

Augmentation as Art Intervention:
The New Means of Art Intervention Through Mixed Reality

by

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Submitted to the Department of Architecture in partial fulfillment of the requirements for
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ABSTRACT

This thesis explores an emerging art form—mixed reality art—the new opportunities, changes, and challenges it brings to art intervention. Currently, mixed reality art is in its early stage of development, and there is relatively little scholarship about this subject. However, I believe augmentation as a new art form has great potential in the art field, and this thesis aims to address this gap. I argue that augmentation can be used as a new means for art intervention, and that it can bring new opportunities for artists not only to augment the use of sites, but also to create a better cultural and emotional experience for the viewer.

Within the scope of mixed reality art, this thesis discusses augmentation of senses, sites, and data; this includes not only the exploration of this medium through a series of my recent artworks, but also includes experiments of other mixed reality art pioneers. I believe that my art will not only inspire my future creation, but also shed more light on this new art form.

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I. INTRODUCTION

Back when I was an architect in 2013, I had a keen interest in the art interventions that architecture and landscapes can have on a city. Large-scale art interventions, however, have many limitations. To break through these limitations, I have experimented with many different methods and art forms. Such efforts, however, have resulted in little success. This was the case until 2016, when I was exposed to mixed reality technology during my Master's degree in Los Angeles. I found that when it comes to an art intervention, augmentation could be a very promising art medium, even though mixed reality technology had only just emerged. The interest in art and technology prompted me to come to ACT. Over the past few years, I have made many attempts to explore the possibilities of augmentation as art intervention and to do so from different angles. I hope my art practice will inspire other mixed reality artists.

“Art intervention” is an interaction that engages an existing situation, context, or audience. Rather than a standalone project, an art intervention is a form of performance art with many contingencies that engages the public, attempting to make its audience aware of a condition they had no prior knowledge of, to alter an economic or political situation, or to challenge an existing piece of artwork or view. Today, with the needs of the times and how quickly technology is progressing, there seems to be a shift in how an art intervention is defined and used.



Figure 1. Stuart Brisley, *Beneath Dignity* 1977, Tate, © Stuart Brisley.

Long before the incorporation of electronic technology, art interventions have succeeded in creating changes on a global scale, and this art creativity continues to date. Societies have always organized against repression by any means available and have been organizing and participating in art movements against the political and corporate elite since the beginning of recorded history.

In the 1960s, artists tried to fundamentally change their role in society and strive to create social change. Art intervention came into being. Hence, art installations are most commonly associated with conceptual art and performance art.

Before the 1990s, art interventions were expressed through a variety of mediums, including sound, billboard art, graffiti, sculpture, structural installations, and architecture. These artworks understood restraints, whether physical, metaphysical, or behavioral, as the given conditions in which new meanings could be introduced through disturbance, superimposition, or redefinition.

For instance, Eberhard Bosslet's *Concomitant*, completed in 1983 at the Canary Islands, features a series of site-specific outdoor art interventions and is an example of an artwork that uses contextual limitations as creative guidelines and boundaries. The

installation simultaneously respects the existing topographical logic and conditions of the site and alters the viewer's expectations and perceptions of the context at a scale in between architecture and landscape.



Figure 2. *Begleiterscheinung II*, Eberhard Bosslet, 1984¹

Street art and graffiti stenciling is another example of a creative intervention that takes advantage of existing site restraints. Often occupying building facades, self-built physical prop pieces, or public space areas, graffiti art aims to exert thought-provoking political messages, critical social commentary, or visual-spatial distortions and illusions. A notable example is the British interventionist artist Banksy, who demonstrates the subversive combination of dark humor and street art that explores political and social themes and challenges existing belief systems and human conditions. Similarly, the New York multiethnic group of writers, visual and performance artists, filmmakers, and

1. Fig. 2. Since 1983. Bosslet has worked with ruins: so-called Bauzeichnungen, Reformierungen und Begleiterscheinungen (construction drawings re/formations and side effects), this is the transformation of industrial buildings and housing by means of linear or laminar painting.

historians collectively known as REPOhistory intervenes in selected sites in New York City to highlight and retrieve the missing histories and overlooked narratives of past peoples and events, focusing on issues of race, gender, class, and colonialism, essentially questioning the way history has been constructed and told. Democratic in nature, interventionist art values the idea of the body in space and uses art as a medium to engage the body to complete the creative production process.



Figure 3. REPOhistory: Lower Manhattan sign project, 1992²

Although past interventionist projects were meant to be engaging and provocative, drawing the public's attention, they have been highly limited by both space and time, political sensitivity, physical boundaries, and theoretical shortcomings because of a lack of information available to the artist. The aforementioned examples typically target only one media of artistic expression and are highly restricted to the spatial and temporal boundaries of the selected sites of intervention.

2. Fig. 3. "Stock Market Crashes by Jim Costanzo as part of REPOhistory's Lower Manhattan Sign Project," last modified March 28, 2011 by Justin A. Langlois, <http://www.brokencitylab.org/notes/repohistory-lower-manhattan-sign-project/>.

Today, the computer is the universal machine driving the new information age. This technology, which is currently being propelled by an increasing range of interactive global networks, has had a profound impact on the social, political, and cultural landscape. Take REPOhistory as an example. After 2010, the artwork of this art organization turned from the streets of New York to the Internet and created a website (www.repohistory.org). In 2014, REPOhistory published the article titled “REPOhistory's Circulation: The Migration of Public Art” on the Internet, discussing art intervention, network information, capital, and democracy in the information age.³

It is in the information age that there is a gap between art intervention and what is needed— a need to take advantage of digital information as a powerful art intervention expression tool. This gap, however, is not only embodied in technology, but also in cognition. Fortunately, in the context of data space and emerging technologies, a new concept— mixed reality—has sprung up.



Figure 4. Mixed reality by Microsoft HoloLens, © Microsoft

3. The Information Age (also known as the Computer Age, Digital Age, or New Media Age) is a historic period in the 21st century characterized by the rapid shift from traditional industry that the Industrial Revolution brought through industrialization, to an economy based on information technology. Manuel, Castells, *The information age: economy, society and culture*. Oxford: Blackwell, 1996.

Mixed reality (MR) is a form of virtual reality (VR), but it is a broader concept than augmented reality (AR), which augments the real world with synthetic electronic data. On the opposite side, there is the term augmented virtuality (AV), which refers to technology that enhances or augments the virtual environment with data from the real world. MR covers a continuum from AR to AV, embracing the definition of MR stated by Paul Milgram.⁴ It seems that MR has the potential to become a perfect form of art intervention. Not only that, but the art intervention is also being redefined because of this technology.



Figure 5. Augmented reality art takes over the MoMA

With mixed reality technology, changes in art have taken place. With device and digital visual information, artists are breaking down what was once deemed impossible. Time and space are no longer authentic. Virtual reality has blurred the boundaries of the existing situation. Therefore art interventions no longer face the limitations of space and time. Indeed, digital information invades real space and can directly affect the human

4. P. Milgram and F. Kishino, "A Taxonomy of Mixed Reality Visual Display," *Inst. of Electronics, Information and Communication Engineers (IEICE) Trans. Information and Systems E77-D*, no. 12 (1994): 1321–1329.

senses. Augmentation itself has become a form of intervention. Using technology to augment space, human senses, and data, art interventions have become more complex yet more straightforward. So far, mixed reality technology is still in an early stage of development, and there are relatively few studies available on the subject.

However, some artists have attempted to work within the realm of mixed reality, and they have had a positive impact. At the same time, most people have not realized that mixed reality could become a revolutionary technology that will change how we look at the world. In the future, we will become the media. Freeing the virtual from a stagnant screen, we will transform data into physical, real-time space. Then, we will be able to make site-specific art without a specific site and time-based art without relying on continuous time.

I believe that augmentation through mixed reality has a great potential in the field of art. The current thesis not only analyzes my art practice over the past few years but also combines and summarizes the achievements of other mixed reality art pioneers. I believe my art studies will not only inspire my future art creation, but also can attract more attention to this new art form.

In the following pages, I will introduce several of the new technologies and art forms, including their contributions to the field and exploration as art interventions. The following chapters I provide a series of parallel discussions on the augmentation of the senses, sites, and data.

II. METHODOLOGY

To begin with, there are two terms that need to be clarified regarding augmentation: mixed reality (MR) and augmented reality (AR). In fact, the relationship between MR and AR is somewhat confusing, and there are no sufficient scholarly definitions and studies to clarify the relationship between them. Because this technology is still in development, the related terminology is constantly being adjusted and updated.

At the very beginning, as pointed out in Jonathan Crary's "Techniques of the Observer,"⁵ in seventeenth and eighteenth centuries, one's sense of vision was seen as related to one's sense of touch, so the faculty of vision was not privileged over the other senses. The space of order was unified. In the early nineteenth century, the metaphor of the camera obscura lost its authority. The vision was no longer seen as completely based on an external object—the primary tool of seeing was the process of perception. It became possible to calculate and measure vision, so the rationalization of vision occurred. Hence, the boundaries between the subject and the object became blurred. This is a change in vision in the era of modernity, even before the advent of art or technology. Today, a similar history is repeating itself.

In the early 1990s, people used the term mixed reality for the first time, it is the merging of the real world and visualized digital image to produce the new media interface where physical and virtual objects coexist and interact in real time. Mixed reality takes place not only in the physical world or the virtual world but rather is a mix of reality and virtual reality, encompassing both augmented reality and augmented virtuality via immersive technology.

5. Crary, Jonathan, *Techniques of the observer : on vision and modernity in the nineteenth century*, Cambridge [Mass.] : MIT Press, 1992, c1990, 171 p. : ill. ; 24 cm.

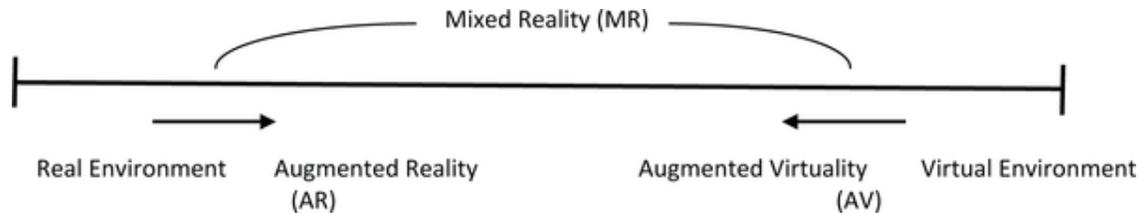


Figure 6. Representation of the reality-virtuality continuum, redrawn from Milgram et al. 1994

If Descartes wrote about camera obscura as a “detached eye,” which could provide an objective and truthful view of the world, then today’s mixed reality technology is the “creative eye,” which can provide a world that conforms to reality’s logic but goes beyond the reality.⁶ The new medium of mixed reality expands our imagination and understanding of an art intervention by providing new opportunities and ways of hybridizing existing medium, MR blurs the boundaries of space and breaking the limitation of time, fundamentally changing the audience’s behaviors and interactions with the virtual world. Mixed reality not only allows for the seamless transition, juxtaposition, and exchange between the material and the immaterial, but fundamentally bypasses temporal and spatial limitations of traditional interventionist art medium. It allows artists to imagine and expand the scope of the art to include works produced by industries such as entertainment, gaming, performance, and content display, and to reach out to a broader audience.

As an emergent technology, the application of mixed reality is still uncertain and open to reimagining and negotiation. Locative media pioneer Ben Russell identifies a similar openness in earlier locative technologies that he saw as seeking “grassroots and consumer level interpretation of what these devices are” indeed, in these emergent mixed reality/augmented reality systems, there is a sense of the artists looking for technology usages that are meaningful to the broadest constituency, seeking to expand, rather than constrain, these technologies as they begin to enter mainstream usage. This presents an opportunity for artists and activists to shape these technologies, to establish them as tools for location-based annotation, and to critique and expand the range of applications and

6. Descartes, *The Philosophical Writings of Descartes*, vol. 1, p. 166; *Oeuvres philosophiques*, vol. 1, pp. 686-687.

understandings for these technologies as they progress from new to “mature” technologies.

Compared with augmented reality, in the current thesis, I chose mixed reality as an adequate term because projections and augmented reality play similar roles in many art interventions. In a transition from traditional media to virtual images, projection art has played a leading role. Therefore, I include them together in the definition of mixed reality. In the present thesis, mixed reality art intervention mainly refers to projection intervention and augmented reality intervention through the use of wearable/portable equipment.

2.1 Projection as Augmentation

Projection art is centuries old. Usually, artists project text and image information into specific spaces, and the visual information becomes an augmentation that mingles with space. Critical art and activism are constantly found together with projection art. In recent years, as technology and equipment have become cheaper, projection art has begun to appear more frequently in the public eye. The result has been an attention-grabbing method of protest, one that has raised questions about its legality as it brings what activists call new opportunities for conversation.

Krzysztof Wodiczko is a well-known artist born in Warsaw, Poland in 1943. He is known for his projections on building facades and monuments. War, conflict, trauma, memory, and communication in the public sphere are some of the major themes of Wodiczko’s body of work. He was one of the first to pioneer guerilla projection, utilizing very powerful machines capable of projecting images onto entire buildings facades. In 1985, he famously projected a swastika onto the South African Embassy in London for about two hours before it was shut down by the police. Although the work was short lived, photos of the intervention were circulated around the global press, reaching the eyes of millions.

