Chapter 5
Shared-Screen Interaction: Engaging Groups in Map-Mediated Nonverbal Communication

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Introduction

In this chapter, we examine how mass communication can be extended with collaborative interactivity on a shared screen that facilitates and promotes cooperation between two opposing groups of people. In particular, a shared screen that displays a map narrative becomes a representation of a shared physical space, which is claimed by two conflicting groups. In our work, a double screen projection is used to portray dynamic graphics and narratives, which are made interactive through motion-tracking input from a camera.

In the 1970s and 1980s, early video-art installations explored the links between television, architectural space, and community identity. During the 1990s and later, the artistic inspiration caught on with research labs, which developed several systems for Computer Supported Cooperative Work (CSCW). In contrast to the traditional CSCW approach, we focus on nonverbal communication and we make an effort to bring together artistic and scientific aspects of earlier works. For this purpose we take the city of Jerusalem as a case study–a city of extraordinary historic and religious meaning.

The video installation depicts the Israeli-Palestinian struggle for territorial and demographic hegemony, which has transformed the city into a unique urban constellation. The resources and content of the interactive video installation are based on a book published on the same topic, titled "City of Collision: Jerusalem and the Principles of Conflict Urbanism" (Misselwitz and Rieniets 2006). The book presents a unique collection of essays, maps, and photographs, gathered by Israeli, Palestinian, and international authors (Fig. 5.1). However, it cannot provide the immediacy and engagement opportunities of a large-scale interactive video system, which is installed in a public space.

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Fig. 5.1 A two-page spread from the book “City of Collision-Jerusalem and the Principles of Conflict Urbanism”

The interactivity with the video installation is considered to be complementary to the book, providing entirely new forms of conceptualization, mediation, and interaction. In order to realize this project, there was a need for close collaboration between diverse disciplines (McCullough 2004). Urban research provides appropriate graphic representations of a city. Architectural design supports the physical part (form) of the installation. Computer engineering enables the implementation of the dynamic interaction between people and data and most importantly, interaction design is used to translate the static data from the book (image, text, maps) into an elegant and easy-to-use participative video installation.

In the rest of this chapter, we discuss the interaction design process and we then present the implementation of the core concepts into a coherent interactive video installation. We conclude with a discussion about the application of advanced user interface technologies in art and provide some suggestions on the issues and obstacles encountered in this interdisciplinary work effort.

Interaction Design

The main design concept involves the double projection of a slideshow on a semi-transparent screen, which portrays the conflicting image that two groups of people hold about the same physical space.

In addition, we employ real and digital shadows in order to motivate participation and awareness of the image of the other side. The role of interactivity is central in the design of the system because it invites people to influence the presentation, thus making an inference to the historical impact of human actions on the current state of things, as well as to the potential for positive change. In terms of interactivity format there are two concepts: (1) interactivity with real shadows, and (2) interactivity with digital shadows.

The aforementioned initial requirements (double projection, shadows) were mapped into a basic set of concepts that guided the rest of the interaction design. The basic interactivity concepts have many implications for the technical requirements and, at the same time, the interactivity options are defined by what is technically possible. Although this is a linear manifestation of our creative process, it is worth noting that the actual design process was rather iterative. As a matter of fact, alternative scenarios were revealed through the design process that are discussed in the subsequent sections.

Early Requirements and Concepts

An early requirement for the system was to develop an interactive video installation that allows users to navigate the information on the map about Jerusalem. The initial idea was to mix a set of existing map layers and text from the book according to the position of the viewer. By changing position, some layers would be highlighted, whereas other layers would move to the background. This design concept aimed at a technical and a metaphoric effect: (1) The viewer could change the content of the map by moving in front of the screen, and (2) by moving and changing the layers, the viewer would physically and metaphorically change the image of[1] the city (Lynch 1960).

A direct implication of this early concept was that the input device, which is capturing the position and movement of the users, needed to be placed on the ceiling. An inspection of the installation site and lab experiments with video footage proved that this requirement could not be met easily, because the final site floor was black. Despite the advances in computer vision, the majority of the artistic applications have to make some assumptions about the environmental conditions at the site of installation (O'Sullivan 2007).

Although we were very fond of the idea that the presence and position of participants could affect the presentation, the conditions at the installation were not suitable and we did not want to employ a white carpet, as suggested by colleagues (Weber et al. 2007). Therefore, we had to think of alternative concepts that fulfilled the basic requirement of map navigation in a simple, engaging, and intuitive way. Moreover, the design concept should work, regardless of environmental conditions. In general, the positioning of the camera on the ceiling would have been a very flexible solution and it would have provided a straightforward two-dimensional navigation.

