7 The Performance Animation Toolbox: developing tools and methods through artistic research

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Introduction

The Performance Animation Toolbox project is an artistic practice-based research project carried out in the Narrativity Studio at the Interactive Institute in Malmö, Sweden. The project was based on a series of performance animation workshops held from autumn 2001 until summer 2002, followed by two experimental productions in autumn 2002. The core research team was two researchers from the Interactive Institute, Marika Kajo and Jorgen Callesen, and stage designer Katrine Nilsen.

The aim of the project was to create a 'digital theatrical art laboratory' to investigate and develop the artistic potential of theoretical concepts within digital dramaturgy that involve real time animation, tracking systems, role play, virtual puppets/actors and responsive set design. We wanted to make such techniques both functionally and financially more accessible, and to make artists realise how to implement them in their work. The long term goal is to integrate performance animation into modern dance, physical theatre and puppet theatre starting from the performer's traditions, abilities and knowledge.

The project drew from our experience with the theory and practice of improvisational theatre, pedagogical drama and puppet theatre to ensure that the technological concepts were grounded in a theatrical tradition. Through collaboration with stage designer Katrine Nilsen and a range of performing and visual artists, we wanted to develop new types of theatrical situations that integrate the possibilities and aesthetics evolving from digital media.

The main challenges were to bridge the gaps between research and production, and between theory and practice, involving professionals on all levels. It should not be theoretical studies supported by simple prototypes and it should not be full blown productions with very limited opportunities for experimentation—but something in between.

The project went through the following steps:

1. the establishment of performance animation as a model for interdisciplinary work;

2. the development of a technical set up, and a combined design and research method;
3. the definition of theatrical communication within mixed reality environments;
4. experimental research based on practical workshops in collaboration with artists;
5. the production of two experimental performance pieces.

Performance animation as a model for interdisciplinary work

The project evolved from our individual theoretical and artistic approaches and we first had to test some of the ideas through the development of possible theatrical situations. Through a series of meetings with artists, designers, technicians and platform developers from the Interactive Institute we created a method and a modular toolbox concept based on performance animation technology.

Performance animation is a term adapted from animation film production, where motion capture data recorded from a performer's movements is used to create 3D-animation for film, computer games, TV and advertisements. In this project the term is used in a much broader sense, covering various aspects of physical interaction influencing real time computer generated sound, film and animation projected onto the stage.

So far this field of artistic practice is new territory where the borders between technology, dramaturgy and aesthetics are blurred and highly dependent on each other. To us it is a world of unexplored artistic possibilities, new concepts for physical interaction and theatrical communication, but the field is still very immature in relation to stage arts. To gain an overview we started by making a map

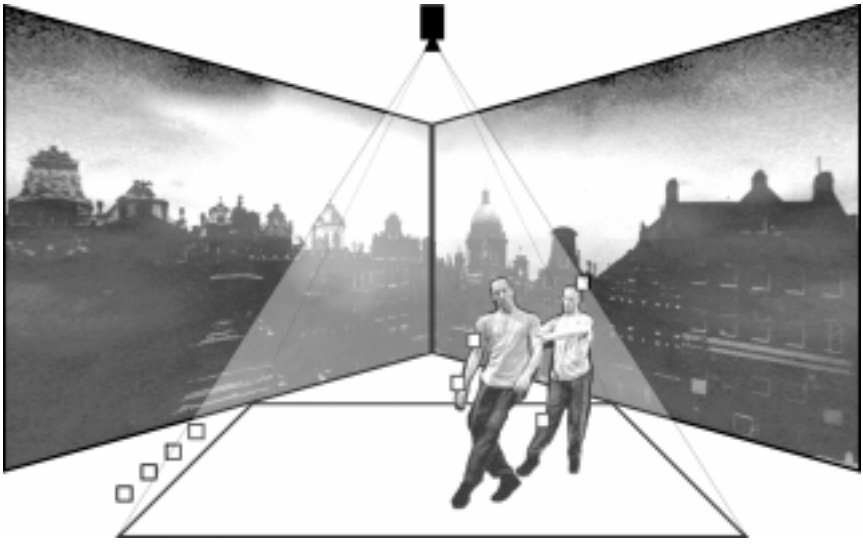

Figure 1. Performance animation as an art form combining technology, dramaturgy, aesthetics and design. (See Top view in Figure 2).

of the interdisciplinary field between electronic engineering, theoretical research and artistic practice based on a simple theatrical situation, where a performer is influencing the set design through sensors.

Every running interactive system can be broken down to the three categories: sensors, dynamic systems and audio-visual expression. We wanted to give the artists involved a chance to consciously know 'what happens inside the black-box' and the

	dramaturgy		*aesthetics/design*
technology	*sensors/mapping techniques*	*dynamic systems/databases*	*audio/visual expression*
	Magnetic MoCap Video tracking Infra red Joystick Temperature Touch pads	Inverse kinematics Steering behaviours Games / AI State machines Self organising maps	2D/3D graphics Character design Digital set design Trick film Sound design Electronic music

Table 1.

consequences for their dramaturgy and aesthetics. Our model enables the whole research team to get an overview and to develop a mutual understanding of the general principles, separate from any chosen technology.

Developing a technical set up and a combined design and research method

Most of the tools for performance animation on the market are developed for professional character animation in film and computer games. It is new to use the techniques in a live situation where the performers are directly confronted with an audience or where the audience are invited on stage to use the equipment.

At present, performance animation technology is very complex and fragile. Compared to traditional theatre technology, it requires high-level specialists to operate . In many cases the tools cannot be implemented for the stage using 'normal' production methods. The creative team therefore often has to build their own tools.

In some cases standardised tools and media formats are too specialised for the needs of the stage, and there is then a need to reconfigure standard software for one's own purpose. In other cases the platforms are very open and contain possibilities that may not have been tried out by the software designers themselves, and there is a need to find a particular configuration and optimise it to a professional standard.

We wanted to create a method for a larger group of artists to develop and share their own customised tools, prototypes and experience in a coordinated mutual process. In this way the technology can be developed and tested from dramaturgic and aesthetic principles in a dialogue with electronic engineers and software developers.

The technical set-up

Setting up a format for theatrical experiments is like building a new type of stage, with new possibilities and restrictions. The basic elements were: real time animation (1600 x 600 pixels) creating a back projected image 7 x 3 metres on a screen; a floor space of 3 x 4 metres; stage lighting for the video tracker; and stereo sound (Figure 2).

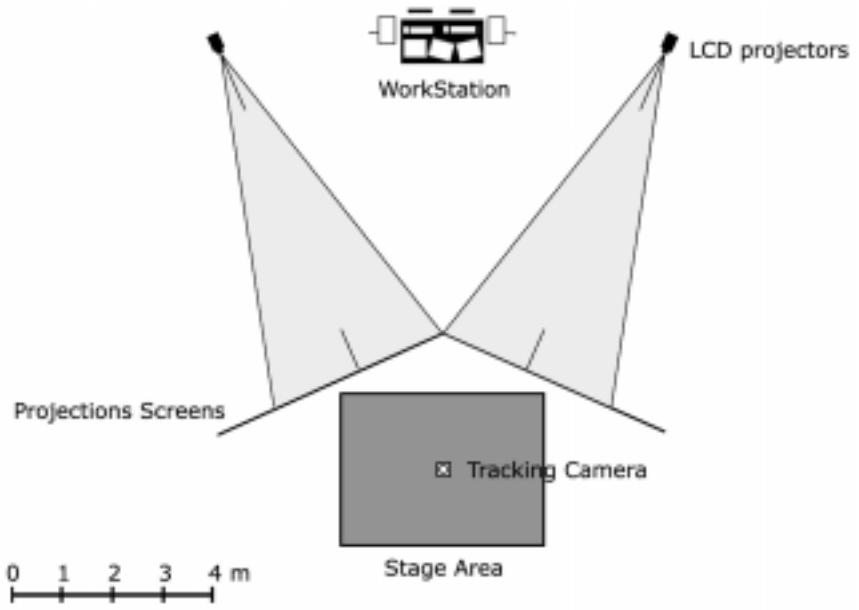

Figure 2. The technical setup defining the stage in the Art Lab. (Top view of Figure 1).

