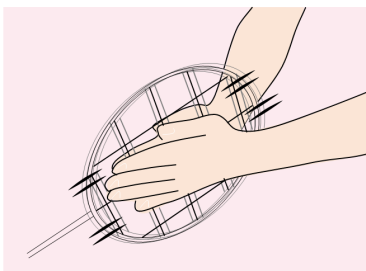


Abstract

To artificially present rich tactile textures, a tactile display that can modulate tactile textures such as hardness and roughness of various daily objects is necessary. In this study, we focused on a tactile illusion, named the 'velvet hand illusion' (VHI), which could be used to modulate tactile textures in a simple setup. We evaluated tactile textures during the VHI qualitatively and quantitatively and found that **the VHI is a phenomenon wherein the tactile texture of metallic wires being touched was perceived to be softer than it actually is, with the tactile texture of cloth.** Based on the findings, **we developed the rotating-frame method wherein tactile textures of arbitrary objects can be modulated to seem softer and smoother than they actually are.** Since the proposed method can be applied to the tactile textures of daily objects, it is expected that the method could be used in various application scenes such as product design and in-store demonstrations.

Investigating tactile perception during the velvet hand illusion

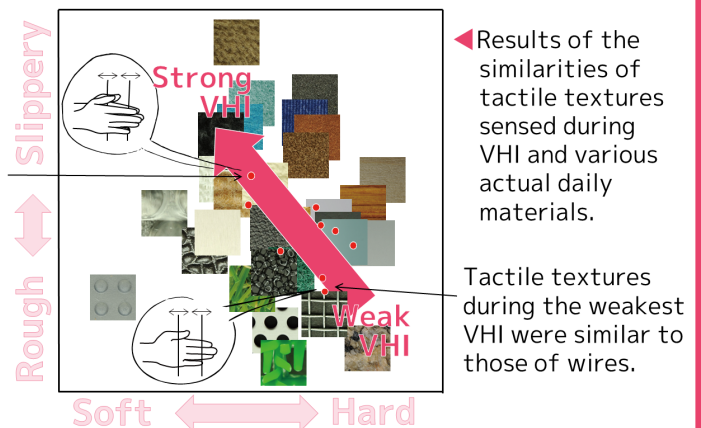
Velvet Hand Illusion (VHI)



When sandwiching moving wires between both hands, one feels **an unexpected tactile texture that is clearly different from that of moving wires.** [Mochiyama et al., 2005]

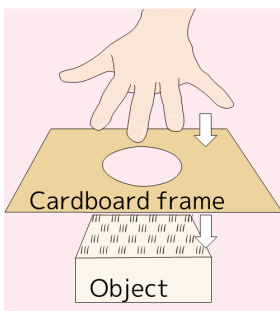
Tactile textures during stronger VHI were similar to those of boa and felt.

- We evaluated tactile textures during VHI by comparing them with tactile textures for various daily materials.
- When feeling stronger VHI, the texture of wires between both hands was perceived to be softer and warmer as if it was cloth.



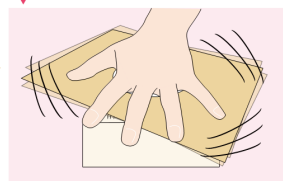
Extending VHI-like modulation from wire to arbitrary objects

Rotating-frame method (RFM)

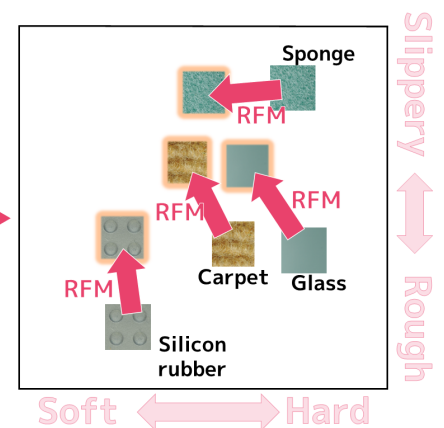


The tactile texture of an arbitrary object can be modulated when a rotating frame is sandwiched between an object and a user's hand.

Unlike moving wires which cross over the contact area between the object and a user's hand, the RFM allows the constant contact area.



Results visualizing the RFM's modulation of tactile textures for various objects.



References

- [1] T. Yokosaka, S. Kuroki, S. Nishida, "Describing the sensation of the 'velvet hand illusion' in terms of common materials," *IEEE Transactions on Haptics*, DOI:10. 1109/TOH, 2020. 3046376. Online ahead of print.
- [2] T. Yokosaka, Y. Suzuishi, S. Kuroki, "Feel illusory texture through a hole: Rotating stimulus modulates tactile sensation for touched object's surface," in *Proc. EuroHaptics2020 (WIP137)*, 2020.

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