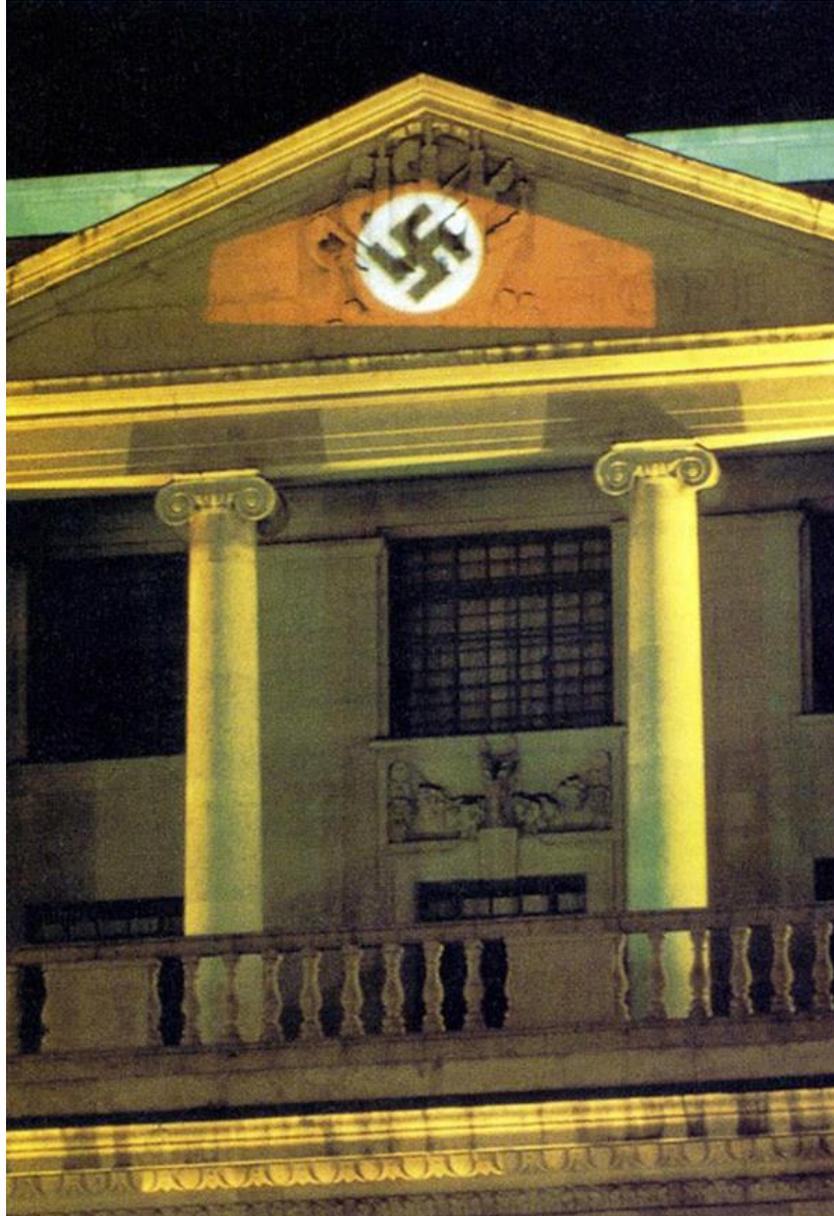


Figure 7. *Projection on South Africa House*, Krzysztof Wodiczko, Trafalgar Square, London, 1985

Conceptual artist Jenny Holzer created her *Truisms* series in the 1970s, printing a series of opinions and aphorisms on paper and posting them around New York City in an echo of advertising techniques. In 1982, *Truisms* took a new, electronic form when it appeared on the Spectacolor sign in Times Square. In 2005, She projected the declassified government documents about the Iraq war onto different building facades in New York City and began her political work in her artistic career.

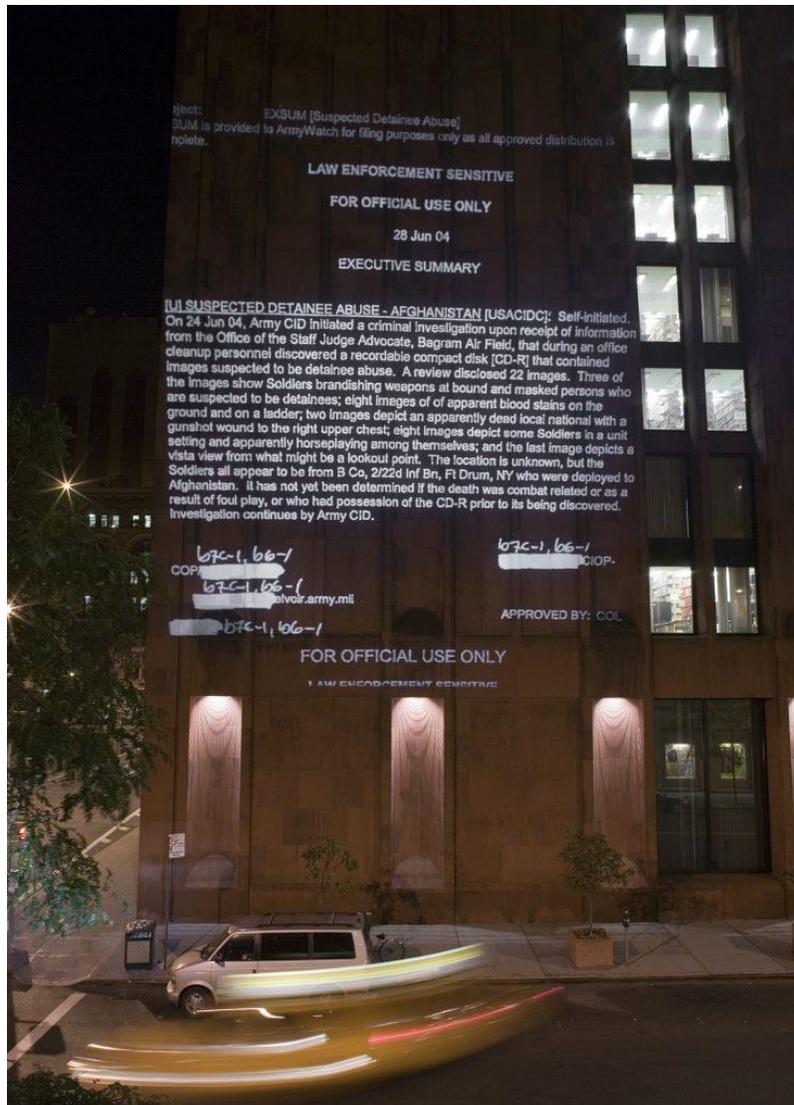


Figure 8. *For the City*, Jenny Holzer, 2005⁷

In recent years, with the advancement of optical technology and the development of the entertainment industry, people have invented a new art form—projection mapping. Projection mapping is the display of an image on a nonflat or nonwhite surface; it uses the standard video projectors, but instead of projecting on a flat and white screen, the projection is mapped onto any surface, turning common objects of any 3D shape into interactive displays for artistic effects, becoming interactive multimedia that is

7. Fig. 8. A light projection by Jenny Holzer appears on the Elmer Holmes Bobst Library at New York University in New York City in *For the City*, 2005. Presented by Creative Time / © 2005 Jenny Holzer. Photo by Attilio Maranzano

holographic or with interactive displays and, hence, of a mixed reality nature that does not require headsets.



Figure 9. Projection (left) and projection mapping (right)

After using critical projection as an art intervention, artists began to make projection art more visual. Artists could use the projection illusion of space to enhance the dimension of the space to stimulate the viewers' senses. This made projection the most intuitive form of augmentation: viewers could experience the illusion space without even wearing any equipment.

Today, projection mapping is no longer an eye-catching gimmick but has become a truly popular art trend. Video editing technology and projection mapping software greatly save production costs. Compared with the vast field of engineering, projection mapping can achieve the same effect at a lower cost by augmenting any everyday life space—from on buildings to on sculptures and even nature itself.

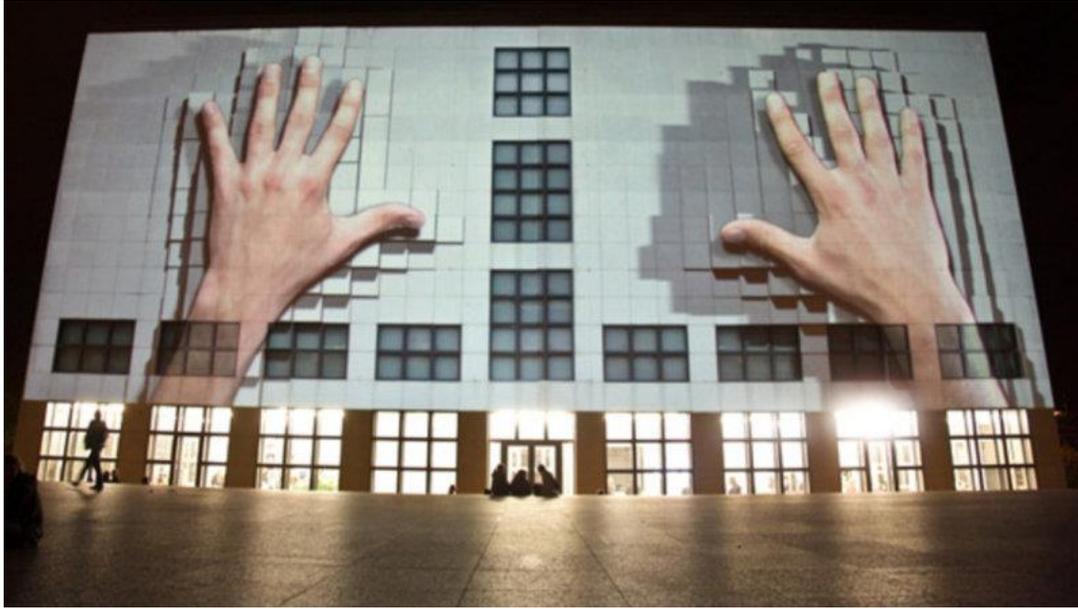


Figure 10. The 555 *KUBIK* facade projection on Kunsthalle in Hamburg, Event ATX, Germany, 2010⁸

Compared with the art interventions that directly project information onto the facade of the building, projection mapping is a direct augmentation of reality, and this augmentation directly affects one's senses, making the themes of this art form more broad compared with traditional art forms.

2.2 New Attempts Through Augmented Reality

In addition to projections, which have been widely used in art interventions in recent years, as an important part of mixed reality technology, augmented reality has become a widely used means form of art. Although the world is abuzz with the first successful and widely popular augmented reality game—Pokémon GO—artists have been creating augmented reality art for years before this. Joseph Farbrook, John Craig Freeman, Will Pappenheimer, and Zachary Brady are all pioneers and early adopters of AR technology. This then leads to the question of what AR is and how it works.

8. Fig. 10. The conception of this project consistently derives from its underlying architecture—the theoretic conception and visual pattern of the Hamburg Kunsthalle, URBANSCREEN, Vimeo, posted on July 14, 2009, <https://vimeo.com/5595869>

AR is a technology that has recently become much more accessible to the general public and has risen in popularity in parallel with the invention of the smartphone. Indeed, mobile technology is sweeping the globe, and more and more people worldwide have been gaining access to networked mobile devices such as smartphones and tablets. In addition to accessing computers and having an Internet connection, mobile AR allows artists to make anything anywhere at a low cost or no cost at all. With AR, artists can make their artworks in their own homes and show them anywhere in a city. Activists can initiate a protest in a city even when they are sitting halfway across the globe.

It is true, however, that AR can never replace the physical presence of people, just as it can never replace reality; it is a tool just like any other tool that artists use for an art intervention, such as installations, placards, signboards, Graffiti, and blogs and so on. For instance, on June 4, 1989, during the Tiananmen incident in Beijing, the spiritual symbol of the student protests—a 10-meter-tall statue of the Goddess of Democracy created by the Central Academy of Fine Arts—was destroyed by soldiers clearing the protesters from Tiananmen Square. The government issued a statement that the erection of the goddess statue in the square violated the regulations and was an insult to and trample on the dignity of the country and the national image. Twenty-two years later, in 2011, the statue of the goddess of democracy once again appeared in Tiananmen Square, but this time eternally, as an object in virtual space that can only be viewed through electronic devices. Today, the voice of art interventions in virtual space has created a considerable influence on the public. On some level, the virtual sculpture (or other piece of art) is “real” and (in)visible, situated in a delicate interstitial zone between the material and immaterial that challenges our perceptions and understanding of art.



Figure 11. Tiananmen Square augmented reality, 4 Gentlemen, 2011⁹

The rise of AR technology poses questions for the next generation of artists, who will be empowered by the possibilities of finer grained precision, greater complexity, expanded notions of space, time, and interface, and more novel ways of approaching human-computer interaction (HCI). In its current popular implementation, AR is largely limited to the interfaces of mobile devices, which display context-specific information overlaid onto a specific location in the “camera’s view,” allowing the viewer to see juxtaposed contents from mixed realities through a physical threshold. For example, recently, a group of eight Internet artists transformed the Jackson Pollock room in New York MoMA into an augmented reality gallery without the museum’s consent, demonstrating the democratization of a space formerly perceived as intellectually exclusive and elitist to introduce a grassroots art movement and freedom of expression.

9. Fig. 11. “Tank Man and Statue of Democracy, Tiananmen Square Augmented Reality, Four Gentleman,” last modified 2011, <http://fourgentlemen.blogspot.com/2011/01/tiananmen-square-augmented-reality.html>.

