Study on the Design of “Scented Space” Electronic Interactive Device System

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Abstract. Fragrance is noble, simple, deep and approachable. It accompanied the Chinese nation for over five thousand years and engaged in the glorious history of Chinese civilization. It inspires the inspiration of great virtues, nourishes people's body and mind and builds a bridge of human wisdom, which is an important catalyst and promotion for the formation of Chinese human spirit and philosophical thought. This project takes the electronic interactive device art work, “Scented Space”, as an example, extracts the visualized elements in fragrance culture and uses natural interaction technologies like digitized “synaesthesia” art and somatosensory sensing, to carry out a communication with visitors on the theme of fragrance culture, to enable the viewers to have the experience of immersive “synaesthesia” from visual sense, auditory sense, virtual gestures, somatosensory interaction and sense of smell for experiencing the past and present of fragrance culture from multiple dimensions, and to explore the philosophy of life through the cross-border integration of science and technology and art.

1 Purpose and significance

Sense of smell is one of the basic forms of human senses. Every life that lives on the earth is breathing, and people and animals constantly interact with the nature through the sense of smell. The fragrance culture generated from the sense of smell has a long history. In the continuous evolution, collision and fusion of Eastern and Western civilizations, it has gradually surpassed pure sensory sense of smell and evolved aesthetic factors in the field of art, speculative meaning in the field of philosophy and religious elements in the religious field.

“The Belt and Road of the 21st Century” proposed by Chairman Xi Jinping has multiple cultural attributes, which is not only the Silk Road but also the Fragrance Culture Road. The circulation of spices through the Silk Road has been existing since the ancient times. During the heyday of the Roman Empire, the Silk Road connected the two great empires, Rome and China. Middle Eastern people exchanged exotic treasures for silk, porcelain and incense which are then shipped to Rome for sale. Later, during the eastern expedition of the Crusades, Europeans saw the essential oils of the Middle East, and invented the perfume after returning home. The local Chinese fragrance culture has been integrated into the incense customs of other nations and regions with the introduction of Buddhism and Islam as well as the inflow of aromatic products from Persia and India. Therefore, the development history of fragrance culture is also a history of the blending and colliding between eastern and western culture.

The “Scented Space” electronic interactive device system realizes the mutual interpretation and enhancement of visual sense, sense of smell, sense of touch and emotion by using the fusion technology of sound, light and electricity and through the use of art “synaesthesia”, and then expresses the historical evolution, connotation and imagery of fragrance culture in the form of new media.

2 Theoretical Background

2.1 Origin and development of fragrance culture

Ancient Egyptians first used perfume as a personal hobby. At the very beginning, the perfume was only allowed to be used by the priests, and only the priests could participate in the production of perfumes, so that many temples had specialized perfume laboratories at that time. Later, Egyptian kings and queens began to use perfumes. When they died, people made their bodies mummified and wrapped them with myrrh and cinnamon. For a long time, only the influential officials could use perfume to decorate their tombs.

The perfume was later brought to Greece. After Egypt declined, Greece controlled the trades in the area of Mediterranean Sea. Ancient Greeks consumed a large amount of perfumes every year and used it in different places. Influenced by the Middle East and Greece, the Romans also began to indulge in perfumes. The Romans were very skilled in producing perfumes, and they

sprayed perfume on floors and walls, and even for horses and dogs. At some important banquets, there were even perfume fountains.

In the East, ancient China, incense smelling, tea tasting, flower arrangement and painting are the four luxurious activities of self-cultivation and the products related to incense have a long history in China. Fragrance culture is extensive and profound, appeared from the Qin Dynasty, grew and perfected in the Tang Dynasty, flourished in the Song Dynasty, popular in the Qing and Ming Dynasty. Since the ancient times, writers, poets, monks and other literati poets have been loving to be associated with incense. The incense is widely used in daily life, such as burning incense beside clothes and burning incense while playing stringed instruments and writing poems. The most contributing Chinese medicine invention is using incense to treat diseases. Gradually, perfume became an art. They are a colorful part of the secular culture of the Chinese people. Nowadays, it is regrettable that very few people know about fragrance culture. People want to retain the essence of fragrance culture and understand the essence of fragrance culture.

2.2 Natural interaction mode in electronic interactive device

Based on sensors and other hardware, the art of electronic interactive device changes the one-way information transmission mode of the work to a common creative mode through the interaction between viewers and creators, thus opening up a broader space for the expressive force of originality and art. With the development of intelligent technology and the appearance of Kinect, Siri and Leapmotion, the interaction method in the artistic work of electronic interactive device gradually evolved from single mouse and keyboard to a multi-channel, multi-sensory natural interaction mode, such as speech art work recognition, gesture recognition, somatosensory motion sensing and so on, and user experience is increasingly humane.

