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Demonstrating SkinHaptics: Softness Perception and Virtual Body Embodiment for Self-Haptics

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***Abstract*—Providing haptic feedback for soft, deformable objects is challenging, requiring complex mechanical hardware combined with modeling and rendering software. As an alternative, we advance the concept of self-haptics, where the user's own body delivers physical feedback, to convey dynamically varying softness in VR. We propose SkinHaptics, a device-free approach that changes the states of musculoskeletal structures and virtual hand-object representations. To demonstrate this methodology, we designed interaction scenarios with SkinHaptics.**

***Index Terms*—Virtual Reality, Haptics, Embodiment, Softness.**

I. Introduction

In this demo, we present SkinHaptics, a self-haptics interface for providing haptic feedback on soft, deformable objects by extending the concept of self-haptics, where one's own body delivers tactile sensations in virtual reality (VR). To reduce the awareness of self-touch, we design virtual body representations to modulate embodiment. Compared to prior work [1], SkinHaptics supports richer interaction by enabling multi-level softness, a wider range of softness variations, and reduced perceptibility of self-touch.

II. Design of SkinHaptics

SkinHaptics uses the non-dominant hand as a haptic prop and the dominant hand for interaction, as depicted in Figure 1.

Using the complex musculoskeletal structure of the hand, SkinHaptics modulates skin softness through gestures and contact points. We selected three contact points—the first dorsal interosseous, abductor pollicis brevis, and second metacarpal bone—and combined them with 24 natural and socially acceptable one-handed gestures to create diverse softness sensations.

SkinHaptics provides two types of haptic feedback. First, it delivers passive static feedback by using the hand as a passive prop at fixed poses, with different contact points corresponding to various softness sensations. Second, it enables passive dynamic feedback, allowing users to vary hand poses while maintaining contact. SkinHaptics can simulate continuous changes in softness in this type.

SkinHaptics also designs different hand-object visualizations to modulate embodiment. In the baseline, a virtual object overlays the real hand (*object+hand*). Alternatively, to reduce the sense of self-touch, the virtual object can be decoupled from the hand, either with a spatial offset (*object+handoffset*) or by hiding the virtual hand entirely (*object*), creating a visual mismatch between the real hand and the object.

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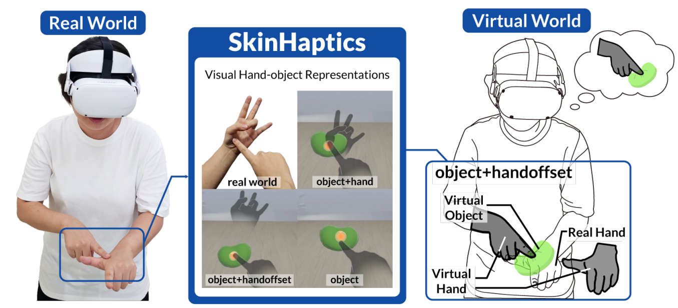

Fig. 1. A user wearing a head-mounted display touches a virtual object in VR. SkinHaptics, a self-haptic interface methodology for providing haptic effects on soft deformable objects, allows the user to experience varying softness of the object using their own hand.

III. Demonstration of SkinHaptics

SkinHaptics offers significant potential for a wide range of haptic applications in VR. We highlight bare-hand interaction scenarios with SkinHaptics in terms of the two following haptic feedback types: passive static and passive dynamic.

The passive static type provides tactile sensations for static objects. Users interact with multiple toys to experience and compare their softness. In addition, we introduce hand-worn items such as watches and rings to cover physical softness levels not achievable by the hand alone. This type is effective when interacting with objects made of different but relatively homogeneous materials.

The passive dynamic type presents varying softness by recognizing hand gestures. For example, users adjust thumb positions to control volume and feel corresponding changes in skin softness. In a VR game scenario, users draw a virtual bowstring by abducting the index finger, perceiving increasing tension through self-haptic feedback.

References

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