Trompe l’Oeils: Traditional and Augmented

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Abstract

Through the use of trompe l’oeils, a French term meaning ‘to fool the eye’, architects offer evidence of being able to or a desire to overcome material, economical and even static limitations by expanding a physical space into an imaginary one with paintings and frescos. This can be observed in the church of Sant’Ignazio, which contains two trompe l’oeils: one that adds ornament to the cupola not afforded in the original construction and another that expands the vaulted ceiling of the church into a painted heavenly world.

A new form of augmented reality trompe l’oeil can be experienced through technological means, layering a virtual world onto the physical one with projections on screens or directly on finished architectural surfaces. One example is the proof of concept system created by Microsoft Research called IllumiRoom which expands the virtual world of a video game from the television screen to the living room through the use of a projector.

Both the traditional and the new augmented trompe l’oeil face similar challenges such as both are restricted by their vantage point. As a person moves through a physical space, they will discover that there is a location where the virtual or imaginary expansion is ideally viewed whereas other spots may show revealing telltale signs of the deception. The new augmented trompe l’oeil, however, has the possibility of augmenting the illusion through moving and evolving virtual expansions. The illusion is no longer limited to a static image but can allow for interaction with the physical space and its inhabitants through projections that react to their movements. Through a comparison between the traditional trompe l’oeil and the new augmented version, this paper shows the successes and failures each contain for creating the illusion of the expansion of space.

Key Words: Trompe l’oeils, augmented reality, architecture, virtual space, imaginary.

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There is a strong connection between art and architecture in how the two and the three dimensional relate to each other, as well as how the relationship between the representation and the reality is defined. Trompe l’oeils, illusionistic mural paintings that’s purpose is to ‘fool the eye’ by creating a perfect duplication of reality, as well as false perspectives found often in the architectural detailing of churches, help show a unique relationship between art and architecture due to their ability to extend the building’s spatial frame through a seemingly flat surface. The division between the two becomes blurred as the physical architecture transforms into an imagined one. More recently, projective augmented reality has mimicked this relationship, allowing the physical to be supplemented with projective imagery and light. The goal of this
new method, however, is not to extend the physical world into the imaginary, but to explode the imaginary into the physical. The original *trompe l’oeils* and false perspectives and the new projective augmented reality successor share similar triumphs and failures in how they allude to a world that is not real and yet is implied as being present while revealing aspects of the relationship between the built world and the imagined one.

1. **Purpose and Method of the Illusion**

*Trompe l’oeils* had two main functions: to expand the physical space into imagined realities and to realize architectural feats not possible in construction due to financial or spatial limitations. A well-known example of the former is the vault fresco of the Church of Sant’Ignazio painted by Andrea Pozzo between 1691 and 1694, depicting the glorification of Saint Ignatius and the missionary work of the Jesuit order. Pozzo used architecture within the painting to anchor his imaginary space to the reality of the church by expanding on the physical architectural style already present. Through the mimicry of the existing architectural style found in the columns, arches, and corbels, Pozzo created the illusion that the vault is three times higher than it is in actuality. The figures and heavenly attributes are applied in relation to the architectural illusion, allowing them to appear real within the context of the newly expanded architecture.

The Church of Sant’Ignazio contains another *trompe l’oeil* by Pozzo that is categorized as having the latter function of realizing impossible architectural feats. At the central crossing of the churches two primary axis, the plans were to build a magnificent cupola; however, due to financial limitations and the neighbouring library fearing a dome would block its access to light, it was not possible. To remove the bare feeling caused by the absence of the dome, Pozzo was commissioned to paint a false one onto the ceiling and give the illusionistic look required to make the space feel complete. Although it could not exist in the physical world, the cupola existed in the extended fictional space found within the *trompe l’oeil*.