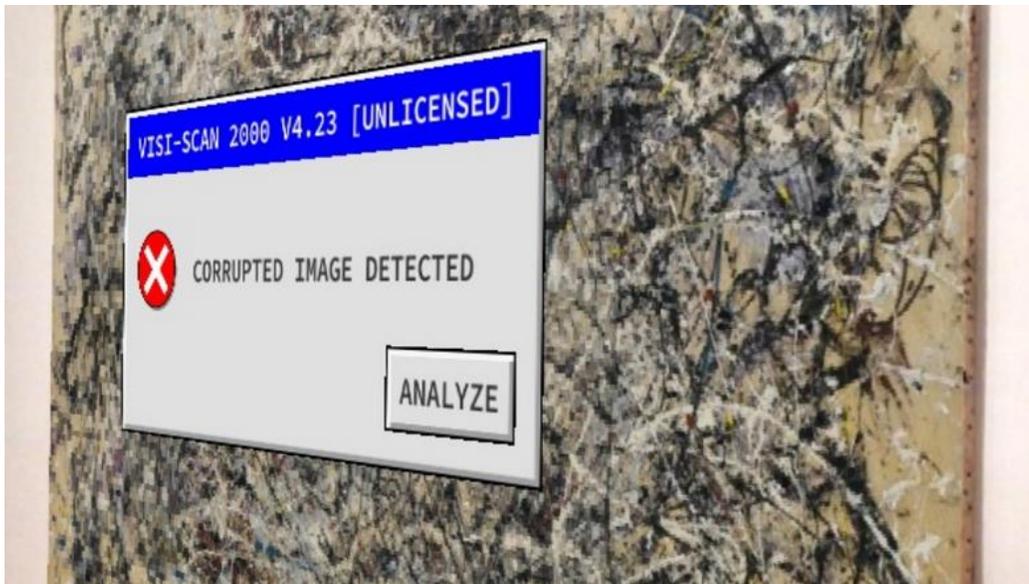


Figure 12. MoMAR in New York MoMA¹⁰

However, this richer conceptualization of augmented space, as articulated by Lev Manovich, goes beyond the two-dimensional threshold of a camera and moves toward augmenting print content with the display of 3D models.¹¹ Emergent AR applications allow artistic and political activation of “sites with large-scale data-led critiques, particularly in conjunction with physical intervention” in a world of open and accessible data that has already been geo-tagged.¹² Compared with art interventionism in the past, AR art benefits even more from site specificity because physicality is now fused with rich invisible layers of data that are available and extend our understanding of the complex and multilayered relationships and interactions among data, context, and audience.

10. Fig. 12. “Image by DeGeurin, Mack, Internet Artists Invaded the MoMA With a Guerrilla Augmented Reality Exhibit,”

https://motherboard.vice.com/en_us/article/8xd3mg/moma-augmented-reality-exhibit-jackson-pollock-were-from-the-internet.

11. Lev Manovich, “The Poetics of Augmented Space,” Academic Journal, University of California, Warren College, San Diego, 2002.

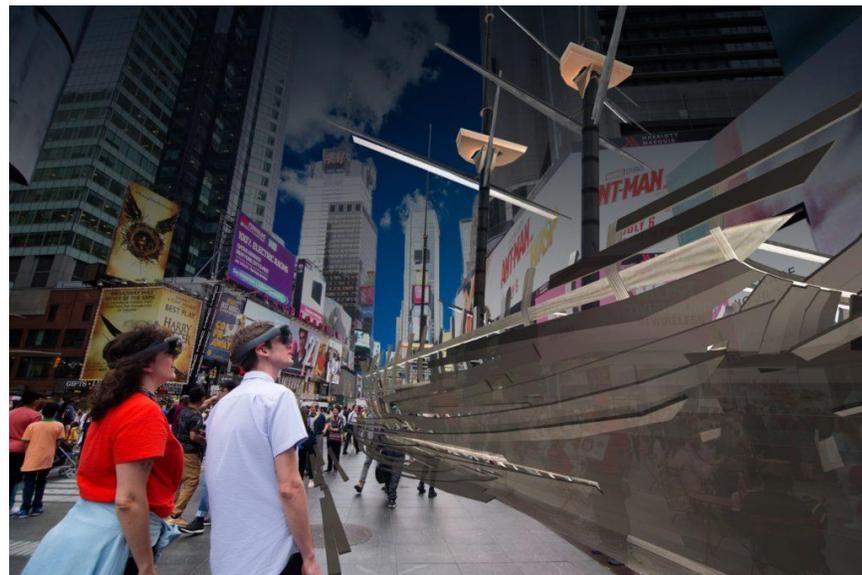
12. C. McGarrigle, “Augmented Interventions: Re-defining Urban Interventions with AR and Open Data,” *Augmented Reality Art - From an Emerging Technology to a Novel*, Springer International Publishing Switzerland, 2014.

2.3 How to Use Augmentation as an Art Intervention

In past art interventions, there have always been some attempts to make the audience aware of a condition that they had no prior knowledge of, to alter an economic, political situation, or to challenge an existing piece of artwork or world view. Today, with the help of the Internet, this knowledge is exposed by artists in a more authoritative way and is presented by artists in more diverse forms. By augmenting the reality or information—or the senses—these augmentations are freed from the limitations of many realistic factors and can be presented to the people in an unprecedented way.

In July 2018, American artist and activist Mel Chin debuted *Unmoored*, a six-minute mixed reality artwork that envisions a memorable image of New York City's Times Square submerged in water. Using Microsoft's HoloLens smart glasses or augmented reality smartphone app, viewers could see what the city would look like if global warming remains uncontrolled and sea levels keep rising. With Times Square as its backdrop, *Unmoored* depicts animated boats floating 26 feet above the ground, entering the square from adjacent streets. Over time, the number of boats increases, resulting in gridlock. In the final scene, the boats begin to rust, and sea creatures start to appear, “drawing the user's attention downward” and “back into the current reality.”¹³

13. Sarah Cascone, Artist Mel Chin Floods Times Square With Virtual Reality Art to Sound the Alarm on Climate Change, Article, July 12, 2018, <https://news.artnet.com/exhibitions/mel-chin-confronts-climate-change-times-square-virtual-reality-artwork-1317413>



Figures 13 and 14. *Unmoored*, Mel Chin, 2018¹⁴

Times Square has long been used as a venue for protests and art interventions. As Mel Chin said, “I see Times Square as most Americans might; it represents the endless clock, the public heart of New York City.”¹⁵ Today, this has not changed; instead, merely the media of the artists and activists have been updated. Mixed reality is one of the most

14. Figs. 13 and 14. Rendering of the rebuilt USS Nightingale in Mel Chin’s *Unmoored*. Image courtesy of Mel Chin.

15. Ayda Ayoubi, *Experience A Submerged Times Square Using Mixed Reality*, Article on [architectmagazine.com](https://www.architectmagazine.com/technology/experience-a-submerged-times-square-using-mixed-reality_0), July 12, 2018, https://www.architectmagazine.com/technology/experience-a-submerged-times-square-using-mixed-reality_0

powerful tools of current artists, in this case turning Times Square and viewers into a part of the artwork.

However, technology can also hinder the experience at times. First, people have to download the Unmoored app, which takes up 100 MB on Android and 170 MB on iOS devices. Many tourists have to use free Wi-Fi in Times Square to do this, which can take up to 15 minutes. After opening the app, people then have to find one of six badges painted on the ground around the sculpture and line them up with a digital version using the phone's camera. Once the calibration has been completed, the viewers can watch the ships come together from where they are standing.

The scene that people see through HoloLens cannot be constructed with real tools. When the future is intuitively placed in front of you, any doctrine that was once thought to be appalling seems to be credible. This is what the shocking effect that is augmentation as an art intervention can bring to the audience—it stimulates our senses and challenges our common sense.

There are indeed many limitations to mixed reality art. However, the freedom and security it brings to artists and activists are far greater than its drawbacks, which here would be its dependence on equipment. People are just beginning to discover what makes augmentation a great art intervention form, and as many have come to understand, augmentation can be one of the most powerful expression tools for artists and activists, giving viewers the most intuitive experience possible.

III. AUGMENTATION OF THE SENSES

3.1 New Interactive Interfaces

Data have already become an indispensable extension of people's lives, affecting our behaviors and reconstructing cultural and societal norms under shifting economic and technological advancements. With their data capturing and filtering capabilities and artificial intelligence algorithms that increasingly become more and more salient, smartphones infiltrate almost every aspect of our lives. Meanwhile, in the field of HCI, there is a growing trend to make these data become more tangible rather than solely confining them to a flat, two-dimensional digital display. As a first step to using data, there is augmented reality, which fundamentally changes the definition of the screen.

First developed at the ATR Kyoto Research Laboratory, one of the earlier forms of augmented reality is something that uses a specific digital or fiducial marker that gives a unique signature to an objective "seen" by a computer camera. Essentially, this work is an enhanced DJ station where the participants can make audiovisual mixes through the manipulation of vinyl albums by use of the fiducial markers printed on them.



Figure 15. *Augmented Groove*, Berry and Poupyrev 1999 (left); *Reactable*, Jorda, et al. 2005 (right)

In 2005, *Augmented Groove* used an overhead camera, as opposed to *Reactable's* use of cameras underneath a translucent table that used Microsoft Surface tabletop computers. *Groove* showed the use of fiducial markers as controls, but one of the more popular

demos of 3D overlaid media would emerge through videos that demonstrated the ARToolkit proof of concept using a particular animated character.

Over the past fifteen years, starting from its emergence in the 2010s as an art medium, augmented reality has developed as a number of evidential sites. As an extension of virtual media, augmented reality merges real-time pattern recognition with goggles—finally realizing William Gibson’s sci-fi/fantasy—or with handheld devices. This creates welding of the form of real-time video and virtual reality, or an optically registered simulation overlaid upon an actual spatial environment.

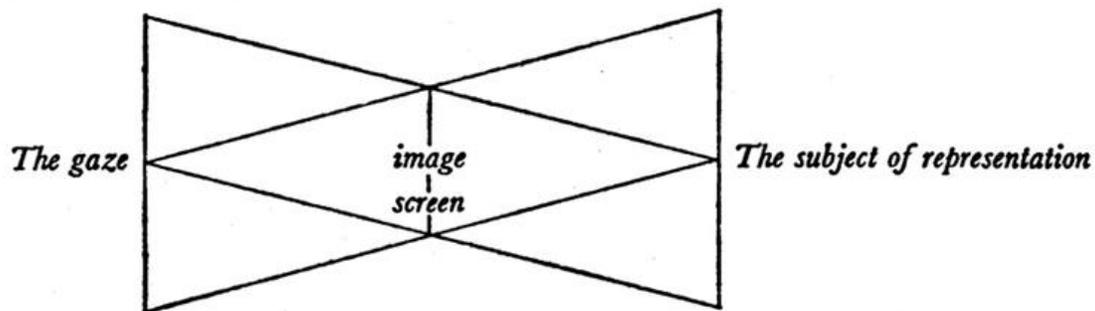


Figure 16. Lacan’s diagram of the visual field¹⁶

Lacan’s diagram of the visual field shows his interpretation of the Freudian psychoanalysis as a double world of object and the subject of representation. In psychoanalytic theory, there is a mirror equivalence between the subject’s inner and outer welt (world).¹⁷ In the era of big data and computer vision, AR blurs the boundaries between the two domains, producing increased control of various design parameters that brings increased possibilities for artistic expression. The image screen is no longer the border between the subject of representation and the gaze; here, the definition of the

16 Fig. 16. Lacan’s diagram of the visual field. *The Four Fundamental Concepts of Psycho-Analysis* (New York: Norton, 1973/1981), 106.

17 Lholm, *Objet Petit A is the Elephant in the Room*, Architects.Lacan, Wordpress, last modified November 11, 2014, <https://lholm.wordpress.com/author/lholm/>

screen has been changed.

Broadly speaking, the screen is a medium that connects multiple different dimensions. The AR screen is a media screen that can manipulate, analyze, and combine live images, and then generate virtual images. Indeed, augmented reality is about combining live mediation with live computational augmentation, a medium whose essential material is not captured in objective reality like cinema or image, but in the electric mediation itself.¹⁸ Simply put, these electronic mediations are real-time data streams that respond to the viewer's behavior in real time, and artists can modify the images or information reflected by these data at any time.



Figure 17. *TRANSFORM* by MIT Media Lab Tangible Media Group¹⁹

Today, the proponents of AR technology have been looking for breakthroughs through augmenting other human senses. MIT Media Lab's Tangible Media Group's paper entitled "Tangible Bits: Towards Seamless Interfaces between People, Bits and

18 G. A. Rhodes, *Augmented Reality Art: From an Emerging Technology to a Novel Creative Medium*, Springer International Publishing Switzerland, 2014, p. 170.

19. Fig. 17. *TRANSFORM* is comprised of three dynamic shape displays that move more than 1,000 pins up and down in real time, transforming the tabletop into a dynamic tangible display. Tangible Media Group/MIT Media Lab.

Atoms” attempts to bridge the gaps between cyberspace and the physical environment, as well as the foreground and background of human activities.²⁰ Their projects *metaDESK*, *transBOARD*, and *ambientROOM* demonstrate how digital information can interact with the user beyond the traditional GUI desktop. Rather than virtualizing everything, physicality is highly emphasized in these projects to mark the importance of the human sense of touch, which is crucial for interactivity.

In popular culture, AR has penetrated into various film and television works. *SIGHT*, a short film by Eran May-raz and Daniel Lazo, explores the world of “augmented reality.”²¹ The film follows Patrick as he goes through his day, playing video games, preparing a meal, and getting ready for a date. We are taken from a computer-enhanced environment of convenience to a more complicated reality, showing us what it might be like if apps and cell phones were not just handheld devices but embedded into our minds, bodies, and culture.



Figure 18. *SIGHT*, Eran May-raz and Daniel Lazo, 2012

20. Hiroshi Ishii and Brygg Ullmer, *Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms*, MIT Media Laboratory, Tangible Media Group, Published in the Proceedings of CHI '97, March 22-27, 1997.

21 Eran May-raz and Daniel Lazo, *SIGHT*, an AR fantasy film explores the world of "augmented reality," 2012.

By looking at augmented reality as a method of delivering artistic content, the film provides more interfaces for art intervention. From the exploration of manipulable interfaces to the definition of the screen to people's minds and bodies, the constantly changing manifestations brought by mixed reality provide artists with more ways to create works of cultural production.

