A Study on Illusionism and Expandability of Virtual Space using Projection Mapping

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Abstract. This paper uses projection mapping to examine the constitutions and methods of expression of artwork influenced by light art. For the projection-mapping analysis, my works and those of others were selected as examples of the expression of illusionism and expandability of space. Furthermore, illusionism and expandability have been expressed through the 3D spatial expression of the other works, achieved with projection mapping, and are different from existing 2D works. Consequently, the advantages include immediacy, whereby the space-time of the works coexist with the audience, and the expression of illusionism and expandability of space propose new possibilities for spatial expression.

Keywords: Light Art, Projection Mapping, Illusionism, Media Facade, Spatial Expression

1 Introduction

Human beings have used art to express themselves in virtual space on numerous occasions, and realistic representation has been studied from differing perspectives. This has led to the development of technology in the late twentieth century which in turn has been utilized for expression in both real and virtual spaces.

Furthermore, the range of expression has expanded from the 2D plane to 3D solid spaces. This development has led to the realization of expressions in both space and time, as well as an expansion of spatial and perceptive senses.

The overall development has led to the emergence of projection-mapping technology. Projection mapping enables us to experience an augmented reality in which virtual space and reality are overlapped. Unlike the past, in which spatial expression was limited, it is now possible to combine physical and virtual spaces into one.
2 Related Studies

In this study, the examples of projection mapping have been classified into architecture, performance, and exhibition in accordance with the purpose of the expression. Additionally, my works were used to examine expandability of space and the expression of illusionism.

Firstly, the realizations of virtuality and expandability for traditional art have been examined, and the role of space has been redefined through theoretical contemplations.

Secondly, this paper has examined the changes in virtuality and illusionism of art which have been the results of computer-graphic developments after the introduction of digital technology.

Thirdly, augmented reality, in which real and virtual spaces overlap, has been studied by reviewing works that used projection mapping.

Fourthly, a thorough examination of my works provides insight into the manner in which the dimensions of the new space-time experience have been expanded through projection mapping.

The use of projection mapping for methods of expression, as proposed in this study, dissolves the boundary between real and virtual spatial areas to define new experiences in a new, expanded space, and to propose the direction of further study.

2.1 Aesthetic Contemplation of Illusionism and Expandability

The concept of illusion can be applied to phenomenal values or perceptive illusion, and is therefore frequently defined in accordance with popular usage instead of a clear definition.

In this study, the concept of illusionism was formulated by expanding the concept of phantasm, as proposed by Plato, while the meaning of virtuality has been reinterpreted through theoretical and aesthetic contemplations.

The concept of virtual reality in art can be defined as the integration of reality and virtuality, which have both been converted into compatible forms, through the elimination of the spatial, temporal, and visual differences that exist between the real and virtual worlds.

That is, it enables the audience to communicate with artworks through an interface (boundary between two different systems; the contact point at which machine and users interconnect with each other and share information) that works as the medium.

2.2 Case Studies of Works Related to Illusionism and Expandability Expressed through Projection Mapping

Projection mapping in computer-graphic terms is the display of a 2D image onto a virtual 3D surface.

This is a method for the delivery of visual stimulation, whereby 3D video is projected onto the façades of a 3D space or the surfaces of a 3D object.
This method of creation has been performed since the 1960s, but has recently taken center stage due to the computer-graphic developments that are indebted to twenty-first-century digital technology.

**Projection mapping in architecture**

In the case of 3D projection mapping, which is displayed on a building, the building itself becomes a screen onto which 3D video can be projected. As a result of such expression, the audience members who previously perceived only the external parts of building, can perceive an expanded virtual space though the overlap of the video projection.

**Projection mapping in performing arts**

The continued use of projection mapping for the stage productions of the performing arts expands the space of the existing stage with further concepts that deviate from the limitations of the space. Ping technology has facilitated this expansion of the stage space.

