ArtClue: A Pneumatic Wearable for Embodied Art Therapy

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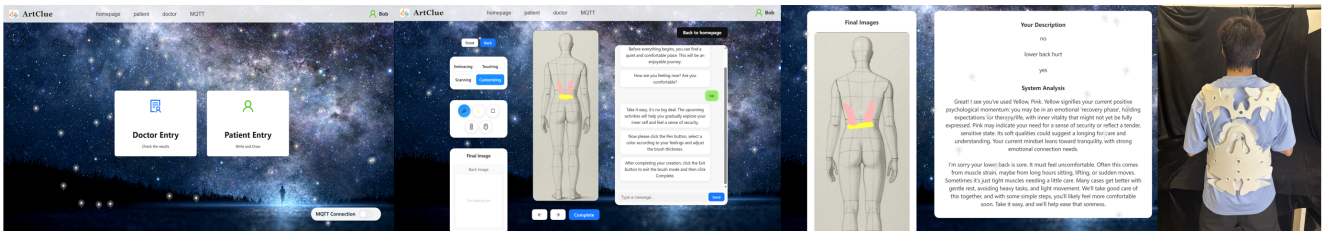

Figure 1: Website

Abstract

Interoception, the perception of internal bodily signals, is a recognized mechanism in emotional regulation, yet digital therapeutic tools rarely engage the body directly. We present ArtClue, a haptic wearable system that explores how embodied haptic feedback can support bodily awareness in the context of art therapy. The system integrates a web-based body-mapping interface, a large language model that interprets somatic descriptions from natural language, and a soft pneumatic vest that delivers real-time haptic feedback to targeted body areas. By physically translating the bodily sensations users describe into tangible pressure on the corresponding body region, the system closes the loop between somatic expression and bodily perception. We detail the system's construction, haptic pattern logic, and interaction cycle, and position ArtClue as an experimental probe for remote therapeutic contexts.

Keywords

Human-centered computing, Haptic devices, Embodied Interaction, Interoception, Art Therapy, Body Mapping, Persuasive Health

1 Introduction

People describe emotional experience through the body: shoulders "carry" stress, the chest feels "tight" with anxiety, grief sits as a "weight" in the stomach. Conceptual metaphor theory argues these expressions reflect the embodied grounding of abstract thought in physical sensation [6]. Clinical research supports this link through the concept of interoception, the perception of internal body signals such as heartbeat, muscle tension, and visceral activity, which is increasingly recognized as foundational to emotional regulation and wellbeing [2, 10]. When people struggle to notice or interpret these signals, emotional self-regulation suffers [11, 12]. This has motivated interventions such as body scan meditation, in which participants sequentially direct attention to specific body regions to strengthen their perception of bodily sensation [4].

Body mapping, a method originating in participatory health research and art therapy, draws on a similar attentional mechanism. Participants represent felt bodily experience by drawing colours, patterns, and symbols on a human outline [5]. The method was originally developed to access people's perceptions of their own bodies, including their sensations, explanatory models, and lived experience [1], and has since been recognized as an embodied form of self-narration in which the physical act of drawing on a body creates a particular kind of reflective attention [3]. Like body scan, body mapping requires deliberate somatic focusing on how specific body regions feel. But it adds an expressive dimension, externalizing internal sensation as visual form and allowing people to observe their own experience with a degree of distance. When describing what they draw, people rely on embodied metaphors: tension is "tight," pain is "sharp," fatigue is "heavy" [6].

Recent HCI work has demonstrated that digital art therapy platforms, particularly when combined with LLM-based conversational

Figure 2: Design process of the wearable device

agents, can effectively support self-reflection and emotional expression in remote and self-directed settings. Integrating AI co-creative art-making with structured conversational guidance has enabled clients to articulate feelings and engage in therapeutic homework without direct therapist presence [9]. Similarly, chatbots leveraging art therapy principles have been shown to help users identify and process emotions through guided reflection on their artwork [15]. These systems validate the potential of digital art therapy as a vehicle for remote emotional support.