3.2 Augmentation in Performance Art

Performance art has always been a very important form of artistic intervention. Typically, this form features a live presentation given to an audience or onlookers and draws on such art forms as acting, dance, and music. The performers draw the attention of the audience using prearranged or impromptu performances and sometimes interact directly with the audience.

Although the new media form of augmentation technology has changed the entertainment industry, performance art has also changed. As mentioned above, projection mapping has gradually become a mainstream form of performance art. Through the confusion of the visual sense and the enhancement of real space, projection mapping brings augmentation to the performing arts. Real-time interaction through electronic mediations greatly enhances the chemical reaction between the audience and the performing arts.

The virtual environment is undoubtedly a new area for the performing arts. When the performance weaves together digital technology, visual arts, and movement, the entire performance space of actors and spectators becomes the stage.

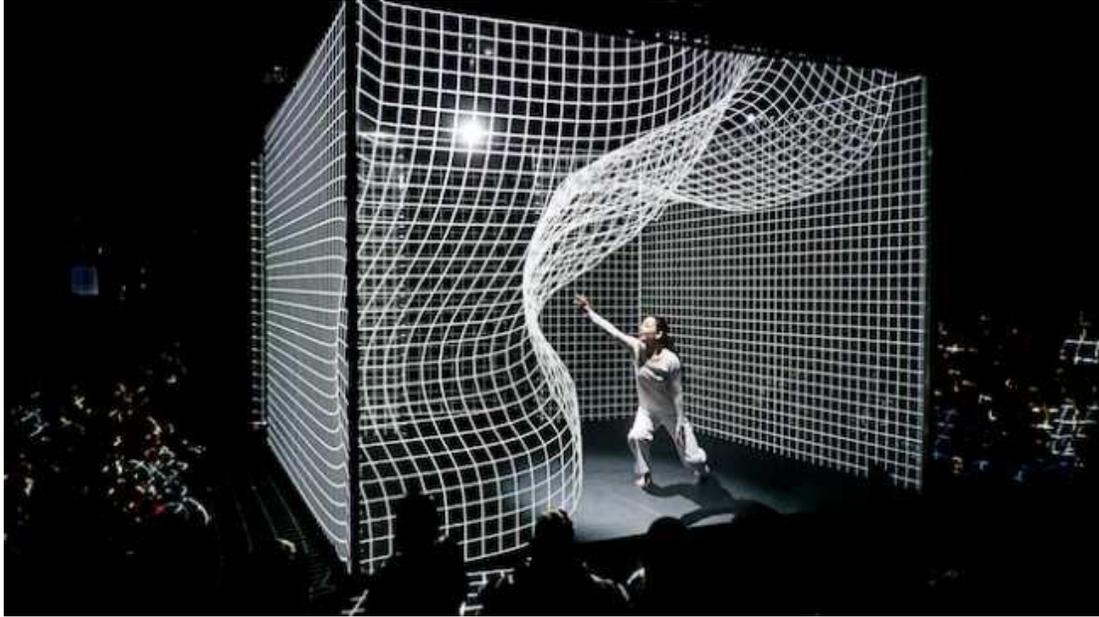


Figure 22. *Hakanai*, Adrien M. / Claire B., 2015

Hakanai is a digital solo performance from Adrien M. and Claire B. that made its debut at BAM's Fishman Theatre on March 17, 2015. The light is projected on a cube device made of translucent veils, and the projected particle effect is generated in real time based on the dancer's motion, thus giving the audience a 3D feast of dream and reality interaction. In the performance, the audience feels immersed; there is no gap between the performer and the audience. The virtual world from the projection enhances the sense of participation and immersion of the audience, which is crucial for the performing arts.

Inspired by actual works, I began to make my artwork combined with mixed reality and performing art, attempted to use projection mapping and interactive technology to engage the public more as a public art intervention.



Figure 19. *INTERACTIVE VOXELS*, Runzhou Ye, 2016

INTERACTIVE VOXELS is my 2016 work; it is an easy-to-assemble interactive projection mapping installation based on a voxel structure, as the name itself suggests.²² The concept of the installation is to have a sculptural object that can be displayed as an art piece with or without visual projection. To engage the public as a public installation, the project allows onlookers to play their own music and light shows through the control table placed in front of the main piece. The installation consists of three groups of different size voxels (three-dimensional pixel) or cubes and a background connective screen that has been assembled in a way to resemble pop-up art, or a kirigami conceptually.

²² *INTERACTIVE VOXELS* by Runzhou Ye, 2016, the link of the demo video: <https://www.youtube.com/watch?v=5fqrCzrT8WM>

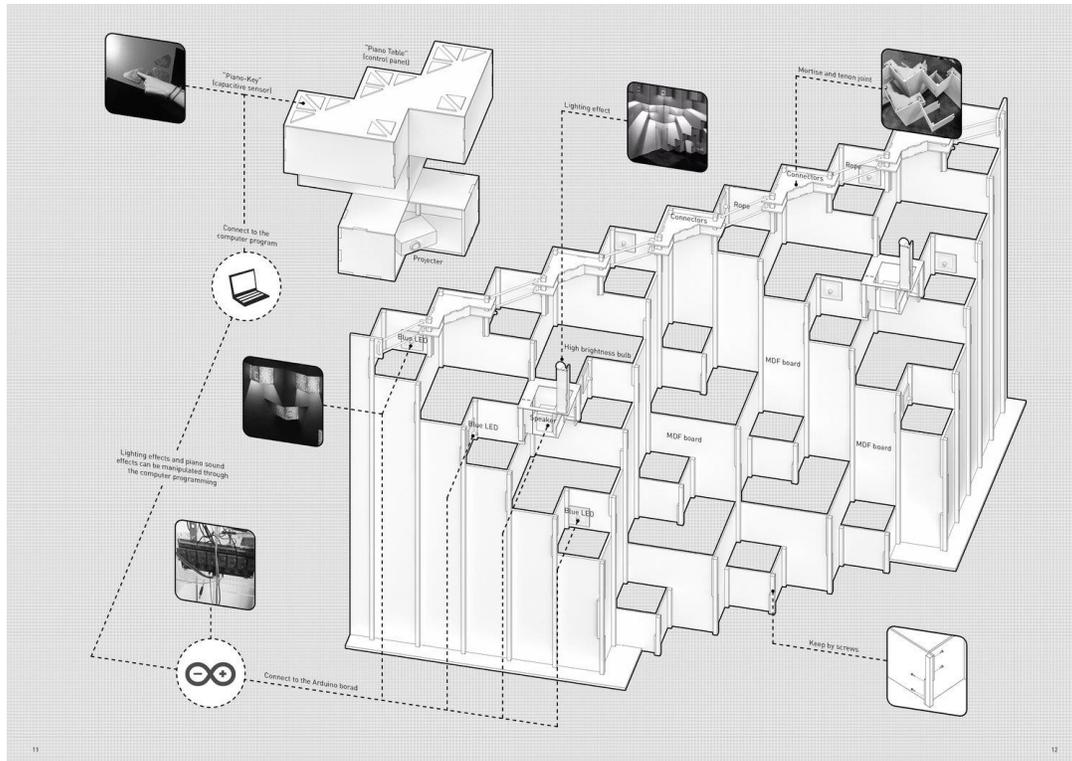


Figure 20. *INTERACTIVE VOXELS*, Runzhou Ye, 2016

Once liberated from its function as a three-dimensional screen for projection mapping, the installation is treated as an object of art in and of itself. Although it creates an immersive environment of light and sound effect while being projected on, the installation is lit up from the back, creating an intense interplay of light and shadow as the light travels through the openings on the top and bottoms of the cubes. This dual nature of the project allows it to be displayed not only during performances but also in between performances.

A series of visuals have been generated to highlight the details and spatial qualities of the project through projection mapping. Abstract images of lines and shapes either accentuate the three-dimensionality of the piece (through image distortion) or completely diminish it. In some instances, these visuals are projected on individual voxels or groups of voxels that are separate from one another. In others, the whole installation is treated as a single solid screen. Although the individual voxels offer a pixelated world, the latter combines everything into a unified whole.

Two sets of four and twelve keys are placed on the top and bottom portions of the table, respectively. Each one of the bottom twelve keys plays a different pitch and lights up one of the cubes on the installation. The four keys on the top portion of the table allow the performer to change the sound of the notes (piano, organ, etc.) or record/play their piece.

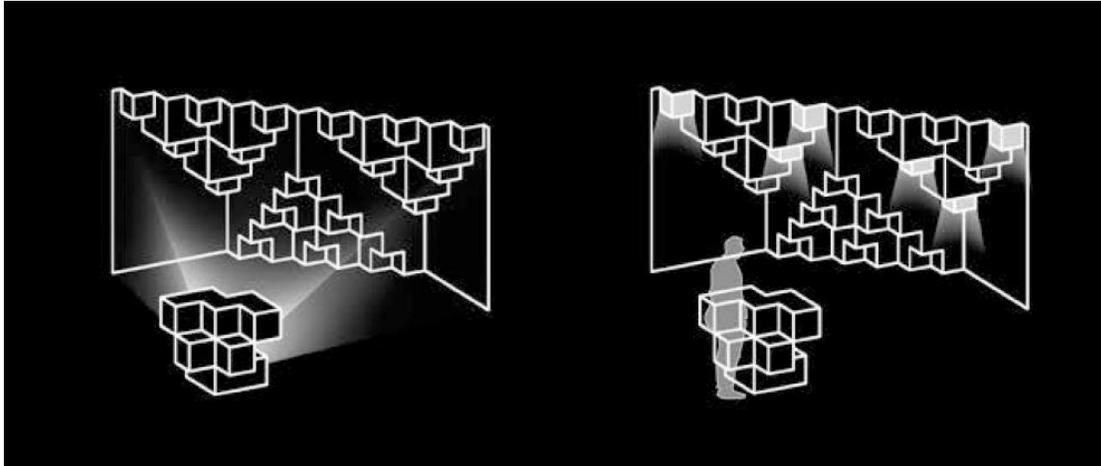


Figure 21. *INTERACTIVE VOXELS*, Runzhou Ye, 2016

The idea behind this project is that it can be projected forward and used not only in small public installations of this size but also for larger architectural projects, such as the exterior pixelated facades of buildings with balconies or interior spaces such as large auditoriums with mezzanine levels and a series of balconies. These spaces can be transformed into virtual environments through the projection mapping techniques used for the specific installation.

3.3 Human Perception and Meditation

In 2014, I made an art installation time capture. The installation consists of an ink tray on the floor, a hanging curtain, and an ink titrator above. It is to help people with meditation and psychotherapy through the intervention on people's perception of time.

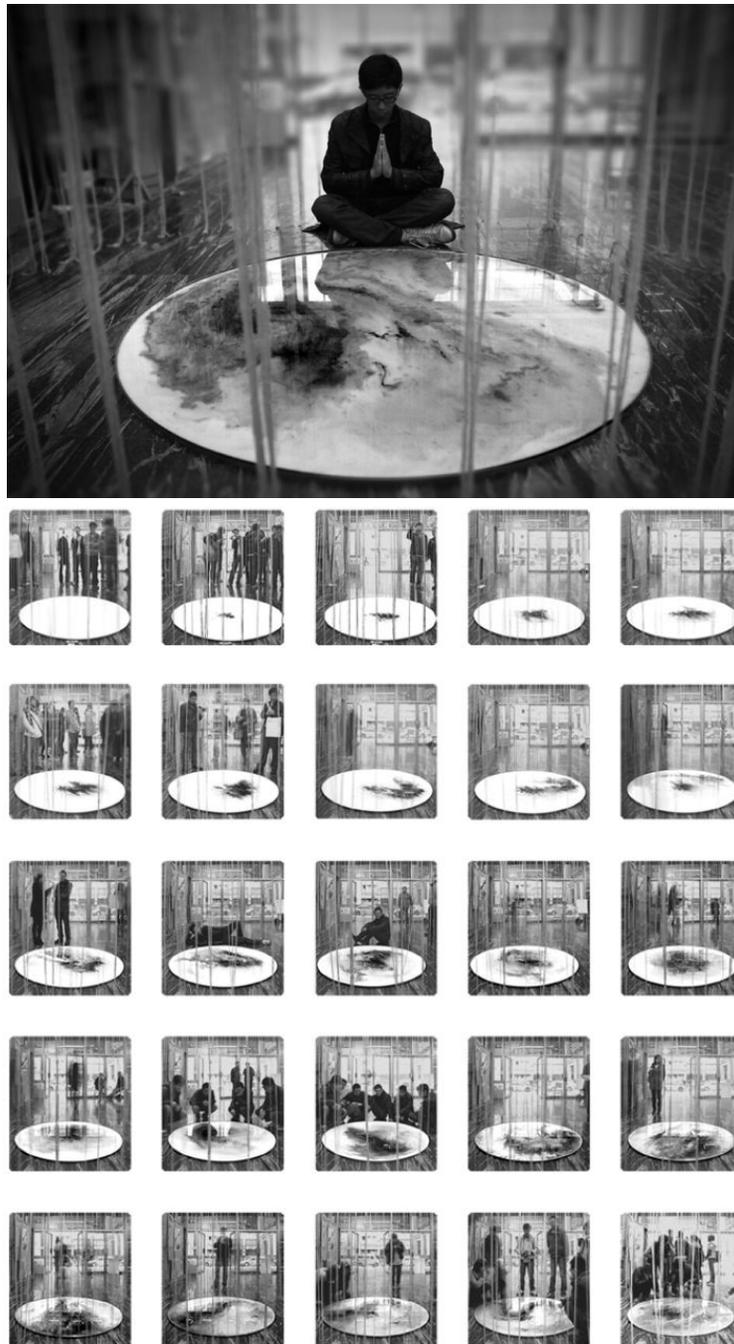


Figure 23. *Time Capture*, Runzhou Ye, installation, 2014

An installation is designed to express time in phenomena and to emulate a human sense of time. Here, time can be seen as being divided into periods within the human perceptive threshold: a person can realize how time is split into slices and organize them together in an orderly way. By using a camera to capture the real-time changes of images,

these photos can intuitively reflect the interaction of changes in time and space, namely the relationship of changes (movements) of the ink's positions in different photos. We may consider any two of the pictures as a time fragment and the change of the images as the result of this time fragment. The people here, as individuals who exist in the time axis, will carry out physical motions with the deducing of time.