A similar example is found in the church of Santa Maria Presso San Satiro in Milan. In the 15th Century, Donato Bramante was commissioned to transform the existing one aisle chapel into a magnificent architectural piece with a crucifix plan. Unfortunately, its location in the centre of the city made the crucifix plan impossible since the location of a road limited the expansion of the apse to four feet. Bramante’s solution was to create, using false perspective, the illusion of a vast arched choir with coffered vaulted ceiling using only stucco and terracotta. The shallow relief is meant to replicate the vaulted ceiling next to it, acting in the same fashion a mirror box creates the illusion of an amputated limb which is made present in the reflection. Through the use of a reflective surface, a mirror box allows the amputee to believe that both limbs are present and moving in a parallel fashion. The Church of Santa Maria Presso San Satiro is architecturally amputated with its ideal
plan being unrealizable due to the presence of an adjacent street. The false perspective illusion and the mirrored vaulted archway beside the apse, allow the occupants to believe that all architectural ‘limbs’ are present. In both the cases of Pozzo’s dome and Bramante’s choir, the ideal architecture exists as an expansion into the imaginary.

Projective augmented reality combines the imaginary with the real by expanding the former into the latter through layering projections onto a physical space. IllumiRoom, a proof of concept project by Microsoft Research, expands the video game on the television screen into the living room with a projector and camera. The camera records the furnishings around the television, allowing the projector to layer invented content onto the physical world. Illusions can range from atmospheric transformations of changing the surrounding area to have a cartoon quality to more elaborate interactions between digital and real with the events on the screen bleeding out into the living room. Objects can jump out of the screen or explosions in the game can cause a ‘radial wobble’ that distorts the appearance of physical objects. To the videogame player, the world on the screen is expanding into the physical, opposite to how a viewer of a trompe l’oeil is entering the imaginary through the physical.

How projected augmented reality can transform spaces can be witnessed in Disney amusement parks who have used it for both scenic and building projections. This technology is advantageous to the amusement park industry since it is an affordable method for transforming existing spaces, without requiring structural or facility changes. Shadows, details, and animated movement have been added to exhibits like Snow White’s Scary Adventures where an old and tired display is given new life and atmosphere. Whole buildings are transformed through projection, such as Cinderella’s Castle at the Magic Kingdom Park in Orlando, Florida being transformed into different colours or the Tower of Terror attraction being covered in a projected wrapping paper for its opening in Disneyland Paris. For Disney, it is not about a fantasy world expanding onto the physical, it is about transforming the physical with imaginary elements.

In both IllumiRoom and Disney, the projective augmented reality exists as a temporary illusion. In IllumiRoom the illusion is a reaction to event occurring on the screen caused by the videogame player’s actions. Disney utilized the technology to aid in storytelling as well as a method for dressing the permanent structures with temporary festive decorations. This difference between the permanent nature of the trompe l’oeils and false perspectives and the temporary interactive nature of the projective augmented reality is a prominent factor in how the two are experienced and appreciated.

2. The Layering of Foreground and Background

The difference between the trompe l’oeils and false perspectives of the past and the projective augmented reality of the present lies in how their illusion is created.
through the layering of the foreground and background. The illusionistic elements of the trompe l’oeil are created to appear real by placing it in the background of an architectural scene. As pointed out by M.L. d’Otrange Mastai in *Illusion in Art: Trompe l’Oeil: A History of Pictorial Illusionism*, an entryway, such as an archway, is depicted in the foreground to act as an entry point into the illusion as well as to separate it from reality. This architectural element is given the intermediary function between the imaginary world and reality. An example of this can be seen in Masaccio’s *Holy Trinity, with the Virgin and Saint John and Donors* where the scene of the crucifixion is set back beyond the archway and columns of the foreground. The two figures of the donors in front of the archway push this architectural frame back from the foreground even further, making it not possible to physically enter the scene. In Pozzo’s vault at the Church of Sant’Ignazio the fictional architecture that is used to anchor the imaginary scene places most figures beyond the architectural frame with a few situated in front to place distance between the viewer and the inhabitants of the painting. The placing of the imaginary scene as the background of the painted architectural extension is what leads to the success of the deception by having the physical world be extended into the virtual while maintaining a sense of distance that cannot be broken.

