Hold my heart and breathe with me: tangible somaesthetic designs

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Hold my Heart and Breathe with Me: Tangible Somaesthetic Designs

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Abstract
We present two tangible somaesthetic designs. The first design resembles a real heart, which allows users to experience their own heart's behavior by providing haptic feedback. Thus, users holding the heart design are able to feel their heartbeat in their hands. The second design is a stuffed animal, which is capable to breathe in synchrony with a user. Both designs were used as probes in a workshop with two experts practicing and teaching a meditation technique referred to as mindfulness-based stress reduction (MBSR). We conclude that tangible designs may guide users' attention away from themselves towards something outside their bodies (i.e., the artifact). Despite this possibly undesired effect, we argue that there is some potential to exploit tangible designs as mediating tools to address wellbeing for challenging user groups, such as children.

Author Keywords
Somaesthetics; positive computing; tangibles.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

For about two decades Hiroshi Ishii [6] has criticized the experiential qualities of screen-based human-computer interfaces as unfortunate and that: *"one cannot feel and confirm the virtual existence of digital information through one's hand and body''*. He argued that tangible interface designs will allow us, as humans to experience digital information with our bodies in richer ways. In this paper, we propose to present real-time digital information about a user's own bodies "hidden" ways of performing in tangible ways. Our work is partially motivated by Somaesthetics (e.g., [15]), a "theory" and interdisciplinary field that among other things proposes to improve self-awareness through somatic introspection (e.g., body scan exercises).

"We need to be able to monitor the unreflective ways our body performs by bringing them into the foreground, at least for the time of critical reflection and possible reconstruction." [15]

Shusterman advocates improved self-awareness, including sensitivity towards difficult to perceive behaviors, such as our heart's beating patterns, which are always there but tend to be in the background of our awareness. Through somatic introspections, these unreflected ways of how our bodies work are brought to the foreground for critical reflection, and thus, to become able to influence the behavior for the better. Since Somaesthetics is a rather new field, the body of related work in HCI is yet limited, with Thecla Shiphorst and Kristina Höök being prominent examples from an increasing group of researchers applying and exploring a somaesthetic approach in their designs, design processes and art installations (e.g., [3, 9, 5, 13]).

Whilst benefits of somatic introspection are argued to be manifold, in this paper we focus on their potential in the health and wellness domains, such as stress reduction therapy and meditation. Our work is thus related to an emerging field, which has also been referred to as Positive Computing [1]. In contrast to most prior HCI research, aiming to improve human performance, Positive Computing aims bringing together approaches to apply technology and design for wellbeing and human potential. In our tangible somaesthetic designs, we focused on heartbeats and breathing movements (as these are relevant "measures" in meditation) and their embodiment in two artifacts that are different in terms of "representation" and "realism". Whereas the first artifact is covered in silicon and resembles a real heart in its feel, the second artifact is a stuffed animal capable to mirror a user's breathing (or heartbeats). We argue that both tangible designs not only have potential to support self-directed practices but more so have potential to support other directed practices, such as guided meditations.

In the following section, we briefly summarize recent related work, which is not directly inspired by Somaesthetics but studies related interfaces for exploring internal states of users. Then we present in detail our tangible somaesthetic designs and discuss insights gained from an initial workshop with two experts, practicing and teaching a meditation training referred to as mindfulness based stress reduction (MBSR). Jon Kabat-Zinn [8] developed this technique, which aims to use the wisdom of one's body and mind originally at the Massachusetts Medical Center.
In the workshop with the experts we used our designs as probes to foster discussions and explore potentials and limitations of tangible somaesthetic designs for

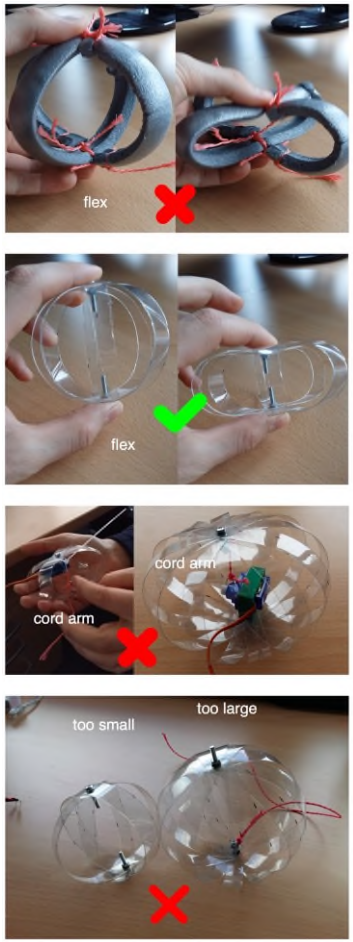

Figure 1: First part of pictures showing insights into the design/crafting process and decisions made for the heart design. See Figure 2 for the second part.

