



Rethink of Urban Arts: AR Technology with Participatory Experience of New Urban Arts

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Abstract. This paper primarily discusses the interactions between citizens and the urban arts. It uses the augmented reality (hereinafter referred to as AR) application of paintings on bridges in the Yantai Economic Development Area (hereinafter referred to as YEDA) as an example to expound the use of an AR application in urban arts and the relationship between citizens and urban arts. As long as tourists download our AR application on their smart-phones and scan the paintings on the nine bridges of the YEDA, virtual creatures related to the paintings will appear on their screens. The users will then be able to interact and play games with the virtual animals. Through such interactions, we can discover that urban arts installations are neither sole artworks nor information carriers placed in cities with the purpose of conveying certain information. In fact, they are brand-new facilities that can interact and communicate with people. They allow tourists to transfer from appreciators of urban arts to participants and creators of urban arts, formulating the fascinating interactions between human beings and urban arts.

Keywords: Design thinking · Urban art · Augmented reality · Interactive design
User Centred Design

1 Introduction

The Yantai Urban Art Project was commissioned by the YEDA. When we talk about Urban Art we will mention sculpture, graffiti and installation. *the definition of “Urban Art”, is either based on the mission of art work to improve the quality of urban landscape or on a variety of art works in the city; however the interesting point here is that the Urban Art is not clearly determined in the previous studies. How can it affect the quality of urban landscape? And whether all works of art in the city are caused such qualities? With the distribution of artworks all over the cities and failure to reach their maximum determined targets, it seems that Urban Art has been backed away from its original essence and subdued by some styles attenuating its values as much as decorations and ornaments of city¹.* Because the urban arts are characterized by existing in the public space, they are often viewed as vandalism and destruction of private property. But Yantai Urban Art Project’s goal is not only to create an art landscape for public to enjoy but

also to use interactive methodes to engage visitors to play with the art work and influence their behavior.

2 Objectives

- This project will study public’s experience of Urban Arts and find a way to encourage public participating into it. We will study the background context of engagement and participating.
- We will research the reasons restricting public to participate into Arts. How can we encourage public get involved into Urban Art or to create a participatory experience for public.
- Research the HCI design field and User Centred Design methology.
- Gamified methodology to encourage public participating.
- Study public’s emotion especially Achievement Emotions.
- The technologies behind New Urban Art.

The study of public’s experience of Urban Arts. Urban Art is a general idea about visual art forms in urban areas. What we have often seen in city are graffiti, sculptures, and installations. Most of these art forms are viewed by public by a passive way which means the art will be there and public will give it a glance when people pass through it. *Definition of art is a specific form and shape of social consciousness and its aim is to reflect the reality correctly and multilaterally for the purpose of reaching the aim and loftiness which has passed a very tortuous and difficult way. What has caused evolution of urban arts is creating the pictures which have full resemblance to the reality, because they have public addresses and are seen in the paths of the city and daily passing of life. General art are meaningful activities that can be recalled as art. This art has been*

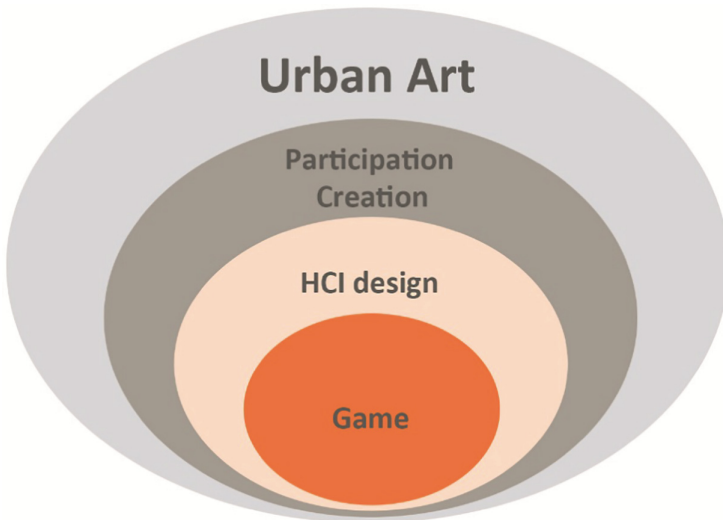


Fig. 1. Participatory urban arts diagram

*shaped in the city space with public investment or by persons and is paid attention by the public and it is appeared with a clear aim and in the form of general activities of the city*². It means that art is not only related with author's ideas to express but also involved with audience's perception and participation (Fig. 1).

