The Aesthetic Experience of Augmented Reality Art
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Abstract

In the digital age, we create new technological forms and media artworks that define new relationships between the environment and us. Artists and actors are increasingly using their own mobile computing devices and AR to create artworks. When we experience an artwork in an "Augmented Space", we can consider it as an interactive event. As a result, we can treat interaction, immersion and realization as three components of the events within augmented space. In this paper, by using the dynamic event concept and through analyses of famous mobile AR artworks, we reach three major conclusions of aesthetic experiences in AR artworks: the event of real   time interaction is the aesthetic manner; the immanent event of the fuzzy boundary immersion is the aesthetic distance; and the immanent event of augmented realization is the aesthetic purpose.

Keywords

Aesthetic Experiences, Interaction, Event, Digital Art, AR, VR, Augmented Space.

Introduction

Because of the advancement of media development in the Twenty-first century, the new form of digital art created through Augmented Reality (AR) (Azuma, 1997) technology is impacting the traditional aesthetic principles. In aesthetics research, art has always been an important field for analyzing the essence of aesthetic activities through analyzing artistic works. Digital Aesthetics (Jensen, 2007) here are understood and analyzed as the mediation of an individual experience, which comes from mediated and unmediated social interaction (Jensen, 2007, p.7-24). Similarly, digital aesthetics of AR art (Geroimenko, 2014) focus on how we perceive our world while interacting with AR through augmented perceptions, then triggering our realizations.

Literature Review

As shown from Table 1. Bill Verplank, a pioneer in HCI design (Johnson, 1992), summarized the core issues for interaction design, which are "Doing, Feeling and Knowing" (Verplank, 2003, p.6-10). Since these actions only relate to people, Timothy Barker proposed the event of interaction, that includes not only people, but also software and hardware (Barker, 2012, p.196). Katja Kwastek's Interaction Aesthetic theory tells us that interaction in digital media occurs between "Distanced observation" and "Active Realization" (Kwastek, 2013, p.90). In addition, from the "4Is" theory introduced for explaining VR (Burdea, 2003), we can treat Kwastek's "Distanced observation" as a result of Immersion. However, none of these theories are particularly accurate for explaining AR art, in that they refer to digital theory in general.

Theories	Perceptions		Realizations
Verplank (2003) Interaction Design Theory	Do	Feel	Know
Burdea, & Coiffet's "4Is" theory for VR (Budea,2003)	Interaction	Immersion	Imagintaion Insight
Timothy Barker (Barker, 2012,p.109) "Interactive event"	"Connections are formed between the user, the machine, the software "(Barker, 2012, p.196)	N/A	N/A

Kwastek (2013) "Aesthetics of Interaction in Digital Art"	"Interaction is a process of feedback" (Kwastek, 2008, p.15-26)	"Distanced observation" (Kwastek, 2013, p.97)	"Active Realization" (Kwastek, 2013, p.97)
For this research	Event of Interaction (Between actor, mobile AR and physical environment)	Immanent Event of Immersion	Immanent Event of Realization

Table 1. Digital Theories

Research Methods

In this paper, we analyze the existing aesthetic theories for digital art in general, then choose the most suitable parts for examine the aesthetic experience in AR art. Literature review starts from Albert Einstein's "Theory of Special Relativity" (Einstein, 2015), A.N. Whitehead's "Process Philosophy" (Rescher, 1996, p.20) and Deleuze's 'Event' (Deleuze & Conley, 1992, p.76-82) thinking to provide this research with a dynamic analysis methodology. This research will use the event of interaction, immersion and realization as the basic research framework. This analysis is integrated with three case studies from AR artworks, which are "String" (http://string.co./, 2015), "erasAR" (https://erasar.wordpress.com./, 2015) and "ARART" (http://arart.info./, 2015). Because of the instability of the changing forms of digital information, we cannot divide the concept of time and space apart. Jack Burnham enlightens advises us to treat *"The entire environment"* (Burnham, 1968, p.30-35) as a whole work. It can be regarded as the *"Augmented Space"* (Manovich, 2006, p.223) that is generated by an AR artwork. In this research, we will only use the terminology of 'augmented space' instead of "augmented reality environment".

Digital Information Flow and Events in Augmented Space

According to Whitehead and his Process Philosophy, the event is every substantial thing that we encounter in our daily *"substance of nature"* (Whitehead, & Douchement, 1957, p.19). Einstein believes that the *"collection of space-time"* (Einstein, 2015, p.201) is an event. Both Whitehead and Einstein try to describe a dynamic space-time flow that uses the event as a fundamental unit.

Manovich's (2006) *"dynamically changing information"* concept, not only integrates the relationship between physical and digital, but includes a variable factor about time inside of this space model. This concept makes augmented space an event. Deleuze states that: *"The event is of a different regime than the actions and passions of the body, even if it results from them."* (Badiou, 2007, p.38-39). The "actions and passions" in augmented space represent the actor's perceptions and realizations. Deleuze's event includes the 'power beyond the visible' among the 'truth' as a consequence. Deleuze shaped this event to "immanent event" (Patton, 2005, p.400-413). Here, perceptions are not the final purpose; instead, the point is beyond perceptions; the result of perceptions is realization.

