The Digital Design of Performance System for the Synthesis of Image and Music：

Through the composition of the Digital Shadowplay "Shadow of Rama"

Shigenobu NAKAMURA*, Keisuke WATANABE**:

*Department of Acoustic Design, Faculty of Design, Kyushu University / Professor

** Department of Acoustic Design, Kyusyu Institute of Design / Graduate School Student

Abstract: This aims at explaining the work, Digital Shadowplay "Shadow of Rama", which was composed and performed by Nakamura and Watanabe in March, 2004, and also at demonstrating the possibility of the synthesized expression of image and music by the technical description of "Performance System for the Synthesis of Image and Music" that was utilized for the performance of "Shadow of Rama".

"Shadow of Rama" is composed by the inspiration of shadowplay in Southeast Asia. In this work, instead of shadow pictures, a performer's hands are displayed as digital images. The camera captures a performer's hands, which are projected on the screen as digital images. The movements change the signals of producing and controlling the digital sounds. It means that a performer's hands produce and control both digital images and digital sounds at the same time. That makes image and music correspond each other. This correspondence relates image with music and then generates various effects for the synthesized expression of image and music. In this work "Shadow of Rama", these effects deepen the synthesized expression as well as add the story.

1. Introduction

Nakamura, Shigenobu and Watanabe, Keisuke produced and performed Digital Shadowplay "Shadow of Rama" in March, 2004(1). This work has been composed by the inspiration of shadowplay in Southeast Asia such as Wayang kulit(Bali Island) and Sbaek(Cambodia). (Fig.1) "Tale of Ramayana", the main motif of Shadowplay in Southeast Asia, remains the same role in this work.

Fig.1 Sbaekthom (Cambodian Shadowplay)

However, in this work, instead of shadow pictures, a performer's hands are utilized. The camera captures a performer's hands, which are projected on the screen as digital images. Also, instead of the traditional musical instruments in Southeast Asia, digital sounds are used. The movements of the performers hands control the digital sounds. It means that a performer's hands produce and control both digital images and digital sounds at the same time

This aims at explaining the work Digital Shadowplay "Shadow of Rama", which was composed and performed by Nakamura and Watanabe in March, 2004, and also at demonstrating the possibility of the synthesized expression of image and music by the technical description of "Performance System for the Synthesis of Image and Music" that was utilized for the performance of "Shadow of Rama".

2. The Purpose of Composition and Design

First of all, we put the great importance on digital sounds that would give us the feeling of being at a live performance, not on another type of digital sounds that have been recorded to CDs and tapes already. That feeling is brought to the audience by showing visually that it is surely performed.

Then, in order to make the hands' movements seen,

the movements themselves are projected on the screen as the performance itself. The movements of the hands are digital imaged as visual expression. The point is that the everyday materials could be seen completely different when projected on the screen. It is interesting that the relation of the hands' movements and the digital images is just the same as the one of shadowplay. (Fig.2)
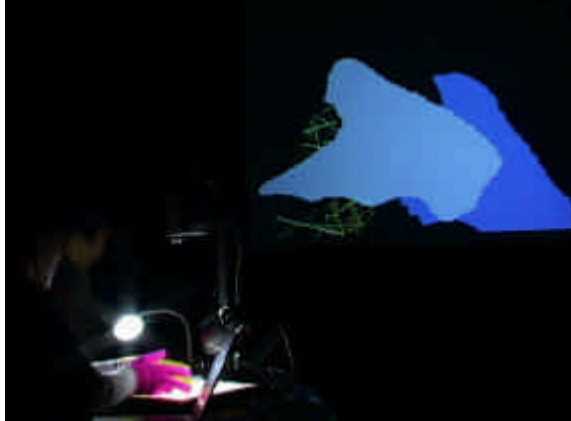

Fig.2 Performance scene of Digital Shadow play "Shadow of Rama"

In order to use the hands' movement as the performance, it is necessary to have the system that changes the movements into performing information. The system needs to be made without any large-scale device, which may increase the frequency of the performance. Also it is intended to avoid using the complicated systems on the purpose of not limiting the hands' movements.

Music is an abstract composition by itself. However, in this work, the music should contain the story by corresponding with the image. The story gives us a way to understand the work well. The motif of this work is "Tale of Ramayana", which has been the main motif of the Southeast Asian arts. That story is about the history of Prince Rama and it is relatively easy to follow. But, there are a lot of different details of the story, depending on the regions or times. That is to say that "Tale of Ramayana" allows various representation of the details.

