HAPLÓS

Vibrotactile Somaesthetic Technology for Body Awareness

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How can somatic approaches lead the design of a wearable technology for facilitating somatic learning? We explored this question by taking educational strategies of one somatic approach— the Feldenkrais Method (FM) [2, 5]—and integrating it with artistic research on "somatic costumes... [as] portals of perception" [1] and neuroscientific research on the effects of vibrotactile stimuli on the organization of the sensorimotor cortex [3]. The result was Haplós, a wearable device that aims to develop body awareness through the application of programmable, pleasurable tactile patterns to the skin using small vibratory motors. Table 1 maps how somatic principles from FM were translated into design principles for Haplós. We argue that because Haplós both creates an aesthetic experience as well as facilitates body awareness by heightening proprioceptive sensitivity, it exemplifies what we propose as a *somaesthetic* [4] *technology*. Haplós was initially tested in one quasi-experimental workshop involving deception. Using the floor as a "kinesthetic mirror" [5], 8 participants were asked to notice their awareness of their body before and after experiencing Haplós vibrations on only one side. Participants were initially told that the unilateral stimulation was not deliberate and merely due to a technical error. Generally, participants reported feeling more aware of the area of their body that was stimulated, and even reported experiencing more awareness in parts of themselves that were not stimulated but which belonged to the same side laterally. These reports were captured both in verbal reports and through visual representations they created of their perception of their body's contact with the ground (Figure 4). For more details, please refer to the full paper (*QR code right*) or visit cognovo.eu/project-8.

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Table 1. Mapping somatic educational strategies to Haplós design principles

Educational strategies used in the Feldenkrais Method for developing body awareness	Related design principles for the technical specifications for and usage of Haplós
To increase kinesthetic and proprioceptive sensitivity, first reduce muscular activation in the extensors of the torso by lying down horizontal [2, 5]. Create a learning environment that affords safe, distraction-free somatic attentiveness.	To increase sensitivity to vibrotactile stimulation, reduce muscular activation in the extensor muscles of the back by supporting the torso through clothing, furniture, or other apparatuses (Figure 1). In addition, Haplós should be used in a quiet room.
Start with movements of the torso (pelvis-spine-neck), which will likely stimulate movement and sensation in the more distal parts.	Apply vibrotactile stimuli on the midline of the back with emphasis on the upper thoracic spine, since it is a part of the user that they usually do not get to touch and explore themselves.
Increase the student's ability to perceive subtle differences in kinesthetic and proprioceptive stimuli by moving just enough that they notice the movement.	Strength and duration of vibrotactile stimulation should be just to enough to draw attention to the vibrated body part. Space vibrotactile motors just at the threshold of two-point tactile discrimination on the torso (2-3 cm) (Figure 2)
Ask the student to start with a simple movement, advance to more complex variations of that movement, and then revisit the initial movement in order to find the ease of movement	Stimulate the user's skin with structured patterns of vibrotactile stimuli that progress from the simple to the complex, before returning to the initial simple pattern.
Facilitate self-curiosity and playful self-exploration in the student so that they can attend to their experiences in a value-free way	Present Haplós not as a therapeutic tool but as a playful device. Make the patterns interesting to attend to by programming them to be "musical"—e.g., finding the balance between repetition and variation.
Ask the student to move always within the limits of comfort and ease, resting whenever they feel tired or when they feel their attention waning, promoting reorganization in the sensorimotor cortex	Provide users the option to create and change patterns on the fly (Figure 3), and to silence the motors at any time in order not to overstimulate the user.
Repeat a movement several times in order to notice differences in sensation as well as when there is a gaps in their kinesthetic awareness	Take advantage of the user's ability to gradually identify and anticipate elements in a pattern by playing a pattern more than once before moving on to a new pattern, in order to train the user to uniquely distinguish the motors from each other
Take advantage of the bilateral symmetry of the body by moving only one side at a time to create differences in sensations that can be compared across midsagittal plane (a "one-sided lesson") [2, 5]	Apply the vibrotactile stimuli on only one side of the torso (see Figure 4).

Figure 1. Haplós attached to a modified, commercially-available back support garment.

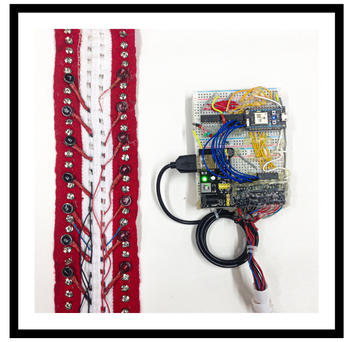

Figure 2. Haplós hardware and textile components.

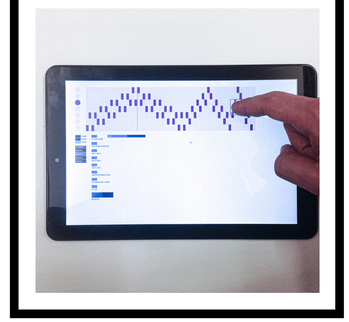

Figure 3. Haplós controller and sequencer. Patterns and pattern playback speed can be adjusted on the fly.

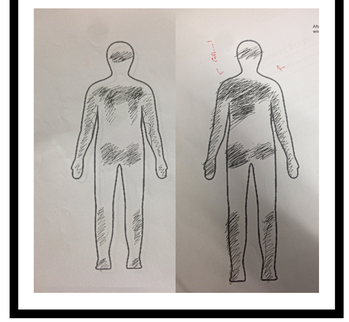

Figure 4. One workshop participant's drawing representing their perception of the contact of their body on the ground before *(left)* and after *(right)*.

References

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