System Development of Immersive Technology Theatre in Museum

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Abstract. Varieties of museum theatres include historical characters, puppetry, movement, music, etc. Visitors can experience the storyline of knowledge about history, science and technology in the theatre which creates immersive environment and engages experiences, such as those in performance, games and simulation. With this kind of experience, knowledge learning in museums becomes more effective and interesting. In addition, it requires multiple disciplines to accomplish the multi-sensory experience provided in the theatre environment. This article focuses on the design process and the system development of the Immersive Theatre in a systematical method. There are three phases in the process: Design, Configuration Negotiation, and Implementation.

Keywords: immersive technology, museum theatre, Configuration negotiation.

1 Introduction

Interactive technology exhibition is becoming a stage for government, engineers, designers, and artists collaborating together. Meanwhile people can learn about the life in the future from interactive technology exhibition which usually take immersive technology as a tool. Immersive technology refers to technology that blurs the line between the physical world and digital or simulated world, thereby creating a sense of immersion.

Museum theatre is the theatre and theatrical techniques being use in a museum for educational, informative, and entertainment purposes. It can also be used in a zoo, an aquarium, an art gallery, at historic sites, and so forth [1].

The theatre is generally performed by professional actors in addition. Varieties of museum theatres include historical characters, puppetry, movement, music, etc. Visitors can experience the storyline of knowledge about history, science and technology in the theatre which creates immersive environment and engages experiences, such as those in performance, games and simulation. With this kind of experience, knowledge learning in museums becomes more effective and interesting. In addition, it requires multiple disciplines to accomplish the multi-sensory experience provided

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in the theatre environment [2]. The design of this kind of theatre has been studied by painters, theatre directors, scenic designers, lighting designers, filmmakers, producers, artists and control and image engineers. These fantastic experiences rely on the collaboration both of designers and engineers. The process of this collaboration is quite complicated and messy; also, it needs an organizational management [3].

2 Case Study

In this section, three cases of immersive theatre will be reviewed. Two cases bring out culture and educational meaning with immersive technology. Each case is with different purpose and outward appearance. However, this study expected to find a general path and elements of these immersive technologies

2.1 Pavilion of Dreams

Pavilion of Dream [4] is one of the exhibition sections of 2010 Taipei International Flora Exposition. The Pavilion of Dreams is an interactive exhibition hall with art and technology integrations. It is a grand platform of ITRI technologies fused with creativities exuded by Taiwanese artists, whereby technologies are granted with new application opportunities.

Through continuous communications and attempts, engineers and artists have come together to solve problems and overcome obstacles, and together with the production team, all parties have worked as a team to build the Pavilion of Dreams and to turn it into a magical space full of imagination and amazement.

The team of the Pavilion of Dream selected five technology: FleXpeaker [5], Multi-View Naked-Eye Stereoscopic Display [6], Smart Controllable Liquid Crystal Glass, Non-Contact UWB Physiological Sensing Technology, and Ultra High Frequency RFID Technology

Audience will received a RFID bracelet which will record the data during the interactive journey, also with the RFID bracelet people can play a trigger role of the special event in the scenario. The way to experience the immersive technology theatre of Pavilion of Dreams is complete free, audience follow the path designed without any time limitation. In 360 square meter real-time interactive environmental theater, the display will follow the behavior of the audience have different animated.

In the process of development, the 2010 Taipei International Flora Exposition decided the main theme, then they planed the series topic of areas. The designers constructed the view of the Pavilion of Dream with looking into the technology provided by ITRI (Industrial Technology Research Institute). After the vision of the Pavilion of Dream was completed, designers communicated with artists and engineers about how to work together. The Artist put esthetic feeling into the scenario, and the engineers need to face to the technical problem and find out the solution with designers and artist. Finally, the Pavilion of Dream would be ready for visiting, then the operators of 2010 Taipei International Flora Exposition have to make sure the experience of audience would run as the working team expected.

