atmoSphere: Mindfulness over Haptic -Audio Cross Modal Correspondence

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Abstract
We explore cross-modal correspondence between haptic and audio output for meditation support. To this end, we implement atmoSphere, a haptic ball to prototype several haptic/audio designs. AtmoSphere consists of a sphere shaped device which provides haptic feedback. The users can experience the design aimed at instructing them in breathing techniques shown to enhance meditation.

The aim of the haptic/audio design is to guide the user into a particular rhythm of breathing. We detect this rhythm using smart eyewear (J!NS MEME) that estimates cardiac and respiratory parameters using embedded motion sensors. Once this rhythm is achieved the feedback stops. If the user drops out of the rhythm, the haptic/audio feedback starts again.

Author Keywords
Attention; Psychophysiology; Eyewear; Tracking; Sensing; Haptics

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H.5.2 [User Interfaces]: User-centered design

Introduction
In our research we explore how to use cross-modal effects and correspondences to increase immersion and focus

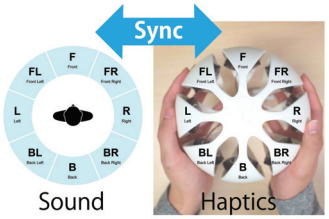

Figure 1: atmoSphere: cross-modal design concept

Figure 2: J!NS MEME and closeup on the EOG electrodes

Figure 3: Demo setup and user

meditation. As the pace in our interconnected world picks up more and more, individual stress and business is increasing, we need methods to calm us down and bring us back to the current moment. Meditation techniques seem to be well suited for this [7].

In our research we explore the usage of cross-modal effects and correspondences to increase immersion and assisted meditation. The contributions are as follows: (1) using a wearable sensing device (J!NS Meme, cf. Figure 2 for input to atmoSphere Figure 1, a haptic device mapping directional audio to corresponding haptic sensations on a round, hand-held device, (2) we show a usage scenario for atmoSphere, the augmentation of focus during mindfulness training Figure 3.

Related Works

As haptic feedback technologies are more broadly available, we also see more and more works that tackle cross-modal effects with touch and vision as well as audio [1]. Still only very few researchers use these principles for interaction or user experience designs [4, 8, 6].

In our research we explore how to use cross-modal effects and correspondences to accelerate learning, increase immersion, and relaxation. This demonstration focuses on relaxation. atmoSphere has been presented at Siggraph Emerging Technologies focusing on creating a more immersive music experience [2].

Approach

There are different forms of meditation that are proven to promote human mental and physical well-being. Often, in the initial stage of learning meditation, it is important to develop the ability to concentrate by focusing on one's breathing.

Our atmoSphere aims at teaching people how to meditate in a non-invasive manner by helping them to focus on their own breathing. Based on the attention regulation process [3] which describes the cycle of self-regulation, we are concentrating on augmenting peoples' self awareness and supporting their way into a more fruitful mediative state, specifically through a haptic-audio cross-modal expression of their own breathing.

Demonstration Setup

Sphere Device

AtmoSphere uses a USB audio interface(Roland UA- 1010), a preamplifier and a power amplifier, 8 tactile sound transducers (Acouve Laboratory Vp2), a USB-audio transducer (PLANEX PL-US35AP), noise-canceling headphones (Boss QuietComfort 35), and a 3D printed sphere made of white ABS resin. Each of the 8 sections is equipped with one sound transducer. By holding the sphere with both hands users can feel the vibration through the different transducers. This provides them with a spatial-tactile sensation corresponding to the spatial audio.

Augmented Mindfulness

Participants will go through a short calibration period for the smart glasses. They will wear noise canceling headphones, J!NS Meme smart glasses, and hold atmoSphere in their hands. Instructions on the meditation process will be given to all participants prior to the session. We use J!NS MEME, smart glasses that measure relative eye and head movements, to infer the meditation state of the user[5]. The atmoSphere is a 3D printed spherical object made up of eight connected slices, which join together at the top and bottom of the sphere. Each slice is equipped with its own output speaker. Each speaker is only about one inch in diameter. These speakers can work independently or in stereo of each other. Using the Logic Pro X software sys-

tem we are able to program particular patterns of vibration to play through the speakers to create haptic sensations. The speakers can produce sound, but for our purposes we stick with using the vibration settings sans sound. We do this by reducing each programed audio input in Logic Pro X down to simple bass notes. We can control intensity of these vibrations by extending or shortening the audio loop, increasing the bpm, and or changing the frequency rate. The user simply grasps the Atmosphere between their hands. Fingers spread to encompass the Atmosphere as much as possible. Picture a quarterback grasping a football just before picking a pass. Headphones are then placed over the participantsâĂŹ ears to shut out all other noise. The user is asked to close their eyes thus limiting external stimuli except those we intend to produce through the headphones and atmoSphere. Through audio/haptic feedback designs we will transmit breathing patterns to participants' hands and ears and will simultaneously monitor their natural breathing rhythm. With the help of J!NS Meme's Electrooculography (EOG) and motion sensors we estimate the participant's focus based on head movements and eye movements. EOG can also work when a users eyes are closed. Therefore, the audio-haptic feedback will be tuned down in moments the participants have reached a state of mediation. When we recognize that a participants is seemingly loosing focus and the breathing pattern changes, our cross-modal feedback will reappear and guide the user to a more suitable breathing pattern for meditation: breathing out should be approximately double the time as breathing in [9].

Conclusion and Future Works

Overall, this demonstration constitutes the first step for our work towards technology to support mindfulness. In the future, we want to work on more effective ways to cope with users' stress.

Audio and Haptic Cross-modal Correspondences are still not well explored in related research. We believe there are interesting applications away from relaxation for these phenomena in hci research.

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