

Combining Digital Games with Art History to Create an Interdisciplinary Learning Experience for Students

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Abstract

This paper presents an interdisciplinary to develop content-aware application that combines game with learning. The employment of content-oriented game enhances the gamification of learning in culture education. The gamified form of the application is used as a backbone to support and provide a strong stimulation to engage users. However, developing content-aware game is a demanding work without proper guidance. The purpose of this research is the development of an interactive game-based learning application to combine the cultural content with game. Therefore, we present the application which in form of augmented reality (AR) ~the Digital Hukou Project. The Digital Antique Project aims to transform artistic cultural heritage into content of AR application named “Adventure for Hukou Treasures”. By using AR application and watching AR presence through mobile screen, the users can immerse in appreciating virtual cultural artefacts which are selected as representatives from Chinese art history and learn the beauty of historic artefacts in ubiquitous computing environment. The results reveal the advantages of gamification having appearance for users to have better understanding on Chinese historical artefacts. We expect this research to extend the adaptability of game development in art culture education.

Keywords: interdisciplinary, gamification, augmented reality, artefact

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Introduction

In the Digital Hukou Project ~ “Adventure for Hukou Treasures”, local art history ~ in this case, local culture ~ is being converted into an AR card game. Global culture has shifted aside local culture within the society and made it less attractive in comparison with modern foreign culture. By using game design, the Digital Hukou Project aims to develop a content-aware application/ game that combines gamification experience with local culture learning when the users are playing the game. readers are hoped to feel a different sensation when they are playing this game. The gamified form of digital content is used as a backbone to support and provide a strong stimulation to engage users to comprehend and enjoy art/architecture information of Hukou Old Street. The project transforms artistic cultural heritage of Hukou Old Street into content of AR application. By playing AR table cards, the users will immerse in a virtual scene of Hukou Old Street and learn the beauty of Hakka culture and historic architectures in ubiquitous computing environment.

Augmented Reality (AR) technology extends Virtual Reality (VR) performances by blending real and virtual elements into real scenes, and to enrich the visual object with a non-artificial view of real scenes. AR technology has already made vivid impact on many domains. This paper focus on how AR techniques can offer a great solution of enabling visualization of 3D models of cultural architectures to be applied in art education for children and to be used to enhance user’s cognitive skills.

1.1 Research Motivation

With the innovation of technology and mobile devices, the features and performances of portable digital products have been increasing dramatically, prompting more convenience and mobility of digital game products in use. By multi-touch somatosensory interaction, the player's gesture touch and limb movements involved in the game, bring a more intuitive feeling, instead of something more than the emotional reflections. When the direction of information technology gradually being taken seriously into the future development of education model, along with computer hardware and software and the Internet to flourish, constructing a multimedia and interactive digital learning environment continues to provide more learning opportunities and quality optimization for development and to enhance cognitive and affective skills.

Mobile devices are capable of real-time rendering of high-end video, synchronized transmission of voice, text, images and other media learning activities; they are beyond the traditional teaching model to provide a ubiquitous computing environment (Ubiquitous Computing), and trigger the restructuring of many learning styles in the way of changing imagine (Reimagined) concept. Many studies have found that computer software, computer games or interactive multimedia interface can be used to enhance young children’s cognitive and language skills and promoting their motivation and performance.

1.2. Research Background

Hukou Old Street had been once prospered and is now declined because of the changing of railroad exportation. Located in Hukou Township, Hsinchu County, the old street is a long street occupied by two-story redbrick buildings that were built around 1920 and are probably the most complete Japanese-era shop-houses in

Taiwan. Therefore, the project focus on developing a proper approach to serve as interactive game, and offer a learning opportunity on Hukou Old Street through playing cards to appreciate Hukou historic architectures.

