Interactive Interfaces in Projection Mapping Projects:
Participation through Play

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Abstract. With the development of technology there is various and lively activity concerning interactive arts at the seam of the real and the virtual. Interactive Projection Mapping comes out of this active climate, allowing real-time interactivity between audiences and art. Audiences have become attracted and engaged to become participants in a game of communication. This paper focuses on Interactive Projection Mapping’s interfaces that are the communication tools, which perpetuate the contents of the project and its suitability. The interactivity of engagement suggests a sense of participation enjoyment and play.

Keywords: Interactive art, Artworks, Immersion, Media art, Installation.

1 Interactive artworks

1.1 Research Background and Goal

When one thinks of art, he or she evokes an image, most likely a painting, set in a rectangular frame. Before this stereotype of “a piece of art,” art had been made in caves in pre-historic times, painted pottery was produced, and tiles with drawings were applied and frescoes were painted to decorate sections of buildings. The development of paper and the canvas set up the rectangular paradigm of images of art which continues into new media, like photography, video, film and monitors and print outs of the computer era. Expanded Cinema breaks the tradition of stationary and passive viewers watching film on a rectangular flat screen. Instead, viewers walked about and interacted with the projected qualities of the film. In 1969, Disneyland’s Haunted Mansion presented 5 singing heads projected onto 5 busts; they sang “Grim Grinning Ghosts,” the theme-song of the ride.

Projection mapping is a projection technology that allows any irregularly shaped surface to display images and further create a space of “augmented reality,” hence it’s earlier academic name “spatial augmented reality, or “mixed reality.” Virtual space can be applied to real space in real time. This new environment has opened a new projection paradigm for artists, advertisers, architects, performers and possibilities.
For viewers, projection mapping offers an immersive effect into the presented fantastical space. Interactive projection mapping provides viewers with opportunities to control the environmental reality they are in. Through this control, the viewer/users are engaged firmly with the content. This particular genre of projection mapping is being adapted to art works, commercial and cultural events and exhibitions. The interactive interface are designed for the controlling users to manipulate and/or influence the visual contents of the project. They get to play.

1.2 Research Range and Method

In general, when discussing interactive art the interactive interface refers to user input and system response systems. In this paper projection mapping projects which involve Human Computer Interfaces will be discussed, hence only projects with digital input sensor systems will be analyzed.

The interactivity is bidirectional activity and communication between users and presented projection mapping piece. In this paper, only participatory, as opposed to reactionary interactive pieces are discussed. The paper's main focus is case studies of interactive projection mapping work which were held in outdoor public spaces. This paper deals with interactive interfaces that deal with multiple users within a crowd in order to study the interaction between a multitude and projection mapping and focus on its elements of play.

2 Interactive Projection Mapping and Human Computer Interaction

2.1 Definition of Interactive Projection Mapping

Merriam-Webster’s second definition of interactive states a two-way electronic communication system that involves a user’s orders or responses, which outlines the technical aspect of the interaction, while the first definition states “mutually or reciprocally active,” which could be understood in a relational aspect. Interactive Projection Mapping requires an action or actions from participants for it to fully
reveal its projected contents. Projection mapping utilizes a projector to layer images onto a tangible space, to create an augmented sense of space. The layering effect causes interest, engagement, enjoyment, and exposure of content. Interactivity adds another layer, which augments the experience of mixed reality and content.

2.2 Realization of Interactive Projection Mapping

By projecting images onto real objects a user’s physical space is supplemented with images that are fused directly in the user’s environment, not simply in their periphery field. Real space is augmented by digital sensory input such as imagery and sound, which enhances a viewer’s perception of reality [1]. Through HCI the audience can interact with the mappings in real time. The combination of the real and the virtual, the fact that this event happens in three-dimensional space and in real time makes interactive projection mapping coincide with Ronald Azuma’s definition of Augmented Reality [2].