However, these platforms operate entirely in visual and verbal modalities, leaving the body itself unengaged. HCI research increasingly integrates somatic principles into wellness technologies, from wearable sensors to immersive meditation apps, yet these tools often assume a universal model of bodily awareness and rarely go beyond monitoring or visualization [14]. The somatic descriptions users produce during body mapping (their "tightness," "heaviness," "burning") are captured as text but never fed back to the body physically. Meanwhile, research in affective haptics has shown that wearable tactile stimuli can influence physiological arousal and emotional states [7, 8], and that natural language can drive personalized haptic output [13]. But these systems frame haptic feedback as a direct emotional intervention (calming the user, simulating a hug) rather than as a tool that supports users in attending to what is already happening in their bodies.

This leaves an unexploited design space. If directing sustained attention to bodily sensation strengthens interoception [4], and body mapping already surfaces rich somatic descriptions, then feeding those descriptions back as targeted physical stimuli should deepen this feedback loop. This paper presents **ArtClue**, a wearable haptic system that explores this approach as an experimental probe. Rather than claiming therapeutic efficacy, we investigate how the cycle of attending to sensation, externalizing it through drawing, and receiving a corresponding physical stimulus might support bodily self-awareness in remote, self-directed practice.

2 Design Concept

The design of ArtClue is grounded in two premises. First, that sustained attention to bodily sensation strengthens interoception, so every design decision aims to direct, sustain, or redirect this attention. Second, that the somatic metaphors people use to describe their bodily experience reflect real embodied cognitive structures, so the system treats these descriptions as actionable design inputs rather than data for verbal analysis.

2.1 Wearable Design

The wearable component is a soft pneumatic vest covering the lower back and shoulders. These regions were selected because they are among the most frequently referenced in somatic metaphors of stress and tension and are common sites where people locate emotion-related bodily experience in body mapping practices. The vest uses six airbag groups arranged to follow anatomical contours, with a layout inspired by the morphology of manta rays for ergonomic surface coverage.

The airbags are fabricated from thermoplastic polyurethane (TPU) using hot-melt welding. A temperature-controlled metal soldering iron welds along preset paths on the TPU sheet, forming high-strength seals after cooling. Sealing integrity and burst pressure are verified through gradual inflation testing. Dotted surface textures locally control material stiffness: textured regions act as rigid contact points during inflation while non-textured regions stretch to form soft contact surfaces. This differentiation improves the perceptual hierarchy of haptic feedback [16]. By creating distinct tactile textures within a single inflation, the vest offers richer sensory information for the user to attend to, supporting fine-grained bodily attention.

2.2 Interaction Framework

The system's interaction follows four stages, each mapping onto a recognized element of somatic practice: attending to the body, focusing on a specific region, externalizing what is felt, and receiving feedback that redirects attention back to the body.

(1) Guided Attention. Such practices typically begin with verbal prompts that direct attention inward. Drawing on the demonstrated effectiveness of LLM-guided art therapy dialogue, ArtClue uses a large language model to initiate a conversational prompt, inviting users to describe how their body feels. The model analyses the description (e.g., "my shoulders are stiff and sore") and classifies the dominant sensation into one of three descriptors (*soreness*, *pain*, or *itchiness*) while identifying the body region. These categories represent qualitatively distinct modes of bodily sensation with different temporal and spatial profiles, allowing for differentiated haptic responses.

