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Diversifying Grain-Based Compliance Illusion by Varying Base Compliance

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Abstract— **This demonstration invites participants to explore a wide range of tactile sensations created by grain-based vibration feedback. By interacting with different combinations of base material compliance and algorithmic parameters, participants will feel how subtle changes in design can lead to distinctly different perceptions of softness, depth, and texture. The system builds on findings from our CHI 2025 paper, which examined how base compliance influences the perceived quality of grain-based illusions, and from our WHC 2025 Work-in-Progress, which compared implementation strategies. Participants will directly experience how tactile illusions can be fine-tuned and diversified using simple hardware and programmable feedback.**

Note: This demonstration requires a multi-plug power strip with at least six sockets to support devices including a transducer, motor, microcontroller, and a laptop.

I. Introduction

The grain-based compliance illusion simulates a sense of softness through short, force-triggered vibrations. Our CHI 2025 study demonstrated that changes in base compliance significantly change the perceived magnitude and texture of the illusory compliance, even when the vibration parameters remain unchanged [1]. This finding reveals a rich perceptual design space, where tactile sensations can be diversified by manipulating both base and illusory compliance.

As shown in Fig. 1, the illusion remains effective across various base compliance levels, producing clear differences in perceived softness. Users report not only changes in magnitude but also shifts in qualities such as depth, granularity, and heaviness. These differences emerge without any visible change in the interface, highlighting how tactile perception is shaped by subtle interactions between physical and algorithmic elements.

To extend these findings, our WHC 2025 Work-in-Progress study explored different implementation strategies under varied interaction conditions. This work suggests that not only the material under the finger, but also the software logic driving the illusion, plays a key role in modulating the overall tactile experience.

II. Apparatus

The demonstration system consists of multiple modular compliance units. Each unit includes a finger plate, a vibrotactile actuator, a force sensor, and a base material with a distinct level of compliance. When a participant presses the unit, the system detects the force input and triggers grain vibrations in real time, according to predefined illusion parameters. These parameters, such as the grain threshold or implementation logic, can be dynamically adjusted through software.

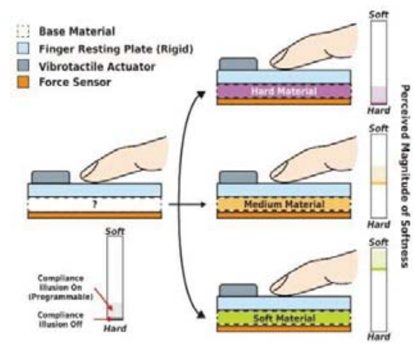

Fig 1. The grain-based compliance illusion remains effective in various base compliance, resulting in shifts in the perceived magnitude and quality of softness.

For the demonstration, we prepare several of these modules, each configured with different combinations of base compliance and algorithmic control. This allows for a direct comparison of tactile sensations across conditions. The system is managed via a microcontroller connected to a PC.

III. Demo Experience

Participants follow a guided exploration to compare how the same grain-based illusion feels across different base materials. While pressing each module with their index finger, they focus on the magnitude and texture of compliance. Even when the vibration logic remains constant, changing the base compliance makes the illusion feel deeper, lighter, or more granular. Some modules also incorporate different implementation strategies, such as adaptive grain thresholds, which can subtly influence the sensation depending on how the force is applied. This combined comparison highlights how both material and algorithmic design shape the overall tactile experience.

In the final part of the demo, participants can try a handheld version of the system that embeds the same illusion logic into a compact form. This device demonstrates how compliance illusions can be applied in portable interfaces for applications such as virtual tool feedback, object manipulation, or interactive storytelling.

References

[1] B. Mun, J. Lee, J. Kim, S. Heo, and J. Lee, “Diversifying Grain-Based Compliance Illusion by Varying Base Compliance,” in Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems, 2025.