This work has the "diversity" for the axis of time by having the story in itself. This work has 6 chapters as following:

Chapter 1 "Long, long ago. Into the woods"
Chapter 2 "The Archenemy Ravana's kidnapping of Princess Sita"
Chapter 3 " Looking for Princess Sita"
Chapter 4 "Battle. Ravana vs. Prince Rama"
Chapter 5 "Prince Rama's struggles"
Chapter 6 "Princess Sita's death and reborn"

The image and music change its characteristics drastically chapter by chapter. In order to do so, it is essential to change the methods of transforming the hands' movements into digital images and performing information, and the way to relate the image with the music. The system design for this purpose has done.

In terms of expression, regardless of the abstract music or images, it is intended that the audience could imagine the story in a concrete by synthesizing music and image.

In addition, Nakamura has made a basic plan, written the scenario, composed the music and designed the system for music. Watanabe has created images and designed the whole systems including the system for image. At the performance, Nakamura made the movements of his hands and Watanabe managed and controlled the whole systems.

3. The system structure
3.1. The whole system

The performance system does not need any specific sensors. It just has two computers; one is only for digital images (Image PC) and another is only for digital sounds (Sound PC), and one video camera. Image PC is managed by Max/MSP/Jitter and Sound PC is by Max/MSP(2).

A performer moves his hands on a performing board. A video camera projects the movements and transforms its data to Image PC. Image PC processes the digital image, which is soon on the screen. Also, Image PC transforms the image data into performing information that is sent to Sound PC through LAN port. Sound PC produces the sounds based on this information and plays the music through loudspeaker. (Fig.3)
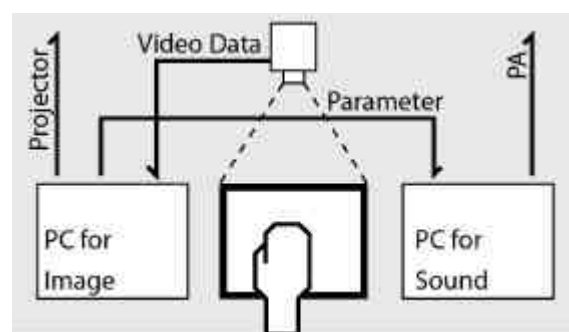