Participation is not only a set of techniques. It is more of a state of mind (psychology) or an attitude towards others. A good technique is more like a belief that will encourage everyone to participate and enjoy the process. If we can provide people with the right tools to help them to participate, they will be able to invest in activities and feel happy to enjoy in them.

2.1 Participatory Experience

When we design for uses and audiences to participate that we need to pay attention for a problem. That is our users and audiences are made up of different age groups and they have different knowledge backgrounds, which lead to a different cognitive development levels. The cognitive development theory can provide us a very good foundation and be a effective guideline to help us design. The theories we have researched related to these below:

We explore the world and observe law of nature and make summaries just like what scientists do. Piaget has recognized two fundamental cognitive processes that they work somewhat in a way of supporting each other. Piaget called the first one "Assimilation", which is a process involved to incorporate new information into an existing cognitive structure. The second one is called "Accommodation", which is to form a new cognitive structure that can incorporate new information. As summed up by Piaget that "Assimilation" and "Accommodation" these two simultaneous processes represent a balanced system. Piaget emphasizes the repetition of experience of individual and subjective, which can help human being to develop an understanding of the world and move from one stage to another. Piaget hoped to be able to use his theory to involved into the educational system so that can have new thinkings on the cognitive sciences. The related documents involves Vygotsky's theory which supports the idea that the cognitive development is highly intrinsic.

There are so many researches emphasise that design should take care of user's experience and the cognitive theory is a very important study field for it. Through the better understanding of cognitive theory we can do better design for users and have a effective guideline for design methodology. The result would be perfect to bring a better participatory experience to users.

Besides audiences' personal knowledge background and structures there are a lot of other factors will affect their experience in cognitive process which are including individual needs, motivation, and degree of participation. If we can encourage our users from different dimensions by using multiple measures their degree of participation can become higher. If a user has more knowledge or experience in some aspects of his/her own, the higher amount of information he/she will get. Different forms of participation can bring different degrees of cognitive behavior and influence to users, stimulate users' different senses, interests and behaviors, all of which can affect users' degree of information acquired in cognitive process.

In the book “Emotional Design – Why We Love or Hate Everyday Thing”, Donald A. Norman mentioned Three Levels of Processing. They are Visceral, Behavioral, and Reflective. The visceral level is fast: it makes rapid judgments of what is good or bad, safe or dangerous, and sends appropriate signals to the muscles (the motor system) and alerts the rest of the brain. This is the start of affective processing. These are biologically determined and can be inhibited or enhanced through control signals from above. The behavioral level is the site of most human behavior. Its actions can be enhanced or inhibited by the reflective layer and, in turn, it can enhance or inhibit the visceral layer. The highest layer is that of reflective thought. Note that it does not have direct access either to sensory input or to the control of behavior. Instead it watches over, reflects upon, and tries to bias the behavioral level³.

Donald mentioned the actual product can be not only the present of functions and problems but also can solve the problem for our feelings and needs, and more importantly it can help user to create his or her personal identity and social status. Therefore, understand users’ cognitive style and level will help designers to learn users’ basic needs and encourage them to participate into designated experience.

It is very important for us to create a sound participation environment for users. In our daily basis circumstances to create a direct access for users is a very hard challenge. We have to study these challenges when we do the design to understand users’ needs in new era. How people perceive things in urban and use new technologies to help them explore the art world.

