JUKE Cylinder: a device to metamorphose hands to a musical instrument

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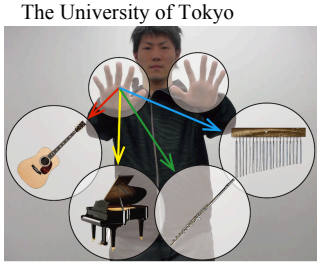

Fig. 1 Hands metamorphosed to any musical instrument

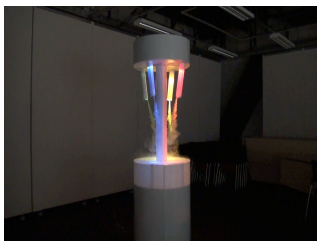

Fig. 2 Whole view of JUKE Cylinder

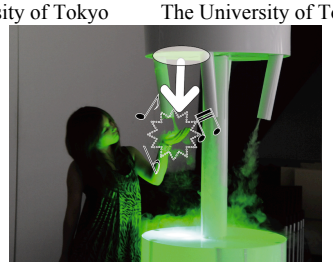

Fig. 3 Interaction and how to output sound

Fig. 4 Multi-user interaction

1. Introduction

If you knock an object, it sounds. If you play music, loudspeakers sound. The sound you usually listen to is generated by actions or objects supposed to generate sound. However, the development of parametric loudspeakers made it possible for people to feel that the sound comes from actions or objects which are not supposed to generate sound, because the parametric loudspeaker can localize the sound image on the reflected surface[1][2]. The parametric speakers work in an entirely different way from conventional loudspeakers. They generate ultrasound, and it travels out from a parametric loudspeaker in a narrowly focused column like a flashlight beam. When it hits something, it turns back into ordinary sound you can hear. There is a computer interface using this characteristic of the parametric speaker[3].

2. Concept

The characteristic of the parametric loudspeaker provides people with extraordinary sound experiences. We came up the idea from this amazing characteristic. In the case of invoked computing[3], users can't control the sound by themselves. The concept of our study is to metamorphose hands to a musical instrument by localizing the sound image on the hands and make it possible for users to control the pitches of the sound (Fig 1). The only way to use one's hands as a musical instrument is hand clapping. However, our system can metamorphose the hands to various musical instruments like a guitar, a piano, or a flute, and users are able to control the pitches of the sound like those real musical instruments. With our system, people can feel that the sound is generated on their hands, and have an illusion that their hands metamorphose to a musical instrument.

3. Implementation

We developed a cylindrical interactive device (Fig. 2), named "JUKE Cylinder", that could localize the sound image on one's hands and play various tones. JUKE Cylinder consists of four parametric loudspeakers, two Kinects, eight dimmable LEDs, and four fog machines. All parametric loudspeakers, all Kinects and four LEDs are put on the upper part, and the rest, four LEDs and four fog machines, are put on the lower part.

4. Interaction

The interaction with JUKE Cylinder is to hold one's hands to the misted light and go up and down them. The parametric loudspeakers output sounds to their hands (Fig 3). Therefore, we should design this device to make users to hold their hands to the light. The fog machines are used to visualize the ray of LEDs and lead users to hold their hands to the light. This design guides users to interact with JUKE Cylinder naturally. The mist from their hands looks like the sound is spreading from them. This effect makes users to recognize that the sound is coming from their hands.

When users hold their hands to the light, the Kinects get the depth data of them. By the depth data, the pitch of sound and the brightness of the LEDs are decided. Each parametric loudspeaker is assigned its output sound by software instrument like a guitar, a piano, or a flute. The parametric loudspeakers output sounds that have pitches and tones to one's hands, and the sounds spread from their hands.

When you play a musical instrument with other people, it is important to act in harmony, called "session". One to four users can play with JUKE Cylinder simultaneously (Fig. 4). When multiple users play with JUKE Cylinder, a beat sound is generated with the original sound from the parametric loudspeakers. By the beat sound, users feel cooperativeness with others.

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