Designing with Biosignals: Detailed Workshop Description

EKATERINA R. STEPANOVA, JOHN DESNOYERS-STEWART, ALEXANDRA KITSON, BERNHARD E. RIECKE, and ALISSA N. ANTLE, Simon Fraser University, Canada

ABDALLAH EL ALI, Centrum Wiskunde & Informatica, Netherlands

JEREMY FREY, Ullo, France

VASILIKI TSAKNAKI, IT University of Copenhagen, Denmark

NOURA HOWELL, Georgia Institute of Technology, USA

1 INTENDED AUDIENCE AND RECRUITMENT STRATEGY

We will advertise our workshop through the DIS'23 website and our various networks (via newsletters, email lists, and social media posts). As the organizers come from distinct backgrounds and institutions, collectively we have access to a diverse set of communities. To ensure a productive discussion we will select participants who have sufficient expertise working with biosignals. Prospective participants will be invited to either submit a 2-4 page position paper, or a 5-min speculative design video with a 1-page description in an ACM extended abstract format, presenting a project or articulating a challenge that relates to this call. Alternatively, authors may submit their previously published paper raising relevant questions. Additionally, participants will be asked to complete a short survey to help us better understand the distribution of participants and forms of engagement (online or in-person) to optimize the planned workshop structure. The survey will enquire on the planned form of attendance, the primary field or work, ranking of the interest in proposed workshop topics with an option to suggest new ones, and a consent to be invited to a Slack group for communication with organizers and other attendees prior to the workshop. We aim to attract and select about 30-35 participants.

2 SCHEDULE AND DESCRIPTION OF ACTIVITIES PLANNED

The workshop will begin with an introduction by the organizers and a short warm-up attunement activity. This attunement activity will help attendees to focus their attention and to reconnect with their bodies and it's physiological signals, aligned with the topic of biosignals. Then, participants will engage in 3 rounds of small-group (4-6 participants per group) discussions in a form of roundtables. Each group online and offline will be joined by 1 organizer, who will focus on timekeeping and deliverables to ensure that the groups are ready to contribute to the large group discussion

at the end. After each small group discussion, the moderator of that group will report to all other participants on the outcomes of the discussion.

Through discussion, we will aim to map out the **key challenges** and **opportunities** presented by biofeedback technology. The three 3 rounds of discussion will build towards this outcome: (a) R1: hands-on provocations (exercises) + discussion; (b) R2: breadth roundtables based on topics (Meaning-Making and UX, I/O, Representing biosignals, and Ethics); (c) R3: depth roundtables based on application areas. This way R1 exercise will thematically connect to topics in R2, and will prompt participants to reflect on relevant themes and challenges through hands-on first-person experience. R2 will connect participants across disciplines to stimulate the cross-pollination of ideas between subdomains and encourage new connections to generate a wide map of observed challenges. And R3 will allow for a more in-depth discussion of specific challenges between participants who already work in a more narrowly defined field.

- **Introduction:** We will set the goals and schedule of the workshop, We will invite all participants to include their self-introductions on the Slack channel in advance.
- **Warm-up Interoception Attunement Activity:** Using principles of body-centric design [5], we will spend 10 minutes at the beginning of the workshop to practice a non-mediated interoceptive activity to help participants *arrive* and re-focus for productive discussion. One of the organizers will lead a body scan exercise fostering interoception by directing participants' attention to their physiological activity such as breathing and heartbeat.
- **R1 - First Round: Hands-on Provocations and Discussions:** To stimulate reflection on opportunities and challenges emerging with the use of biosignals, we will invite participants to engage in a series of exercises set up in stations. Stations will include a basic biofeedback interface and playful prompt cards. The stations will be designed to prime participants for discussion in the following round by provoking questions and observations relevant to discussion topics. For example, one activity would include a visualization of all participants' heart rates in ranked order, and a task to guess which heart rate belongs to whom. This would prompt participants to think about their level of interoceptive awareness of their own physiology, how they make meaning from seeing their own and others' heart rates represented as a number or a bar chart, and which effects seeing everyone's biosignals may have on a group dynamic. There will be 4 stations of activities for in-person participants, 2 stations for a hybrid interaction across participants, and 4 online stations.
- **R2 - Second Round: Discussion Based on Workshop Topics**. To ensure a breadth of discussion and cross-pollination across diverse fields of participants we will structure the second round based on large common topics across domains and application areas. This will bring together researchers and practitioners across different domains, who struggle with similar challenges. Groups will be tasked with identifying and expanding on a broad set of challenges fitting within each topic. For each identified challenge participants will be asked to describe it, explain why it is a challenge, unpack it and provide specific examples of where it is being observed, and position it in relation to other challenges in terms of its criticality and solvability. We will provide the groups with a set of prompt cards with some examples of challenges to start off the discussion and blank cards to fill out. Then groups will engage in affinity diagramming to group the cards together to identify common thematic threads.
- **R3 - Third Round: Discussion Based on Application Areas**. To provide a space for a deeper discussion of prominent challenges observed in each individual application domain, for the final round we will group participants based on the application areas they are working in. Here participants will be tasked to select 2-3 challenges from the previous round of discussion and brainstorm approaches for addressing these challenges within a specific application domain.