It is full of challenge to encourage different kind of people happily to dedicate into a event in the ordinary environment. A good design will reach the goal successfully but the bad design will tear people away from urban art.

2.2 Games Are Better Participatory Experience

Games can represent the most effective participation. By playing games the participation will be greatly improved. Many of our current studies and theories, especially HCI are related to Malone’s idea back to the 80s of last century which is based on the fun of games. Those information can provide us the theoretical ideas and explanation for design a interesting user experience. We did some research about how game can encourage the participation and what benefit it could bring to us.

Salen and Zimmerman did many researches to define “Game” at 2003. They found that most of the definitions are about rules, objectives and descriptions of how to play. In 2013 Adams had a definition of game: “a type of play activity, conducted in the context of a pretended reality, in which the participant(s) try to achieve at least one arbitrary, nontrivial goal by acting in accordance with rules.”⁴

According to the definition a game is an activity including one or more players. This activity will involve players to reach certain objectives or give players a set of rules to tell them what can do or can not do. The goal of game is to have fun or pleasure but it can also provide training, education or simulation opportunities.

Game has become a part of our daily life since long time ago. Nowadays new technologies have involved into the game and featured it digitalized and virtualized which makes it more easily to play at anytime and anywhere.

Many researches explored the positive impact of the game in general or particular. A large number experts and scholars studied how game will have benefit on cognition for participants in our life. When people play games it can help to improve their cognitive skills especially for space. It could be very helpful for users to get involved into urban art as participants but not only visitors. Game is a very effective means to encourage and stimulate positive emotions and it can promote the development of social skills. Jan McGonigal mentioned in his book “Super Better” that traditional games are complicated and hard to master, so when players are in the process of play they will be pushed to learn more general and challenging skills and abilities⁵.

Design and develop a game is a very complicated work and process. This is not simply a task that can be done by playing. It requires not only creativity but also many cognitive skills. Designing a game is a tough and complex task. It can provide participants a strong learning environment. Game can offer a variety of opportunities to exercise many different skills.

Game is one of the most participatory activities. The process of design a game is very participatory too. The definition of design a game is: “It is a process of creating and designing content and rules for a game.”⁶ Game should be as simple as possible at the beginning because simple is easy to participate. Game should be fun and attractive so players can reach a high active state. Fun will stick players and enhance their desire to participate, then allow them to reach a flow state. Moreover it is very important to have a good structure with rules of the game, and a attractive way to elicit players’ emotion. For example, The ability to provide feedback to players to encourage them to continue to participate and learn. To make players feel satisfied and constantly stimulate their adrenaline. To motivating the participants’ creativity through different measures.

2.3 The Process of Design a Game (Project)

There are so many methods to design a game. Some like to design it based on personal experience and imagination which is called “My Way”. But we believe that the method of human centered design is one of the best to adopt. Because in this way, we can put players at the center of design, so we can have better understanding of players’ needs and behavior. By following a user centered design approach, designers should focus on the most important two functions of games during the design process. First, it needs to be able to make the players happy, and second it needs to be able to fell empathy with players. There are 3 main steps to design a game in our project:

- 1 Analysis goals and game design concepts.
- 2 The development of game concept.
- 3 Prototyping development.

For our project, it’s very important to analyze our goals first and then to get ideas to conceptualize them. They are foundations. We will think what do we need and what to do for a game as a participatory urban art project. It is very important to think about the core mechanism for the project. Core mechanism can represent the core of participation.

It can create participatory methods and processes. It can define the challenges of participation and provide participants with the rules to be completed in the challenge. It also determines the impact of the actor's behavior on the project (Fig. 2).



Fig. 2. Yantai Economic Development Area bridge pier 122.

3 YEDA AR Procedure Design

The AR Project in Yantai is initiated by YEDA to provide interactive experience in art between people and the city. By means of Augmented Reality (AR), tourists can use their smartphones to look for 9 AR targets in the paintings of the bridge piers, and to interact with the virtual objects they find. Tourists are encouraged to combine the virtual objects with the real painting and to experience the joy within.