In projective augmented reality, the reverse is true. The existing architectural and physical elements become the background of the illusion. For IllumiRoom, the projected imagery is layered on top of existing elements found in the room. Virtual outlines are placed onto the surrounding furniture and architectural details. This first augmented layer allows additional layers of animated components bursting out of the screen to have more credibility. With the virtual being layered over the real, it becomes the imaginary which is being extended into the physical. It is not about the deception of the illusion being real or expanding physical space into the canvas, but the explosion of the imaginary into the physical. The illusion lies in the reality becoming elements of the imaginary world no longer limited to the screen.

### 3. Perspective Limitations

Both the trompe l’œil and the projected augmented reality is created and limited through the use of perspective. The trompe l’œil has a specific vantage point that allows the illusion to succeed. In Sant’Ignazio, Pozzo painted a marker on the floor that would allow visitors to know where to stand to view the vault and dome correctly. When not at the ideal spot, the trompe l’œil appears distorted and the architectural details do not line up. Since the perfect viewing is at the centre of the vault, there is an approach that occurs where the imagery becomes distorted and gradually lines up with each step, until finally, the viewer arrives at the centre and the deception is complete. Although the coming into view reveals that the trompe l’œil is an illusion, it also allows for a moment of discovery which adds to the phenomenal impact. The marking of the physical center of the vault in the floor marks a temporal and physical entrance into the illusionary world, where the illusion
is perceived and felt to be there and where a viewer enters the painted vault projection through experience.

The projected augmented reality created with IllumiRoom consists of a singular projector, causing there to be one perfect viewing spot for the videogame player on the couch. If there are multiple players or viewers in the room, this would mean that only one person would experience the whole effect. Since the scale of a living room is much smaller than that of a large cathedral, the distortion will not be as noticeable; however, there will also not be a monumental moment where the image is complete. Any distortion noticed will be understood as errors in the programming to the participant. IllumiRoom creators take note that the distortion only occurs in illusions that transform the room’s geometry and not in modifications to surface colours of the room’s objects, and therefore try to keep large distortions to a minimum. IllumiRoom also takes advantage of the fact that the videogame player will be looking at the television screen with everything being projected existing in their peripheral vision, making illusions that may not be realistic when closely examined, still effective peripherally.

Disney use multiple projectors to remove the need for one vantage point and allow for a shared experience between the guests. This solves the problem of viewpoints but introduces the complication of alignment. With more projectors there is a greater opportunity for misalignment where one projection’s minor offset will ruin the whole illusion. Since Disney projects onto active display scenes that involve moving objects and actors, there is an added challenge to selectively project or not project on parts of a scene in real time.

The advantages of projective augmented reality lie in its dynamic nature which allows for changing imagery and temporal specific projections. IllumiRoom and Disney both show how a fictional space can burst out into the physical world with moving and transforming projections, such as a grenade jumping out of a television screen or butterflies flying around the Seven Dwarves’ house.

