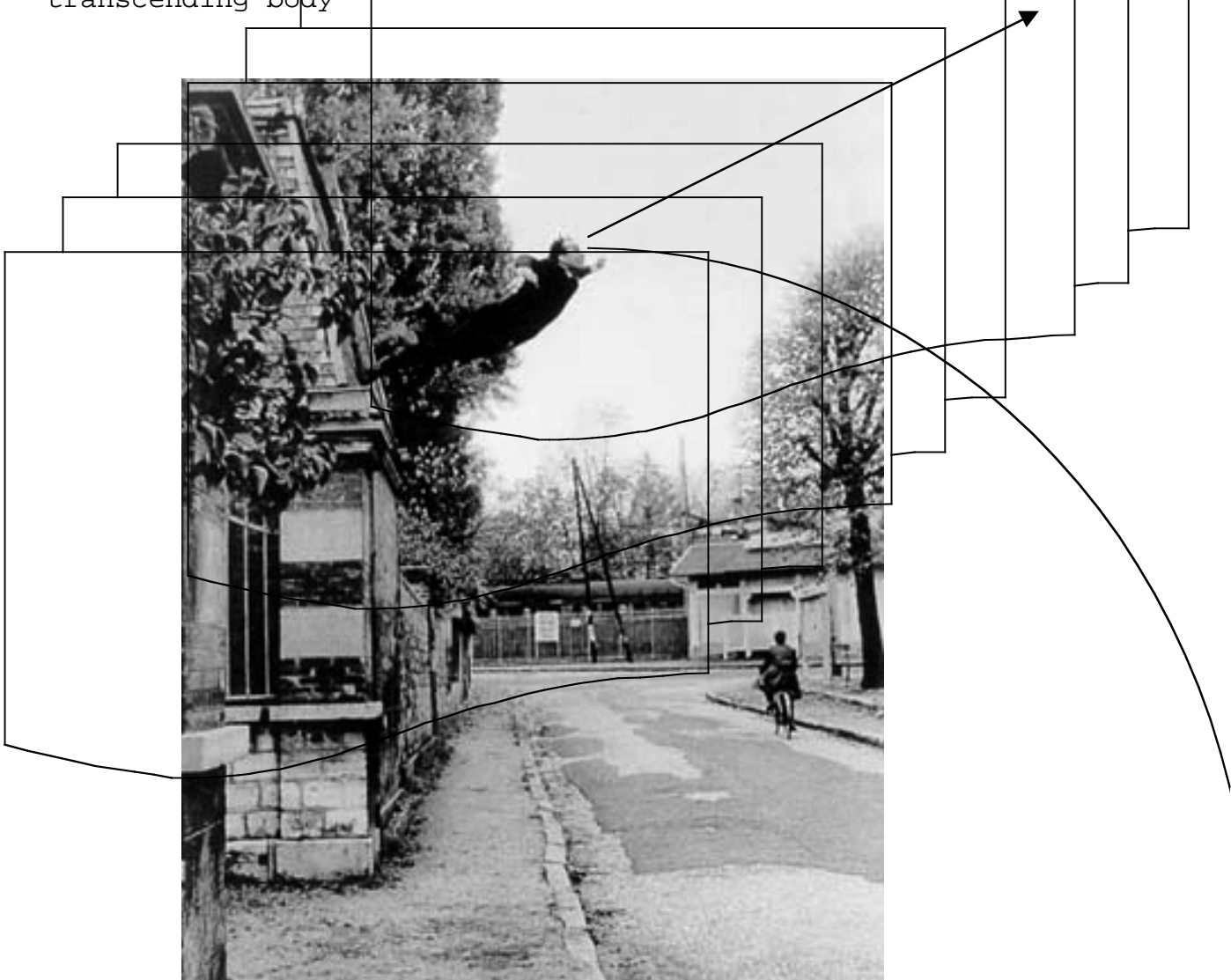
Is it possible to avoid the confined space this mechanical operation creates and open up to a seamless assembly of several planes of existence?

" We say that the art of imitation (of places, of scenes, of external objects) has had its day and that the artistic problem today consists of making mental representation more and more objectively precise through the voluntary exercise of imagination and memory (it being understood that only the perception of the outside world has permitted the involuntary acquisition of the materials which mental representation is called up to use). The greatest benefit that Surrealism has gotten out of this sort of operation is the fact that we have succeeded in dialectically reconciling these two terms - perception and representation - that are so violently contradictory for the adult man, and the fact that we have thrown a bridge over the abyss that separated them." (Andre Breton, Surrealist Situation of the Object, 1935)

dreaming/longing/imagining/lying

defying gravity (lightness of being)

transcending body



Yves Klein, Leap into The Void, 1960

seamless assembly of several planes of existence

(superimposition)

## Idea overview from posted texts

Method: cut 'n' paste!

### Activity of persons and objects

Physical movements activate objects

Movement of individuals (is then reflected in the activity of a piece of furniture in the remote space)

Scurrying armchairs and sofas on hydraulics

lack of movements

length (time) of movement or lack of movement

gestures (style of movement)

- appliances (on/off - for example, coffee machine)
- vibration of floor
- vibration of furniture

length of movements

- motion of people present
- activities of people present (eg reading, talking, sitting, standing)

### Presence

Presence of individuals, ie each person has a unique indicator of his or her presence in the space -- as sound maybe

size of person/object mass

breathe

location of object or person

Sensing

- presence/absence of any person
- number of people present
- identities of people present
- identity of objects present
- position of objects
- state of all objects (eg lights on/off; ???)
- motion of people present
- activities of people present (eg reading, talking, sitting, standing)

### Biofeedback

someone's pulse/body temperature can then affect the pitch of their signature sound and we can make all kinds of crass assessments about that person's state of mind at that particular time

thoughts/mood

### Sound/Light

Sound : pitch, volume, rhythm, style

someone's pulse/body temperature can then affect the pitch of their signature sound

halogen lamp, or lamp with a dial: if the dial is linked up with volume for example perhaps this could be a way to create an opportunity for conscious engagement. For example there is a soft murmuring in the room so you know that there is a conversation happening remotely. You turn up the light in order to hear more (illuminate the conversation) meanwhile the light turns up across the world letting them know that they are being listened to.

