

ランダム・キューブを用いた茶道の動きの表現

Expressing the Japanese Tea Ceremony (Sado) Movement using "Random Cube"

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Abstract: In this work, we attempted to express the concept of the Japanese tea ceremony (Sado) by showing the tea ceremony movement using "Random Cube." The movement was captured via an optical motion capture system and applied to the "Random Cube" in 3D CG software (Maya). We made 2 moving pictures to present stereo-vision. In order to express the "closed room" of the tea ceremony, we displayed the moving pictures via the 3-dimensional Cyber dome. We showed the work to 13 graduate students whose major were design. As a result, our work's concept, expressing the aesthetic thought of traditional culture "Sado" using Random Cube, was well received to most of the viewers.

Keywords: Japanese tea ceremony (Sado), traditional culture, Random Cube, stereovision,

1. Introduction

The tea drinking was adopted from Chinese customs long ago during the B.C. period. After the introduction of this custom into Japan, it was developed as "Sado(茶道)" which was adapted to Japanese own aesthetics and its manners in the teahouse (Fig 1).

The teahouse, called "Sukiya" and written 数奇屋 or 好屋 in Kanji character, is the place where the tea ceremony is performed. It means the space of "Kyo(虚)," which is the empty space, the unsymmetrical room, the microcosm that projects poetic ideas. The tea serving manner is called "Otemae(お手前)" and it is divided into different schools. These manners were inherited around 800 years before as a tradition. The occasion when the master serves tea is called "Do(動)," movement and when guest appreciates tea serving is called "Sei(静)," no movement. The balance of one's mind and the spirit of Sado is reflected in the teahouse. It is considered that not producing movements which may break the balance, not uttering any word, and behaving simply and naturally are the manners of Sado. In this work, we attempted to show the movement of tea ceremony using "Random Cube" to suggest the spirit of Sado as applicable communication method oriented to producers of digital contents.

2. Developing method of the new Sado

2.1. The relationship between Random Cube and Sado

Laozi, who was the patriarch of "Doke(道家)," is closely related with the history of tea. Laozi stated that the real substance only exists in Kyo. For example, the substance of a room exists on the empty space which consists of roof and walls but not on the roof and walls. In Kyo, that is, the empty space, moving is possible. The principles of Sado are derived from the concept of



Figure 1: Sukiya, the room for doing tea ceremony (This image named "totsutotsusai" is retrieved from <http://www.urasenke.or.jp/textc/chashitu/totutotu.html>)

"Zen(禅)", which emphasize greatness in simple events of life. The principle of Doke establishes the fundamental aesthetic principles of Sado. Zen embodied the ideal of Doke.

What we want to express is the movement of Sado, which means Zen, in the space of Kyo which means the ideal of Doke. Intangible thoughts that are hidden in the teahouse are realized if there is any movement, however, they are not realized if there is no movement and even its existence is forgotten. In this way, we attempted to express the relationship between the space of Kyo and the manners of the tea ceremony using "Random Cube." The space of Kyo, the thoughts of Doke are composed of motionless and irregular cubes in the manner of the tea ceremony. The thought of Zen is composed of cubes' movement. When the cubes do not move, the relation of the cubes is indistinguishable. In its all, is the world in which nothing happens, when the cubes move, the scene played among the cubes is showed.

In this way, similar to a teahouse, in which there is

apparently nothing, resides the importance of thinking about life, the movement of simple cubes visually represent the “Hisomu(潜む)” of Sado, the hiding.

2.2. Characters of Random Cube

Random Cube is a group of cubes which are displayed randomly. A cube is commonly used as a the basic object in most of 3D computer graphical software. The followings are the properties of random cube.

2.2.1 Properties of cube

- a. The contrast between the sides of cubes is clear.
- b. The overlapping cubes are easy to be layered.

2.2.2 Properties of the movement of cubes

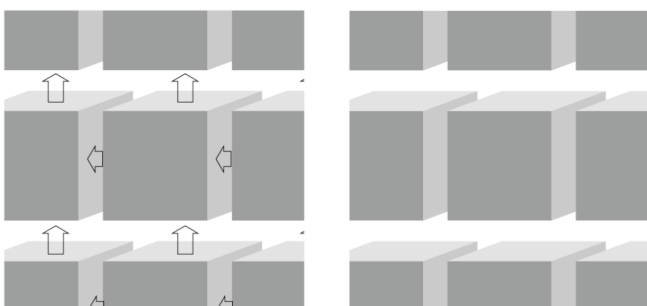


Figure 2: Horizontally moving of cubes

aa. Horizontal shifting

As shown in Fig. 2, in the case of moving cubes that entirely fill the screen horizontally, it is difficult to realize the change when compared to their original motionless state.

