2025 IEEE World Haptics Conference (WHC)
Suwon Convention Center, Suwon, Korea
July 8 ~ 11, 2025

From Personal Vibration to Shared Perception: A Demonstration of Velcro Texture Tracing

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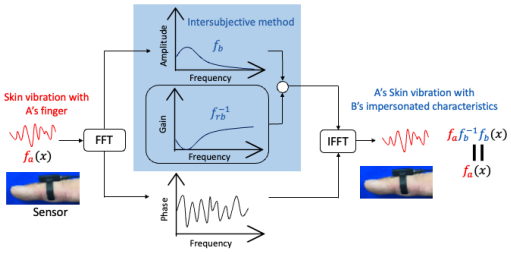
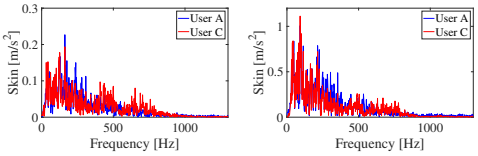


Fig. 1: Method to cancel out individual characteristics.

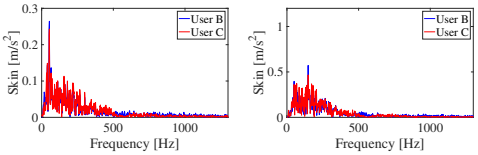
Presenting skin-propagated vibration may be a method that allows people to share the sense of touch, inducing an intuitive understanding of other people's haptic sensations. This technology can present and explain textures for various experiences and utilize them for applications such as skill training. However, various individual factors cause perceptual differences, such as the pitch of the fingerprint and skin characteristics. Thus, individual factors may be crucial when sharing the sense of touch.

Here, we demonstrate an example of the individual difference when tracing Velcro tape's hook-and-loop sides. The texture of the hook side of Velcro tape would be described as a "catching" or "scratching" sensation, whereas the texture of the loop side would be described as a "soft" feeling or a "fluffy" sensation. We adopted Velcro tape because past experiences in haptic sharing showed that there are people whose skin-propagated vibration is difficult to discriminate, which side of the tape is being traced. In contrast, there are other people whose skin-propagating vibrations are easily discriminable, which is caused by the differences in individual factors. Prior studies have demonstrated that the ease of discrimination is related to the power balance of high/low frequencies for noisy vibrotactile stimuli [1].

Thus, for the demonstration, we will measure each receiver's skin characteristics to cancel them out and reproduce the transmitter's skin-propagating vibration on the receiver's finger, using the method shown in Fig. 1. This method includes the force exerted by the transmitter and the receiver as part of the shared interaction. Fig. 2 shows the acceleration measured between the first and second joints of the index finger for the transmitter tracing Velcro tape and the acceleration measured from the receiver after canceling out the receiver's skin and actuator characteristics; Fig. 2b are the results for user A being the transmitter, which is easy to diffentiate and Fig. 2a shows the results for user B being the transmitter, which is difficult to differentiate.



(a) Comparison between User A (transmitter) and User C (receiver)



(b) Comparison between User B (transmitter) and User C (receiver)

Fig. 2: Comparison of acceleration in the frequency domain

Additionally, we will show the power balance between high and low frequencies by measuring each receiver's skin-propagating vibration when tracing the hook-and-loop sides of Velcro tape using a GUI. We also plan to show the data of past participants so that it is easy to understand each individual's relevant area. Through this demonstration, we aim to present the possibility of sharing haptic sensation by presenting skin-propagating vibration.

This work was supported by JST SPRING, Grant Number JPMJSP2112, JST Moonshot R&D Program under Grant JPMJMS2013, and Inamori Research Institute for Science.

References

[1] C. Bernard, E. Thoret, N. Huloux, and S. Ystad, "The High/Low Frequency Balance Drives Tactile Perception of Noisy Vibrations," *IEEE Transactions on Haptics*, vol. 17, no. 4, pp. 614–624, 2024, doi: 10.1109/TOH.2024.3371264.