Using external sensory stimuli to bring the user's attention to their soma in the context of relaxation

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1 Background and objective

A study conducted in the United Kingdom revealed that 74% of the participants had felt **overwhelmingly stressed** in year 2018 and have had difficulties coping with it (*Stress: Are We Coping?*, n.d.). According to the report by TNO research institute, **burnout and stress-related complaints** cost the Dutch society about 9 billion euros a year (Douwes et al., 2019).

Anxiety and (chronic) stress can have **negative effect on health and wellbeing**, for example, cause cognitive impairment or increased risk of depression (de Kloet et al., 2005), lower levels of job satisfaction (Khamisa et al., 2017), difficulties concentrating (Robinson et al., 2013), lack of sleep, increased heart rate and blood pressure leading to strokes and heart disease (McEwen, 2008). Issues like that pose a huge strain to both employers – stressed out and anxious workers take more days off work – and the healthcare system that needs to treat those patients. Not to mention that feeling anxious and under pressure is simply a bad state to be in from a daily psychological view as well.

There are various recommendations for how **to cope with stress and anxiety**, such as regular exercise, breathing and body scan exercises, meditation, or mindfulness (Donald et al., 2016). Although these stress relief methods can and are traditionally practiced without any technological aid, the scientific interest of the Human Computer Interaction field lies in how these **practices could be enhanced with technology**.

To leave out various mobile applications, in the domain of relaxation and meditation multiple **immersive virtual reality systems** have been designed and tested. For example, the audio-visual neuroadaptive RelaWorld where the levitation of the avatar in the virtual environment is controlled by the user's level of focus (Kosunen et al., 2016) or Immersive Natural Scenes using 360° videos of the outdoors (Anderson et al., 2017). Some have further explored how **biofeedback** can assist in relaxation, for example, breathing exercises guided by a jellyfish in a virtual underwater environment (Soyka et al., 2016).

However, there are also solutions that use **stimuli other than virtual reality**. In Sonic Cradle, the user's breathing patterns create a soundscape and control various aspects of the added sounds (e.g. pitch, timbre) with the goal of teaching mindfulness and meditation (Vidyarthi et al., 2012), (Vidyarthi & Riecke, 2014). LightStress is a discreet device that visualises the user's stress level in colour by measuring body temperature (Rodrigues et al., 2019). In (Aslan et al., 2016), they created two biofeedback probes that were used in a mindfulness-based stress reduction workshop and discovered that tangible designs can direct the user's attention to outside factors instead of bringing attention to the soma.

It is generally undesired to direct attention to something outside the body during meditation which is why **somaesthetics** (Shusterman, n.d.) and **soma design** might come useful in exploring relaxation via sensory stimuli. Some of the ways to achieve such body awareness using external technological stimuli are, for example, Soma Mat that directs the user's attention to their body parts with heat and Breathing Light that reacts to the user's breathing patterns (Höök et al., 2015). The authors of those designs also agree that **visual stimuli direct the attention away from one's body**. Therefore, it would be good to build on that knowledge and explore how various external sensory stimuli could still assist users in focusing on their body and mind when engaging in relaxation practices.

1.1 The company's interest

The practical part of the degree project will be carried out mainly in collaboration with the company Sensiks[1] in the Netherlands. The company produces sensory technology. By the term "**sensory technology**", the author means technology that triggers at least one of the five human senses (sight, hearing, taste, smell, touch) in the form of **sensory stimuli** (e.g. scent, wind, sound). "**Multisensory technology**", on the other hand, stimulates more than one sense at a time.

The Sensiks cabins enable combining **audio-visual experiences with scent, temperature, airflow, and light** frequencies. To do so, the cabins are equipped with one big light panel on the ceiling and two smaller ones in side walls, heating panels on the back wall and on both sides of the user (depending on the model, there may be an additional one in the front left side of the pod), four small ventilators in each corner near the ceiling, a scent dispenser in the left wall, surround-sound speakers, and a digital computer screen that acts as a control panel built in the wall on the right. Additionally, a virtual reality headset can be connected to the system. The most popular Sensiks pod models have a wooden bench the user can sit on, although a bigger model that is accessible with a wheelchair also exists.

The idea for the Sensiks pod partly originated from the CEO's experience with meditation. His initial goal was to explore how human senses could be manipulated in a way that would bring focus back to the body and mind instead of the outside surrounding world, especially without using the virtual reality component which the company has by now adopted due to popular demand. This project partly builds on the **initial motivation for Sensiks pods** and aims to reveal how sensory technology can help with achieving the goal of self-awareness in the domain of relaxation.

Currently, Sensiks has the hardware solution, but wishes to expand their offering regarding the content and experiences.

