Space Time Pixels

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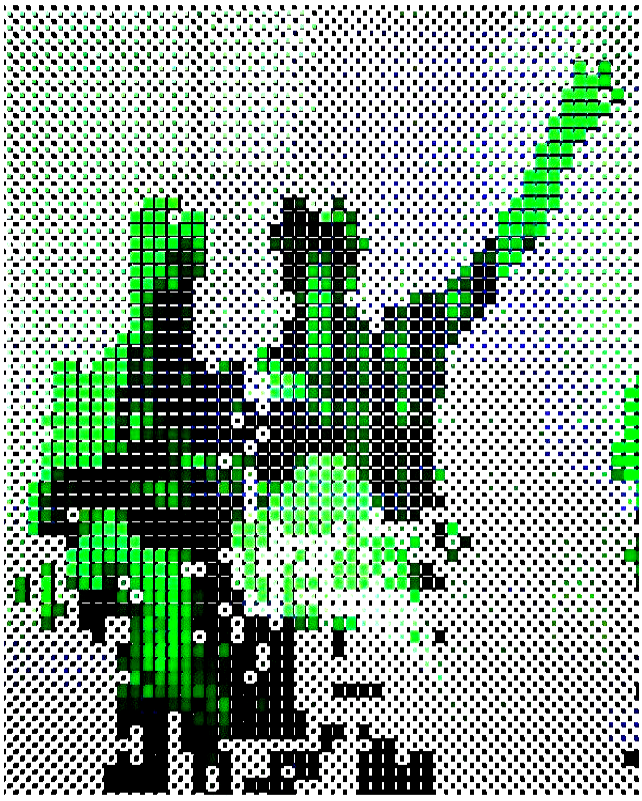

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Abstract **(-1)**

This paper reports the design of a networked system, the aim of which is to provide an intermediate virtual space that will establish a connection and support interaction between multiple participants in two distant physical spaces.

The intention of the project is to explore the potential of the digital space to generate original social relationships between people that their current (spatial or social) position can difficultly allow the establishment of innovative connections. Furthermore, to explore if digital space can sustain, in time, low-level connections like these, by balancing between the two contradicting needs of communication and anonymity.

The generated intermediate digital space is a dynamic reactive environment where time and space information of two physical places is superimposed to create a complex common ground where interaction can take place. It is a system that provides awareness of activity in a distant space through an abstract mutable virtual environment, which can be perceived in several different ways – varying from a simple dynamic background image to a common public space in the junction of two private spaces or to a fully opened window to the other space – according to the participants will.

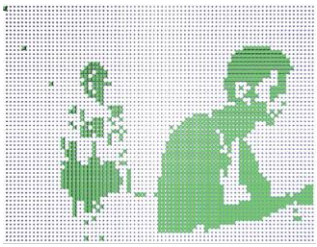
The thesis is that the creation of an intermediary environment that operates as an *activity abstraction filter* between several users, and selectively communicates information, could give significance to the ambient data that people unconsciously transmit to others when co-existing. It can therefore generate a new layer of connections and original interactivity patterns; in contrary to a straight-forward direct real video and sound system, that although it is functionally more feasible, it preserves the existing social constraints that limit interaction into predefined patterns.

Keywords:
Awareness, Ambient media, body interfaces, social interaction

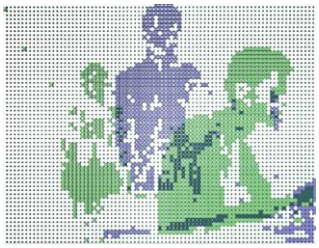
Words: 10.180

Contents (00)

…interactive architecture has turned out to be a very popular term, especially recently that digital technologies are becoming more and more integrated into our everyday life and constitute an acceptable and common part of our environment.



…interactive architecture can be defined as the design of time-dependent environments that can be transformed according to user's input in order to somehow adapt themselves to several different possible functional scenarios.



…interactive architecture is supposed to more effectively support the users' needs and desires by assuring greater levels of connectivity between them and the space itself or them and other individuals that comprise their immediate action environment.

…interactive architecture at last is a term used to describe a new kind of electronically augmented spaces, while interactivity is an old notion in the architecture discipline; whose main role is to provide the appropriate spatial configuration that will support social communication and human relationships.

Pics.01-04

Architectural space and social communication are two strongly interconnected notions, whose relationship is being constantly but subtly revised and redefined; mostly due to certain advances that take place in the communication science realm and gradually change the patterns of interaction and information exchange. During the 20th century though, a number of key technological advances have profoundly altered the way that space and social interaction are interrelated. For example the advance of the telephone has changed the office's organizational structure and the automobile has dramatically altered the urban network of our

cities. This dramatic transformation process is once more initialized in the digital age, where communication technologies are spreading rapidly, aiming to create a unified global space that will support universal growth.

The effects of the digital technology are evident as much in the micro scale of everyday life as in the macro scale of a largely expected globalized society. The built environment, as the container of all these transformations, is also being transformed to follow and support the contemporary way of life. This is the point where the discipline of architecture is about to make the next great shift – this time towards the creation of environments that draw their characteristics from the information science realm. The new architectural space is minimizing its previous hard, solid, well-defined nature to acquire qualities like fragmentation, flexibility, temporality and transformability. It is a more fluid and inter-connective architecture that will allow for unimpeded information flow and consequently will provide enhanced communicational capabilities.

This shift of weight from materiality to connectivity, while it implies a revaluation of the existing role of the built environment in relation to social interaction, it cannot be predictable as far as the direction that it will follow is concerned. While communication is gaining more and more importance, it is vague to say whether the new digital environment will prove to be innovative in generating new interactivity patterns and actions or – in reliance to the reasons that released the information technology rise - it will come to strengthen those forces that aim to the conservation of the existing social structure. In the same way that the physical space functions, as we shall see later, the digital space should also be designed to integrate characteristics that will simultaneously ensure its generative and preservative capabilities. If preservation imposes a degree of social and spatial disconnection, then what are the characteristics that a digital communication environment could incorporate to provide new connections, which cut through the existing barriers, and generate the formation of original social networks?

In an attempt to make a step towards that direction, the project that this paper reports, sets out to create a communication

environment, mostly directed to provoke new playful and imaginative ways of interaction, rather than coming to serve and reinforce the conventional, production-organized, collaborative communication patterns. In the rest of the paper, the characteristics of communication spaces, social interaction and some relevant projects are going to be firstly described, to be followed by the “Space Time Pixels” project analysis, concerning its features, technical structure, installation and user’s feedback.

Pre-Discussion (02)

Generative/Preservative Physical Space (02.1)

The act of designing space always incorporated scenarios about how the produced environment could optimally function; not only passively as the background of pre-existing social activities but also actively, as a factor that could inspire new ideas, behaviours and relationships. By default and definition, the architectural space is designed to incorporate mechanisms that have as a purpose to reinforce and sustain the existing social constraints, in order to effectively function as the vessel for society’s established processes. For example an office building is separated in different sectors according to the hierarchy of the employees (management and personnel), or the city is divided in different areas where people with different financial status reside.

At the same time, as Hillier and Hanson have argued (1984), the built environment, through the way it forms patterns of space, creates multiple states of co-presence that produce innovative social interactions and thus, can shape - up to a certain point - society. In other words, the complexity of the built space produces the necessary conditions that will allow the formation of unpredictable and unexpected connections, which operate on top of the existing social network; deconstructing and reshaping it. For example public spaces like plazas, museums, shops, the road network, or even a corridor or the lobby of a building formulate a system of horizontal connections to an otherwise vertically divided organism, and arbitrarily bring in touch people from

different backgrounds that will have the potential to interact and establish new relationships.

It can be thus argued that the physical built space, in the scale of the building, the neighbourhood or the city, acts as a balancing factor between the forces of conservation and innovation; by maintaining a two-way, complex relationship with society. It draws its form from society's organizational structure, but it simultaneously provides the tools that support society's transformational procedure. As William Mitchell argues [*"E-topia: urban life"*, 2001] this balance is being today destabilized by the advance of the digital space, which comes to deconstruct the existing associations and redefine them in a so far unpredictable way.

Generative/Preservative Digital Space (02.2)

Digital technology provides a number of new connection alternatives that come to add and enrich our communicational capabilities. These new capabilities as Schnädelbach, Penn, Benford and Koleva argue are, until now, mostly functioning as reinforcements to the already established social structures. "*Although new technologies have had an effect of compression of space […] there appears to be a concomitant elimination of chance interactions and their unpredictable outcomes*", a fact that could lead to the assumption that, today, digital technology acts as a preservative force, in contrast to the built environment that still offers the potential for innovation [*Mixed Reality Architecture: Concept, Construction, Use,* page 2, January 2003]. This seems to be true up to a point, considering the effect that technologies as the electronic mail or the collaborative working environments have; when in principal they are alienating the users from their immediate spatial surrounding, and are forcing them to function inside pre-designed and well defined structures. These environments support a strictly and intensely pre-programmed method of action with certain causes and goals, and are minimizing any undesirable, irregular incidences, which may, though, lead to social originality and innovation.

