Learning Modernism Heritage, Playing the Minecraft Game

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Summary: Sun Yat-Sen Memorial Hall is a historic building in Taipei, Taiwan. The hall is one of the representative public constructions after Taiwan's restoration. It is designed by the important modernist architect in Taiwan, Wang Da-hung. It carries out the functions of history and architectural education. This paper describes an experience to incorporate the realization of virtual routes about the Modern Architecture heritage of the city in the classroom by developing a simulation of the environment using the video game. We use the "Minecraft My God of Creation" to create the "Digital Sun Yat-Sen Memorial Hall." The virtual reality (VR) of the game is tested by players with the aim of exploring the experientiality of the virtual digital cultural space and the methods of conveying information. It serves as a process of seeing-playing-seeing to learn the meaning of Modernism and architecture. How to improve the users to understand the concept of architectural history and spatial proportion through creating and playing in the VR experience is the main goal of this research.

Keywords: Modernism, Architecture, Minecraft, Virtual Reality, Experiential learning.

1. Introduction

Modern architecture was an architectural movement or architectural styles based upon new and innovative technologies of construction. It emerged in the first half of the 20th century. "Sun Yat-Sen Memorial Hall" (from here onwards abbreviated as SYS Memorial Hall); completed in 1972 is a modernism heritage in Taipei, Taiwan. The hall is one of the representative public constructions after Taiwan's restoration. It carries out the functions of history and architectural education.

Visiting or experiencing the site is often an important **exercise** in learning architecture. During the exercise, information is formed and inspired while students are in the context themselves. The association between the glance of context (site) and the images in the students' minds is a proved operation for collecting and visualizing the information of context. They often take sketches, photos or notes for catching these associations while they are visiting.

This research uses the video game "Minecraft My God of Creation" to create the "Digital SYS Memorial Hall". And conduct a virtual reality (Virtual Reality, VR) immersive experience by students, hoping to explore the experientiality of the virtual cultural space scene and the way of conveying information, as a teaching tool for learning the meaning of history and architecture. The objective is presenting the development process and observing the students' feedback for creating a suitable virtual environment for learning architecture.

2. Background

2.1. THE STYLE CONTEXT OF ARCHITECHTURE IN TAIWAN

After 1949, Chinese-style architecture was consciously used as a representation of cultural tradition in Taiwan. In 1966, the "Chinese Cultural Renaissance Movement" was launched, resulting in a significant number of public buildings in Taiwan adopting classical Chinese architectural styles, such as the Zhongshan Hall in Yangmingshan (1966), the Martyrs' Shrine in Taipei (1969), the Confucius Temple in Taichung (1975), and others. However, the SYS Memorial Hall in Taipei (1972) was one of the few cases at that time that adopted an abstract expression. SYS Memorial Hall is designed by the important modernist architect in Taiwan, Wang Da-Hung who studied in Harvard mentored by Walter Gropius. His self-designed house is affected by Mies van der Rohe's "Core House Project". (Figure1.)

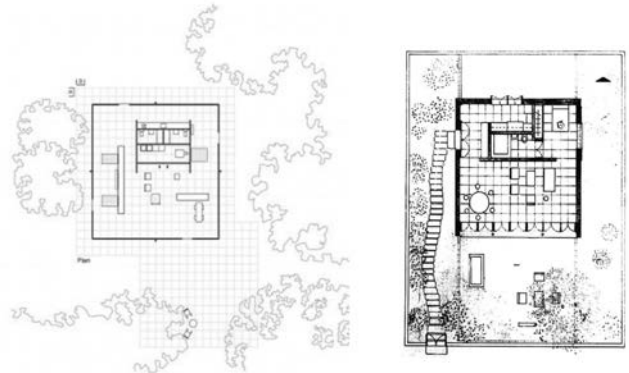


Figure1. The plan of Coren House Project (Left) and Wang Da-Hung's own house (Right).

And his whole life was trying to combine Modernism and Chinese traditional architectural spirit in his works.