The audio-visual engine was based on the multimedia platform *Macromedia Director* with the ability to deliver real time animation and montage of a large variety of digital media formats controlled by a high level scripting language (*Lingo*). The choice of design was partly influenced by the limitation of the technical setup and the choice of *Director* as a real time animation engine.

The virtual design and the video tracking system

We decided to work with simple dramaturgic structures and ended up developing a number of prototypes for responsive set design and characters. In the design the style was a kind of 'virtual cardboard' design, very similar to old-fashioned puppet theatre, with different layers of two-dimensional set pieces and mobile elements or characters. This made it possible for us to create sceneries, with prefixed animations and different interactive elements.

A video tracking system called *Basker Vision* (programmed by Johan Torstensson) was developed to support interactive theatrical situations. The

tracking system feeds information about the performers on stage to the animation engine which generates a response. The video tracking system was designed to track colour codes worn by the actors such as *Basker* hats, full body dress, objects, etc. Their identity, position and relation to fellow actors and space were identified through the measurement of distance and view angle. The system handled three actors, the minimal size of a group, and was chosen to limit the complexity of possible interpretations of relations and movement. This also kept us within the technical limitations of bandwidth and CPU, so we could achieve acceptable live response for the actors on stage (Figure 3). All in all this was a very simple low-cost and low-tech set-up, but it proved to be fast, flexible and a good prototyping tool for the development of new staging techniques, tracking principles and media formats.

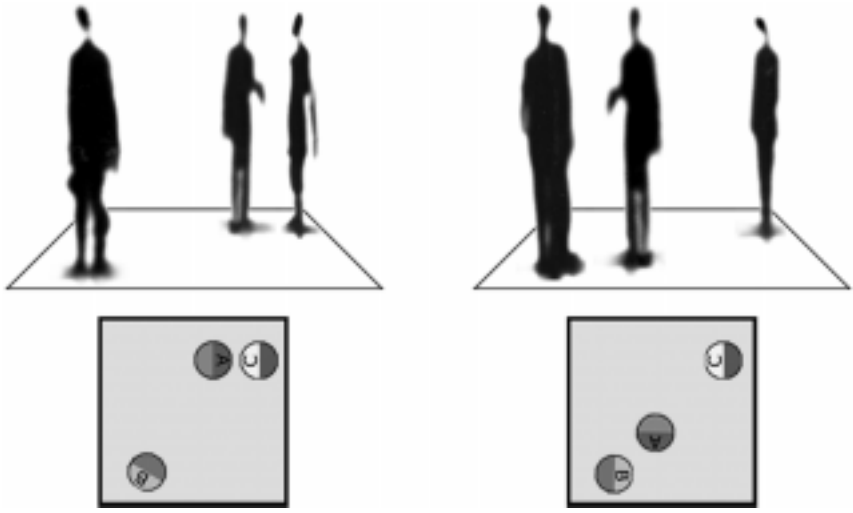

Figure 3. *Basker Vision*: a video tracking system registering the relations between the participants on stage.

Developing the research method

During the project we undertook a lot of activities, some in parallel and some in succession, ranging from free artistic experimentation, tool building and creative production, to theoretical discussions, methodology discussions and evaluation. For this there are no set methods and experiences to draw from, which meant that we had to define the methods as we went along, based on the backgrounds of the participants.

In the last evaluation session we created a more formalised process model giving an overview of the different phases in the project, showing the different hybrids between research and production, theory and practice (Figure 4). These hybrids could be a starting point for the development of a method for artistic practice based research.

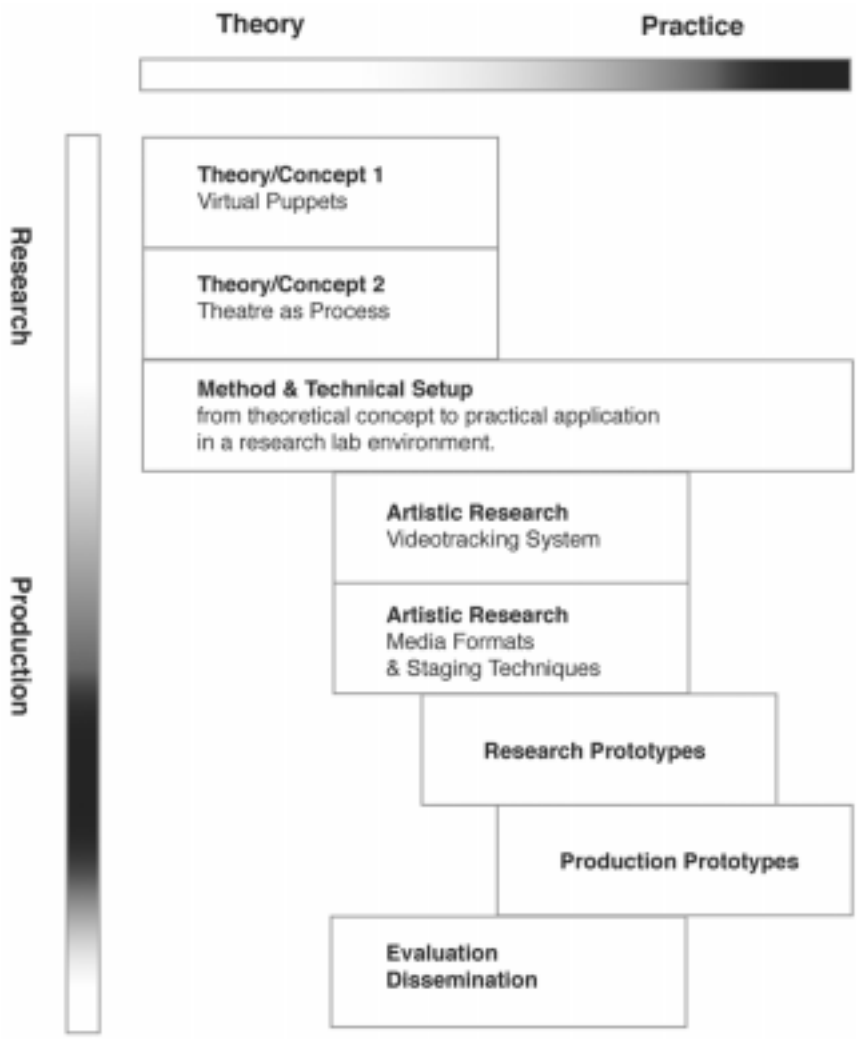

Figure 4. A process model for practice based research.