Positive Computing. We conclude by highlighting that tangible designs might redirect a user's attention towards something outside the body and potentially distract the user in their efforts of somatic introspection. We argue, however, that directing one's attention towards an external object episodically for the purpose of sharing or the demonstration of a training effect has its own benefits.

Related Work

Gervais et al. [4] have propose a toolkit to expose inner workings of users based on physiological readings. While they use an anthromorphic physical avatar, the physiological signals (e.g., heart rate) and various high level metrics (e.g., workload and arousal) are presented visually (e.g., the avatar has a screen as a face and a light emitting diode embedded in its chest represents its heart). Roo et al. [12] have presented "Inner Garden", an augmented sandbox, which represents a user's internal state and how the state changes. The feedback is provided through augmented reality (e.g., using a projector) and the sandbox may flourish with plants and flowers growing. While users may use their hands to reshape the sandbox no haptic feedback is provided about their internal state. Furthermore, virtual avatars and games have been utilized (e.g., [11, 14, 16]) to support and guide breathing exercises.

Compared to previous work, which has applied screen-based and visual feedback we have explored hand-held tangible artifacts that change their form and thus provide haptic sensations. Moreover, the haptic feedback is synchronized with a user's breathing and heartbeats. Thus, our goal was not to represent the internal state of users visually but to simply replicate the inner organs' real movement and embed it in a contextually "appropriate" physical form (e.g., heart vs. stuffed animal).

Designing the Artifacts

We present the design process and many of the decisions we made in terms of, for example choosing a physical material, form, and dimensions in pictures (see Figure 1, 2, and 3). While both designs are depicted, we focus on decisions made for the heart design since for the stuffed animal we did not have to redesign the existing surface.

Sensors and Actuators

An off-the-shelf pulse sensor from Adafruit.com was used to detect heartbeats. In order to measure breathing movements, a chest strap was developed. The chest strap utilizes a light emitter (attached outside a metal spring) and a light sensor (attached inside a metal spring) to measure change in chest volume by changing the amount of light that passes between the opening metal spring. In order to actuate the designs non-continuous servo motors were used. In order to synchronize sensing and actuation we implemented (hardware) interrupts on an Arduino Uno.

Design Process

Our design process was similar to what has been proposed by Loke and Robertson [10] as embodied approaches for movement-based interaction design. We have also taken an exploratory approach for the investigations as proposed in design research (e.g., [17]). That is, we have spent extensive periods of time exploring how the designs feel in our hands through giving physical form to our own physiological data (i.e., heart rate and breathing movements) in different ways

Figure 2: Second part of pictures showing insights into the design/crafting process and decisions made for the heart design.

and through engaging in phenomenological reflections. Hereby, we have used our own bodies' signals and its movements as material for exploration and developed the necessary "bodily movement skills" [10]. In our case this meant exploring breathing patterns and movements, and moving our bodies to change our pulse rate.

Experts in somaesthetic practices, such as Shusterman himself describe episodes when they have been able to clearly feel their beating hearts, including the different places and direction of contradiction [15]. However, many people lack the skillful sensitivity for their own heart's behavior. While it is clear that the heart is beating non-stop during our lives, its behavior is linked to our feelings through the body-mind connection, which is elaborated extensively in related contemporary work in embodied cognition (e.g., [2, 7]). Consequently, stress-inducing factors that influence our feelings (e.g., many people feel anger or sadness) also influence our bodies' behavior and thus our heart rate. We chose to use heartbeats and breathing movements since both these "measures" are related to meditation training and emotional states associated with stress.

The two designs we have created are different in terms of how "directly" they represent a user's body part and behavior. One could argue that the stuffed animal is more social, playful, and "downplays" the seriousness of the represented data. In comparison, with the heart design we aimed to replicate the feeling of a beating heart including its weight, form, dimensions, fragility, and movements. Because we were still in the beginning of our research in tangible somaesthetic designs for Positive Computing, we chose to design two different tangible designs in order to explore the variety of possibilities they would offer and to have differing tangible probes for the following workshop.

Workshop with Experts

The two experts, who took part in the workshop have been meditating themselves on regular basis for more than 20 years. They have been teaching MBSR courses in their own offices for two and half years.

Participants and Procedure

The workshop took place in the experts' offices. One of the experts has a background in social pedagogy and the other expert used to work as pediatric nurse and now is a non-medical practitioner. The workshop took exactly one hour in which one researcher moderated the discussions and a second researcher prepared and demonstrated the prototypes. In addition to a semi-structured interview, which was applied to structure the discussions, experts were asked to "think aloud" while trying out the prototypes.

