Whisper of the Hear·t

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ABSTRACT

Most of the paintings in the galleries and museums are prohibited from touching; therefore, it is hard for visual-impaired people to admire an artwork. Whisper of the Hear·t is an immersive sound room that translates a two dimensional painting into a four dimensional representation, 3D space ant time which invites both visual-impaired and sighted people to explore not only the color or shape on the painting, but also the background and technique of the painting. We hope that one day, more people can enjoy those heritages our ancestors left in a more immersive way.

Keywords

Movement-based interaction, Kinect, Touch gesture

1. INTRODUCTION.

It's hard for a visual-impaired person to explore a painting in the gallery or museum, as most of the painting is not touchable and the information of the painting is encoded highly depended on visual information. Inspired by this concept, we created Whisper of the Hear·t, which interpret the two dimensional painting into a four dimensional representation, 3D space with time, to invite both visual-impaired and sighted people to explore the painting in a new way.

In this project, we chose Claude Monet's painting – Poppy Field in a Hollow near Giverny (1885) as our target, and translate it to a four dimensional representation. We create a 3D space with tangible objects and audio feedback to encode four important concepts: 1.Viewing Distance and Decomposed Sound, 2.The Temporal Immediacy and Shifting Sound, 3.Ordinary Subject and Spatial Interaction, and 4.Immersive Texture. The detail of these four concepts will be discusses further in Section 4.

In the rest of the paper, I first present the design scenario and design decision of this project. Then, I go over the system, and describe the interaction used in this project. Finally, I discuss issues we discovered and encountered while developing and testing the system and future works.

2. DESIGN DECISION

In Helen Keller's autobiography[1], she talks about the story how she understood the word "water". At first, she had difficulties to distinguish the words "mug" and "water"; however, when her teacher placed her hand under the spout, the cool something that was flowing over her hand gave her the idea of water. Inspired by this story, we tried to find a way to help visual-impaired people to explore things they cannot normally experience.

Painting is an interested area to facilitate our concept. Visual-impaired people highly depend on tactile and audio feedback to explore the world. However, most of the paintings in the galleries and museums are prohibited from touching. Besides that, it is also hard to translate a painting into verbal descriptions. In history, many people tried to find out the relationship between color and sound[2]–[4]. Adding on these, we want to make the connection not just between sound and color, but also the background and meaning of the painting. Therefore, we decided to make an immersive space to let people experience the painting in a different way.

When deciding which painting is going to use in our project, we explore several different painting including impressionism, and cubism. We want to choose a painting, which riches with context and sound. We choose Claude Monet's painting, since impressionist painter accentuating the effects of the passage of time, which we can cooperate in the installation.

3. SYSTEM OVERVIEW

3.1 Physical Environment

The whole physical space is roughly 7 ft. x 9ft. rectangle. An artificial grass rug is put in the middle of the area to simulate the feel of grass field. We use roof shingles to simulate the field of ground and small pebbles, and used it as a guiding path to indicate the user both the interaction boundaries and the path to the touchable interactive painting, which was pinned on the wall at the end of the space.
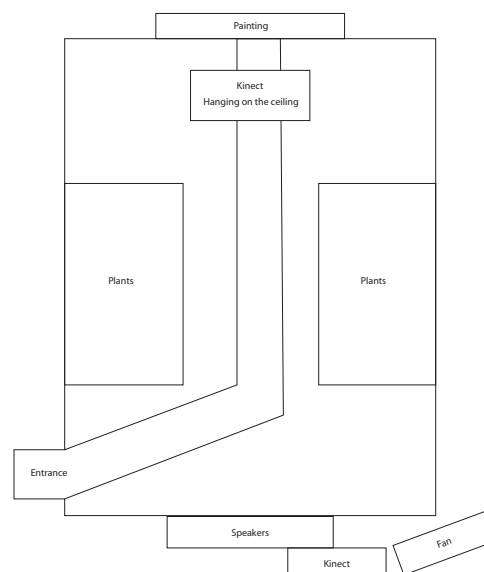

Figure 1. The environment setup

Figure 2. Floor Plan

On both side of the interactive area, we put four plants to simulate the feeling of higher grass and natural plants in the painting. In Figure 1., we present the picture of the environment setup, and we present the floor plan of the space in Figure 2.