Theatrical communication in mixed reality environments

When you establish a virtual dimension on stage you deal with complex relations between virtual and actual representations of characters, space and the audience. The greatest dramaturgic challenge is how to make these relations clear and use them consciously when staging a play or a performance for an audience.

With the points of departure in our individual backgrounds, we took three conventional theatrical approaches to the experiments.

1. Puppet theatre, which deals with the materiality of the medium and different levels of representation.

2. Improvisational drama and pedagogical drama, which deals with the involvement and activation of an audience.
3. The concept of 'the impersonated stage', which deals with anthropomorphic space, blurring the border between space and character.

Following Brenda Laurel (Laurel 1993), who used Aristotle to develop a new understanding of the computer medium, we found it useful to base our research on an established description of the minimum theatrical situation: A (the actor) plays B (the character) for C (the audience) (Bentley 1976).

This model for theatrical communication is not introduced to try to define new forms of theatre, which would go far beyond Bentley's conception of the theatre. Rather, it is used in the experimental process as a method to maintain focus on the theatrical elements in the experiments. We see this simplification as a way to combine the three different theatrical approaches and relate them to the formal rules of the tracking system and the computer-controlled characters and space.

The concept of the virtual puppet

The concept of the virtual puppet is developed in the performance animation project *The Family Factory*, based on the theory and practice of the contemporary puppet theatre (Callesen 2003a). In this context, the term 'puppet' is understood as an object which is used to communicate something to somebody by representing something other than what it is. In puppetry it is well known that the audience's ascribing of life to an object does not depend on how well the object portrays an original. Neither does it depend alone on the obvious factor of the skilled use of puppeteering technique. The crucial point is the way in which the player relates to the object, not only formally and technically, but socially and emotionally as well. From a dramaturgical point of view another level of representation can emerge from these relations, the story told being not only 'the story of the puppet' but also 'the story of the puppeteer'. Puppet theatre is in its core a theatre of more than one level of narration.

The other important factor about puppetry is the materiality of the object: form, colour, weight, surface, smell, texture and history. The expression of an object on stage results from a synergy of all these factors. Social and emotional experiences, common to both the player on the stage and the audience, creates a base to recognise one's own experiences and invest one's emotions. In this way the audience can ascribe the puppet (human) characteristics and personality and see the puppet as a character with independent will, opinions, intentions and emotions (Lund 2003).

The concept of the virtual puppet suggests that virtual characters in the projections are also puppets made out of a special material, which is light on a screen (Callesen 2003b).

In *The Family Factory* four virtual puppets operated by puppeteers were projected onto stage in a performance together with human actors. The puppeteers were professionally trained to control the puppets and made them seem 'alive' by making them relate to their surroundings in different ways. This made the communication between the human characters and the virtual characters convincing and understandable to the audience.

It is possible to create computer generated figures which are very lifelike

models of living beings. Researchers in autonomous computer-generated behaviour are developing techniques to make virtual characters not only seem lifelike, but also seem rich in personality. The concept of the virtual puppet suggests this to be only one part of the problem. If the virtual puppet is controlled by a computer, the computer program will not only have to move the puppet in a lifelike manner, but will also have to do what the puppeteer does to the puppet: make the puppet behave and react to allow the participant to relate to the puppet socially and emotionally. These relations will have to be defined and used consciously.

The theoretical assumptions and the practical experience from *The family factory* project indicates that the material level of the virtual representation and the possible relations between objects, characters, actors and space (virtual or physical) is the foundation on which the possible dramaturgical constructions can be made. By using the puppet theatre as a theoretical point of departure it is possible to describe the different levels of representation in the virtual medium and the use of autonomous behaviour in a dramaturgical perspective (Andersen and Callesen 2001).

Theatre as process

The project also tried to integrate the audience on stage by working with theatre as a process. Bringing the audience on stage establishes a difficult theatrical situation. An actor (A) is trained to play a character (B), whereas the participating audience needs help to understand whether they are represented as themselves (A) or playing a character (B) for someone (C). Elements of the dramatic environment have to inform them of what to be and what to do, when to act and when to watch. The group also has a mutual responsibility to inform each other and to create the dramatic fiction together, as you do in improvisational theatre and pedagogical drama (Spolin 1963). The audience is put in a double role since they have to participate in the creation of the theatrical situation and to observe and experience it at the same time. In this experimental framework we call the new audience 'participants', but this is not satisfactory. In the future we need new terms to define how the participant relates to the complexity of relations and levels of fiction when experiencing theatre in mixed reality environments.

In an interactive drama, as well as in drama pedagogy, the intention and dramatic rules are normally introduced and skilfully managed by a director. We wanted to investigate whether a virtual actor (V-actor) can take over parts of this role and function as an artificial coach, represented by a virtual character or a responsive environment/scenery.

This V-actor has in many ways the same characteristics as the virtual puppet in the sense that the computer can take the role of the puppeteer. To become a proper V-actor it should have autonomous behaviour enabling it to possess the openness and ability to give and take or to imitate on the same conditions as the physical participants and thereby participate in the play and improvisation.

The final staging takes place as a process between the formulated dramaturgy and the participant's choices and intentions, in a mutual give and take. This principle is known as 'devising theatre'—good exponents of it are the British group *Forced Entertainment*, and it was used as a principle for interactive performance in

the digital theatre project at Århus University in 2001 (Kjølner 2002, Etchells 1999).

The integration of a virtual coach in a performance demands certain capabilities of the participants and the design of the V-actor. To give a sense of a 'live meeting' between the V-actor and a group of participants on stage we wanted to try out different kinds of autonomous computer-generated behaviours for the V-actor. Through the use of different technologies, such as self organising maps (Kohonen 1997), games, artificial intelligence and steering behaviours (Reynolds 1999) this might become possible. This is a long-term process where the technologies have to be integrated into staging techniques and developed through practice, trying out the possibilities step by step.

The main focus in this project was on the development of a video tracking system, analysing group behaviours, and on different artistic approaches to the embodiment of the V-actor.

The impersonated stage

For the stage design we developed the concept of 'the impersonated stage' to refer to the consequences and possibilities of the new technology and the ideas of interactive staging. The challenge was first of all to impersonate and transform the universe of a drama into a visually and emotionally interesting and functional medium for physical interaction on the stage. In 3D computer game engines it is possible to give the illusion that you are surrounded by space, because you are fixed in front of the screen. But how do you embody and translate this into a physical space without simply creating empty landscapes beyond the walls? The task is to establish a design with some kind of presence and situations with direct confrontations that encourage playing and acting.

The first important step was to clarify the dramaturgic settings and mechanisms and to make them work. At first the possibilities of our set-up seemed very restricting compared to those that used high-end equipment such as magnetic motion capture and real time 3D animation, but it soon became obvious that the challenge does not lie in the visual finish or the performance of the technology, but elsewhere .

When we started the experiments in the set-up we therefore built a simple and clear structure, almost a kind of mechanical 'engine', as we wanted it to be as physical and emotionally logical as possible to make it easier for the participants to understand and learn how to control the virtual set and characters. Through the involvement of participants and V-actors on stage, the designer could relate directly to the new theatrical situation. Even though we had a long term ambition to stage a play, we agreed that the new relations had to be defined and investigated before the actual character development and design process could begin. In this way the designer had to postpone her ambitions to create an elaborate visual design and instead partake in the development of the technical and dramatic setup. By testing different prototypes with very simple themes and visual embodiments, the technical and dramaturgic principles became clear to us, after which we could start optimising the design and increase the complexity.