[1] http://www.v3ga.net/processing/BlobDetection/

Nevertheless, we found that this unforeseen obstacle allowed the effort of the design thinking to become the focus at the core of the requirements for this installation.

Double Projection

> 'As long as I have remembered myself, I have moved within two strata of consciousness, wandering in a landscape that, instead of having three spatial dimensions, had six: a three-dimensional Jewish space underlain by an equally three-dimensional Arab space.' Meron Benvenisti from the Book "City of Collision" (Misselwitz and Rieniets 2006)

The main concept for this video installation originates from the content itself: Two groups – Israelis and Palestinians – are claiming the same space, politically as well as through their different perceptions, narratives and memories. In fact, a shared screen becomes a representation of a shared physical space, which is claimed by two opposing groups (Fig. 5.2).

While two-dimensional printed maps can hardly depict this multilayered urban reality of Jerusalem, a double interactive projection opens up entirely new possibilities. In particular, a floating, semitransparent screen allowed for video projections from two sides, each side presenting a particular view of Jerusalem – an Israeli view in blue hues, and a Palestinian perspective in green hues. As the screen consists of semitransparent material, both projections are mixed on the surface and are unified to one coherent representation of the otherwise divided city of Jerusalem.

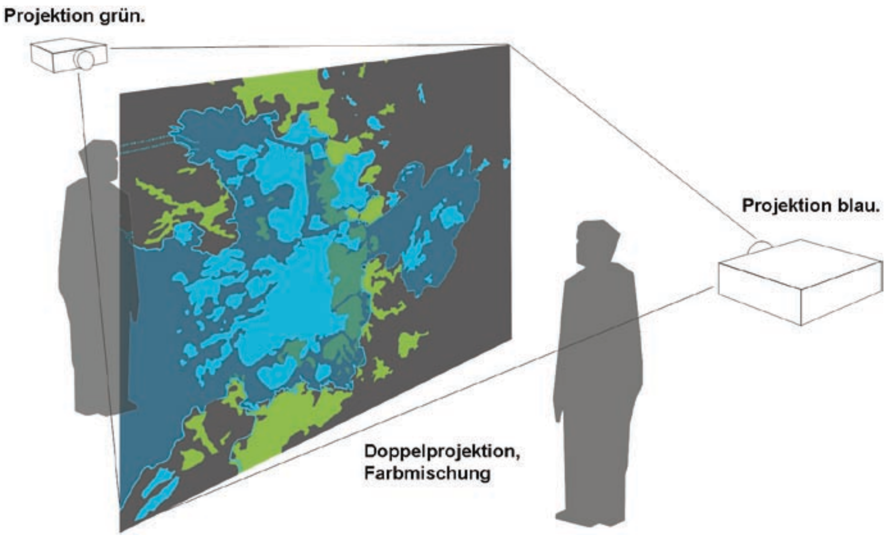

Fig. 5.2 Each of the two sides in the video installation corresponds to the respective (Israeli, Palestinian) image of the city

Additive Color Mix

By projecting from two sides onto the translucent screen, colors are mixed according to the principles of additive color mixing: the more colors that are mixed, the lighter they become (Fig. 5.3). This effect supports the concept of the double-projection of the cartographic essay. When the video installation shows a map of Jerusalem, the map consists of both views, the Israeli view (blue projection) and the Palestinian view (green projection).

