Traditional Art, Interactive Technology, Gamifying Cloud: Cross-Cultural Hybrid Puppetry New Experience

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Abstract
Ministry of Culture put forward that hand puppet was one of the top ten potential highlights of "Masterpieces of the Intangible Heritage of Humanity" in Taiwan while the United Nations Educational, Scientific and Cultural Organization (UNESCO) passed the "Convention for the Safeguarding of Intangible Cultural Heritage" in 2006, which clearly shows that hand puppet has become the performing art culture that can best represent Taiwan and is highly valued. With significant increase in computing capability, the new digital tools (such as tablet PCs and smart phones) have been able to present various kinds of 3D digital media materials in recent years. Together with navigation system and internet technology, users have been able to make real-time interaction on the internet platform and so the concepts generated from interactions in different fields will be an important trend for development of digital content industry. Therefore, this paper offers Gamifying museum, a design development mode using display space of Li Tien-lu Hand Puppet Historical Museum as the scene, combining virtual and physical interaction, and integrating elements of Monopoly to create new experience of hand puppet culture.

Keywords: hand puppet; augmented reality; gamification; Gamifying museum

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Introduction

Glove puppetry is also known as hand puppet, a local play manipulating puppets as performance, originated in 17th century (the end of Ming dynasty and the beginning of Qing dynasty). Hand puppet has a history of 300 years in Taiwan since being introduced to Taiwan in the middle period of Qing Dynasty and is one of the three major folk puppet shows in Taiwan. The hand puppet culture combines a wide variety of performing elements, such as literature, philosophy, storytelling, sculpture, embroidery, painting, music and drama, which may be called " integrate eight performing fields into one performing art" that is "the best extraction of such performing fields" (Wu, 2005). With development of internet technology and popularity of all kinds of image devices, the puppet show has gradually been integrating into the performing mode using lights, special effects and montage. It is now the traditional performing art that can best represent Taiwan for its rich cultural connotation and multi-type performing modes and an indispensible part of the entertainment in modern life.

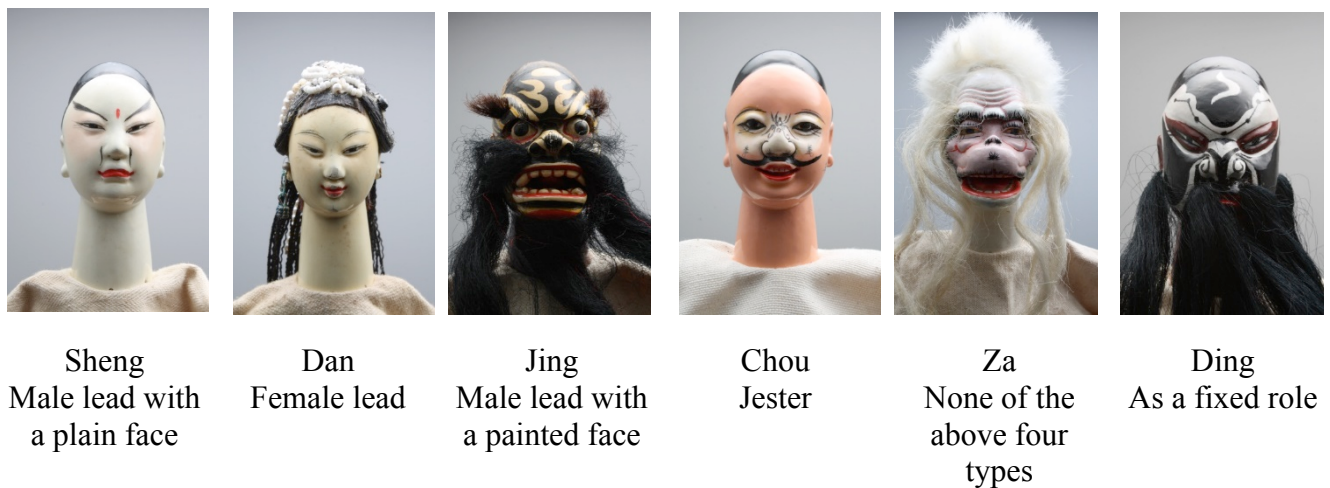| Sheng	Dan	Jing	Chou	Za	Ding
Male lead with a plain face	Female lead	Male lead with a painted face	Jester	None of the above four types	As a fixed role