The YEDA Bridge is 5 km in length with paintings reflecting four seasons on its piers. Based on the design drawings of the paintings, 9 piers that are appropriate for interaction are selected. The following factors are considered: Location, Light and shadow, Recognition degree of the paintings.

3.1 Location

Considering the fact that the pier paintings are 30 m² in area and the equivalent focal length of cameras in iPhone 4s and other following iPhone devices is 28 mm–35 mm, the best distance for interactive experience is 15 m from the pier. We follow the tourist route in person to measure the distance between the road and the pier to find the piers best for interaction (Fig. 3).

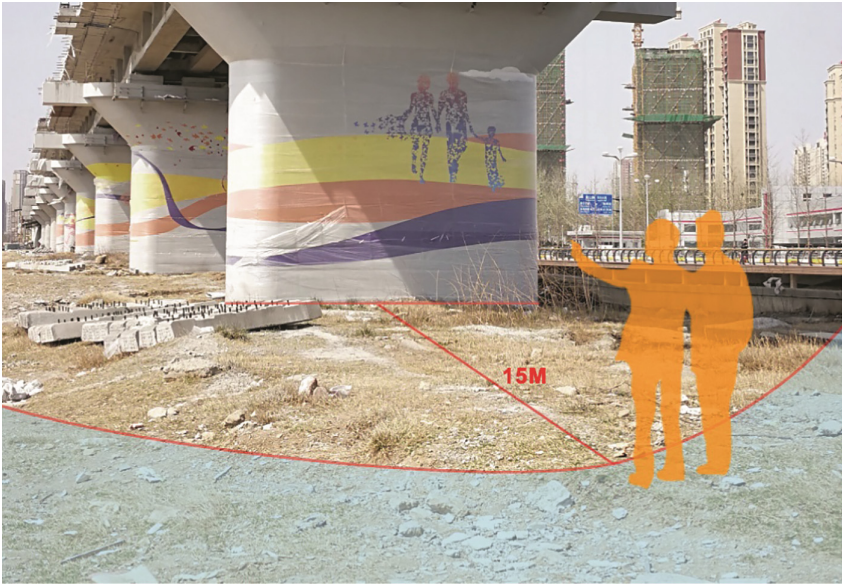


Fig. 3. Yantai Economic Development Area bridge pier 122.

3.2 Light and Shadow

The AR Project in YEDA is an outdoor AR experience. As a result, the change in natural light and shadow can have an influence on recognition of the pier paintings. Thus, we choose those paintings influenced as little as possible by the natural light and shadow, i.e., the paintings facing north or without direct exposure to natural light (Figs. 4 and 5).

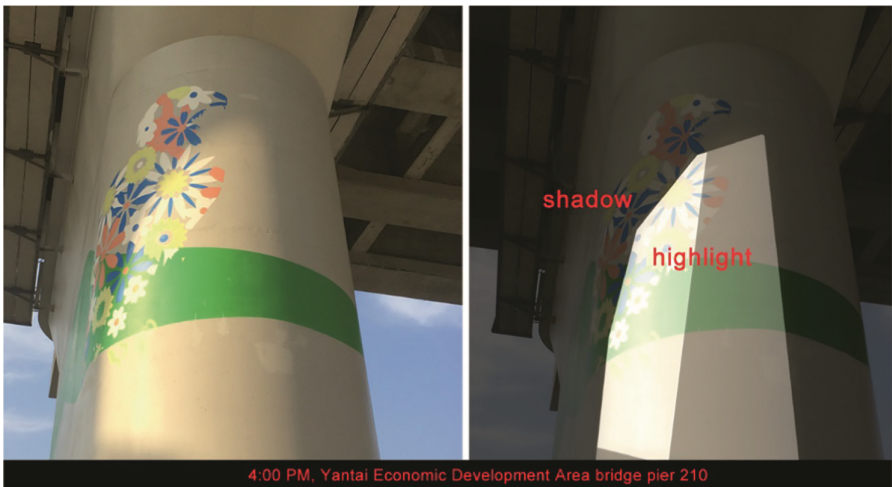


Fig. 4. Yantai Economic Development Area bridge pier 206.



