Designing for Self-Regulation from both Pragmatic and Critical Design Lenses

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Abstract

This paper outlines two case studies of constructive design research. These describe prototypes designed to support users' self-regulation of attention, and emotional arousal, respectively. The paper draws from key aspects of pragmatic design as well as of critical design. It also develops an argument that the described prototypes are illustrations of a critical design approach, albeit not the rather restricted conceptualization of Dunne but its revision advanced by Bardzell and Bardzell, and Senger's reflective design.

Author Keywords

Self-reflection; attention; affect; wearables; metaphors; embodiment; materiality.

ACM Classification Keywords

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

Introduction

There has been a growing body of HCI work focused on health, wellbeing [2,7,14] and self-reflection [10]. There has been however, limited discussion on the different design approaches employed in this space. This paper outlines some of our lab-based constructive design research illustrated through two case studies. These describe wearable prototypes designed to support users' self-regulation of inner experiences such as emotional arousal or attention during mindfulness meditation.

The two case studies are then used to illustrate our position on the relationship between constructive design research and critical design. We argue that critical design is a specific type of constructive design research, and that the two case studies represent distinct points on the continuum of critical design. Distinct qualities are used to characterize each case study, borrowing from Bardzell and Bardzell's broader conceptualization of critical design [1], and Sengers and colleagues' reflective design [17].

Background

Constructive Design Research

We agree with Koskinen and colleagues' [4] conceptualization of constructive design research, aka pragmatic design, or research through design, as a methodic imaginative exploration of novel alternative designs and of how they work. Key here is materializing these design concepts, usually through tangible prototypes, whose value resides primarily in their ability to generate debates, and secondary in their ability to solve problems or change the reality. Nevertheless, successful constructive design requires dialog and engagement in public discourse, as well as playful and creative experimentation with materials.

Research prototypes generated through pragmatic design tend to be theoretically grounded in ecological psychology, post-Cartesian philosophy, and phenomenology emphasizing the role of human body rather than merely cognition in design [4]. Aligned with this, an emerging body of work in HCI has also shown the importance of richer, tangible interaction and designers' own experiences [19] and emotions during the design process [12,13].

Critical Design

Critical design is a specific type of constructive design research drawing from contemporary art and design. It focused on alternative design with the specific intention of being provocative in challenging the status-quo [4]. Such challenging of status-quo can vary from disrupting the habitual electronics consumption lacking reflection on their impact on one's life [3] to broadly promoting ethical design values [1]. The former emphasises a rather militant quality of critical design against the dominating consumerist ideology and towards supporting self-reflection and people's discovery of what they need rather than accepting what advertisement pushes on them [4]. The latter position highlights unique qualities of critical design such as changing perspectives towards holistic understandings which invite users to think for themselves, and improve their ability to look beyond the surface as active participants in their sense making [1].

A specific type of critical design is *reflective design*, conceptualized by Sengers and colleagues [17] as aiming to reveal tacit HCI assumptions negatively impacting on quality of life. Reflective design draws from Schön's reflection-in-action and designer's conversation with materials [16]. It also embodies values that both interaction designers and users should be mindful of in order to develop and adopt more socially responsible technologies.

Case Study 1: MeditAid

MeditAid [9] is an interactive system aiming to support real time mindfulness meditation practice. It integrates wearable Brain Computer Interface (EEG) technology with aural feedback. The system identifies different meditative states and provides real time aural

Figure 1: The Spiral display

Figure 2: The Heart display with all three layers and biosensor attached
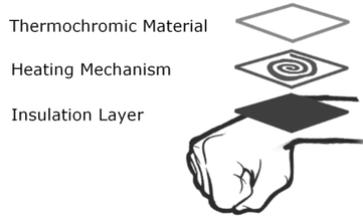
Figure 3: Multilayer approach to digital fabrication of affective displays

feedback. This design was evaluated with 16 meditators, 8 experienced and 8 novices in a 30 minute session, and findings showed that binaural feedback helped people deepen their meditative states, particularly for novice meditators, i.e. from alpha to lower alpha.

The system design fits within the growing HCI interest for wellbeing and health, taking an embodiment perspective to support self-monitoring for positive changes. It is however novel through its focus on attention regulation and sound-based embodied metaphors rather than on relaxation and the predominant visual metaphors. In designing the MeditAid system we leveraged our own experience of practicing mindfulness meditation and explored the feasibility of one specific metaphor for mapping the brain activity to sound pitch. This embodied metaphor can be captured linguistically through *meditation quiets the mind:* as meditator progresses through deeper meditative state (or quieter mind), the binaural bit is perceived as lowering its pitch.

