Experiments for Developping Touchable Online Shopping System

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Abstract

The touchable online shopping system we propose enables users can touch a virtual commodity with their own hands. One purpose of our proposal is to evaluate whether it is easy to measure the size and weight of the commodity intuitively only with small-scale size and low-price elements. Another is to make a general-purpose system only with them for general applications. With such virtual reality, we used a data-glove with vibrators and a simple force feedback device to cover any impressions such as interface interference during use. We evaluated whether users can measure the size and weight of a virtual commodity. Using this system, we found that users could measure them similar to the use of real ones.

CR Categories: H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems—Artificial, Augmented, and Virtual Realities; H.5.2 [Information Interfaces and Presentation]: User Interfaces—Haptic I/O

Keywords: virtual reality, online shopping, haptic and force feedback

1 Introduction

Many experiments in virtual reality (VR) research and object manipulation involve glove-like input devices. The latest developments include gloves with vibrators in the fingertips for conveying information or that provide feedback forces to individual fingers. Introducing haptic and force feedback usually involves larger, more expensive equipment, although fields such as medicine prioritize precision over cost [Okamura et al. 2003] [Okamura et al. 2001].

On the one hand, utilization of online shopping is increasing recently as the evolution of the mail order. In the former mail order, only the images of a commodity and their explanations are shown. In the next mail order system through TV, the motion and sound of a commodity are shown too. And now we can look it from any direction on the Internet with interactive 3D technique. However we usually touch and take the commodity in our hand at a store for checking the size and feeling of it.

In this research, we considered the Touchable Online Shopping system with thin haptic and force feedback [Funahashi et al. 2008]. The system consists of only small-scale size and low-price elements, because our goal is widely generalization. We already evaluated that virtual object thickness was compared with another virtual one with vibration feedback. Then at the experiment of 2cm difference, positive answer ratio was 100% and the ratio of 0.5cm was 75%. It remains as our task that real object thickness should be compared with virtual one, and size of virtual hand should be calibrated. It also remains that real object weight should be compared with virtual one.

We begin with an overview of touchable online shopping system and informative control, proceed with experiments and results, and close with conclusions. This technique might be not only for touchable online shopping system but also for any virtual reality system to use at personal home.

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2 Touchable Online Shopping

In our system, we considered the virtual hand in PC monitor which moves, opens and closes following the movement of the real hand which wears a data-glove and force feedback device. The illustration of our future system is shown in **Figure 1**. Although the data-glove with vibrators and force feedback device we used were expensive exactly, the Essentialreality P5 GLOVE which was able to connect to PC via USB was marketed for around $100 recently, and The Novint Falcon which is force feedback device is marketed for around $200 (**Figure 2**). It is expected that vibration and force feedback system are able to be attached on a data-glove such as the P5 GLOVE, and the glove with vibrators and force feedback element is able to be marketed in low-price if there are many demands.

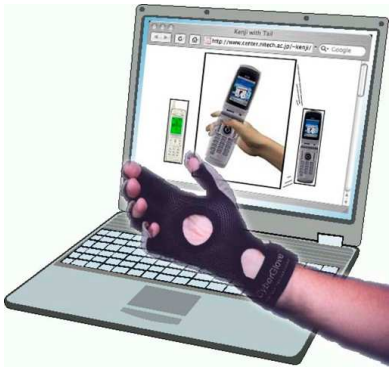

Figure 1: *Illustration of our future system.*

Figure 2: *P5 GLOVE and Falcon.*

For simplification, only rectangular parallelepiped is considered as commodity in the experimental system, for example, digital camera and mobile phone. When a subject touches a virtual object, the system convey information through vibration. However actual feeling of grasp dose not convey to a subject, subject feels touch sense

through vibration and feels the size from vibration as reaction force. When a subject put a virtual object on a hand, the system convey information through force feedback. However the force feedback device we used was simple one, it could not feedback force at multi point like every fingertips but at only one point.

