

Demonstrating the MoTTs: Minimalist Smartwatch-based Wearables to Support Physical Rehabilitation Activities

José Manuel Vega-Cebrián
jovegac@inf.uc3m.es

Department of Computer Science and Engineering, Universidad Carlos III de Madrid
Madrid, Spain

Elena Márquez Segura
elena.marquez@uc3m.es

Department of Computer Science and Engineering, Universidad Carlos III de Madrid
Madrid, Spain

Ana Tajadura-Jiménez
atajadur@inf.uc3m.es

Department of Computer Science and Engineering, Universidad Carlos III de Madrid
Madrid, Spain
University College London
London, United Kingdom

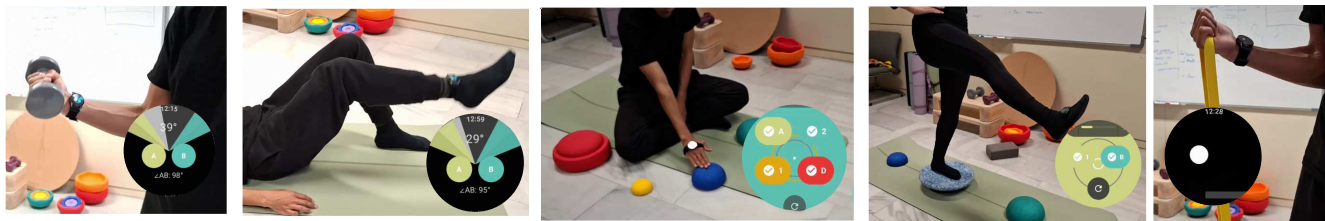


Figure 1: Example activities supported by the MoTTs: biceps curl and leg extension supported by the *Angle* MoTT; coordination activities supported by the *Points* MoTT; and a tilt game supported by the *Maze* MoTT.

Abstract

We present the Movement and Training Technologies (MoTTs), minimalist multisensory wearables that appropriate commodity smartwatches and provide movement feedback. Developed through embodied co-design in neurorehabilitation, the MoTTs are guided by minimalism, open-endedness, and generalisability. At the workshop, we bring a live demo and contribute with a reuse-oriented, sustainability-driven perspective on personalized health wearables.

Keywords

Wearables, Embodied Interaction, Health, Rehabilitation, Physical Training, Assistive Technologies, Body Perception, Sound, Haptics, Multisensory Feedback, Smartwatch, Wear OS

1 Introduction

We would like to contribute to the *Everyday Wearable for Personalized Health and Well-Being* workshop at CHI 2026 with a live demo of the Movement and Training Technologies (MoTTs), minimalist wearables that provide multisensory feedback in response to movement while leveraging the sensing, computation, and actuation capabilities of already-existing smartwatches (Figure 1.) Rather than introducing new custom hardware, the MoTTs appropriate commodity devices as infrastructural substrates for interactive movement support in contexts such as physical rehabilitation and training.

Movement-based application domains have witnessed an explosion of technological prototypes and approaches in recent years.

While this expansion demonstrate technical capability and innovation, it also aligns with a dominant paradigm of technological expansion. We contend that such growth is difficult to reconcile with the urgent need to design within ecological and planetary limits [5]. Inspired by calls proposing alternative approaches for technological development [2, 5], and works arguing for the value of reusing devices [1] rather than creating new custom hardware [3], we propose to explore how wearable health technologies might be conceived not as additional artifacts, but as reconfigurations of devices already embedded in everyday life.

The MoTTs are three minimalist prototypes designed to support physical rehabilitation and training activities by providing multisensory feedback in response to movement. They originated in a Research-through-Design process with a focus on supporting physical rehabilitation after peripheral nerve transfer surgery in the upper limbs [8]. Based on three design drives: *minimalism*, *open-endedness*, and *generalisability* [8], each MoTT was designed for a different rehabilitation goal, including passive motion therapy, repetition of precise hand movements, and isolation of upper limb movements. The design of the MoTTs took inspiration in previous works about minimalist technology probes, which proved apt for reappropriation in multiple application domains beyond rehabilitation [4, 6]. Preliminary embodied explorations with experts suggest that the MoTTs can also support a variety of rehabilitation and physical training activities, such as upper and lower limb motor rehabilitation, yoga, Pilates, pelvic mobility training, and strength training in general.