1.2 Objective

The expected outcome of this project is an exploration and a collection of selected sensory design concepts and various different relaxation experiences. The research aims to reveal novel design opportunities and potential future directions in the domain of technologically enhanced somaesthetic relaxation experiences that can be used not only with the Sensiks technology, but when designing for various perceptions in general. The resulting work will be a documented exploration of examples meant to inspire others and shine light on the process of designing for relaxation practices using sensory stimuli.

2 Research question and method

The main research question can be formulated as:

- **How can (multi)sensory technology support users in traditional non-technological relaxation practices?**

[1] https://www.sensiks.com

Secondary research questions are:

- **How can we use external sensory stimuli to direct attention inwards, to the user's body and mind?**
- **How can immersive relaxation experiences be achieved without the use of a virtual reality headset (by employing the abstract sensory stimuli)?**
- **In what way can biofeedback help with bringing attention to the soma in the context of relaxation practices?**

2.1 Methods and process

The project will rely strongly on the method of **research through design** (Stappers & Giaccardi, n.d.). **Qualitative semi-structured interviews** on the topics of stress and relaxation will be conducted to explore why people seek relaxation in the first place and which practices they use for achieving that goal. Common underlying themes will be identified from the interviews. These will act as input for refining the design space.

As **first-person bodily practices** are often involved in the auto-ethnographic soma design process, the author will also explore various methods of relaxation and body awareness herself, e.g. yoga, meditation, mindfulness, or contact improvisation, to familiarise herself with the practices and gather ideas for the design process.

The sensory possibilities will be explored both by the author alone and in collaboration with participants in **participatory design** sessions. Due to the personal and intimate nature of relaxation, these sessions will most likely involve one participant at a time. The Sensiks technology will prove to be useful in this stage as sensory stimuli (wind, light, scent, sound, temperature) can be individually controlled via a built-in control panel of the Sensiks pod. **Brain- and bodystorming** will be used to find which sensory stimuli elicit feelings of relaxation and in what way they can be used in the context of relaxation. If necessary, supplementary non-technological artefacts, such as blankets, pillows or warm drinks, will also be used. An additional focus will be on the role of the soma, trying to find ways of actively including the body and mind in the experience as opposed to being a passive observer.

Next, **one relaxation practice** to continue work with will be selected. This decision will be influenced by information gathered from the initial interviews and author's personal interests. Insight gained from sensory exploration sessions will guide the process of **designing**, **(co-)creating**, and **testing** various sensory relaxation experience designs with the participants. Multiple aspects of sensory stimuli will be used in the design process, e.g. light brightness (intensity), patterns, colour, and movement. The whole process will be iterative, learning from and creating improved design artefacts based on feedback.

In addition, the role of biofeedback will be analysed. Relaxation experiences enhanced by incorporating biofeedback will be **compared** to those without biofeedback to observe in what way it affects how comfortable and effective the relaxation experience is perceived. This will be done qualitatively, using **interviews** and **self-reports** from the participants.

The result of the work will be a set of relaxation experiences supported by sensory technology for one selected stress-relief practice and a reflection on the design decisions and process.

3 Evaluation and value

Assessments and evaluations of the relaxation experiences will be done continuously throughout the project in the form of **user tests** and **qualitative interviews**. Participants will experience the (multi)sensory designs and give feedback that will be used to correct the designs in the next iteration.

Author's opinion and assessments will also have an effect on the design decisions. In the end, the author hopes to present a limited number of refined relaxation experiences for one particular stress-relief practice and knowledge on what to take into account when designing for body-awareness and relaxation using senses.

Standardised multidimensional measure of presence for virtual reality could be used as a generalisable and comparable method of measuring the quality of the relaxation experience (Makransky et al., 2017) and stress levels could be measured via **Perceived Stress Scale** (Cohen et al., 1983). However, the focus of this work will be less on high-fidelity visual environments and more on abstract, yet immersive somatosensory experiences. Therefore, **user tests** combined with **self-report scales**, **qualitative interviews** and **(first-person) self-exploration** can give even more valuable feedback on the experience. Furthermore, **discussing the prototypes** with participants and **reflecting on the design decisions** are important methods in research through design.

The finished work will be of interest to many different groups. Firstly, the work will act as **inspiration** for interaction technologists as it will describe design opportunities and in what ways sensory technology can be employed for creating somaesthetic relaxation experiences. The knowledge and experience gained from this project can be adopted in **creating other similar (multi)sensory experiences**.

Secondly, one of the results of this work will be a **set of relaxation experiences**. These can be shared and used on the Sensiks pods. Therefore, Sensiks as a company can widen their product offering.

Clinical psychologists might be interested in introducing the designs in their **anxiety treatment** plans, although further research on the exact medical effects of the experiences is needed.