(2) Somatic Focusing. Body mapping requires participants to sustain attention on how a specific body area feels, translating perception into visual form. ArtClue translates this into a drawing task: the model guides the user to a digital body map canvas, directing attention to the identified region. Drawing on the body outline

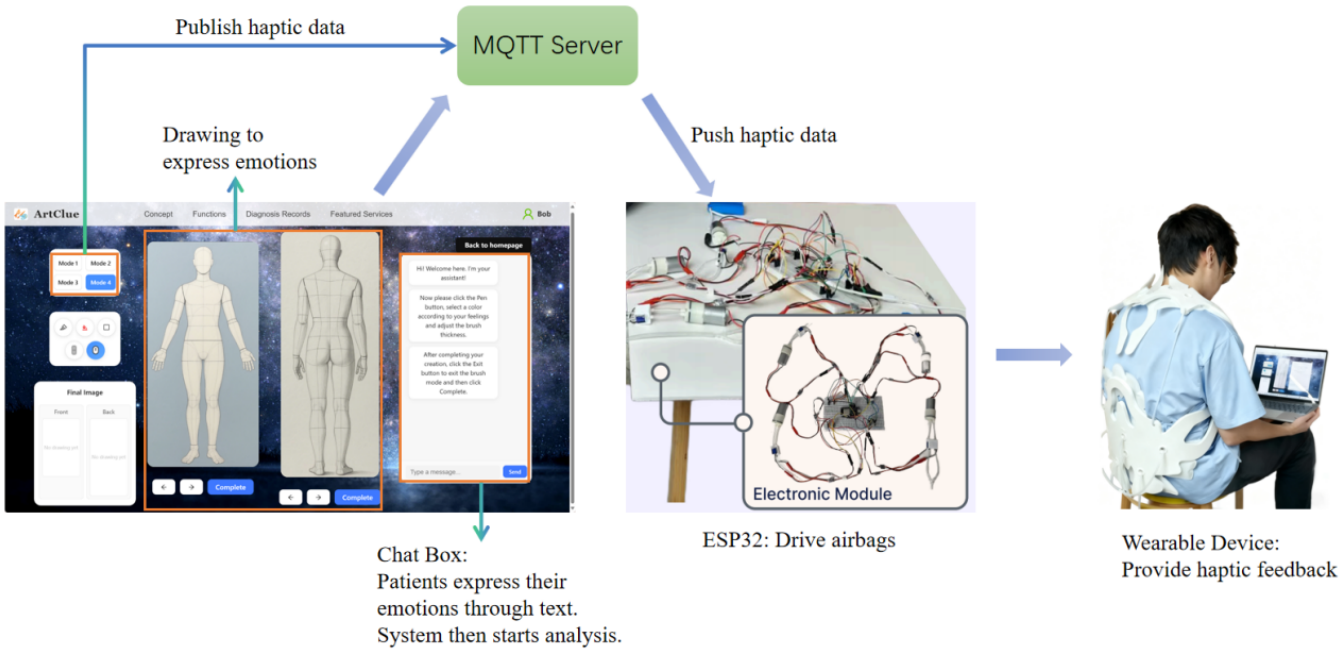

Figure 3: System overview

requires the user to make perceptual judgments about the quality, intensity, and spatial extent of sensation.

(3) Externalization. The drawing act constitutes what body mapping researchers call externalization: the translation of internal felt experience into an observable artifact [5]. This step objectifies sensation and facilitates non-judgmental observation. It also generates the system's input data: drawing location and brush colour.

(4) Haptic Re-engagement. This is where ArtClue departs from existing platforms. Upon completing the drawing, the system triggers the corresponding haptic feedback pattern on the pneumatic vest. The user receives tangible pressure on the body area they just mapped, physically translating their somatic description into a felt stimulus. The design intent is to redirect attention from the screen back to the body, completing a somatic feedback loop that existing digital tools leave open.

2.3 Haptic Pattern Design

The haptic output is governed by three parameters: **location**, **sensation descriptor**, and **colour**. Location grounds the feedback in the body, the descriptor shapes the quality of the stimulus to echo the user's own somatic description, and colour gives the user agency over rhythm.

Location is inferred from the user's drawing area on the body map (shoulder or lower back region).

