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Subjective Haptics: Sharing and Augmentation of Sensorimotor Control

Abstract: Haptic sensation depends on our bodies as well as an object touched. Mechanical interaction between the skin and object derives haptic sensations and individual skin characteristics and movements influence haptic sensations. Furthermore, the movement is consciously or unconsciously adjusted by the haptic sensation. Thus, haptic sensation involves individual physical skill, indicating that haptic technologies reflecting individual sensorimotor controls might be available not only for object recognition but also for human augmentation. We have developed a wearable tactile sensor that allows a user to touch an object with their bare fingertip and measure subjective tactile sensations. Integrating it with the tactile feedback interface can be available to enhance tactile sensation, improve motor skills, share tactile sensations with others, and human-human/robot collaborations. In addition, we have investigated body integration through a robotic avatar in which multiple users cooperate. We have observed the effect of improving the operation and sense of agency in body integration, indicating that embodied collaboration can overcome individual abilities. Under these research and developments, the design of haptic interfaces for integrating sensory information with motor information is crucial in inducing intuitive recognition and operation, promoting collaboration, and improving a sense of agency. I will introduce interfaces and systems developed and findings, and discuss future applications and challenges using individual haptic sensations.

Bio: Yoshihiro Tanaka skipped from undergraduate school to graduate school and received the M.S. and Ph.D. degrees from Tohoku University, Japan, in 2003 and 2006, respectively. He was a Research Fellow with the Japan Society for the Promotion of Science, in 2005. In 2006, he was a Research Associate with the Nagoya Institute of Technology, Japan. He was a Visiting Researcher with Utrecht University, The Netherlands, in 2011; a Visiting Associate Professor with Fujita Health University, Japan, from 2015 to 2019; a PRESTO Researcher of the Japan Science and Technology Agency, from 2014 to 2018; and an Associate Professor with the Nagoya Institute of Technology, from 2015 to 2021, where he has been a Professor with the Graduate School of Engineering, since 2021. He is also a fellow of Inamori Research Institute for Science since 2023. His research interests include haptic perception, tactile interfaces, tactile device design, and human– human/robot cooperation with shared haptic perception. He is a member of the Society of Instrument and Control Engineers (SICE), the Robotics Society of Japan (RSJ), the Virtual Reality Society of Japan (VRSJ), and a Fellow of the Japan Society of Mechanical Engineers (JSME). He has also been an Associate Editor of Advanced Robotics, since 2019, and the IEEE Transactions on Haptics, since 2020.