Figure 1: Role classification of traditional puppet show
Data source: Jun-Kuan, Li at I Wan Jan Puppet Theater (2014)

Augmented Reality (AR) was put forward by Milgram and Kishino in 1994. This technology has been quite mature now and AR development functions (such as Unity) have been built in many development tools that have been extensively used in a wide range of fields including education (Echeverría et al., 2011; Kaufmann and Schmalstieg, 2003), entertainment (Wagner et al., 2004), geographic information systems (King et al., 2005), media art (Levin, 2006), psychology (Juan et al., 2005), surgery (Glossop and Wang, 2003), and city planning (Ben-Joseph et al., 2001). The utilization in these fields all has specific achievements and values.

Gamification has been a new research topic in recent years. Gamifying Library at University of California, San Diego let students experience services provided by the library through digital tools such as navigation and interaction (Young, 2013). Google and Volkswagen collaboratively developed SmileDrive system that starts to collect records like distance, time, weather, route and people users meet on each of users' drives and a smile score will be given automatically when users reach destinations and their friends and family members can all participate in interaction. This is called

Gamifying Driving. For promoting the concept that "fun is the easiest way to change people's behaviour for the better", Volkswagen has worked on Thefuntheory for re-construction plan of public facilities based on gamification since 2009 (Volkswagen, 2009). Also, Nike, the sport brand, combined game competition systems and was the first one launching Nike Plus App for jogging records (Park & Bae, 2014). These examples all show that gamification design is an important basis and a development trend for design in modern era.

This paper put forward Gamifying museum, a design development mode using display space of Li Tien-lu Hand Puppet Historical Museum as the scene, combining virtual and physical interaction and integrating elements of Monopoly, which has changed traditional static and one-way display behavior for museums' exhibits. Integrating interactive technology and gamification into mode design and development, Gamifying museum creates a whole new experience of visiting museum.

Rationale of Design

This study started from the field research and was based on principles of interactive design and gamification; it established Gamifying museum mode and completed development through the four steps of study implementation. Together with digital content production, cloud database establishment and APP with integration of game elements, this game makes display area in the museum is no longer a static and one-way exhibition but a virtual and physical interactive game, creating the mechanism that is fun and able to learn when visitors enter into the museum. The four steps are:

1. Inventory: Made an overall inventory of the existing exhibits and display space and divided the actual museum collection of each showcase into two levels, "type" and "item" and then used the classification framework to acquire result of tentative classification.
2. Conversion: Made the whole display area a virtual and physical interactive game and turned the inventory result into a Monopoly game that players needed to pass levels in the game. Four major game levels created correspondingly were casting, equipment, nurturance and life.
3. Development: Software and hardware development tools for Gamifying museum include embedded radio frequency device, server database establishment and gamification user interfaces, exhibit digital contents and game levels and procedures for the interactive game APP.
4. Completion: Prototype testing of Gamifying museum was based on the actual museum, mainly used the left-side display area on the second floor of the museum and subsequent practice development was proceeded by trying hard not to affect the existing showcases and exhibits within the museum.

Also, the below four main design concepts were followed for design and implementation of this study:
1. The major premise is not to affect the existing showcases and exhibits within the museum.
2. Give "new experience" to both curators and visitors of the museum.
3. Increase time for visitors to stay and their knowledge of hand puppet.

4. Become a "new tool" to understand visitors' behaviors.

Process of Design

1. Field Research – Onsite Exhibit Inventory of the Museum
This study adopted the field research method by making an onsite exhibit inventory of the museum on Nov. 07, 2014 and making showcase classification based on the museum collection. Classification means the extension of the concept that is the set of the things that divide into smaller classifications under that concept (extension, relative to intension, refers to a range of applicability that a term denotes) (Chen, 2012). After the overall inventory was made, all showcases were classified into four major types, namely puppet heads, accessories, puppets and sets and part of showcase types were further classified into items, the second level, based on the museum collection. After classification and level were clear, the existing exhibits of the study field were tentatively classified based on the classification framework (See Table 1).