MIDI Interface: could we use MIDI to translate lets say the pitch or rhythm of someones voice into a series of light movements or it could play a particular song in that rhythm. Or turn on and off switches that control anything.

length of stay of one person is mapped onto volume of certain sound in order to denote a taking up of space. As these mappings change do we show these to people?

- position of sound
- characteristics of sound
- position tracking lights
- color/intensity of lights
- lights (on/off)
- color light track person in other space (color by person)

## Visuals/image/video

Controlling Video Functions: Is there a way to control the actual functions within the video camera? For example, the image of the remote sight could get more or less blurry depending on the level of engagement-- or more zoomed in when they are handling objects or more zoomed in when they are talking loud: someone screams and all of a sudden the image is so close we can see the weave of the fabric on their pants.

Projector & Writing Pads: regarding conscious communication: for example if the table was actually a drawing pad so folks could draw on the table and then these scribbles, writings, paintings could get layered into an image (that perhaps also had silhouettes of the room or something) and then projected into the remote space. Hence there would begin to be an emotional/internal mapping as well. Perhaps the projector could even be on some sort of mechanical tripod so that it could illuminate the position of the participant in the remote location. This would also allow for communication to take place through the table. (ie someone here could respond to the etchings of folks in sweden.) Another possible site for this interface is the window, perhaps these scribbles could be layered through the windows.

Composite Imaging: Perhaps one of the ways we can address time delay is through composite imaging. In our real time segments there is a cleaner image perhaps just the image of whoever is in the room. While at other times the image gets denser and less intelligible perhaps it becomes layered or randomly selects images from another part of the day or there is a delay so we see the previous frame layered above the current frame...

## Other ideas

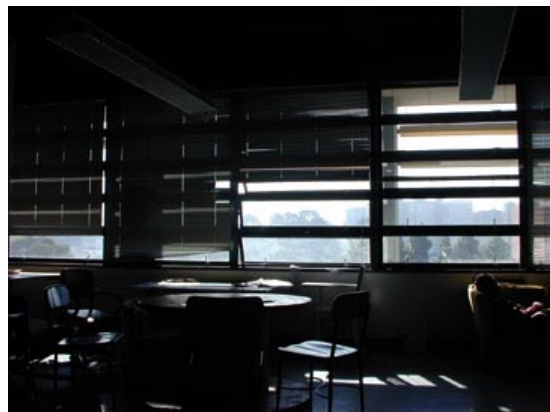
Fish tank: a very normal object, which offers many things to be activated and very interesting/surreal aural and visual quality. Air pump can be turned on and off sound of running water therefore turns on and off. Also can have bubble strips that turn on and off referencing breathing. The light can turn on and off as well. Interesting direct metaphor for life: bubbles (breath), light (activity), running water (emotional quality, spatial quality).

Fans: If material (even cheap material such as tinfoil) is hung inside the walls, and fans are put behind the material then when they go on, they will produce sounds. I think this could be interesting and have a lovely, haunting effect. Fans also have different speeds which would be good for mapping various meanings.

I like the idea of remapping throughout the project, if the remapping was open to all who participated somehow (not just artists who created piece). And if remote locations remapped their mirror (so we would remap sweden and vice versa).

## 2. The collaborative process

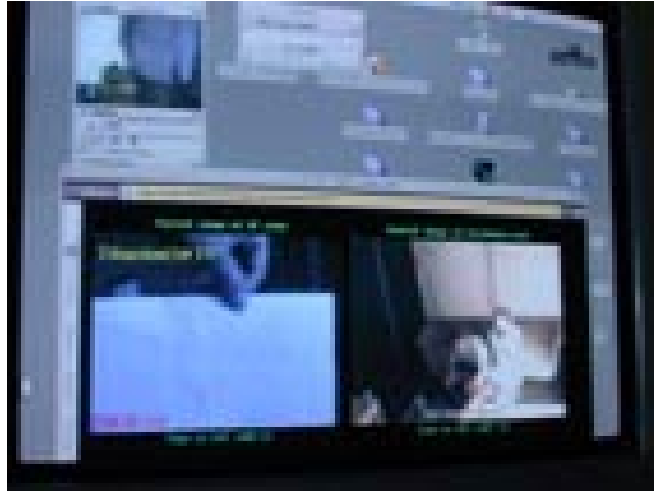
The first tentative contact between the two groups was made by exchanging some images to give each other a sense of the local place.



Selection of photos taken in Stockholm and San Francisco

We also set up a communication link by using the available public conferencing systems: Yahoo Groups for mail, chat, storing files and iVisit for webcam access. The two groups had

telemeetings twice a month. In SF everybody had just woken up, in Stockholm everybody was ready to leave work. The webcam gave a low resolution(320x240) image with considerable delay. The audio transmission was somewhat better. At times we had difficulties to connect and had to resort to the telephone.



Holding up sign: "telephone!"

The meetings would last approximately 45 minutes. They gave both groups a sense of contact and moving forward together which would fade away between these occasions. Any silence during the meetings was perceived as frustrating and created a potential space for misunderstanding. The facial expressions were difficult to discern and we had to rely more on the audio transmission. There were participants from the two groups that knew each other personally and this in itself made the contact more informal and relaxed. These participants could more easily translate the remote situation and at times catch the gestures, brief comments and other peripheral or more subconscious signs involved in a normal conversation. The remote visual contact is somewhat strange and detached due to the lack of direct eye contact- the person you speak to is looking down or up at the screen, at his own and the other persons image online. It is rather voyeuristic, even narcissistic as you simultaneously look at your own image to see how you present yourself.

However, the teleconferences were more popular and vivid than the group site exchange. The group site was more focused on written content, discussion and the archival organization of text and this required more individual effort and active participation. Most participants were involved on a voluntary basis and even though the group site had many members, only a few posted messages regularly. Due to the loose structure of the groups and their commitments, it was hard to determine the quantity and quality of work input. The project was based on personal engagement and the will to keep in touch, which was considered to be a precondition for the interaction to take place on the spontaneous, intuitive level we were aiming at.

In retrospect, it was extremely difficult to keep up work continuity remotely and each of the groups asked for clearer guidance, especially the student group in SF.

