

Sketching With Haptics: Authoring Multimodal Soft-Haptic Cues Without Explicit Parameters

Heeji Jolie Kim¹, Heeju Mun², Ji-Sung Kim², Ki-Uk Kyung² and Andrea Bianchi¹

¹Industrial Design, KAIST, Daejeon, Republic of Korea

²Mechanical Engineering, KAIST, Daejeon, Republic of Korea

(Email: jolieheejikim@kaist.ac.kr)

Abstract — Authoring haptic feedback has traditionally relied on specifying explicit parameters, with recent efforts shifting toward text-based generation. However, bodily expression is often preverbal, text alone is insufficient to capture its subtle nuances or to support rapid, exploratory articulation of as-yet-unnamed sensations. We present Scribbl, a tool for authoring multimodal haptics, built around sketching. A designer starts from a felt moment, sketches it as a pattern, refines it in words or by hand while feeling it on the body, and collects patterns that are then composed across body-worn actuators into a whole sequence, all without entering explicit parameters or wiring logic.

Keywords: haptic authoring, sketching, multimodal actuators, large language models, interaction design

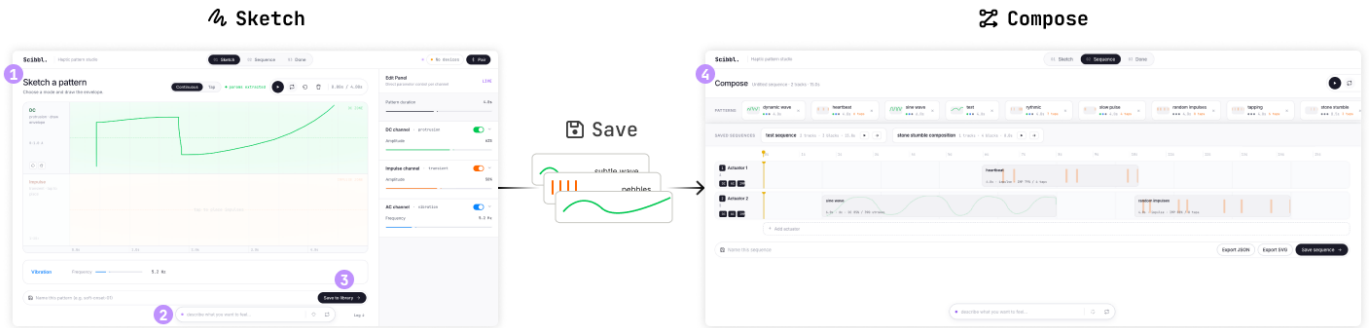


Fig. 1: The Scribbl authoring workflow: (1) sketch a pattern, (2) refine in words, (3) save to library, (4) sequence across the body.

I. INTRODUCTION

Haptic feedback has traditionally been authored by specifying low-level parameters: setting frequencies, amplitudes, or writing control logic [1], [2]. Recent work moves beyond hand-tuned parameters by driving haptics from natural language: text-to-vibration models such as HapticGen [3] generate a signal directly from a written prompt [4].

Yet words alone rarely capture a haptic experience: a sensation is felt before it can be named [5], and text is too coarse for its shape and timing. This gap is sharpest for interaction designers who treat haptics as an expressive material, especially in soma and embodied design, where practitioners work iteratively rather than toward a known target [6], [7]. Sketching fits this practice: a drawn stroke is already a time series, so its rises, falls, and rhythms map onto how a sensation unfolds. It is fast, disposable, well suited to iteration [8], and familiar to designers who think by drawing [9], [10]. With text alongside, a designer can both show and tell what they want.

We propose authoring haptic sensations by sketching, with text as a scaffold for getting started and refining. In Scribbl, a designer draws a sensation on a canvas whose channels

mirror an actuator’s modes, or describes it for a language model to draft an editable sketch, and composes patterns into sequences. Scribbl runs on a multi-actuator setup [11] rendering protrusion, impulse, and vibration, so sketches can shape rich, multimodal sensation on the body.

We contribute Scribbl, a sketch-based haptic authoring system in which designers sketch across the actuator’s modes while an LLM assistant drafts, refines, and sequences sketches into compositions, and we report a preliminary session with 20 participants.

II. THE SYSTEM

A. Authoring Workflow

Figure 1 illustrates the overall workflow loop:

Sketch a pattern. The user begins by choosing a continuous or a tap-based pattern. For a continuous pattern, they draw a protrusion curve across the timeline; the stroke is the actuator’s protrusion envelope itself, describing how it rises, holds, and recedes against the skin over time. They can add vibration and adjust its frequency with a slider, and play or loop the pattern. For an impulse pattern, they tap on the timeline to place individual impulses and set a rhythm.