For example, in the work “Light Chords” by the art team of new media Teamlab, light becomes a string, and when the viewer jumps up and touches the strings, the light starts to beat and play music; in their work “dance on the water created by koi and people’s dance — infinity”, the viewer can change the swimming direction of the koi through walking in the water. The walking direction of people determines the moving trajectory of the koi, which presents colorful lines on the surface of the water. When the fish hit the viewer, they would scatter around like the light of flowers. The picture in the water is rendered by the computer in real time, and the interaction between the viewer and the device is not reproducible and cannot be reproduced.

2.3 Extraction and arrangement of the visual elements of fragrance culture

Fragrance culture is not just the culture of spice. Its connotation is far-reaching, including incense ware, incense Tao, incense making technology and so on.

Typical cultural elements are collected from Chinese and foreign fragrance cultures, and the characteristic rules of graphics and colors from typical cultural elements are analyzed. Based on the generative rules and derivative rules of shape grammar, graphic derivative research and design are carried out. The vocabulary obtained through perception analysis is sorted out, screened and extracted, several of the most representative visual elements are screened out: psychedelic, dense fog, butterfly, incense burner, flowers and plants, petals, dragonfly, sachet, perfume bottles and so on. Related images on these representative elements are searched. The visualized elements in the fragrance culture are summarized, the basic graphic units are extracted through the design rules, and the visual content design of the electronic interactive device system is conducted by using the shape grammar, repetition, rotation method and symmetry method.

Table 1. Visualized extraction of fragrance culture elements.

Fragrance Culture Elements		Visualization of Fragrance Culture Elements
Animal	Butterfly
	Dragonfly
Spices	Plants
	Other Spices
Incense Ware	Incense Burner
	Sachet
	Perfume Bottle

3 Design and production of “Scented Space” electronic interactive device system

3.1 Overview of the originality of “scented space” electronic interactive system

This is an electronic interactive device system with interactive fun and magical illusion that aims to spread fragrance culture. It creates visual immersive experience through visual sense, auditory sense, somatosensory interaction of virtual gestures and synesthesia of smell, so that the audience can understand the development and integration of Eastern and Western fragrance culture. The system is mainly divided into three parts, as is shown in Figure 1, background wall (video demonstration on the theme of the development and evolution of the fragrance culture), interaction wall (natural interactive acoustic optoelectronic device of somatosensory sensing), and perfume bottle mapping table combining the virtual and

the real. The system vision is set mainly with Chinese ink, rendering elegant atmosphere.

Figure 1. System diagram.

3.2 Representation of fragrance elements in the digital images on background wall

The video background uses Chinese ink style as the main representation style, and the special effects introduced in the later period are mainly the video processing of the scene, the halo of the ink painting, the deduction of the ink and picture packaging. In the production of the scene, the PS image processing software is first completed by using hand-drawn scene rendering and image processing, to achieve freehand style. Secondly, planar image software is used to convert static landscapes, landscape paintings or dynamic images into ink style through filtering effect, and then special effects are applied in the post-composition software to imitate the style of ink painting. The black and white effect, blur effect and transparency are mainly adjusted by software later, and the plug-in components are used to simulate ink effect. “Step-by-step” editing methods and rules are adopted and special effects, image extracting, image overlaying, dyeing control and layered rendering techniques are mainly applied to achieve the final effect.

The title part synthesizes a large number of rendering smog effects with animation. The fluid rendered by the AE software plug-in is abstract pure ink effect, which is composed of hierarchical editing, intermediate frame generation and composition rendering, promoting the creation of freehand style.

3.3 Display of the integration of digital images and perfume bottles

In order to combine the virtual image with the actual object, the perfume bottle is made of transparent glass with round bottom, the particles revolve round the round bottle body to conduct particle effect display around the perfume bottle, and the image and the object are blended by adjusting the height through the top projection. The special effect particles adopt the effect of bright light and shadow, the perfume bottle produces a beautiful luminous effect through the glowing particles, and then the fragrance is properly added, so that the fragrance particles and the visual particles are synchronously divergent. In addition, some LED light-emitting cables are added around the booth, making the entire exhibition

space more smart and beautiful. AE is used to create cool particle light effect, the filters used are Partition, Glow, Starglow, Separate XYZ Position and Ramp, and the final result is shown in Figure 2.

Figure 2. Effect diagram.

The specific production steps are listed as follows:

- 1) Create a new file and set parameters.
- 2) Create and synthesize solid layer of the same size and add Ramp effects for it.
- 3) Create a new light layer.
- 4) Create a new solid layer, add Particular special effect for it and set parameters.
- 5) Create a new empty object layer and click 3D.
- 6) Select the light layer, click the Position attribute, add an expression for the Position attribute and connect to the Position attribute of “Null 1” layer.
- 7) Create a new camera layer, create a new empty object layer, add key frame animation to the attribute, set it to 0° at 0 second, set it to 20° at 10 seconds, select the camera layer, and set the camera layer’s Parent attribute as “camera control” layer, as is shown in Figure 3.