Experimental research based on practical workshops in collaboration with artists

In the first workshops we went through a series of very free and experimental sessions trying out a lot of audio-visual staging and playing techniques, developing a repertoire to draw from in the workshops that followed.

CityWalk

In *CityWalk* (Figure 5) we used some ideas from handling backgrounds in computer games and converted them to something that we thought would work on stage. The material for the animation was a scanned photo of the Copenhagen skyline showing rooftops and chimneys. The scenery was created as two 'virtual cardboards', a sky and a the city placed one in front of the other, like set elements, to give the illusion of depth and perspective.

This was hooked up to the video tracker and animated by the movement of the participant in the following way. If you stayed in the centre of stage nothing happened, you were at rest, but as soon as you moved away from the centre you would start to move around in the city. This involved moving a photo, twice as long as the visible scenery, in the opposite direction as the performer. The further you moved away from the centre the faster you would move over the city. This seemed to be a very efficient format for a responsive digital set.

Furthermore we wanted it to be possible to walk or zoom into the city. But this did not work out very well in this particular technical set-up, so instead we made it scroll up and down, so that the whole town seemed to rise when you approached and sink when you moved away.

CityWalk was effective because the participant gets an immediate response by moving around the space and therefore easily learns how to play with the effect. The dark and gothic style gave it weight and substance. It was suggestive, imaginative and created a sense of presence. We concluded that it had some dramaturgical potential: it could be useful both for a group of participants, and for a sole performer with the cityscape as a responsive backdrop.

GroupSound

With reference to devised theatre the aim with this prototype was to embody a V-actor as a device for interplay with the group of participants. We set out to embody the V-actor as a visual responsive impersonated space that would change dynamically depending on the behaviour of the group on stage. We soon realised there is a problem in balancing attention between the group and a projection. In many cases the images in the projection would attract the attention of the group, rather than stimulating the participants to relate to each other. By creating a non-visual soundscape we solved this problem because it made possible ambient and imaginative omnipresent expressions of space.

In the first prototype of *GroupSound* the space was divided into zones with different sounds. The zones were circular starting in the centre of the stage and expanding outwards. The quality of sound changed from a positive to a threatening sound as a person moved outwards. If a participant was present in a zone its particular sound would be activated. The number of actors within the same zone determined the volume of its sound.

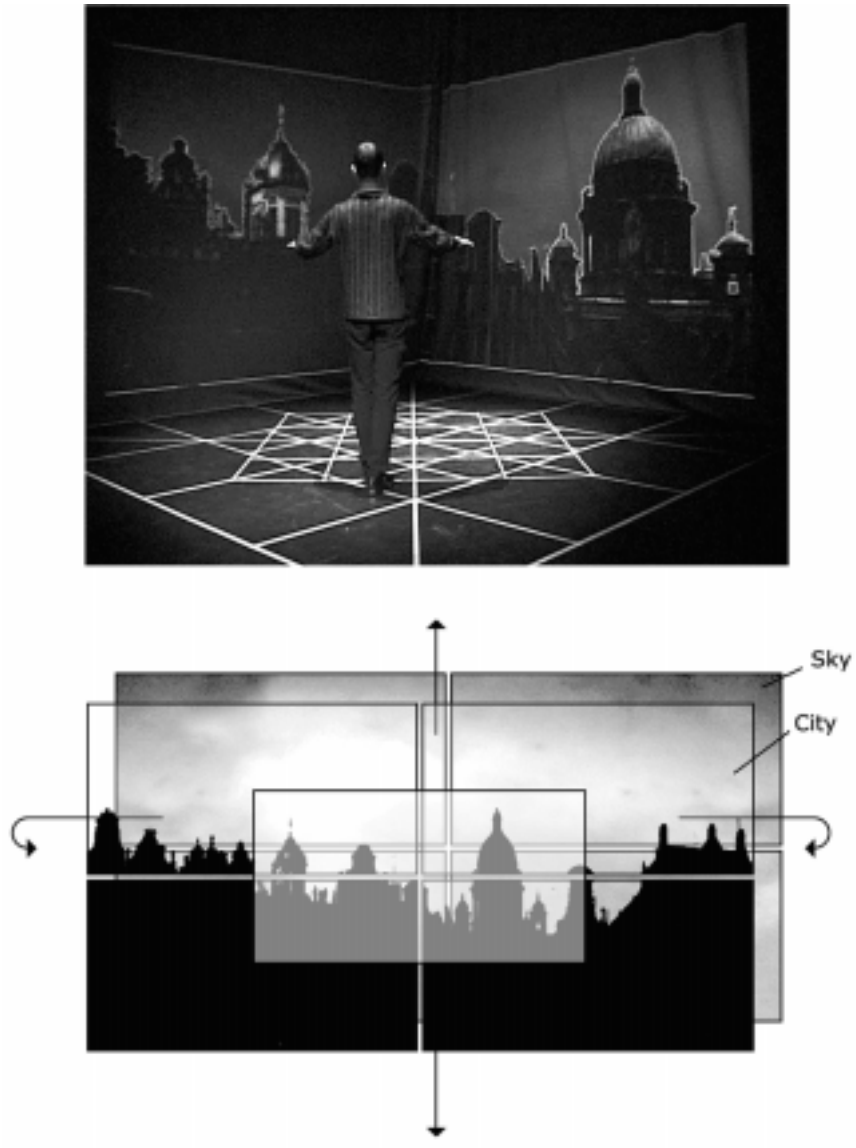

Figure 5. *CityWalk*: navigating in a cityscape through movement.

In tests the soundscape proved to be a good way to direct the focus towards play and negotiation among the group, stimulating varying improvisations. Gradually the participants developed an intuitive feeling of how to manipulate the soundscape, both as individuals and as a group.

Red sculpture

The use of physical objects as an interface is another way of directing the focus of the group and working with physical material as a link to a virtual soundscape. This was tried out in a performance art project in collaboration with sculptor Pierre

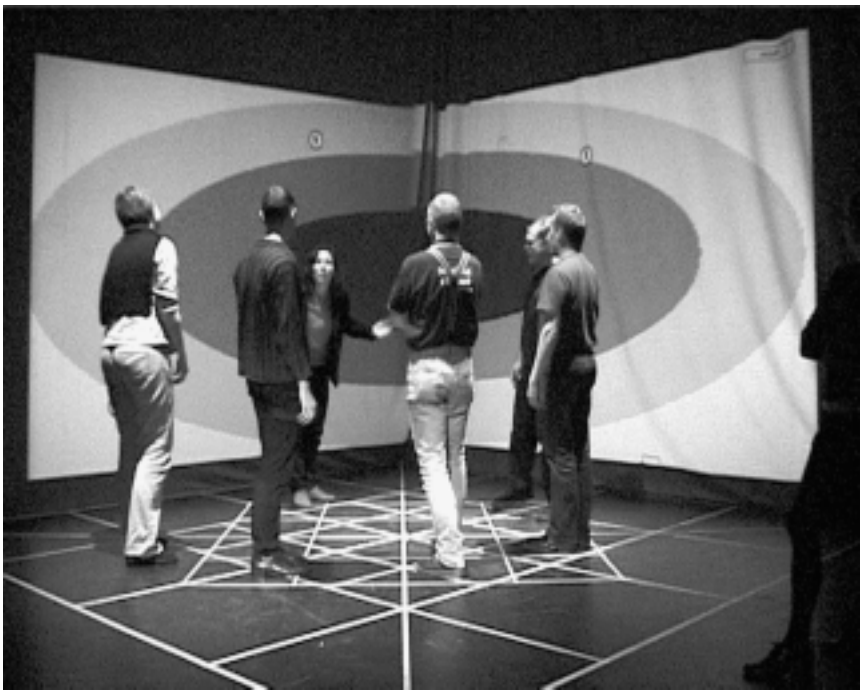

Figure 6. GroupSound: a responsive soundscape for group improvisation. The visual representation shown in the picture illustrates the principle used during the construction. In the finished soundscape, the screens are dark.