3.2 Hardware and Sensor

To detect the user's movement, we use two Kinect sensors in our installation. The first Kinect is used to detect the user's body movement and location in the spaces, which is set in the back of the room. The second Kinect is used to detect the user's finger gestures which interacting with the painting on the wall. We hang the second Kinect on the ceiling to get a better angle sensing the finger interaction without occluded by the user's body.

Two computers, each one connects to a set of stereo speakers, are used in this installation. Each computer processes Kinect's sensor data and generates corresponding sounds separately. Both stereo speakers are put in the back of the environment. The system schema is show in Figure 3.
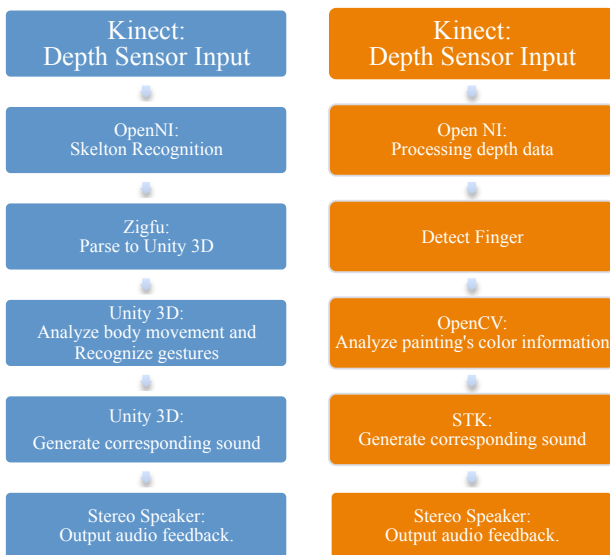

Figure 3. System Flow

3.3 Software System Schema

We use the first Kinect to collect the user's movement input. The OpenNI SDK provides support for body motion tracking, which will generates user's skeleton position based on the raw data from Kinect, and than Zigfu wrapper parse those data to the game editor, Unity 3D. In the application, we track the limbs' and head's position in the space. The system will generate corresponding sound based on the location information.

The second Kinect is used to detect the user's fingers interaction with the painting on the wall. We used OpenCV to analyze the painting in HSB color space, and generate corresponding sound based on that information.

3.4 Sound Generation

There are three different types of sounds in this installation. The first one is natural sound environment, which is like the ambient sound in the natural world as well as animals' sounds.

We used the sound in BBC sound effect library. The second one is the artificial sound, which we generate it in GarageBand and analyze the sound in spectrum via the audio analysis and editing tool, SPEAR. We divide the sound based on the frequency into three part, and applying filters to the sound based on the user's movement in the space in real-time. The last one is primitive sound, which we use when the user touching the painting on the wall. The sound was generated via Synthesis ToolKit (STK) based on fingers' location as well as the color information from the painting.

4. INTERACTION

4.1 Viewing Distance & Decomposed Sound

The viewing distance is related to how a sighted people perceived a painting. It was Foucault, the French radical who suggested that to understand a painting you need a chair. Therefore, we try to encode this distance information in our installation. When an audience keep a distance from the painting, they can overview the whole picture, understand what is only painting. As the audience comes closer to a comfortable distance, they start to appreciate the style and the history of the painting, understanding more background of the artist as well as the artwork. When the viewing distance between the audience and the painting becomes too close, the audience then only sees paints, colors, and brush strokes. They no longer perceive the flowers, the trees or any other objects on the painting.

