Performative Uses Of Space In Mixed Media Environments

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1 Introductrion

Moving computing and interfaces from the virtuality of the screen into the physical environment of space and artefacts not only enables people to interact in an embodied and performative way, it also provides the interfaces with a spatial dimension. As a result, computing becomes embedded in people's physical and social world, opening up possibilities to actively stage their own interaction through creating configurations of interactive artefacts, media and space.

Performative events in interactive and multimedia environments have for some time already been experimented with in the arts. Its potential has been much less explored in everyday environments at work or in domestic settings. This is why in order to argue our case, we use field work material from two different sources: a) an earlier study on the use of programmable light and projections for an artistic performance – the musical 'Kiss of a Spider Woman' [1]; b) a project developing architectures and technologies for inspirational learning environments for an architectural master class[2].

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[1] TECHKUL (Uses of computer systems for architectural practice, film-making, and the theatre), a project supported by the Austrian Science Fund, which was carried out 1993-95 in collaboration with Martin Kompast.
[2] IST-2001-33064 Atelier - Architecture and Technologies for Inspirational Learning Environments http://atelier.k3.mah.se/home/

In the first case we observed how computation was used to create mixed media spaces on the stage of a musical theatre. These observations help us gain a better understanding of how configuring and re-configuring a space (using the principle of collage/montage) affects performative action within the space. It also provides a framework for discussing possible extensions and amplifications of such an environment through, for example, tracking systems and media processing.

The second case deals with a different kind of activity – learning architectural design – and a more advanced technical environment, which offers a variety of input and output components in addition to lighting and multiple projections. We observed interesting similarities between the theatre performance and the ways, in which the architectural students used the technologies for re-creating and re-experiencing aspects of places and situations outside the studio. At the same time, we explored new and additional possibilities of creating connections between spaces (e.g., a field site and the studio), of integrating mixed representations within a space, and of navigating a remote space in ways that are integrated with the physical environment of space and artefacts.

1.1 The interest in space

The study of the social organisation of space has its place in social science literature, in particular in urban sociology and in the work of social geographers (Gregory 1994). Their focus is on issues of culture, power, knowledge, and spatiality. As has been argued in particular by Giddens (1990) and Bourdieu (1989), spaces bound and structure activities. A space can be designed to reflect important aspects of context. It may be connected, reflect other places and times. The specific artefacts, symbols, knowledges, and ideologies that inhabit a space are resources, which both, are mobilised in social interactions, and shape these interactions. A sociology of space has "to demonstrate how spatial arrangements construct, sustain, constrain, and, occasionally, transform human practices" (Tellioglu & Wagner 2001, p. 164).

The social organization of space is at the heart of architectural design. As architect Bernard Tschumi argues, "space is not simply the three-dimensional projection of a mental representation, but it is something that is heard, and is acted upon" (1981, in Nesbitt 1996, p.45). Spaces are spaces for something, not things stripped of use. Tschumi critiques the programming of space within architecture in terms of function. He suggests to look at architecture not as an object (or work in structuralist terms), but as an "interaction of space and events" (in Nesbitt 1996, p.162). Tschumi's interest in choreographed movement as creating space – "bodies not only move in but generate spaces produced by and through the movements" (1980, in Nesbitt 1996, p. 154) – stresses the performative aspect of space. Already in the 1920's Oskar Schlemmer formulated this principle for the theatre. It was commented that in his Bauhaus dance performance in Berlin the moving body is often disappearing „behind the movement, behind moved cloths and forms, behind metal, glass, a system of circles, rods, cubes, etc". Seemingly lifeless objects have "quite intelligently been provided with wings, 'like light on glass' " (Fiebach 1995, p.52). Schlemmer juxtaposed two concepts of space – cubic space with its edges and connecting

lines, and the relational network, which results from moving bodies (Lainer and Wagner 2000).

The connection of space with movement introduces the element of time. Michel de Certeau includes the dimension of time into his definition of space (de Certeau 1984, p. 117):

> "A space exists when one takes into consideration vectors of direction, velocities, and time variables. Thus space is composed of intersections of mobile elements. It is in a sense actuated by the ensemble of movements within it. Space occurs as the effect produced by the operations that orient it, situate it, temporalize it, and make it function in a polyvalent unity of conflictual programs or contractual proximities ".

While the interest in space and performance has influenced architectural and artistic practice, few studies investigate the performative aspect of how people actively, flexibly and reflexively stage their actions within space, making use of the resources at hand. To think about the social use of space as 'event' takes a step in this direction, by emphasizing the situated, contextual, evolving, temporary, and performance-like character of activities within space (Lainer & Wagner 1998). One of the few empirical studies in this direction was carried out by Heath *et al.* (2002) in a museum setting. They use the term 'active spectator', pointing to the "relevance of the ecology or setting in which a painting or sculpture is positioned, and to the ways in which the spectator actively 'connects' features of the object to action within the local milieu" (Heath *et al*. 2002, p. 11). This study not only stresses the cooperative nature of encountering art work but also looks at how 'active spectators' perform these encounters within physical space.

1.2 On the notion of performance

We focus on interpretations of space that emphasize the importance of considering time and performativity as fundamental aspects of its use. We first of all need to make clear how the notion of performance is to be understood in our context, as from an anthropological perspective it can embrace virtually all aspects of our life. In the following we will deal with how it relates to space, to narrativity, and to mixed media, and how it can be applied beyond the theatre in other communicative events where spatial features are consciously created.

"A 'performance' may be defined as all the activity of a given participant on a given occasion which serves to influence in any way any of the other participants", Goffman (1959). Definitions of performance can be taken to include all human acts carried out "with a real or notional spectator in mind, and so with an awareness that they are expressive" (Counsell & Wolf 2001, p. 157). While anything can be studied "as" performance, something "is" a performance when social context and convention say it is, referring to specific cultural circumstances (Schechner 2002). Performative events differ widely, with respect to the resources that are used and their cultural and spatial framing, as can be seen in familiar examples, such as games (soccer), rituals (church), or theatre performances.