Treille and puppeteer Gabriel Hermand-Priquet and the *KeyStroke* software team at Ecole supérieure de l'image (ESI), Angoulême, France in 2002. This project used video tracking and a multimedia platform *Keystroke* that worked through similar principles as our setup for the *GroupSound* prototype. Instead of tracking the participants on the stage we tracked a flexible red sculpture manipulated by two performers. Different positions and configurations of the sculpture would then trigger and modulate a digital soundscape, designed for the piece, which was performed for an invited audience.

The following description is taken from the evaluation report of the workshop.

> *The austerely choreographed, semi-ritualistic duo of the two dancer-manipulators (Jørgen Callesen, Gabriel Hermand-Priquet) during the Friday evening performance generated an effective embodied counterpoint to the interactive sonic space, which evolved with the movements of the red sculpture. Simplicity of the movement sequences and sound components allowed the audience to quickly and effectively grasp the logic behind the various elements (performers, sculpture, sound), enhancing engagement in this interactive dance performance. (Norman 2002)*

This experiment showed that an audience is able to grasp quite complicated abstract relations between physical and virtual levels of representation if they are choreographed and staged using known conventions—in this case a hybrid between sculpture, dance and puppet theatre.

Figure 7 Red sculpture: performance art in a sonic space.

Research prototypes

The problem with artistic practice-based research in academic environments is that the research team often lack the practical knowledge, experience and artistic skills to be able to define the research questions and carry out meaningful experiments, seen from the perspective of the production environments. In this project we aimed rather to find out how a person with artistic skills would define the research questions and carry out experiments in the set-up.

This was mainly done in a 3-day workshop with performers, technicians, directors and designers from Sweden's free theatre groups as part of the theatre festival KONKRET in Malmö, 3–5 May 2002. For this workshop we prepared a series of artistic prototypes to demonstrate the principle of performance animation in the particular setup. It was then the task of the invited artists to define a project and a research question in collaboration with the researchers. During the three days of the workshop we produced five different prototypes. The results were shown to an audience and discussed among the group with invited evaluators who had a background in theatre and performance. The results were finally published on a CD-ROM (Callesen, Kajo and Hallborg 2002).

Dancing shadows

Dancing shadows was made as a collaboration between modern dancer Peter Jul Nielsen from Copenhagen and Jorgen Callesen. It involved a trick film, showing a pre-recorded sequence of the dancer, which was animated by two principles: the speed in which the trick film was replayed would follow the speed of the performer; and the position in which the film would be shown would move in the opposite direction as the performer.

The movements and speed of the trick film were influenced by a dynamic model, giving it elastic resistance, which made it fluent and added plasticity to the movement. *Dancing shadows* was extraordinary effective in spite of its simplicity. By entering the space you got an immediate response and feeling of 'contact' with the shadow. It shows both the potential for a performance where dancers use the virtual shadow as a partner for a choreography and also for an installation that invites the audience to participate by stimulating them to move in space and even dance themselves!

The *SheMonster*

As in *Dancing shadows* the principle behind this prototype was also very simple. When you walked across the room a woman would flirt with you but when you went closer to her she would gradually transform into a monster. This was done as a trick film consisting of 72 drawings made by animator Anna Kellert from the Department of Animation and Animated Film, Eksjo, Sweden. The playback of the animation was influenced by a dynamic model, to make it more fluent and to give it life (Figure 9).

This prototype shows that traditional frame animation can work very well for performance animation if it is designed for the space. It can be used by an actor or a puppeteer for a performance with a V-actor but will, of course, need to be developed and integrated into a story. It will also work very well with the general audience as participants, because even though the story is revealed very quickly it does not unfold its nuances until you start moving in space.

Heaven and Hell

With *Heaven and Hell* we moved from a responsive space to space as an abstract character with autonomous behaviour. The intentions were to create a mood space, where the space had an attitude to the group of actors and the way they behaved on stage. The dramaturgy was based on a gradual movement from positive to negative energy. The mood space should be controlled by the output from the *Basker Vision* video tracker parsing information about behaviour from the individual and the group as a whole. The idea was that it should react differently if the participants face each other, turn away, are close together, move slowly or fast, etc. (Figure 10).

The V-actor was not intended to be an artificial actor with naturalistic human features, which is often the chosen embodiment in many projects dealing with autonomous agents. Depending on the chosen dramatic universe the V-actor can be open for play and negotiation in many different embodiments such as an audio-visual character, as abstract material, anthropomorphic space, a physical object, etc. To investigate possible relations between a group of participants and a V-actor, two types of embodiment were designed: a responsive space; and an abstract character with autonomous behaviour. We discussed using ambient expressions as texture, colour and light but, with *Director* as the animation engine, we ended up making an animated abstract space based on the principles from *CityWalk*.

To focus the attention of the participants, a mystical virtual character, a kind of big black spheroid with autonomous behaviour, was introduced. The spheroid could be pre-programmed for different movement patterns, depending on which