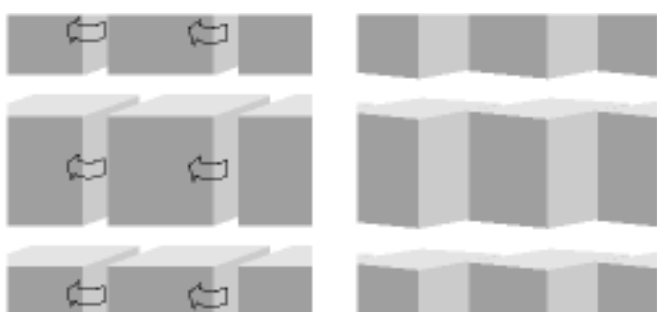


Figure 3: Rotation of cubes

b. Rotation and revolution movement

As shown in Fig. 3, the change of the cubes’ position by rotation or revolution can be realized clearly when the cubes stop unless the cubes rotate or revolute at 90 degree.

c. Divergent and gathering shifting

As shown in Fig. 5, divergent shifting and gathering shifting are inverse movement. Because they are the sum of horizontally shifting in x, y, and z directions, in the case of cubes that entirely fill the screen diverging or gathering, it is

difficult to realize the change when compared to their original motionless state.

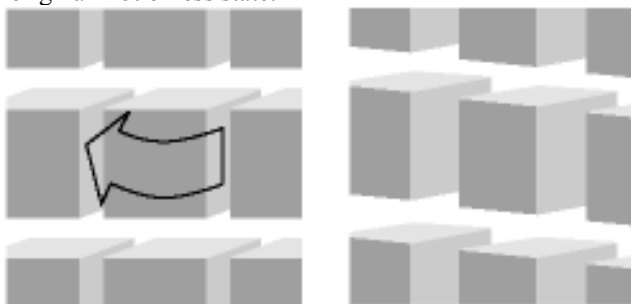


Figure 4: Revolution of cubes

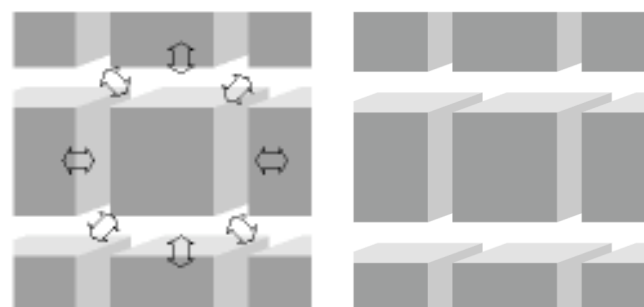


Figure 5: divergent shifting and gathering shifting

To express Hisomu (mentioned above), we can use properties a and c. When parts of the cubes move, their movement can be realized. When they stop, they will be realized as hiding. In this way, we can use cubes to show the 3D appearance and the movement of Sado.

2.3. Creating process

2.3.1. Digital recording of the motion of Sado

We used an optical motion capture system to record the motion of Sado as digital data.

2.3.1.1. The motion capture

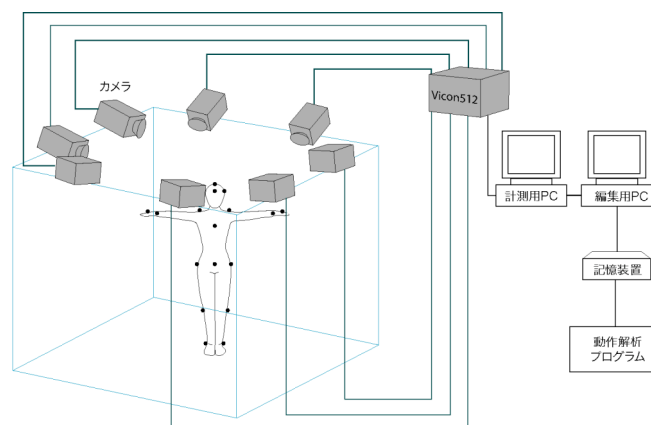


Figure 6: Structure of optical motion capture

According to Hachimura (2007), motion capture

systems can be divided into optical, magnetic, and mechanical type. The optical type is usability for a performer. The performer is attached with 20 ~ 30 reflecting markers to the body surface near joints. The size of a marker is smaller than ping-pong ball. Multiple high-precision video cameras with lights are placed around the performer. The markers' light reflection rays are shot by the video cameras.

