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# Wearable Confidence — Concept and Prototype Design

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**Abstract.** We present Wearable Confidence - a vibrotactile display for facilitating self-confidence through applying emotionally resonant vibrotactile feedback generated from natural soundscapes and music pieces. The short-term research objective is to test how emotionally resonant vibrotactile stimuli influence the physiological parameters of a person correlated with various affective states. The objective of the demonstration is to offer the first-hand experience of the interaction with the Wearable Confidence prototypes and contribute conversations around designing vibrotactile body-centric technologies for self-perception change.

**Keywords:** Body-centric · vibrotactile display · affect.

## 1 Introduction

The importance of touch for humans has been demonstrated in numerous studies [7,6]. One of the powerful properties of touch is to communicate and influence the emotional state of a person. The researchers from the field of affective vibrotactile technologies utilize the knowledge about physiological aspects of tactile sense in the design of novel affective touch technologies for the purposes of emotion regulation, enhancing remote communication and more [2].

Prior research shows some consistent results on how various combinations of engineering parameters (e.g., amplitude, frequency, placement) influence the affective state of a person, specifically the levels of arousal and valence [5,4]. We also know how to simulate types of touch to elicit various sensations (e.g., pleasant touch) [3]. While some knowledge about the design space of vibrotactile stimuli and their effect on perception is well-established [10], there are many remaining areas worth investigating further. One of them includes understanding how to achieve (or influence) a specific affective state by using different emotionally resonant natural sounds in the form of vibration [4]. We plan to investigate this question in our research. Here we present Wearable Confidence - a conceptual dress and a functional jacket meant to facilitate self-confidence through implicit vibrotactile sensations applied to the body. The sensations are generated from various emotionally resonant natural sounds and music pieces.



Fig. 1: Wearable Confidence concept dress. Photo credit: Marin Sild.

## 2 Envisioned Applications

We envision that the concept of Wearable Confidence can be used in two main scenarios — for the purposes of emotion regulation and immersive experiences.

In the case of emotion regulation, imagine such a situation. You are about to go for an important interview and feel nervous and even insecure. Your “Wearable Confidence” jacket that you currently wear knows about it because it has access to your daily calendar. It also knows your current physiological parameters and decides (or you give an explicit command to it) to make you feel more confident. The jacket does it by applying specific emotionally resonant tactile stimulation for a specific duration so that by the time you reach your interview destination, you feel ready to conquer the world!

In the case of an immersive experience, we envision a wearable that can make one feel what others feel. In this case, we name the display “Wearable Emotion”. Imagine you are watching an online performance. During this performance, both spectators and the performer wear an affective vibrotactile display. Such displays can translate the emotional state of the performer back to the audience and the other way around, making everyone’s heart and soul beat in unison.

These are only two examples. If we know how to influence specific affective states with emotionally resonant vibrotactile stimuli, the applications are endless. We can enrich remote communication, help the elderly feel less lonely, influence our mood, and even become more empathic.

## 3 Design Rationale

In the first stage of our research, the primary goal is to design and test a body-centric vibrotactile display that allows a person to feel more confident in various contexts. For that, we developed two prototypes - a concept dress and a functional jacket. Follow this link <https://www.youtube.com/watch?v=tg166Rj901k> to get more details on our design process.



The dress is meant to showcase visually how a discrete stimulation of the body can make a person feel more confident and evoke discussion around the topic. The dress as a fashion piece is meant to not attract attention. The confidence, in this case, comes not from the visual forms, but from the inside, by means of vibrotactile stimulation sensed by the wearer only. The functional prototype is designed in a form of a sleeveless jacket, constructed of thin stretchy material.

A grid of six (2 by 3) miniature voice-coil vibrotactile actuators (model: TEAX13C02, Tectonic Elements, UK) are attached between two thin layers on the upper rear of the jacket. We chose these particular actuators because they provide a wide range of frequencies and the ability to manipulate the amplitude and frequency separately (as in LRA type of vibration motors) as has been proven in prior research [3]. We chose to place the actuators on the wearer’s upper back because it allows more space for stimulation as well as placement by the shoulder blades may provide greater radiance of the sensation. Also, as we plan to apply a longer duration (20 seconds) of stimulation, the lower sensitivity of skin receptors on the back may be beneficial. The rationale behind the longer duration of stimulation was based on the prior work that showed that longer duration elicits a stronger emotional response to the vibrotactile stimuli [4].