Figure 3. Create a new camera layer.

- 8) Select “Particle_1” layer, copy the layer, press “Ctrl + D”, and modify the specific parameters.
- 9) Add the expression of the location XY attribute of the specific effect of the particle_2 layer and connect it to the position attribute of the “empty1” layer.
- 10) Select “Particle_1” layer and name the layer copied by pressing Ctrl + D as “particle line”. Modify the special effect parameters and remove the Starglow effect.

3.4 Fragrance culture elements in the image design of interaction wall

Based on natural sensory interactive technology, the interactive wall expresses the visualized elements of fragrance culture first extracted, “incense burner”, “petal”, “flower branch”, “sachet”, “poet”, “butterfly”, etc., through the somatosensory interaction with the viewers by design methods and expression methods such as animation, projection, emotional synaesthesia and so on,

to guide the audience to participate and immerse in it, to convey the characteristics of “fragrance culture”, to convey the two key characteristics of the fragrance culture, pattern abstraction and combination association, and then to convey the cultural essence contained in the “fragrance”. While rendering the fragrance, it also conveys people’s outlook on the world, outlook on life and happiness, as is shown in Figure 4.

Figure 4. Display effect of interaction wall.

To implement interaction wall, Kinect non-touch gesture recognition technology combined with Visual Studio programming is applied.

```

212 Skeleton s = GetClosestSkeleton(e);
213 if (s == null)
214 {
215     return;
216 }
217
218 if (s.TrackingState != SkeletonTrackingState.Tracked)
219 {
220     return;
221 }
222
223 var joints = s.Joints;
224
225 Joint rightHand = joints[JointType.HandRight];
226 Joint leftHand = joints[JointType.HandLeft];
227 Joint head = joints[JointType.Head];
228 Joint leftShoulder = joints[JointType.ShoulderLeft];
229 Joint rightShoulder = joints[JointType.ShoulderRight];
230
231
232
233 Joint rightHandScaled = rightHand.ScaleTo(900, 495, 0.3f, 0.3f);
234 float rightHandX = rightHandScaled.Position.X;
235 float rightHandY = rightHandScaled.Position.Y;
236

```

Figure 5. Threaded code of Kinect device.

Through somatosensory sensory interaction, when a person waves his/her hands, smoke flies through the incense burner, the petals flutter around, the sachet sends out scented light-effect particles, and the butterfly dances. Render the video into a complete sequence, use Visual Studio software, use code control, and play the corresponding frame, as is shown in Figure 6.

Figure 6. Interactive effect.

After positioning by gesture bone tracing, the feedback is obtained by the cursor “Handpoint”, the position of the cursor is set as the read position of the

gesture bone, and the initial position of the cursor is the upper left corner (distance from the left is 0, and the distance from the upper is 0), as are shown in Figure 7, 8,9.

Figure 7. Feedback Reflection of Cursor “Handpoint”.

```

212 Skeleton s = GetClosestSkeleton(e);
213 if (s == null)
214 {
215     return;
216 }
217
218 if (s.TrackingState != SkeletonTrackingState.Tracked)
219 {
220     return;
221 }
222
223 var joints = s.Joints;
224
225 Joint rightHand = joints[JointType.HandRight];
226 Joint leftHand = joints[JointType.HandLeft];
227 Joint head = joints[JointType.Head];
228 Joint leftShoulder = joints[JointType.ShoulderLeft];
229 Joint rightShoulder = joints[JointType.ShoulderRight];
230
231
232
233 Joint rightHandScaled = rightHand.ScaleTo(900, 495, 0.3f, 0.3f);
234 float rightHandX = rightHandScaled.Position.X;
235 float rightHandY = rightHandScaled.Position.Y;
236

```

Figure 8. Visual studio code.

```

238 if (rightHandX > canvas1.Width) rightHandX = (float)canvas1.Width;
239 if (rightHandY > canvas1.Height) rightHandY = (float)canvas1.Height;
240 Canvas.SetLeft(handPoint, rightHandX);
241 Canvas.SetTop(handPoint, rightHandY);
242

```

Figure 9. Visual studio code.