On the other hand there are several examples that point towards the opposite direction. Technologies like chat rooms, game rooms or the 3-dimensional multi-user environments (like Active Worlds,

Blaxxun etc) that are recently developed across the internet, seem to attempt to restore the balance between preservation and generation of interaction patterns. These environments, even though are still having restrictions and rules that determine whether somebody is applicable for membership or not, they are permitting larger participation that cuts through the established social barriers and brings together different groups and communities. They are technologies that have the capacity to generate new relations and trigger *out-of-the-usual* interactions between users; and that seems to become possible because of their functionality organization, which is based on two key points.

Firstly they provide to their users a kind of common public, virtual environment that seems to be able to support the same procedures of social interactions that we can recognize in the physical space. This environment – regardless of being text-based or representational, two or three-dimensional – gives the ability to the user to wonder around in search of other users (or more accurately, representations of other users) to contact and socialize. Furthermore it provides the flexibility to determine sub-environments with customizable levels in the scale of private/public (like a chat room that contains numerous smaller rooms with more specialized topics of discussion), a fact that makes possible a variety of communication connections and reinforces interaction.

Secondly they are not highly specialized environments. While they have a main purpose or function, they are permitting - because of their interface structure - several more, satellite activities to take part simultaneously. That is, they allow for an extra, playful interaction between their users, which finally generates a new topology of relationships. In addition to that, this playful connection is responsible for minimizing the existent status barriers between different users, which usually prevent new, creative relations to occur. In almost the same way that happens in the physical space, users of these digital environments, take advantage of the medium (or the space) to present and introduce themselves to others, without being constraint by their social position, and subsequently to formulate a new kind of a more imaginative relationship.

These characteristics – still visible from the commercial birth of the networked environments – are going to be intensified and become progressively more influential as the digital technology's generative capabilities advance to higher levels of complexity. Progress made in areas like networking, real-time rendering, 3-dimensional modeling, alternative interfaces, augmented reality and many more, is already redefining the way that people use and utilize digital technology in a social context.

The most recent advances in information technology have provided a new set of tools that can significantly assist the formation of digital environments capable of more efficiently supporting every aspect of social interaction. This leads to the expansion of the physical public space (in the sense of a space that contains social activity) to new territories that extend towards purely virtual spaces and include all the different variations of augmented or mixed realities. Moreover, research made in the field of intuitive interfaces is gradually minimizing the hard and uncomfortable barrier that comes in between the user and the machine. This is transforming the machine into a subtle and invisible background organism, which receives, decodes, processes and transmits back intuitively understandable signs.

These developments lead to an entire new reality. The integration of digital media with physical spaces acknowledges and uses the advantages of both physical and computational domains. The full sensorial immersion of the physical plus the malleability and responsiveness of the digital realm combined together, construct a unified space with considerably enhanced communicational capabilities. This multilayered and complex space has the potential to be socially generative in the sense of producing new kinds and patterns of relationships and interactions. Designers now have the choice to use the new media to boost interaction by easily attracting participation without needing to utilize complicated and uncomfortable electronic devises. Furthermore they have the tools to design comparatively convincing and effectively reactive (or maybe intelligent?!) spaces that can support many of the characteristics that the physical built space incorporates to sustain social interaction. These digitally augmented environments can successfully 'play' with the classic

binary notions of public/private, abstract/realistic, interior/exterior and actions like open/close or hide/expose, that traditionally architects use to formulate interaction patterns in the physical space.

On the other hand, there is always present the issue of excessive connectivity and information overdose. The new media are so effective in producing multiple network connections and so powerful in data processing, that they often add more problems to the communication procedure than they solve. The audio and visual information that they communicate can be so strong and descriptive that often catalyzes privacy and becomes inconvenient or even intrusive. This is not a weakness of the technology, but mostly has to do with the interface strategies and the features that are being employed to serve the several needs. The design of communication environments that are focusing on interactivity patterns generation, has not as a primary aim to assure the rational and massive transportation of information, but it rather perceives information itself as a subtle and intuitive environmental feature, which does not intrude but attracts participation. They are mostly environments that have as a main purpose to provide background awareness of other people's actions in order to direct them towards interaction.

Resume I (02.4)

Building an application that would provide awareness of activity and support out-of-the-norm interactions, presupposes the existence of a number of participants that their presence is not determined by the application itself - rather the application exists as an ambient background to a place with an already defined activity. The system should incorporate the appropriate features that would provoke participation and interaction with it and with any other simultaneous users (…that would not have necessarily, otherwise and autonomously engaged themselves to a similar process). According to these thoughts, a program that would generate an intermediary communication environment between remote users was decided to be designed and installed. That would make it possible to exploit the spatial dispersion of the participants in order to more effectively and clearly test, in an actual and well-defined set-up, how the available today media technologies can create environments that could generate

innovative, creative connections between diverse, remote audiences. This system would raise, not only the connectivity level of these spaces, but also the variety of the different connection qualities that are provided to the users of the spaces (like physical, telephone and mail connections).

The characteristics of such a program, as we have seen until now, can be summarized to the following:
1- Common spatial frame of reference that provides the basis for interaction
2- Configurable environment that controls the amount of information transmitted and the levels of privacy.
3- Intuitive interface that does not require complicated actions in order to participate and communicate.
4- Multilayered, complex and aesthetically pleasant environment that can attract participation and provoke playful and inventive interaction.
5- Degree of representational abstraction that provides anonymity and minimizes the existing social constraints that prevent non-standard interactions.
6- Ambient, subtle information presentation that is not intrusive but offers background awareness of other people’s actions and thus triggers interaction.

These features, combined altogether, are actually creating a filter between the two spaces that manipulates the transmitted information in order to define values of awareness, anonymity, abstraction, attraction, co-existence and interactivity. A filter like this, I believe, is the necessary element that can generate social interaction as it offers firstly the medium through which people can controllable present themselves to others and secondly the essential barrier that will prevent raw, unintended exposure to others.

In the field of electronically supported social interaction there are numerous installations that have been already designed or completed, which offer a valuable basis for a project like the “Space Time Pixels”. These projects are actually aiming at creating communicational environments, either with the emphasis set on the interaction between the different users through the system, or to the interaction between the user and the system itself. The latter kind involves a considerably different kind of environments but it can provide information that is related to methods of interface designing, user representation and electronic reactivity. Furthermore, a reactive system that is designed to ‘communicate’ with its users indirectly provokes interaction between the users themselves - who are called to examine and act in a common set up - and thus promotes social interaction. In this chapter a small choice of similar projects are going to be briefly described in order to show the grounds that this project was built on and to provide a sample for productive comparison.

Flux-space 2.0[1] (03.1)

Pic.05

Pic.06

Pic.07

The “*Asymptote*” architectural office designed and built for the Venice Biennale 2000 the *Flux-space 2.0* pavilion that experimented with co-presence of visitors from different spatial origin. The project sought to engage an audience including, but not limited to, visitors of the biennale by providing a simultaneous spatial experience for a virtual audience through the internet. The pavilion consisted of an air-filled plastic

[1] The description and the images of the “Flux-space 2.0” project are taken from the site “http://www.asymptote.net/” and the article “ARCHITECTURE=SPACE=INTERFACE”, 2000, “Designing for a Digital World”, p134.

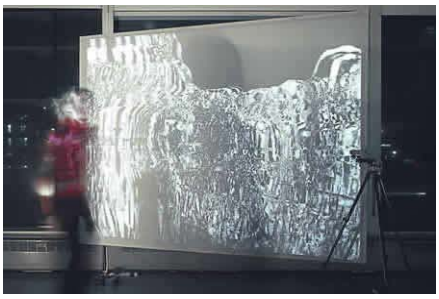
envelope, supported by a computer-modeled steel framework that dictated the morphology of the interior space that was formed. The pneumatic envelop was continuously reconfiguring its formal presence, creating a fluid and ambiguous impression to the several visitors. Underneath the air-filled shell, two large rotating discs, fabricated with one-way mirrors, were located at opposite ends of the interior space. The semi-reflective, semi-transparent mirrors were able to fully pivot in place, and they supported at their center two 180-degree cameras. These cameras recorded the ever-changing interior space and relayed that information to the internet. What was seen on the web was an evolving architectural project in constant flux. These cameras were able to record the interior condition of *Flux 2.0* at 30-second intervals for the duration of the five month installation in Venice. *Flux-space 2.0* therefore generated 1.6 million different images of the interior condition and in this way the project was able to be virtually occupied.

Drawing Spaces[2] (03.2)

Drawing Spaces investigates strategies for creating a bodily sense of presence and awareness in networked space through the intersection of shared physical and virtual spaces. The installation is a playful situation for interaction and communication where the creation of time based 'difference images' as traces or virtual shadows allows for a re-conceptualization of presence. "Drawing Spaces" starts with an empty virtual space – a black surface on the projection screen. As soon as a visitor enters the installation's physical space,

Pic.08

Pic.09



Pic.10

[2] The description and the images of the "Drawing Spaces" project are taken from the site "http://www.brighton.ac.uk/design/staff/m.ramsgard-thomsen/www/embodiedinterfaces.html"

his/her movement is captured by the system, transformed, and drawn as traces of light on a projection screen. Still objects, or immobile visitors, dissolve leaving only movement present. Movement is the source and the only reason of the existence of the virtual space and of the perception of real space in this installation. Without movement no space exists. Fast movement creates large surfaces, while subtle movements result in fine lines. Moving closer or farther away from the camera changes the size of the body-brush that paints the screen. Body shape, size, distance, speed and rhythm of movement are parameters that translate participant's actions into imaginary spaces on the projection screen. The dynamic images become a medium or space where users experience a heightened awareness of their physical presence. The aim of *Drawing Spaces* is the production of a distributed space of interaction where remote users are interfaced through the shared creation of 'difference images'. The shared surface of the 'difference images' becomes a spatial dimension where remote users can interact and communicate with each other.