## 4 Future Work

We are currently preparing for a study to categorize natural sounds and music pieces to be perceived as vibrotactile feedback to elicit various combinations on the arousal and valence circumplex model [8]. The goal of this study is to select the most effective vibrotactile stimulations to influence the extreme states within the arousal and valence dimension. We will use an existing open-source database of sounds, DEAM [1] where each sound has a specific arousal and valence rating, assigned through a self-report by the participants. We will select several sounds that represent opposites in terms of valence-arousal parameters and will transform them into vibration. In addition to self-report, we will gather physiological data [9] to see how the applied stimuli influence the skin conductance level (an indicator of arousal), facial tension (an indicator of valence), and heart rate variability (an indicator of stress).

## 5 Engaging with Wearable Confidence Prototypes

Both the dress and the jacket will be demonstrated. The dress is meant to evoke a discussion around the topic and the jacket will serve as a testbed for exploring how emotionally resonant vibrotactile stimuli may influence affective states. Specifically, during the interaction, a participant will have an opportunity to wear a jacket and feel various sensations on the back while his or her physiological data is taken. We will also ask the participants to report on their experiences. The physiological data will be gathered through a skin conductance sensor and heart rate sensor. The output will be predefined and controlled by the researcher. The participants will be asked to fill out a consent form. We

anticipate that participants will get the following insights by interacting with the Wearable Confidence prototypes:

- Getting an awareness about their bodily signals when exposed to emotionally resonant vibrotactile sensations;
- Getting an awareness about the key vibrotactile parameters that influence the affective state of a person;
- The demonstration may spark curiosity in the topic, produce discussion and result in future research cooperations.

## References

1. Aljanaki, A., Yang, Y.H., Soleymani, M.: Developing a benchmark for emotional analysis of music. *PloS one* **12**(3), e0173392–e0173392 (mar 2017). <https://doi.org/10.1371/journal.pone.0173392>, <https://pubmed.ncbi.nlm.nih.gov/28282400>
2. Eid, M.A., Al Osman, H.: Affective Haptics: Current Research and Future Directions. *IEEE Access* **4**, 26–40 (2016). <https://doi.org/10.1109/ACCESS.2015.2497316>
3. Israr, A., Abnoui, F.: Towards pleasant touch: Vibrotactile grids for social touch interactions. In: *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*. p. LBW131. ACM (2018)
4. Macdonald, S.A., Brewster, S., Pollick, F.: Eliciting emotion with vibrotactile stimuli evocative of real-world sensations. In: *Proceedings of the 2020 International Conference on Multimodal Interaction*. p. 125–133. ICMI '20, Association for Computing Machinery, New York, NY, USA (2020). <https://doi.org/10.1145/3382507.3418812>, <https://doi.org/10.1145/3382507.3418812>
5. Mazzoni, A., Bryan-Kinns, N.: Mood Glove: A haptic wearable prototype system to enhance mood music in film. *Entertainment Computing* **17**, 9–17 (2016). <https://doi.org/https://doi.org/10.1016/j.entcom.2016.06.002>, <http://www.sciencedirect.com/science/article/pii/S1875952116300209>
6. Montagu, A.: *Touching: The Human Significance of the Skin*. Perennial library, HarperCollins (1986), [https://books.google.ee/books?id=XU7Z\\_aqCYggC](https://books.google.ee/books?id=XU7Z_aqCYggC)
7. Morrison, I., Löken, L.S., Olausson, H.: The skin as a social organ. *Experimental Brain Research* **204**(3), 305–314 (2010). <https://doi.org/10.1007/s00221-009-2007-y>, <https://doi.org/10.1007/s00221-009-2007-y>
8. Russell, J.A.: A circumplex model of affect. *Journal of Personality and Social Psychology* **39**(6), 1161–1178 (1980). <https://doi.org/10.1037/h0077714>
9. Wagner, J., Jonghwa Kim, Andre, E.: From physiological signals to emotions: Implementing and comparing selected methods for feature extraction and classification. In: *2005 IEEE International Conference on Multimedia and Expo*. pp. 940–943 (2005). <https://doi.org/10.1109/ICME.2005.1521579>
10. Yoo, Y., Yoo, T., Kong, J., Choi, S.: Emotional responses of tactile icons: Effects of amplitude, frequency, duration, and envelope. In: *2015 IEEE World Haptics Conference (WHC)*. pp. 235–240 (2015). <https://doi.org/10.1109/WHC.2015.7177719>