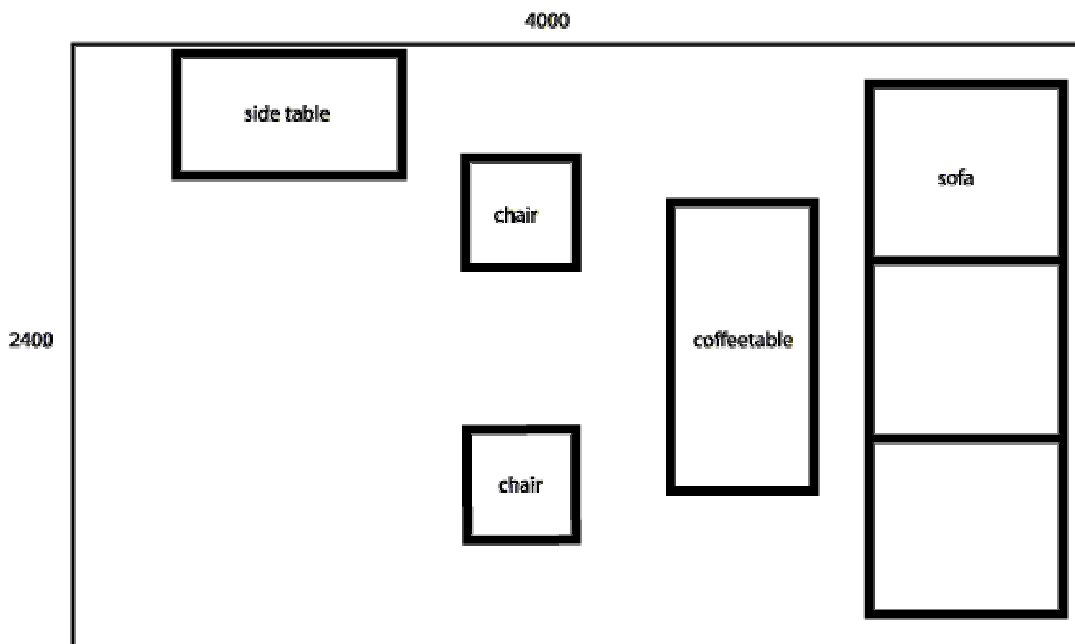
### 3. Concept

The groups decided to build two identical rooms, one in each place. The rooms were to be furnished identically and we discovered that the Swedish furniture store, IKEA, existed in both places. They were contacted for sponsorship but unfortunately we were not able to come to an agreement with the SF outlet. Therefore we had to settle for furniture that existed on site.

The two room's physical sameness was chosen for several reasons. Superimposed they conceptually became one room, creating an imaginary common, shared space.

The focus was rather on the difference that would occur through the movement and how the separation is to be defined when the specificity of the place is eliminated.

#### Placement of furniture



Consequently, the issue of how to handle time became central. Firstly there was the nine hour timezone difference. As we were subordinate to the working hours of the institutions where the rooms were situated, we could only consider daytime as active time and this narrowed down the shared(synchronized)

time to 4-5 hours. The remaining time was a large block of 'blank' time where the time difference became obvious. This time, we found, could be considered as storage time that enabled us to take advantage of the 9 hour delay. For example, signals transmitted during that time could be stored and manipulated, condensed or pulled out, or used as echoes. One place could send signals from the 'tomorrow' of the other place.

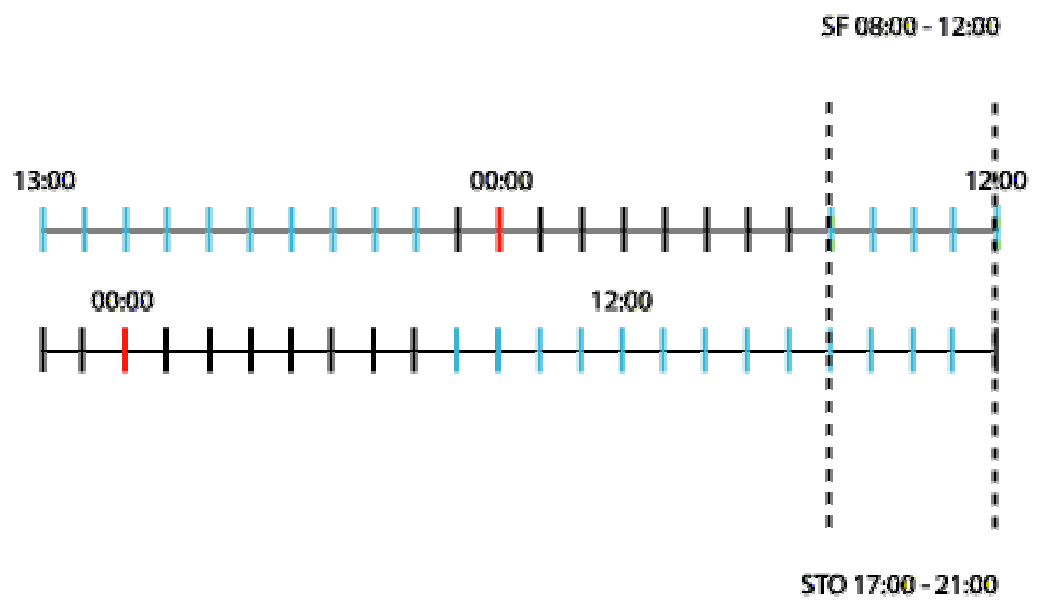
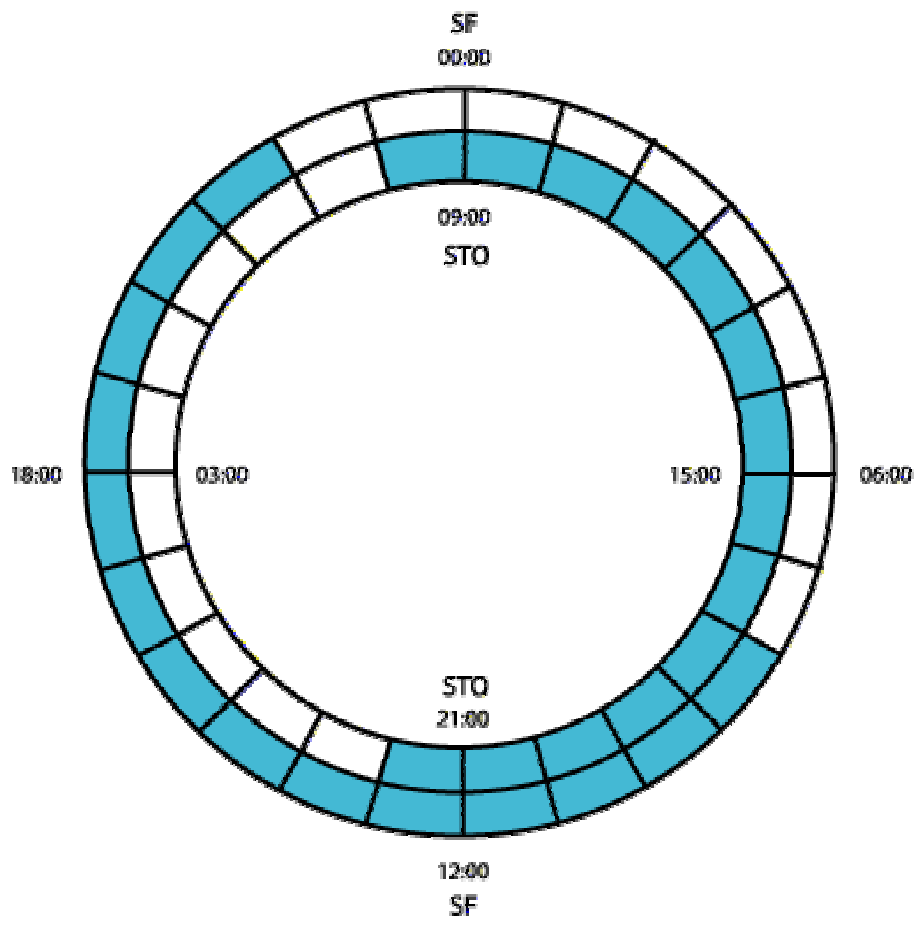
Some of time management models are presented on the following three pages.