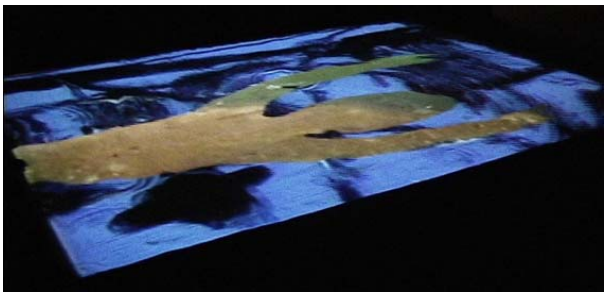
David Rokeby[3] (03.3)

David Rokeby is an interactive installation artist whose work is related with creating body interfaces that support interaction between users and his systems. He is also going a step further, using the same body capturing equipment to create surveillance systems that question the behaviour of individuals when they are being watched or when they are watching others. He is actually creating windows to other spaces (physical or virtual) that are responsible for communicating information and connecting people.

For example in his "*Silicon Remembers Carbon*" installation, he is using a number of sensors and input devises that trace users' movement and a 4x4 meters video image projected down onto a bed of sand on the floor of the installation space. When one enters the dark space, a single video clip, usually showing water, is playing out across the sand. Movement around the space is sensed, a fact that causes a second image (usually consisting of human shadows or reflections) to be dissolved in along the side of the

and the paper "drawing spaces: experiments in presence and awareness of body and space in mixed realities", 2000, by Jasminko Novak and Mette Ramsgard Thomsen.

[3] The description and the images of David Rokeby's projects are taken from his homepage: "http://homepage.mac.com/davidrokeby/home.html"



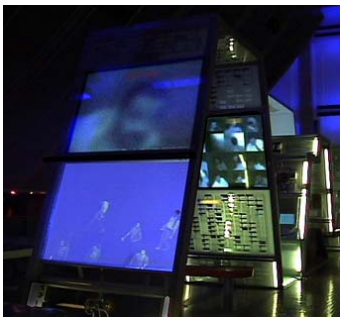
Pic.11

Pic.12

sand bed where the movement took place. One tends to interpret these reflections and shadows as being generated by people actually in the room, rather than being part of the projection. Each visitor in that way subtly changes the projected video and leaves traces which affect the experience for later visitors. The installation presents a fragile illusion that requires the visitors' participation for its continuation, through their body movements. They are offered a range of possibilities from sustaining the illusion by creating and maintaining distance, to dispelling it by stepping into the illusionary space itself. For the artist, the visitors' movement through this range of possibilities and their indirect connection represents a more important interaction than the direct interaction with the system itself.

The *“Watched and measured”* project, is a system that observes, tracks and catalogues people walking through the Welcome Wing at the Science Museum in London, UK. It aims to explore some of the ethical questions surrounding surveillance systems: do they invade our privacy, act as guardian angels, or, perhaps make us sanctioned voyeurs? In “Watched and Measured”, surveillance cameras observe the threshold between the Wing and the rest of the Museum. The images from these cameras are digitally processed in real-time to extract motion, things that are still but not part of the building, or things that might be human heads. These resulting altered images are presented by three large video projections. Sometimes everything that is still disappears, leaving only moving people visible in a blue-tinted void. At others people who are moving dissolve and blur into invisibility leaving the building and those visitors standing or waiting to be seen. Occasionally, the system selects a human head to investigate. The digital zoom tracks and frames the head, to

further analyze it. These close-ups are collected in a grid displaying a slow-motion replay of the 20 most recently investigated heads. The work presents a series of people looking and being looked at, watching and being measured. The audience's feelings may alternate between sympathy and suspicion as they realize that they are not only witnesses to, but also subjects of, the system's activities.



Pic.13

Pic.14

Pic.15

Resume II (03.4)

The above described projects present several suggestions on ways to utilize virtual environments to support communication between participants or participants and an electronic system. As it can be seen, the main procedure that they use to achieve this is to establish a simple body-based intuitive interaction with the system. The user’s body is represented inside the virtual environment and this representation becomes the medium through which information is transmitted. The “Drawing Spaces” project uses the user’s body as a brush that paints a digital canvas and the “Silicon Remembers Carbon” installation tracks the body to project shadows and reflections according to its movements. These projected traces subsequently are being accepted by other users and are interpreted as signs of presence and communication patterns. This procedure establishes a connection between the participants – an interaction which is playful, atypical and generative as it is mediated by abstract, non-descriptive filters that add weight and significance to the transmitted data. The “Watched and measured” project on the other hand, uses a less abstract format to communicate raw information that tests the users’ limits to surveillance. Here the communication is stronger and intrusive and can lead – according to Rokeby – to feelings like suspicion or anger.

The first example however, the Flux-Space 2.0 project, is quite different from the rest. The ‘virtual’ space that it is using to transmit information is not a digital environment but an actual physical construction, which is however, fluid and transformable – characteristics that can mostly be found in the digital realm. It uses analogue means like the rotating mirrors to capture and transmit the images of the users and digital network to send them through the internet to the virtual users. Even though it can only support one way information flow, it offers a more spatial, immersive and sensorial experience to the users. It is far away from being an effective interaction system but it suggests that the physical space, enhanced with electronic devises, can offer a more complete and natural base of interaction.

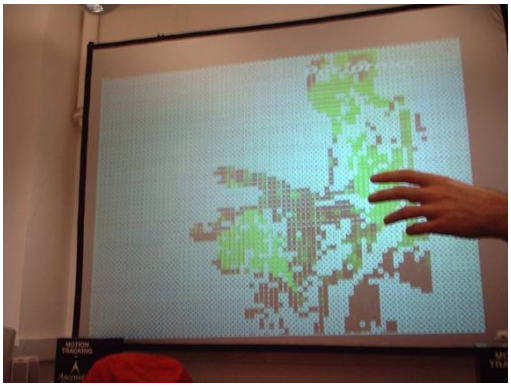
“Space Time Pixels” project (04)

Using the above ideas and projects as a basis, the “Space Time Pixels” project aims at creating a social interaction support system between users of two distant physical spaces, based on mutual activity awareness. As has been mentioned, it adopts the thesis that an intermediary abstraction filter can be supportive and generative as it can control the quality (significance and nature) and quantity (intrusiveness or ambience) of the information flow and interaction. The final version of the program is a balance product between the initial intentions and the constraints that the programming language and technical equipment presented.

Functionality Description (04.1)

The required equipment that should be installed in each one of the two interconnected spaces, for the application to function, is a PC unit, a web-camera, a projector and a relatively large projection screen. The cameras capture sequential frames of each space, which are exchanged, processed and presented. The output of this procedure is abstract but is also directly related to the real image that the system receives from the camera. What is actually projected in each space is a version of the real image, reduced to reveal only activity; which, however, holds certain of

its spatial characteristics (shape and scale of the users and the perceived space, size-distance distortion, etc). The use of projectors and screens is preferred instead of the usual desktop monitor for two reasons. Firstly, because of its substantial size, the projection can actually be interpreted as an architectural element of the space that is installed – the electronic equivalent of a window to another room. Secondly the scale of the users' representations is more related to their actual size, a fact that raises the level of, not only immersion, but also awareness of activity and presence of the distant participants in each space.



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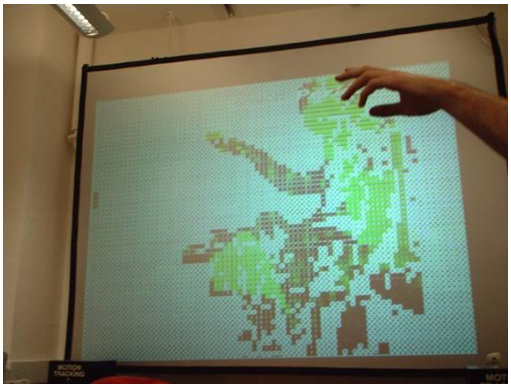
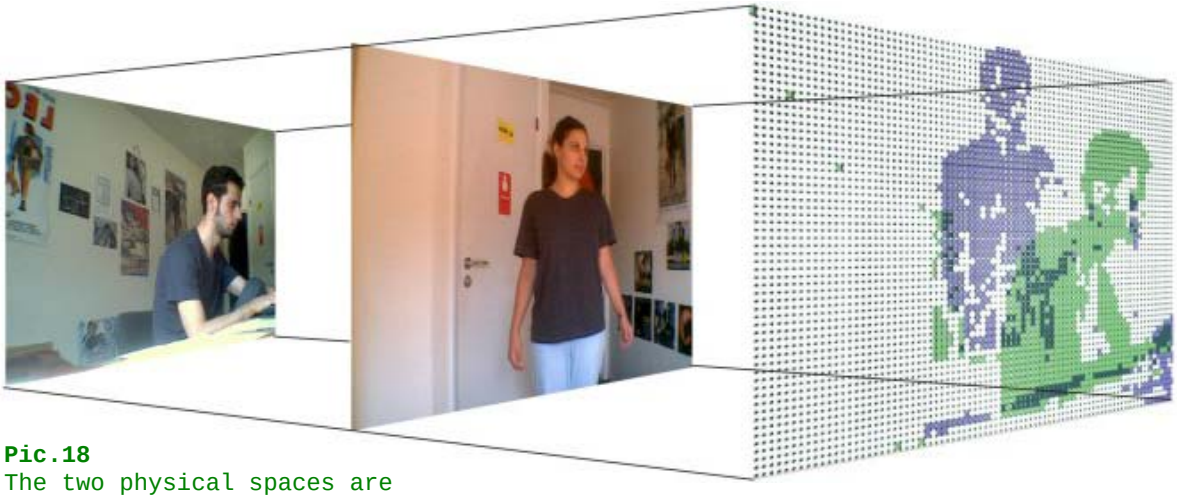