The approach provided by Eugenio Barba contributes with an additional perspective on performance, stressing the importance of skills, energy, and consciousness (thinking) of the performer. Barba (1991) distinguishes between daily and extra daily techniques (p. 9):

> "The way we use our bodies in daily life is substantially different from the way we use them in performance. We are not conscious of our daily techniques: we move, we sit, we carry things, we kiss, we agree and disagree with gestures which we believe to be natural but which are in fact culturally determined… ".

While in our daily techniques we follow the principle of less-effort, that is obtaining the maximum result with the minimum expenditure of energy, "extra daily techniques are based, on-the-contrary, on wasting of energy" (Barba 1995 p. 16). The principle might even be opposite: "The principle of maximum commitment of energy for a minimal result". During the performance, besides investing energy in accomplishing successfully actions on the practical or on the expressive side, we must invest energy in thinking.

Obviously performances are of a varied nature, each commanding a specific context and space: "Culture viewed as speech, gesture, and action is performance; and performance not only requires but commands its own kind of space." (Tuan 1990). Spatial features may be functional, such as walls, but they may also be charged symbolically, resulting in a specific perception of space during a performance. In a theatrical performance, for example, we accomplish:

> "an essentially interpretative act, translating real bodies, words and movements into the objects of another, hypothetical world; ... everything within the defined spatial compass of the stage is to be read differently from the objects seen elsewhere" (Counsell and Wolf 2001, p.155).

The reading of space in performative events, however, does not always imply maintaining a hypothetical world. Spatial features may convey narrative elements to be experienced directly as in some performance art pieces. Particularly interesting to this discussion are artistic movements in the 60ies and 70ies that blurred the boundaries between traditionally separated disciplines. An example is the mixing of art and life in Kaprow's Happenings. As Carlson (1996) notes, Kaprow traced their roots in Cubist collages, which questioned traditional harmonies by introducing irrational juxtapositions and foreign matter into the painting. Kaprow summarising this evolution writes: "The pieces of paper curled up off the canvas, were removed from the surface to exist on their own, became more solid as they grew into other materials and, reaching out further into the room, filled it entirely" (Kaprow 1966 p.185). Carlson, commenting these words, notes how "canvas evolves through collage to assemblage and environments" (1996, p. 97). Happenings emerged out of the evolution in structure and complexity of these environments and of activities of the participants. Kaprow defines his approach to happenings as being through "action collage".

1.3 Theatre, installation art and experimental cinema

One of the focal points of this discussion is the use of technology in performative spaces. Already in the 1920s Moholy-Nagy worked with projections of moving light for creating surprising effects on the stage, like in his stage designs for Piscator. Their main element was the interweaving of space with representational functions (Gropius 1934). Much later Richard Kostelanetz took up this tradition in his book "Theater of the Mixed Means", which he elsewhere explains, differs:

> "from conventional drama in de-emphasizing verbal language, if not avoiding words completely, in order to stress such presentational means as sound and light, objects and scenery, and /or the movement of people and props, often in addition to the newer technologies of films, recorded tape, amplification systems, radio, and closed-circuit television" (Kostelanetz 1994).

Other examples of how to make use of digital media for creating spaces can be found in installation art (e.g., Nollert 2003) and experimental cinema (Shaw and Weibel 2003). After decades of pioneering work of artists like Vito Acconci, art installations are increasingly mixing multimedia with architecture and bodily presence. Acconci explains well how performative architecture operates:

> "The viewer activates (operates) an instrument (what the viewer has at hand) that in turn activates (builds) an architecture (what the viewer is in) that in turn activates (carries) a sign (what the viewer shows off): the viewer becomes the victim of a cultural sign which, however stays in existence only as long as the viewer works to keep the instrument going." (Acconci 1981)

In more general terms, performative installations can be considered a "synthesis of art event and art work, of presence and representation, of immateriality and materiality" (Nollert 2003, p.4), with the artist intertwining different levels of presence, temporality, space and experience. An installation is produced in a process of arranging and placing; it is three-dimensional; it relates to the surrounding space, invading it, thereby creating a particular experience of the space. Linked with the materiality of an installation, the solidness or fragility of its physical components, are events or performances. This results in a fusion of presence and representation, ephemeral and static elements, short-term event and duration, immateriality and materiality.

Examples of mixed media installations are provided by Diana Thater who "turn(s) video into architecture, throwing the image up to play over the found space of her installation" (p. 139); or the work of Jennifer Steinkamp where "riots of colour, form, and light blur and reconfigure the place of bodies in space and the relationship of those bodies to the installation, the architectural environment, and one another" (Lunenfeld 2001, p. 11).

While some work focuses on producing dynamic, interactive, non-linear narratives, other work produces installations that explore immersive and technologically innovative environments diverging from the conventional screening formats. An important element

of experimental cinema is its move away from a central author – the director. It follows new models like the one of Chilean Filmmaker Raul Ruiz:

> "whereby the autocracy of the director and his subjugating optical apparatus can be shifted towards the notion of a cinema located in the personally discoverable periphery" (Shaw and Weibel 2003, p. 19).

1.4 Methodological premises

One of our aims is to inform technology development programs about new opportunities and roles for technology with a view to the performative use of space. Performance refers to interactions as part of an event; it stresses the simultaneousness of action and experience, of presence and presentation. Performance points to how communicative acts are embodied in expressions within the space, the artefacts, and the movement of the body. We also talk of performance insofar as there is a particular consciousness of the act and we have a particular interest in the activities done in preparation of interactions, in actors' configuring or staging the event.

We will use the two field studies to uncover how the roles technology and people may assume in performative events challenge established human-computer interaction frameworks. Moreover we seek to understand, how spatial features participate in the configuration of mixed media environments and the performative aspects of how people interact in them. While our ultimate interest lies in situations of everyday life– in learning, work, and mundane social interactions - we included the case of a theatrical performance. We think that studying artistic performances and the ways these make use of space and technologies helps us identify some of the most salient features of performative interactions. But as we will see, the theatre case also contains some very distinctive features.

2 The theatrical performance

"The Kiss of a Spider Woman" is a musical based on a novel of Marcel Puig. The story is based on a dialogue of two men who share a prison cell in a fictitious totalitarian regime. Interwoven into the narrative, is one of the protagonist´s memories of movies with his favourite female star, Arora (the leading actress in the musical). She invades the real world of the prison, haunting the dreams, visions and agonies of the captives. As the plot draws to its culmination, the comforting Arora is transformed into the demonic "Spider Woman" and the death of her admirer merges the world of the movie with reality.