In AR art, the visual and kinetic properties of the multi-space include two-dimensional and three-dimensional digital information flow into the temporal experience of interaction. Without space-time as the basic element to create an event, we are unable to assign any meaning to augmented space.

The Event of Multi-Space Real-Time Interaction as the 'Aesthetic Manner'

Barker describes interaction as *"event in digital encounter"* (Barker, 2012, p.49) meaning that an interaction comes in and out of from both sides between human and machine. Kwastek uses "active entities" (Kwastek, 2013, p.90), as a concept that upgrades Whitehead's idea of "actual entities" (Whitehead, 1957, p.95) that he used to explain 'event'. They both highlighted that the interaction involves both human and machine. However, the physical environment also plays a crucial role in interaction of AR. Therefore, we have to re-think this interactive relationship from 'Human-Computer Interaction (HCI) (Johnson, 1992)' to "'Actor'-'Mobile AR'-'Physical Environment'" Interaction.

The first case study, *"String"*, shows how AR artworks rely heavily on the interaction with the actor. Three artworks were integrated into one application software, which is triggered by three different Identification paintings.

Figure 1. 'AR walking monster' © "String", (http://string.co./, 2015)

The first one, as shown in Figure 1, 'AR 3D painting' provides the actor with a '3D sketchpad', which exists in the three-dimensional augmented space; by moving and positioning their mobile phone, the actor can create their own three-dimensional paintings.

Figure 2. 'AR 3D painting' © "String" (http://string.co./, 2015)

The second one, as shown in Figure 2, 'AR walking monster' allows actors to manipulate a cartoon monster walking around in augmented space by interacting with their device's screen

Figure 3. 'AR sneakers',© "String", (http://string.co./, 2015)

The third one, as shown in Figure 3, actors can point, rotate and see a 3D shoe through 'AR Sneakers', and change its color by tapping the color toolbar.

Hu-man	Actions (Sending)	→	Input Devices (Gathering)	Com-puter (VR)
	Perceptions (Receiving)	←	Output Devic-es (Sending)	

Table 2. Human Computer Interaction in VR

Ac-tor	Ac-tions (Send-ing)	→	Input Devices (Gather-ing)	Mo-bile com-putin g de-vice (AR)	Input Devic-es (Gath-ering loca-tion/Ca mera infor-mation)	Phy-sical en-vi-ron men t (Sou rce)
	Per-cep-tions (Re-ceiv-ing)	←	Output Devices (Sending aug-mented infor-mation)			←
		←	Output Devices (Sending reality-based infor-mation)			

Table 3. 'Actor-Mobile AR- Physical Environment' Multi-space Interaction Circular in Augmented Space

Comparing Table 2 and Table 3, we can see that the actor, mobile AR and physical environment all play key roles both as the information sender and the receiver, influencing and being influenced at the same time. Inside each interaction event, the actor is not only a participant, but also the co-creator in establishing interactive experiences. Aesthetic experiences in mobile AR can only be created when an actor interacts in augmented space, meaning that interaction is the only manner to obtain those experiences.

In augmented space, mobile AR becomes an 'event generator of multi-space interaction' which includes five significance characteristics.

1) the diversification of interaction manner;

2)the mobility, expressed by the possibility of engaing with mobile AR in any location;

3) the real-time interactivity

4) the multi-directional interaction between actor, mo bile computing device, and the physical environment.

5) the unique individual experiences.

In the aesthetic experience, we treat the event of multi-space real-time interaction as the aesthetic manner for obtaining aesthetic experiences in augmented space.

The Immanent Event of Fuzzy Boundaries Immersion as the 'Aesthetics Distance'

For the immersion experiences, interaction plays a key role in both VR and AR. Nechvatal considers immersion in VR as a computer generated artificial environment with interaction, which can give people immersive experiences (Nechvatal, 2010, p.48-61).

Figure 4. ©Mark Skwarek, "erasAR", New York city,(Nech-vatal, 2010, p.48-61)z

Figure 5. ©Mark Skwarek, "erasAR", New York city (Nech-vatal, 2010, p.48-61)

AR Artwork "erasAR", as shown in Figure 4 and Figure 5, the Statue of Liberty has been erased from the screen view of an actor in his/her mobile computing device. In AR, we experience an augmented type of reality through our perceptions. This type of mixed reality, which is made of artificial augmented reality and physical world reality, feels real, and the actor believes he/she exists in it.

Type	Film	VR (3D games)	Mobile AR ("erasAR")	
Relationship with people	Passively watching	Interaction		
Storytelling manner	Linear structure	Virtual Environment	Augmented Space	
			Digital Information Layers	Physical Environment
Sensory perceptions	Visual, Auditory	Visual, Auditory, Tactile and Action	Visual, Auditory, Tactile and Synchronous Action of matching with physical world objects/ environment/l ocation	

Immersion experiences	"I do not see anything from the outside" (Béla, 1938, p.215)	VR "put you inside a computer world" (Kelly, 2009, p.150). The actor feels like they are part of the simulated world. Senses are under the control of the VR system, it brings actor into the virtual world	The actor has not totally cut off from the physical world, also not totally intoxicated in digital world, they maintain a "sense of being"(Brown & Cairns, 2004) between physical and digital world, which we call it 'Fuzzy Boundaries Immersion'.