Sensation descriptor determines the core haptic pattern. Each pattern is designed to echo the quality of the sensation the user described, so that the haptic feedback feels congruent with their reported experience rather than generic:

- *Soreness* → **Gentle Stroke**: upper back airbags perform slow cyclic inflation and deflation, followed by sustained lateral inflation. Soreness is typically described as gradual and diffuse; the progressive pressure changes mirror this temporal profile.
- *Itchiness* → **Wave Massage**: airbags inflate and deflate in sequential waves. Itching is characterized as restless and surface-level; the travelling wave stimulus echoes this spatial quality.
- *Pain* → **Gentle Hug**: all lateral and bottom airbags inflate slowly and synchronously. Pain metaphors emphasize localized intensity; broad, steady counter-pressure provides a contrasting embrace.

Colour acts as a frequency modulator. The brush colour selected by the user (pink, blue, yellow, green) adjusts the inflation/deflation cycle duration (4s, 5s, 6s, and 7s respectively) without changing the pattern type. This parameter gives users control over their own haptic rhythm, supporting a sense of personal agency over the experience.

The combination of these parameters (2 locations × 3 descriptors × 4 colour frequencies) generates 24 distinct haptic configurations.

3 Discussion and Conclusion

This paper presented ArtClue as an experimental probe for supporting interoception through embodied haptic feedback in art therapy. The system closes the loop between somatic expression and bodily perception by translating users' descriptions into targeted haptic stimuli. The contribution is twofold: a design approach that reframes haptic feedback as a tool for redirecting and sustaining body-directed attention rather than a direct emotional intervention; and the four-stage interaction cycle (Guided Attention,

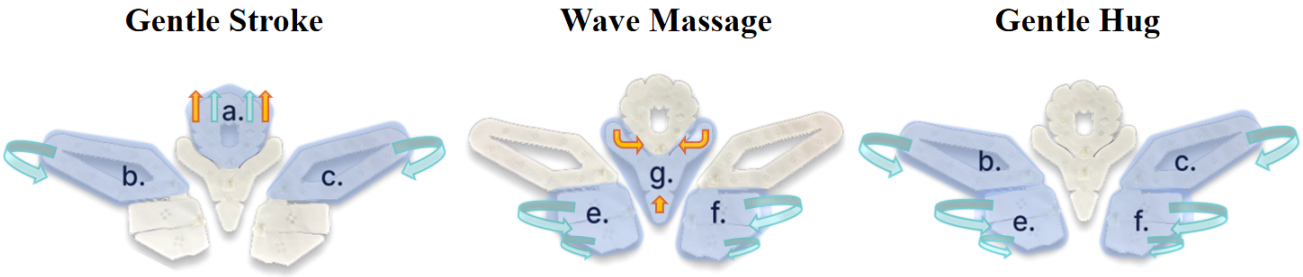

Figure 4: motion feature

Somatic Focusing, Externalization, Haptic Re-engagement), each stage grounded in an established element of somatic practice.

Recent work has demonstrated the viability of LLM-supported digital art therapy for remote emotional support [9, 15]. ArtClue builds on this foundation by adding an embodied, haptic dimension, responding to calls in this literature for tactile and sensory enrichment of digital therapeutic tools. The prototype deliberately simplifies somatic experience into three descriptors mapped to fixed haptic patterns, constraining the range of sensations the system can respond to but providing a controlled starting point for investigating whether physically grounded feedback produces qualitatively different experiences compared to body mapping alone. The use of a large language model to interpret somatic descriptions raises questions about misclassification, particularly with vulnerable users, requiring robust fallback mechanisms in future iterations. Richer continuous inputs such as brush pressure, stroke speed, and drawing density offer promising channels for more nuanced haptic responses.

Next steps include structured user studies combined with qualitative accounts of the embodied experience, to empirically assess whether the haptic feedback loop deepens self-directed somatic practice. ArtClue concretizes a design space at the intersection of body mapping, interoception, and embodied haptic interaction, one that we believe warrants sustained investigation in the persuasive health community.

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