The main characteristics of SYS Memorial Hall including the overall layout, surrounding corridor, and curved roof of the main entrance. (Figure 2.) Mr. Wang Da-hung said, "Dr. Sun Yat-Sen is a revolutionary, so there must be some innovation for the building in memory of him." Therefore, we can learn from this case the possibility of transforming Chinese classical style buildings into modernism style[1].

Figure2. The curve roof of the main entrance.

2.2. PLAYING VIDEO GAME IN EDUCATION

Some researchers use video game creation to motivate pre-university students to become interested in computer science[2]. Kelleher and Pausch[3] use the Storytelling Alice programming environment to create computer-animated movies that inspire the interest of high school girls in learning to program.

Furthermore, video game engines are not used specifically to teach programming but to work on other contents. Fernandez and Medeiros[4] pointed out that the video game Minecraft is one of the best solutions for digital cultural assets and is an effective tool to convey architectural heritage. The project "Tate Worlds" [5] is the digital interpretation of landscapes based on works in the museum's collection and is an inspiration for a successful collaboration between educators and heritage professionals in Scotland called Crafting the Past, which saw communities undertake digital archaeological excavations and reconstruct historic buildings in Minecraft, attracting audiences of over 100,000 people. Indeed, the potential benefits of Minecraft and video gaming for heritage visualization more generally have been recognized by UNESCO[6].

It is important to consider that Minecraft's unit is 1×1×1 cube not an accurate reproduction of proportions of architectural elements of particular importance, such as the walls thickness and round column.

The key point of using Minecraft as an educational tool in architecture degree is the possibility of building not only virtual projects, but meaningful learning, which, as we have seen, comes from active experiences. Building with Minecraft offers the future architect the experience of making by themselves all the paths. Méndez, et.al.,(2016) outline Minecraft are of high interest in education as students develop skills for problem solving. It can be a good tool for learning basic elements about circulation in buildings, its types, functionality, and accessibility[7].

The game allows to perceive different aspects, nuances and details like the people who will live in real life buildings. It is a good teaching strategy when we realize that playing, creating, experimenting and making mistakes improve the learning process. Furthermore, to play games increases the student's motivation as they have clearly defined the goals and expectations, and they can improve their own project playing efficiently.

In this paper, the Minecraft program was used to work on the city's architectural heritage. The students learned to create and navigate in an interactive three-dimensional world. They were asked to represent the architecture's characteristics and interactivity with players, so the activity, in addition to the objective of getting to know the city's heritage, also aimed to empower the imagination of the participants.

2.3. VR WALKTHROUGH AS AN IMMERSIVE LEARNING PROCESS

For previous studies [8], "Virtual Reality" (VR) is a medium which can represent reality or create an alternate scene to experience the real site. It could potentially be used for triggering memory recollections by connecting users with their past or provide an interactive environment to accumulate new memories. It can be a great tool for people to visit a cultural site without time and location limitations. It is to give the impression of being immersed in that environment" offering the possibility of interacting with additional contextual cultural data. Guttentag[8] mentioned that VR provides the tourism industry with another useful tool to experience. Woodard and Somsak[10] said to the present by using virtual walkthroughs in a three-dimensional environment is the most efficient way to present two-dimensional sketches. Eugene Ch'hg et.al., [11] revealed that VR is a powerful medium for communicating cultural sites. Using immersive technology/VR for the visualization of concepts as it enhances learning and immersive experience.

3. Creation of the architecture of Minecraft

3.1. THE CHARACTERISTICS OF THE SYS MEMORIAL HALL

The space is almost square, and the roof has been abstracted and simplified, expressing a modernist reinterpretation of classical forms. Inspired by the commemoration of it, since the 1980s, there has been a clear increase in the number of Chinese

classical-style buildings with abstract designs in Taiwan[12].