An object's 3D location can be fixed if the object can be shot by 2 cameras at the same time. Because the performer moves around in the space changing poses, it is impossible for just 2 cameras to capture all the markers at the same time. As a result, 6 ~ 10 cameras are used to capture all the markers ensuring that at least 2 cameras are constantly capturing the markers.

2.3.1.2. Capturing

As Fig. 7 shown, we put the markers to the important positions for motion on a performer's body surface, who has received Sado lessons for years. 4 markers on the head, 1 marker on each hand, 2 markers on each wrist, 1 marker on each elbow, 1 marker on each shoulder, 1 marker on the chest, 3 markers on the back, 4 markers around the pelvis, 1 marker on each knee, 1 marker on each ankle, totaling 26 markers. The performer sat on the floor in Japanese style and then performed the characteristic movements of whipping and drinking tea.



Figure 7: The positions of reflecting markers

The markers' reflection rays were shot by 8 video cameras. The signals were sent to a computer system and processed as digital motion data of Sado.

2.3.2. Editing motion data

When capturing the motion data by the optical motion capture system, the signal is cutoff depending on the pose. For example, when the performer sat on the heels, the markers attached on the heels were covered by the performer's hips. As a result, the markers became untraceable producing data lost or misinterpretation. Only if the lost data is in static condition, it can be complemented well. In the case of markers' relationship being confused, they can be re-assigned correctly. Once the error free movements were captured, we edited the motion data. (Fig.

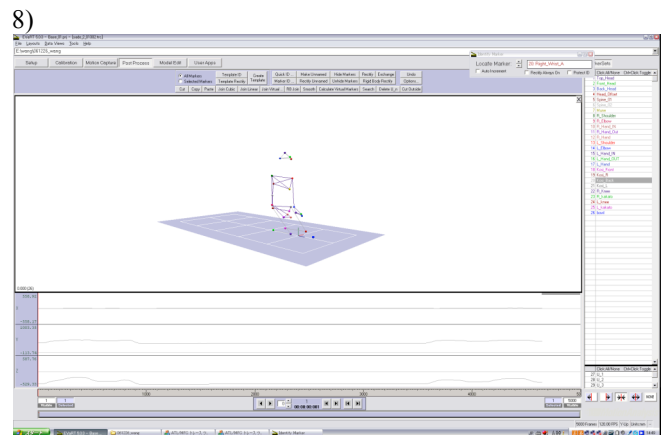


Figure 8: Editing data

2.3.3. Move Random Cubes

We modeled the space in Maya by placing 3 walls, a ceiling and a floor with random cubes. We matched the edited motion data with the cubes, whose size were the same with the wall cubes and their number matched the markers. To express the space depth, both images for left and right eyes needed to be written out. We placed 2 virtual cameras 65 mm apart as the average intervals between left and right eyes, keeping the closest point on the cubes which were matched with the Sado motion data. At last we rendered the images as animation for left and right eyes.

2.3.4. Cyberdome display

We displayed the images on a Cyberdome² to show the stereo-vision space of Sado as shown in Figs. 9 and 10. The Cyber dome is an hemispheric image display system to display life-size, three-dimensional virtual images, in which 2 computers control 2 projectors with polarized filters. Another computer Synchronizes these 2 computers. The images are reflected by mirrors and reach the hemispherical screen.

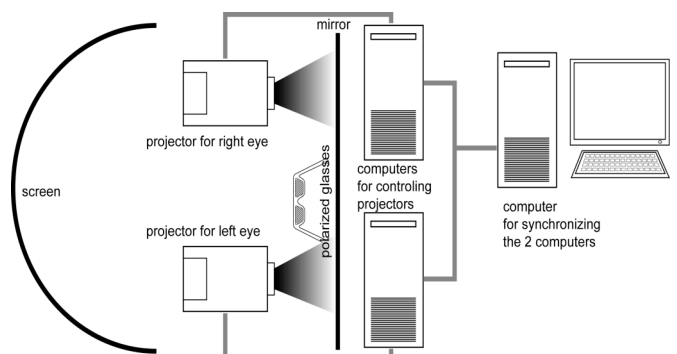


Figure 9: Mechanism of Cyber dome system

The image files for the left and right eyes were imported to each computer then displayed on the screen at the same time (see Fig. 11). As a result of a minor deviation between the 2 images, when the images are seen through polarized glasses, the viewer is able to see the 3-dimension cubes and feel the space depth. During projection time, the

closed space of the hemispherical screen was effective to set viewers in the mood the Sukiya's closed space.