Fig.3   System Construction

3.2. Image System (Image PC)

Image system has 6 processing programs in total. As the work goes, the programs change one by one. It is made by hitting numbers on the keyboard. The change of image processing affects the music processing programs, because the input of the number with Image PC transforms to Sound PC. (Fig.4)
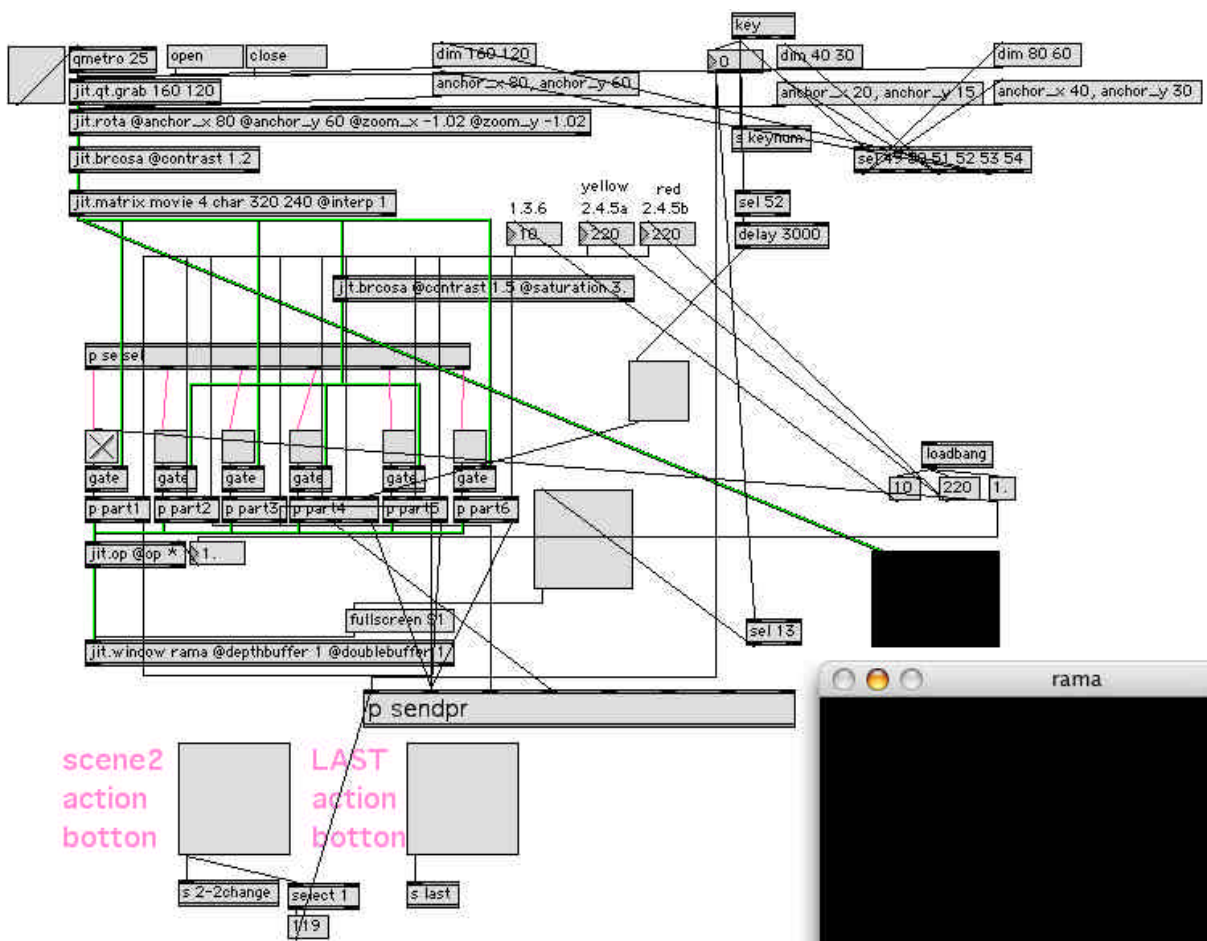
Fig.4 The main screen of Max/MSP/Jitter for Image PC

3.2.1. The concept of Chapter1 and Chapter 6 is "Obscure Lights on Black Screen". In these chapters, the camera captures the hands' movement and uses its outlines for producing images. Its procedure is;

1. To reverse negative and positive of input image,
2. To divide the image into two values by any number
3. To apply the feedback effects to the image. (Fig 5)

Fig.5 The image production of Chapter 1 and 6

As the performing information for Sounds PC, Bang of Max/MSP is produced when the hands' movements get over a certain length.

3.2.2. The concept of Chapter 2 is "The Convergence of yellow lines and the Mass of the lights". The convergence of yellow lines and the mass of the lights should be operated simultaneously or separately according to the chapters. Then, a performer wears yellow glove and magenta glove for each hand. So, the two hands are recognized differently. (Fig.2)

As the performing information for Sounds PC, Number Message of Max/MSP is produced when the hands' movements get over a certain amount. This amount continuously changes.

3.2.3. The concept of chapter 3 is "A lot of lumps of lights approaching to small lights waves". A performer's hands are almost posed at the center of performing board but sometimes moved a little. These very little movements produce the images that have the lines of lights toward the center of screen. (Fig.6)

As the performing information for Sounds PC, Bang of Max/MSP is produced when the hands' movements get over a certain amount.
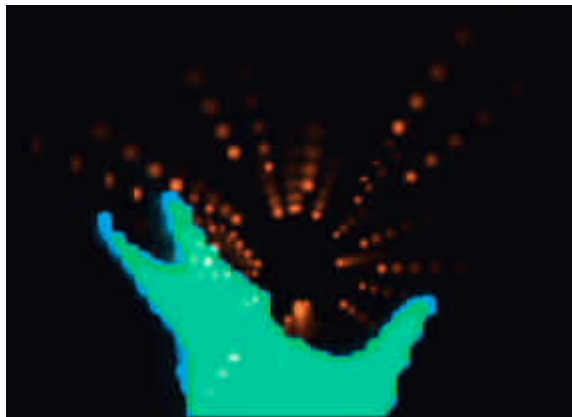
Fig.6 Image of the Chapter 3