Pics.17

What the users are actually seeing in the projection is a shared environment where their representations are mapped together with the representations of the distant users. It is a layered environment where different space and time fragments (*pixels*) are presented simultaneously to create a complex interaction space that communicates a certain type of information, related to activity from the two connected spaces. This intermediate environment consists of two interleaved coloured grids of cubes – each grid representing one of the two spaces (green for the present and blue for the distant space). Every cube of each grid has two parametric values, its size and color, which are directly and dynamically connected to a neighborhood of pixels from the processed image of the camera input. The system detects movement in every point of the surface, where the perceived space is mapped, and the corresponding to this point cube is responding by changing its parameters. In that way the shared virtual environment that is projected in both the two spaces acts simultaneously as a mirror and a window that shows the action in the present and distant space respectively.

This multilayered environment as has been already mentioned before holds information about activity related not only to space but to time as well. The system renders the present motion of the users' body and, at the same time, presents selectively captured past aspects of their activity. This is done in multiple ways that will be described later and has as a result a final output of a complex rich, dynamic and 'pixelated' environment; an environment where pixels of the two distant spaces and of several time instants are simultaneously presented to enhance awareness and familiarity between the remote users.

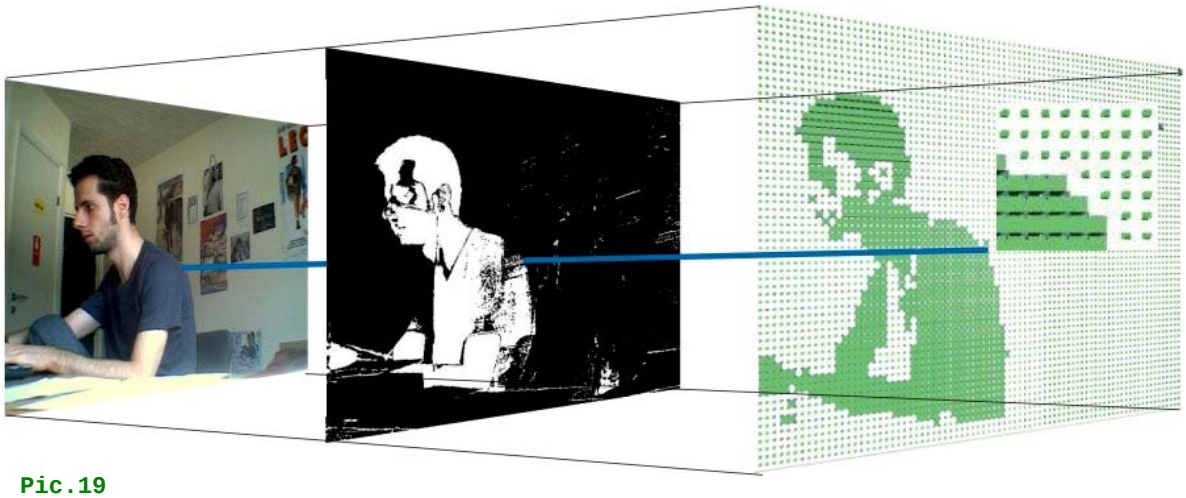
Moreover the system has a degree of flexibility in the sense of being configurable as far as the abstraction of the information that transmits is concerned. The users have the capability to send to the distant space different qualities of information through the simple action of approaching the camera. This gesture triggers a series of changes in the virtual environment that result on the broadcasting of more descriptive data to the remote space. This is the electronic equivalent of opening or closing the curtain of the physical window in order to perceive and communicate more directly. It ensures the ability to customize the 'abstraction filter' according to someone's special needs in different moments of the day.



Pic.18
The two physical spaces are superimposed inside the shared digital environment

The entire program is written in C++, using two additional libraries, the *Intel OpenCV* library that captures and manipulates

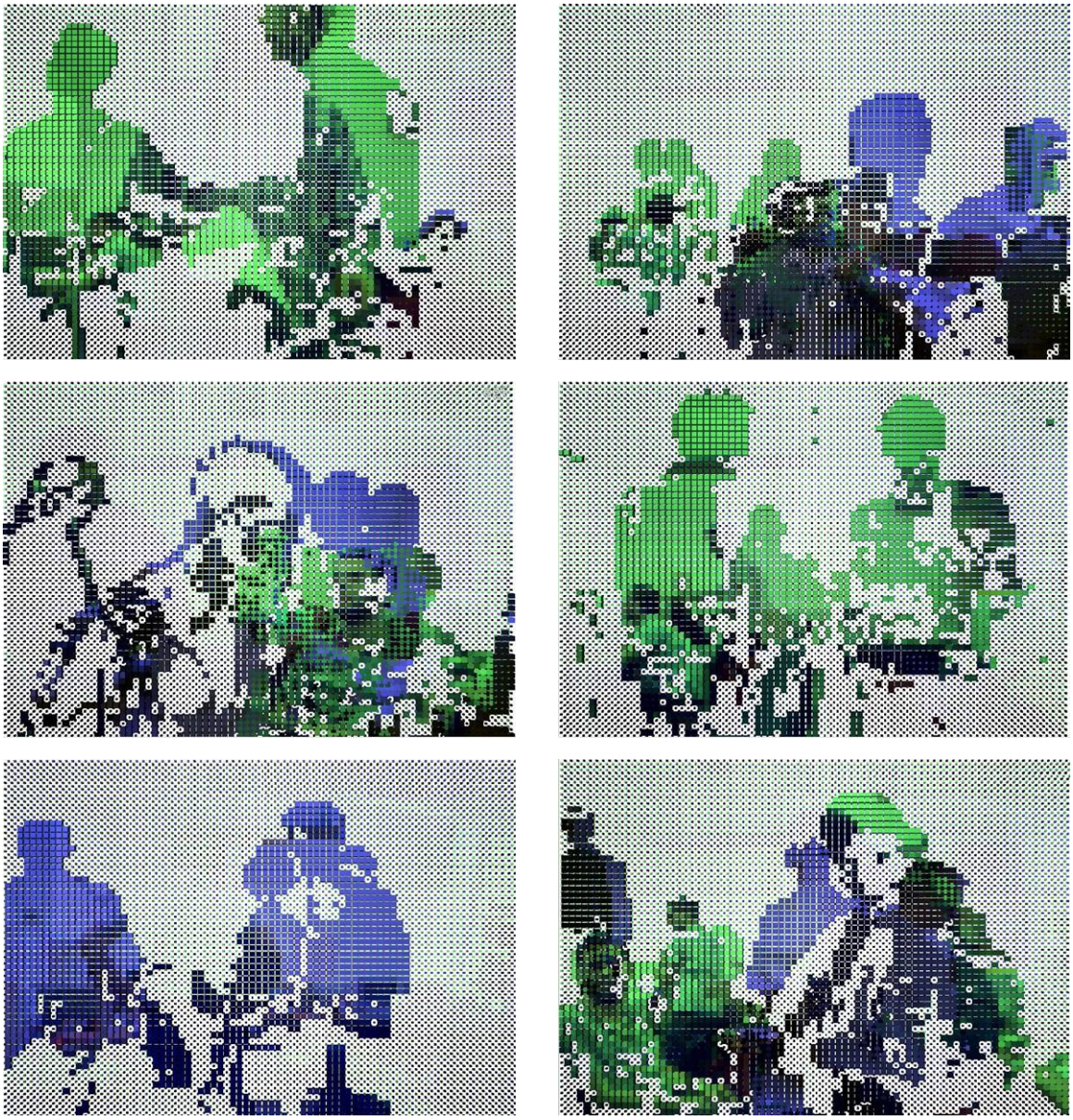
images and the *Performer Opengl* library that generates the 3-dimensional virtual environment. Technically, the above described process is realized using the following techniques. When the program is initialized, the virtual environment is constructed, which is consisting of the two 80x60 arrays of cubes. During initialization, an image of the physical space is captured and is reduced from the 640x480 pixel size - which a web-cam usually grabs - to a very pixelated 80x60 pixels image in order to correspond to the dimensions of the cube grid. The RGB values of each pixel are then retrieved and applied to the matching cube – with the green value increased for the present space and the blue value for the distant space. In that way the two grids present an undertoned impression of the two spaces and at the same time make a clear distinction between the two spaces and their corresponding grids.