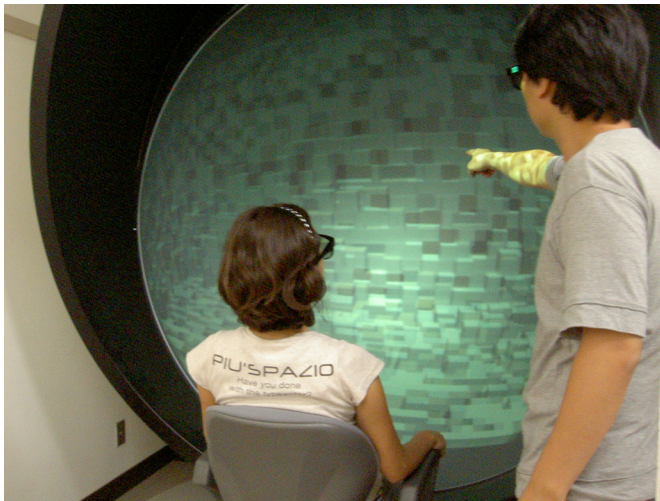


Figure 10: Showing on Cyber dome

3. Conceptual evaluation

We developed this project based on Sado and Doke the keywords mentioned at the beginning of this paper. A series of movement on Sado can be seen when Random Cube with the Sado's captured motion data moves, whereas they are seen just as cubes existing randomly when the cubes do not move. The person who serves tea (master) and the person who drinks tea (guest) are hidden in the Random Cube. When the master is whipping tea, the cube group belong to the master can be realized. However, the group of cubes for the guest cannot be realized. At the moment, when the master finishes making tea and passes the tea to the guest, the movement of the master stops and looks as if the master disappears. On the other hand, when the guest drinks the tea and starts moving, the guest can be perceived as if the person emerges suddenly.

To analyze the viewers impression, we conducted free response questionnaire. 13 students of Kyushu University Graduate School of Design, aged from 22 to 33 years

viewed the work. After its viewing, they gave their opinions concerning their impression or evaluation about the work in their own language. The viewers were 7 Japanese, 3 Chinese, 5 Korean, and 1 Canadian. Six people among the viewers have had experienced Sado. The results are as shown in Fig. 12 and Tab. 1.

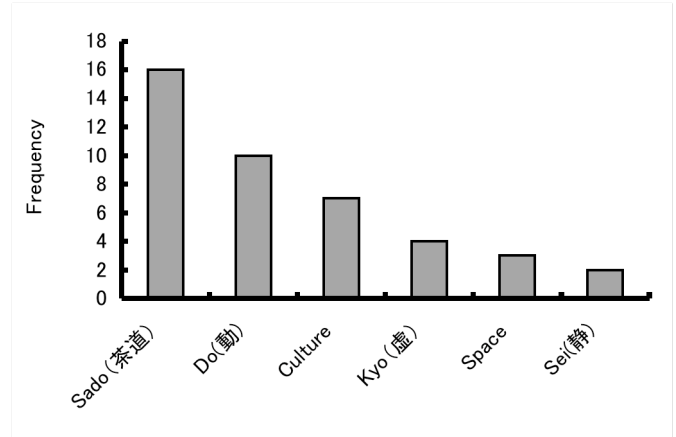


Figure 12: Frequency for the keywords in the results of questionnaire after viewing the *new Sado*.

Table 1. Results of impression and evaluation for the *new Sado*

Answer	Numbers
A series of the movement of Sado is seen when the cubes move	9
When the cubes don't move, only the group of the cubes are seen	8
The movement of Sado was well understood	8
The intention to express the space of Kyo was well understood	5
The work was good enough to express the nature of culture using cubes	4
The movement of the cubes was interesting	3

