# Reconnecting the Body and the Mind: Technology to Support Mindfulness for Stress

**Karen Anne Cochrane**
University of Sydney
Sydney, Australia
karen.cochrane@sydney.edu.au

## ABSTRACT

Mindfulness meditation has the potential to help practitioners cope with their stress. Currently, projects often use corrective feedback models to help people understand when they are out of a mindfulness state. My dissertation uses research by design to build a technology intervention for mindfulness meditation that adopts a strategy of gently guiding and supporting the user's in-the-moment experience of practising meditation through a natural soundscape that responds to the user's brainwave activity collected from the Muse EEG Headset.

## CCS CONCEPTS

• **Human-Centered Computing**; • **Interaction design**; • **Interaction design process and methods**; • **Participatory design**;

## KEYWORDS

Mindfulness meditation; research by design; soundscape; wearables


*CHI'19 Extended Abstracts, May 4–9, 2019, Glasgow, Scotland UK*

ACM ISBN 978-1-4503-5971-9/19/05.
https://doi.org/10.1145/3290607.3299083

**ACM Reference Format:**
Karen Anne Cochrane. 2019. Reconnecting the Body and the Mind: Technology to Support Mindfulness for Stress. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI'19 Extended Abstracts), May 4–9, 2019, Glasgow, Scotland Uk.* ACM, New York, NY, USA, 6 pages. https://doi.org/10.1145/3290607.3299083

## MOTIVATION AND PROBLEM STATEMENT

In our daily lives our experiences can be negatively affected by stress. However, stress is not always negative; it can drive us to be better at the task at hand. Our response to stress ranges from positive to negative and some people struggle with developing coping strategies to manage this fluctuating landscape. In situations where people suffer from chronic stress, they can develop depression and anxiety disorder [2].

An established way for people to manage stress, or a more serious mental health disorder such as anxiety and depression, is mindfulness meditation. Mindfulness is described as "bringing oneâĂŹs complete attention to the present experience on a moment to moment basis" [10]. The practice of mindfulness teaches the importance of accepting and becoming aware of any thoughts, emotions or sensations that may arise in the present moment with non-judgement. It is about bringing attention and awareness to the present without reverting to auto pilot [9].

My research explores how interactive technologies can support the daily practice of mindfulness towards the potential management of stress. My intention is to translate mindfulness principles into experience design and develop a framework to design technology to support mindfulness meditation. To address this, I am interested using a commercial wearables that are worn by the user, and assist with the management of stress. Specifically, I would like to explore the use of brainwave data (EEGs) to develop individualised soundscapes for use when people are practising mindfulness. When a beginner practices mindfulness meditation, it might take months for them to see any health benefits [8]. Therefore, technology interventions have the potential to keep novice mindfulness meditators consistent with their practice.

## RESEARCH QUESTIONS

(1) How can the use of interactive soundscapes assist with the daily practice of mindfulness towards the potential management of stress?
(2) How can interactive soundscapes developed using EEG data foster a quality of experience that leads to a state of being more present in the current moment?
(3) How can mindfulness principles be incorporated into design principles in order to design technology that effectively supports mindfulness?

**Sidebar 1: Novice practitioner listening to the soundscape.**

## BACKGROUND RESEARCH

Currently in human-computer interaction, there is a convergence in the field of mindfulness and technology. In secular mindfulness practice, technology interventions are becoming more prevalent, especially those that assist users with their mental wellbeing [3]. Researchers are developing technology interventions that make users aware of their inner processes such as brain waves, muscle movement, heartbeat, breathing, and skin conductance.

Electroencephalography (EEGs) that measure the electrical activity of the brain also provide useful brainwave data and have the potential to develop interactive mindful experiences. The HCI field has evolved to include Brain-Computer Interface (BCI). Currently in BCI, projects are being developed for mindfulness interventions using virtual reality [7, 11] and interactive soundscapes for meditation and meditative walks [4, 12]. Currently, these research projects are all tested in lab environments with expensive equipment. There is little research on how mindfulness wearable technology could be used in homes and everyday environments outside the lab. Current trends for researchers teaching mindfulness meditation to novices is to use a corrective feedback model where sound interventions become more pleasurable the longer the practitioner remains in a calm state [1, 12]. Therefore, I am interested in designing a technology intervention for mindfulness meditation that adopts a strategy to use the soundscape to gently guide the novice practitioner through a mindful listening exercises without using corrective feedback.