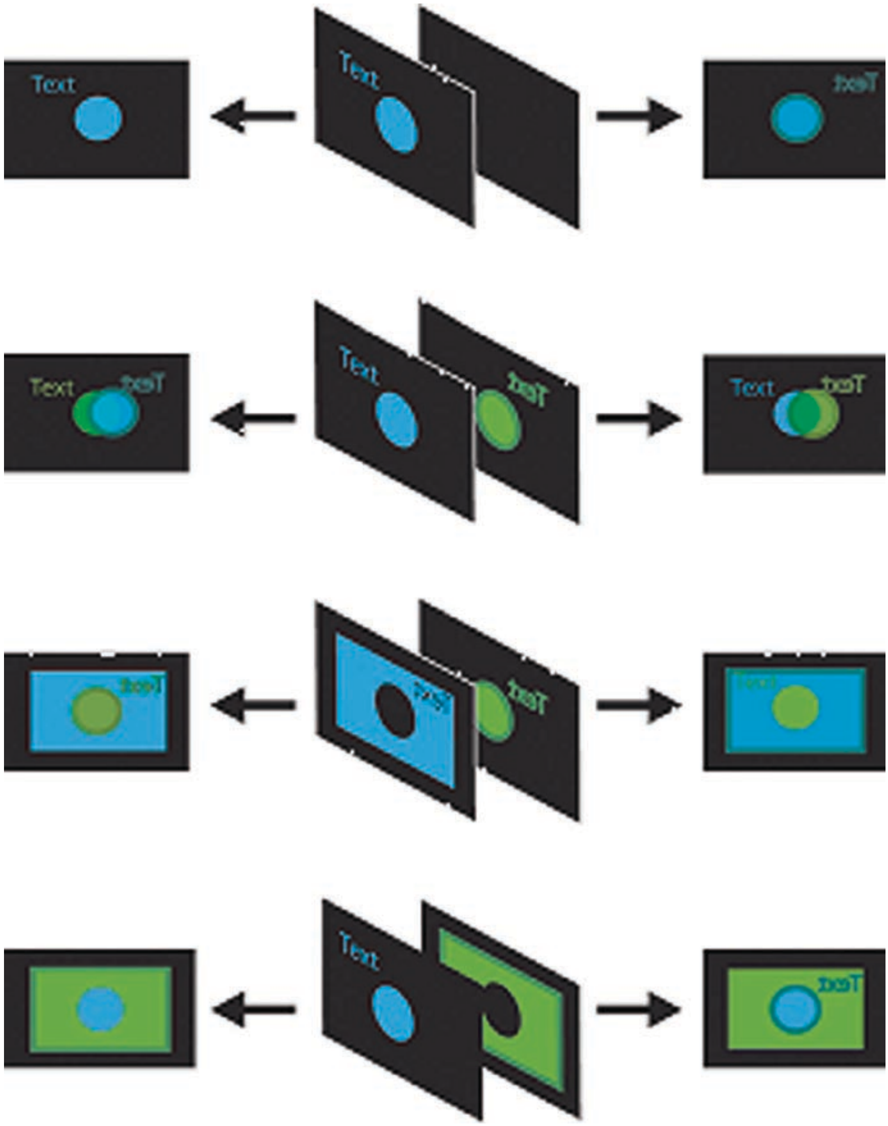

Fig. 5.3 Examples of different types of color mixing on a double projection system

Real vs. Artificial Shading

In addition to the requirement for digital interaction, we emphasized a parallel requirement for physical embodied interaction. When the viewer moves in front of the screen there are two effects: (1) the light from the projector is blocked by the body of a person, which creates an analogue (real) shadow on the respective side, and (2) at the same time digital cameras are capturing the presence of people and perform dynamic effects that combine the digital (artificial) shadow with the slide show.

We realized that although a real shadow would have been nice simply on its own, we recognized that people might misunderstand the installation and try to avoid making shadows. Thus, the need for a digital shadow was also acknowledged as a main requirement. By shading one projection, the projection of the other side suddenly appears clearly through the semitransparent fabric of screen (Fig. 5.4). This effect allows for a playful exploration of the projection on both sides, and