When the direction of information technology gradually being taken seriously into the expected development of education model, along with the boom in hardware and software of mobile devices, constructing a multimedia and interactive digital learning environment that provides more learning opportunities and quality optimisation to enhance cognitive and affective skills. Therefore, the knowledge/ information of Hukou cultural architectures is transformed into real-time rendering of high-end video, synchronised transmission of voice, text, images, objects, and other learning content in the AR card game.

1.3. Objective

The present project for building a virtual scene of cultural architectures enables user, or tourists especially in this project, to bring magnificent architecture closer to see and use for interactive appreciating and learning. The solution of this project makes cultural architecture portable and interactive, and furthermore, to transform viewers into players to interact with AR content in an intuitive and exciting manner. For presenting AR component in a more attractive and functional way, future works will integrate the AR target into the form and function of toys that are more appealing to children. It means the transformation of AR target markers will also function as essential approach of production development to accomplish both business and cultural creativity purposes. Therefore, this research aims to evaluate the current development of game-based learning and presents an overview in achieving interoperability between playing and learning/appreciating.

Since game is an attractive and effective medium to interpret solid knowledge into pleasure information through designed images, music, sound effects, and missions. By applying game as a medium, it is hoped that the process of re-introducing Hukou historical buildings can be a more easier and fun way for user to absorb the designated information.

1.4. Methodology

To stimulate user's interest to learn about local culture by playing card game, this project uses AR technology to make game more attractive and interesting to introduce Hukou historical heritages. This project applies game design method to develop the concept of the serious game on certain subject of the past Hukou life. We had built 27 pieces of 3D buildings and created more than 10 game characters for this Hukou card game and the AR application.

In this game, the figures possess special attributes served as crucial elements allow users to recognize the figures as Hakka people. On the other hand, Hukou Old Street is classical in appearance and is accepted as one of representative settlements of Japanese-era architecture. The traditional looks of Hukou is preserved well after several renovation projects. However, these buildings not only differs from each other to show their own individual feature, but also decorates with relief motifs of Chinese-style feature such as dragons, cranes, and immortals to declare it origins. Hence this project will present 27 3D buildings to serve as the AR image with its paired AR card.

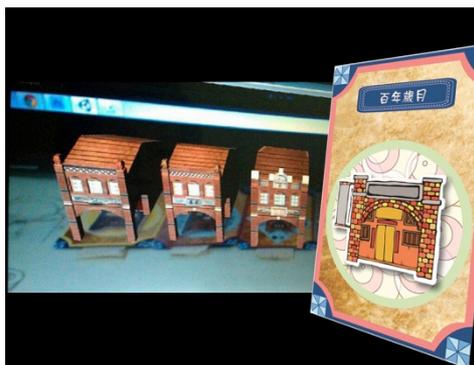


Fig. 1 3D Hukou historical buildings on AR cards

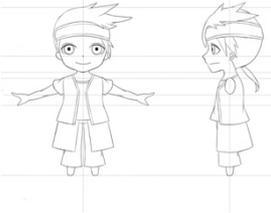
2.1. Game synopsis

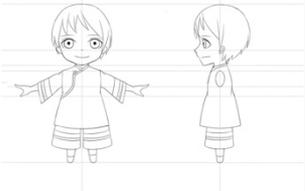
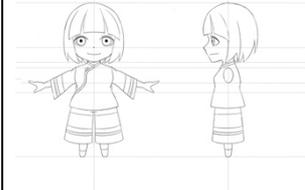
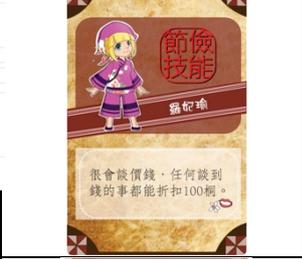
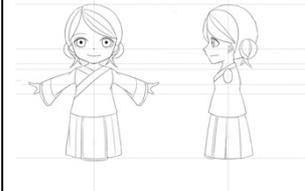
“Adventure for Hukou Treasures” is a game designed to help users/players to grasp a concept of cultural treasures and to absorb the educational information on Hukou history. The Hukou “treasures” should be defined as a cultural concept but to be designated as any specific person or thing. This game brings the beauty of Hukou local culture and traditional architectures to the palms of players. However, the purpose for designing this game is to stimulate players’ motivation to pay a visit to nowadays Hukou Old Street and to taste the cultural atmosphere in person.

