

Advanced haptic feedback systems for mindfulness practices

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Abstract—This project explores the development of novel haptic interfaces designed to enhance mindfulness practices using biofeedback technologies. Work previously carried out with meditation experts found the physical sensations that was experienced during meditation such as a sinking feeling when beginning the process. Using haptic actuators like vibration or thermal devices, we aim to create innovative technology that produce these meditation feelings through interactions. This project will aim to develop these haptic actuators to facilitate meditation and hopefully enhance the process of meditation.

I. INTRODUCTION / BACKGROUND (SYTLE: HEADING 1)

Haptic Interfaces have been widely used in the world but the most popular use is likely to be VR. Using haptic actuators on the VR headset and the controllers gives the user an immersive gaming experience and has only been developed more since VR was first ever made possible. Because of this development, we definitely have other uses for these haptic actuators and the aim of this project is to see how they can benefit the process of meditation and mindfulness.

Haptic interfaces have been used largely for affective interaction but their application to mindfulness technologies has been limited. This project will explore novel technologies to support the communication of different mental states during mindfulness.

This project builds on our previous work we conducted with meditation experts (awarded Honourable Mention at DIS2020 Conference), whose findings show the physical sensations that emerge during meditation and how they may facilitate the practice. Key examples are a sensation of sinking down when starting the meditation practice, and a tingling sensation in the hands and a warm feeling in the chest when becoming mindful.

In this project, we will be working with neurofeedback or biofeedback technologies (such as EEG, heart rate or respiration sensors) and haptic actuators such as soft robots, vibration or thermal ones to develop exciting new interactive technologies to facilitate meditation. The use of biofeedback will facilitate providing personalized feedback based on one's experience during meditation. The project will focus on the exploration of blending haptic actuators with different materials to create novel materials that provide artificial touch sensations that emerge during meditation.

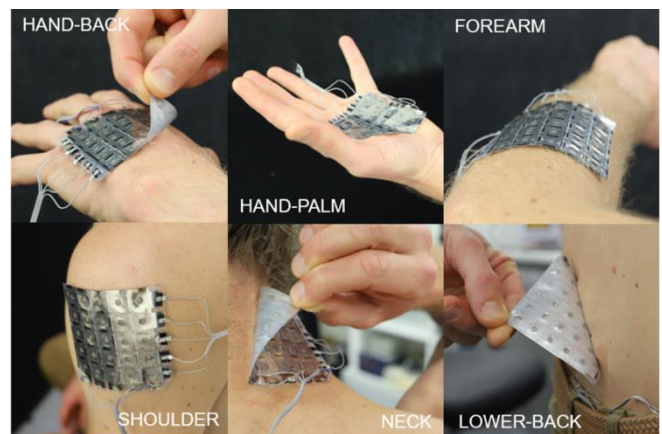
II. RELATED WORK

Some work that I found useful to read over is a research article written by Caludia Roquet and Corina Sas which gave me some insight into the different levels of meditation and how heat actuators can map the feelings in a pattern.

I also looked at an article that gave a comprehensive overview of haptic actuators including what they are, how to use them, and an evaluation of each different type.

III. IMAGINGED OR EXISTING PROTOTYPE SKETCHES/DRAWINGS/PHOTOS

I haven't built any prototype for the project but when deciding what I wanted the prototype to look like, I wanted the design to match with the mediational process. For example, meditation is supposed to be calming and peaceful with a lack of movement so I wanted the model to be exactly that. It shouldn't be moving your hand in order to feel some sort of effect. This is why I decided to look at many haptic interfaces being placed around your body as shown in the image.



Using this model, we would be able to use different actuator types around the body that would suit the feeling we want to create from meditation. For example, we may use a thermal actuator on the neck to bring on a calmness effect or we could use a vibration actuator to replicate the tingle feeling in your fingers. These actuators could be applied before the meditational process begins and it is a way of just enhancing the mindfulness feeling.

IV. RESPONSIBLE INNOVATION

I believe this research would be very beneficial to society since it is a mindfulness technology. The main aim is to improve the meditational process but the research could also have great implications into other aspects of real life. The technology brings on a calming effect which could be beneficial into helping people with anger issues, or are even just struggling with a mental illness since it would bring on those relaxed feelings.

In terms of environmental sustainability implications, there isn't too many issues with this haptic interface. There are some general issues like the difficulties in gathering these rare and raw materials and the energy that is consumed to build and use the interfaces. However, the technology would be relatively small and they could be used to greatly benefit the quality of life for people within the meditational process or with other possible implications.

V. AUTHOR BIO(S) / EXPERIENCES

My name is Kieran Newcombe and I am a student at Lancaster University studying Computer Science at an undergraduate level.

Personally, as a student, I am unsure of what career path I want to choose but when selecting a final year project, this project genuinely interested and excited me. Truthfully, I have very little prior knowledge or experience in this field but the prospect of creating technology such as the one I have talked about here is something I really want to learn more about.

VI. ACKNOWLEDGEMENTS

The main acknowledgement I would give is to Corina Sas who is a professor at Lancaster University. The project that I have talked about here is one that she created and offered out to students for the final year project. I have just explained it the best I can with the limited knowledge I have on the subject area as the project does not start until next year.

VII. REFERENCES

VIII. [1] ROQUET, SAS:

(Interoceptive Interaction: An Embodied Metaphor Inspired Approach to Designing for Meditation, 2022)

[2]

(Guide to Haptic actuators in product design – Feedback actuators, 2024)