Another issue was the degree of abstraction of the transmitted signals. A preliminary decision was made to try to avoid any direct visual or auditory contact through the rooms. That is to say, any direct communication similar to the kind that took place during the meetings. We chose to use mainly sound and light to mark the telepresence in the rooms. The presence of a living body in a distant place would only be sensed through slight changes in the room. These would exist unobtrusively and simultaneously with the local activity and setting of the room.

The loss of direct individual, (inter)personal contact raised the question of how interesting it would be to maintain telepresence in the long run and above all how engaging it would be between strangers. Why would anybody want to interact abstractly with someone they have no idea about, no feelings for and no relation to? How much detail can be omitted without that unknown presence becoming unvaried, over-simplified and meaningless?

On the other hand, if one does not think in the terms of communication but rather more in terms of atmospheric (spatial/sensory) disturbances, movement in space and time, a shifting displacement of frames of reference, then these small changes can take on a new meaning. In that case the focus shifts from the interpersonal, subject-object-subject to the movement between these, the inter-action and how it continuously reshapes time and space and thereby creates new meanings.

If we consider the information stream as a plasticity in and of itself we are able to transform it and make it visible any way we choose, our imagination combined with the available technology being the limit.



Timecircle sketch1

Time management model 1

## Time management model 2

	14	15	16	17	18	19	20	21	22	SF prerec. Sun							23	00	01	02	03	04	05	06	07
STO (Mon)	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	
SF (Sun)	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	
STO prerec. Sun	23	00	01	02	03	04	05	06	07	STO prerec. Mon							08	09	10	11	12	13	14	15	16

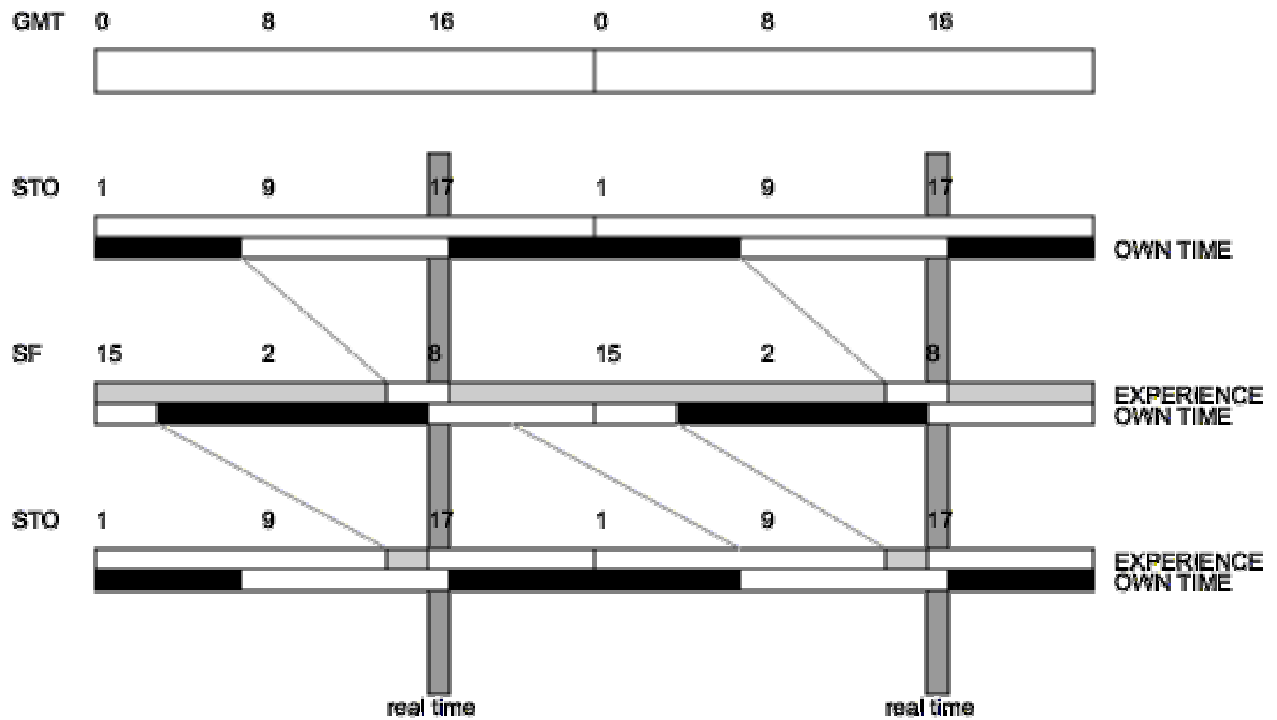
Using the common active time (uniform blue in the center) as realtime in/output, the remaining active time (blue) as prerecorded past time in/output and the passive (white) time as realtime output and prerecorded past time input.

