

Space time pixels

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This paper reports the design and installation of a networked application that records body activity and generates a wall-projected, intermediate, shared, electronic space, which can support original interaction between multiple participants in two distant, physical spaces.

Keywords: *Awareness; Ambient media; Body interfaces; Social interaction.*

Introduction

The Space Time Pixels (STP) project is an installation that supports a real-time computer mediated space by means of launching a semi-transparent and configurable electronic filter of visual communication. It is a networked system that provides an intermediate and public digital space, which establishes a connection and supports interaction between multiple participants in two distant physical spaces. The intention of the project is to explore the potential of the digital environments to acquire and subsequently increase the socially generative functionality that is inherent to the physical built space.

Generative and conservative space

So far, technology has offered a variety of new connectivity alternatives that have multiplied our communicational capacity and efficiency. These innovations have a profound but unpredictable impact on the way space is produced and utilized in a social context. Architectural space is primarily designed to reinforce and sustain the conventional societal constraints, in order to effectively function as the vessel of defined and established processes. Simultaneously though, the built environment, through

the way it forms complex patterns of space, creates multiple and unexpected states of co-presence that operate on top of the existing associations and formulate original social topologies. In brief, the built space draws its form from society's organizational structure, but it concurrently provides the tools that support society's transformational procedure.

Conservative electronic space

This balance is being today destabilized by digital communication technology, which appears to act rather as a conservative than a generative force. "Although new technologies have had an effect of compression of space and time, there seems to be a concomitant elimination of chance interactions and their unpredictable outcomes" (Schnädelbach et al, 2003). This is true up to a point, considering that most of the communicational applications that are largely used (e.g. mail clients, collaborative environments, messengers) are in principal alienating the users from their immediate spatial surrounding, and force them to function inside pre-designed and well defined structures. These environments are intensely specialized, with certain causes and goals and high security restrictions; resulting to the minimization of any undesirable, irregular incidences, which may, though, lead towards social originality and in-

novation. They could be described as highly private spaces of action.

Generative electronic space

On the other hand, there are more than a few examples of functional public digital spaces (e.g. chat rooms, game rooms, 3-dimensional multi-user environments) that support nearly unlimited participation and unhindered communication between their users. They are mostly playful and anonymous environments with no specific functional agenda; characteristics that minimize the existent social barriers between the participants and provide the medium through which innovative interaction can occur. This digital public space – still limited inside the computer's screen – in association with progress made in areas like networking, real-time rendering, alternative interfaces and ambient media is bound to expand and merge into the physical world. Consequently to lead towards the formation of responsive mixed-reality spaces, relieved from the uncomfortable and hard barrier that comes in between the user and the machine. The machine becomes a subtle and invisible organism, which receives, decodes, processes and transmits intuitively understandable signs. The produced augmented space utilizes the full sensorial immersion of the physical plus the malleability and responsiveness of the digital realm to present a unified public environment with considerably enhanced communicational capabilities.

Space Time Pixels application

Towards this approach the STP application sets out to generate a communication environment and provoke new, inventive and atypical ways of interaction between people, whose current spatial and social position can difficultly allow such connections. Furthermore, to explore if digital space can sustain low-level connections like these, by balancing between the contradicting needs of communication and anonymity. It creates a common public space, which acts like a filter in the midst of two distant spaces and ma-

nipulates the transmitted information in order to define values of awareness, privacy, abstraction, attraction, co-existence and interactivity. The thesis is that the creation of an in-between public environment that operates as a non-descriptive activity abstraction filter between several users, could give significance to the overlooked ambient data that people unconsciously transmit to each other when co-existing. It can therefore form a completely new layer of connections and original interactivity patterns based on this data; enhancing the socially generative properties of the physical space that it resides.

Functionality

The STP intermediate space is a dynamic, reactive environment where presence and movement (through time and space) information of two physical places is simultaneously superimposed, to create a complex common ground where interaction through gestures and postures can occur. Technically this is achieved by using camera input to detect activity as well as to capture layers of time frames, and subsequently use this data to manipulate geometrical objects in a shared OpenGL environment. The cameras capture sequential frames of each space and subtract them to extract movement information. This data is exchanged through a TCP-IP connection so as the same shared environment can be presented in both spaces. The time lag is negligible as the data that is sent is not image information but a small set of binary numbers indicating motion or absence of motion. The projected shared environment consists of two interleaved coloured grids of cubes – each grid representing one of the two connected spaces. Every cube has two parametric values, its size and colour, which are directly and dynamically connected to a neighbourhood of pixels from the live-video image. The system detects motion in every point of the surface, where the perceived space is mapped, and the corresponding cube responds 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.