2.3 Spectators as Participants/Users >> Players

Interactive projection mapping transforms passersby into active participants. Artists and experience designers concern themselves with user behavior patterns to attract otherwise viewers to engage with the work and sustain that engagement to understand the project; the artistic or commercial message. UX designer, Bilda, has developed an engagement-process-model based on audience studies with a range of interactive art works. Bilda indentifies 4 stages of interaction; adaptation learning, anticipation and deeper understanding [3]. Cross-referencing Bilda's engagement model with Costello's "pleasure framework" [4], which is a taxonomy of the nature of play she found in interactive art, interactive projection mapping presented in public spaces show an intention of play. Users/Participants of interactive projection mapping eventually become players, as they manipulate and add images to the space or become performers.

2.4 Types and Characters of different Interfaces

The development in technology is bringing more advanced and complex interfaces, which can take various human behavior patterns in different forms of input systems. In interactive projection mapping events there are interfaces that processed hand or body movements, participant who need to press button or draw; tactile types of interface, and voice-activated type of interface. In this paper, the interactive interfaces are divided into 2 main types; Contact gestural interfaces and non-contact gestural interfaces.

Contact gestural interfaces utilize input systems that process tactile information for interactive results. Players mostly use their hands or fingers to draw and/or control a mobile device or controller to manipulate the scene of the projected environmental reality. The advantages of this interface is that the control device will provide precise interactions and manipulations.
Secondly, non-contact interfaces use IS tracking or audio sensing interfaces. There is no tactile contact between the user and any hardware. IS tracking interfaces utilizes one or more camera as an input hardware. The image is processed as information to track gestural movements. IS tracking interfaces are considered a more natural interface, yet they are programmed to track specific gestures in specific manners. Obstruction of camera view or lighting matters can result in inaccurate information processing which would have no outcome. IR cameras can be added to correct these issues, and 3-dimensional tracking systems which improve these input situation are rapidly being developed.

3 Case Study by Type of Interaction

3.1 Controller

Jan van Nuenen, Physics Distorter 1.1 (2009)

Fig. 2. Physics Distorter 1.1

Real-time computer simulation of falling and colliding objects projected onto a building. The audience can control the direction of the gravity and some of the properties of the objects with a wireless globe which is made with processing and arduino. Other types of controllers seen are laser pointers, joysticks and others.
3.2 Mobile devices

Janet Echelman & Aaron Koblin, Skies Painted with Unnumbered Sparks (2014)

Echelman's suspended fabric sculpture at night becomes animated with interactive projection mapping. The projection is a Google Chrome web browser, displaying input from mobile devices, namely smart phone and/or tablet PCs, of participant choreographing graphical elements in real time. The complex interface consists of several innovative software that allow personal interactions seen on mobile devices translate into a projection in the sky.

3.3 Voice Activated

1024 Architecture, Perspective Lyrique (2010)

The building deforms and the figures were controlled by the audience, using microphone and an audio analysis algorithm. This voice activated interactive interface brought participants together to make louder and different noises collectively. It also utilized a face-detection program to recognize 3 different expressions to manipulate parts of the architectural image.
3.4 Combined: 3 input methods or more

YesYesNo and others, Night Lights (2009)

3 different types of interaction interfaces were involved; 1) body interaction on two stages, 2) hand interaction above a light table, and 3) phone interaction with the tracking of waving phones. There were 6 scenes, cycled every hour for the public. Participants become performers in this installation. Their body movements are amplified 5 stories tall through projection mapping. 2 of the interfaces process gestures which makes it physically fun to participate.

4 Conclusion

Projects mentioned in the previous section illustrate how Human Computer Interfaces in the interactive projection mapping in public spaces have been used to transform existing architecture into mixed realities. Through studies in interactive interfaces, artist advertisers, designers, event planners and various other professionals can explore more pleasurable methods to communicate interactively. Through these experiences, participants share a visual interactive environment and collectively feel enjoyment, fascination. In this immersive space they are not separated or specifically chosen provide input for the sensors. They get to play with the temporary environmental reality as a group and share their memories.

References