Ambient soundscapes are "designed to encourage relaxation and even sleep...its sounds and lyrics (where they exist) ...[emphasise] a special place both generic and real, that are remote from urban [centres], and physically attractive - usually involving mountains, falling or flowing water (in streams rather than rivers), rain forests, coasts, seashores and oceans, occasionally deserts, and more generally wilderness" [6]. There is potential to apply ambient soundscapes in computationally interactive ways to support the practice of mindfulness.

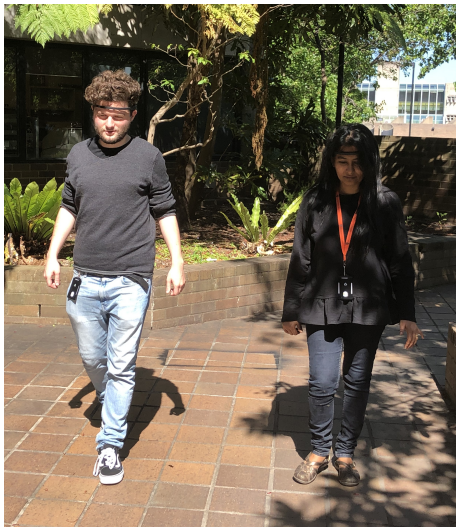
## RESEARCH APPROACH AND METHODS

### Phase One

The research project is divided into four phases. In the first phase, I used thematic coding to develop a literature review on the current research in HCI on mindfulness meditation. The literature review has been completed and currently it is being edited for publication.

### Phase Two

In phase two, I designed an interactive ambient soundscape that depicts a calm day at the beach (Sidebar 1). Both questionnaires and open-ended interview questions were collected. This phase began with a preliminary study that included four participants that went through the iterative design process



**Sidebar 2: Preliminary testing of walking meditation.**

three times. Preliminary results can be read in the published paper *Sounds in the Moment: Designing an Interactive EEG Nature Soundscape for Novice Mindfulness Meditators* [5] Finally, in the final section of phase two, I completed a study where twenty participants tested the mindfulness experience. Currently, I am analysing the data from the study and preparing phase three and four. With the data from phase two, I am planning to build a framework for designing technology to support mindfulness.

### Phase Three

In the third phase, I plan on giving participants the devices to take home to practice mindfulness meditation for four weeks. During the process, I will collect qualitative and quantitative data.

### Phase Four

In the forth phase, I plan to design a walking meditation interactive soundscape where I will test the framework for designing technology to support mindfulness in a public setting rather than in individual homes to help validate the framework. I am in the preliminary phase of recording participants EEG data while they are walking so that I develop the interactive soundscape (Sidebar 2).

## RESEARCH AIMS

The aim of my research is to use EEG data to develop an individualised soundscape in order to create an environment that facilitates the practice of a positive coping strategy, specifically, mindfulness meditation. EEG data is able to depict whether a person is engaged in an experience or distracted [1]. In this research project, a BCI interface will be designed to enhance the mindfulness practice of people who experience stress. Using an iterative design process with novice mindfulness practitioners, EEG data will be collected from the participants using the Muse Headset to create interactive ambient soundscapes. The lived experience can be defined as "how individuals make their actions unique and personal experiences through their own particular interpretations, feelings, and value judgements" (McCarthy and Wright 2005). In this exploratory project, I am interested in how digitally-controlled ambient soundscapes can support the practice and experience of meditation without using corrective feedback. The sound will dynamically change in response to the individualised EEG data of the participant. Therefore, to truly understand if this is a useful way for participants to learn meditation, it is important to not only collect quantitative data but also collect qualitative data of the participants' lived experience while using the artefact.