Pic.19

After that, the main loop is called, which is repeated until the program is terminated. During each loop a new camera image is captured, which is subtracted by its previous one, in order motion to be extracted. The pixel by pixel subtraction has as a result an image where everything is close to black except those pixels whose RGB color value has been considerably altered during the last loop – that is, the pixels where motion occurred. A ‘threshold’ function is subsequently applied in order to exclude any noise due to subtle light changes or slight movements and to eliminate any color variations. That leaves us with the final binary *end-image* whose pixels are either black (= zero) if unchanged or white (= 1) if they represent motion. Until this point the program performs almost the same steps as a generic

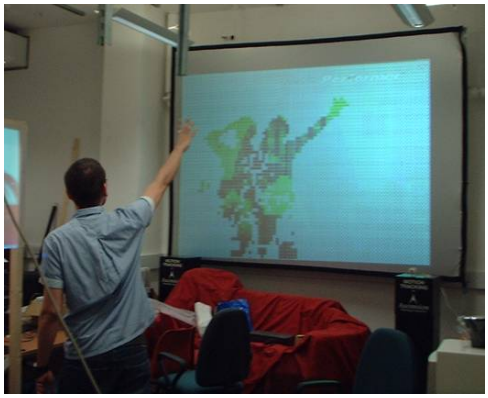
motion-detection software. At this point the processed camera input is passed to the *Performer* 3-dimensional environment, which is the system's output. Each one of the binary values of the *end-image* is responsible for defining the size of its corresponding cube of the grid. If the value is zero the cube retains its original size of 0.15 units, otherwise its size is increased to 0.4 (the center distance between each cube is 0.5 units). The final output is abstract but retains the shape of the moving subject; it has the same behavior as a shadow would have with the exception that is only 'there' when the subject is moving. Moreover these shadows are textured with a past version of the background physical environment since, as has been mentioned, the cubes draw their color tones from that.

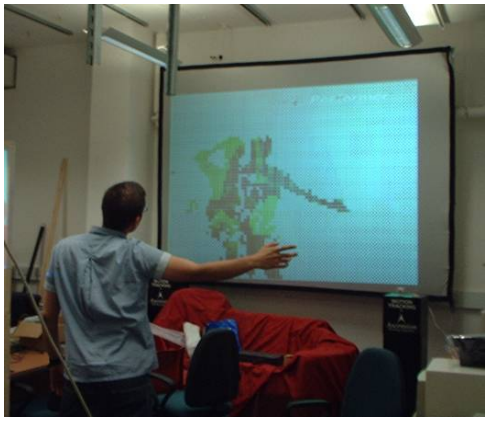


Pics.20-25

All the output data, as described above, is transmitted through the internet so as both the physical spaces to be able to present the same virtual shared environment. This becomes possible by setting up a TCP-IP connection between the remote computers. The program can actually function either as a server or a client – a choice that has to be made at the start up, where also the proper settings (IP address and port) have to be inserted. After that, users can see themselves and the distant users mapped on the same, common virtual space – a space where everyone's 'shadows' can reside and interact.

Additionally to the above described main function of the system there are two more supportive functions that aim at reinforcing interaction between the system and the users and subsequently the users themselves. The first of these functions, the *still-frame function* captures a frame where the activity is minimal and displays it as an additional layer of the place's history. This is done by tracking the number of pixels that are changing during a defined number of loops. If this number remains approximately static for all these loops, it is assumed that the user stands still in front of the camera and as a result his motionless 'shadow' is stored to memory and is continuously rendered until another 'still-frame' will be grabbed. In that way there are simultaneously represented inside the virtual environment the users' present activity and a fragment of their recent history.





Pics.26 & 27: a past-frame has been captured by the system and is presented simultaneously with the present movements of the user

The second function, the *real-video function*, ensures the flexibility of the system. The function tracks in every loop the number of pixels that motion has been detected. If the number is getting big enough the system assumes that a user is moving

towards the camera – a sign that can be interpreted as will for more direct communication. In that case the cubes that represent his/her space in the distant space would increase their size to the maximum (0.5) and change their colors to the real RGB values of the captured images. In that way the action of one approaching the camera has as a result to send one's real video to the distant space. This action can be answered by a distant user in the same way. If it is not answered the distant user will keep being represented by the default abstract cube-shadows. (Here it should be noted that when the lighting conditions are dramatically changing the system interprets it as motion across the entire image surface and changes its mode to real-video.) After several minutes the real-video mode gradually turns back to the abstract mode by slowly decreasing the cubes to their original 0.15 size. After that, the cubes retain the last projected real-image's colors tinted blue or green according to the space they represent, in order to introduce a second history layer of the place.

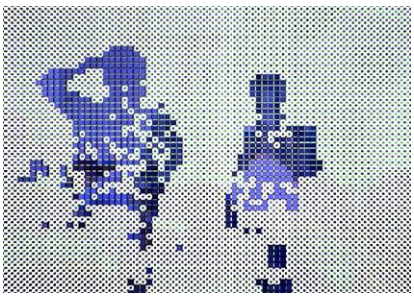
Pics.28-31:
Real-video mode: The 2 spaces exchange their real images in a pixelated form

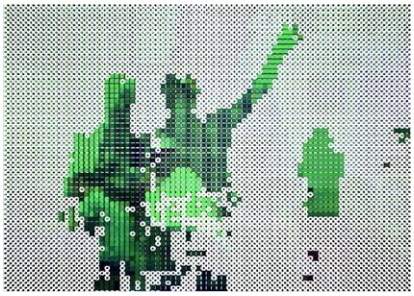
Pic.32:
Approaching the camera to switch to real-video mode

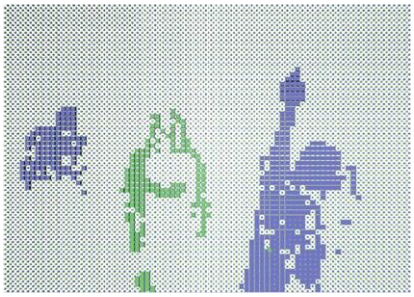
Pic.33:
Only one space sends real-video. The others stay ‘abstract’

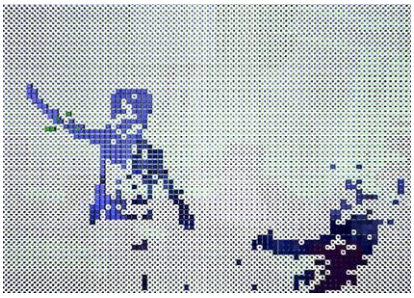
Scenario (04.3)

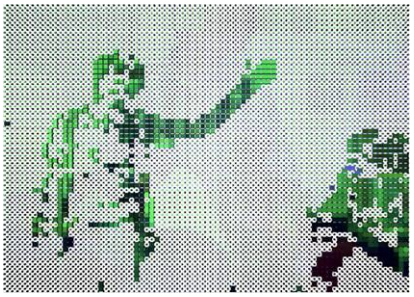
When no action is taking place in the installation’s physical space, every cube retains its original, default size of 0.15 units, and the projected image is a still, dispersed, minimal, almost empty environment. When motion occurs it is captured, as described, by the system and the virtual space becomes animated. Participants from both spaces can see their representations registered into the shared digital environment and they become aware of the activity levels in each space. This mutual peripheral awareness of the actions of other people will eventually lead to interaction between them. Awareness is the first step of a communicational procedure that continues with curiosity and then desire to interact with people that co-exist in a common environment. In order however, this procedure to have a considerable generative effect it is essential the common environment to hold the appropriate characteristics that can allow for low-level connections. The space should become the medium that, without overexposing the participants, can create playful, lively, pleasant situations. Situations like these have the ability to reinforce original social interaction by reducing the existing social constraints that tend to be preservative - in the sense that they do not permit significant number of new relations to occur.











Pics.34-38:
Users are interacting using gestures and

The environment that the “Space Time Pixels” system generates is a common spatial framework that acts as a ‘public’ space between two ‘private’ ones – it is an interface that filters the transmitted data to minimize it only to the essential ambient information that will trigger awareness. It moreover provides the tools that will convert this ‘public’ space to a virtual *playground* – a place that new social interaction patterns could develop. It is a complex, reactive, aesthetically provoking environment that can trigger participation and interaction with the system itself and consequently with the rest of the users – the present and the distant ones. The participants use their body and motion as the interface to manipulate the virtual space. They can experiment with their ‘shadows’, while they are overlapping, interacting or merge with the ‘shadows’ of the remote users. They can use the available functions to reveal part of their place’s recent history, or stay still for some time in order to form static, immobile shapes in the background of the digital environment or eventually establish a communication based on gestures, figures and postures (see pictures beside). All these features and actions have as a main purpose to heighten the feeling of familiarity that a user has with the remote space as well as the sense of presence of the remote users in his/her space, and consequently to provide a motivation for communication with them.

In addition to that, the designing of the system attempts to go one step further by incorporating the flexibility

to let the participants to decide on the amount and descriptiveness of information that will be sent. They have the ability to select and utilize the default, abstract or the real-video mode according to the type of communication that they desire or the relationship that they have previously established with the remote users. When each user has the capability to open or close the communication window, it is more probable that will have the opportunity to form more flexible and colorful connections and interactions. The system, as it is designed, does not force undesired communication; it just encourages it.