The visualization of this concept is based on the interweaving of set, slide projection and lighting into the design of a multi-facetted, lively and quickly changing optical surrounding for the actors that is additionally stimulated by music, songs and dancing. At the core of the set are bars outlining a prison cell. Projected images and the painting of the multicoloured brilliant light beams furnish this basic setting, turning the simple prison cell into a variety of imagined outside worlds.

Our study took place in a Viennese theatre that is specialized in the performing of musicals. The new production in preparation had been bought as a whole from the US production company that originally had designed and implemented it for a stage in New York. The play had already been adapted and performed in London and in Toronto. Our fieldwork focused on the process of adapting the system to the specific environment of the theatre. This was done by a lighting design assistant and a programmer, who both had been working together in the original and in all consecutive productions. Our fieldwork started with the beginning of the lighting rehearsals in the middle of the installing period, covering those and most of the dress rehearsals up to the beginning of the public performances. We observed the work of adjusting the lighting design as well as its effects on the stage.

The technical base of computerized lighting consists of a "VariLite" system, a central controlling and programming unit and a variable number of spot-lights each of which is directly addressable by remote control. The detailed lighting program from the US performance was brought on floppy disks. These pre-designed settings needed to be adapted to the special dimensions of the new stage (and, partially, to changes of the artistic concept). This is basically done in three steps: First, each light setting is adapted to the dimensions and light absorbing and reflecting properties of the stage. Then, the setting is

accommodated to scene positions and variations of the set. Finally, it is adjusted to the estimated positions and actions of actors and dancers. All these adaptations are done in real time by the VariLite Programmer who can modify and re-adjust every single parameter (position, intensity, beam, colour, iris etc.) of a single spot or a chosen combination of spots, by turning control knobs or by entering numbers on keypads.

Light has always been a central artistic medium. Light is used for structuring visual fields, for multiplying visual options, and for producing atmospheric qualities. Light illuminates, shadows, hides, creates sharp or diffuse boundaries; it dims or makes persons and objects glow. Its programmability adds another dimension: As a precise instrument for parametricising a visual field, programmable lighting widens the options for stage design. It is possible to rapidly and synchronously modulate a great number of light sources, their position, movement, colour, intensity, and patterning. Lighting design becomes an integral part of the design of setting and decor; it is used for underlining musical and dance effects and for dramatically accentuating the script. The programmable light allows to implement techniques of representing and visualizing which have been developed in photography and the film: dimming, inserting, cuts, the play of framings, immobilities, still-shots, kaleidoscopic sequences of images can be simulated by rapidly changing lighting arrangements and projections.

We observed, for example, how lighting designer and programmer made small adjustments of the colouring and the intensity of the lighting; how they reprogrammed a fading-out effect; how they frequently consulted their lighting script for checking parameters; how they coordinated the lighting effects with the stage set, adjusting the positioning of spot-lights, actors and decor; how they controlled the positioning and animation of a slide projection.

While watching their work, we observed how the real scene with its fixed spatial dimensions, partitions, walls, openings, vistas, closures, and objects got impregnated with a "space in flux". This space was virtual in the sense of non-tangible, futile and only present as an image of some distant or fantasized place. Light made a thick green jungle with pink orchids fill the prison cell, some image of a movie scene flicker in front of the window, the vista of a bridge appeared and faded out. This virtual space was dynamic. It furnished and re-furnished the here-and-now location of the stage in a rapid sequence of variable light situations, each of which suggested a different arrangement of spatial elements. The modulated shower of light, which swept over the scene, introduced surface equivalents to the spatial dimensions of depth, connectedness and bodily movement (Sobchack 1988).

One of our observations is to do with how the automated, animated lighting affects actors' interaction on the stage. Gliding through beams of light, the actors changed between "light spaces", thereby creating the illusion of bridging large distances and times. Their bodily presence on a real stage in real time was modified in a strange way since the mixed media space they occupied was fluent and multi-layered; it blended a variety of places; it was synchronous and asynchronous at the same time. Paul Virilio talks of 'telepresence' as a mixture of being there and simultaneously at another place (Virilio 1990).

Another observation is to do with the performative qualities of this mixed media space. Already the text of the book works with what art theory coins collage/montage – the assemblage of seemingly unconnected fragments into a new whole. Programmable

lighting and projections amplify and perfectionize the collage/montage effect of the textual script, in various ways. One is the sheer speed with which light animations can be varied. This literally pulls the spectator into the unfolding events. Their attention is captured by the rapid display of electronically created sub-spaces.

Art theory argues that collage/montage breaks with the idea of representation. With the cutting out and assembling of material, in this case remote spaces and situations, there is a loss of reference. The projection (houses, bridge) signifies itself and something else (within the new frame into which it has been mounted). It may disrupt, surprise, provoke, irritate, confuse, but it does not offer an unambiguous relation to a "referent". The resulting multi-layered space is both, real in its connection to embodied interaction, and illusionary. Assembling the fragments becomes an integral part of the performance.

A final observation relates to the fact that a performance is a dynamic event, not just a static presentation, intertwined with movement of scene and actors in time. We may look at a theatre (musical) performance as merging a variety of temporal orders: the temporalities that are constituted by actors' movements and speed and flow of speech, the internal rhythm and speed of the accompanying music, the temporal structures of the lighting arrangements, and, finally, the audience's temporalities which may or may not be tuned into time on the stage. The lighting not only dynamizes and virtualizes the stage. It simultaneously serves as a "stage timer" - a predominant temporality, parametrizing the action on stage. In addition to key phrases, stage dimensions, co-actors and music, all persons on the stage had to fine-tune their activities to the rapid light modulations. Even the slightest incorrectness in entering and leaving the stage, in positioning themselves, in the tempering of speech and song became highly visible due to their incongruity with the "blindly acting" light. The granularity of this animated lighting sequence was so fine that the actors had no room for letting the performance evolve as a process.