In this timeplan STO will have an 18hr delayed past and SF will have a 6hr delayed past during the active time. During the passive time STO will have a 24hr delayed past and SF will have no delay.

This timeplan can be mapped onto the objects/furniture.

Different pieces of furniture can be used for and at different times.

Eg. the couch can be used as a passive time interface, the coffermachine can be used as a common active time interface, etc.



#### 48 HOURS IN THE WORLD

When a new day begins "in Greenwich", it is 1 AM in Stockholm and 3 PM in SF.

The bottom halves of the bars show when we are awake (white) and sleep (black), in local times. (We are both "awake" between 8 AM and 6 PM).

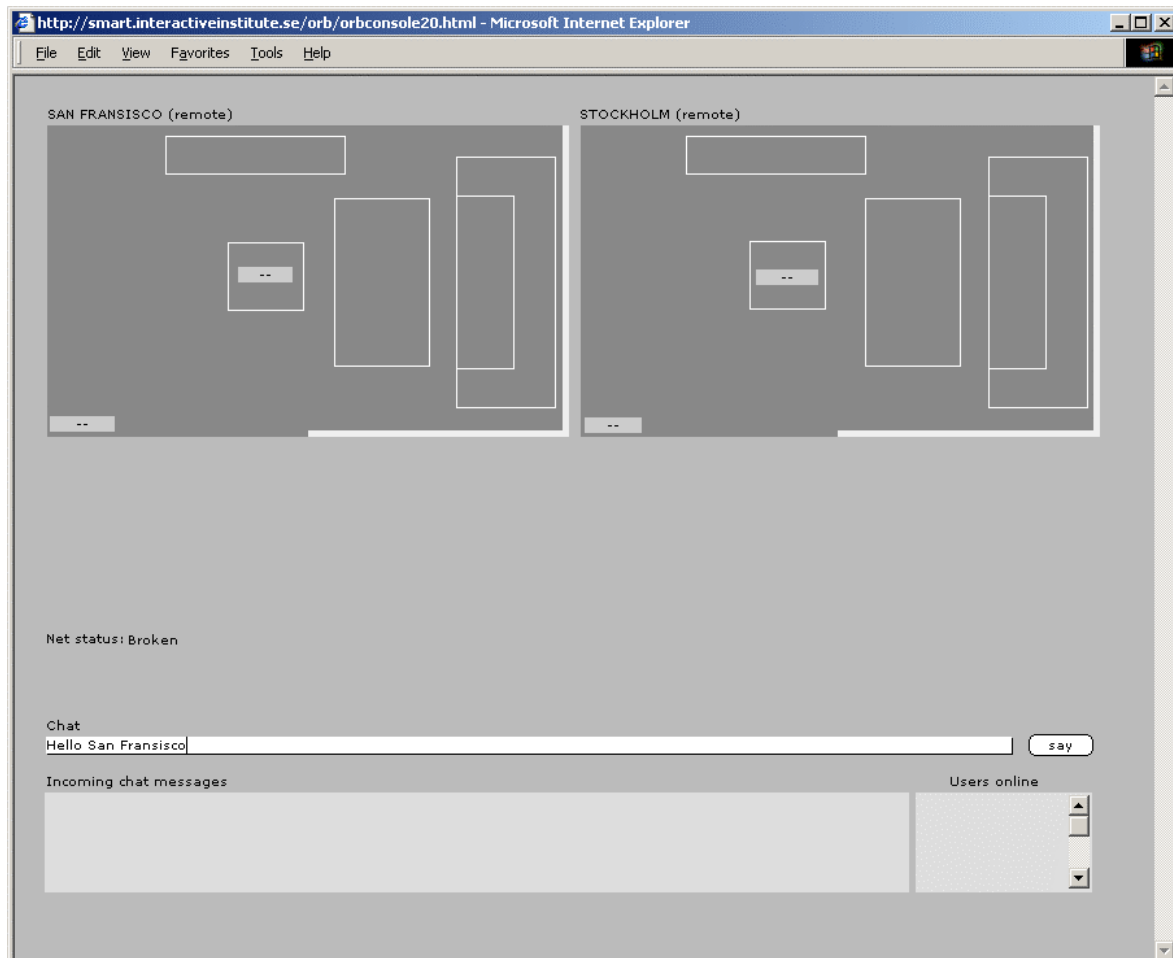
The top halves of the bars show what we are experiencing from the other side - their day (white) and night (gray).

When we in Stockholm wake up at 8 (lowest bar) we are seeing SF's afternoon. Around 3 PM their night begins, but it is contracted so it only lasts until around 5 PM, when they wake up and we see things in real time.

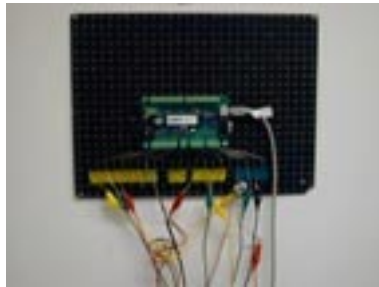
#### 4. Implementation

Being two groups in two separate places, once the construction started it soon became obvious that the coordination of sameness was a difficult task. Some participants did not understand the point of sameness, already conceptually one could discern difference on many levels of the term- personal, cultural, environmental, etc. Even down to the pragmatic level, sameness was difficult to achieve. Obtaining identical building materials was not possible unless it was bought in one place and shipped to the other. Technical misunderstandings arose, for example in understanding and communicating measurements, as when I arrived in SF the room was longer.

We set up a system for shipping and exchanging the signals between the rooms. We used commercial software for this purpose - a multiuser server (Director 8.5, Macromedia) was set up with an interface designed to show the connections and the data input/output in the two rooms. The goal was to make the interface as simple and clear as possible, and easily expandable by adding on a data frame for every sensor/actuator in the room. This served as a technical data map of the two rooms where one would get a general overview to see that the transmission is up and running.