By demonstrating the MoTTs in situ, we seek to stimulate discussion around how everyday wearables—particularly commodity



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devices such as smartwatches—can be repurposed to support personalised, adaptive healthcare while remaining attentive to sustainability, scalability, and inclusivity. Our contribution to the workshop is therefore twofold: (1) a hands-on instantiation of minimalist, adaptive movement support built on existing hardware infrastructures, and (2) a set of design drives that articulate how sustainable and generalisable wearable health technologies might be developed within, rather than beyond, the material and ecological limits of everyday computing. At the same time, we aim to explore the broader design space of wearable health technologies through engagement with other participants' prototypes, to connect with fellow design researchers in this area, and to learn how different projects articulate their design drives and respond to questions of sustainability and designing within ecological and resource constraints.

2 The MoTTs

The MoTTs consist of a Wear OS app running on off-the-shelf smartwatches (Samsung Galaxy Watch 7, 40mm) attached to velcro straps. The app [7] is free and open source software, compatible from smartwatches running Wear OS 3.0 and later. The MoTTs are stand-alone and do not require any connection to other devices or to the Internet. Relevant application parameters, such as sensitivity thresholds, are saved in-device. Sound and vibration are emitted from the device, although Bluetooth headphones or speakers can be connected as alternative audio outputs.

2.1 Angle

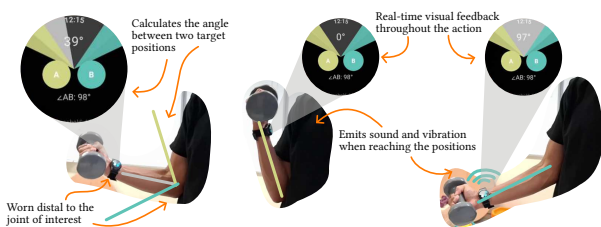


Figure 2: Angle MoTT

The *Angle* MoTT provides multisensory feedback in the form of visuals, sound and vibrations to support repetitive movements between two target positions (Figure 2.) It calculates the angle between the two targets and also the current angle of the body part with respect to them, based on a tilt angle of the device. One can configure the location of the target points, the detection threshold to trigger the feedback, and the number of repetitions for the activity.

2.2 Points

The *Points* MoTT provides multisensory feedback when arriving to up to four positions which can be chosen and configured depending on the target activity (Figure 3.) The saved positions depend on the absolute orientation of the device—a quaternion—and therefore allow for rotations around any direction.

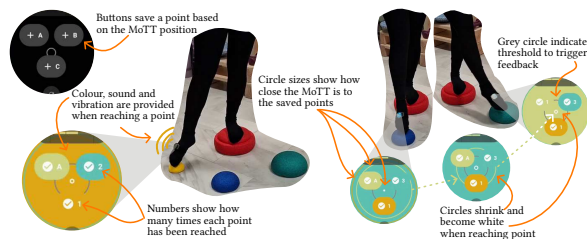


Figure 3: Points MoTT

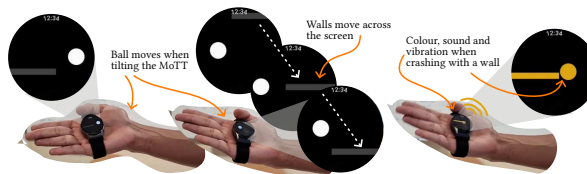


Figure 4: Maze MoTT

2.3 Maze

Finally, the *Maze* MoTT consists of a minimalist and movement-based game, focusing on the coordination of repetitive flexion-extension movements (Figure 4.) The game has three parameters that can be adjusted depending on the activity: (1) Sensitivity: how much the ball responds to the tilting of the device; (2) Speed: how fast the obstacles move; and (3) Duration: how long the game lasts.

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