Since Walter Benjamin (1963) this phenomenon is connected with the notion of reproducibility. The musical was divided into hundreds of small units which are marked by a set of numerical parameters: codes that mark the intensity, colour, speed of the lighting, temporal markers, spot-light numbers. They were used for programming effects and for reading the correctness of a setting. This encoding of sensual categories is necessary for operating the technical equipment. Together with the splitting of the unfolding activities into smallest units, it allowed the directing team to perfectionize each unit and to conserve it, thus ensuring its reproducibility. Once media and interactions have been configured, they form a script, which determines the performance. By storing each unit in a computer, an electronic representation of the performance was created. In this sense, the programmable, animated light is far more than just an additional source. It allows to store the artistic concept in the form of a visual representation of actors' positions and movements, of the duration of actions and their sequencing and temporality, of the properties and dynamics of alternating virtual spaces. This is why the performance can be sold on an ordinary diskette. In combination with a VariLite instalment (which can be rented) and some tailoring of the program, the lighting concept can be implemented on any stage with any team of actors, musicians (which can easily be substituted by an electronically created sound track), and stage personnel.

Our observations of how lighting design created mixed media spaces on a stage influenced the ways in which we experienced the use of technologies and space in the architectural master class, directing our attention to several aspects:

the fluent, ephemeral, and rhythmic nature of mixed media spaces

the role of movement – of the performers but also of the interface (a "space in flux")

the principle of collage/montage – it resonates with what architects see as an important aspect of their work: the peripheral presence of events or objects, with short-time events, fast, assembled, ad-hoc, such as film, video and fashion photography being important inspirational resources (Wagner 2003)

the configurability of the space which in the case of the theatre performance becomes fixed in a script.

As we will see, students' mixed media performances in the Atelier project were more informal, less designed and elaborate. At the same time, the more advanced technological environment provided them with additional resources for integrating the environment of space and artefacts into their work.

3 Mixed media performances in the Atelier Project

Within this project we explored approaches to mixing physical and digital artefacts and experimented with ways of integrating the physical space into the students' learning activities. The project proceeded in three design circles, starting with an extensive period of fieldwork – video-supported observations and interviews – at the two sites. Based on this material we looked for opportunities for technology-support, developing a set of prototypes and scenarios of use, and designed field trials at both sites (Iacucci & Wagner 2003). Our strategy for these field trials was not to create new and dedicated artefacts and spaces but to enhance existing practices with new technology and to motivate students to integrate the prototypes into ongoing project work.

In the first cycle of field trials we used simple prototypes of physical interfaces and projection set-ups and made extensions to them whilst students were experimenting. Students came up with a wide range of ideas of how to integrate interactivity in physical objects. They used the space as a resource, e.g., by re-creating elements of remote places in the studio with projection surfaces. The experiences of the field trials were used to extend and further evolve the prototypes. The experimental environment we developed consists of input components (sensors, RDIF tags, and barcodes), output components (beamers, the Texture painter), an infrastructure providing messaging and registration, configuration applications, a shared hypermedia database, and a configurable spatial set-up (3D Table and Interactive stage). Sensors, tags, and barcodes provide a simple way to associate media files with the environment of space and artefacts. Associations of physical input, digital media and output can be edited and loaded through configuration tables that are stored in the database. The following examples show how the students, through simple configurations of space and technologies, created dynamic representations of their design ideas.

3.1 Bodily presence in mixed media spaces

One of the first trials involved simple physical interfaces, such as a barcode scanner interface. The application was used by two architects (also teachers at the Academy of Fine Arts) for associating multimedia files to barcodes. They placed the barcodes on the scale

model of one of their designs, a private home and its surrounding garden. Scanning the barcodes triggered the playing of sounds that evoked particular situations and images of the site or of inspiring architectures and interiors were displayed. The architects used this set-up in their presentations to the client. At first they placed the model near the wall, onto which the images where projected (Figure 1), but also other projection arrangements were tried out on different walls and in different scales. For example the architects used the entire wall for a 1:1 projection, creating the feeling of literally "sitting in the garden" (Figure 2).
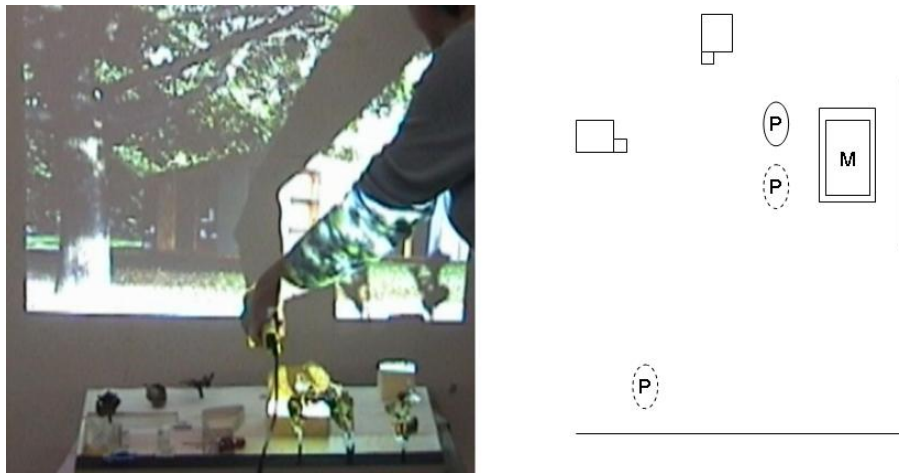
Fig. 1. Animating a model barcodes, two performers (P) using two projection set-ups.

As one of the architects commented[3]: "If I want to associate a material with a model, I can use a projection of it in the same space where the model is and get the atmosphere of it or the texture in the right scale and one has to interweave the two representations that help to make a decision." Of Importance for him was not only the multimediality of the emerging amalgams of physical model and large size projections but the fact that the technology enabled him to create and place associative material directly "at the model where I had the association... like having the hyperlink right there where it belongs". He pointed out that adding notes, correction-clouds, and hyperlinks to a document, such as a CAD plan, is already a wide-spread practice in architecture. The barcode application added an important new dimension to this practice, by introducing an expressive element.