To reflect the visual effect of viewing distance, we decide to use the shifting and transition of sound to emulate this feeling. When the audience first enter the space, he/she will here the sound of natural environment, indicates the first glance of the painting. When they go further inside the area, an artificial instrument sound will come out. This artificial instrument sound indicates that the audience starts interacting with the painting, reading the history, the background ant other humane information of the painting. As the audience approaching the painting, the sound starts decomposing: the sound distorts, and the low frequency sounds shifting into mid- and high-frequency region. We try to use these spectrum alternations to indicate that as the user comes closer to the painting, they can only see part of the painting and focus on those painting techniques instead of the semantic meaning of the painting. As the audience stands right in front the painting and exploring it by his/her hands, we used the noisy and primitive sound synthesis to symbolize the drawing techniques, colors and the uncomfortable feeling when a viewer comes too close to an artwork.

4.2 Temporal Immediacy & Shifting Sound

Impressionists' painting emphasis on accurate depiction of light in its changing qualities, and often accentuate the effects of the passage of time. In order to convey this idea in our installation, the sound effects in the space would gradually transits from morning, afternoon to the evening as the time goes by.

4.3 Ordinary Subject & Spatial Interaction

Another important factor in impressionism is the painters like to capture the moment that is "unplanned". This feature makes their works rich and dynamic. We capture this emphasis of the unplanned spatial richness and reflected in the installation through sound. We put different sound in different space, so the users can explore those living event either by lowering their body to hear the animals sound behind the bush, or they can raise their hands to feel what's happening in the sky.

4.4 Immersive Texture

To make a more immersive environment, our installation not only provides audio feedback, but also is implemented with tactile feedback. We use different materials to make the audiences experience the environment not only through their ears, but also feel the space through their hands and feet.

5. DISCUSSION

We recruited six students in our department as tester to experience our works and asked about their feeling and feedback. To simulate visual impairing situation, we asked the participants to wear eye patch as they exploring the installation. We also asked the participants to experience this space with their bare feet to get more tactile feedback. The participants are free to exploring in this area and do any movement, as they want to experience the audio feedback. Limited to the physical space, we do not have physical wall as boundaries to notify the user about the interactive area. Therefore, we have a host to inform the participants preventing them from going beyond the region. After the participant exploring this installation with eye covered, we ask them to take off the eye patch and explored the area again as sighted person. In the end, we make a short interview asking their thoughts and feeling about this installation.

Most of them feel excited about this artwork, as this installation provides a whole different to explore painting not only for visual-impaired people, but also for sighted people. From the sound of animals and insects as well as the feel of grass on the ground, all of the participants can imagine they are exploring in wildlife, although some of them admit that the imagine in their head when their eye closed is a little different from the painting they saw.

While exploring in the area, some people said that they feel disoriented and nervous since their eyes are covered. To some participants, the guidance we had on the ground is not obvious enough to them; therefore, they need the host to guide them to the painting.

The decomposed sound is a little confused to most participants. Some of them mentioned that it is hard to understand the connection between the noisy sound and their finger interaction on the painting. After explaining our concept about viewing distance and the relationship to the decomposed sound, most of them think that can understand our design decision.

6. CONCLUSION AND FUTURE WORK

Due to the time limitation, our installation is relative simple. We do not provide haptic feedback on the painting or on the object we put in the space. Besides that, we could try to encode some body movement gesture, instead of using position data only. From our interview, it shows that the time transition feature in our installation is not clear to the participants, where we can improve this by different strategies such as make the sounds much different than others, or decrease the interval between each transition. Limited by Kinect's viewing angle, the vertical movement does not detect very well. Therefore, we can try to uses some pressure sensor under the carpet, to detect user's precise position in future version.

Overall, our participants provide positive feedback about their experience, and this installation successfully provide a new way to experience the painting in an immersive four-dimensional environment. We hope that in the future, there will be more an more works like this to help both visual-impaired and sighted people experience an artwork in a more comprehended way.

7. REFERENCES

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8. Appendices

Video links: http://youtu.be/8OPZbmFCtdU