Table 4. The immersion types between film, VR and AR

Through immersion, VR provides a relatively open virtual environment that an actor can interact with. Unlike film which brings the audience into a linear story, VR puts the actor's perception into a completely digital virtual environment; instead, AR pulls the actor back in the middle between digital and physical reality. In "erasAR", AR makes it hard to distinguish the reality of the augmented space from the physical world because it retains the connection between them by maintaining the real aspect while simulating digital conditions. Information can not only be added, but also subtracted.

We cannot simply say that immersion in VR is a complete immersion, or that AR is semi-immersion. In AR, immersion is not only created by digital information flows, but also by mixed information flows resulting from the integration of digital and geographic information from the physical environment.

"Immersion equally relates to a state of intellectual absorption in an action or condition." (Palmer, 2007, p.1).

The event of real-time interaction brings actors into the immersive condition, which is the result of interaction from perception level. In Table 4, we can define the immersion in augmented space as 'fuzzy boundaries immersion'. The immanent event of fuzzy boundaries immersion as a result of perceptions through the event of real-time interaction forms a condition while making a path to actors' realization, which makes them experience the mixed reality in augmented space.

The Immanent Event of Augmented Realization as the 'Aesthetic Purpose'

Through perceptions, interaction and immersion, the immanent event of realization, like the prior experience and imagination in AR artworks, raises up the aesthetic experience to the final purpose. Here, perception makes a bridge from interaction to immersion then reaches realization, from the event of interaction to the immanent events of immersion and realization.
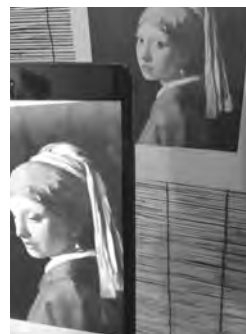

Figure 6. "ARART – Animate paintings", "Girl with a Pearl Ear-ring", NTT-ICC, Tokyo, ©ARART.INFO. (http://arartinfo./, 2015).

Figure 7. "ARART – Animate paintings", "Sunflowers", NTT-ICC, Tokyo, © ARART.INFO. (http://arart.info./, 2015)

Another case study is the "ARART- Animate paintings" (http://arart.info./, 2015). Artists use masterpieces like Johannes Vermeer's "Girl with a Pearl Earring" in Figure 6, Van Gogh's "Sunflowers" in Figure 7, and Leonardo da Vinci's "Mona Lisa" in Figure 8 and bring them into the world of AR, it turns dreams and fantasies into an actor's 'real' experiences. The virtual realization from AR digital and the realization from physical world are both necessary for this type of realization, that we can name "Augmented Realization". It mixes and augments the realization that is not only based on reality but also goes beyond reality.

The immanent event of augmented realization is the aesthetic purpose for AR arts through the immanent event of prior experience and imagination. Also the immanent event of augmented realization relies on the event of multi-space real-time interaction and the immanent event of fuzzy boundary immersion as aesthetic distance.

Figure 8. "ARART – Animate paintings", "Mona Lisa", NTT-ICC, Tokyo, © ARART.INFO. (http://arart.info./, 2015).

Conclusions

	Aesthetic Manner		Aesthetic Distance	Aesthetic Purpose
	Perception			Realization
Events	Events		Immanent events	

AR artworks	Multi-space real-time interaction			Fuzzy boundary immersion	
	Interactive methods	Locations	Multisensory		
"ARART" "String"	Image (Painting) recognition	Anywhere with print images	Visual, auditory, kinetic, and actions	Strong relevance to original paintings / Strong relevance to physical environment	Imagination rely on the physical environment and 3D digital content
"eras AR"	Location based service (LBS)	New York City, USA			Comparison between the physical environment and augmented space

Table 5. Aesthetic experiences in AR Artworks

As shown in Table 5. By comparing the AR artworks introduced in the paper, we can observe a multitude of details from their attributes. AR artworks combine visual, auditory and kinetic aspects. Some of the artworks require a specific location, while others can be experienced everywhere. We experience the augmented world by interacting with our mobile device and/or by moving it around. Some AR artworks allows us to image we are traveling through space and time. Our aesthetic experience of our environment is redefined through our perceptions and realizations with AR.

To conclude, three major conclusions can be drawn

about aesthetic experiences in AR artworks:

1.The event of multi-space real-time interaction is the aesthetic manner.
2.The immanent event of fuzzy boundary immersion is the aesthetic distance.
3.The immanent event of augmented realization is the aesthetic purpose.

These three distinguishing characteristics shape AR art and transform the media artist from someone who creates art-works to someone who creates experiences and events. It also turns the passive participator or audience from the past into an active 'interactor'. AR art breaks the location limits, carries art out of art museums and cinemas, making it walk into public spaces with an individual and mobile view, which allows it to be experienced anywhere and at any time.

Acknowledgements

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