More importantly, the technology allowed evoke specific qualities of an environment or an atmosphere in the working space, with the multimediality affecting all the senses. Being "*emotional animals*" we respond to soundscapes and immersive projections. Moods and emotions play an important role in design decisions and the use of sound has recently become more common in architecture, as animations of architectures are created with soundtracks.

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[3] All the quotes from interviews with students and teaching staff have been put into italics.

The potential of creating atmospheres and playing with them is seen as important, especially as many architects consider their office not only as a place to work in but as a place "to be in". Architects tend to spend more time than other professionals in their studios, which they often furnish with collections of all kinds, from inspirational resources, such as art books, poetry, and music, to samples of materials: "*Many offices store their records and CDs in the office to emotionalize a working night*". This not only points at immersive multimedia as a source for creating a more pleasurable environment, in line with the tendency of equipping offices with coffee corners, lounges, fitness rooms, recreations areas, bathrooms, music fountains, and magazines. It also shows that immersive and pervasive (integrated in a physical model) multimedia can become an integral aspect of design work.

Fig. 2. Animating a model with barcode and projections of different scale.

Our observations of how the Academy's students integrated those first simple prototypes into their work reveal some additional aspects. As part of one of their semester projects - the 'least expensive stadium in the world' - a group of students went on an excursion to London-Lille-Paris, from which they returned with lots of materials in their bags – videos, photos, objets trouvés, their personal diaries. Their task was to use this material for creating a themed presentation of their experiences before they went on to their next assignment, to design an "extreme stadium". We followed the work of three students on these individual stadium projects.

Fig. 3. The "train ride" - spectators become passengers sitting and standing in a recreated travelling space

The students used and adapted the space and technologies we provided for re-creating aspects of a <u>remote place</u> – in different ways. One student group decided to present their analysis using the video of a trip to the Stade de France as a structure of their presentation. The *Atelier* space was used by presenters and spectators to perform and thus re-experience this trip with the Parisian métro. Seats were arranged like in the métro and some spectators became passengers. They had to stand and were provided with a handle made from orange plastic. In this configuration they watched the video, which alternated sequences of travelling the métro(which accelerated, growing noisier and more hectic) with the presentation of stills at a calm and slow pace (Fig. 3).

Figure 4. A miniature soccer field as an interface to guide the presentation

One student prepared an elaborate presentation of her design ideas for an 'extreme stadium' in the area between Vienna's two large museums. She had prepared a soccer field and two slide shows, with one screen displaying cultural aspects of soccer (images, sound, video) and the second screen displaying her design ideas in the making. The slide show was operated through a sensor that had been fixed underneath the soccer field (Figure 4). The presentation itself was designed as a soccer-game, with the building sites being the teams - stadium versus museums - explaining the design ideas being the team-tactics, and herself as the referee, with a yellow card and a whistle signalling a 'bad idea' and shooting a goal a 'good idea'. In the words of the performer "*it was the idea to have soccer-games or soccer tools like the ball, yellow card as sensor tools. Also the architectural project used soccer terminology instead of common architecture words*".
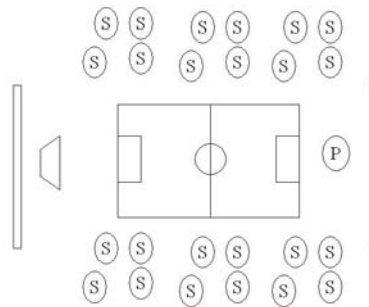

Fig. 5. Disposing the spectators as in a noisy stadium

When the ball touched the goal, a sensor triggered off a reporter's voice shouting 'goal, goal' and the cheering of the visitors. The yellow card was also given to members of the

teaching staff to interrupt the presentation with questions and comments. Spectators were invited into an arrangement like in a stadium: "*In the presentation them sitting around me, like in a stadium, the whole atmosphere was like in a noisy stadium.*" (Fig. 5).

3.2 Recreating and performing space

As part of his individual stadium project, a student projected images of two residential buildings with two beamers onto double layers of cloth, which he arranged in the curved shapes of the buildings, with the buildings facing each other so as to recreate the site. During the presentation the two buildings were undergoing changes. He visualized the transformation of the balconies into seating arrangements for viewing a soccer game in the space in-between, performing these changes while the class was watching. (Figure 6).
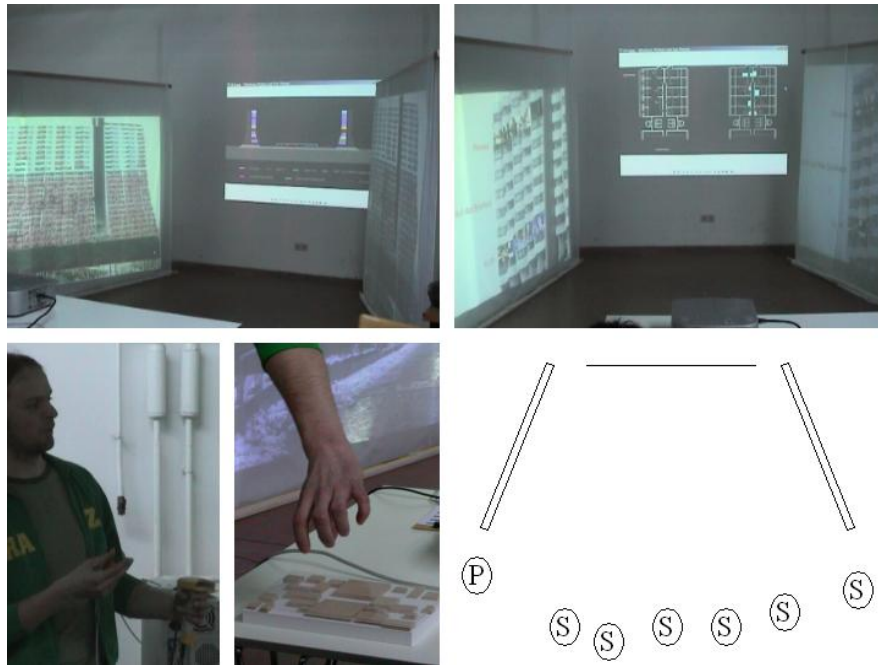
Fig. 6. Two back projections on textiles hanging from the ceiling and one front projection on the wall -several artefacts make it possible to direct media in space

The performer held a barcode scanner in one hand, with which he scanned barcodes he had placed on diagrams and plans, a switch in the other hand. This allowed him to direct the display of media onto the three different projection surfaces. A physical model representing his design of bathrooms and other spaces underneath the stadium was augmented

with touch sensors. He used this arrangement for projecting detail drawings of this space onto the wall in between the two buildings.