This is an art project that I really like, but the regret is that I can not find a suitable way to make this artwork interact with the sense and perception to express its theme better. Now, with the help of mixed reality technology, I can seek breakthroughs in one's perception of space, something that is continuous.

When we enter a new space, our senses will automatically assess the size of the space, where we are, and the degree of danger; then, feedback is sent back from the brain so that we can “survive” in the new environment. This is the instinct of human beings, that is, the ability of people to perceive and evaluate space.



Figure 25. Mixed reality portal²³

23 Fig. 25. “Visiting museums in augmented reality [ARKit],” eyeSphere, Youtube, published on Aug 6, 2017, https://www.youtube.com/watch?v=CyVZ_IBi2gA

Therefore, when viewer see the mixed reality portal trick for the first time, they feel a sense of magic and are excited because it is contrary to their past perceptions of spatial continuity. The virtual space created by mixed reality has changed people's connatural cognizance toward traditional space. By combining humanity's collective unconscious, mixed reality technology brings a new sensory experience.



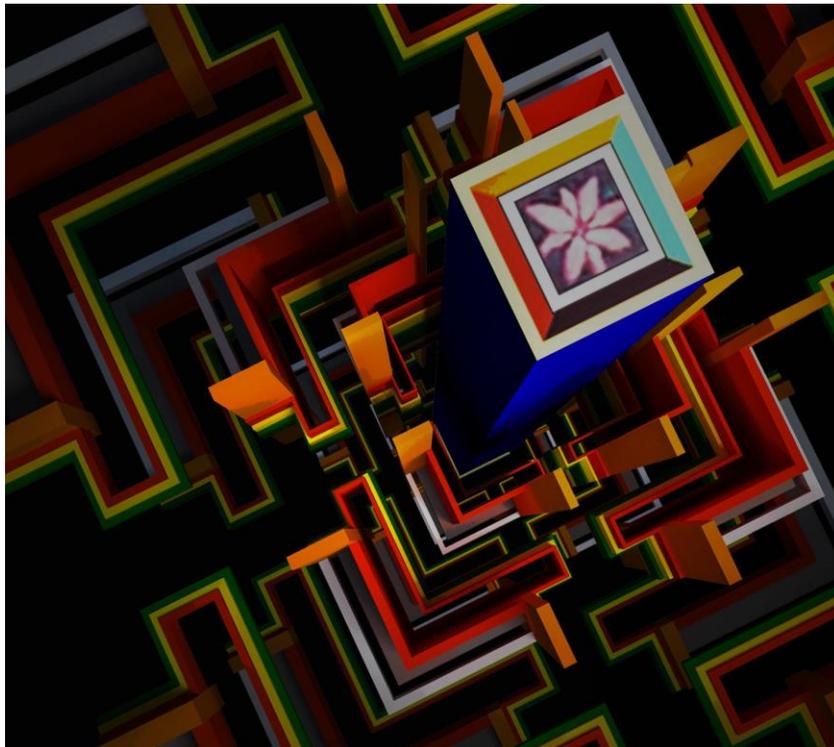
Figure 26. *Visualizing Mandala*, Runzhou Ye, 2017

Visualizing Mandala is a mixed reality project that I created in 2017. With the HoloLens head-mounted device, the artwork allows people to walk into a surreal space depicted by a mandala intended to help viewer with meditation and psychotherapy, here

be creating an intervention that affects viewer's perception of space.

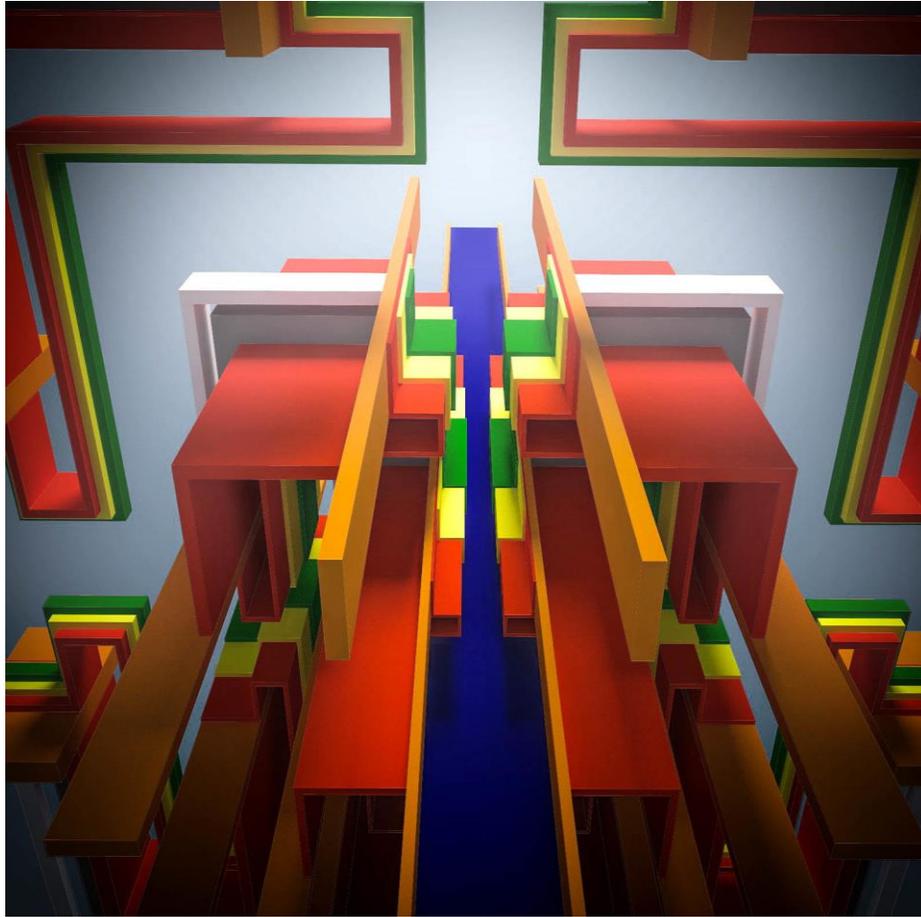
A traditional practice in Tibetan Buddhism is called visualizing a mandala, which is a sort of meditation ritual where monks sit next to a sand painting, a mandala, imagining the form of the ideal world, called Sukhavati.²⁴

According to Carl Jung, the Swiss psychologist and psychiatrist who founded analytic psychology, the mandala is a product of humanity's collective unconscious.²⁵ Jung believed that the spiritual strength of the mandala is derived from the way in which the geometric figure represents the structure of the human mind. Jung regarded the mandala as a meditation space where the universe and the inner world of human beings can connect and interact. For Jung, this meditation space represents the ultimate harmony between the internal and external worlds.



24 Sukhāvātī, or the Western Paradise, refers to the western pure land of Amitābha in Mahayana Buddhism. The Sanskrit sukhavātī (sukhāvātī) is the feminine form of sukhāvat (“full of joy; blissful”) from sukha (“delight, joy”) and -vat (“full of”).

25 Jung, Collected Works vol. 9.I (1959), "Psychological Aspects of the Mother Archetype" (1938/1954), 156 (p. 81).



Figures 27 and 28. The virtual world in a mandala, Runzhou Ye, 2017

Using the various two-dimensional versions of the mandala symbol as the starting point, I abstracted the mandala from the specific cultural background, placing it within the world of contemporary art. Based on various religious concepts and theories of psychology, I created three-dimensional models of the universe to mimic the archetypes of the world as seen from the subconscious. When people are looking at the images of mandalas, they can walk into—or more precisely, fly—into the universe of this mandala through wearable mixed reality devices. Space extends and expands infinitely around the viewer, and the geometric figures in people’s subconscious will then constitute the space they are in.

By collecting the viewers’ feedback, I am convinced that mixed reality can indeed influence one’s perception by combining virtual images with reality. After significant progress in wearable devices, along with the development of rendering technology and

space recognition technology, mixed reality technology has the potential to change significantly the way people meditate and relax, with the potential to help the treatment of mental illness.

However, this was not a religious-themed art project; the translation of the 2D symbols was not entirely objective. Despite this, I still invited ordinary viewers, artists, Tibetan Buddhist scholars, and Tibetan monks to experience this artwork. The vast majority of the viewers were positive about this experience. But contrary to my expectation, Tibetan Buddhist scholars and Tibetan monks highly valued the experience brought by this work and hoped to see more in-depth content; in their words, although the content of the transformation was not precise, or even subjective, the process was a reflection of the different worlds in everyone's eyes and different Buddhas in their hearts, which is the so-called "Trisahasra-maha-sahasra-lokadhatu"²⁶ in Buddhist cosmology.

When looking at these previous art installations, it can be seen that the virtual experience in contemporary art is still in its early stage of development. Despite the limitations of device performance and media communicability, people want to accept the illusion and let these installations hypnotize them. As mentioned above, augmentation as a direct art intervention impacts the senses, mind, and consciousness, helping viewers challenge their worldviews or discover themselves.

²⁶ Trisahasra-maha-sahasra-loka dhatu is a case of Buddhism illustrating the world's organization. The big world is integrated through the small world and middle world, called Trisahasra-maha-sahasra-loka dhatu.

IV. AUGMENTATION OF SITES

4.1 Extreme Art Activism

There are many different ways to virtually augment sites, and the main purpose of doing this is to enhance creative freedom, reduce production costs, and reduce risks for the activist art. At this point, being a field outside of the legal framework, virtual space has become the last paradise for extreme art activism.

Extreme art activism is a work that pushes the edge, a work where the real danger is involved. The artist's message usually deals with a controversial subject matter, and the artists usually executed these works in politically dangerous locations. Throughout history, artists have been prosecuted, arrested, jailed, and discriminated against for their art. An artist's ability and right to express himself or herself through a chosen medium is one that should be cherished and celebrated. However, many countries, including the United States, can not see it that way. Being caught making or viewing a work could result in fines, blacklisting, deportation, jail, or worse.

Graffiti artist Kenny Scharf has been arrested multiple times for his work: first in New York City in 1982 when he was in his twenties and recently in April 2013 at the age of fifty-five. Scharf spoke candidly about his ordeal and said that the main difference between being arrested now and thirty years ago was that in the more recent arrest, the police actually appreciated his work and knew who Banksy was. In 2012, Essam Attia, an Iraq War veteran, replaced over 100 advertisements around midtown Manhattan with posters shunning the NYPD and their anti-civilian tactics. Attia was arrested later that year and charged with fifty-six counts including grand larceny, possession of the stolen property and a weapons charge for possession of an antique, unloaded .22 caliber handgun.²⁷

²⁷ "New York City police arrest artist who created drone satires," Sandy English, WSWS, last modified Dec 10, 2012, <https://www.wsws.org/en/articles/2012/12/10/nypd-d10.html>



Figure 29. Projector graffiti on the Trump International Hotel in Washington DC, Robin Bell, 2017²⁸

Despite all of this, some artists are still willing to take these risks because this type of work usually provides the best opportunity to create actual change. Augmented reality technology gives artists new ways to express themselves and a relatively safe expression environment.

In recent years, as people's dissatisfaction with President Donald Trump's administration, projection art hack has begun to appear in thy public eye. On the evening of May 16, 2017, artist Robin Bell performed an art hack at the Trump International Hotel in Washington, DC. He projected the attention-grabbing and controversial text on the building facade, and quickly ended the art hack with the text: "We Are All Responsible to Stand Up and End White Supremacy." The projection mapping was all part of an act of protest by artist, filmmaker, and video editor Robin Bell, who has been creating these types of guerrilla light protests for more than six years. His latest action, however, began to go viral on social media almost as it was happening.

Indeed, projection mapping is a branch of mixed reality. The success of the entire act rests on the sense of substitution and high operability brought by the technology. Would it

²⁸ Fig. 29. Artist Robin Bell projected messages of protest onto the Trump International Hotel in Washington, DC on a Monday night, 2017.

be a better idea to “paint” on the president’s building? It is obvious that virtual space is a safer solution.

Four Gentlemen is an art group of three Chinese artists in exile and an American artist. The name Four Gentlemen refers to a group of Chinese intellectuals—Liu Xiaobo, Hou Dejian, Zhao Duo, and Gao Xin—who actively participated and led the Tiananmen Student Protest in 1989 and who were consequently put into jail or fled after June 4th when the Chinese government, led by Deng Xiaoping, cracked down on the movement by killing many civilians using tanks and machine guns.

Despite more than two decades of Tiananmen protest took place in 1989, the facts that Chinese people pursued democracy in democracy and anti-corruption movement is still covered by the Chinese government. All related discussions and activities to Tiananmen Square are regarded as extreme activities that endanger political security and that are severely punished.



Figure 30. *Tank Man*, Four Gentlemen, Beijing, 2011²⁹

29 Fig. 30. Viewing Tank Man with an iPhone or Android phone with the Layar application installed on Chang'an Street, Beijing, 2011.

By using augmented reality apps, the Four Gentlemen group created the virtual projects *Statue of Democracy* and *Tank Man*, installing these monumental icons on the physical sites where the real incidents took place. With the iPhone or Android mobile device, any domestic and foreign visitors can find these virtual monuments in Tiananmen Square and nearby East Chang'an Street. Anyone who is brave enough can travel to Tiananmen Square and view the work. In China, people searching for these areas using these apps are under observation by Chinese cyber-police. Currently, mixed reality art is very low on most governments' radars. The data being transmitted is often overlooked. This will surely change—along with the dangers associated with this type of work—in the upcoming years.