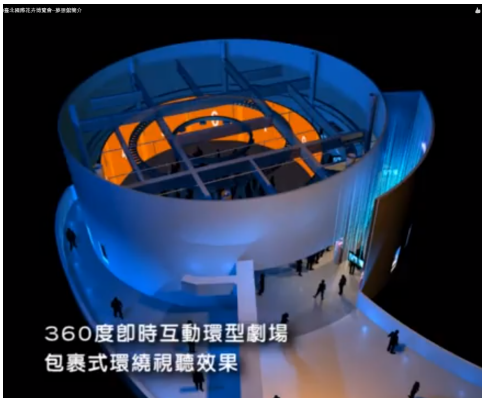

Fig. 1. 360 square meter real-time interactive theatre [4] (加圖片)

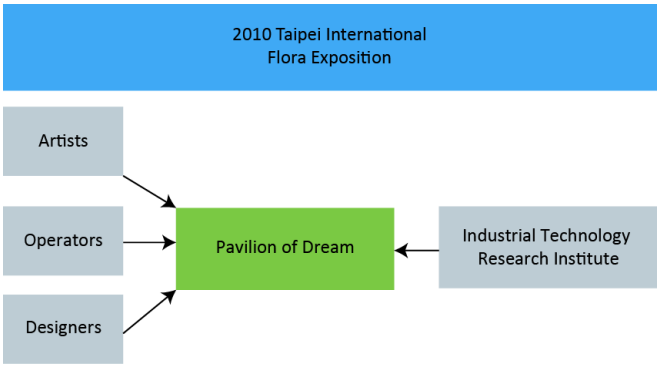

Fig. 2. Involving organizations of Pavilion of Dream

2.2 Discovery Theater in Discovery Center of Taipei

The "treasure" within the Discovery Center of Taipei [7] is the 360 square meter Discovery Theater with its rotating screen. It is different from other theaters because it is an anthropocentric and dynamic theater reflecting daily life. The rotating screen, concrete models, twelve solid projectors, and special music and light generate a unique and futuristic vision.

This kind of experience is completely immersive, because there is no boundary of the stage. The view angle is dynamic with the rotating seat, and with the physical model, the experience emphasize the blur of the reality and visual world.

Difference from Pavilion of Dream, the audience of Discovery Theater sit still in the middle of the theatre and surrounded by the 360 square meter display. There are different films for audience to choose to look. Hence that, the collaboration will be very long term if the client (Taipei City Government) decides to add a new topic of film.

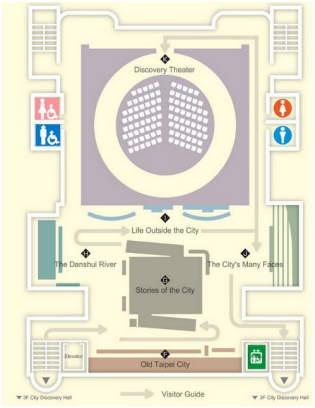

Fig. 3. A plan view of Discovery Theater in Discovery Center of Taipei [7]

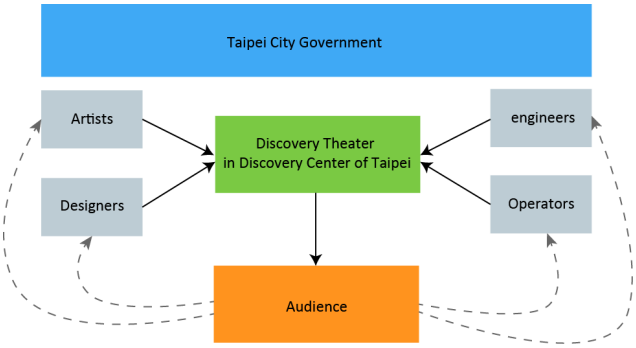

Fig. 4. Involving organizations of Discovery Theater in Discovery Center of Taipei

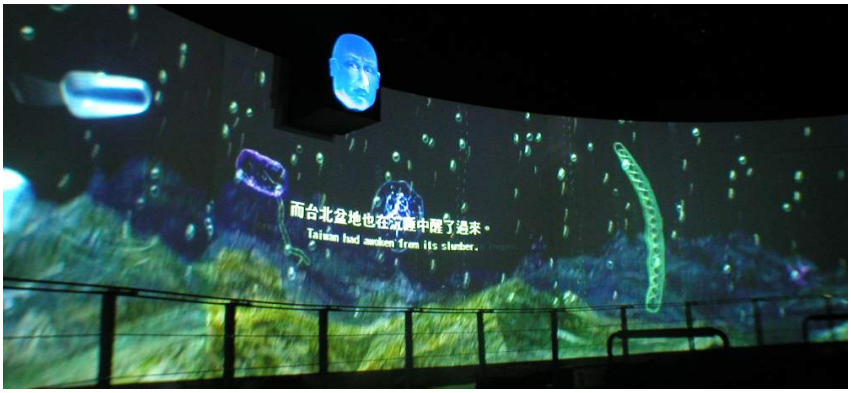

Fig. 5. A view of Discovery Theater in Discovery Center of Taipei

In this case, the audience will play an important role to the immersive technology theatre. The content of the experience will update, and the designers and artist will consider the feelings of common from audience when they get into a new film. Therefore, audience become a factor of the theatre.