After the architect's transformation, the Chinese architecture is modernized, it is found that many elements originate from the evolution and concept of calligraphy. In this SYS Memorial Hall, the architectural characteristics, including the Tang-style streamlined yellow roof, the four curved roof angles extended to the sky. The design is transformed from the character "ren (人)". The building of the hall combines the elements of "red bricks, yellow tiles, and green forest.", the upward cornice at the entrance, fair-faced brick wall covered with red steel bricks, the columns made with the chiseling technique, the special care for 135 degrees between the columns and beam corners, the simple bench beside the columns of the surrounding corridors, the warm design of the beauty's rails, the slender ratio of 1:4 between the width and height of the gate, solemnity and grandeur, and the color choice of dark red[13].

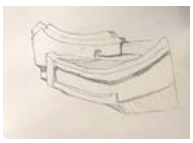
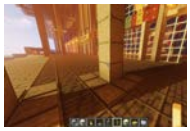
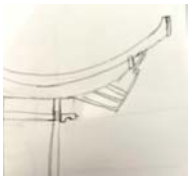
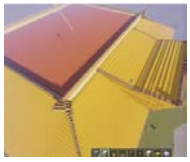
Free circulation is an important meaning of this modernist building, people can freely shuttle in from different entrances, and the open corridors create space for people's daily activities.

3.2. FROM REAL SITE TO VIRTUAL SITE

At this stage, we require students to take pictures of the features observed in the real field and draw them into manuscript records. The study found that students can quickly grasp the architectural elements and take pictures through explanations on the spot, but drawing sketches still needs to be done beforehand. With the assistance of photos and information reading, a more accurate description can be made.

Then go back to the classroom to use the Minecraft game. Through unit superposition and material selection, students transform manuscripts and photos in their minds, and organize themselves with 3D thinking (Table 1.).

Table 1. From hand drawing to Minecrafting the characteristics of the site.

	Hand drawing	Minecrafting
shape	The four curved roof extended to the sky	
		
material	Columns made with the chiseling technique	
		
shape material	The warm design of the beauty's rails	
		
shape	The design is transformed from the character "ren (人)".	
		
shape material	Tang-style streamlined yellow roof	
		

4. Virtual visiting and learning

After all the site visiting and minecrafting the model, the team develops a Minecraft VR walkthrough in Digital SYS Memorial Hall (Figure 3.).

Figure 3. The Digital SYS Memorial Hall.

It conducts an experiential observation that aims to observe how players learn from the virtual environment and to know the quality of the learning process.

4.1. PARTICIPANTS

The activity was carried out with eight students of Department of Cultural Assets and Reinvention. The students were the 2nd -year of both sexes. Before the activity, all students who are equipped with basic cultural heritage training and have been the site for visiting. They are also familiar with the basic mechanisms of the Minecraft game to make a part of elements of the building.

Considering being a heritage officially recognized by the government, we have invited three experts to provide the professional viewpoints. The two are associate professors of Department of Cultural Assets and Reinvention, the other one is a professor of Department of Architecture. They were compared the difference of the VR Digital SYS Memorial Hall and physical site's visiting experience, architectural similarities and learning methods.

4.2. HARDWARE AND SOFTWARE

For the second part of the activity (virtual site building through the model created by the students and advising teacher.), Students are required to use their own devices such as smartphones, digital tablets and computers. It was possible because to navigate a 3D world of Minecraft is only necessary to install the application and register with a user. We create a server and allow users to build and modify the model in the platform together.

For the third part of the VR activity, it was developed in ViveCraft, which is an open-source mod that transforms Minecraft into an VR experience in room-scale or seated play. The interactive equipment is HTC VIVE FOCUS3 (one headset, two sensors and two hand-held controllers).

4.3 MEASUREMENT TOOLS

In order to validate the activity carried out, the participants filled two questionnaires, one at the beginning of the activity after visiting the real SYS Memorial Hall. It's for confirmation that every participant had understood the information of physical site. Once the VR activity was finished, the participants filled in a second questionnaire (Likert scale 1-5) to obtain values about the use of Minecraft as an educational tool in the classroom, their perception about the playing video games and about the experience of the modernism heritage for learning.