After the background finishes playing, if there is no trigger, it would be played back to the starting point. If the cursor is in the position of the flower tree/ incense burner/sachet, it would start the switch, in a complete video, touching different positions, the cursor would be in the corresponding position, and the corresponding video segment would be played. Each video lasts about 30 seconds, and the same place accepts no instruction before the video is ended, as are shown in Figure 10, 11 and 12.

```

30 public partial class MainWindow : Window
31 {
32     public MainWindow()
33     {
34         InitializeComponent();
35         this.video.LoadedBehavior = MediaState.Manual;
36         // video.MediaEnded += new RoutedEventHandler(mediaEnded);
37     }
38
39
40
41 int currentPos = 0;
42 int lastPos = 0;
43
44 //int videoState = 1;
45 enum videoState {bg,bg_flower,bg_particle,bg_smoke,butterfly};
46 int[] videoTimeStart = {0,31,61,91,121};
47

```

Figure 10. Play the corresponding video segment.

```

if (!flowerShow && !particleShow && !smokeShow && !butterflyShow && currentPos < 8 * 30 - 1)
{
    //背景播放完，无触发情况下，从头播放
    if (currentPos > 28)
    {
        currentPos = 1;
        video.Position = new TimeSpan(0, 0, 1);
    }
}

```

Figure 11. Play the corresponding video segment


```

242 if (rightHandX > 600 && rightHandX < 600 && rightHandY > 200 && rightHandY < 300 && !particleShow && currentPos < 8 * 30 - 1)
243 {
244     particleShow = true;
245     timeCount((int)videoState.bg_particle) = 30;
246     stateChange = true;
247 }
248
249 if (rightHandX >= 40 && rightHandX < 90 && rightHandY >= 40 && rightHandY < 90 && !flowerShow && currentPos < 8 * 30 - 1)
250 {
251     flowerShow = true;
252     timeCount((int)videoState.bg_flower) = 30;
253     stateChange = true;
254 }
255
256 if (rightHandX >= 320 && rightHandX < 370 && rightHandY >= 320 && rightHandY < 370 && !smokeShow && currentPos < 8 * 30 - 1)
257 {
258     smokeShow = true;
259     timeCount((int)videoState.bg_smoke) = 30;
260     stateChange = true;
261 }
262
263 if (leftHand.Position.Y - head.Position.Y < 0.2 && rightHand.Position.Y - head.Position.Y > 0.2 && !butterflyShow && currentPos < 8 * 30 - 1)
264 {
265     butterflyShow = true;
266
267     if (butterflyShow) //butterfly触发后，不接受其他操作，直至播放完毕
268     {
269         butterflyShow = false;
270         currentPos = 8 * 30 + 1;
271         video.Position = new TimeSpan(0, (int)(currentPos / 60), currentPos % 60);
272     }
273
274     if (currentPos > 8 * 30 + 28) //视频播放完毕，回到起点播放
275     {
276         currentPos = 1;
277         video.Position = new TimeSpan(0, 0, 1);
278     }
279
280     lastPos = currentPos;
281 }

```

Figure 12. Play the corresponding video segment.

4 Conclusion

This project uses an interactive device system combining sound, light and electricity to create an experience of beautiful “scented space”, based on the technical integration between art design means of “synaesthesia” and natural interaction, to enable the audience feel the past and present of fragrance culture from multiple dimensions. Through immersive experience from visual sense, auditory sense, virtual gestures, somatosensory interaction and olfactory sensation, the system allows visitors to feel the art enjoyment of fragrance culture and discover the philosophy of life.

Technology advances at an alarming rate every moment, and strengthening the immersive experience and interactive devices from the perspective of user experience enriches the art form, emphasizes the emotional experience of the art form and enhances the

interaction between the entire device and the audience. The future art device will surely be more natural, original and humane, and the cross-border integration of art and science and technology and the application of art synesthesia will become the main direction of the development of art in the new era.

References

1. Zhang Duo. Road of Fragrance: Research on the “The Belt and Road” Fragrance Culture Beyond the Category of Spices [J]. Ningxia Social Sciences, 2018 (02): 251-256.
2. Dai Xuelai. Analysis on the Contemporary Interactive Device Art Based on “Synaesthesia”[J]. Beauty and Times (I), 2017 (12): 22-24.
3. Wang Shuaibing. Research on Natural Interaction Design Based on Interactive Device Art[J]. Science and Technology Innovation, 2016 (16): 29.
4. Li Sida. Research on the Interactive Mode of Interactive Device Art. Art and Design (Theory), 2011, 2 (08): 146-148.
5. Han Weiping, Wang Yanyu. The Application of 3D Somatosensory Interaction in Display Design [J]. Art Science and Technology, 2015, 28 (02): 16-17.
6. Liao Hongjian, Yang Yubao. Somatosensory Interaction Design and Its Application in Three-dimensional Virtual Experiment [J]. Distance Education Journal, 2013, 31 (01): 54-59.
7. Cai Linying, Zhang Jianrong, Liu Binbin. Somatosensory Interaction Control of Virtual Environment Based on Gesture Recognition [J]. Journal of Huazhong University of Science and Technology (Nature Science), 2015, 43 (S1): 136-139+165.