2.2. Game design

There are 8 main characters in the game; they individually represent the Hakka ethnic, Taiwanese ethnic, aborigine, modern traveler, and catholic priest. These game roles are all in vivid characteristic designs, no matter on clothing, hairstyle, or personality. This game feature aims to provide players with multiple options to play self-chosen roles to immerse in the Hakka society and to experience the story of the Hukou Old Street. Furthermore, the game world is mixture by the past and the present, player immerse in the Hukou historical heritages and nowadays scenes to appreciate the beauty of Hukou culture.

Table 1. Character Card Setting and Design

No.	Name	Ethnic/ Occupation	Character Design	Card Design
1.	Hayong.Yumin	Aboriginal Male		

2.	Limuyi.wayu	Aboriginal Female		
3.	Jiang, Ta-Chang	Hakka Male		
4.	Roh, Fei-Yu	Hakka Female		
5.	Roh, Shih-Fu	Taiwanese Male		
6.	Wu, Kuo-Yu	Taiwanese Female		
7.	Yo, Ker	Traveler Male		

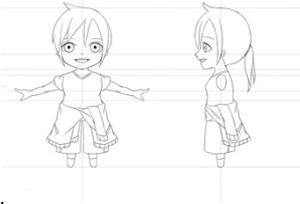
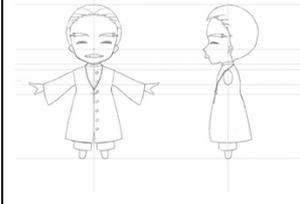
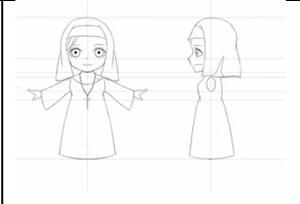
8.	Ru, Zen	Traveler Female		
9	W. M. Jones	Catholic Priest		
10	Emma Dane	Catholic Nun		

Table 2. Four Seasons Event Card Setting

No.	Name	Season	Description	Card Design
1.	The Feast of Spring Festival ~ Event 1	Spring	To attend the feast, and to make acquaintance with local residences.	
2.	The Feast of Spring Festival ~ Event 2	Spring	Intruding into the feast in progress, player turns away from the activity.	
3.	The Aegiceras Festival ~ Event 1	Summer	Win a photo competition award by the picture of aegiceras blossom.	

4.	The Aegiceras Festival ~ Event 2	Summer	To participate the Aegiceras Festival and spend money on eating and drinking.	
5.	Autumn Date with Hukou ~ Event 1	Autumn	Speeding up for the reason of attending the Hakka Yimin Festival.	
6.	Autumn Date with Hukou ~ Event 2	Autumn	Left a time capsule to pray for lucks.	
7.	Santa Dragon Caroling ~Event 1	Winter	To give assistance to the Santa Dragon Festival.	
8.	Santa Dragon Caroling ~Event 2	Winter	Immersing in the festivity of the Christmas when participate the Santa Dragon Festival.	