4 Pre-study and related literature

The literature study will provide background knowledge on stress, anxiety, their effects and relaxation practices (e.g. Mindfulness-Based Stress Reduction). Knowing this will help create structure for the initial interviews about relaxation.

Another section of the pre-study will be about embodied experiences, somaesthetics and soma design to find out how to design with the soma in mind. Related projects, some of which have been mentioned in section "Background and objective", will be analysed and taken as inspiration. The most important is to find out how others have created designs that use external stimuli, yet still manage to have the user focus on their body.

To ensure a scientifically relevant practice, the concept and best practices of research through design will be read up on. Additionally, frameworks and guidelines on how to assess experiences and operationalise relaxation will be looked into.

As sources, the literature study will mostly use scientific papers from journals and books, but also seek out additional concepts to look into from relevant web pages and online forums.

5 Conditions

The main resources required for this project are the technology, the participants, and skills needed to control and create custom programs for the technology.

The **sensory technology** will be provided by the company Sensiks in the form of a multisensory cabin. These cabins are finished products in themselves and, thus, can be used immediately. The

biofeedback technology will be borrowed either from Sensiks or from the University of Twente where the author is enrolled.

The **participants** will be recruited from people working at the XR Base in Amsterdam where one of the Sensiks pods is located and from English-speaking employees of the medical establishment Aveleijn. It is desired to have participants both familiar with and new to relaxation practices. Therefore, some extra "off-the-street" participants may also be included to satisfy this selection criteria.

The author is no stranger to programming, having done an undergraduate degree in computer science. However, Sensiks team is willing to help with specifics regarding creating software for the Sensiks pod and will organise an introductory demonstration of their technology.

5.1 Limitations

Since the project is done in collaboration with Sensiks who has already developed the pods which enable controlling multiple sensory stimuli, this research will not explicitly focus on designing the hardware. Instead, **focus will be on creating experiences** (i.e. content for the pod) using the available sensory technology. If, however, the exploring and user sessions reveal that the hardware could be improved in some way, it will be mentioned, but not actively dealt with unless relevant for the current project.

The project will be largely **explorative** and focus on **research through design**. Therefore, the result will not be one holistic relaxation experience, but a **journey through iterative designs** towards new knowledge about designing for relaxation using external sensory stimuli. The designs will be tested and discussed throughout the process, but in a qualitative way that helps improve the designs as opposed to (quantitatively) analysing their effectiveness in the context of stress reduction. Special focus will be on how the participants perceive the experiences as motivating and helpful for relaxation practices – do the experiences encourage them to pick up a technique or change their view on relaxation practices. Measuring the stress reduction will have to be done in follow-up studies.

5.2 Collaboration with the external supervisor

Fred Galstaun, the CEO of Sensiks, will provide me with access to the company's technology including the Sensiks multisensory pods and a network of people in relevant industries including, but not limited to VR developers, medical professionals, olfactory designers. In addition, a tutorial on how to use the technology and develop multisensory experiences for their software platform will be given.

Furthermore, collaboration will occur with researchers at the Netherlands Organisation for Applied Science Research (TNO), specifically with prof. dr. Jan van Erp, dr. Alexander Toet, and dr. Victor Kallen. They will provide advice and guidance in the fields of human perception, haptics, stress, anxiety, and cross-modal effects.

Specialists from Tactus and Aveleijn will assist in matters regarding psychology, therapy, and partly in finding participants for the user tests.

6 Schedule

Weeks 7-10: Literature review, exploring various relaxation methods (e.g. contact improvisation, yoga, meditation)

Weeks 11-13: No thesis work will happen due to attending an extracurricular course abroad

Weeks 14-15: Initial interviews with participants on relaxation, exploring Sensiks pods

Weeks 16-20: Deep diving into one relaxation practice, iterative design process combined with continuous testing resulting in at least three different designs

Weeks 21-25: Incorporating biofeedback in the designs, comparing designs with and without biofeedback

Weeks 26-30: Analysis, final reflection, writing the gathered knowledge into a well-structured report

Week 30: Report sent to the examiner

Week 32: Thesis defence

Week 33: Implementing feedback from the defence

Week 34: Submitting the final report

The thesis defence is planned to be done in August, not in June, due to the additional course in March during which no thesis work will happen and due to some other extracurricular activities, which require the author to commute often and irregularly and disturb the thesis work occasionally.