There is another symbolic artwork called *The Apparition of the Unicorn, Pink and Invisible at the Same Time* by the artist collective Les Liens Invisible, in which “art overtakes faith in imagination.”



Figure 31. *The Invisible Pink Unicorns*, Les Liens Invisible, 2010³⁰

30 Fig. 31. A screenshot of *The Invisible Pink Unicorns*, Les Liens Invisible, augmented reality, copyright Les Liens Invisible. Description: An invisible pink unicorn is suspended in the air over the Vatican Obelisk, 2010.

These prankster artists took the phenomenon of web-based parody religions to produce a humorous intervention that breaks the law while still being comical. Using augmented reality, these artists brought about an event that people on the Internet had long been waiting for: the apparition of the Invisible Pink Unicorn, a legendary figure that first appeared on the Internet in the early 1990s as an eminent deity used to satirize theistic belief. In the words of Steve Eley, “Invisible Pink Unicorns are beings of great spiritual power. We know this because they are capable of being invisible and pink at the same time.”³¹ The Invisible Pink Unicorn made her appearance as a cyber-monument in Saint Peter’s Square in Rome on April 23, 2011, Easter Day. The work demonstrates the illegal, unauthorized use of public space. However, this particular square in front of Saint Peter’s Basilica is not located on Italian territory; being the Vatican City, home of Pope Francisco I, it is an independent state. It is also an undemocratic state, where protests and demonstrations of any kind are strictly forbidden.

Although the boundary of art intervention continues to exert pressure on the rights of various groups such as politician and special interest group, virtual space is still an unclaimed field outside of the legal framework. The mixed reality of tomorrow will be considerably more powerful, easily accessible to a much larger population, and, if abused, more dangerous.

Where does the artist’s responsibility lie? At what point is he or she to be held accountable when something goes wrong? These are just a few of the difficult questions facing the artists who are working with mixed reality. Indeed, the creators of extreme art activity must be held accountable for their actions.

4.2 Artwashing

In the strictest sense, “artwashing” is a branch of mixed reality activism, but because of its importance, it is necessary to discuss it in its own section. The term artwashing was

31 Brad Kim, “The Invisible Pink Unicorn,” Know Your Meme, 2010, <https://knowyourmeme.com/memes/the-invisible-pink-unicorn>

coined amid the anti-gentrification protests that began two years ago in the Boyle Heights district of Los Angeles. The protests began because the emergence of art galleries forced out local shops and services and drove up property prices; this was a deliberate policy on the part of property companies, whose aim was to “artwash” an area to prime it for development to a richer demographic.

But the artwashing I will discuss is not using art to raise the value of a neighborhood for development; on the contrary, many mixed reality artists and activists are working on using virtual site-specific art to question and protest the rules or the values set by “the elite.”

In March 2018, a group of artists launched an unexpected art project—the Augmented Reality Gallery, at the Museum of Modern Art in New York. They digitally superimpose their artwork on the works of the museum and help visitors install the app on their mobile devices to watch their artwork. *Hello, We're from the Internet* is an “unauthorized gallery concept aimed at democratizing physical exhibition spaces, museums, and the curation of art within them,” according to MoMAR, which developed the exhibit.³²

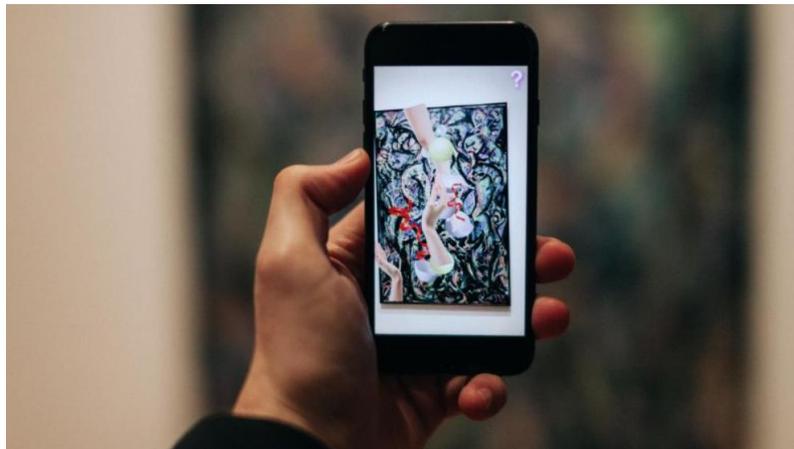


Figure 32. MoMAR in MoMA³³, 2018

32 “Artists Protest Elite Art World With Unauthorised AR Gallery at the Museum of Modern Art,” Melanie Ehrenkranz, GIZMODO, last modified Mar 6, 2018, <https://www.gizmodo.co.uk/2018/03/artists-protest-elite-art-world-with-unauthorized-ar-gallery-at-the-museum-of-modern-art/>

33 The Museum of Modern Art (MoMA) is an art museum located in Midtown Manhattan, New York City,

“As with any establishment—be they media, church or government—the richest of galleries are canonized, to the point where the public’s role and contribution are reduced to the passive observer,” MoMAR claims on their official website.³⁴

In fact, as early as 2010—when some spoke of smartphones as elitist devices for the wealthy—Sander Veenhof and Mark Skwarek already realized that the institutional walls of the white cube were no longer solid and organized a guerilla exhibit of augmented reality artworks called *We AR in MoMA* inside the walls of MoMA.³⁵ MoMA tweeted back, “Nice, looks like we’re having an ‘uninvited’ AR exhibition tomorrow!”



Figure 33. *Manifest.AR* in MoMA, 2010

on 53rd Street between Fifth and Sixth Avenues. Interestingly, MoMA has always been the primary target of art hackers in recent years.

34 “About,” MoMAR, last modified Sep 6, 2018, <https://momar.gallery/about.html>

35 In October 2010 Sander Veenhof and Mark Skwarek organized the AR intervention “We AR in MoMA” (Veenhof 2010) for the Conflux Festival of Psychogeography (Conflux Festival 2010). Cyberpunk author Bruce Sterling blogged the intervention on WIRED (Sterling 2010), MoMA tweeted “Nice, looks like we’re havin an ‘uninvited’ AR exhibition tomorrow!” (Museum of Modern Art 2010), and later in an interview with the New York Times the director of digital media welcomed our engagement with her museum (Fidel 2010).

The artwork is hidden in the virtual world. Viewers need to download the app and view the artwork through the screen. The digital painting is positioned by recognizing the digital features of other physical paintings and are "covered" to the corresponding paintings.

Since time immemorial, location has been used to consecrate objects and people. The religious and power centers of the world maintain sacred spaces where only the chosen elite is allowed to enter. In the art world as well, access to a location—a gallery, a museum, or other curatorially closed space—is tightly controlled to confer value and thus, via this exclusivity, to canonize the works shown there as “high art.” What does it mean to control physical space when in geolocated virtual space, anyone can show whatever they want?

Mixed reality artists require no permission from the government or artistic authorities to place their works at a specific site; they merely need to know the GPS coordinates of the location—and unlike street art or other physical art interventions, the infiltrated institutions cannot remove the works, which remain at the site as long as the artist wishes. The emergence of these works has changed the rule for judging regional values based on art-in-site. Their behavior is tantamount to redefining the values that have been whitewashed by the elite through “artwashing.”

After constant experimentation by artists and activists, the emergence of such artwashing activism has inspired artists to think about the connection between physical space and virtual space. How can one use virtual space to intervene more in reality realistically? Can site-specific art be separated from a specific site?

4.3 Site-specific Art Without Specific Site

When people talk about site-specific art, they generally mean the artwork created and hence intended, to exist in a certain place. Usually, artists use some instances of work such as sculptures, stencil graffiti, rock balancing, and other art forms combined with the existing venues to create art.



Figure 34. *Untitled*, Zander Olsen, 2008³⁶

36. Fig. 34. Photographer Zander Olsen has created this remarkable ongoing project entitled *Tree, Line*. The constructed photographs show trees in the forests in Surrey, Hampshire, and Wales that have been

However, with mixed reality technology, artists and activists can create site-specific art without having a specific site. The data-based cyberspace provides an infinite “private domain” where artists and activists are not limited by rules, space, and exhibition time. Technologies such as Vuforia image recognition and GPS positioning enable a high degree of integration between cyberspace and real space.



Figure 35. *Wynwood Walls*, Heavy, Miami, Florida, 2012

Heavy Projects AR Murals is a good example of site-specific art in mixed reality. The project uses Vuforia’s image recognition technology combined with a portable device, here mixing with architecture to create a context for the content. Compared with traditional large, architecturally based installations, the low cost and high degree of freedom of mixed reality have made this arm form a new favorite of many new media artists. At the same time, it has also been used in many mural restorations and street graffiti creations.



Figure 36. *Yuanlin in the Window*, Runzhou Ye, 2018

Using the characteristics of site-specific art in mixed reality, in 2018, I made the art project *Yuanlin in the Window*. Yuanlin is the traditional Chinese garden, the epitome of classical Chinese art, cultural values, architecture, aesthetics, and philosophy. In Chinese culture, the Yuanlin is a microcosm, an earthly glimpse of Shangri-La. In Chinese lore, the universe is called Yu Zhou, where Yu is the space, the boundless universe of the

garden and Zhou is time, the garden's four seasonal blossoms that have no beginning or end.

Today, only from a few classical Yuanlin remain, with many having become the victims of China's rapid urbanization. The construction and upkeep of a Yuanlin demand a lot of time and financial investment, a fact that has further exacerbated its demise.



Figure 37. Abandoned Chinese garden, Guangzhou, 2015

It is only in the last few centuries that mankind has entered into “modern” civilization. Before then, people could not escape from the “soil.” When humans build worlds in relative isolation, it seems that we can survive without nature. However, humans are always a part of the natural world. Yuanlin represents a world that links nature and humans, an ideal that has never been forgotten; it still survives in the cracks of the city: in small towns of Southern China, in the center of the cities, and even a room in a museum. Perhaps, it could also exist in a window or in a wall.

Yuanlin in the Window utilizes the Yuanlin techniques of “borrowed-scene” and the

“framed-scene.”³⁷ Using the multiform window combined with mixed reality, in the project, the traditional Yuanlin was scaled down from a room to a window, bringing the infinite space and time from the Yuanlin to a public space.



Figure 38. The “framed-scene” technique in a Yuanlin’s design

The windows were set up in multiple areas of Cambridge, and these selected areas became the entrance for people to peep into a Yuanlin, allowing them to view their city in a virtual way and rediscover a piece of their natural selves that is missing from their busy

37. In a Yuanlin's design and construction, there are eight main techniques of mise en scene, including the framed-scene, the borrowed-scene, the blocked-scene, and the pointed-scene. Ancient craftsmen used these compositional techniques to convey atmosphere and artistry.

lives. Although the final effect did not look very real because of the limitations of the rendering technology, mixed reality technology makes the connection of two distant spaces possible.



Figures 39 and 40. *Yuanlin in the Window*, Runzhou Ye, 2018

In this project, the creative freedom and high flexibility of mixed reality made it possible to set and dismantle the installation according to the site conditions and to do so in a short period of time. In addition, the artificial stone used to hide the projector in front of the window also interacted with the specific site, whether it was perfectly hidden in the woods or abruptly appeared in the center of the square. At the same time, the artificial stone added a sense of humor and dramatic effect on the artwork.

With a quick and easy installation like *Yuanlin in the Window*, any real-world space can be connected to the virtual space, thereby becoming a specific site for expressing the artist's point of view, making site-specific art without a specific site that is based in reality.

V. AUGMENTATION OF DATA

5.1 Data Visualization

Data visualization refers to the technique of encoding data into visual objects such as dot matrix, pixels, colors, or lines, for transmitting data or information, thereby clearly and effectively communicating information to users. Vitaly Friedman stated the following, “main goal of data visualization is to communicate information clearly and effectively through graphical means. It does not mean that data visualization needs to look boring to be functional or extremely sophisticated to look beautiful. To convey ideas effectively, both aesthetic form and functionality need to go hand in hand, providing insights into a rather sparse and complex data set by communicating its key-aspects in a more intuitive way. Yet designers often fail to achieve a balance between form and function, creating gorgeous data visualizations which fail to serve their main purpose—to communicate information.”³⁸

Data consist of facts that can be analyzed or used in an effort to gain information. Dating back to ancient history, mankind has written texts and numbers and drawn pictures in caves, on objects, and paper to record their lives. And since the Victorian era, humans have been trying to visualize data, starting with the research of Francis Galton. Galton devised a technique called “composite portraiture,” which is produced by superimposing multiple photographic portraits of individuals’ faces registered on their eyes. Galton hoped his technique could help in medical diagnoses, even criminology, by identifying typical criminal faces. However, his technique did not prove useful and fell into disuse.

38 Vitaly Friedman (2008) "Data Visualization and Infographics" in: Graphics, Monday Inspiration, January 14th, 2008.



Figure 41. *The Jewish Type*, Francis Galton, Composite portraiture, 1924³⁹

Although Galton's work seems to lack scientific evidence and can even be thought of as absurd by today's standards, he is perhaps the first person in history to apply data visualization thinking to medicine and criminology.

In the information era, data have become a medium for digital realism: web-browsing histories show recent interests; instant messaging services keep your personal conversations as unstructured data; and credit card usage shows the things you eat and buy regularly. Indeed, the digital data collected from our daily lives can describe, depict, and represent the truths about ourselves and our surroundings. Digital data allow us to picture not only what we can readily see, but also the things that are not visible.

In this sense, data visualization provides excellent opportunities and the required materials for artists and activists, who can transform data on human migration into video, make urban road traffic data into images, and make forest area change data into animations to tell a person's history, reflect social problems, and think about the status quo of human existence.

³⁹ Fig. 41. Composite portraiture of the Jewish Type [From Karl Pearson, "The Life, Letters and Labours of Francis Galton"].