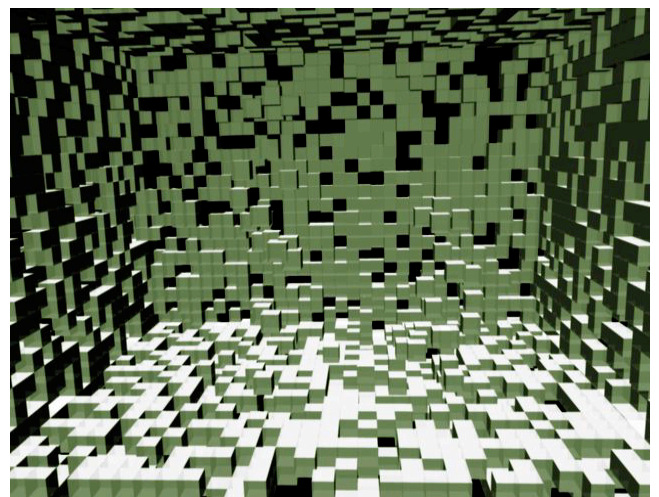
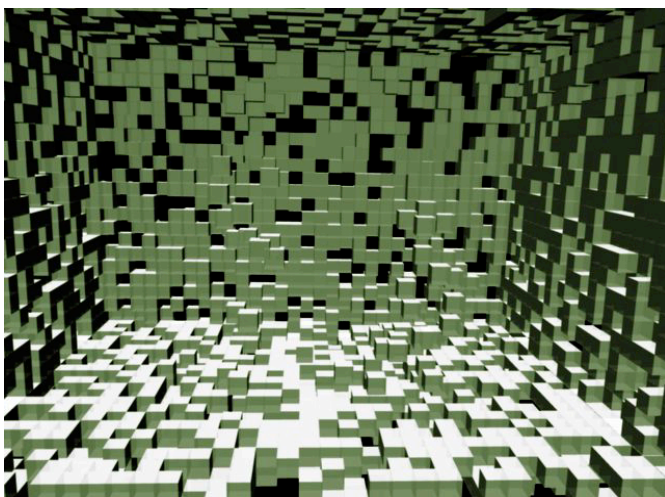


Figure 11: Images samples for left eye and right eye

3.1 The movement of Sado

As Fig 12 shows, the Sado word frequently appears in the answers of the questionnaire. Next to it the word “movement” frequently appears. That is, it was found out that “The Sado movement, which is the main object of expression was perceived”. In addition as Table 1 shows, among those who viewed the work many of them answered that “The Sado movement was well understood”. Therefore, it is considered that the object of expression in this work is fully and properly perceived.

3.2 New method of expressing traditional culture

As Fig 12 shows, the frequency of the word "culture" is 3rd highest. Also, the answer “the nature of culture was expressed using cubes” was obtained from Table 1. That is, it is possible to interpret the traditional culture-Sado using Random Cube.

3.3 Hisomu in aesthetic ideal of Sado

As Table 1 shows, the shape of people and the movement of them were recognized when the cubes started to move. When the cubes are motionless or come to a stop, they are seen as just stationary cubes. Moreover, some people recalled the concept of “Kyo” of “Dokyo(道教)”. That is, I confirmed that using cubes was effective to express Hisomu in a aesthetic idea of Sado.

3.4. Others

There were some opinions that it was enjoyable to watch the cubes and speculate what was going to happen if using artificial cubes. There were also some opinions that expressed that lively movement of Sado by using the cubes increased sophistication and delicacy of the work. Moreover, there were some opinions concerning three-dimensional vision. Before the cubes move, eyes were dazzled. It is considered that the cubes with same size and color were full of the screen, and as a result viewers couldn't focus on any place. However, when the cubes started to move, the eyes' dazzling disappeared. It is regarded that the point of focus was able to fix down and the space could be perceived.

4. Conclusion

The work demonstrated the concept of Sado using the “Random Cube”. In addition, I researched how the work was understood by those who appreciated and found that it could convey author's intention well, yet there were some technological problems in which there were some points where the cubes flied in an instant and the motion editing did not work. We consider that the optical motion capture

caused the problems and it could be solved in the future by using 3-D computer graphics software that could control the cubes arrangement.

Notes

¹The custom of drinking tea and the process of tea were brought by Japanese envoy to the Tang Dynasty in the Heian Period. The custom and the process of tea, however, died out since they were not rooted in those days. In the Kamakura Period, Powder green tea, which was brought as medicine by Eisai(西) and Dogen(道元) who introduced Zen Buddhism(禅宗), has spread along with the spreading of Zen Buddhism and increasing the factor for disciplining one's mind. Then when cultivation of tea prevailed, the custom of drinking tea was also popularized. Present “Wabi cha(侘び茶)” was established by Jyo ou Takeno(武野紹鷗) and his follower, Sen no rikyū(千利休) in the Azuchi-Momoyama Period. Tenshin Okakura(岡倉天心), who worked for Boston museum, the department of China and Japan, published “THE BOOK OF TEA” in 1906. The book attracted interest of person of culture in the West, and then it has become common to call Sado “tea ceremony” in English.

The influence of Okakura upon Sado was significant, and after he introduced it, generally “Cha no yu(茶の湯)” changed to the name of Sado.

²Cyberdome is a hemispheric image display system released by Matsushita Electric Works Ltd. Its hemispheric dome can display a wider viewing angle (the horizontal angle of more than 140[degrees] and the vertical angle of more than 90[degrees]), enabling itself to display life-size, three-dimensional images.

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