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Induced pseudo-haptic sensation using multisensory congruency in virtual reality

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Pseudo-haptic refers to the illusory haptic sensations users experience when contacting virtual objects (VOs) in virtual reality (VR). Conventional haptic technologies to produce haptic sensations in VR have focused on mimicking physical haptic sensations by outputting electromechanical forces on user's body surface using electronic devices. The present study investigated the possibility of inducing a pseudo-haptic sensation using a multisensory integration procedure by presenting verisimilar sensory information (visual, auditory) of a rough textured VO in VR. Twenty-two (22) participants experienced three different multisensory conditions in within-subject design: Touching a rough-surfaced VO with the sound of stroking rough texture (congruent condition); touching a rough surfaced VO with the sound of stroking smooth texture (incongruent condition); touching a rough surfaced VO with no sound (controlled condition). Participants were instructed to stroke the surface of the object with their index finger at a constant speed. A roughness sensation questionnaire (RSQ) and skin conductance response (SCR) were measured to quantify the degree of the pseudo-haptic illusion. Subjects reported a higher RSQ score (Q4: How strongly did you experienced the "Rough" sensation while touching the VOs) in the congruent condition in contrast to incongruent and controlled conditions ($F=14.924$, $p<.000$, one-way ANOVA). SCR analysis, however, did not show a significant difference of average amplitude between conditions. The results suggest the possibility that congruent multisensory information of VOs might be able to induce pseudo-haptic illusions. This novel approach presents an alternative to inducing haptic sensations in VR compared to the conventional haptic implementation methods to produce haptic sensations.

Biography

Chan Hyun Park majored in Biotechnology at Ulsan University and received his Bachelor's degree in 2014. He is currently an MS student in the Lab of Psychophysiology & Brain Imaging in the Department of Psychology at Korea University. His current research interest is the effect of top-down perceptual processing (e.g., auditory-visual multisensory integration) on the induction of pseudo-haptic sensations.

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