Table 1: Showcase classification framework and result

First Level (Type)	Second Level (Item)	Content		
		Number	Showcase Picture	Museum Collection Picture
1. Puppet head		1		
2. Accessory	2.1 Hat	1		
	2.2 Costume	2		

	2.3 Prop	1		
3. Puppet		12		
4. Set	4.1 Procession	3		
	4.2 Stage	1		

2. Design of Gamification Content

The data and framework acquired from the field research was further integrated into interactive design and gamification concept and result of tentative classification was turned into content of interactive game APP. For example, accessory, the showcase type under the second type of classification, was turned into equipment, the game level. The following are details of the four major levels that are casting, equipment, nurturance and life in the game:

(1) **Casting:** Li Tien-lu hand puppet shows define six types of puppet roles, that is to say Shang, Dan, Jing, Chou, Za and Ding. This study chose two roles for each type as design of casting, derived correspondingly occupation names and capability value settings and provided a total of 12 profession roles for players to have various choices so that they would always be interested in the game.

(2) **Equipment**: Chose six exhibits from the showcases under this type as the menu content for the game level of equipment. In addition, the game level

APP interface was displayed using purely text-form choices and information, making players stop in front of showcases and watch actual exhibits by understanding their motives for appearances and styles they want to know.

(3) **Nurturance**: Chose four showcases under this type as content development for the game level of nurturance. Each level has three NPC settings that can have dialog boxes. Based on capability types players want to nurture, they can choose relevant NPC to have questions and answers for having interactions to increase values.

(4) **Life**: Based on role values of the above three game levels, find out order to participate in events for the game level of life. For example, for players whose capability values are high will be led to No. 12 showcase to trigger an event and will be led to next event game level based on the items selected by the players. After three events, all players will go back to No. 26 showcase and result will be exported after calculation of values.

Results of Design

1. Virtual and Physical Interactive Display Area

This study used the left-side display area on the second floor of Li Tien-lu Hand Puppet Historical Museum. There were a total of 30 showcases with different features. After evaluation of design concepts and establishment needs, only 12 of the showcases were selected for embedding radio frequency devices and route design was produced according to the corresponding showcase locations for tasks of game levels (See Figure 2). Visitors can bring their own smart mobile devices or borrow public devices at the information desk in the museum free of charge. After installation of APP specific for the display area, visitors can enter the area and start their ongoing interactive visit activity.
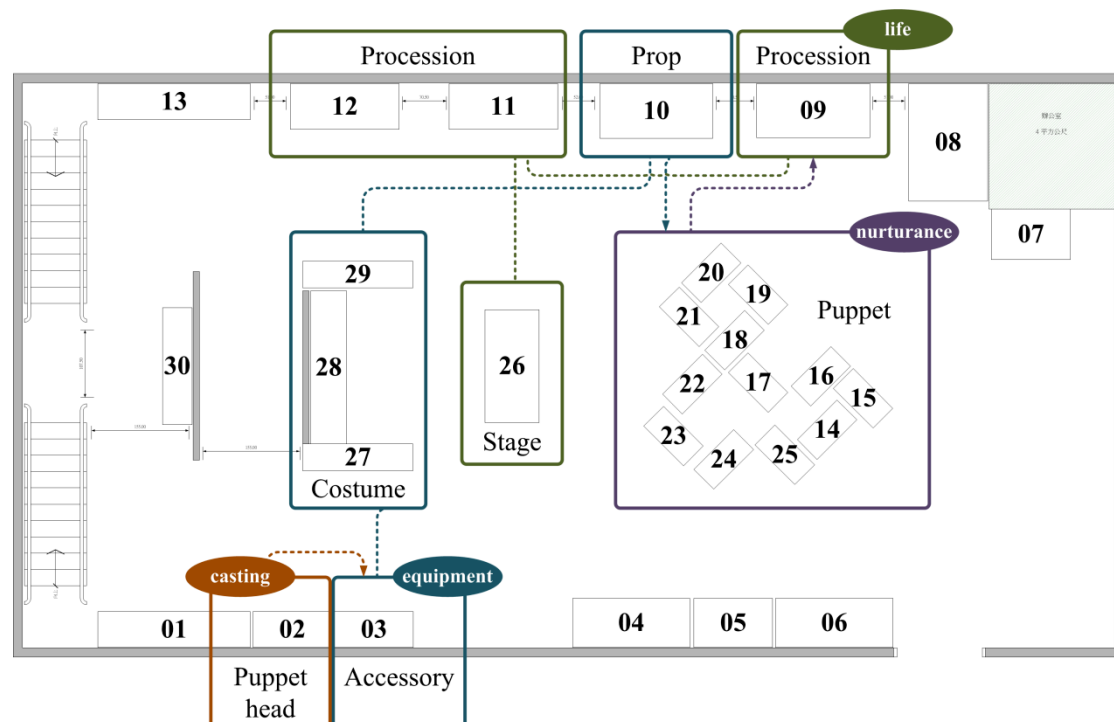