Figure 7. Arranging posters and projection so that they form an enclosed space,

Narrative configurations of design ideas within a physical environment such as these take the bodily presence of spectators into account. This becomes particularly evident in the preparation of another presentation, where a student thought to arrange the posters and projections so that they form an enclosed space, thereby recreating the trapezoid square in the city of Vienna which she had analysed (Figure 7). She later explained: "*First I wanted to create a new space with those hanging posters, a space that can only be experienced, when you walk through the room, change your seat. But the reviewers cannot do that, I mean they could, but you know, they are too lazy maybe. So I arranged the posters and everything so that they could see it from one perspective.*" The new arrangement is shown in Figure 8.
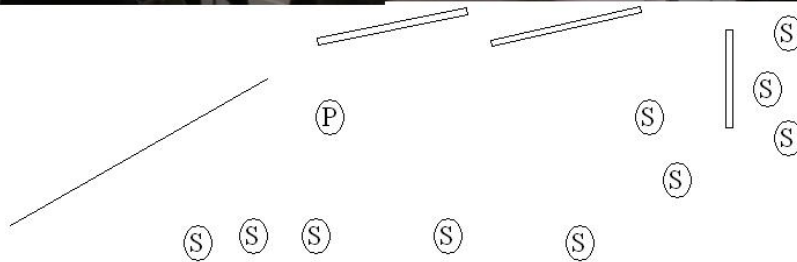
Figure 8. The final arrangement during the presentation

Another group of students reported on their excursion to London-Lille-Parisas well as on their emerging initial ideas for an "extreme stadium", by staging a "poetry game" with a multi projection installation (Fig. 9). Their narrative was based on contrasting the memories of those who had participated in the excursion with those who had remained in Vienna. The presentation consisted in the two groups reading short phases capturing their impressions and interpretations in a dialogue, while pictures were shown. This dialogue of experiences and concepts was embodied spatially with four projections: onto a set-up of double layers of transparent cloth facing each other, onto the ground (projected from above), and onto the wall. Te wall was used for projecting enlarged details of street signs (Fig. 9). This spatial configuration expressed the contrasting positions of the groups. The double layers of cloth created interesting spatial effects, blurring and distorting the projected images.
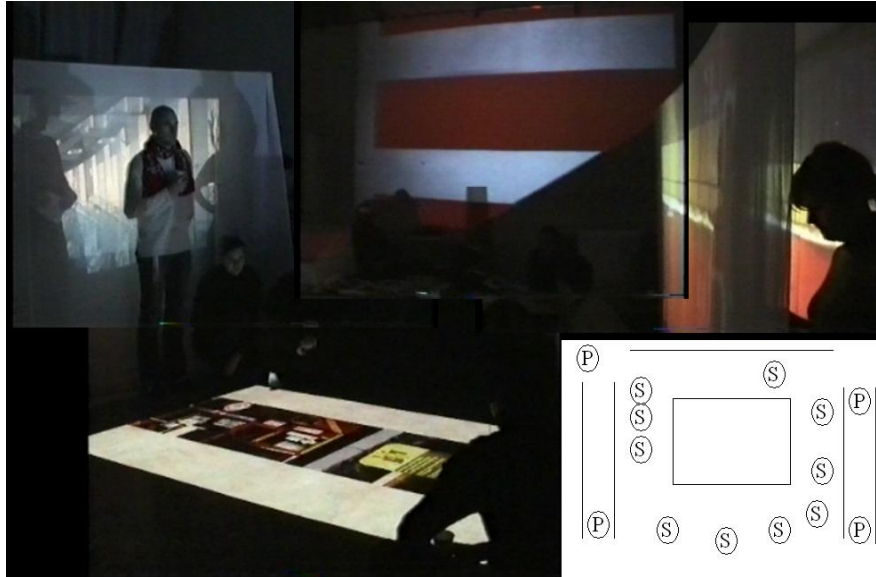
Fig. 9. The arrangement of four projections in space for the "poetry game".

Reviewers' feedback, which also included some criticism, pointed to important aspects of this conceptual performance. One comment was that "*having these two layers of fabrics, with one and the same image appearing in two different scales, opens up opportunities for simulating a space*". Another teacher saw in performances of this type a method for conceiving architecture by exploring the "*simultaneity of oppositions or of things that seem unconnected*". This is again an example of how multimedia installations may become an integral part of design work.

3.3 Staging and performing "mixed objects"

These ad-hoc arrangements developed into the *Interactive stage*, a low-tech immersive environment produced by a simple arrangement of a grid, three large-size projection screens, which can be fixed at different angles, and numerous beamers. The grid provides an infrastructure for fixing light-weight, movable projection screens (easy to change projection material) and lighting equipment (Figure 4).

In the *Interactive stage* architecture and technologies can be easily configured for experimenting with immersiveness and scale and for creating mixed spaces. Immersiveness can be obtained with simple means, using several beamers and projection screens, "projecting everywhere". Students may use the space for enacting a design concept in performed scenarios, relating to it with the strong presence of the body. 1:1 scale projections of models and other objects may help them to discover new features of a material or a site, experience how a detail of a model or texture looks like when it is blown up.

Part of the *Interactive stage* is the *3D Table*, a table with an integrated mirror and a semi transparent table-top, which can be used as a surface for placing objects and as a display component. Models placed on the table can be electronically painted with the *Texture painter*. This is a tool for painting virtual overlays – colour, textures, images or video - onto physical objects, such as models, in real time, scaling and rotating them. It provides a fast and highly interactive way of experimenting with scale, colour, background, and social use. The *3D Table* is equipped with integrated plugs for webcams and barcode readers and it has two integrated RFID tag readers. These physical interfaces make it possible to load textures to be used with the *Texture painter*, to load backgrounds on the large projection screens, as well as to save configurations of painted textures and backgrounds. As we discussed in Binder *et al.* (2004), the use of the *Texture painter* allows create "mixed objects". These have material and digital features and affordances, and they are the product of digital and physical configurations.