Time	Activity	Task Description
9:30-9:45	Introduction	Arrival and Introduction of the workshop goals and schedule
9:45-10:00	Attunement	Interoception exercise for connecting with one's body
10:00-11:30	Hands-on Provocations (R1)	Exercises provoking reflections on workshop topics. Discussion
11:30-11:45	Coffee Break	
11:45-12:30	Large Group Discussion	Map out themes emerging from reflection on exercises
12:30-13:30	Lunch	Networking
13:30-14:30	Round tables by topic (R2)	Grouped by discussion topic
14:30-15:00	Report back	Each group summarizes identified challenges
15:00-15:15	Coffee break	
15:15-16:15	Rounds tables (R3)	Grouped by application areas focused discussion
16:15-17:00	Large group discussion	Building research agenda and future directions
18:00-20:00	Open Dinner	Networking

Table 1. Workshop Schedule

- **Summarizing Findings**: A representative from each group will report on their findings with the help of created affinity diagrams. This way collectively we will present a map of common challenges and identify future research directions for integrating biosignals in HCI. We will document these findings by saving the Miro board and Presentations containing affinity diagrams, and taking pictures of the whiteboards in the conference room. We will use these notes for writing a blog post on Medium.com, and reporting the observation in the ACM Interactions Magazine article.
- **Social Spaces** at the end after workshop. We will invite virtual participants to move into a virtual social space where they can continue their conversations in an informal setting. The physical participants will be encouraged to go together for dinner for which we will make a reservation at a local restaurant. Together with the attendees, we will also decide on the preferred Online Social Media space to have an online group/channel for growing the community and staying connected.

3   INTENDED OUTCOMES OF THE WORKSHOP, THEIR BENEFITS AND SIGNIFICANCE

The goal of this workshop is to bring together a community of researchers, designers, artists, and industry professionals working with biosignals to formulate a **research agenda** by exploring key challenges in the field, synthesize future research direction, and facilitate new connections and future collaborations between attendees. The discussions will be structured to create a map of common challenges observed across diverse domains of researchers and practitioners working with biosignals, and identify shared themes and strategies for addressing these challenges. This would foster a shared vocabulary across diverse domains and articulation of future directions for the field. By reporting these results in ACM Interactions and on Medium.com we will inspire academic researchers and designers, industry practitioners, and policymakers to start working toward these future directions.

Following the workshop, we will start a Social Media group (e.g., Facebook, Slack, Matrix, Wiki, depending on participants' preference), through which participants can continue the evolving discussion of challenges and opportunities presented by designing with biosignals: post questions, share posts about their work, recruit participants, and form collaborations. Attendees will be encouraged to work with the organizers and other attendees on future journal publications and co-organizing workshops and panels in academic and industry venues. Through this timely workshop topic, we will establish a lasting community focused on the design of interactive biofeedback systems.

4 REQUIRED FACILITIES

The workshop will require a room that can accommodate up to 45 persons, includes a projector and a whiteboard, and a stable internet connection for the involvement of remote participants.

5 MATERIALS AND EQUIPMENT

For Round 1 activities: We will bring biosensors and basic interactive prototypes (e.g. visualizations and sonifications of heart rate and breathing). We will also prepare cards with provocations and instructions that will invite participants to engage with the exercise in a playful manner. For R2 we will prepare physical and digital cards with examples to kick-off the discussion. We will bring sketching materials, such as paper, sticky notes, markers, etc. for physically present participants to note down their discussion, and prepare a Miro board for online participants and the summary of everyone's discussion.

