Chapter 8
Entertainment Media Arts with Multi-Sensory Interaction

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ABSTRACT

In a field of application of virtual reality technologies, lots of multi-sensory entertainments have been developed. Researchers have been trying not only to develop the haptic, tactile, olfactory, and taste displays individually, but also to represent subtle sensations with combinations of multiple displays. In this chapter, we will introduce three entertainment applications which utilize multi-sensory stimulation for representing and improving the reality of virtual worlds. (1) Haptic Canvas: An entertainment system with dilatant fluid based haptic device, (2) Fragra: An entertainment system with a hand-mounted olfaction display, and (3) Invisible: An entertainment system that reproduce presence of virtual creatures by indirect information.

INTRODUCTION

Currently one of the largest entertainment field in which applications are interactive and utilize digital technologies is a video game industry. In the field of video game consoles, players receive a large part of feedback through visual and auditory senses (sometimes we have vibration of controllers, but it is auxiliary). In 2006, Nintendo’s Wii introduced player’s motion as an input method to gaming consoles. Sony’s PlayStation 3 and Microsoft’s Xbox360 have been following Wii and now they are ready to release motion input devices based on image processing. However, these new devices extend only input modality and the senses which are utilized as output from virtual worlds are still limited.

Virtual Reality (VR) technology is a collection of technologies that reproduce the essential part of the real world by stimulating users’ senses appropriately. To reconstruct realistic virtual environment, VR technology must cover the wide-
range fundamental technologies which include multi-sensory inputs and outputs. In a field of application of virtual reality technologies, lots of multi-sensory entertainments have been developed. Researchers have been trying not only to develop the haptic, tactile, olfactory and taste displays individually, but also to represent subtle sensations with combinations of multiple displays, for example, a sucking feeling (Hashimoto, 2005) or a creepy feeling (Sato, 2008).

In this chapter, we will introduce three entertainment applications which utilize multi-sensory stimulation for representing and improving the reality of virtual worlds.

- **Haptic Canvas**: An entertainment system with dilatant fluid based haptic device (Yoshimoto, 2010).
- **Fragra**: An entertainment system with a hand-mounted olfaction display (Mochizuki, 2004).
- **Invisible**: An entertainment system that represents existence of virtual creatures by indirect information (Nakano, 2006).

These applications were created by the students in (1) BioImaging Group (Oshiro Laboratory), Department of Mechanical Science and Bioengineering, Graduate School of Engineering Science, Osaka University, and (2, 3) Image Processing Laboratory, Graduate School of Information Science, Nara Institute of Science and Technology from 2003 to 2009. All of these applications were submitted to International collegiate Virtual Reality Contest (IVRC) which has been hosted by Virtual Reality Society of Japan from 1993. To know more about the IVRC, please visit their web site: http://ivrc.net.

**HAPTIC CANVAS: DILATANT FLUID BASED HAPTIC DEVICE**

**Introduction**

Painting visually attracts peoples. To add colorings on the canvas and to draw a picture are also the entertainments of visual sensation. Like painting, to draw haptic sensations on the canvas could be an entertainment. The purpose of this study is to realize “Haptic Canvas” on which users can paint and arrange haptic sensations like painting a picture on the canvas. Users blend and draw the haptic sensations, which we call “haptic colors”, on the canvas with his hand directly touching virtual “haptic” paints, thus paint a haptic picture. Users intend to blend haptic colors to create a new sensation so that the picture can haptically attract peoples. While we need several paints to draw colorful pictures, users also need haptic paints, i.e., “haptic primary colors” to draw colorful haptic pictures. While we can create fascinating colors by blending paints, in case of haptic sensations, some paints could be attractive by themselves when we touch them.

The slurry made from water and starch - i.e., dilatant fluid, is one of the haptically fascinating substances and presents amusing but mysterious feelings like playing in the mud when you were in childhood. The distinct haptic sensation comes from the property of the fluid, “dilatancy”, which means reversible change of state from liquid-like material to solid-like material according to an external force (Cates, 2005). The change in the state of the fluid is not only useful for building a soft and morphing robot (Mozeika, 2009) but also for building haptic devices. If we can mechanically control the state of the dilatant fluid, we can present wide range of haptic sensations because the change of the state of dilatants fluid from the liquid to the solid is drastically and even fast. As shown in Figure 1, the concept of Haptic
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