MeditAid emphasizes alternative designs to the HCI state-of-the-art work on technologies for wellbeing, with a focus on the body and its phenomenology, and post-Cartesian philosophy. It also opens up the design space for a new class of interactive biofeedback technologies integrating Brain Computer Interfaces and entrainment technologies, beyond their current use for game design and towards increased self-regulation.

Case Study 2: Dynamic Affective Displays
The second case study focuses on two prototypes we developed as color changing displays for ambiguous representations of arousal: Spiral (Figure 1) and Heart (Figure 2) [18]. The aim was to design novel, always on sight, and flexible wrist-worn displays to support real time self-reflection on changes on one's emotional arousal. The two displays were evaluated by 6 participants with findings showing people's preference for their wearing-like quality, for ascribing personal and potentially hidden meaning to the ambiguous colors mapping changes in arousal, and for richer and more responsive change in shape.

The prototypes integrate biosensors measuring galvanic skin response and digitally fabricated affective displays. For designing the latter, we employed a playful material exploration of a range of elecroactive materials such as thermochromic liquid crystal sheet and pigments; copper, aluminum and nichrome; or epoxy resins, polypropylene and polyimide insulation tape. We ended up employing a multi-layered approach to digital fabrication of such displays consisting of a thin and low-cost thermochromic materials layer, a custom shaped heating mechanism layer, and an insulation layer (Figure 3). We used the metaphors of heat for the heating layer, of warm colors in the thermochromic layer for mapping emotional arousal.

We also kept lab records of all our material explorations, and the decisions made to keep or discard specific materials. In this respect, we are in position to provide rationale for all our design choices. These prototypes extend the state-of-the-art of tracking technologies for health and wellbeing, by taking a material exploration approach. They represent alternative designs for a new class of biofeedback technologies integrating biosensors and digital fabrication.

Discussion

The two case studies represent examples of constructive design research. The argument for this is threefold. First, from a theoretical perspective, both case studies are grounded on phenomenology [6], embodied metaphors [4], and the critique of Cartesian mind-body dualism. Second, they also highlight the importance of designers' own emotions in shaping the designs [12,13] and prior experiences with biofeedback as a strategy for self-regulation. In addition, the first case study is based on designers' prior experience with mindfulness meditation practice. Third, the second case study is particularly structured around material exploration aiming to deconstruct the emotional experience of change in arousal and to communicate it through metaphors that can be interrogated and personalized, to better support meaning making.

We now discuss our case studies through the lens of critical design. While neither intends to provoke or transgress the values underpinning people's consumption of self-tracking technologies, they both support users' self-regulation practices and their role as creators of meaning. In this way, both case studies contribute towards design knowledge [15] for a new class of technologies supporting not just self-reflection, but also self-regulation through biofeedback. Indeed, both case studies critique the HCI state-of-the-art and its limited focus on self-regulation. As suggested by Sengers and colleagues [17], we as designers, have used self-reflection [8] to identify this limitation in the state-of-the-art, and the unsupported value of empowering users to become better skilled in self-reflection as well as self-regulation.

With respect to empowerment, both technologies allow for personalization of the embodied metaphors, albeit this has not been evaluated in none of the case studies. The argument for reflective design is further strengthened through integrating reflection in the practice itself [17]. Arguably, we went even further by supporting access to real time data to facilitate reflection-in-action and self-regulation.

While both case studies detail the employed embodied metaphors to illustrate design choices, they differ however in what Sengers and colleagues' [17] called interpretative flexibility. We argue that dynamic affective displays through their novelty and variety offered richer potential for strangeness, and increased ambiguity which was particularly valued. They were particularly expressive, through art-like use of colors, movement and shapes. Another key aspect through which the dynamic affective displays differed from MeditAid is their richer material exploration. This intimate conversation with materials allowed us to deconstruct the emotional experience of change in arousal and to communicate it through metaphors within two layers of our digital fabrication process. In turn, such metaphors can be better interrogated and personalized, to support meaning making. We have already seen the possibility of engaging end users in electronic DIY of complex technologies [11] and our future work will explore democratizing production of affective displays through DIY approaches.

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