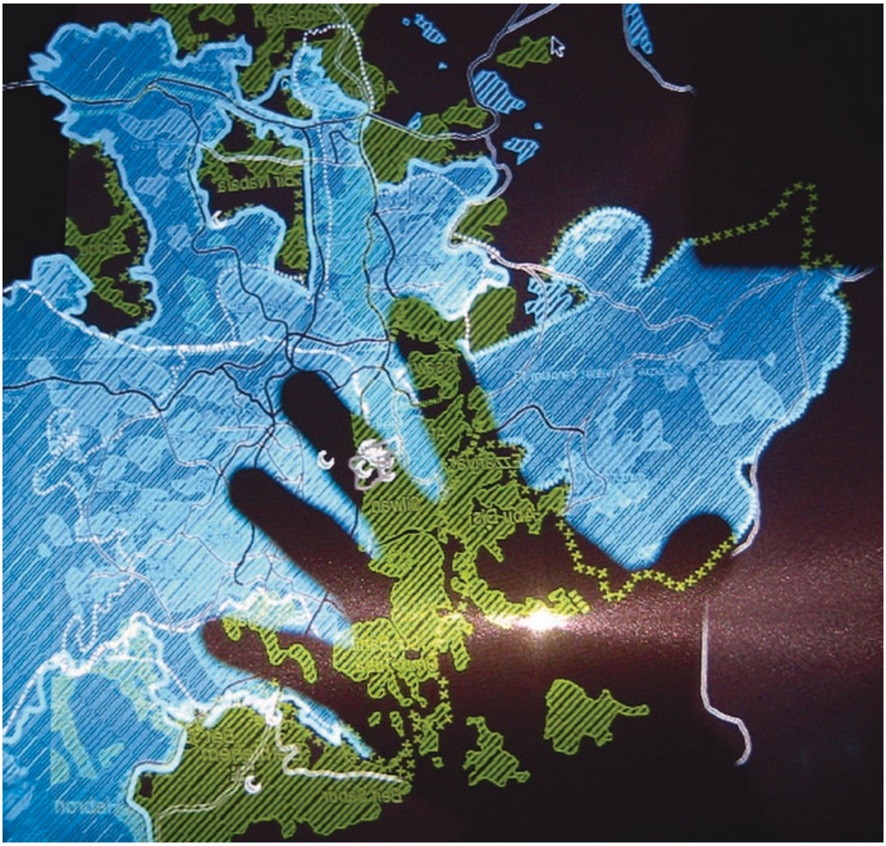

Fig. 5.4 In a double semi-transparent projection screen, if somebody blocks the image of one side, then the image of the other side is revealed

confronts the viewer with an important realization: *the more a viewer on one side is hiding (forgetting) his own "view" by shading the projection, the more he can recognize (understand) the other side.*

Final Requirements and Refined Concepts

After an analysis of the basic concepts and of the aesthetic requirements, we concluded that the interactivity had to be very subtle and the system should be technically robust and easy to both install and keep running. Moreover, we realized that the horizontal motion tracking (i.e., camera together with projector instead of the ceiling) would be the best option, because it is technically less sophisticated, less expensive (no white carpet or fancy hats are required), and it invites people to directly interact with the screen. In particular, interactivity was realized with real and artificial (digital) shadows. A "digital shadow" is an image stored inside a computer, so it could be processed in various ways. A digital shadow can be changed and transformed to create various effects (Levin 2006). First, shadows can be frozen for some seconds, or the motion of shadows can be delayed. This effect would enable people to "wipe out" their map. Moreover, digital shadows can be dynamically outlined, blurred, or they can display text and photos.

We were also aware that the shadow, however appealing, might evoke the same misunderstandings (i.e., "I am disrupting the projection"). Therefore, we had to evaluate several concepts for inviting and facilitating the involvement of the attendees. Some of these ideas included digitally transformed shadows, so that the shadow would look artificial and not be confused with the real one, or the use of the digital shadow to temporally wipe out parts of the map. Moreover, we decided to pause the slideshow when a person was close to the map. A technical implication of the latter effect was that if we employed pausing, then the two computers had to be synchronized through networking. Otherwise, the whole storyboard would be out of sync after participants have walked-in and out of the installation space.

In summary, the refined concepts mentioned here were mapped into a number of requirements which bring the interaction design closer to the final architectural and multimedia design. The detailed requirements are analyzed in the following subsections.

Maps and Narrative

The employment of maps into the video installation served two purposes: First, the maps are the graphic basis for the double projection. Early exploratory experiments revealed that the more graphic information that is projected on the screen, the better the effect of the double projection works (Fig. 5.4). Second, the maps portray all the information needed to understand the city and the urban conflict. However, the maps are rather abstract. Therefore, it became apparent that maps should be augmented with additional information in order to be legible without the full text of the book being at hand. Ideally, the maps would become most legible if a narrative was provided. The narrative was envisioned to run as a slideshow that embedded text and symbols that would refer to the current map, such as a map legend. Moreover, the slideshow between the two sides needed to be synchronized, in order to allow for comparison of the two conflicting “images of the city” through the semitransparent double projection. The slideshow consists of single layers projected one after another. Each layer contained brief text legends (e.g., “Wall; 700 km long; 8 m high; expropriating 11% of West Bank area”).

Although the initial installation was planned to take place at an architecture faculty, future installation could not make such a specific assumption about the scientific background of the users. The information should also assume an audience who are not able to understand the urban scale.

Outline Effect

One favorite concept involved the drawing of an outline around the digital shadow. The outline of the digital shadow serves multiple purposes:

- It makes the “holes” (digital and real shadows) in the map more visible.
- If a person moves close to the projector, then the outline becomes a metaphorical visualization of the urban causalities like an outline on the asphalt. This concept is based on the idea of the white-chalk outline that police paint around a victim at a crime-scene. Participants could perform in front of the screen in a way that they create similar outlines on the map.
- The outline could have a conflicting color: On the Israeli side (blue) it could be green, and on the Palestinian side (green) it could be blue.
- The outlines could have the same color corresponding with the respective map borderlines so that the map-lines dynamically mix with the shadow-outlines and create “new maps” of Jerusalem.

Wipeout Effect

In addition to the shadow effect, there was also a transient wipeout effect. The shadows of the moving people delete the map, but the map rebuilds itself after the person moves out of the camera view. The objective was to create playfulness and involvement with the map views. We called this effect “person as a brush,” where the size of the brush depends on the relative position of the person/camera and of the object-detection threshold.