First experts where asked to introduce themselves and describe their work. Then the prototypes were demonstrated and afterwards the experts were asked to express their opinion in terms of potentials and limitations considering the prototypes and scope of application. The workshop was audio recorded for post-hoc analysis. The experts described that in a typical MBSR course body scan exercises are applied. They explained that the exercises typically originate from Yoga or Qigong practices. In addition, theoretical information, such as information about stress-inducing thoughts is presented. They argued that they prefer to combine therapeutic elements with elements from pedagogic coaching to help their clients to unite mind, body, and spirit.

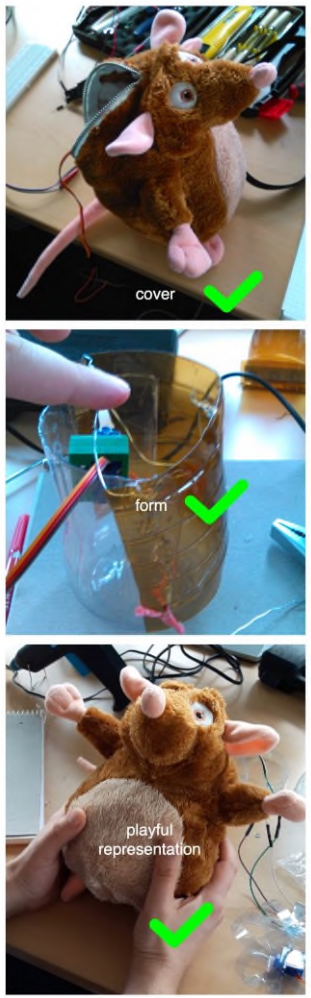

Figure 3: Pictures showing insights into the design/crafting process and decisions made for the plush toy design.

Results and Discussion

Experts argued that nowadays groups of people requiring MBSR practices are diverse, ranging from inmates, victims, pupils, to (cancer) patients. Considering the probes (with respect to how they were very different in look and feel) they said that for some adults, it might help that the heart design highlights the fragility of a real human heart, which has potential to remind users of how fragile their health situation can be, while the same heart design might be inadequate for children. They said for children the softness and cuteness of the plush toy would be beneficial. Other user groups, such as patients with serious health issues and chronic pains might also benefit from different tangible tools. For example, one of the experts mentioned cancer patients in hospitals and how they often have special (hugging) pillows, which could be augmented with technology to support MBSR practices, aiming to reduce their chronic pains and to improve their quality of life.

Locus of Attention

Experts stated some concern about the prototypes' potential in guiding the attention of users away from their own bodies towards something (i.e., an artifact) outside their bodies. Whilst, on occasions a stone that provides weight is placed on a user's chest who is lying on their back on the floor, aiming to help them focus on their breathing, it is in general undesired during meditations to attend to something outside the body.

When technology is used for somaesthetic designs, there is a chance that the technology will guide a user's attention away from their body. For experts, listening inward may be an easy activity, but as Höök et al. argue [5], inward listening is a demanding activity that would benefit from designs supporting users in directing their attention. Some helpful inspiration for design may be found in contemporary theories of cognition, which discuss how the human body is capable to change its schema by absorbing tools (outside the body), such as a walking stick that is used by a blind person (as an extension of their hand). In any case, we need to build a sensitivity towards designing for bodily presence and locus of attention, in order to design for the simple question "where are you at this moment with your mind and body?"

Visibility and Demonstration

In accordance with Ishii's [6] vision of tangible interfaces experts saw the potentials of turning the invisible (digital information about the bodies "hidden" ways of performing) graspable for one-self but also for others. They argued that there are situations when a tangible design could be helpful for them to demonstrate the effect of, for example stress-inducing thoughts or breathing exercises on heart rate. However, the experts themselves would use tangibles only for convincing; that is, with clients and in the beginning journey towards becoming able to independently practice MBSR exercises. Thus, the main purpose of tangible designs would be in enabling general trust towards the meditation practices and helping in overcoming any doubts about the usefulness of meditation exercises.

Conclusion and Future work

In this paper, we reported on our research in somaesthetic tangible designs for Positive Computing. Two designs were presented. We discussed initial results gained from our own explorations and a workshop with two experts in meditation training (i.e.,

MBSR). We highlighted that for tangible designs a special sensitivity is required, considering how tangibles may direct and focus a user's attention. We have also highlighted benefits of turning "hidden" behaviors of our bodies graspable and visible through tangibles for shared monitoring and guided critical reflection. The workshop with the experts indicated that user groups with special needs, such as children, inmates, (cancer) patients, or crime victims, may benefit from tangibles most, convincing and helping them in establishing trust towards healthy meditation practices. In our future work we aim to study with users how well our tangible designs perform when used for somatic introspection and reflection, considering the "critical" relationship between externalization and awareness. Furthermore, we aim to continue our collaboration with experts to improve our understanding of design needs for special user groups.

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