Remote Ikebana with Olfactory and Haptic Media in Virtual Environments

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ABSTRACT

In this paper, we handle a remote ikebana (i.e., flower arrangement) system with olfactory and haptic media. In the system, a teacher or a student can hold a flower, adjust the length of the held flower's stem with a pair of scissors, and impale the flower on a flower pinholder in a 3-D virtual space. We investigate the influence of the size of smell space (defined as a sphere in which we can perceive the smell of flower) on QoE (Quality of Experience), and we illustrate that there exists the optimum value of the smell space size.

Keywords: Ikebana, Olfactory media, Haptic media, QoE, Virtual environment

1 INTRODUCTION

Recently a number of researchers have been paying attention to multi-sensory communications, in which we treat vision, auditory sensation, gustation, olfaction, and tactile sensation [1]. By handling multiple sensations together, we can improve realistic sensations [2] and immerse ourselves in various applications such as ikebana (i.e., flower arrangement) [3], cooking [4], and harvesting fruit [5]. However, there is few papers which study networked applications using vision, olfactory media and haptic media together.

In this paper, we deal with a remote ikebana system with vision, olfaction media, and haptic media. Since the output timing of olfactory media affects the experience of realistic sensations, it is very important to clarify the influence of the output timing of olfactory media. Thus, we assess the influence of the output timing of olfactory media on QoE (Quality of Experiment).

2 REMOTE IKEBANA SYSTEM

In the remote ikebana system, by manipulating a haptic interface device, a teacher or a student can hold a flower, adjust the length of the held flower's stem with a pair of scissors, and impale the flower on a flower pinholder (see Fig. 1, in which the student is going to cut the held rose's stem). The teacher is able to teach the student at a remote place how to arrange flowers, and the teacher is also able to change the arrangement designed by the student. Moreover, when the viewpoint of the teacher or student enters the *smell space* (defined as a sphere in which we can perceive the smell of flower. It is called "aroma aura" in [2]) of a flower, the smell of the flower is diffused by using an olfactory display, and he/she can perceive the smell of the flower. We employ PHANToM Omni as a haptic interface device and use SyP@D2 as an olfactory display.

3 ASSESSMENT METHOD AND RESULTS

We carried out QoE assessment to investigate the influence of the output timing of olfactory media by changing the smell space size (i.e., the radius of each sphere). In the assessment, each subject was asked to select a rose from among flowers on the table, hold and move the rose at a constant speed toward his/her viewpoint until he/she starts to perceive the smell of the rose. Then, he/she moved it away from the viewpoint until he/she became insensitive to the smell at the same speed as the speed when he/she moved the flower toward his/her viewpoint. Each subject was asked to judge how

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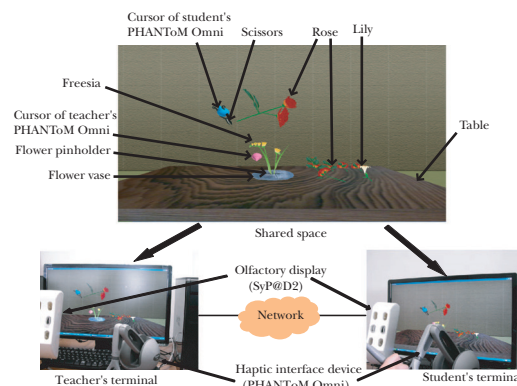
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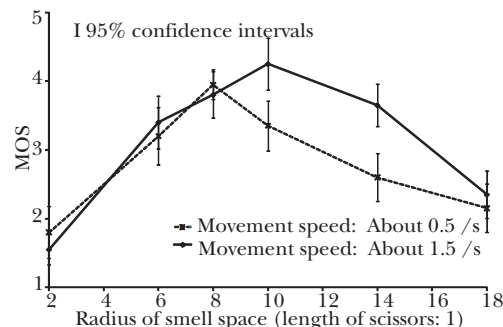

Figure 1: Configuration of remote ikebana system.

Figure 2: MOS versus radius of smell space.

good the output timing of olfactory media is. The subject gave a score from 1 (bad) through 5 (excellent) to each test to obtain the mean opinion score (MOS).

We show MOS for two movement speeds in Fig. 2. We see in the figure that there exists the optimum value of the smell space size, and the optimum value depends on the movement speed.

4 CONCLUSIONS

In this paper, we handled a remote ikebana system with olfactory and haptic media. We also investigated the influence of the smell space size on QoE. As a result, we saw that there exists the optimum value of the smell space size, and the optimum value depends on the movement speed. As the next step of our research, we plan to investigate the influences of network delay, delay jitter, and packet loss on QoE in the remote ikebana system.

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