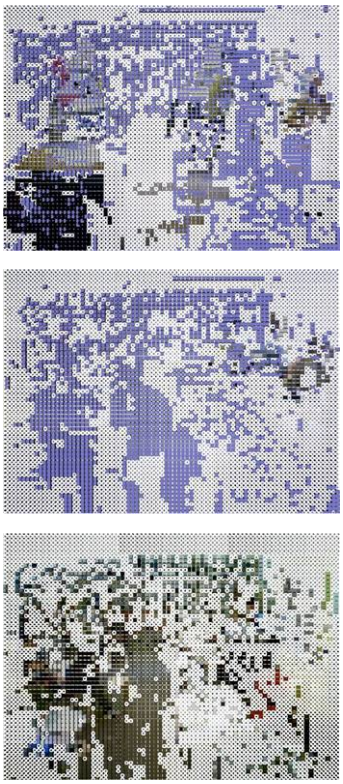
Meta-Discussion (05)

The “Space Time Pixels” project was installed and tested in three different space or activity conditions. The first attempt was to connect the “*Space Syntax Ltd*” offices at 11 Riverside Studios, 28 Park Street, London, with the UCL Space Syntax Laboratory in the third floor of the *Bartlett School of Graduate Studies* building in 1-19 Torrington Place, London. The second experiment was a connection between the Virtual Environments Laboratory in the Wates House, 22 Gordon Street, London, with the same space in Torrington Place that also houses researchers that belong to the Virtual Environments team. The third and last test was contacted in the same set up as the previous experiment but it was for a small amount of time and for a particular occasion. While the first attempt failed to function properly due to technical problems that had to do with the environmental conditions in the “*Space Syntax Ltd*”, the next two experiments were successful and provided a lot of information concerning the advantages and weaknesses of the system, features that could be improved or added to it, participants’ behaviours towards it and the potential directions that a research like this could follow in the future. Additionally, a small number of questionnaires were given to some of the participants in order to acquire a more solid and direct knowledge about the way that the installation was perceived and utilized.

It should be noted here that the selection of the testing environments was mostly dictated by the availability of equipment and other practical reasons, and that they are not necessarily the most suitable for testing a system like this. However it was

interesting and informative to see how people actually reacted and made use of the medium that the system provided even though they wouldn't expect something like this to be in their specific environment. It was gratifying to realize that the designed system could actually be generative, as far as the interactions between people is concerned, and be accepted even if it was installed in 'difficult', not thoroughly planned conditions.

Installation I (05.1)



Pics.39-41: Extreme visual noise and its effect in the Space Syntax Ltd

Pic.42: …while the real-video mode works perfectly

The first installation of the program was based on the scenario that people from two distant working environments, who however perform similar work, would develop new, original kind of connections between them. That additionally to their standard, everyday relations, which are based on the professional needs, the several specialties, and on the correlations concerning the company's hierarchies, were going to establish innovative connections that could unwind and make more pleasant the working environment; and thus generate new productive interrelationships and patterns of interaction.

Unfortunately the installed system did not function as expected due to several reasons that were mostly of technical nature. The "*Space Syntax Ltd*" office is a relatively long single space where a considerable amount of people are working together. It is also a bright environment, full of physical sunlight – a fact that makes the lighting conditions change continuously during the day. On top of that the materials and textures of the space are bright-coloured and reflective and there are constantly moving parts like the funs on the ceiling. This kind of physical space created a big amount of visual noise that the system – being until then tested in

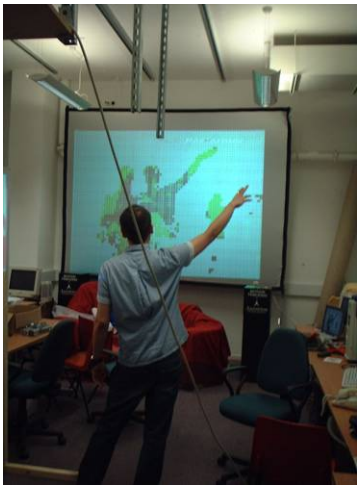
darker and more static environments – interpreted as dispersed movements across the entire surface of the input images. As it is evident from the pictures, the output image was a random collection, a ‘cloud’ of colourful cubes that do not hold any interpretable information about the space that they refer to. As a result the people in the *Space Syntax* office could not connect their actions with the system’s reactions (i.e. meaningfully interact with the system), and at the same time the distant users could not read the incoming information (i.e. interact with the remote users). While many of the software settings could be adjusted in order to achieve better results, it soon became obvious that the system – as it was designed – required a more controllable environment. That is, an environment less busy and with primarily artificial lighting conditions.

Installation II (05.2)

The second installation, which proved to be successful, was the central one and lasted for two successive days. The Virtual Environments laboratory is in the basement of the Wates House building, a fact that offered entirely controllable and stable lighting conditions. Additionally the office in the third floor of the Torrington Place building is mostly lit by artificial light as it has small windows that do not allow considerable amount of sunlight to come into the space. The single drawback of this set up was the fact that both spaces were not much active, as no more than four or five people were simultaneously using each of the two places.

The aim was to see how people were going to interpret the installed system, which can be understood and utilized in several different ways. The reaction towards it can vary from perceiving it simply as a dynamic image (an electronic painting on the wall), as an interface that mediates ambient information (a window to another space), as an autonomous, third space - or surface - that accommodates social interaction (a common public yard), or even as a primitive collaborative environment (when the *real-video* mode is being excessively used). As the case has actually proven to be, the system was used in all the different ways that are described above. As it was mentioned from the beginning, the program did not have a well-defined and focused functional goal. The aim was to generate and support playful and

subsequently creative interaction between its users by providing an interesting and flexible environment that could be easily utilized in various different ways, according to the several connections that the users could invent and establish. It should incorporate a certain degree of freedom so as to be able to support non-standard, original interactions. As it is obvious by the questionnaires and the third installation, which will be described later, the system functions poorly in well-defined uses, for example a collaborative environment or a surveillance system. However it is ideal as a flexible base and successful in its main purpose to attract participation and provoke some kind of interaction between people – a mutable interaction that will be constantly defined and formulated by the users themselves.



Pics.43-45:
The stable light conditions in the VE laboratory provided the perfect conditions for the system

The third and last time that the “Space Time Pixels” was installed was for the needs of a short presentation of a university research project. It was set up in the same as above spaces aiming at establishing a connection window through which the “*Arthur*”[4] project would be briefly and merely visually presented to remote audience situated in the Virtual Environments laboratory. Even though the time that the set up lasted was minimal, some valuable results were extracted. It became apparent that the system, as it is designed, was inefficient to support connections more focused than just awareness of activity and low-level interaction. While the spaces where connected and the participants where conscious of the actions of the remote user, several features where missing to establish an effective goal-directed communication line; the most important of them being support for sound. Although sound wasn’t needed for the specific presentation (only image was required), its lack was obvious in organizational and synchronizational matters. Of course, the specific experiment was out of the “Space Time Pixels” framework of function; however it gave a few ideas about directions towards where the system could be expanded in the future.

Users’ Feedback (05.4)

During the second installation a questionnaire was given to eight of the participants in order to state their opinion about the system and the way they utilized it. This questionnaire helped to extract a more solid and factual view of the advantages and weaknesses of the project as well as points for further development. The actual questionnaire can be seen in the appendix of this report on page 34. In this chapter a discussion of the users’ feedback is going to be made in relation to some observations concerning the experiment, the initial intentions of

[4] The Arthur project belongs to the University College London VR centre. It is developing an augmented reality interface for round table design meetings. It is using see through augmented reality glasses to present virtual models of the design scheme being discussed and placeholders to allow the users to manipulate the virtual objects. For more information about the project visit the http://www.vr.ucl.ac.uk/projects/arthur/ site.

the project and the theoretical background, as it was presented earlier in the paper[5].

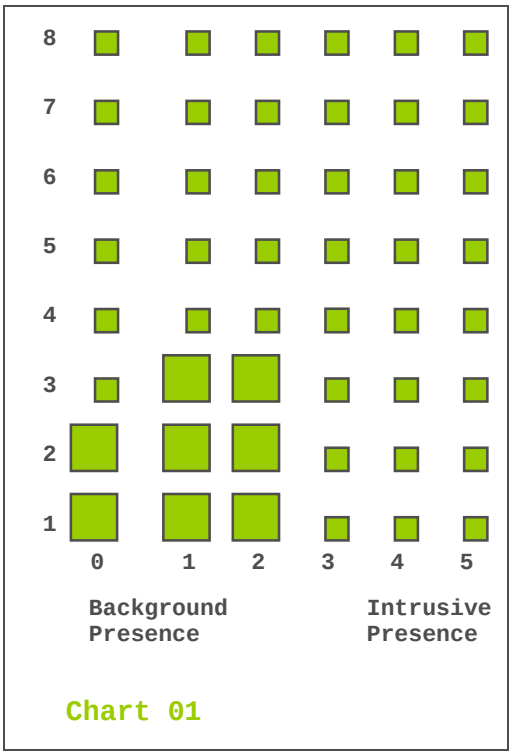


Chart 01

The first questions of the feedback form were about the general aim of the project. According to everyone that participated, the "Space Time Pixels" project was rather successful as an awareness project since the level of activity of the remote space was effectively communicated and interpreted. However awareness did not guarantee the feeling of presence of the distant users. As it can be seen in the first bar-chart, 25% of the participants did not feel the distant users as present in their space. However, the rest of them considered that the digital intermediate environment created a feeling of background presence of the remote participants. An interesting observation though, was the fact that during the experiment, whenever a person moved more actively or slightly strangely, at least one of the remote users would be motivated, seeking to interact with that person. Eventually he or she would switch to the real-video mode in order to take a glimpse of what is 'really going on there'! This fact indicates that presence could actually be more intrusive than it was initially characterized in the users' answers. The abstraction of course minimizes presence since the *'shadows' can not be perceived as a particular person but just as any person*, and the lack of sound means that *you are aware of others only if you deliberately look at the projection*. But the knowledge that something unusual is taking place in the distant space, and the ability to go and change the mode to real-video in order to 'steal a look', turned out to be more distractive and maybe intrusive than it was expected. However it certainly can be characterized as generative since this kind of curiosity caused a number of previously inconceivable behaviors, between the remote users, to emerge.

