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HapticThings: Tangibles to Deliver Grain-Based Vibrotactile Compliance Illusion

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***Abstract*—This demo showcases the compliance illusion using grain-based vibrotactile feedback delivered through a device called HapticThings. This device simulates varying levels of compliance and allows users to perceive differences in material softness. Participants will first observe mock illustrations of physical objects to contextualize the compliance experience. They will then be asked to hold two HapticThings—one in each hand—and press them with their fingertips. The device in the right hand will deliver vibrotactile feedback to simulate changing compliance levels, while the device in the left hand will remain static, serving as a hard surface baseline for comparison. Participants will feel how the strength and frequency of vibrotactile pulses affect the perception of compliance. The demonstration lasts approximately 3-5 minutes per participant and offers a hands-on understanding of how vibrotactile parameters influence compliance illusion.**

***Index Terms*—compliance, grain-based compliance, illusion, haptic, softness.**

I. Hands-on Demonstration Setup

THE grain-based compliance illusion is widely studied in the haptics domain. In our recent accepted paper to the WHC25 titled "*Physical compliance and the compliance illusion: The importance of action for perception*", we showed that the experience of compliance illusion is distinct from that of physical softness and that distinct sensorimotor processes mediate both physical softness and the compliance illusion. However, we believe that some of WHC25 attendees might not be familiar with the concept of grain-based compliance illusion. For this purpose, we are interested in demoing this type of compliance illusion to the attendees of the conference to familiarize them with the concept for a better understanding of the findings of our accepted paper. This demo can also provide an opportunity to engage with interested attendees in discussions about future directions for exploring and discovering new illusory haptic experiences.

In this demo, visitors will experience the grain-based compliance illusion created with HapticThings. HapticThings are tangible tokens for exploring grain-based vibrotactile feedback including the illusion of compliance. HapticThings consists of hardware and software components, along with a web application designed for wireless communication with a PC or mobile device. As shown in Fig. 1a, vibrotactile signals are created along the pressing action dimension. The range of pressure is provided in bins (gray lines) and when the measured pressure level transitions from one bin to the next

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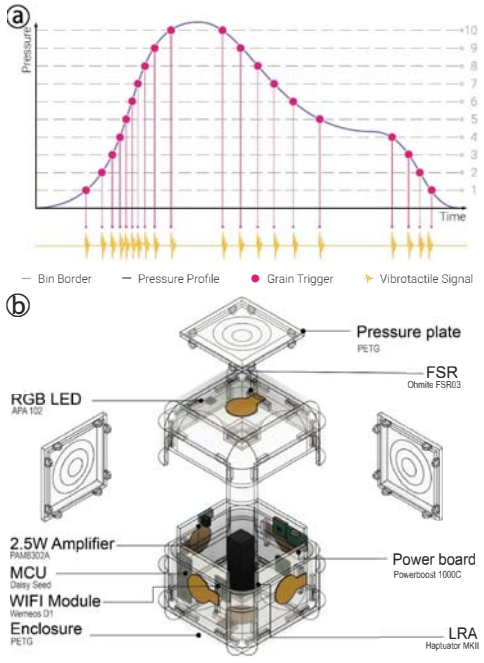

Fig. 1. (a) Visual representation of the algorithm. (b) Exploded view of a HapticThings token.

(purple line), a grain is triggered (pink). This creates a signal (yellow) that unfolds in a seemingly arbitrary manner in time but has a fixed mapping to the pressure dimension. We used the Daisy Seed to generate the analog control signal. It is then amplified by a PAM8302A amplifier to audio levels for driving the actuator (Haptuator Mark II). The Daisy has access to signals from 6 FSRS (Ohmite FSR03). The Daisy can communicate with a laptop or phone using the WiFi module (Vemos D1). The entire system is powered by a 400 mAh LIPO battery. The housings for the HapticThings were fabricated using an Ultimaker S5 3D printer (See Fig. 1b). The embedded code was written in Arduino. A web application developed in Html/CSS & JavaScript allows users to set the stimulation frequency, granularity, and pulse amplitude of the HapticThings.

II. Technical Requirements

The demo setup requires a table with two chairs—one for the visitor and one for the organizer—to facilitate interaction and discussion. Additionally, two power outlets are needed to support the equipment during the demo. Adequate space should also be allocated for displaying a poster, which will provide context and visual information about the demo.