Procedure and features

When no action is taking place in the installation's physical space, every cube remains scaled down to minimal size, and the projected image is a still, dispersed, almost empty environment. When motion occurs, the corresponding cubes expand and the electronic space becomes animated. Participants' representations are mapped altogether and they become aware of the activity levels in each space. At the same time and constantly the relative size of the users is detected. If someone gets too close to the camera, the system will interpret this as a sign for more direct communication and will switch to its real-video mode. In this case the cubes that represent his/her space, maximize their size and change their colours to the real RGB values of the captured images, presenting a highly pixelated but descriptive version of the live video. This action can be answered by a distant user in the same way.

After several minutes the digital space gradually turns back to the abstract mode by slowly decreasing its cubes' size, retaining however a tinted version of the real-video colours, introducing a layer of the past, which remains there until the same function will be activated again. Another layer of the place's history is introduced through the still-frame function, which holds in memory and renders the latest frame where activity was minimal, that is the last time when users were being idle in front of the camera.

The above described functionality results to a final output of a complex, adaptable and abstract environment, where pixels of the two distant spaces and of several past time instances are simultaneously presented to enhance awareness and familiarity between the remote users. This peripheral awareness of other people's actions eventually leads to low-level, body-sign interaction between them. Awareness becomes the first step of a communicational procedure that continues with curiosity and then acceptance of interaction with strangers, who happened to co-exist in the same electronic space.

Postscript

Building an application that would function as an alternative low-level communication tool, presupposes the existence of a number of participants that their presence is not determined by the application itself. Specifically the application is not meant as an exhibit but should exist as an ambient background to a place with an already defined activity. The digital shared environment should not intrude and force undesired communication, nor overexpose the monitored space, but simply attract participation and encourage interaction. It is designed to provide an excuse and simultaneously a protective cover of anonymity, which can discharge communication that cuts through the existing social constraints (e.g. unfamiliarity, social position and status, indifference, etc), whenever this is desirable.

Various experimental installations of the STP



Figure 1
Shared environment: abstract
and video mode

project offered a valuable feedback concerning its advantages and weaknesses. Generally, as reported, the system acted as a new syntactic layer of communication, which aroused curiosity and created an ad-hoc responsive game, leading towards new behavioural patterns and a kind of theatrical interaction. Its flexibility allowed to the user, the freedom of deciding the time and way the connection would be initialized and developed. It made her the subject (the one who acts) instead of the object (the one who is being perceived). Users would establish interaction through the abstract mode and later would always switch to real-video to confirm and somehow 'formalize' their communication. Apparent at that point, was the lack of sound, which could support a more consistent communication during the real-video mode. Another suggestion was the possibility of an actual and dynamic behaviour of the system itself, which would autonomously respond to certain inputs and motivate participation. It should, however, be noted that the software was designed to function in as many as possible environments could be installed. The need to be functional in spaces with uncontrollable environmental factors (background noise, light density, population) imposed a lot of limitations concerning its ability to record, understand and respond to more complicated actions.

The STP project showed that ambient awareness of activity signifies the subtle and unique language of movements, gestures and body postures. These signs being captured by the electronic system are augmented and re-transmitted, aiming to form new, parallel ways of communication. Electronic interaction in the context of physical environments, can be benefited by the emergent disappearance of the inconvenient hardware and the continuous advance of the software's computational abilities, to facilitate the formation of alternative and socially generative interconnections. However, as M. Krueger (2002) notes "the infrastructure required to support the ultimate integration of the real and virtual worlds requires monitoring human location, direction of gaze, physical action and speech on a moment by

moment basis". Namely computational power that is largely unavailable and practices that are ethically questionable. Research and experimentation in the field of computer mediated physical spaces can provide the technical solutions and the compliant answers.

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