[5] In this chapter every text in *italics* is part of the users' answers in the questionnaire.

In the question about how the interaction between the users could be characterized the descriptions used were mostly *playful* but also *difficult, engaging, responsive, with gestures and signs, curiosity-based and confusing*. It was described as a theatrical and intimate kind of interaction, which *allows the development of a narrative beyond words*. The above adjectives portray an inventive and non-standard interaction; an interaction that is being formulated 'on the fly', in contrary to the usual, pre-defined connections, which have a certain procedure and goal. People would use the several functions, provided by the system, to make other people *able to see what they were doing more clearly*, or *to copy their actions to set up some kind of a game*. They were using signs or body postures to attract the remote users and make them respond and communicate. It was however suggested that the relation between the two planes/grids, which represent its one of the two spaces, could be more connected and interdependent. That is, the cubes of the two grids to interact with each other in a dynamic way; a fact that would make communication even more interesting and playful as it would provide not only a shared space that the users could 'be', but also the means to more visibly affect the person (or the representation of the person) with whom the interaction is taking place.

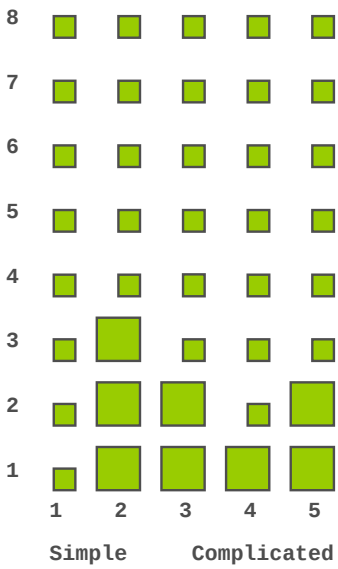


Chart 02

As it was observed, in some cases the firstly established interaction would be with the system itself – playing with the traces that one's movements would leave or even spending a considerable amount of time trying to decode the language and the functions of the system. As it can be seen in the second bar-chart, the participants' opinions about how much user-friendly is the system, vary a lot. 25% of the users characterize it as totally complicated and difficult while the users' average lies somewhere above the middle between simplicity and complexity. This apparent difficulty in understanding the interface of the program is a result of the abstraction filter itself. The existence of that

filter adds a new syntactic layer on the otherwise generic real, physical image that the camera alone would provide, which requires an extra amount of effort in order one to become accustomed to its language and utilize it effectively. This effort though, which is perceived as difficulty, could be responsible for generating innovative behavioral patterns as the system's output is interpreted differently by different users, who subsequently get involved in a mutual procedure of inter-recognition and familiarization. This procedure is moreover enhanced by the fact that the system actually offers a barrier of anonymity, which draws the participants in a game of guessing and imagination that finally stimulates curiosity and interaction. To explore and familiarize with the application's interface though requires a certain amount of time, which unfortunately was not available during the two days that the installation lasted. As it soon became obvious, descriptions and explanations about the general scenario were necessary to be given for the duration of the installation.

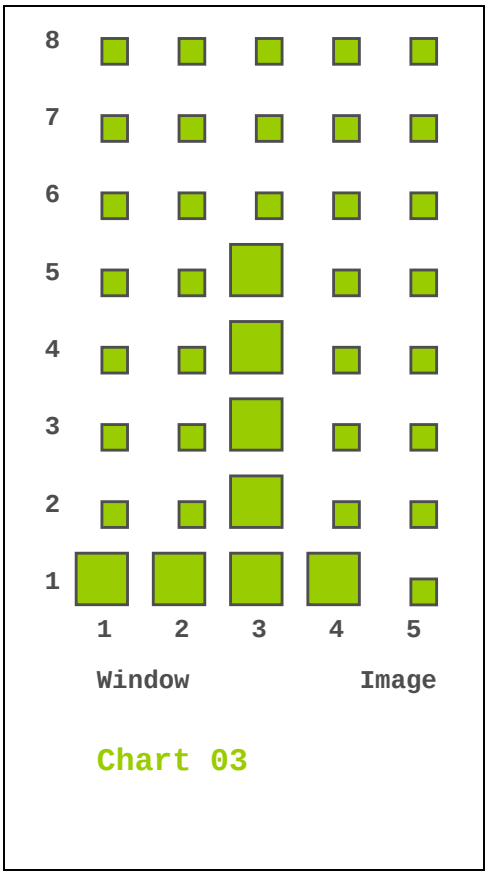
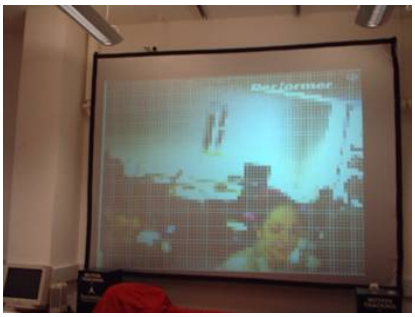


Chart 03

The different interpretations of the abstraction filter that the system generated have also to do with the varying willing of each user to communicate and interact. In the question about whether the project can be defined as an interactive painting or a window to another space, the answers were as a rule in the middle between the two extremes (see third bar-chart). People would interpret the digital environment both as an interesting dynamic image and as a communication device, according to their mood and willingness to interact with others. This flexibility of the system, the ability to present ambient information that can be perceived in several different levels, leaves to the user the freedom of deciding the time and the way that the

interaction is going to be initialized and developed. It makes him the subject (the one who acts) instead of the object (the one who is being perceived).



Pics.46-48

Another, important point concerns the real-video mode. This feature was the most frequently used function of the program and still the most questioned. As it was actually said by a user, *this intimate kind of narrative is broken & the magic lost if at any given time one can see you in video mode*. Furthermore the program did not give an intuitive and simple feedback to 'confirm' that the user is actually sending his/her real-video to the other space – a fact that created a slight disturbance as some users had the feeling of possibly being watched without intending to. As it seems from the participants' answers the function was used for several different reasons. The most popular one was curiosity to perceive, using a more descriptive image, what is happening in the distant space. In that way, the default abstract representation that the system generates *reminds the potential to communicate that the real-video mode fulfils*. People would establish an interaction through the abstract filter and almost always, after some time they would switch to real-video to confirm and somehow 'formalize' their communication. An additional common reason was technical interest that had to do with the rendering speed, the network delay and the system's reaction and precision to the action of approaching the camera. Technical was also the nature of the most comments concerning the real-video mode. These mostly had to do with the resolution of the image, which being 80x60 did not offer a clear and precise view of the distant space, especially when the user was close to the projection screen. As the application's resolution does not allow fine detail, the users had to stand and 'perform' relatively close to the camera. Unfortunately, in the way that the system's several

parts were configured during the experiment, if the users were close to the camera, they would also be close to the projection screen, a fact that made it *difficult to figure out the outlines of people in real-video*. If the camera had been positioned one or two meters in front of the screen this problem would have been eliminated. More apparent though was the lack of sound in the system. As users said, they preferred the gestures and signs interaction that the mute application generated while in abstract mode, but during the real-video mode in order for the application to be able to support a more consistent communication it should integrate sound input and output.

To finish, as it can be seen from the answers in the last question, the “Space Time Pixels” application was rather pleasant and enjoyable, augmenting the physical space with a dynamic electronic environment that functions as a flexible link to another physical space. However this is most likely true only for a relatively short amount of time, after which the system could become unexciting and thus ineffective; especially in a working environment, such as these of the experiment, that do not serve the essential number of people that would activate the program’s generative capabilities. This suggests that a more suitable place for this project would be a public environment where several people would spend some time – executing an activity or waiting for something. It would be suitable for places like plazas, museums, clubs or stores and for transportation spaces as tube, train and bus stops – where it could be installed in successive stations and create a line of electronic connections parallel to the physical ones that the trains or buses establish. However this brief installation indicated that people are actually willing to utilize the presented medium; manipulating their output representation by adjusting the values of abstraction, awareness, co-existence and anonymity. The system’s activity filter would signify the ambient and trivial communicational signs that people unconsciously transmit and that usually remain in the background subsided by strong information data as voice, image or video. Thus trigger curiosity to interpret these signs and desire for further social interaction. The subject would not feel as being perceived by strangers, but as being called to participate in a generative procedure of playful interaction and inter-identification; a relationship that could later be formalized using the stronger communicational data that the real-video offers.

