KUSUGURI: Visual Tactile Integration for Tickling

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Figure 1 *Remote tickling with video chat (left). Users can observe a moving fingertip, which looks like someone is actually tickling the palm with his/her fingertip (center). Tickling as a physical contact (right).*

1. Introduction

Tickling as physical contact plays an important role in close relationships [Provine 2004]. Whereas a mobile phone and video chat are commonly used for remote communication, remote tickling is seldom used for physical contact.

It is necessary to producing a tickling sensation to realize remote tickling. For instance, a tactile display used in network gaming, tickles the wearer's midriff via an unpredictable and uncontrollable vibration [Tsetserukou 2010]. Such a tactile display, where the tactile sensation is produced by a mechanical approach, however, tends to be larger and less portable because a tactile sensation is required to induce the tickling sensation. In this paper, we propose a remote tickling method using visual tactile integration that is easily achievable with the existing telecommunication infrastructure.

2. Principle of Perception

The proposed method is based on an illusion we discovered: simple vibration, which does not induce a tickling sensation by itself, is perceived as tickling when accompanied by a moving visual cue. It is widely known that a tickling sensation can be felt simply by watching a tickle gesture close to our body, regardless of whether there is physical contact. In addition, an acoustic cue produced close to our ears also evokes a tickling sensation [Kitagawa 2010].

We focus on the palm, which is suitable for physical contact as shown in Figure 1 (right), and propose a method that includes a visual tactile display, appearing as a continuation of the palm as shown in Figure 1 (center). Users can observe a moving fingertip, which looks like someone is actually tickling the palm with his/her fingertip, while feeling a simple and slight vibration provided by the device during the tickling. As a result, users perceive a tickling sensation due to the sensory integration of the visual cue from the movement of the fingertip and the tactile cue from the simple vibration.

Furthermore, our proposed method also enables bidirectional tickling using the same device, and is expected to be applied widely to other parts of the body, on which the device can easily be placed.

3. Design and Implementation

Pre-captured palm and fingertip images are stored in the device (an Apple iPod touch 3rd Gen., 32 GB model). The device is placed in such a way as to suit the displayed palm image as shown in Figure 1 (center). Once the touch panel of the device measures movement of the fingertip when one user tickles another with the device as shown in Figure 1 (right), the movement is sent wirelessly to another device in real time. The touch panel does not receive an actual tactile sensation; only the fingertip's movement.

The device receiving the movement of the fingertip generates an audio signal amplitude-modified and proportional to the velocity of the finger (Figure 2 (left)). The vibration is provided by a vibrator attached to the rear of the device as shown in Figure 2 (right), and amplified with an audio amp. For practical application, the pre-captured images are obtained using the internal camera of the smartphone and exchanged via a network, while an internal vibrator is used instead of the attached vibrator and audio amp.

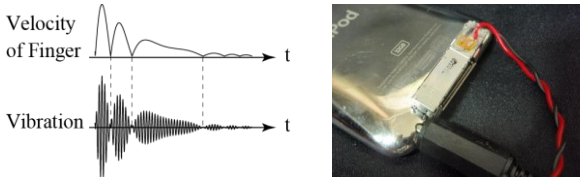

Figure 2 *Vibration synchronized with velocity of the finger*

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