3 Methodology

The design of this kind of theatre has been studied by painters, theatre directors, scenic designers, lighting designers, filmmakers, producers, artists and control and image engineers. These fantastic experiences rely on the collaboration both of designers and engineers. The process of this collaboration is quite complicated and messy; also, it needs an organizational management.

Based on the above cases of cooperation, we can be summarized in the following ITT's basic cooperation as fig. The clients provide the requirement of the theatre, also most of the limitation such as the budget, physical space and the special request, is from the clients. The designer is the one who draw the big picture of the immersive technology theatre, and he merges all the elements (sounds, visual effect, and human factor) together. The engineer brings the fancy scenario to real. When the immersive theatre is well developed.

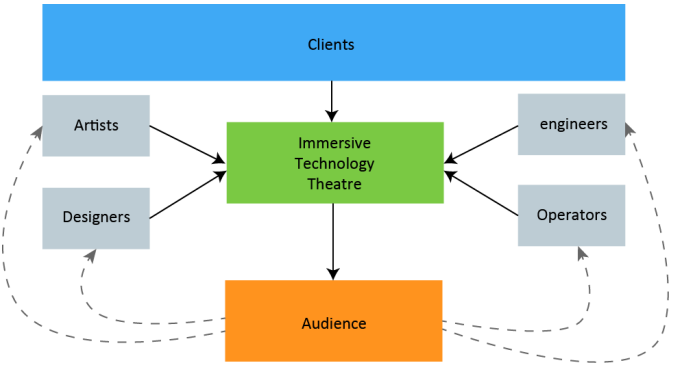

Fig. 6. Involving organizations of Discovery Theater in Discovery Center of Taipei

Fig.7 shows the relationship of the collaboration in making an immersive technology theatre. The clients make the offer of an immersive technology theatre, then the designers will draw a picture of the immersive technology theatre, planning the way of the experience, and listing the elements and tools needed. The engineers provide the technical provide professional technical to make the fancy scenario come true. The artist is the one who put the meaningful content (which with a culture or an educational meaning). Finally, an immersive technology theatre will be ready to construct, the operator have to make sure the theatre can be operated.

3.1 Phase 1 Design

Once an Immersive theatre is needed to be composed, designers and engineers have to consider the requirement of the immersive technology theatre.

In Design phase, designers brain storm the view of what will the theatre look like; then designers and engineers have to work together about the solutions of these ideas.

The first thing to think of is the scenario and atmosphere in the theatre including the storytelling to present. According to the cases reviewed, the main elements needed to concerned are in following: View angle, audience orientation, Life performance, and special effect.

View Angle

In display technology parlance, viewing angle is the maximum angle at which a display can be viewed with acceptable visual performance [8].

The ideal picture size is defined for movie theatre for a horizontal viewing angle of 45 degrees at the prime seat. The prime seat is (mostly agreed) a center seat two-thirds to the rear of the house [9]. THX recommends having a 36 degree viewing angle from the farthest seat in the auditorium. Prior to construction, THX advises cinema designers and architects to accommodate for the 36 degree horizontal viewing angle. And, to make sure that every seat has an unobstructed view, THX often recommends either elevating or lowering the entire floor to adjust the seating location [10].

Audience have to be completely immersed in the atmosphere of the immersive technology theater, as the result, view angle have to be concerned based on the requirements in the beginning of the design. The main field is produced based on the view angle decided.

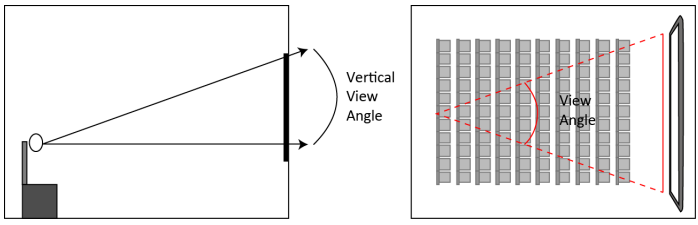

Fig. 7. View angle of theatre

Audience Orientation

Audience orientation [11] is the direction of the audience view, and the main stage will follow the audience orientation. Audience Orientation can be dynamic, so it is important to consider about audience orientation when designing the stage which mainly present.

Live Performance
Without live performance, the experience of an immersive technology will be nearly the same. Live performance is not definitely refer to drama act with actors at stage, but it also could be the real time interaction between the storytelling content and the audience. Therefore, there will be plenty of possibility during the experience.