Further Work (06.1)

The designing and construction of the “Space Time Pixels” project, together with the installation in a ‘real’ environment, was a long procedure that offered valuable knowledge on the creation of interaction spaces and body interfaces, and indicated fields and directions that research could be further contacted. Particularly for the described project the need for broader users’ feedback and further testing in a variety of different environments is obvious. The installation in several spaces and for longer time-spans would reveal the potentials and weaknesses of the application. Pairs of strongly interconnected physical environments (like stations connected by buses or trains, chain stores, spaces inside a museum, distant offices of the same company, etc) present a more apparent background to perceive the formation of new relationships that penetrate and deconstruct the usual, conventional communication topologies. In spaces like these, the new emergent interactions would be easily monitored and defined comparatively to the already existing formal relationships. A related point of further development would be the redesigning of the application so as to be able to maintain connections between more than two physical spaces. This would require an entire different interface structure that would support greater participation (probably by utilizing a virtual 3-dimensional space) and more functions like, for example, the ability to set up private sub-environments.

As far as the intermediate virtual space is concerned, more research and testing should be made to extend its interactive capabilities and interface efficiency. Further development in order to support more actions and reactions, and the use of different representations of users in relation to their levels of activity, would enhance the quality and quantity of communication. A more thoroughly designed connection between the digital and the physical space in order to play with scale and proportion relations or perspective distortions could furthermore make the system more immersive and attractive. This could also be supported by additional research in the level of the physical space configuration. It is an entire new issue, that focuses on

whether a digital projection (a virtual space), can be perceived and function as a vital architectural element of the physical space. How virtual and physical presence can be combined through this element and what are the relations and possible configurations so as to be better incorporated and utilized by the users of the space.

Another issue is that of sound. Even though sound is usually intrusive, it could augment immersion and presence in certain installation spaces that function more as passageways rather than as working environments. In that case sound could constitute another layer of the history of the spaces – i.e. past sound pixels presented in present time and revealing moments of unusual activity. Furthermore it could significantly enhance the functionality of the real-video mode that could easily support real communication or collaborative environments.

At last, from a more technical point of view, the action of directly connecting camera image data (pixels) to virtual 3-dimensional objects is crucial in order to translate the user's movements into controlled virtual spaces and thus create intuitive body interfaces. The pixels can be processed to extract motion, gestures or face expressions, which can subsequently be connected to manipulate objects (avatars or items) in a virtual environment. The capability to affect a digital space just by moving the body is an important step towards the creation of more immersive VR systems and towards the actual inhabitation of the virtual realm – not through the obtuse interfaces that we are used today, but through more physical actions, very similar to the ones that we use to navigate and communicate in the 'real' world.

Resume III (06.2)

Building an application that has as a main purpose to generate innovative social interaction, by definition incorporates a certain degree of contradiction. The very act of designing a communication environment – that is, the setting of a number of constraints that will affect and direct interactions inside it – is challenging the requirement for complexity and indetermination, which is necessary in order to achieve unpredictable and generative behaviors. The designer is called to

carefully balance between hard definition and absolute abstraction, sterile complete determination and unproductive excessive complication (not complexity). Communication though, is a self-organizing and inherently complex process that difficultly can be fitted into pre-defined boundaries, and this is the reason that social interaction is essentially generative in formulating new connections, even in the most restricted environments. Therefore the creation of a communication environment to sustain non-defined interaction patterns is mostly about setting the proper guidelines and parameters that will facilitate and enhance the generative processes that are anyway innate in social communication. The system should be left ‘open’ to be able to support, not only the numerous conventional relationships, but moreover, new unpredictable patterns that may emerge during the procedure of communication itself. It has to be able to trigger connections that are formulated on top and across the existing social associations. The subject of interactiveness in architecture is huge and is connected to every aspect of the designing process, from the single building to the urban structure. However, if a small project, like the one described in this paper, has been able to generate a playful, inventive interaction, which is formed irrelevantly to the existing social identities of the participants, then it should be considered as a valid step towards that direction. The fact that the users would take advantage of the system’s anonymity barrier to temporarily discard their identity and theatrically perform (sometimes even dance!) in front of the system’s camera, in order to interact with each other, signifies the formation of innovative relationships far away from the standard that can be found in a working environment, such as the ones that the testing was contacted. The project showed that abstracted awareness of activity can actually give meaning to the background, and usually overlooked, information that people transmit while in action, as the manner and speed of their movements, their gestures, body postures and many more. These signs that actually form a unique, subtle language are captured by the “Space Time Pixels” project, augmented and re-transmitted, aiming to generate new, parallel ways of social interaction.

The End

Martin Knowles, *"Between Spaces: Augmented reality and installation art"*, 2001, http://vancouver.lucidoc.com/~martin/folio/389-augmented-reality.htm

Holger Schnädelbach, Alan Penn, Steve Benford, Boriana Koleva, 2003, *"Mixed Reality Architecture: Concept, Construction, Use"*

Nitin Sawhney, June 2000, *"Computer-mediated Social Awareness and Perception in Everyday Environments"*

Hani Rasid, 2001, *"Architecture = Space = Interface"*, Designing for a Digital World, pg 134 (Wiley-Academy)

Jasminko Novak, Mette Ramsgard Thomsen, 2000, *"drawing spaces: experiments in presence and awareness of body and space in mixed realities"*

Maia Engeli, 2000, *"DIGITAL STORIES: the poetics of communication"* (Birkhauser)

Luigi Prestinenza Puglisi, 2000, "Hyper Architecture: spaces in the electronic age" (Birkhauser)

Bill Hillier & Julienne Hanson, 1984, *"The social logic of space"*, (Cambridge University Press)

William J. Mitchell, 2001, "E-topia: urban life, Jim – but not as we know it" (the MIT press)

Space Time Pixels *project >> theory >> design >> description*

The aim of this project is to design an intermediate dynamic virtual 'image' that will support low-level communication of multiple participants in two distant spaces, by superimposing space and time information of the two physical spaces simultaneously.

The (hidden!!) aim of this project is to test whether the use of virtual reality - and digital technologies – has the potential to support and most importantly generate new connections and relationships in the 'real' world by providing an 'abstraction filter' that will attract participation and sustain interaction. The purpose of this filter is to maintain a desirable level of anonymity between the several users, which will reduce the existing social constraints that limit communication, and minimize the feeling of annoyance that is common when somebody's actions are being watched. Moreover, this filter should provide an aesthetically pleasant and structurally complex environment that will rouse interest for an initially playful interaction with the people (or most correctly the representations of the people) on the other side.

In an attempt to achieve the above prerequisites this project has the following design characteristics:
*** The interface of the system is based on body and action mapping of the users to be as intuitive, simple and friendly as possible.*
*** It fragments the time and space continuum in small sequential bits (or pixels) that are presented to the users to enhance the feeling of co-awareness and presence between them. That assumes that knowledge of the activity that took place in each space in several time fragments can create a feeling of familiarity with the distant space and its users.*
*** It generates a multi-layered complex environment where all these bits of information from both spaces are overlaid together in a single virtual environment. This intermediate space acts as a 'public' space between two 'private' spaces. It can be the meeting place of the users, the theatre for interaction.*
*** It provides the capacity for more real and immediate communication by giving the possibility to the users to manipulate the abstraction filter (an equivalent of opening and closing the window). That can be done by approaching the camera – an act that shows will for further communication. In that case a less pixelated real video is sent to the other end of the system.*

Dear all,

I want to thank you for accepting this project to be installed in you place and apologize for any inconvenience and annoyance that it may cause. I would also like to ask if it is possible to spend some minutes to answer the questions that follow, which will help me to draw some conclusions and write my dissertation.

Thank you

Questions (10):

1- Did you feel aware of the people's actions in the other space?
Yes__ No__

2- Did you feel any kind of presence of the other people in your space? If 'yes' this presence can vary from background to intrusive presence. Please grade.
Yes__ No__
Background >> 1__ 2__ 3__ 4__ 5__ >> Intrusive

3- Do you feel that you interacted with the distant users? If 'yes' how would you describe it (ex effective, playful, meaningless, difficult)?
Yes__ No__

4- Did you ever used the real-video mode (by approaching the camera) and why?
Yes__ No__

5- Having recently experienced a real-video and sound communication, what do you think are the advantages and disadvantages in relation to the more abstract, virtual-mediated connection?

6- Did you find the system user-friendly and easy to understand and use or the output was too much complicated to be informative? Grade and comment…
Simple >> 1__ 2__ 3__ 4__ 5__ >> Complicated

7- What do you think should be added to the system to be more complete (functionally and aesthetically)?

8- Which description is closer to your opinion of the project?

A window to another space >> 1__ 2__ 3__ 4__ 5__ >> A dynamic interactive painting on my wall

9- Please state any more comments you may have, based on the description of the project in relation to its actual installation or generally about the potential of a research like this.

_____
_____
_____
_____
_____

10- At last, the installation was a pleasant happening or an annoying and disrupting one?

_____
_____
_____

Thank you
Athanasios Bampanelos