We used EZIO hardware, an input/output box (developed by Michael Rodemer, Univ.of Michigan) for the connection between the room and the computer. Ideally we would use a wireless system but EZIO was compatible with Director and was within our limitations.



EZIO board

Our initial setup was a doorsound which marked the entrance/exit of the room. Each time a person walked through, a sound was actuated in the other room. The sound was designed to give the person a sensation of walking through time as if being sucked up through a 'wormhole'.

**techtest1**

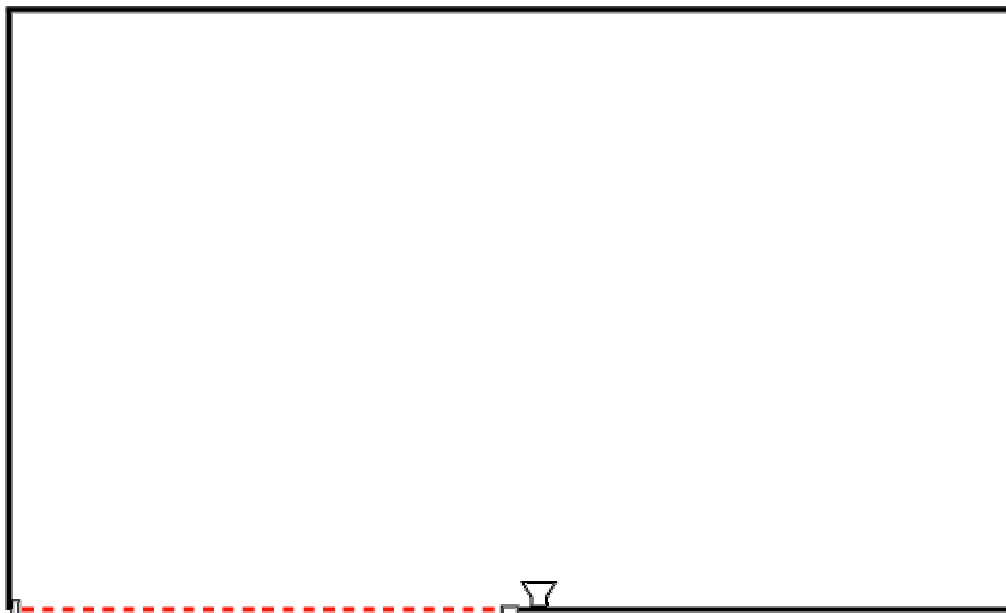
a simple device to detect when somebody enters/exits the orospace

**input**

movement detector (e.g. photodiode & photocell)

**output**

sound - small speaker

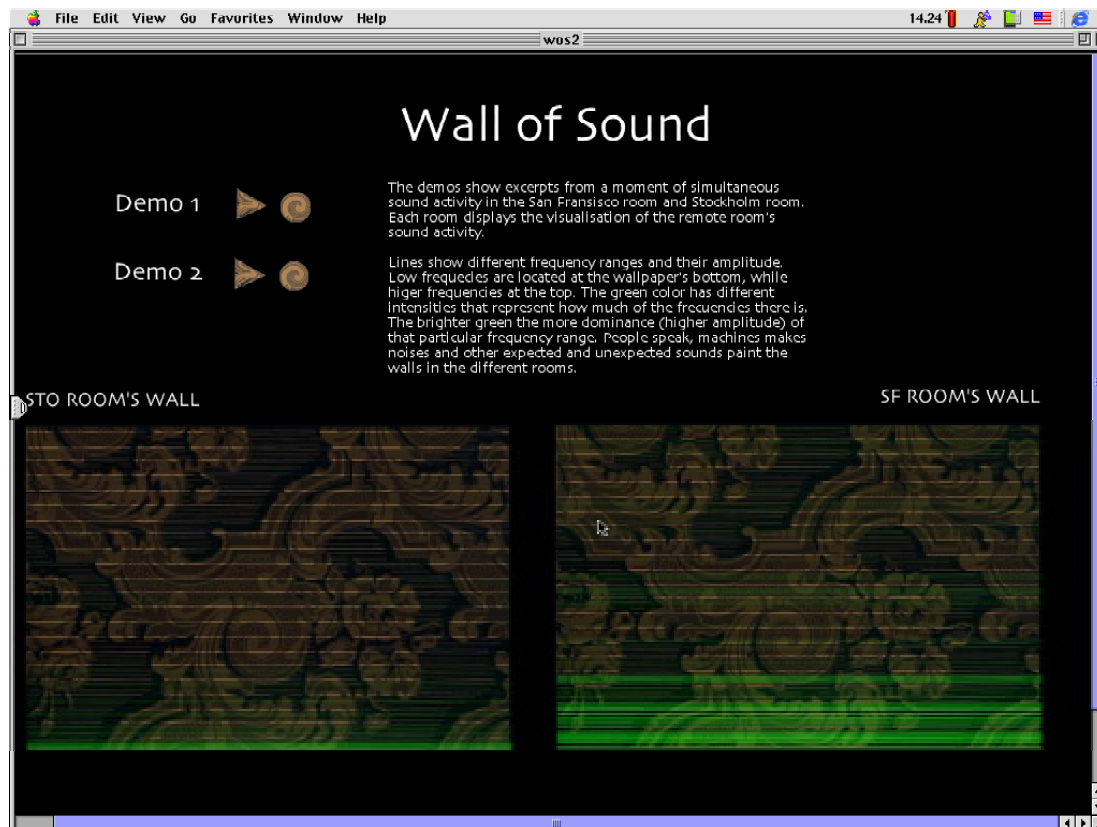


The testing of this initial setup was done at a video meeting and we tried to establish a 'here and now' of the transmission. This turned out to be impossible.