In the case of “RIDOME,” the stage background, which is physically limited, has been expressed in various ways through the utilization of 3D projection mapping. By projecting video onto various prominent structures rather than a flat screen, the audience is provided with experiences of illusory effects.

Such expressions of space on stage newly reinterprets the relationship between the parts and the whole by providing experiences of spatial transformation through the display of video projections that express the physical structure of the actual space.

**Projection mapping in formative art**

“Augmented Sculpture Series,” by Pablo Valbuena, is a projection-mapping artwork that consists of architectural elements and visually expresses the contemplation of space and time. Rather than a static object, Valbuena depicts sculpture as a floating object that is constantly transformed.

The artist designed the work on an existing structure, using an interior, building, or temporary sculpture as the canvas. This work is characteristic of a movie, in which hexahedron objects are projected onto surfaces such as white buildings, a forest, or a sculpture made of various piled objects, which function as the physical framework of a nonphysical space.
3 Realization of Illusionism and Expandability through Projection Mapping

The illusionism of the artworks can be defined as a visual effect that projects reality onto the human eye through the generation of a 3D illusion that is projected onto the physical space of a 2D plane. That is, it is the acceptance of false phenomena as real based on the information that the viewer’s eyes receive, which does not exist in reality, but is expressed as visible through a perceptual illusion.

3.1 Constitution of Artwork and Installation Method

The fixed conditions that make projection-mapping work feasible have been set prior to the enactment of the projection.

Before the work can be processed, the location of the projector, for projection of the 3D video, and the location of the surface onto which the video is to be projected must be established.

Furthermore, the environment in which the work will be projected must be assessed by testing the different points of view that the projected results will be viewed from, and through the use of a haze machine.

By setting such conditions, it is possible to observe the differences in the audience’s spatial perception, according to the different points of view, that are generated by the imaging.

3.2 Process of Expression for Projection Mapping

At present, the process of projection mapping requires the use of a mockup 3D video to trial the location so that the final projection is free of any distortion. Preparation of the location allows for the identification of any potential sources of interference—
including other sources of light—and the projector can be used to establish the projection distance and the appropriate projector lens type.

After the locational coordinates for each façade are set in accordance with the size of the object that the 3D video will be projected onto, the 3D video needs to be repeatedly tested based on the coordinate data of each side.

Due to the labor-intensive nature of the above process, I strongly believe that an automated system needs to be developed to simplify projection mapping and exhibition. Notably, a Keystone-patch system exists for real-time video control, and an automated function can match up the screen image and the object by utilizing the “vvvv” (real-time motion graphics programming).

3.3 Analysis and Contemplation of Spatial Expression through Reviewing Artworks

![Image](image.png)

**Fig. 2.** Jae Joon Cho, Beyond the Gravity, Incheon Art Platform, 2014

My work “Beyond the Gravity” is a convergence work based on the “Art + Technology Play” platform that combines art and digital technology. The image projected onto a transparent screen that is installed in front of the audience becomes another layer existing inside space. It works as a tangible (exists in reality) object, but it is not simply a reflected image, as the layer occupies the space between real space and the vision of the audience. The patterned layers inside the work enables the audience to perceive space as both a tangible object and a visible object similar to space, but which really exists through illusory space. Each of the images projected onto the layer becomes a visible object as well as a physical object that exists in the real world. The projection therefore becomes a tactile object that constitutes space, which enables the audience to have a tactile experience with a physical object.
4 Conclusion and Future Research Project

The artworks of this study possibly differed from existing projection-mapping works, as the projection-mapping techniques are based on light art and the 3D expressions are different from existing 2D works.

A merit of this type of artwork is that the projection-mapping technology organically connects the work and the audience, whereby the space-time coexistence of audience members and the artwork is achieved in the present through the conversion and augmentation (expansion) of real space into an illusory space. Therefore, this study may provide new possibilities for spatial expression.

References

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