Fig. 5. Yantai Economic Development Area bridge pier 132.

3.3 Recognition Degree of the Paintings

The recognition degree of the paintings can influence tourists' experience, so paintings with high degree of recognition are our first choice. Recognition degree of AR symbols shows whether the symbols can be properly recognized under various conditions and the speed of their recognition. Besides, symbols with low degree of recognition can cause instability of the model. The AR SDK Vuforia that we adopted has a function of rating the recognition degree of the paintings. After reading the SDK documents of Vuforia and some tests, we find that paintings satisfying the following three conditions have higher degrees of recognition:

- The paintings have numerous corner angles;
- The corner angles are evenly distributed;
- Single elements in the paints are small.

After filtering, we have 15 piers that are suitable for AR interactive experience. Combining the tourist route and storytelling together, finally we select 9 of them.

4 YEDA AR System Design

The AR Project in YEDA adopts the gaming engine of unity3d 2017, and is combined with Vuforia. First of all, symbol paintings are detected using the AR camera. Then, GPS location detection is carried out⁷. If the two detections match with each other, the 3d model will be displayed on the symbol painting for interaction.

The AR Project in YEDA aims at providing interactive experience in art between tourists and the city. We do not want that kind of interaction where tourists turn on their smartphone cameras to recognize a fixed card. Instead, in the interaction experience, tourists are required to place themselves in the real artistic scenes of the city. Thus, proper interaction ways should be that, the tourists are in YEDA Liuzihe Park, and he or she turns on the smartphone camera to recognize the paintings on the piers and interacts with the virtual images generated. Therefore, the proper procedure should be that, GPS location of the tourist should be recognized immediately after he or she recognizes the symbol, and if the tourist is in the correct location, the model and animation should be displayed for interaction (Fig. 6).

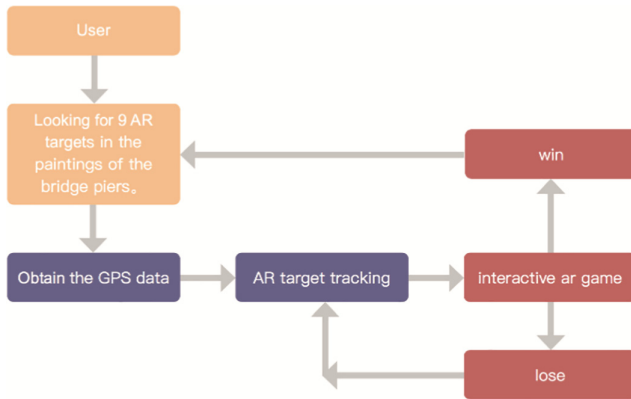


Fig. 6. Yantai Economic Development Area AR project flow diagram.

4.1 Obtain the GPS Location Data of Users

GPS location of the tourist should be obtained immediately after the tourist recognizes the symbol, and compare the data with target zones (in unity3d, `Input.location.lastData.latitude` and `Input.location.lastData.longitude` can be used to obtain users' current longitude and latitude information). If the tourist happens to be around a painting, the model and animation should be displayed for interaction.

4.2 Time Limit on Interaction Games

Because the AR Project in YEDA is an outdoor project, tourists' maximum interaction time with the virtual images should be limited to 60s in order not to cause traffic jam (Fig. 7).