4.3. DESIGN TASKS

The VR Digital SYS Memorial Hall visiting is about 15 minutes for each player to understand the architecture and historic learning, we have designed some tasks of eight steps as below:

1) The starting point for seeing the façade.
2) The entrance for observing the ratio of the big gate.
3) The hall for interior view.
4) The left side of second floor for learning architectural history.
5) Go through the left corridor for visiting an art exhibition and observing the spatial structure.
6) Go to the backside of the building for observing the roof shape and elevation.
7) Go through the right corridor for visiting an art exhibition and observing the spatial structure.
8) The right side of second floor for learning architect's concept and works. Then the player finished the visiting.

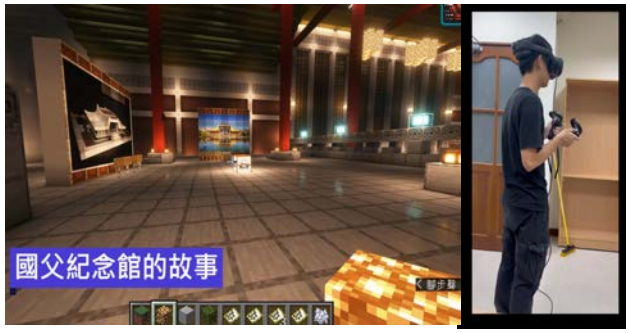


Figure 4. Users were visiting in the VR Digital SYS Memorial Hall.

5. Analysis and observations

5.1. SEEING-PLAYING- SEEING

In the process of students building Digital SYS Memorial Hall virtual environment, we found that is not just a heritage represented but also a process of designing a new way of experience the heritage. Based on Schön and Wiggins (1992) describe design as an activity of "seeing-moving-seeing" [14]. This work presents cases from users draw key elements of photos that they took on site, playing (building and modifying) the blocks by their translation from real field and seeing in the virtual environment to learn the interpretation. The process we observed is Seeing (hand drawing) to Playing (building and modifying Minecraft model) to Seeing (Learning in VR):

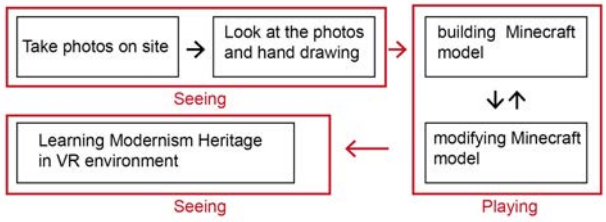


Figure 5. Student's learning process of Digital SYS Memorial Hall.

5.2. FEEDBACK FROM QUESTIONNAIRE

After the above-mentioned observation, from the questionnaire, we found that there are 100% of players agree that the experience is interested and entertained. 60% of players think that they had been inspired and would like to add more content in the building by themselves.

The table 2 shows the results of the questionnaire after the activity, measured on the Likert scale which is valued from 1 point (Nothing agreed) to 5 points (totally agreed).

Table 2. Results of the questionnaire after the activity.

	Questions	Average value
1	Is it a good way of visiting the virtual site to understand the design concept of the SYS Memorial Hall?	4.20
2	Is it a good way of visiting the virtual site to understand the characteristics of the SYS Memorial Hall?	4.50
3	Do you think Minecraft video game is suitable for the presentation of virtual heritage?	4.20
4	Do you like the experience of visiting the exhibition in the virtual SYS Memorial Hall?	3.90
5	Do you think virtual heritage are suitable for online exhibition space?	4.10
6	Do you think this is suitable as a teaching tool to introduce modernism heritage?	4.50

5.3. EXPERT'S SUGGESION

The three experts (Expert a, b and c.) are all cultural and architectural professors and not familiar to wear VR headset and played Minecraft game for the first time. Due to the lack of Minecraft experience, they all agree that this VR experience is fun and interesting. Expert a. Mentioned that it would be easier to walk freely in each space in the building. Virtual experience must have advantages that cannot be replaced, such as being able to see heights that cannot be seen on the spot, or hidden places that cannot be reached in the real site. Expert b. is impressed of Minecraft's block effect and similarity of buildings, he thought it could be a good tool for learning the meaning of heritage by VR guided tour. However, a tour guide service should be considered for the purpose of guiding player's direction. Puzzle-solving interaction design can increase more motivation of exploring the virtual space. Expert c. hopes it can add audio guide to assist players to find the route, wayfinding system should be considered in the immersive scene.

