Position Paper: Physicalization of Human Body Sensing Data

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1 INTRODUCTION

Body sensing technologies such as electrocardiography, electromyography, muscle movement, muscle, contraction, surface body temperature, PH, oxygen level and breathing rate can provide meaningful insights about a person's emotional state, health conditions or wellbeing. Existing research shows that they are beneficial for mindful self-awareness, self-reflection and regulation of affect states, empathy, compassion and caregiving, relationship skills for authentic social connection, motivation, performance, and coordinative effort [8]. Current healthcare or wellbeing related applications use these data mostly in the digital form. While such digital representations have shown positive impact, data physicalizations have the potential to communicate these data effectively and interactively: (a) physicalizations enable more expressive, physical and multisensory representations that are easy to interpret, and that create felt experiences thus are more impactful compared to digital screen based representations; (b) physicalizations can be easily deployed in user's day to day environments (rather than as an app on a mobile phone or desktop), this increases accessibility and invites interaction; (c) data physicalizations have the potential to improve inclusiveness and accessibility due to their multisensory potential. Thus, by physicalizing body sensing data, we can externalize health and wellbeing related data into a more engaging and accessible format.

Hannah Thomas [3] defines "soma" and distinguishes it from the "body": *"the 'soma': namely the body as perceived from within by first-person perception. When a human being is observed from the outside—i.e., from a third-person viewpoint—the phenomena of a human "body" is perceived. But, when the same human being is observed from the first-person viewpoint of his own proprioceptive senses, a categorically different phenomenon is perceived: the human soma"* [3]. The soma, is thus concerned with observing the inner feelings, sensations through the human sensorimotor system and *"is predicated on the interconnectedness of mind, body, emotion and social engagement, considering all to be inseparable aspects that together form an embodied, holistic subjectivity"* [11][10]. The soma-based design focuses on designing through first person perspective (i.e. by focusing on our own felt experience) and using our felt experiences to design interactions and experiences [4, 5, 7, 9]. It has enabled a diversity of applications targeted at, for example, emotion regulation and relaxation, understanding or changing your own movement habits, aids for playful discussion

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with others through movement, expressing ourselves and extending human expressiveness some focus on whole-body movements, others add to our expressiveness [6]. Our felt experiences (for example, when we are aroused) are reflected in our biosignals data such as heart rate and skin conductivity. Thus, soma-based design can greatly benefit from human biosignals data, acquired through biosensing technologies. Such data enable participants (of a soma-based design session) to deepen their somatic awareness [1]. Indeed, biosignals data has been used widely in the soma-based design process (e.g. [2]).

In order to facilitate both of the above purposes (bodysensing for (a) health and wellbeing (biofeedback), (b) somaesthetic appreciation design), bodysensing data needs to be converted into representative, interactive physicalization so that being aware of, understanding, and engaging with one's health and wellbeing data or soma is possible via this external material representation. In order to enable embodied interaction, such physicalizations often need sensing and actuation and realtime physicalization of bodysensing data. Realtime sensing of body data and translating them into actuation and physical form is challenging. Thus, we need to establish tools and processes for physicalizing bodysensing data so that the researchers designing biofeedback systems and somaesthetic design have a platform to translate body sensing data into meaningful, interpretative, expressive and engaging physical interfaces. Furthermore, externalizing body related data and making them available also raises privacy and ethical concerns. In this position paper, we highlight the need for for the research on these two areas. By taking two usecases, we aim to reflect on the challenges and future research directions related to these two areas.

2 CHALLENGES AND FUTURE RESEARCH DIRECTIONS

Usecase 1 focuses on physicalizing human emotional state from heart rate and galvanic skin response data in realtime. Usecase 2 focuses on designing a tool for dealing with sports related competition anxiety of female athletes using heart rate variation data. In both of the above use cases, we face technical challenges related to data physicalization and ethical challenges related to deployment, sharing, privacy and security. During the workshop, we will present the current challenges we face and the opportunities and future directions we foresee. We will look at the two use cases from two different perspectives: (a) a tool for providing biofeedback (b) data as material for somaesthetic experinece design. While, we aim to reflect on the opportunities and challenges, we also want to stimulate a discussion on further research collaborations along these lines.

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