7 Research area

Experience design, research through design, multimodal interactions, soma design, affective computing, positive computing

8 References

Anderson, A. P., Mayer, M. D., Fellows, A. M., Cowan, D. R., Hegel, M. T., & Buckey, J. C. (2017). Relaxation with immersive natural scenes presented using virtual reality. *Aerospace Medicine and Human Performance*, *88*(6), 520–526. https://doi.org/10.3357/AMHP.4747.2017

Aslan, I., Burkhardt, H., Kraus, J., & André, E. (2016). Hold my Heart and Breathe with Me: Tangible Somaesthetic Designs. *Proceedings of the 9th Nordic Conference on Human-Computer Interaction - NordiCHI '16*, 1–6. https://doi.org/10.1145/2971485.2996727

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*(4), 385–396. https://doi.org/10.2307/2136404

de Kloet, E. R., Joëls, M., & Holsboer, F. (2005). Stress and the brain: From adaptation to disease. *Nature Reviews Neuroscience*, *6*(6), 463–475. https://doi.org/10.1038/nrn1683

Donald, J. N., Atkins, P. W. B., Parker, P. D., Christie, A. M., & Ryan, R. M. (2016). Daily stress and the benefits of mindfulness: Examining the daily and longitudinal relations between present-moment awareness and stress responses. *Journal of Research in Personality*, *65*, 30–37. https://doi.org/10.1016/j.jrp.2016.09.002

Douwes, M., Hooftman, W., Houtman, I. L. D., Ploeg, K. van der, Vroome, E. M. M. de, Kraan, K. O., Fernandez Beiro, L., Pleijers, A., Venema, A., Dam, L. van, Eysink, P., Molen, H. van der, Visser, S., & Steenbeek, R. (2019). *Arbobalans 2018: Kwaliteit van de arbeid, effecten en maatregelen in Nederland*. TNO.

Höök, K., Ståhl, A., Jonsson, M., Mercurio, J., Karlsson, A., & Johnson, E.-C. B. (2015). Somaesthetic design. *Interactions*, *22*(4), 26–33. https://doi.org/10.1145/2770888

Khamisa, N., Peltzer, K., Ilic, D., & Oldenburg, B. (2017). Effect of personal and work stress on burnout, job satisfaction and general health of hospital nurses in South Africa. *Health SA Gesondheid*, *22*(1), 252–258.

Kosunen, I., Salminen, M., Järvelä, S., Ruonala, A., Ravaja, N., & Jacucci, G. (2016). RelaWorld: Neuroadaptive and immersive virtual reality meditation system. *International Conference on Intelligent User Interfaces, Proceedings IUI*, *07-10-March-2016*(March), 208–217. https://doi.org/10.1145/2856767.2856796

Makransky, G., Lilleholt, L., & Aaby, A. (2017). Development and validation of the Multimodal Presence Scale for virtual reality environments: A confirmatory factor analysis and item response theory approach. *Computers in Human Behavior*, *72*, 276–285. https://doi.org/10.1016/j.chb.2017.02.066

McEwen, B. S. (2008). Central effects of stress hormones in health and disease: Understanding the protective and damaging effects of stress and stress mediators. *European Journal of Pharmacology*, *583*(2–3), 174–185. https://doi.org/10.1016/j.ejphar.2007.11.071

Robinson, O. J., Vytal, K., Cornwell, B. R., & Grillon, C. (2013). The impact of anxiety upon cognition: Perspectives from human threat of shock studies. *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00203

Rodrigues, A., Lopes, L., Costa, C., & Cabral, D. (2019). LightStress: Targeting stress reduction through affective objects. *Proceedings of the 2019 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2019 ACM International Symposium on Wearable Computers - UbiComp/ISWC '19*, 191–193. https://doi.org/10.1145/3341162.3343773

Shusterman, R. (n.d.). Somaesthetics. In *The Encyclopedia of Human-Computer Interaction* (2nd Ed.). Retrieved 9 February 2020, from https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/somaesthetics

Soyka, F., Leyrer, M., Smallwood, J., Ferguson, C., Riecke, B. E., & Mohler, B. J. (2016). Enhancing stress management techniques using virtual reality. *Proceedings of the ACM Symposium on Applied Perception - SAP '16*, 85–88. https://doi.org/10.1145/2931002.2931017

Stappers, P., & Giaccardi, E. (n.d.). Research through Design. In *The Encyclopedia of Human-Computer Interaction* (2nd Ed.). Retrieved 6 February 2020, from https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/research-through-design

Stress: Are We Coping? (n.d.). Mental Health Foundation.

Vidyarthi, J., & Riecke, B. E. (2014). Interactively mediating experiences of mindfulness meditation. *International Journal of Human-Computer Studies*, *72*(8–9), 674–688. https://doi.org/10.1016/j.ijhcs.2014.01.006

Vidyarthi, J., Riecke, B., & Gromala, D. (2012, June 11). *Sonic Cradle: Designing for an Immersive Experience of Meditation by Connecting Respiration to Music*. Proceedings of the Designing Interactive Systems Conference, DIS '12. https://doi.org/10.1145/2317956.2318017