Special Effect
Special Effect is refer to the effect which create the atmosphere, including lighting, video display, working model, and immersive technology. In an immersive technology theatre, there will be a lot of programs, dynamic mechanical, and audio effect filling in the space of the theatre. Therefore, it become a hug issue to make the arrangement of all the equipment.

3.2 Phase 2 Configuration Negotiation

After the whole view of the immersive theatre is constructed, it is stepping into the second phase: Configuration Negotiation. In the phase of Configuration Negotiation, designers and engineers need to face the limitation of the physical space, or the request of the business entrepreneur, and the limitation of legislation. The elements discussed above will need to be adjusted base on the reality limitation.

Orientation will be an important matter in Configuration Negotiation phase. Multiple technology are applied in the theatre, and they need to be merged into the physical space, meanwhile, it is important to make sure that the mechanical or electronic equipment will not harm the audience. The shows in the theatre should be checked again and again. Designers and Engineers can have a clear view of the details in the shows with a script.

3.3 Phase 3 Implementation

Finally, the theatre will start building in implementation phase. In this phase plenty technical support will be needed. All the parts have to work together, and it is necessary to prepare a check list of works, tools, and equipment. Moreover, the schedule should break down all the detail of works, so there will be no mistake, and wasted time.

4 Discussion

With the three phases mention above, as well as with various experts in the field of professional required, the study sorted out the construction of a journey map as Fig. 8. Developing an immersive technology theatre an intensive iterative design process.

Frist, an offer is brought by clients, which usually will be government units. Clients narrate the purpose of the immersive technology theatre, and let design and engineer team know how many recourse can be used. Then designers and engineers will get together to draw a picture of the theatre. In some case, artist will be invited to

add some culture and educational meaning into the theatre. For wasting no time, it is very important for the team to settle all the details before construction.

The human factor is an important issues in an immersive technology theatre, because the immersive environment will be a deadly mechanic experience. The human factor here is not just for the user part but all the participants of all the process of the theatre. The communications is the main topic in this issue, including culture between technologies, clients between producing team, government between people, and audience between the theatres. In the last part of the journey map (Fig. 8) is the "Operations", however is not the end of an immersive theatre. Because the culture and the technology keep moving forward, as a present of the ideal future living and a role of spreading knowledge and culture, an immersive technology theatre in museum should keep refreshing and moving forward with the society.

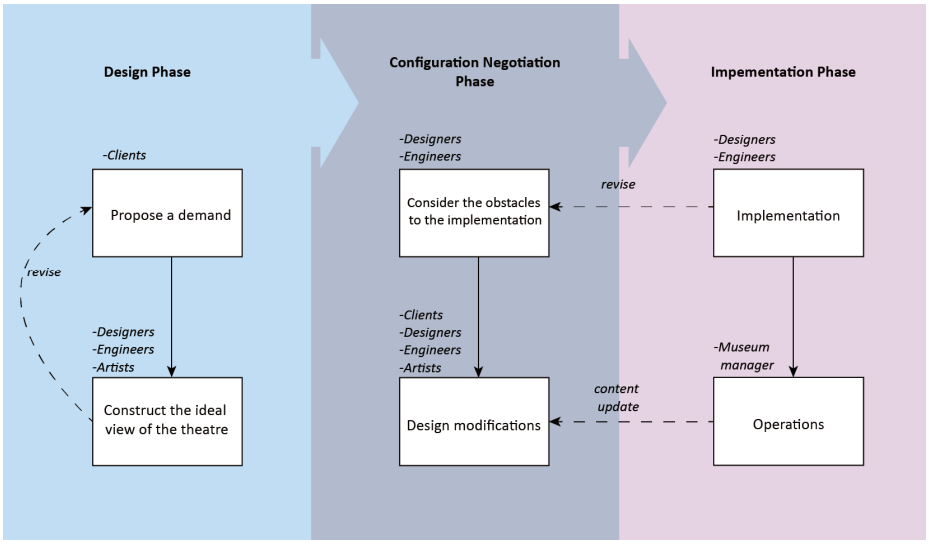

Fig. 8. Process of immersive technology theatre development

5 Conclusion

The immersive technology theatre in museum shows people the ideal of the future living, and it is a stage of professionals in various fields. With a large number of ideas for different kind of views, the team have to communicate very carefully, and the leader, which could from any fields, needs to have a clear mind that which stage is it. Although between each immersive theatre and each museum, the topic, content, and the technology implied will be very different, the rules and process is the same. The three phases is the big structure of the develop process, in the future, there will be more cases, so that the research team can break down the big phases into more details steps for development.

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