Pause Effect

It was decided that the slideshow at both sides should stop when there was somebody in the view of the camera. If there was nobody in front of the camera, there was a delay between each slide. Of course, the software had no idea if someone was actually in front of the camera. The only thing that the software understands is that something "big enough" to be detected by the object tracking sub-system is covering a "big enough" part of the screen. The former "big enough" depends on the relative position of person/camera and the object- detection threshold, while the latter "big enough" depends on the person-detection threshold. These options were defined as calibration parameters that depend on the desired qualities, and most significantly on the characteristics of the installation location. One side-effect of the combination of the two requirements for (1) pausing in order to engage passers-by and to motivate exploration, and (2) combined narrative between back and front, which facilitates comparison and reflection is that the two parts of the projection needed be synchronized, in a way that when one of the slideshow paused (due to a person) the other one paused too.

Architectural and Multimedia Design

The physical installation of a combined architectural and multimedia system creates many challenges. Each challenge could be broadly categorized in either architectural and multimedia categories, or a combination of the two. In particular, we had to address design problems such as: an indoor installation at a public everyday place, double screen projection, corresponding narrative with maps, combining real and digital shadows, and calibration of the camera subsystem. In the rest of this section we present the design solutions devised to address the actual installation of the system in physical space.

Architectural Container

The interactive video installation was prepared for an exhibition at the hall of the faculty of architecture at ETH Zurich. The entrance hall of the building is an open public space with high ceiling and at the time of the installation it would host additional exhibitions as well as the normal daily activity of the faculty. Therefore, there was a need to explicitly define a space which would provide a context and focus for the particular video installation (Fig. 5.5).

Semitransparent Double Projection Screen

The projection screen consisted of a double layer of semitransparent satin textile material. The doubling helped to distinguish front- and back-side projection, as through the space between the layers of textile, the colors of one side appear bright, while that of the other side appear slightly dimmed.

Fig. 5.5 A model overview of the interactive video installation

The double projection provided visual comparison of the colliding image of the city between the two groups. After several experiments in the lab with video projectors displaying a simple static image of maps (Fig. 5.4), it was found that a small distance (approximately 8 mm) between the textile layers controls this effect (Fig. 5.6).

The video projectors were positioned at a height of 2.20 m. This position allowed the viewers to use the installation in two ways. First, if they looked at the screen from a longer distance, they were able to watch the installation loops without disturbing it with shadows. Second, if they moved closer to the screen they created shadows on the screen and could play with the interactivity of the system as described earlier.

Map Layers and Narrative

The original maps were rather abstract and for most people who are not directly involved with the issues in Jerusalem and who are not familiar with cartographic principles, these maps are difficult to understand. There were several cartographic layers that were produced for the book, and consequently we had to devise a coherent way to manipulate them dynamically at the software-level. We decided that the maps should be presented in a loop. The loop showed one layer after another and

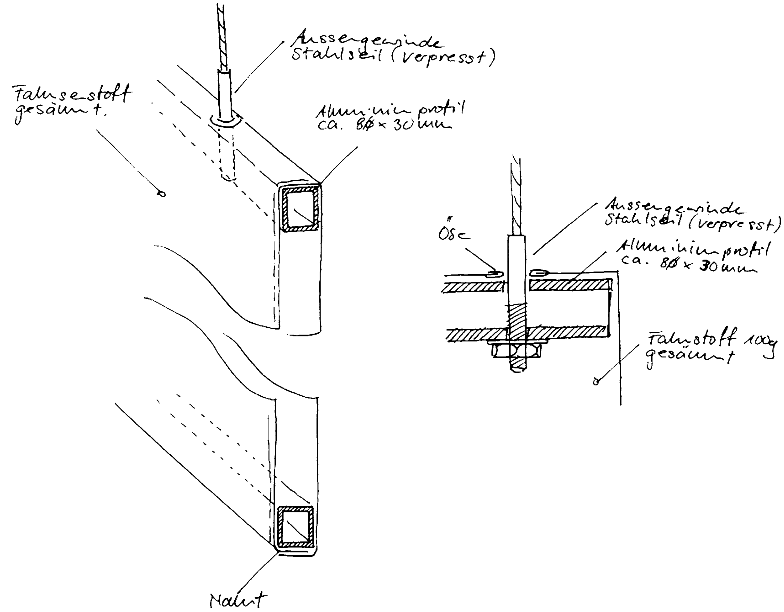

Fig. 5.6 The double projection screen consists of two sides of semi-transparent white tectile material arranged in parallel to each other and organized in the same frame, which is lightweight enough to hang from two metallic threads; thus it looks like it is hovering

provided some additional text- and symbol-based data. In this way, participants gained a gradual familiarity with the projected map space, starting with satellite images and ending up with religious meanings and historical facts. Another factor is that as a result of the double projection, one side of the installation was always mirrored. To avoid an imbalanced representation of the Israeli and Palestinian view of Jerusalem, the projections changed sides after each loop. This effect was achieved by composing the loops as Möbius strips; the end of the Israeli narrative smoothly ties in with the beginning of the Palestinian narrative, and vice versa.