Figure 2: Showcase location and route plan

2. Interactive Game APP

There are a total of 12 tasks of game levels in the whole interactive game APP. Visitors can start the fun exploration (see Figure 3) when turning on the APP in their smart mobile devices. The initial screen makes use of texts and pictures to tell a story leading players into imagination space of the game situation and takes them to the showcases of puppet heads for the first level in the game. After players choose their roles, enable them to input ID so as to increase their role identity and then start adventures. Game routes and final results will depend on the choices of each game level by players, which boosts the overall pleasure and durability and let players to have new experience of rich hand puppet culture.
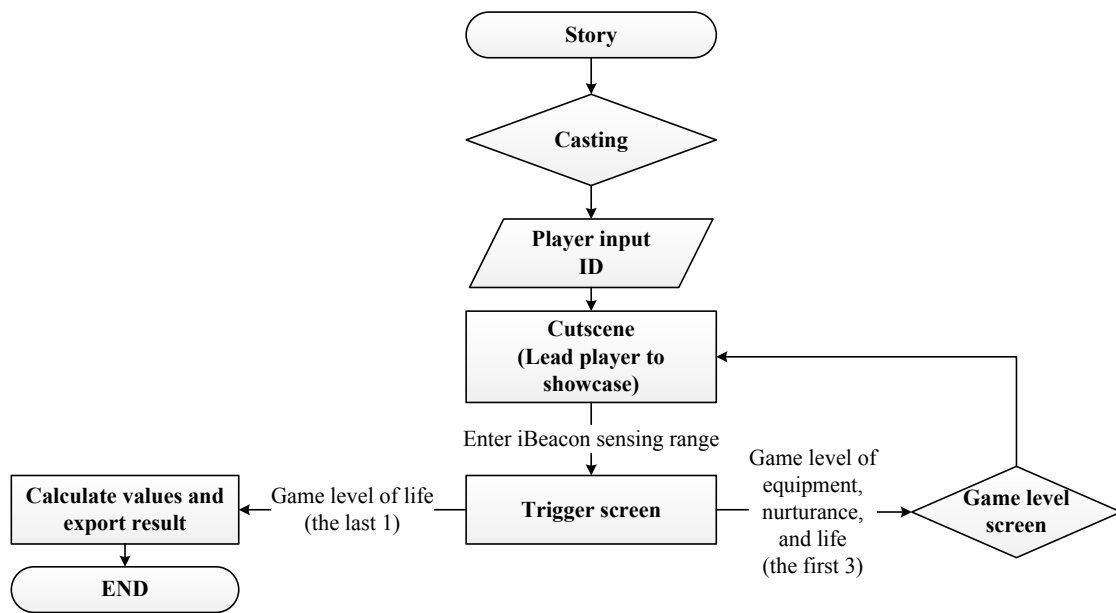

Figure 3: Interactive game APP flow chart

Conclusion

The main study achievements are listed as follows:
1. Made an inventory of the existing exhibits and display area within Li Tien-Lu Hand Puppet Historical Museum at Sanzhi, Taiwan and deeply analyzed essential connotation of all showcases such as puppets, puppet heads, helmets, musical instruments, and elaborate and colorful stage.
2. Integrated interactive design and gamification elements into the game APP and made the whole display area set as a virtual and physical interactive area. Enabled visitors to choose to explore different routes via gamification setting and created the gamifying museum mode with specific study actions.
3. Worked in cooperation with Li Tien-Lu Hand Puppet Historical Museum for development of the virtual and physical interactive display area and completed establishment of structures include embedded radio frequency device, cloud database and interactive game APP.

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