Pilot study suggested that vibration at the ring finger and little finger gave poor results, as did strong vibration, so we focused on the thumb, forefinger, middle finger, and palm as vibration points, and set "Felt" strength ("Not felt excessively" strength for palm) when they contact to an object. And the feedback point of a force feedback device was decided on palm.

3 Experiment and Result

The Touchable Online Shopping system mentioned above was implemented on a PC with C language with Immersion CyberTouch, Polhemus 3SPACE FASTRAK and PHANTOM Omni. The system appearance images of this system are shown in **Figure 3** and **Figure 4**. It refreshed the CG image at 20 frames/sec. The virtual hand shown in CG was assumed as that of subjects.

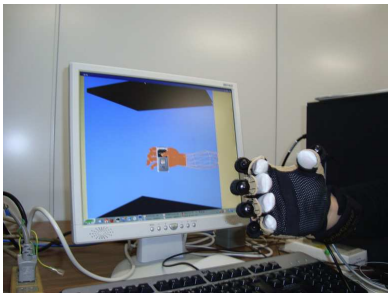

Figure 3: *Experiment system with CyberTouch.*

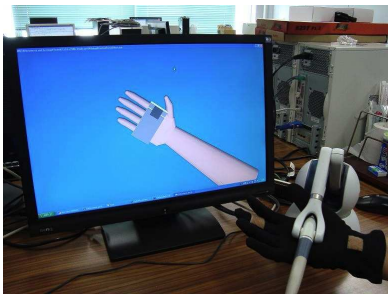

Figure 4: *Experiment system with PHANTOM Omni.*

It was evaluated whether subjects could compare virtual object size with real one. The number of right-handed subjects was nine and they did not have any experience of this system before experiments. The number of real object was eleven and the size was 100mm height and 10mm thicknesses, and the width was 20–70mm at 5mm intervals. The number of virtual object was also eleven just like real one. Every subject tried two times tasks for two given real objects. The task was to check a given real object first, then to try to select a same size virtual object from eleven virtual one (R→V). And they tried second tasks in the same way as first task (V→R). The result is shown in **Table 1**. There were many correct answers and no error more than 10mm. We found that subject could see the size of virtual object from vibration feedback.

The second experiment was to evaluate whether subjects could compare virtual object weight with real one. The number of subjects was ten and they did not have any experience of this system before experiments. One 130g real object and seven virtual objects were prepared (cf. **Table 2**). Every subject tried nine times for each weight pattern. The subjects checked real object weight without VR system, then selected a same weight virtual object from three virtual one with PHANTOM Omni system (**Figure 4**). The result is shown in **Table 2** and the number of times of 130g is correct one. Although we could find good result, 10g difference was difficult task and there was a tendency to feel virtual weight heavier then real one. We think that we could revise virtual weight.

Table 1: *Experiment for size.*

	correct	±5mm	±10mm	more
R→V	20	15	1	0
V→R	15	16	5	0
sum	35	31	6	0

Table 2: *Experiment for weight.*

pattern 1		pattern 2		pattern 3	
weight	times	weight	times	weight	times
80g	20	100g	33	120g	43
130g	67	130g	53	130g	29
180g	3	160g	4	140g	18

4 Conclusion

In experiments to evaluate online shopping system, vibration feedback is effective as force feedback, and the vibrational stimulus where man can realistically never touch, i.e., palm is also effective.

Their size and price preclude using many of the force and haptic feedback devices developed thus far for home use, while the vibrator system is used for the silent mode of mobile phone and video game controller. Although the data-glove we used is very expensive one, there are/were some data-gloves for video game in the market. It would be able to make a data-glove with vibrator at a low price in the future. Using this data-glove and the method proposed, various virtual reality system might be produced and sold, for example, for our home through the internet.

Despite some favorable results, bugs remain. We could not test sufficient statistical hypotheses for experiments because of too few subjects, meaning for example, that we tested some vibration and strength patterns, leaving them for future work. It remains as our task that virtual hand (thickness of finger and color of hand) should be calibrated. Of course actual Touchable Online Shopping System should be realized. We are looking for the data-glove production company and Online shopping company.

References

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