6 PLANS TO ACCOMMODATE HYBRID PARTICIPATION

We will conduct a synchronous hybrid workshop. Our hybrid approach will facilitate sharing between virtual and in-person attendees ensuring discussion grounded in equitable and diverse participation, integrating a broad range of perspectives. For the first round of discussion based on activities, we aim to leverage the distribution of participants across virtual and in-person participation to provoke reflection on the use of biosignals across co-present and tele-present interaction through our activity provocations. For the second and third round of discussion, we will structure groups to put remote participants together to ensure ease of engagement for each participant in a small group. For the large group discussion, remote groups will present their conclusion through Zoom to everyone in the room.

During the workshop, we will introduce discussion topics to attendees using a presentation that will be projected in the physical room and shared on the teleconference platform for remote attendees. We will use a Miro board for noting down discussion topics to make them available for both in-person and remote participants. One of the organizers will be copying the topics from the whiteboard into Miro board and vice-versa. Remote participants will use the Miro Boards, which will also be projected on the whiteboards in the conference room. This way participants in the conference room can add physical notes to the same discussion space and see the contributions of remote participants. One of the facilitators will update the virtual Miro board by making a virtual copy of physical sticky notes. We will use automated transcription in Zoom during large group discussions to improve accessibility.

We will also encourage remote participants, where possible, to join the workshop together with their collocated colleagues from the same physical location, if e.g. there are multiple attendees from the same university. This would allow them to experiment with a broader range of exercises if they can have a collocated partner.

We will share all the materials on the workshop website and through the Slack channel for access by participants who are not able to attend synchronous sessions. These materials will include papers and videos submitted by accepted participants, descriptions of the provocation exercises that participants can experiment with on their own, prompt cards used for structuring the discussion, and links to the Miro board summarizing our discussion.

7 DISSIMENATION OF RESULTS

We will report back to the community by publishing the summary of the discussion on the workshop website. We will report on key findings from the discussion in an ACM Interactions magazine for the academic HCI community, and in a Medium.com or Conversation article for audiences in the tech industry, policy, and the general public. Together

with interested participants, we will work on submitting a paper for DIS'24 presenting an overview of the generated research agenda, that will augment the existing systematic reviews of this research domain [1–4, 6] with an overview of practice-based reflections in this field. Finally, we will prepare a proposal for a special issue at TOCHI on the integration of biosignals in Human-Computer Interaction.

8   ORGANIZERS' BIOGRAPHIES

The organizers of the workshop come from industry, academia, and art from a variety of backgrounds and levels of seniority including: affective computing, cognitive science, VR, installation art, body-centric design, tangible design, design ethics and biofeedback for children, and design for health and wellness.

Ekaterina R. Stepanova is a PhD Candidate at the School of Interactive Arts and Technology at Simon Fraser University with a background in cognitive science, developmental psychology and virtual reality. In her research, she employs somaesthethics and embodied cognition to design mediated experiences with bioresponsive and immersive technologies that can promote a genuine feeling of connection.

Abdallah El Ali is an HCI research scientist at Centrum Wiskunde & Informatica (CWI) in Amsterdam within the Distributed & Interactive Systems group. He leads the research area of Affective Interactive Systems, where he focuses on ground truth label acquisition techniques, emotion understanding and recognition in XR, and affective human augmentation using physiological signals. Website: https://abdoelali.com

John Desnoyers-Stewart is a media artist, designer, and a PhD Candidate at the iSpaceLab at Simon Fraser University. With his background in engineering and interactive art he creates immersive experiences using VR, pseudohaptics, and biosensors to stimulate embodied social connection and creative expression.

Jérèmy Frey is a researcher at Ullo with a background in cognitive science and a PhD in computer science from the University of Bordeaux. His projects explore how physiological computing and tangible user interfaces can augment communication in order to support wellbeing and facilitate human relationships.

Alexandra Kitson is a postdoctoral researcher in the Tangible Embodied Child-Computer Interaction Lab at Simon Fraser University. Her past research investigated the ethics of biowearables on children's identity formation, and current research focuses on developing virtual reality emotion regulation interventions for youth.