According to good programming practice, the most obvious way to go forward would have been to load the layers in the software and then manipulate them dynamically and mix them with text according to a given narrative and script notation. However, at the time of coding the Processing environment, the software was still in beta version and after experimentation with a large set of images (map-layers) it was found that the Processing interpreter was rather inefficient with loading large numbers (i.e., more than a hundred) of images and manipulating them in real-time.

Computer Hardware Specification

We had to consider the performance of the available computer hardware which consisted of PowerMacs with dual G4 500 MHz processors and 1 Gbyte of RAM.

In comparison, the most contemporary interactive video installations with similar requirements employed one or more dual core computers at 2 GHz. Although in terms of software there are always many possibilities (which we discussed in the design section), in practice the performance of the available hardware turned out to be a very important factor in the selection of the concepts that could feasibly be implemented. In total, we employed two separate systems (i.e., two computers, two cameras, and two video-projectors), one for each side of the projection. Ideally the system design would also have required a separate computer to control each of the cameras, giving a total of four computers. Although a dedicated motion tracking computer would have greatly improved the responsiveness of such a system, it would have introduced the trade-off of extra networking complexity and protocol programming.

The maps were drawn in Adobe Illustrator and had to be reworked in order to make them appropriate for video projection. This meant change of colors, line width, sizes of symbols etc. Next, the map layers were imported into Adobe Flash and were edited into a narrative together with the respective text and symbols. Finally, the Flash movie was exported into a sequence of image files, which were loaded in custom-made Processing software and mixed in real-time with the digital shadow.

Digital Shadows

The system was implemented in the Processing environment, which employs the java programming language and provides simple interfacing with the functionality commonly needed in video installations, such as video tracking. The computer vision functionality was built upon the "BlobDetection" Library by v3ga1. These tools and libraries are an open source and run on a variety of platforms that support Java, thus making the application portable. Moreover, further development by the authors or other groups is feasible to be sustained in the future. The BlobDetection library is based on a threshold between light and dark. Dark and light are measured as relative terms and they therefore depend on the particular installation environment. Also, each camera has different responses. Therefore, there is no recipe for "correct" design of the system besides allowing for calibration of some parameters in the field.

Position of the Camera and Image Transformation

There are a number of possible options for the position and the viewing angle of the camera. For example, the camera may be located at the screen or it can be positioned together with the projector. The latter option was selected due to simplicity of the installation. In this case, there were also options in terms of the camera viewing angle and zoom factor. We decided to have a wide viewing angle, but we only used (achieved through the zoom facility) the central part of the image, since the rest of the projection contained text (see Fig. 5.7).

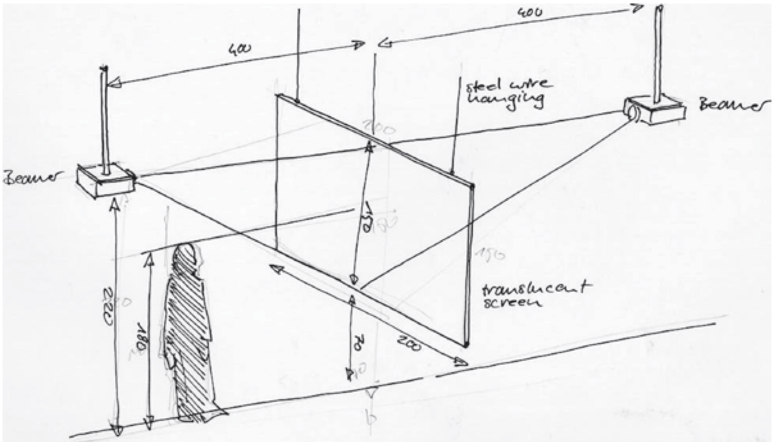

Fig. 5.7 Overview plan with scale and dimensions of the elements in the video installation

In the installation, the real shadow and the digital shadow had to be as close to each other as possible. For as long as a person remains stationary, the real and digital shadows had to be identical. For this reason, the camera was situated close to the projector. This was the only way to capture people in a position which is identical with the shadow produced by the projector. If the camera had been positioned at the screen pointing to the projector, the digital shadow would have been completely different from the real shadow.