## PRELIMINARY RESULTS

The results from my preliminary study indicated that my alternative approach may have potential. For example, participants found that they mirrored their breathing pattern to the waves in the soundscape. Therefore, slowing down the waves help participants take deeper breaths [5]. I hope that analysing

the longer study will help us unpack more justifications for my alternate approach, and help create a framework for designing technology to support mindfulness. On review of my phase two study, I noticed that participants would like some customisation. For example, some individuals requested a different breathing exercise during the guided meditation at the beginning of the session, while others did not appreciate the bell which started and ended the meditation. Another interesting result which we will examine further is the idea that participants are building a narrative around the soundscape. For example, one participant stated that during the listening exercise, they were pretending they were sitting on a deserted island with a playful, energetic dog.

## DISSERTATION STATUS AND NEXT STEPS

I am currently in the third year of my PhD program. My next step would be to finish analysing phase two data and unpack the comments into proper findings for a paper. Once that is complete, I will make the appropriate modifications to the design and start phase three. I will also continue to analyse the walking data and begin to program phase four of the study.

## CURRENT AND EXPECTED CONTRIBUTIONS

My contributions to the field of HCI include the development of a design and evaluation framework for technology supported mindfulness. I also contribute to the field of health care and psychology by continuing the discussion on how technology can assist health and wellbeing.

## ACKNOWLEDGEMENTS

Thank you to Dr. Lian Loke, Dr. Caitilin de Bérigny and Dr. Andrew Campbell for their ongoing support as doctoral supervisors.

## REFERENCES

[1] [n. d.]. Muse, the Brainsensing Headband. http://www.choosemuse.com/. Accessed: 2018-08-14.
[2] Anxiety and Depression Association of America. 2018. Stress. https://adaa.org/understanding-anxiety/related-illnesses/stress.
[3] Rafael A Calvo and Dorian Peters. 2014. *Positive computing: technology for wellbeing and human potential*. MIT Press.
[4] Sixian Chen, John Bowers, and Abigail Durrant. 2015. 'Ambient walk': a mobile application for mindful walking with sonification of biophysical data. In *Proceedings of the 2015 British HCI Conference*. ACM, 315–315.
[5] Karen Anne Cochrane, Lian Loke, Caitilin de Bérigny, and Andrew Campbell. 2018. Sounds in the Moment: Designing an Interactive EEG Nature Soundscape for Novice Mindfulness Meditators. In *Proceedings of the 30th Australian Computer-Human Interaction Conference*. ACM.
[6] John Connell and Chris Gibson. 2009. Ambient Australia: Music, Meditation, and Tourist Places. *Sound, society and the geography of popular music* (2009), 67–88.

[7] Diane Gromala, Xin Tong, Amber Choo, Mehdi Karamnejad, and Chris D Shaw. 2015. The virtual meditative walk: virtual reality therapy for chronic pain management. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, 521–524.

[8] Lea K Hildebrandt, Cade McCall, and Tania Singer. 2017. Differential effects of attention-, compassion-, and socio-cognitively based mental practices on self-reports of mindfulness and compassion. *Mindfulness* 8, 6 (2017), 1488–1512.

[9] Jon Kabat-Zinn. 2009. *Wherever you go, there you are: Mindfulness meditation in everyday life*. Hachette Books.

[10] Jean L Kristeller and C Brendan Hallett. 1999. An exploratory study of a meditation-based intervention for binge eating disorder. *Journal of health psychology* 4, 3 (1999), 357–363.

[11] Joan Sol Roo, Renaud Gervais, Jérémy Frey, and Martin Hachet. 2017. Inner Garden: Connecting Inner States to a Mixed Reality Sandbox for Mindfulness. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. ACM, 1459–1470.

[12] Jay Vidyarthi, Bernhard E Riecke, and Diane Gromala. 2012. Sonic Cradle: designing for an immersive experience of meditation by connecting respiration to music. In *Proceedings of the designing interactive systems conference*. ACM, 408–417.