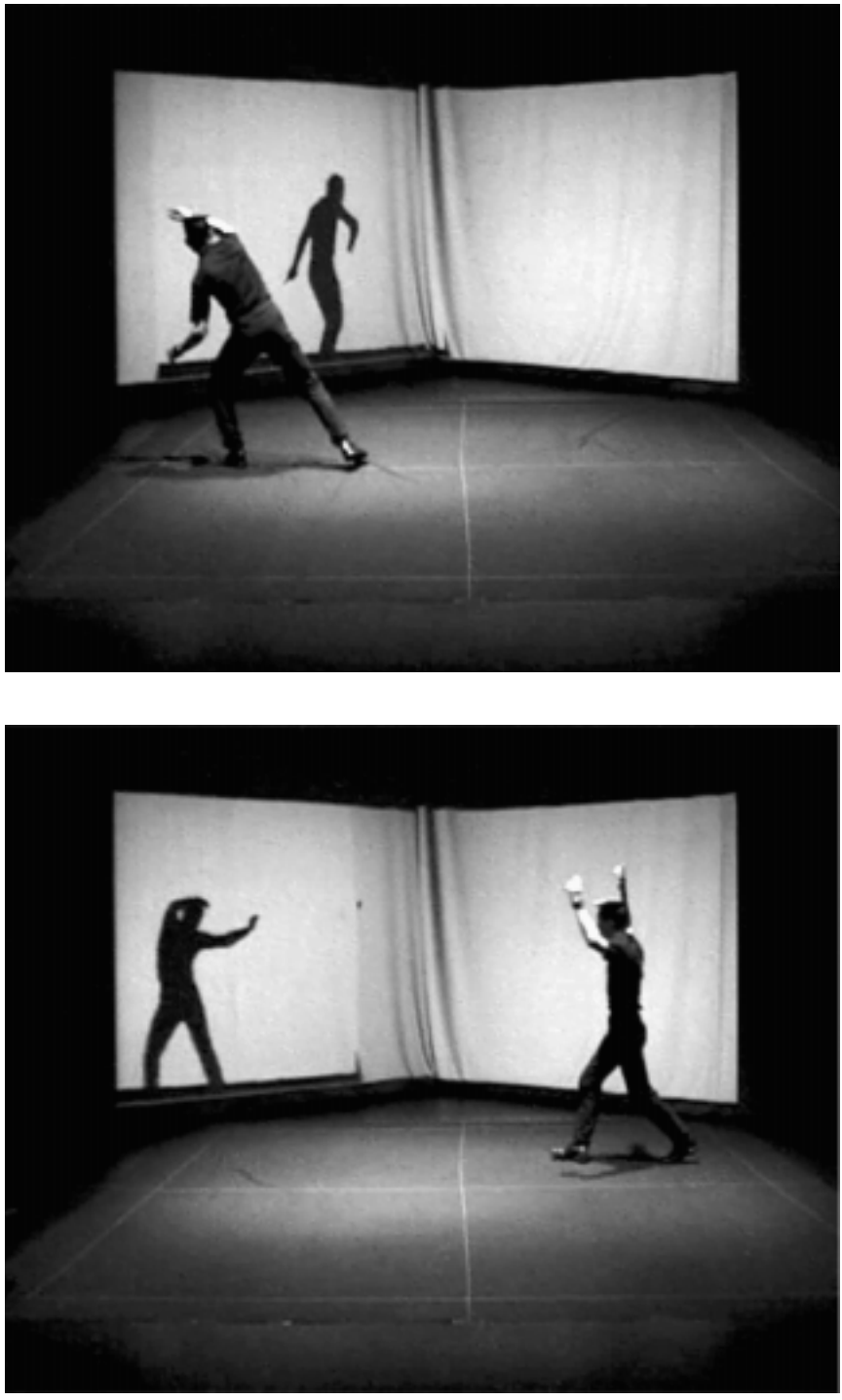

Figure 8. Trick film of dance sequences animated with movement from dancer.

relations to the performer or the group we wanted to respond to. Its dynamic movements were created by autonomous steering behaviours (Reynolds 1999). In the first version it floated back and forth in a predefined horizontal path, repulsed and activated by the movement of the participant on the stage. It looked as if the spheroid was gently pushed and pulled around the stage. In other versions, the scenery was an animated background. By scrolling up or down it could bring you either into Heaven or down to Hell, as a result of interaction with the spheroid.

When designing *Heaven and Hell* we did not have high expectations of what it could achieve. Partly because we had not yet tested the final version of the video tracker, which could register eye contact and more advanced group behaviours. We therefore did not really know what we were designing it for. The available techniques in *Director* were so crude that it was likely that it would quickly reveal its almost mechanical nature, making it difficult for a trained actor to work with and uninteresting for an audience to watch. But when we finally tried it out, we were surprised to realise that its simplicity was what made it so easy to interact and play with, and we had a magic moment together!

Two experimental performance pieces

In the final phase of the project we had the opportunity to produce two experimental pieces based on different elements from the prototypes: an altered version of *Heaven and Hell* as a responsive set design for a dance improvisation, and the interactive ghost story *Spirits on stage*.

Heaven and Hell for an open dance improvisation

We were invited to test *Heaven and Hell* in an open dance improvisation with a group of three dancers at Skaanes Dance Theatre, Malmö, Sweden. For this event we designed two production prototypes working with dynamic relations between the group and the black spheroid. The space would then show its attitude towards the group by changing between Heaven and Hell according to the constellation of the group.

In the first version for three dancers the spheroid was programmed to act as if afraid of dancer A, but attracted to dancers B and C. The space would appear happy (Heaven), if the spheroid was close to B and C and unhappy (Hell), if it was obstructed by A (Figure 11). The dancers wore costumes in red (A), dark blue (B) and light blue (C). The spheroid was repulsed by the red dancer (A), who could scare it away whenever it tried to get near the two blue dancers (B and C). When the two blue dancers were alone on the stage, the sphere would try to go to the closer one. This way the two dancers could either fight to get power over it or mutually manipulate it like a string puppet. Each of the dancers could also interact alone with the sphere, according to whether they repulsed it or attracted it.

In the second version for a solo performance the spheroid was interested in dancer A, but afraid of direct confrontation (Figure 12). A single dancer wore a two-coloured costume with a red front and a blue back. The sphere would follow the dancer whenever he turned his back, but rapidly move away as soon as he turned and faced it. This made it possible for the dancer to create a game of flirtation and peek-a-boo by turning front or back. The dancers invented another