3.2.4. The concept of chapter 4 is "Two of the abstract shapes moving around". In order to operate two hands separately, a performer wears two kinds of colored gloves here as well. Two of the ambiguous shapes move themselves in accordance with the information of the performer's hands.(Fig.7)
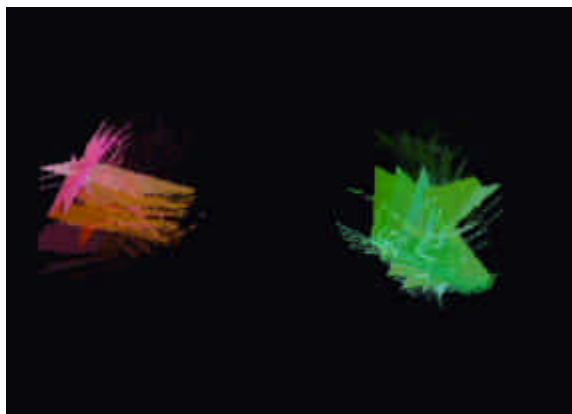

Fig.7 Image of the Chapter 4

As the performing information for Sounds PC, Bang of Max/MSP is produced when the hands' movements get over a certain length.

3.2.5. The concept of Chapter 5 is "The abstract shapes that move slowly but sometimes distortedly". A performer wears the colored gloves. The image is produces by calculating xy coordinates of the hands positions. The shapes are displayed within the area of its xy coordinates. This turns out that the expanded hands make the width

wider, on the other hands, faded hands makes the width narrower.(Fig.8)
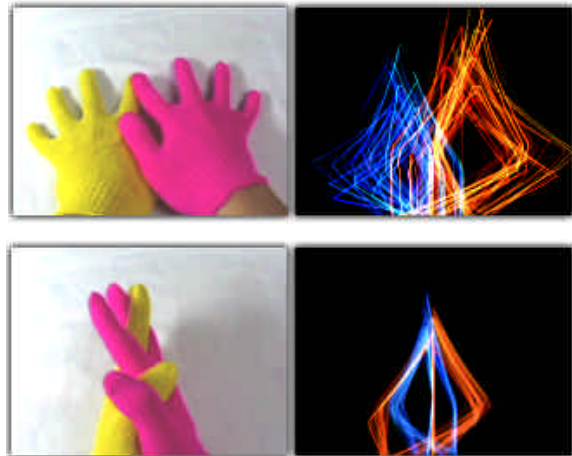

Fig.8 The differences between production figures due to hands' shapes

As the performing information for Sounds PC, Bang of Max/MSP is produced when the hands' movements get over a certain length.

3.3. Music System (Sound PC)

Sound system has 6 processing programs in total, just as the same as Image system. Because the input of the number with Image PC transforms to Sound PC, the processing program switches.

The most of the performing information is Bang of Max/MSP. Bang is very simple information. That is why the information can be exchanged certainly. Sound PC accepts this very simple information. This information becomes performing informations of music fragments. The various music fragments become the music itself for this work.

Number Message of Max/MSP is used only in chapter 2 and 4. The chapter 2 operates Number Message as variables of volume and tone; on the other hand, the chapter 4 operates Number Message" as the numbers that decides which parts of music will be played.