Moreover, there were several technical advantages in overlaying real and digital shadows:

- Interactivity worked intuitively, because the digital shadows were a transformed mapping of the analogue ones.
- If the digital shadows were inaccurate (because of light cloth or other conditions), it would not have a disturbing effect. In this scenario, even if there was no digital shadow the real shadow would still remain.
- The installation can be simple: The camera can simply be attached to the projector (Fig. 5.8).

Ideally, we would have liked to have used multiple cameras (Sparacino 2002). However, in this work, there are already at least two systems involved so we chose not to add more dimensions to the input devices.

Installation and System Calibration in the Field

Before calibrating the motion tracking software there was a need to ensure the robustness of the integrated software (slideshow and motion tracking). Although

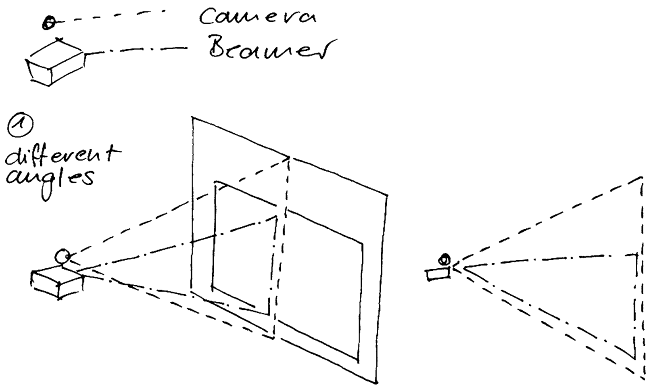

Fig. 5.8 Camera and projector are positioned together

ubiquitous computing systems are assumed to be seamlessly integrated with the environment and to work in a robust way, there is always a possibility of arbitrary input streams that could not be modeled and tested in the lab during development time. In contrast to desktop or web applications, ubiquitous computing systems are supposed to run without a pause for the duration of the day or even overnight. It is for this reason that the robustness of the system becomes a crucial requirement.

The main software (Processing) was in beta, at the time of writing, so we were aware that there might have been issues with bugs, such as inefficient memory allocation, which would have caused an application crash after a while, especially if lots of media was loaded and processed in real-time. These type of bugs are as unpredictable as the input coming from a camera installed in the field and only testing in the field can validate the system. Another remedy would have been parsing of the open-source Processing code base, but this is not within the skill-set of most artists. In engineering terminology, there is no analytic way to check that the system works prior to installation on site, so the system has to be installed and left running for many hours in order to validate robustness.

The methodology for calibrating and testing the system in the lab involved setting up one computer with the software, a camera, and a projector/screen. In this way we monitored how the system performed over a long period of time (i.e., more than a day). Simultaneously, a portable computer with a camera was taken to the field (the site of the actual installation) in order to test the system response against the (changing) ambient light and the particular reflection of the background materials (e.g., ceiling, floors, walls, etc.).

Discussion

The most important contribution of this chapter is the interdisciplinary design process that maps the initial requirements to interaction design concepts, and finally to a particular architectural and multimedia design which was feasible to implement. In the following text we present a reflection on the creative process and on the empirical findings of the design and implementation phase.

The combination of new and traditional media art can be regarded by someone as a dilemma, or even as a conflict between traditional and digital mediums, but in our view, it doesn't have to be the case. This video installation employed a "traditional" double projection semitransparent screen, instead of the approach of mixing the two maps in software over an opaque two-sided screen. Moreover, the use of a double screen allows shadows on one side to become windows that create views over the "image of the city" on the other side; which is an analogue approach. The shadows can be analogue due to the light source of the projector, or they can be digital shadows that are captured by the camera and created at the software level, which allows an infinite number of further manipulations and artistic expressions; this is the digital component. In this way, instead of competing, traditional and digital cooperate to produce a result that is more than the sum of the parts.

Ubiquitous and cooperative computer systems can contribute to the *convergence between different art forms and new media*. These systems employ multimodal sensors as input devices instead of assuming the input from a keyboard and mouse. In our work the use of a camera as an input device for a computer system responds to the objective of alternative human-computer interfaces, which seek to have minimise requirements in terms of both the skill and the effort required to use the system. In this way, the interaction between people and artworks becomes more immediate and natural.