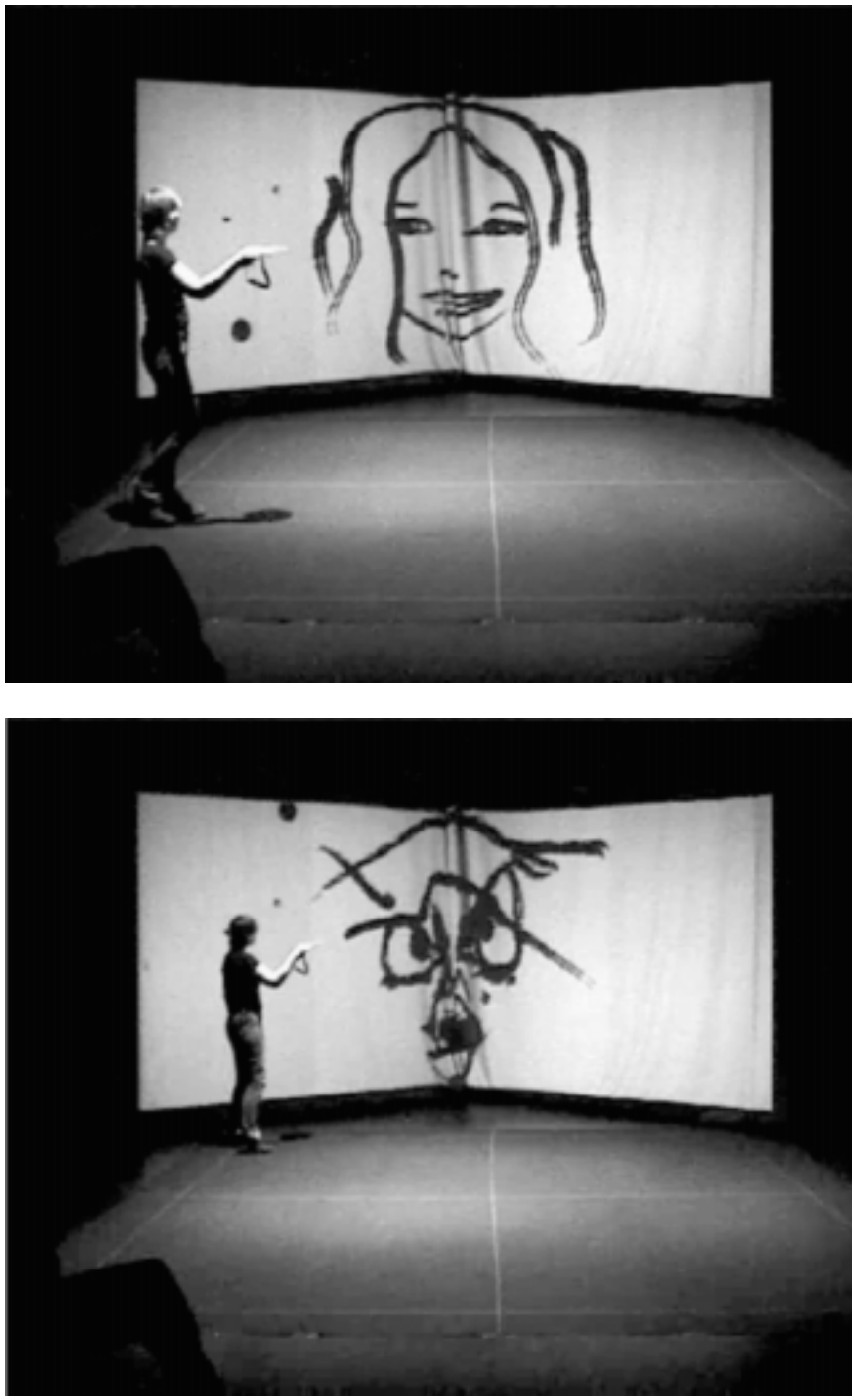

Figure 9. The *SheMonster* was also created at the KONKRET festival from an idea by director Christina Evers, Lilla Teatern, Lund, Sweden.

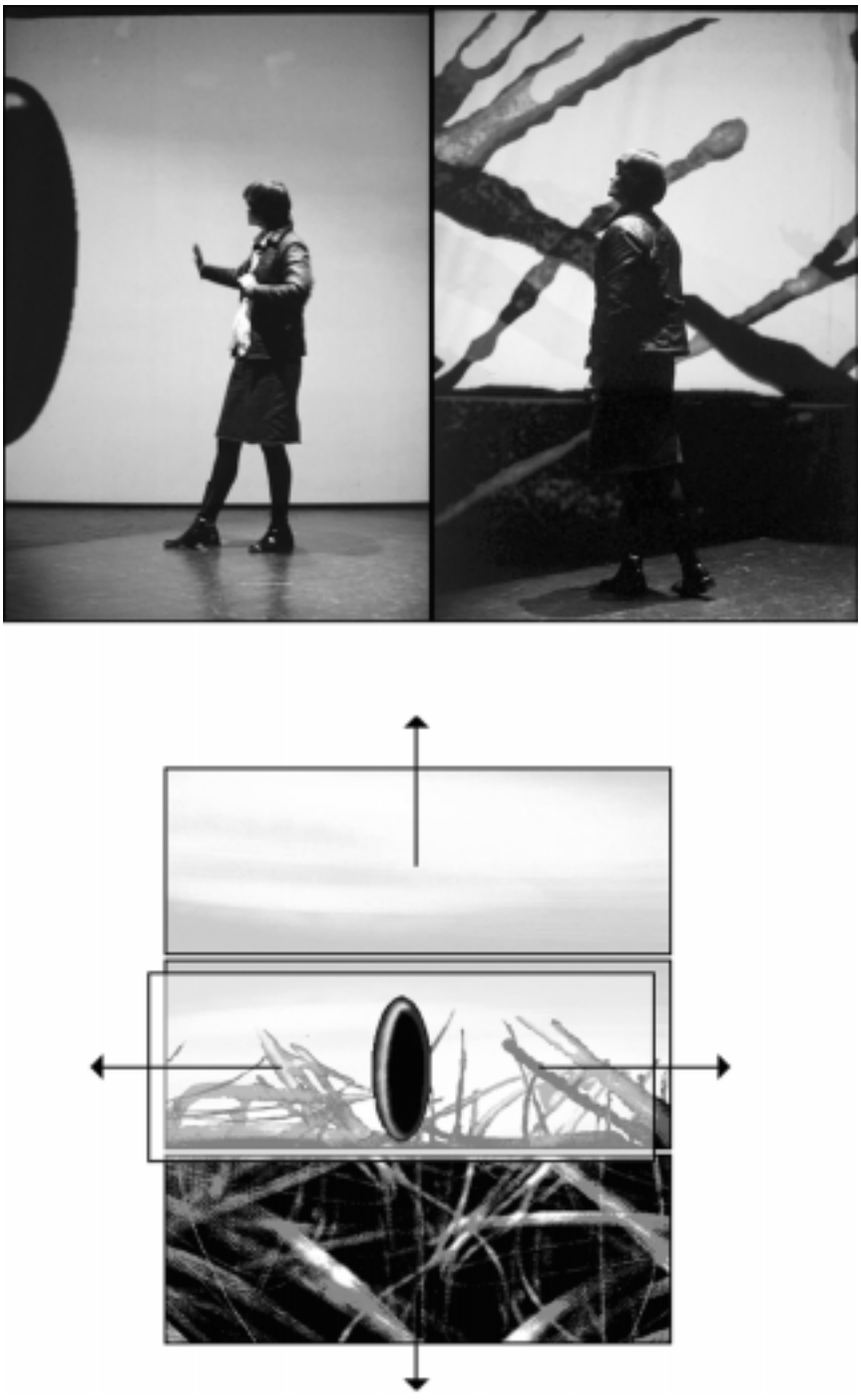

Figure 10. *Heaven and Hell*: the mystical spheroid in relation to the responsive space.

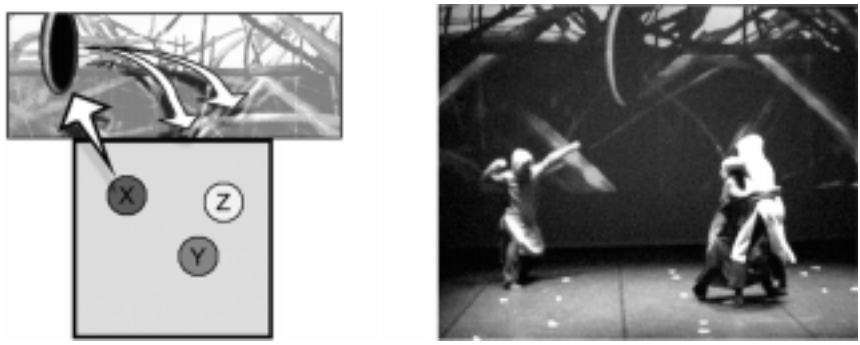

Figure 11. The spheroid is afraid of dancer A, but attracted by dancers B and C.

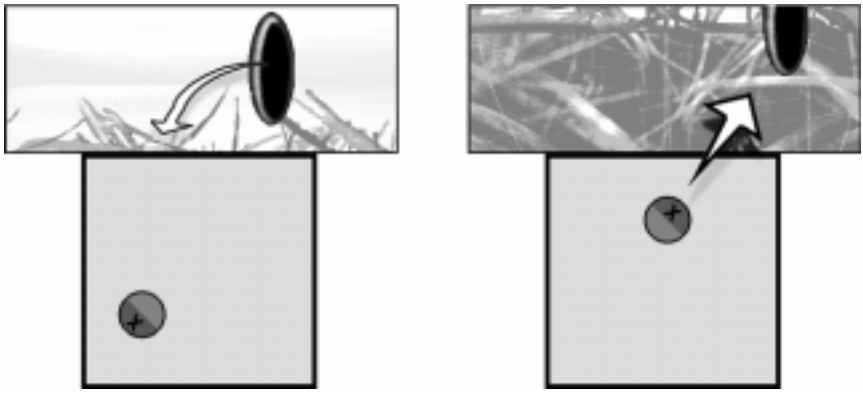

Figure 12. The spheroid is curious about dancer A, but afraid of direct confrontation.

variation of this, by introducing two more dancers, one wearing a red and one a blue costume, making it in to a rare kind of *pas de deux* or should one say *ménage à troi*.