Processing programs for Sound PC are in charge of producing original sounds and parts of music, also if selecting and performing the music. In addition, all the sounds in this work are created only by sign waves and white noises from Sound PC. Neither sampling sounds nor MIDI sounds are utilized.(Fig.9)
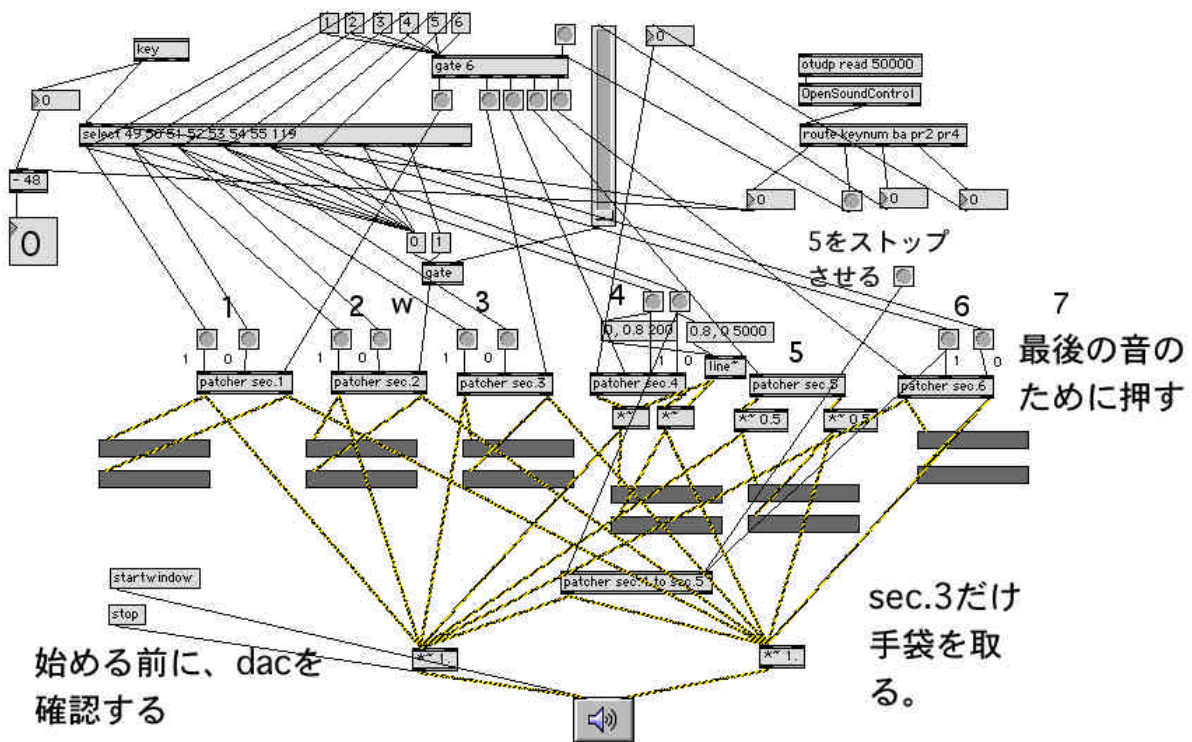
Fig.9 Fig.4 Main Frame of Max/MSP for Sound PC

4. The Synthesized Expression of Image and Music

As mentioned before, the movements of performer's hands become the performing information of the music. It means that image and music correspond to each other, which ends up in relating with each other.

This relation between image and music is the basis of the synthesized expression in this work. The following is the examples of the effects:

- The music adds a new meaning or new image to the very monotonous movements of shapes (Chap. 1 & 6). Vice versa (Chap 1 & 6).
- The movement change stimulates very subtle music variations (Chap 2 & 4).
- The correspondence with the movement and music brings the image with certain continuity (Chap 3 & 5).
- The change of image affects the change of music when the continuous variables of sounds and that of movements are the same (Chap 2).
- Image helps the audience to predict the next sounds, even if the music itself is difficult to be thought ahead. That is to say, the continuity of image gives the music the musical continuity (Chap 4).

These effects not only add the story to this work but also deepen the synthesized expression of image and music itself.

5. Conclusion

We designed "The performing system for the synthesis of image and music" for Digital Shadowplay "Shadow of Rama ". This system should not be large-scale or complicated. Only a performer's hands can produce and control the digital image and sounds. Image and music correspond with each other. This correspondence relates image and music and adds a variety of effects on the musical synthesized expressions. These effects not only add the story to this work but also deepen the synthesized expression of image and music itself.

In addition, "The performing system for the synthesis of image and music" is the multipurpose system. It creates the different works just by processing new programs with Max/MSP/Jitter for Image PC and Sound PC. In order to find the more possibilities of the synthesized expression of digital image and music, this system should be useful greatly for those who wish to compose new works other than Nakamura and Watanabe.

Notes:

(1) First-performed: on March 4. 2004, at Kanagawa prefectural Cultural Hall (Yokohama), "SIGMUS Computer Music

Symposium 2004", Shigenobu Nakamura (Performance) and Keisuke Watanabe (Computer operation)

Re-performed 1: on August 28, 2004. Keihanna Event Hall (Kyoto), " Media Concert ", Shigenobu Nakamura (Performance) and Keisuke Watanabe (Computer operation)

Re-performed 2: on October 30, 2004. Asian Art Hall (Fukuoka), "PreFreq04 Sounding Image", Shigenobu Nakamura (Performance) and Yoshio Kuroda (Computer operation)

(2) Max/MSP/Jitter is the program language of graphical environment for music, sound, multi-media and images. It does programming by connecting the icons which is called objects. Each object has each particular function. This programming was developed by IRCAM in the late 1980's, and now it has been developed and been on sale by Cycling' 74.