This set-up was used in a trial with first semester students whose assignment was to carry out an analysis of one of the 'icons' of modern architecture – Villa Tugendhat/Mies van der Rohe, Ville Savoye/Le Coprbusier, Haus Müller/Adolf Loos, etc. They were required to read texts reflecting original and contemporary views on these buildings. They had to build models in scale 1:50 and 1:20 (of an interesting spatial detail). They used *Interactive stage* and *Texture painter* for exploringing scale, materiality, and context.


Figure 10. Experimenting with scale, materiality and context

The students created "naturalistic" textures, that try to come close to the original ideas about the buildings' interior materials; or they did the opposite, replacing the original function by something completely different, as we can see in the transformations of one model into something like a Las Vegas fuelling station by loading up neon signs and painting them onto their model. They installed a second *Texture painter*, which enabled them to change the appearance of floor and roofs while at the same time 'painting' the façade. They used the projection surfaces for creating different contexts. The students took snapshots of all these variations with a digital camera, thereby continuing the normal architectural practice of documenting change, and projected and viewed these images in the *Interactive stage.*

Fig. 11. Painting a model with the *Texture painter* and taking pictures at different distances and from different directions

One of the effects of such playful variations was that these iconic architectures became more accessible to the students and open to criticism. The technologies offered them a means of expressing their analysis of the building's design, its strengths and weaknesses.
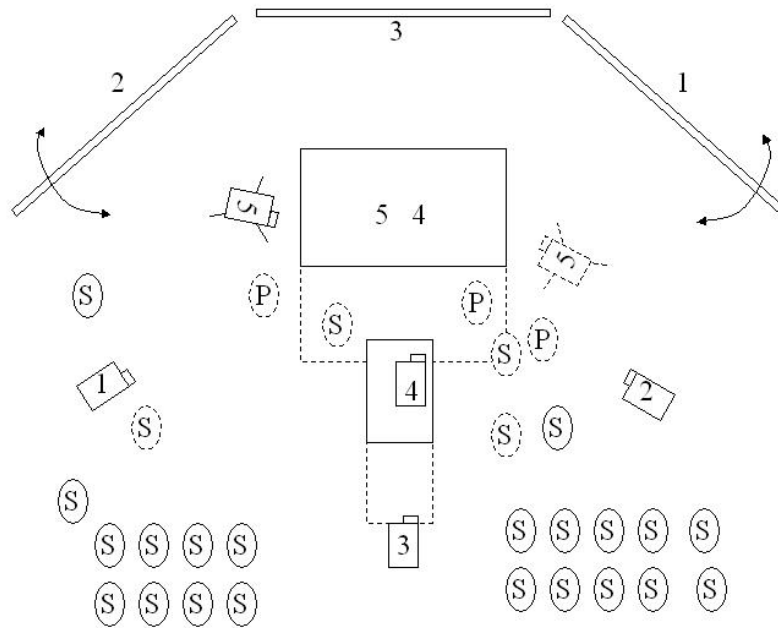
Fig. 12. Interactive stage and 3D Table - students' spatial arrangement for painting physical models and for staging them in different scenographies

The textures which students "painted" onto their physical models, together with the background images on large screens, created effects that could be viewed from different distances, and, indeed, the students took pictures from different distances and directions. The three large screens not only served as a background for creating context and landscape, they also supported students in playing with immersiveness and scale, e.g., by "exploding" details of the painted model. For example, students used the webcam (which was attached to the table) for walkthroughs, projecting the video onto one of the screens (Figure 13).
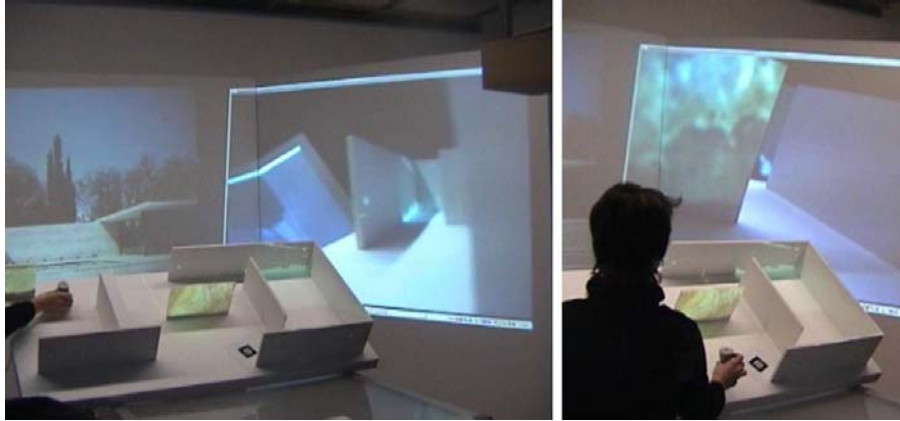
Fig. 13. 'Performing' the painted model with a webcamera

4 Discussion and Conclusions

4.1 Performing Mixed Media Spaces

The cases we have considered are of a different nature. However, both cases point at the event-like, ephemeral character of mixed media spaces as representations. To communicate and be experienced they first of all need to be "performed".

In the first case, lighting and projections contribute to de-materialising the stage; they fill it with additional meaning by adding dynamic symbolisms (e.g., the blue spot light) and pictorial representations (e.g., slide projections of the Moscow buildings). Agency is distributed to actors and programmed effects, which become virtual actors in the performance, as they contribute actively to the formation of action. The stream of light animations accentuates and amplifies the collage/montage effect of the textual script. Collage/montage breaks with the linearity of a movie. The spatial distribution of lighting and projections results in a spatial collage of physical action and media, where temporality is scripted and programmed. While this particular musical performance maintains the traditional performer-spectator relationship, approaches to the theatre have been developed where "for each production, a new space is designed for the actors and spectators. Thus infinite variation of performer-audience relationship is possible" (Grotowsky 1969), p. 19-20).