The two groups decided that, as a person walked through the entrance in one place, the other end would react by raising their hands and shouting 'now'. To start with, there was the slight delay of the audio, then the larger delay of the video. The moment of the action was therefore continuously shifting and neither group could pinpoint the present. The delay of the sound transmission itself would vary from seeming almost instantaneous to longer periods of up to 30-45 second delays. This raised the issue of the importance of real time transmission vs. playback (delayed) transmission. If the intent is not to communicate exact information but rather to create a sensation of extraneous presence then the sense of presence depends as much (if not more) on the mode of expression, how it is presented and interpreted as it does on the real time precision technology, bandwidth etc. On the other hand, we later noticed, an increased range of sensitivity in the i/o devices would give a better sense of the differences between the people involved (and their actions) and would open up the possibility of exploring a sensory communication at a deeper level. One would probably learn to distinguish individual features by discovering patterns in the modes of expression and behavior, especially if the space is used by the same group of people on an everyday basis.

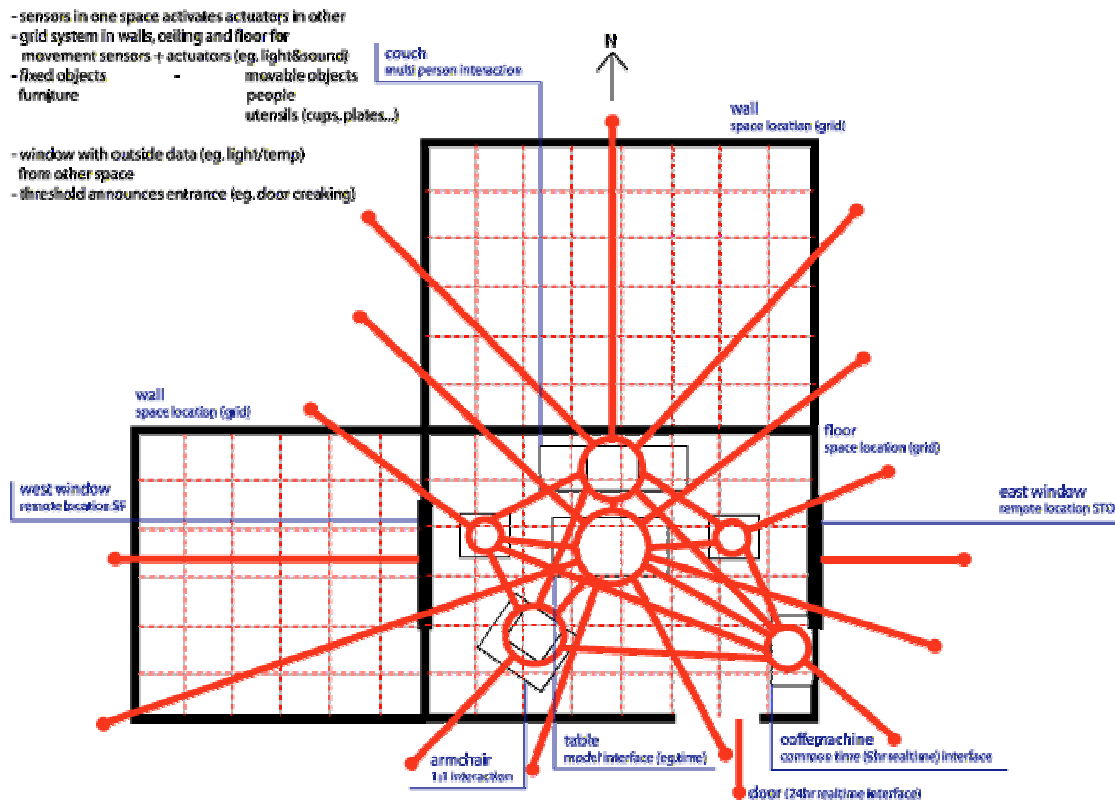
It would be interesting to avoid imposing a specific 'signature' on a specific person but rather create a common base notation that would be personalized through continuous usage. In this way, one might discover (alternative forms of) a more intuitive sensory approach to communication (which could be compared with improvisation techniques in, for example, music or dance).

This could not be properly explored with the limited resources we had at the prototype stage of the project. We did a few experiments with sound visualization using the FFT (Fast Fourier Transform) Xtra for Director which gave us a relatively wide range response in frequency and amplitude. Due to limitations in the transmission rate and network problems we had to limit the resolution/sensitivity of the visualization and found that it wouldn't be possible to distinguish different voices, at most the amplitude of different sound input and possibly human voice from other background sounds.



We also tried using heat as actuator/output. In the case of heat, one could use a simple on/off relay switch because the heat itself increases and diminishes in a 'natural' gradient curve and therefore gives a more subtle sense of presence. On the other hand, heat does not vary greatly between individuals, it is more likely to distinguish between living and dead objects. But this gave us further ideas about looking for similar materials where one could make use of the material's inherent (analog) gradation.

The placement of sensors/actuators was chosen quite randomly but in connection with hotspots, where most activity was expected, that is, in connection with the furniture and the doorway. There was discussion about the mobility/immobility of the setup of the room and of the possibility to have a position tracking system which would enable us to use the room more dynamically and not limit the interaction at certain fixed points connected to fixed objects but rather use the entire space



## 5. Visualisation

There are two levels of visualisation in the project. One is connected to the physical rooms - in the choice, configuration and placement of sensors/actuators and how they represent the action in the two rooms.

The second level is the representation and amalgamation of the two rooms into one virtual space which takes shape through the action.

On the first level it is important to consider the imaginary, evocative power of the person perceiving the telepresence. It is not necessary to create an absolute 1:1 correspondence between the input and output. For example, as mentioned earlier, the more intuitive approach to (sensory) communication leaves a space of uncertainty where one cannot be absolutely sure about the content that is being transmitted, how, from where and when it is being transmitted. The aesthetic choices greatly affect and direct this imaginary space, reinforce or weaken the signals, enrich or impoverish the experience. The technical deficiencies can become creative assets. For example, in our project, the different levels of time perceived due to the distance between the rooms and the delays it creates is also what characterizes the teleaction between these spaces. It gives a heightened sense of displacement through time and space and this is what makes the project conceptually challenging. The point is not to replace the real with the virtual (or create a clear border between

the two) but rather to extend the real and play with the possibilities of that extension. There is not necessarily, as with more utilitarian remote devices, a need for instant accessibility in the transmission but maybe even the opposite, a sense of no now or here, a sense of floating between different nows and heres.