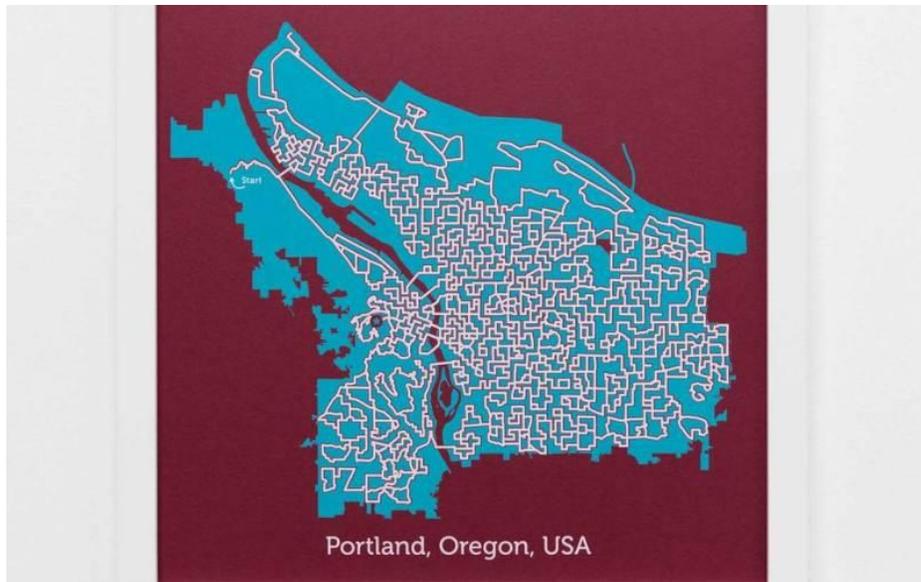


Figure 42. *Solvable Mazes*, city road maps made into solvable mazes, Michelle Chandra, 2018,



Figure 43. *The Earth Puzzle*, Generative Design Studio, 2018

Not too long ago, data visualization was limited to 2D interfaces. Whether it was images, videos, or animations, the relationship between data and reality still remained at the level of expression; data visualization had not reached the point where it could intervene with real space. Today, data visualization combines augmented reality

technology to present data in virtual space. These data are often associated with a specific place.

Through the use of data and GPS coordinates combined with mixed reality technology, artists can project the content of data visualization into the real world, performing narrative and art interventions. *Border Memorial: Frontera de los Muertos* is an augmented reality public art project by John Craig Freeman that is dedicated to commemorate thousands of migrant workers who died while trying to cross the US-Mexico border.⁴⁰ This project allows people to visualize those who have lost their lives, showing the scope of the loss of life by marking each location where human remains have been recovered. Based on a traditional form of wood-carving from Oaxaca, the virtual object consists of life-sized, three-dimensional geometric model of a skeleton effigy, or *calaca*. *Calacas* are used in commemoration of lost loved ones during the Mexican *Día de los Muertos*, or Day of the Dead, festivals. According to indigenous belief, despite the tragedy of the loss of life, death should always be celebrated.

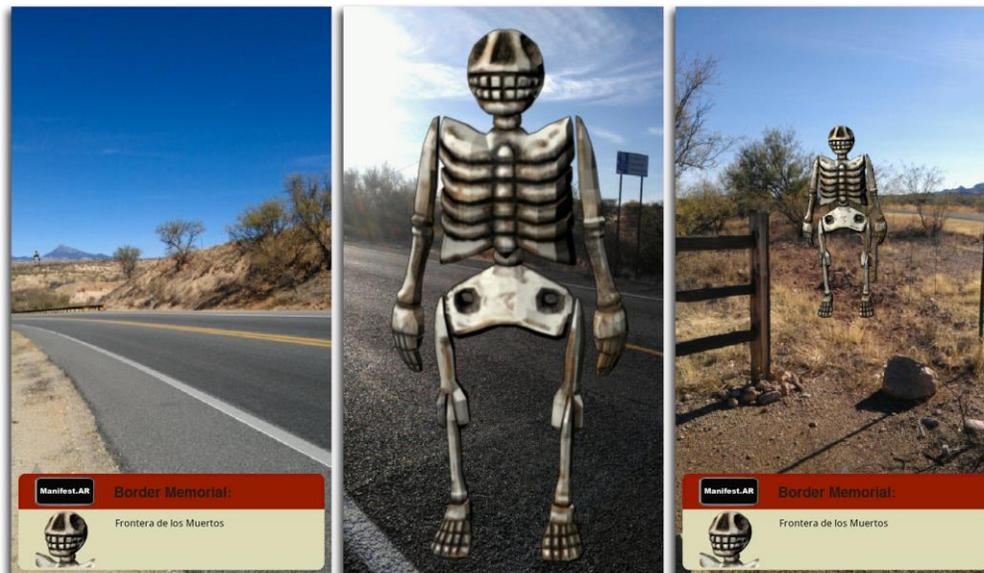


Figure 44. *Border Memorial*, John Craig Freeman, 2013

40 *Border Memorial: Frontera de los Muertos* by John Craig Freeman, On the road to Ajo along Highway 86, Arizona, 2013, Augmented reality public art

“The project is intended to provide a kind of lasting iconic presence in an otherwise ephemeral physical environment and cultural discourse,” John Craig Freeman said.⁴¹ It is the most intuitive use case of data and augmented reality in a data-based spatial intervention.



Figure 45. *Exit Glacier AR Terminus Project*, Nathan Shafer, 2012

Nathan Shafer was one of the first activists to work on environmental issues using AR. Shafer replaced parts of the environment that had disappeared over the last century using mobile AR. His works address global warming and environmental degradation, seen here in Alaska’s rapidly receding glaciers. Shafer used AR to show on site how the glacier had receded over recent years. Viewers have to travel to the site of the glaciers with a smartphone or tablet and can then see the glaciers as they once were years ago. The app allows viewers to roll back time year by year to see global warming’s devastating effect. Shafer’s work shocks the viewer when confronted with the extent of the devastation; indeed, the amount of the damage brings about a sense of urgency

41 G.L. Ulmer and J.C. Freeman, “Beyond the Virtual Public Square: Ubiquitous Computing and the New Politics of Well-Being” in: *Augmented Reality Art: From an Emerging Technology to a Novel Creative Medium*, Springer International Publishing Switzerland, 2014

bordering on hopelessness when the viewer is faced with Shafer's documentation. These data-based glacial images can be constantly updated and bring the most intuitive environmental warnings to people.

With the birth of net.art, the web began to be used as the space for all that was immaterial, encouraging new directions in art focused on the real versus the virtual. The 1990s were about the virtual, and it started with the media's obsession with virtual reality (VR). However, mixed reality now provides better soil for digital art, allowing web-based art ideas to be better expressed in the real world.

5.2 Spatial Narrative based on GPS Data

Augmented by technologies in data collection and analysis, sensor networks, and edge computing, art interventionism in the age of the Internet has broadened our conception of a spatial narrative and has continued to change people's behaviors and basic concepts of living.

In his essay "Database as Symbolic Form," Lev Manovich theorizes about the relationship between database and narrative and the merging of a new form of the two, known as new media art, using Saussure's notions of the paradigm and the syntagma.⁴² The author discusses "the connection between the computer's ontology - the way the computer's organization of data represents the world - and the new cultural forms privileged by computer culture such as database."⁴³ New media objects' use of database models drastically changes the user's experience in traditional viewing experiences, such as in reading a book, watching a film, or navigating an architectural site, from a linear experience to an alternating process of viewing, searching, and navigating all that is happening simultaneously. But because the data being generated are always changing, how can we keep a coherent narrative or develop a narrative trajectory? In this paradigm,

42. Database as Symbolic Form, Lev Manovich, 1999, research article

43. Lev Manovich, "Database as Symbolic Form" in: Convergence 1999 Volume 5 Number 2, p. 83-89

the narrative is a set of links between the different elements stored in the database and are more virtual than the database itself. What differentiates new media objects from traditional art objects is that their database of multimedia material can be accessed by more than one interface. The multiple trajectories generated from this can create an interactive narrative, also called a “hyper-narrative.”

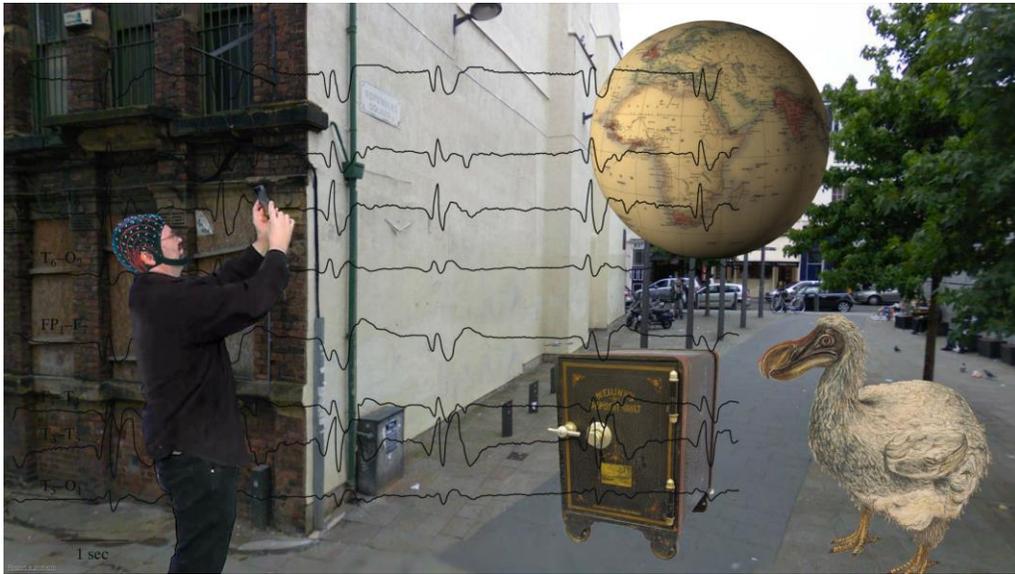


Figure 46. *EEG AR: Things We Have Lost*, John Craig Freeman, AR public art, 2013

Using brainwave sensor technology, *EEG AR: Things We Have Lost* by John Craig Freeman allows participants to summon virtual objects by simply imagining them. In 2012, the artist randomly interviewed people on the streets of Liverpool, recorded the items and places they had lost, and created all virtual objects based on the recorded data, then placed the items back to the precise GPS coordinates using augmented reality. Through this process, a database of lost items is generated, people can watch the lost items, time and place of all the interviewed people.

Another example of a work like this is *Crisis 22*, where the audience experiences a story in virtual space, here being connected to the actual location on a street in Ottawa. The audiences use mobile devices as prosthetics for the narrative and act as agents to

explore the space to understand the entire story: retracing their steps reveals a backstory while going off into an alleyway triggers the plot. In this project, nothing more is being asked of the participant other than the exploration of physical space to find the narrative; they change nothing in the work for others through their interactions.

Today, artists use spatial data narration, data analysis, EEG technology, and so forth to take spatial narratives out of the third person. In augmented reality art, the viewers became part of the spatial narrative, and their bodies also play an important role in art intervention: the medium linking the data space with the real space.

5.3 Information Overload and Media Technology Dependency

The problem of information overload is not new in this day and age, and the discussion and research of related issues are also increasing; here too, artists and activists have also taken action. Last year, an exhibition called “Big Bang Data” was held in Barcelona, focusing on the topic of information overload and waste of resources in the information age.



Figure 47. *24 Hrs. in Photos*, Eric Kessels, 2011; photo: Gunnar Knechtel

Since the advent of computing and through the rise of the personal computer to the dotcom boom, and then to the launch of the iPhone, we have interacted with the Internet through flat, 2D screens. In the 2D Internet, the existence and dissemination of digital information require a media, such as a television, computer, or smartphone. Digital information and the real world are clearly divided.

However, the rise of mixed reality will create the next generation of the Internet, a 3D spatial medium in which we will physically live, work, and interact. As this occurs, HCI will permanently change, and the world we live in will house a 3D Internet. We will see digital objects overlaid in our real world instead of pixels on a tiny screen. Is there any information overload in the 3D network? If the answer is yes, what would it be like? The video produced by Keiichi Matsuda in 2016 shows one possibility of this future.



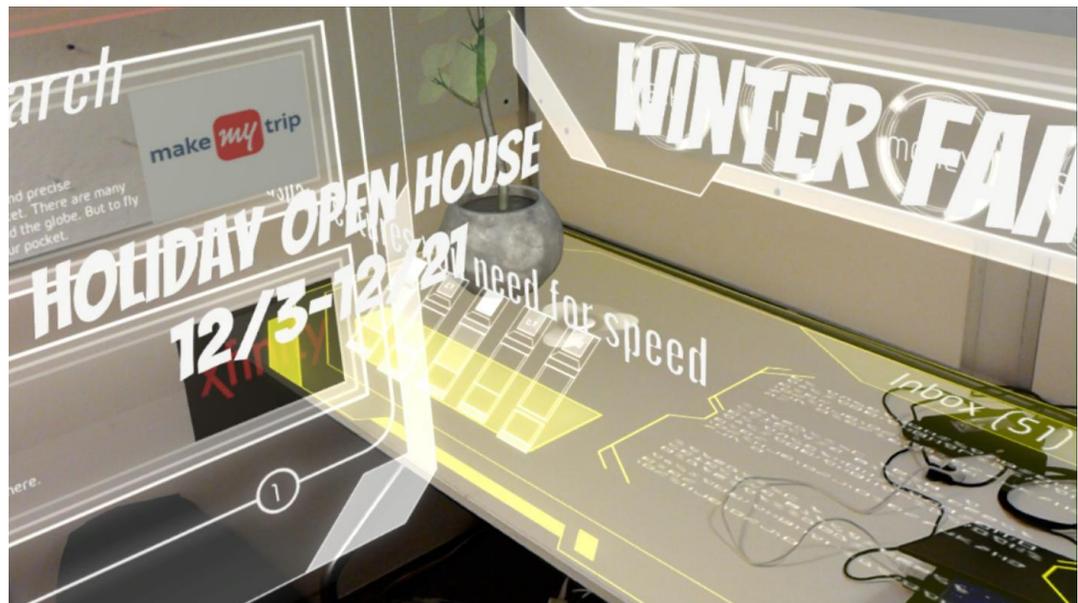
Figure 48. *Hyper-Reality*, Keiichi Matsuda, concept film, 2016⁴⁴

Hyper-Reality (total runtime approximate six minutes) is a concept film by Keiichi Matsuda: “It presents a provocative and kaleidoscopic new vision of the future, where physical and virtual realities have merged, and the city is saturated in media.”⁴⁵ In this future world, visual data have broken the dimension wall and invaded real space. The ubiquitous figurative information blends with the real world, where dazzling video ads and guide arrows fill the streets. As this video shows, our physical and virtual realities are becoming increasingly intertwined. Technologies such as VR, augmented reality, wearables, and the Internet are leading to a world where technology will envelop every aspect of our lives. It will be the glue between every interaction and experience, offering amazing possibilities while also controlling the way we understand the world. *Hyper-Reality* attempts to explore this exciting, but dangerous path. In addition to information overload, the evolution of mixed reality and rendering technology makes it difficult to distinguish what is real and what is virtual. This made me start to think about how mixed reality itself integrates data, conveys information, and how it affects the world.