5.4. LIMITAION OF OBSERVING

The younger generation is familiar with the Minecraft video game, and they are trying to construct the shape-like building's element. However, there are some limitations of this media.

- Square only: All objects must be constructed by cubes. It is unable to construct circular shapes, round columns had been replaced as square columns.
- Limited materials: There are texture packs to choose from in the game, but there may not be completely suitable textures for the use of heritage.
- VR experience is not for everyone: some people don't want to use it because of dizziness.
- VR takes longer time to prepare it takes longer time to prepare, and thus it can't be experienced with many people playing at the same time.

5.5. THE PHENOMENON OF VISITING THE VIRTUAL SITE

Based on the users' feedback and the observation, we found that presenting historical sites through Minecraft with VR is easily accepted, if the spatial proportion and features are appropriately displayed. Participants quickly recognize the corresponding real-world locations of the buildings. Due to the aesthetic style of the game, users often find it interesting and enjoyable to enter a virtual space that is similar yet different from the real world. However, users enter the virtual space often have an urgent need for guidance and look for clues to indicate directions. Five observations of experiment results are shown as below:

1) Users can learn the proportions, materials and features of historical architecture from the process of Minecraft construction.
2) The openly circulation can be experienced in VR environment to learn the designer's thinking.
3) The situation of disorientation in virtual environment is obvious, clear direction guidance is necessary.
4) Users like to explore spaces that cannot be reached in the real site and find different perspectives to experience architectural heritage.
5) Users expect more interaction than simple strolling, and interactive presentation methods are needed.

6. Conclusion

This research starts with a concept of how to learn architecture and culture from games and develops a Minecraft VR heritage: Digital SYS Memorial Hall.

After the activity, we found that, the participants were able to experience freely with the design possibilities of Minecraft resulting in very diverse and imaginative worlds. They were also able to corporate to build and modify the model together by

discussion and comparison of the information they had collected from real site on the online sever. Thus, they worked on both, creativity and heritage learning.

In this paper, we think VR is an important mechanism, it highly affects people's willingness to use and the way they receive information. Experiential learning can occur when users acquire knowledge through the embodied experience of reconstructed cultural sites using VR technology, however, the clear instructions for direction and communication content are important. The virtual experience can add some functions to create a better way for learning. All the students could access the virtual route and visit it in the classroom.

The participants were able to understand the design concept of the SYS Memorial Hall (4.20 out of 5) by developing their own virtual world with Minecraft video game. This activity opens fields of creation to experts who previously think Minecraft were not suitable to present this task. And the result is more spectacular than they imagined. Consequently, it provides the opportunity to increase architectural learning motivation. Most participants have found it is important to know the history of city and the development of Modernism in Taiwan. It's a useful process for Seeing-Playing-Seeing about creating the architectural heritage. Users also consider it a suitable tool to introduce modernism heritage (4.5 out of 5.0). Using Minecraft motivated them to create more content to assist user's visiting experience, for example, some students proposed to add more puzzles in the virtual field.

7. Future work

This result still lacks in many areas, so further additional studies are needed in the future. Learning history or programing in Minecraft is not a new way, a large number of players create famous buildings in the game. How to improve students to understand the concept of architectural history and spatial proportion through playing and VR experience is the main goal of this research. In the future, the aim is to design more interactive interface based on more user's feedback in the Digital SYS Memorial Hall.

Moreover, it is planned to become a virtual space that can regularly update the content. More relevant courses about the history of modern architecture will be exhibited in online Digital SYS Memorial Hall, a space for co-learning and playing. We hope that it will inspire more people to understand Modernism architecture through virtual experience. The development process and observation were described. Hope that it will guide and inspire more people to be involved in exploring the cultural environment using virtual mechanisms.

Acknowledgements

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