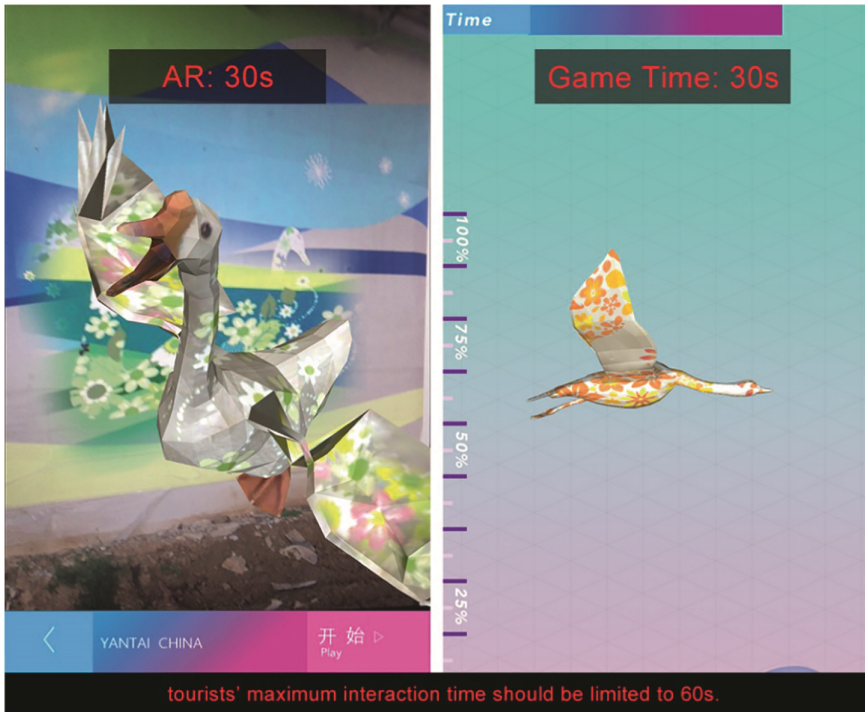


Fig. 7. Yantai Economic Development Area bridge pier 132 and interactive ar game.

5 The Technologies Behind New Urban

The number of Internet users transmitting bandwidth through radio wave for exceeded that through cable. Nowadays, online chatting, messaging and posting through mobile data has become an incredibly important thing in our daily lives. However, the “internet of things” has brought about far more than just interpersonal relationship maintaining. For example, we can check the location of our car through smart phones, check the traffic congestion condition using map applications, obtain weather information using weather applications, and communicate with the sensors all around the city through smart phones. Even so, our interaction with public urban art has been insufficient. Sculptures on streets and wall pictures can only beautify cities. It would be a great experience for people to interact with urban art through some technical methods while appreciating them.

Augmented Reality (AR) is the main technique we adopted to realize YEDA. Although the people-art interaction goal has been achieved, there are still two remaining problems. First, most urban art works are three-dimensional like sculptures, except two-dimensional paintings, companies’ logos and graphic advertisements. However, most AR image recognition is based on two-dimensional characteristics recognition, and three-dimensional logo recognition is not stable; besides, most AR is realized through

smart phones at present, where users download applications through Google Play or App Store to recognize logos and display virtual objects. The process of waiting for downloading relevant applications decreases users' experience. In March 2017, Jerome Etienne developed a solution to realized AR on web browsers⁸. It enables instantaneous video stream through webrtc, and renders three-dimensional virtual objects. Therefore, we may not necessarily have to rely on any application in the future; by opening safari browser on phones to automatically activate cameras, we can scan any urban art work to display the virtual object and enable interaction with it, creating a pleasant and convenient interaction experience (Fig. 8).



Fig. 8. Realized AR on web browsers (Safari).

6 Summary

This paper discusses the process of people-art interaction and the existing problems, and rethinks the relationship between urban art and people. This paper proposes that people's participation in and interaction with urban art works in the future should be strengthened. In YEDA, we used Augmented Reality for viewers to scan the art paintings on piers and then to interact with the generated three-dimensional models. In the future, the interaction experience can be even better with the development of digital technology. More items can be displayed also, to fully convert viewers into participants and creators.

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