In all illusions, there is a moment when the deception is threatened. In the traditional trompe l’oeils and false perspectives this moment is responsible for the overpowering feeling of awe they instill. This is illustrated in the Greek story of Zeuxis whose paintings of grapes on the wall were so realistic that birds tried to eat them; however, they were only impressive when the human observer knew the grapes to be a lie. His story continues that when he was tricked into believing the illusion of a painted table cloth by Parrhasius, the triumph was not in the deception, but in the unmasking of the illusion by the trickster. In Bramante’s false choir of the church of Santa Maria Presso San Satiro, the impression of the illusion before it is dissolved is that of impressive architecture. It is believed to be a beautiful component to the overall detailing of the church. Once this is revealed to be a false perspective, the inhabitant is greeted with an increasing level of awe, caused by the revelation that they were so successfully deceived. The success of the illusion is in the knowing and the discovery of it.
Contrary, however, is the case for projective augmented reality. When the deception is revealed to be false, the successful illusion begins to appear like a cheap trick. The impressiveness only lies when the illusion is fully operational. Any tells give the impression of low quality computer graphics and outdated technology. When the multiple projectors at Disney do not align properly, the deception is revealed, but instead of being impressed, the viewer sees it as a technical error that could have been avoided. The difference may be in the idea that for augmented reality, the illusion is active whereas in the trompe l’oeil it is passive. The projective augmented reality of IllumiRoom is always known to be part of the virtual world of the videogame; it is just allowed to break the barrier of the television screen. It is not a permanent illusion and will disappear when the power goes out. The trompe l’oeils and false perspectives do not need to engage the viewer for the illusion to be present nor have anyone or anything controlling it. It exists whether the church is occupied or not. The projective augmented reality, however, requires the illusion to be actively controlled. The interactive and temporary nature of the illusion leads to its corruption. Whereas for the former illusions, the viewer shifts to observe correctly, the projective augmented reality participant expects the illusion to move itself to the perfect alignment.

4. Standing Still and Observing Atypically

In both the tradition trompe l’oeil, false perspective, and the projective augmented reality, the illusion is experienced through a stationary moment. To feel like one is entering the virtual world, the body must stop to allow the imagination of the mind to continue beyond the physical boundary of the wall or screen. The trompe l’oeils by Pozzo at the Church of Sant’Ignazio and Masaccio’s Holy Trinity both require the viewer to look up to appreciate the illusion. This makes there be an obvious need to stop walking. For the false choir by Bramante at Santa Maria Presso San Satiro, the inhabitant is forced to stop walking when they reach the end of the aisle and, to appreciate the coffered vaulted ceiling, they will look up. In the case of the projective augmented reality of IllumiRoom, the videogame player is looking straight ahead but viewing the augmented imagery with their peripheral vision. Their stationary condition lies in the nature of viewing a television screen from a seated position. Disney augmented reality experiences are mostly viewed from a significant distance and as a performance where the viewer is stationary. In each case, the viewer is still and seeing the imaginary expansion through an atypical method of observing. To believe the illusion, one must not be experiencing it in their usual method of experiencing the world. A distance is kept from the imaginary and real, but this distance is what makes the illusion believable. This idea is illustrated in the Chinese tale of Wu Tao-tsz who painted a beautiful mural of a landscape in the palace of the emperor Ming Hwang. At the unveiling of his masterpiece of a depiction of the mountains and forest, Wu Tao-tsz entered the painting and disappeared into an opening in a painted cave. The emperor was unable to follow
him because as soon as Wu Tao-tsz disappeared, the whole painting did as well. The entering of the illusion was unobtainable for the emperor, and as soon as he physically tried, the illusion faded away.

*Trompe l’oeil*, false perspectives, and projective augmented reality all help merge the real and the imaginary together. The key difference between the methods of the pre digital era and those using a digital methodology is that the former expand the real into the virtual whereas the latter explode the virtual into the physical. This key difference aids in the success and failures of each method but still does not create a huge drift between the two outcomes. Each requires the inhabitant to stand still and allow the imagination to enter the imaginary world that is in front of them. The illusion is linked to the real via use of architectural elements, both in reproducing and continuing the elements already in the building, or in layering virtual elements on top of the existing. The success and failures of each method helps show the secrets to a successful relationship between the real and the virtual.

**Notes**


4Roker, ‘Empire of the Eye:4’


6Mastai, Illusion in Art, 144.


9Mastai, Illusion in Art, 98-100.


11Roker, ‘Empire of the Eye:4’


13Mine, ‘Projection-Based Augmented Reality in Disney Theme Parks’ 38-39.


Bibliography