For the reason that player is endowed capability to use “Aegiceras Currency” to purchase personal property in the game, such as building, or game props. Therefore, this project also designs “Building Card” and “Props Card” to act as the ownership of estates and game objects. The building cards can serve as the image markers for AR application to scan to execute augmented imaging function on device and to meet the educational purpose. The developed result is likely to be as seen below:



Fig. 2 AR card (right) and AR imaging (left)

In this project, the Autodesk 3ds Max, that enables designers to focus simply on creation, is used to make all three dimensional characters and architectures in this AR able game. For modeling game characters and historical architectures, we conducted field investigations and developed the character settings to use as the 3D characters design guideline and to meet the standard of cultural digital archive. According to the research result and game design proposal comes after several field works, the project team can then design game cards and 3D objects to use as the content of both the AR application and the table game, as seen in the picture below:

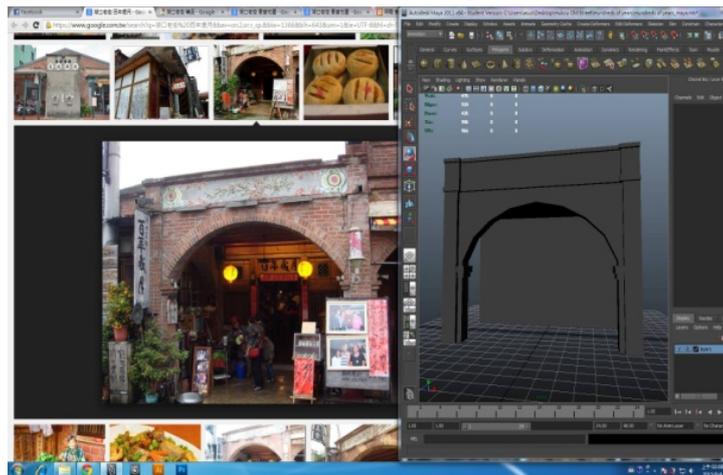


Fig. 3 Modeling in 3ds Max (right) and building reference materials (left)

This project proposes a content system that includes tools and materials used to create representations of digitized cultural architectures of Hukou Old Street. The development of AR contents consists of three aspects: content creation, target management, and AR presentation as shown in fig. 4.

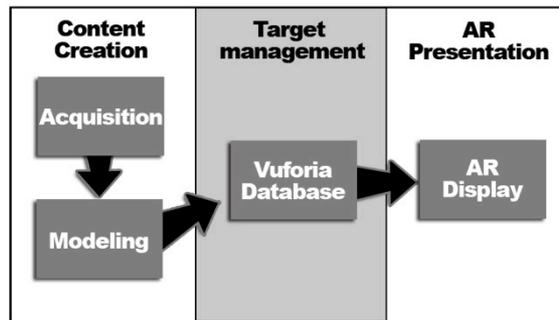


Fig. 4 The structure of developing AR contents

3D models of architectures are stored in the Target Database offered by Vuforia SDK-based AR application. With Vuforia software platform, 3D objects come to life with interactivity through 3D graphics to mobile device and individually show on the corresponding AR card.

Through webcam or mobile device's camera, the front side, which is illustrated with graphic appearance of architecture, will function as AR Target to show corresponding 3D model. Meanwhile, the rear side, which is illustrated in form of doorplate, is design to show the description of details of the specific architecture. This is an import function designated to provide further information for who interested to discover more on any historical architecture.

Conclusion

The present project that builds a virtual scene of cultural architectures enables user, or players especially in this project, to bring magnificent architectures closer to see and use for interactive learning. The solution of this project makes cultural architecture portable and interactive, and furthermore, to transform viewers into players to interact with AR content in an intuitive and exciting manner.

This project adapts the game design style references to AR game projects and also the local culture features, such as traditional clothing, historical heritages, traditional costumes, and a traditional stories. For the modification, we made some attractive media which is video game to attract people learning local cultures. Our purpose to made this demo game is for conserve Indonesia's own culture and tradition. We aren't eliminating the adventure part and the figures in this game. We will rearrange the designs after the demo game give a positive respond from the Indonesian community.

For presenting AR component in a more attractive and functional way, future works will integrate the AR target into the form and function of publications that are more appealing and suitable for user to absorb educational information and appreciate 3D virtual objects simultaneously. It means the transformation of AR target markers will also function as essential approach of production development to accomplish both business and educational purposes.

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