In the performance we again experienced the problem of balancing attention between the group of performers and the projection. The V-actor constantly demanded attention from the performers. To improvise freely they needed a longer rehearsal period to develop an intuitive relation to the virtual space and character. This would enable them to work with it even when it was out of sight. Another way of solving the problem would be by developing other ways of integrating the projection into the set design.

Spirits on stage

In spring 2002 the research group was contacted by a producer from the Malmö City Festival, who wanted to involve installation and performance pieces with digital media in the programme. The Cultural Arena is located in a circus tent in central Malmö and seats 300 people. The repertoire is normally theatre, dance, rock music, stand-up and cultural events, but this year they wanted something new—

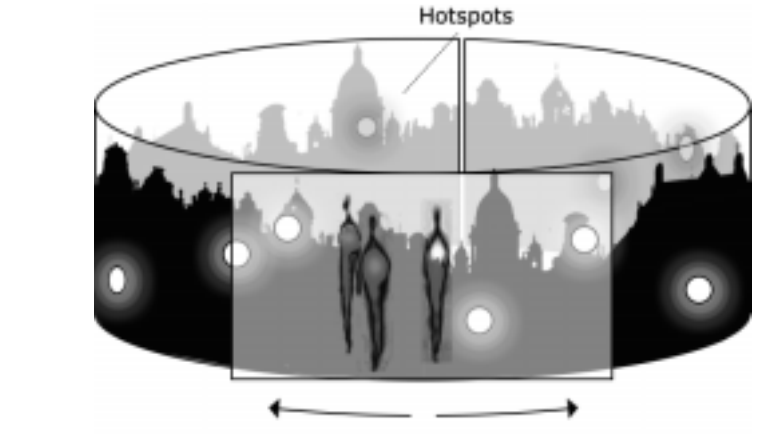

Figure 13. Ghosts, hotspots and 360 degree panorama.

something that involved interaction with the audience and related to digital culture and media. With a point of departure in our research prototypes, we decided to produce an interactive ghost story *Spirits on stage* for the circus tent. In this phase the method was far more production oriented. The goal was to create a great experience for an audience with the available material and tools.

Spirits on stage was designed as a narrative cityscape for audience participation as well as for a traditional passive audience. We agreed to make a prototype for an installation that stimulated audience members to perform on stage in a way that would be spectacular enough to engage the passive audience. We also made an agreement that the installation should be presented as an experiment since it would be the first time we tried out these staging techniques on an audience.

We decided on the *CityWalk* as a point of departure, introducing some kind of group dynamics in relation to a storyline. The installation would be on stage for only two hours, therefore the principles had to be simple and clear and the idea had to be easy to grasp to be sure not to lose the audience.

The result was a ghost story taking place in the city of Malmö, transformed into an enchanted town, that emerged at the stroke of midnight and vanished at dawn. Everybody knows ghost stories, they are small often mythical narratives related to certain locations and their history and can be linked together in a non-linear way. Furthermore the audience could easily relate to known locations from their own city.

The intention was to make a humorous, slapstick interpretation of everyday situations and places that had a special identity. The statue on the plaza would come alive, money would rain outside the casino and you would discover a corpse in the old bath house, see a flying U-boat in the harbour, an exploding TV in the council flat or dancing chillies in the shawarma bar. Locations were selected for their ability to tell a small story.

With the help of game designer and programmer Simon Løvind we optimised the *CityWalk* prototype to run smoothly with a 360-degree cityscape, which was created as a photo-collage in four thematic sections with different

Figure 14.
(*Top*) The cityscape with hidden ghost stories.
(*Bottom*) A story unfolding: 'The water tower turns out to be an UFO'.

locations and elements from around Malmö. Each section was identified by a significant ambient soundscape and held hotspots for 5 or 6 different ghost stories (Figure 13).

There was room for three participants at a time, who became their own ghost by dressing in a colour-coded 'ghost cape'. For each ghost cape there would be a ghost avatar in the virtual set. These ghost avatars were made out of light, following the person on stage like a torch. In this way each person was embedded in the story and was able to 'see' in the dark. A montage was made where only the contours of the city were visible. The ghosts would then light up the details by walking through the city, inviting the participant to explore the space and find the hidden ghost stories. To give each ghost an individual appearance and a character they were pre-animated in a short loop and marked by a distinguishing sound, activated whenever they touched one another. With the beating heart of the individual ghosts the three participants could find the active areas and trigger the ghost stories, which would only appear once during each session.

Each ghost story had three levels of presentation: a single sound or a slight visual change signalling the presence of a ghost story; a second sound level and an animated visual effect giving an introduction to the story; and the full story. No matter which ghost or collaborating pair discovered the hotspot, the first level appeared when a single ghost enters, the second level when two ghosts enter together and the third level when all three ghosts enter together.

For the participants to pan around in the cityscape a navigation control panel, designed as buttons for forward and rewind, was placed on the floor at the front of the stage; still within sight of the tracking camera, but outside the visible area of the virtual scenery. By standing on this control panel the participants were able to move the panorama to the left or to the right at different speeds. The different choices of navigation in the narrative cityscape gave interesting opportunities for the group to negotiate where and how to move together on stage. The participants' ability to play their part also had a great impact on the installation as playground as well as for the audience observing the event. Even though we ended up having a commentator introducing the participants one by one to their virtual ghost and showing them how to navigate, we noticed that after a while the rest of the audience soon learned the rules by watching from outside.

It was a different situation to be partaking on the stage than to be watching it from afar. By entering the stage the participants were part of the action, but they also lost the overview of the full picture because of the size of the details and the short distance to the projection. To regain the overview, they were forced to step back out of the scene, which brought them out of control with the action. This is an interesting dilemma of a participating audience which we would like to investigate further.

Conclusion

Having gone through all the phases in the process model, we have provided some theories, methods, tools and products that shed some light on what happens when visions about new theatrical concepts are tried out in real life.

In this project we did not produce actual works of art, but we have achieved something, which in our opinion is a necessary precondition. We have established a frame where theoretical, technological and artistic concepts can be tested under production-like circumstances.

On the question whether you can conduct this type of experimental research within the frame of normal production conditions or in academic research environments, we are likely to say, No. To develop the prototypes we have crossed a lot of boundaries between theoretical traditions, artistic disciplines and professional boundaries in production teams. This has taken a lot of resources, but has also given us insights in how to deal with different types of creative development in different stages in the process.

We have found it useful to distinguish between prototypes used in research and prototypes used in production. The research prototypes have the purpose to test the theoretical and technological concepts and thereby make it understandable for both artists and researchers. The production prototypes are meant for a specific dramatic production where the technology and artwork are optimised to a standard, which can be tested on an audience.

The Performance Animation Toolbox is meant as a tool for planning, coordinating and building different prototypes in a way that they can be transferred from one phase to the next. It is also a way for artist and researchers to share experience, exchange results and benefit from each other's inventions, which is a necessity if the aim is to develop performance animation as an art form and transform visions into actual works of art.

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