The possibility of remote being and becoming, not to deliberately achieve or communicate anything specific but just by leaving traces, is also an important aspect of communication, indirect communication, which we often overlook when using this technology which inherently seems to imply rationality and functionality.

On the second level there is the aspect of the actual plasticity of the data streams that are being transmitted between the real rooms. This data is in itself the basic element (of the technology used) registering the action that occurs in the two rooms. It gives us a digital mass that can be modeled. For example, it is possible to create a new architecture in a third (virtual) space based on the i/o that the activity between the real rooms generates. Instead of constructing a space and adapting the human to it, the space itself grows out of and adapts to the live action. It can be compared to the 'shortcuts' people take in the landscape and the small paths that emerge out of this.

This space undergoes continuous change through the ongoing action but one would presume that certain patterns emerge through time, as with the shortcut paths.

These visualizations are also aesthetic, interpretive choices made with respect to the content and we have only started to sketch on possible structures. Since our main interest in this project has been the elasticity of time and space that comes out of the physical distance between the two rooms, we have looked for ways to visualize this in the virtual mapping. The virtual mapping could be used as a design model (template) for a real space, by creating three dimensional models that are generated through the action and give it a shape.

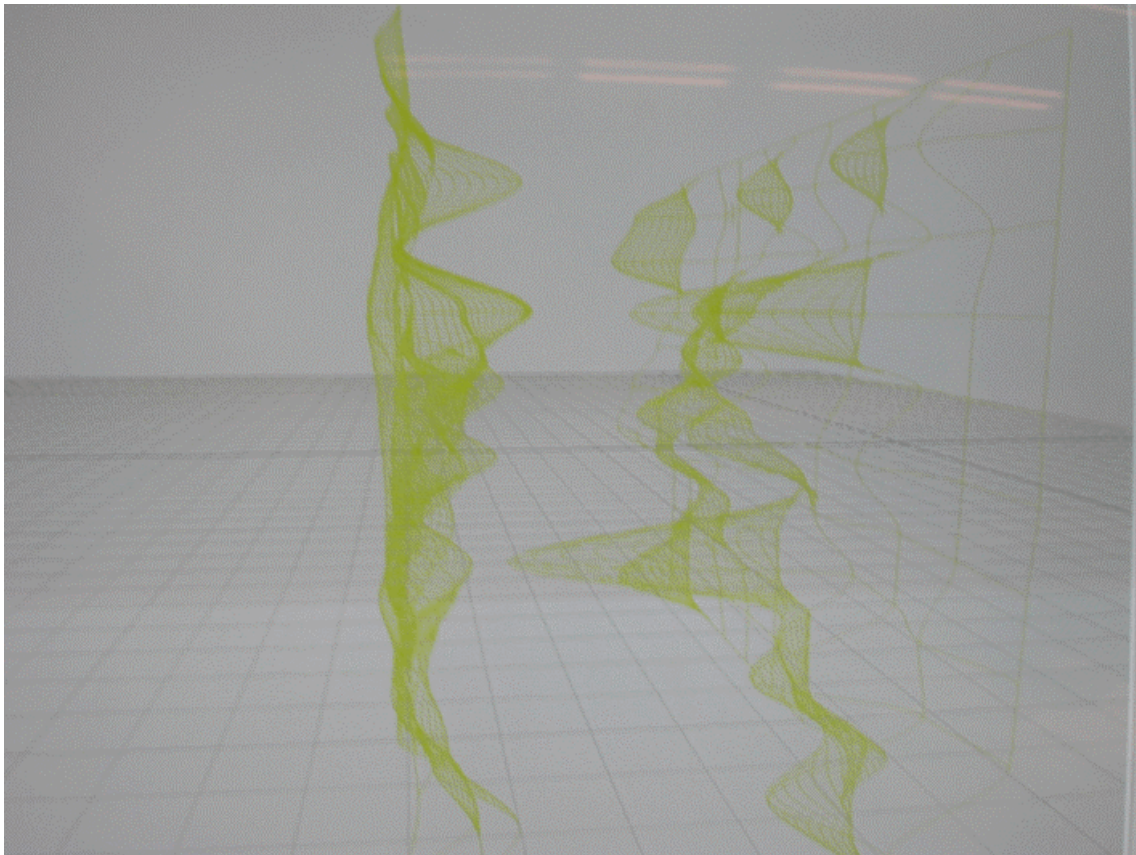
## **7. Conclusion**

This project raised many interesting questions about the usage of information technology as an artistically conceptual and technical device for remote action.

There is something inherent in the technology itself, it's measurability and thereby it's capacity to define and quantify communication, which enables a uniform, neutral representation of abstract notions of activity or energy.

In itself the technology can be quite a restrictive way of approaching the more intuitive, emotional realm of communication, because, constructed as digital code, it is by

necessity simplified. Therefore it will never be able to replace the complexity of the (inter)human ability to think, imagine, associate and connect, which often escapes logic and rational explanation. Therefore, I think it is very important to consider that as much as the technology can enhance the human capacity, the human, interpretive capacity can be used to enhance the technology. Used together, they create interesting and unexpected ways to sense and communicate presence where it can not be physically perceived. Also, if well implemented, they enable us to develop new aspects of perception and make us use our senses in different ways and combinations, thereby question and redefine established social conventions and norms of behaviour.



Both rooms facing each other, activity represented by change in topography- each surface growth representing data feedback from different spots/areas in the rooms (3D Studio Max animation, Pablo Miranda)

In ORB, what I found most challenging, was the idea of creating a fluid space-time by using the data stream as the smallest common denominator that would act as the intermediary between different spaces in time. This can be used as a building block for visualizing the shifting frames of reference. The difficult part is finding the appropriate

medium in which to generate this movement. Light, sound and heat were obvious choices and much remains to be done with these. It would be interesting to try more tactile materials but it is hard to find one's that have enough elasticity and conductivity to withstand the continuous stress of transformation. So, at this point it seems more realistic to try to render a virtual image and resort to physical 'snapshots' or three dimensional frozen moments.

The project just barely initiated this process and we are yet at a stage where the technology poses more limitations than possibilities and where our human imagination still reaches far beyond these limits. Therefore, finding ways of triggering the imaginable through the realizable is a good combination and one that the artistic process manages well.