Refine with words. The LLM assistant bar stays available while sketching or composing. The user can describe a change, such as “make the swell slower” or “make the taps closer together,” and the assistant updates the current editable pattern. They can also start from a description, letting the assistant scaffold a pattern, then adjust it afterwards. Drawing, describing, playing, and revising thus form one continuous loop.

Name and save. Once complete, the user names and saves it to the pattern library, then returns to the sketch view for another pattern or moves to the sequence view to build a full sequence.

Compose across actuators. In the sequence view, the user drags saved patterns onto tracks, each tied to an actuator, then positions and resizes the blocks to shape when and where sensations begin, overlap, or follow one another. They can play the whole-body composition and revise it directly or through the LLM assistant. Finished sequences can be named, saved, and exported as JSON and SVG.

B. Implementation

Software. Scribbl is a locally served web application using WebSocket to connect to a Python bridge for BLE control and model requests. Patterns are stored as JSON with modes, duration, normalized parameters, and geometry: DC strokes, AC amplitude and frequency, and impulse ticks. Commands are mapped to the actuator’s operating range; edges beyond its response limit render as rounded transitions. The firmware provides continuous DC drive at frequencies ≤ 0.01 Hz and otherwise alternates coil current for square-wave vibration; Scribbl implements impulses as nominal 80 ms DC pulses. The bridge forwards text requests to Claude Sonnet 4.6¹, whose structured JSON edits are validated and applied by Scribbl. During playback, the sequencer updates commands and triggers scheduled impulses.

Hardware. Scribbl can drive multiple wearable STEM (Soft Electromagnetic Multimodal) actuators. Each actuator consists of a moving magnet suspended within an electromagnetic coil by a compliant magnetic cap: a magnetic flexure embedded in a magnetic polymer composite that guides magnetic flux and reduces leakage. The actuator measures 22.5 mm in diameter and 10 mm in thickness, operates over a 3–7 V drive range, and provides up to 1 mm of protrusion. Each actuator was driven by a CodeCell C6 board, whose ESP32-C6 microcontroller received BLE commands from the Python bridge and updated the drive signal at a 1 kHz control-loop rate. Each CodeCell C6 board was powered by a 3.7 V, 170 mAh LiPo battery.

III. PRELIMINARY STUDY

We ran an exploratory session with 20 participants from interaction design and mechanical engineering to see how they use Scribbl (Figure 2). Patterns ranged from rhythmic impulse taps (heartbeat, pebbles) to drawn protrusion envelopes (slight curve, intricate pulsation); in the sequence *running in forest*, a 30-second two-track composition, a steady heartbeat repeats

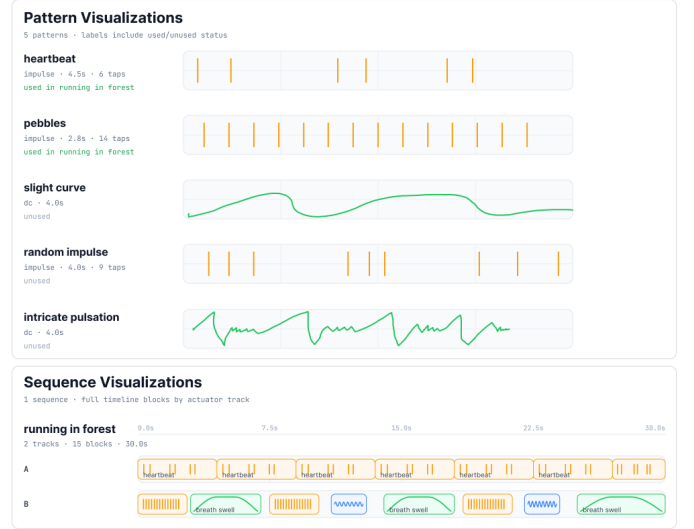


Fig. 2: Example of patterns and a sequence created with Scribbl during the session.

on one actuator while the other alternates pebbles, a breath swell, and bursts of vibration.

IV. CONCLUSION

We present Scribbl, a haptic authoring tool built around sketching. Starting with a sketch of a felt moment, a designer refines it in words or by hand while feeling it on the body, then composes collected patterns across actuators into a sequence, all without explicit parameters or wiring logic. By treating tactile sensation as something to sketch rather than specify, Scribbl points toward a more exploratory way to design multimodal haptics for the body.

ACKNOWLEDGMENT

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