Alissa N. Antle is the director of the Tangible Embodied Child-Computer interaction Lab at Simon Fraser University and a member of the Royal Society of Canada's College of New Scholars, Artists and Scientists, acknowledging her as an intellectual leader of Canada. Her research explores ways to support children's cognitive and emotional development through tangible technology. Her work contributes to the discourse on ethics and justice in technology design.

Bernhard E. Riecke is a professor as Simon Fraser University leading the iSpaceLab. He employs multidisciplinary approaches to investigate VR, spatial cognition, and transformative experience design. His work aims to promote positive change by supporting well-being, feeling of connection, and cognitive shifts.

Vasiliki Tsaknaki is an Assistant Professor in the Digital Design Department at the IT University of Copenhagen. Her research combines materials experiences, computational crafts and somaesthetic design methods. Through practice-based studies she investigates and reflects on intersections of these areas, probing the space of designing for wellbeing and working with (bio)data as a design material.

Noura Howell is an Assistant Professor in Digital Media at Georgia Tech. Her research explores embodied, tangible, emotional, and social experiences with biodata, through dynamic displays such as color-changing fabric, furniture, and sound. She draws from feminist new materialist and decolonial theories, and employs methods including design futuring and retrospective duoethnography.

9 PARTICIPATION CALL

Biosensing technologies become increasingly more widely integrated in Human-computer Interaction. Biosignals provide novel opportunities of interaction, offering valuable insights into ordinarily hidden processes inside our bodies, revealing somatic information pertaining to our and others' bodies, emotions, health, and cognitive processes. However, the integration of biosignals in HCI presents many challenges pertaining to UX, I/O, interpretation of biodata, representation of biosignals, and broader ethical concerns. To map out the landscape of existing challenges and future research directions, we invite participants working with biosignals to join a one-day hybrid workshop held at the 2023 ACM SIGCHI Conference on Designing Interactive Systems in Pittsburgh, Pennsylvania, USA. We welcome participants from HCI, design, digital art, psychology, education, health, philosophy, ethics and law. We invite submissions of 2-4 page position paper, or a 5-min speculative design video with a 1-page description in an ACM extended abstract format, presenting a project or articulating a challenge that relates to this call. Alternatively, authors may submit their previously published paper raising relevant questions. Submissions should be sent to biosignalshci-wks@gmail.com and must adhere to accessibility guidelines outlined by ACM. The organizing committee will select submissions based on the quality and contribution of the work relating to biosignals integration. These submissions will be shared with all workshop attendees in advance to prime them for a stimulating discussion at the workshop. At least one author of each accepted submission must attend the workshop and register for both the workshop and the DIS'23 conference. For more information please visit http://ispace.iat.sfu.ca/project/biosignals-wks/

REFERENCES

[1] Milou A Feijt, Joyce HDM Westerink, Yvonne AW De Kort, and Wijnand A IJsselsteijn. 2021. Sharing biosignals: An analysis of the experiential and communication properties of interpersonal psychophysiology. *Human–Computer Interaction* (2021), 1–30.

[2] Clara Moge, Katherine Wang, and Youngjun Cho. 2022. Shared User Interfaces of Physiological Data: Systematic Review of Social Biofeedback Systems and Contexts in HCI. In *CHI Conference on Human Factors in Computing Systems*. 1–16.

[3] Mirjana Prpa, Ekaterina R Stepanova, Thecla Schiphorst, Bernhard E Riecke, and Philippe Pasquier. 2020. Inhaling and Exhaling: How Technologies Can Perceptually Extend our Breath Awareness. In *CHI'20*. 1–15.

[4] Ekaterina R Stepanova, John Desnoyers-Stewart, Kristina Höök, and Bernhard E Riecke. 2022. Strategies for Fostering a Genuine Feeling of Connection in Technologically Mediated Systems. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. 1–26.

[5] Vasiliki Tsaknaki, Madeline Balaam, Anna Ståhl, Pedro Sanches, Charles Windlin, Pavel Karpashevich, and Kristina Höök. 2019. Teaching soma design. In *Proceedings of the 2019 on Designing Interactive Systems Conference*. 1237–1249.

[6] Bin Yu, Mathias Funk, Jun Hu, Qi Wang, and Loe Feijs. 2018. Biofeedback for everyday stress management: A systematic review. *Frontiers in ICT* 5 (2018), 23.