44 Fig. 48. Keiichi Matsuda, “Hyper-Reality,” 2016, <https://www.youtube.com/watch?v=YJg02ivYzSs>.

45 Keiichi Matsuda, “Project introduction,” <http://hyper-reality.co/>.

Inspired by *Hyper-Reality*, my project *Augmented Future* simulates an extreme future in which people are highly dependent on mixed reality technology. The project discusses media dependence, information overload, and information loss in the 3D Internet era.





Figures 49, 50, and 51. *Augmented Future*, Runzhou Ye, mixed reality artwork, 2018

The information that information providers hope to send people is far more than what the receiver can handle. This extreme and unequal condition of information supply and demand leads to information overload and overflow. Through traditional information media (television, posters, mobile phones, etc.), we can selectively access the information we need through understanding the information stream attached to the 2D media (screens, paper, etc.). Even if information overload still exists, people can still isolate invalid information from the real world through controlling information carriers.

In the 3D Internet world of *Augmented Future*, information overflows occur because of unequal supply and demand of information. People who are highly dependent on mixed reality technology have trouble blocking invalid information from the real world. If devices (such as AR glasses, contact lenses, implanted chips, etc.) are completely shut down, these people will lose a lot of valid information, and it will be difficult to survive in the real world.

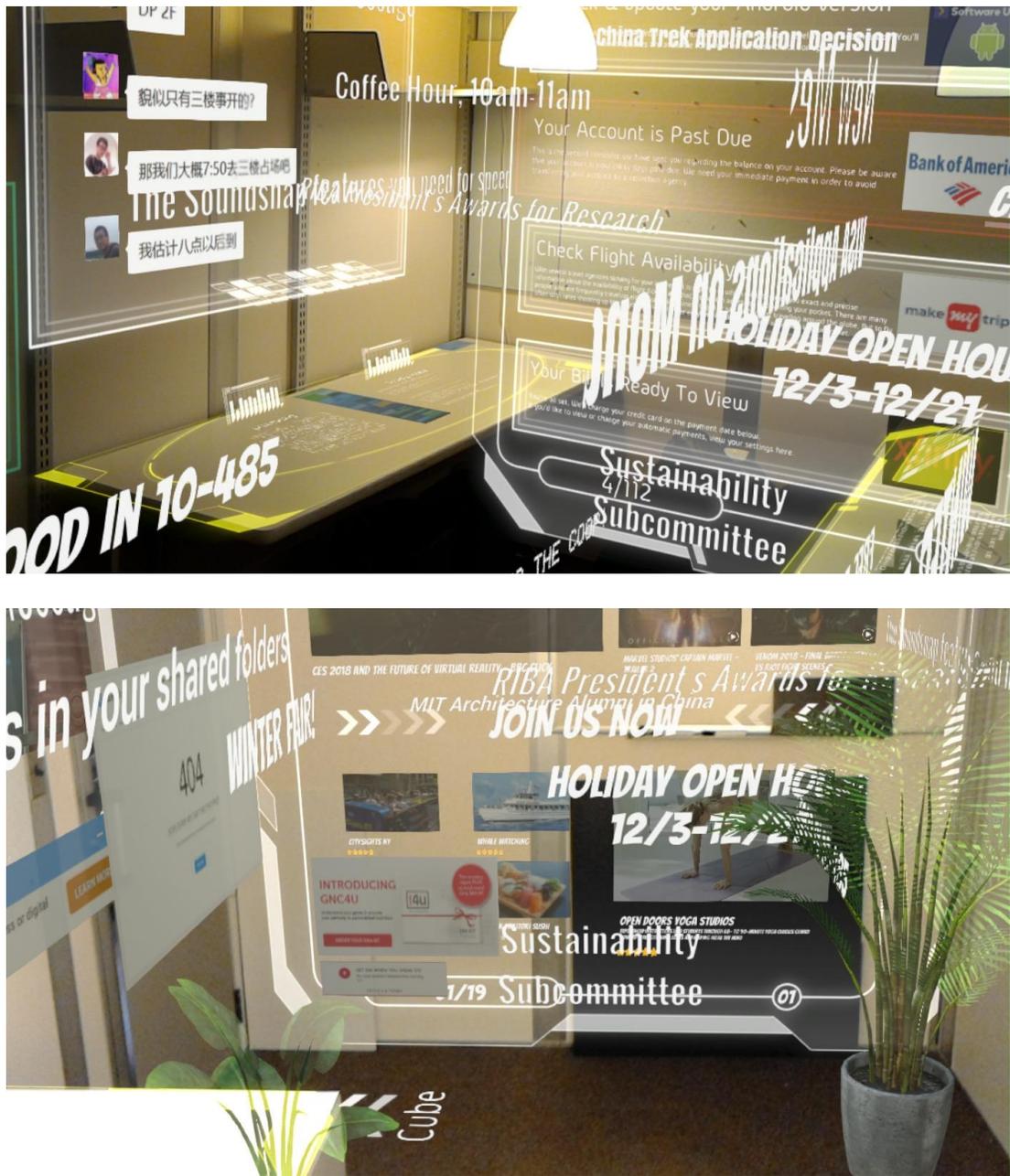


Figure 52. *Augmented Future*, Runzhou Ye, mixed reality artwork, 2018

Augmented Future simulates an extreme future of dilemma—information overload and information loss caused by media technology dependency. Nowadays, mixed reality technology is advancing by leaps and bounds and has been applied in the fields of psychotherapy, entertainment, and information dissemination. After breaking through the limitations of mobile phone AR and interactive methods, AR technology will enter into

our lives more and more. In a future of AR flooding our lives, how can we maintain the information availability of the real world while avoiding more serious information overload? Can we use AR technology to help people better filter effective information?

Augmented Future is an introspection of mixed reality technology itself. At a time when everyone is looking forward to the rapid development of technology, how to use this technology more appropriately, avoid the problems that technology may bring to society, and how to make people view this technology more rationally is a problem that every mixed reality developer needs to consider. It is hoped that in the future, mixed reality technology can provide targeted information-screening solutions based on individual user analysis.

VI. CONCLUSION

6.1 Risk and Responsibility

What can the mixed reality of the future do to aid artists and activist? Perhaps a powerful use for future artists would be mixing real-time information streams with Anonymous⁴⁶ hacktivism to create a real-time mixed reality visualization of corruption and injustice.



Figure 53. Screenshot from an “Anonymous” video on YouTube declaring war on ISIS.

Groups such as Anonymous could hack live data streams to show the political and corporate elite’s wrongdoing, and artists could then turn these hacked live streams into real-time MR visualizations that could be seen around the world. Just think if an artist/activist were to work with Edward Snowden to visualize the intercepted data stream and share it by mixed reality technology in a public space; the effect of such an art intervention on society would be enormous.

46. Anonymous is a decentralized international hacktivist group that is widely known for its various DDoS cyber-attacks against several governments, government institutions, and government agencies, corporations, and the Church of Scientology ([https://en.wikipedia.org/wiki/Anonymous_\(group\)](https://en.wikipedia.org/wiki/Anonymous_(group))).

Another area that shows great promise regarding mixed reality as a tool for art intervention is the further development of AR creation apps. Today, some apps such as ARCore, CreatAR, Vuforia, and so forth allow people to make mixed reality art. In the future, similar applications will democratize mixed reality by giving the public a tool that they can use to create their own messages or ideas and to share them with a public network. Of course, before this becomes a reality, people must first solve the problem of information screening and classification.

An example of one app that democratizes this technology is CreatAR. CreatAR allows people to make anything with mixed reality, anywhere simply by downloading the app. People can create and edit whatever they want wherever they want while also uploading their own creations.

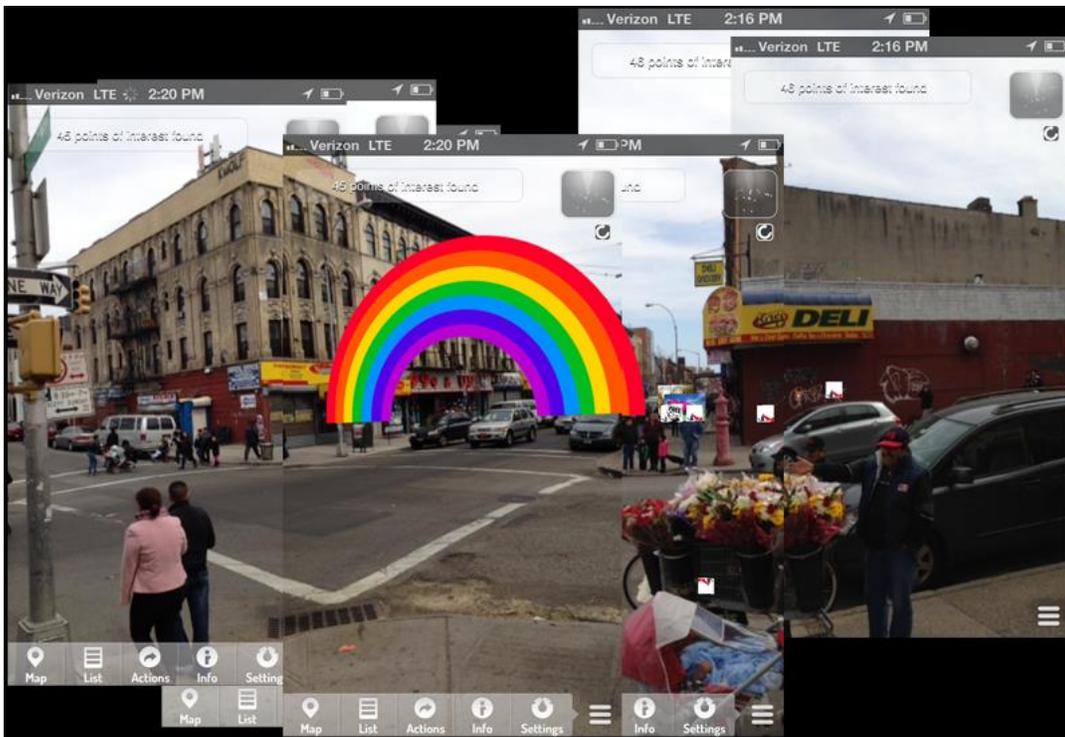


Figure 54. Screen captures of the CreatAR App taken from smartphones

Harnessing the combined creative power of the public thought is a very powerful tool that can allow an artist/activist to create incredible amounts of work that one person could

not possibly do on their own. The collective consciousness of the public makes it possible to generate a wide range of ideas, hence allowing the group's overall message to stay fresh, unique, and unexpected.

As mixed reality rapidly evolves, it will quickly become more useful. Artists and activists should seriously consider the work they will make and its desired impact on society. How does mixed reality affect private and public space? How will it engage with existing situations, contexts, and audiences? How will it replace or revive traditional forms of art performance? Indeed, the digital era has arrived, and new and sophisticated tools will continue to appear. Emerging mobile technologies such as the smartphone, HoloLens, and Google Glass are here to stay. It is the job of all future artists and activists to use this technology for the better and to bring people together, make the world a better place.

6.2 Outlook for the Future

Mixed reality is still a very young technology but one that has a real chance to change the world. The ability to overlay reality with the virtual is what artists and activists dream of.

Until mixed reality can create actual social change, it will continue to be questioned by society. People are just beginning to discover what makes mixed reality a unique technology, and as they learn more about it, they will understand that it can offer artists one of the most potent tools for art intervention. This technology is not bound by nation-state borders, by physical boundaries, or by conventional art world structures. A mixed reality art intervention reflects the rapidly expanding and developing new realm of mixed reality art that radically crosses dimensional, physical, and hierarchical boundaries.

Nowadays, more and more mixed reality artworks are allowing viewers to interact and influence people's behaviors. Interactive new media works challenge traditional interpretive methods in numerous ways. The addition of interaction diversifies the means of artistic expression and augments the audience's reception of the artwork. Although

they partake of the digital content, there is always an element of the physical to an augmented reality artwork, something to tie it to the viewer and their embodied experience of the piece.

I believe that shortly, artists may be able to record, recall, and edit historical events at any time in the virtual reality interface, and, when applied to more significant scenes of artistic creation, mixed reality technology will be a powerful tool for art intervention, allowing artists to engage public discourse beyond traditional art space. With the visualization of information, and high interactivity with real-time information flows, artists will be able to shape a broader cultural dialog in the public realm to engage audiences that are not expecting to encounter art.

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