The second case reveals additional emerging aspects of mixed media spaces by situating them nearer to everyday life. Architecture students create interactive installations to objectify, present, and discuss their design projects. Installations are inherently different from staged performances, as they engage the spectator bodily, allowing them to turn into co-players (cf., Suderburg 2000). This is evident in some of the installations the students produced, such as the "train ride" or the "soccer game". The created media space is designed to be inhabited and interacted with, also by spectator-participants. The opportunities for interactivity space and technologies provide invite improvisation. Only part of the performance or presentation is scripted, pre-configured in digital associations of physical inputs and multiple projections. What also distinguishes the students' work from the theatrical performance are some of the functionalities the more advanced technological environment provides. The students were able to integrate physical artefacts in their perform-

ance in dynamic ways, through equipping them with barcode and/or sensors or by "painting" them electronically in real time.

The examples from the architecture class also move beyond the traditional 1:1 scale of a staged performance. The examples how the creation of immersive installations resulted from: enlarging a small detail, or scaling a large building down to the size of a person; using multiple projections differently in space resulted . Finally, while in staged performances the represented places may be imaginary and physical location and features of a site secondary, in everyday use it may be important to convey and re-produce specific qualities or features of a site. Students recreated spatial features of remote physical locations.

Based on these observations we single out some features that characterise performative uses of mixed media spaces:

Simultaneousness of *presence and representation*, *experience and action*: Spectators and presenters in the *Atelier* trials became part of the representation. Bodily presence is important for both, how participants perceive the staged situation and how they contribute to the representation.

Directing digital media in space using interactive artefacts: Before our interventions students used projectors for slide presentations, moving to the next slide with a keyboard key. In the trials a variety of interactive artefacts enabled them to direct digital media in real time on multiple projectors.

Staging and performing mixed objects: Physical artefacts were staged, linking them with digital scenography and providing them with digital costumes. Walkthroughs with a camera through artefacts, such as a physical model, added a performative element to them . This resulted in a , dynamic process, through which students experienced physical representations of their evolving design (rather than a product or static representation).

Roles of participants and authorship: Activating the spatial dimension of media environments and working with them invites people to participate in the performance, either being present in the space or assuming a specific role. This problematises the notion of authorship since spectators can turn into performers.

Scale and immersiveness and site specificity: Scale and immersiveness are important aspects of mixed media spaces. They enable participants to e.g., enact a scene/use situation in a life size environment. Real size is to do with bodily presence. It is not scale in the geometric sense that matters but immersiveness and realism. The possibility of blowing up small details or scaling down pictures of buildings to the size of a person lets objects and their environment mutate in surprising and inspiring ways (Rumpfhuber & Wagner 2004). Another issue is the unusual view onto an object or scene that can be achieved by e.g., using the (web)camera as an artificial eye. This is one of the ways models can be staged.

Temporality and reproducibility: This is a central aspect of a theatrical performance, which enacts a script within a pre-configured environment. In the mixed media examples we described, agency and interactivity are distributed spatially, with a multiplicity of outputs and control points. But also in this case webcams may be used for recording changes made to the space or to an object.

Spatial narrativity: As audio-visual material is configured spatially in a mixed media space, the stage becomes part of a narrative. The story unfolds and can be read in the space architecture as well as in the images and sound that are produced. Spatial features

are carefully prepared to co-adapt physical and digital artefacts. The space turns from a passive background into an active element of the performance.

4.2 Design Challenges for Human-Computer Interaction

Traditional human-computer interaction approaches, in the attempt to evaluate the usability of products for people, tend to see the person as a "user" and the product as a "tool", where the latter one is used to accomplish a task (cf., Jordan 2003). The trials we reported on brought the spatiality of interfaces with a multiplicity of inputs and outputs into focus, where all - performer *and* spectators - participate in the interaction. As physical interfaces spread into the environment of space and artefacts, it becomes problematic to reduce applications to a tool. Moreover, complex situations such as the ones we have described, cannot be reduced to a task (cf., Dourish 2001). The configurability of these physical interfaces potentially turns the user into director, scenographer, and architect. Finally, the fact that in such an environment sensuous experiences, including the body, become central, make use a limited concept.

Experiments with physical interfaces such as ours invite "radical" explorations of the ways space, artefacts, and digital media combine in new experiences, which seek to address our senses more than our analytical thinking. This resonates with Dewey's notion of sense (Dewey 1980/1934 p. 22):

> ""sense" cover(s)ing a wide range of contents: the sensory, the sensational, the sensitive, the sensible, and the sentimental along with the sensuous. It includes almost everything from bare physical and emotional shock to sense itself – that is, the meaning of things present in immediate experience"

Our findings also move beyond a reflection-in-action perspective (Schön 1983). Performative interactions build upon people configuring, acting in, and perceiving mixed media spaces, in addition to talking with the design material. The performative arrangement of (moving) bodies, projections, and physical artefacts creates a sensual experience of grasping, touching, painting, moving, smelling, hearing, while at the same time being immersed in changing contexts. Spectators are no longer restricted to the role of external observers; their bodily presence makes them part of the performed presentations and representations. As one of the architects pointed out, design work involves playing around with moods and emotions. Students' experiences with staging and perceiving a situation from within open up a new view of computer technologies and of situated action.

The relevance of these elements for ubiquitous computing and other technology development programs is to challenge established imperatives. The notion of user, and the clear distinction between users and designer, is no longer sufficient for explaining the roles people may assume participating in the production and performance of mixed media spaces. While technology, such as in our case the VariLite system or the *Atelier* environment, is still designed by some people, other people configure and reinvent technologies to create interactive spaces, where these and other people perform in social interaction. The notion of user is further problematised by the fact that the system interface no longer

is the prime stage of action, since the whole environment becomes included in what traditionally is termed interface. While all these notions are still applicable to the cases we presented, they are distributed and arranged in novel ways. Mixed media spaces, which are composed by a collection of systems, artefacts and infrastructures, are designed, configured, and performed. The interface does not exist singularly. A *multiplicity* characterises actions and reactions, inputs and outputs. Finally space is not merely part of the context of use, a "found space", but is consciously exploited in disposing narrative elements and affordances.

Acknowledgements

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