In contrast to the narrow interaction modalities of traditional office computers, the interfaces available in ubiquitous computing provide extended opportunities for seamless integration with cultural and artistic forms. Ubiquitous computer tools include powerful, small, and portable computers, projectors, efficient computer vision, and easy-to-use programming environments. They also offer novel opportunities for artistic expression. Moreover, the relationship between tools and artists is mutual. As artists employ new tools in new projects, and the tool creators get feedback about the new uses and improve their tools. Indeed, the processing-programming environment is supported by a very active design and arts community.

In addition to the technological and design process aspects, the most interesting part of this project is undoubtedly *the potential for social impact*. The book behind this project contained much more information and visual images than could feasibly be displayed in a video installation. Yet, a book offers only restricted possibilities for engaging and creating initial awareness about the impact of political issues. Consequently, the video installation allows for an entirely new interaction with the content and becomes a portal to an appreciation of an important social issue that affects the lives of thousands of people everyday.

The motivation behind the basic concept was that the installation should be a metaphor for the situation in Jerusalem: two groups (Israelis and Palestinians) are claiming the same urban space and fighting for territorial dominance. Both groups have a completely different view of the same city (Lynch 1960). The image of the city changes very rapidly and depends upon political decisions, activism, and other events. In this way, the video installation adopts the role of a memory aid, and of a tool for understanding the current situation. In addition, the integration of computing and networking into this project provides the opportunity to display new map layers, photos, and text about new events that alter the image of the city in Jerusalem. Thus, the video installation, in addition to the artistic qualities of abstracting a geopolitical conflict, provides further opportunities as a live artwork and most importantly, as a placeholder for social encounters, interaction, and hopefully, mutual understanding.

The public installation of the system was initially regarded as an opportunity to evaluate the system in a realistic environment and collect feedback about engineering and design aspects that could inform further video installations. In addition, we would have liked to test alternative design features of the system. For instance, do people actually like the interactive options at all, or would they have preferred a simple slide transition? What is the difference in average attendance between the interactive and the simple version? Which kind of visual interactivity is the most appealing? In order to address these research questions, we have subsequently implemented some simple counters and image logging inside the motion tracking system and we also considered performing observation and note-taking during the exhibition. Unfortunately, university regulations and the scope of that particular exhibition (artistic) did not allow for such an elaborate data collection and analysis approach. Therefore, although a formal evaluation of an interactive system is technically feasible, it might not be appropriate for the particular context (artwork).

The collaboration between different disciplines was very beneficial both for the creators and for the artwork itself. In fact it would have been impossible to reach the same outcome in the realization of this project without the many roles assumed during the different phases. For example, cartographic skills were necessary to create and then to transform the vectors maps into a combined slideshow narrative. Architectural design and engineering expertise were employed to design and implement the physical aspects of the installation. Computer engineering was employed to develop a combined hardware and software system that brought together the maps and the presence of people in the exhibition. Finally, collectively all these skills were orchestrated in the process of considering the interaction design aspects of the video installation. In the following section, we summarize the main outcomes of the project and draw conclusions.

Conclusions and Ongoing Work

Three basic concepts have been crucial for this interactive video installation:

- *Semitransparent double-projection screen* allowing for a shared experience of back- and front-side.

Maps narrative provided specific information about an urban space. The map layers and the information about them appeared in synchronized back-and-front (two parties in conflict) story line, which looped.

Embodied interactivity invited the viewer to be "self responsible" for his/her view on the city. The presence of the viewer was sensed by means of a shadow (real or digital), which distorted the map and the flow of the slideshow.

These concepts have been progressively implemented into several installations at national and international exhibitions and into several software versions. The first version of the software part of the system was developed and tested in the lab. Then the system was installed and tested at the exhibition site in conditions that corresponded to the final installation at least in terms of scale and lighting conditions. The first public presentation of the complete installation was performed in April 2007 at the main hall of the department of Architecture at ETH Zurich in Switzerland (Fig. 5.9).

We have a number of plans to evolve the project in future. In terms of additional software features, we plan to integrate real-time photos and text from web sources. In particular we plan to employ geo-tagging of external data into the system map. Thus, we would like to enrich the linear and fixed map narrative of the video installation with live information from the field. In this way, there would be many evolving (and real-time) stories told and users would be able to compare the multiple overlaying images of the city, which would be updated in real time. With regard to the physical aspects of the system, we would also like to implement a remote version of the system, which would have screens installed remotely.

Finally, we are going to consider the application of this interactive video installation for cities that face similar issues of urban conflict, such as Nicosia (Cyprus). It is expected that there are a number of additional case studies for this system, because in most big urban places, even the most peaceful ones, there are conflicts and colliding views about the image of the city.

Fig.5.9 Installation site faces the entrance at the faculty of architecture (ETH Zurich)

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