Body x Materials

A workshop exploring the role of material-enabled body-based multisensory experiences

Bruna Petreca
Royal College of Art, bruna.petreca@rca.ac.uk

Ana Tajadura-Jimenéz
Universidad Carlos II de Madrid, atajadur@inf.uc3m.es

Laia Turmo Vidal
Universidad Carlos II de Madrid, lturmo@inf.uc3m.es

Ricardo O. Nascimento
Royal College of Art, ricardo.o'nascimento@rca.ac.uk

Hasti Seifi
Arizona State University, hs@di.ku.dk

Judith Ley-Flores
Universidad Carlos II de Madrid, jley@inf.uc3m.es

Aneesha Singh
University College London, aneesha.singh@ucl.ac.uk

Nadia Bianchi-Berthouze
University College London, nadia.berthouze@ucl.ac.uk

Marianna Obrist
University College London, m.obrist@ucl.ac.uk

Sharon Baurley
Royal College of Art, sharon.baurley@rca.ac.uk

Over the last 15 years, HCI and Interaction Design have experienced a "material turn" characterized by a growing interest in the materiality of technology and computation, and in methods that support exploring, envisioning, and crafting with and through materials. The community has experienced a similar turn focused on the body, on how to best design for and from a first-person, lived experience, and the moving and sensual body. In this workshop, we focus on the intersection of these two turns. The emerging developments in multimodal interfaces open opportunities to bring in materiality to the digital world as well as to transform the materiality of objects and bodies in the real-world, including the materiality of our own bodies. The different sensory qualities of (touchable and untouchable, physical and digital) objects and bodies, including our own, can be brought into the design of digital

technologies to enrich, augment, and transform embodied experiences. In this "materials revolution" [15], what are the current theories, approaches, methods, and tools that emphasize the critical role of materiality to body-based interactions with technology? To explore this, in this workshop we will focus on five related themes: material enabling expression, material as a catalyst for human action, material enabling reflection and awareness, material enabling transformation and material supporting the design process for the re-creation of the existing and the yet-to-exist. This workshop with technology presentations, panel sessions with experts, and multidisciplinary discussions will: (i) bring together researchers who work on (re)creating sensory properties of materials through technology with those who investigate experiential effects of materials and material-enabled interactions, (ii) discuss methods, opportunities, difficulties in designing materiality and material-enabled interactions, and (iii) form a multidisciplinary community to build synergies and collaborations.

CCS CONCEPTS

Human-centered computing → Interaction design • Human-centered computing → Human computer interaction (HCI); *Interaction techniques; Interaction paradigms*

Additional Keywords and Phrases:

Materiality, Multisensory interaction, Embodied interaction, Embodied experience, Body perception

ACM Reference Format:

Bruna Petreca, Ana Tajadura-Jiménez, Laia Turmo Vidal, Elena Márquez Segura, Ricardo O. Nascimento, Hasti Seifi, Judith Ley-Flores, Aneesha Singh, Nadia Bianchi-Berthouze, Marianna Obrist, Sharon Baurley, 2023. Body x Materials: A workshop exploring the role of material-enabled body-based multisensory experiences In CHI EA'23, April 23–25, 2023, Hamburg, Germany. ACM, New York, NY, USA, 10 pages.

1 Background

We are living a "materials revolution" [15] that sees a blurring of roles in material practices (e.g., with bioengineering and computation allowing for non-experts to be more actively (re)engaged in making of/with materials) and an appetite for more conscious and personalized engagement. The emerging developments in multimodal interfaces open opportunities to (re)create different aspects of materials such as texture or stiffness with technology. At the same time, materiality can be brought to the design of technology to augment, facilitate, or transform experience and interaction. In this workshop we will focus on exploring materiality in connection to technology with respect to five themes: (1) material enabling expression, (2) material as a catalyst for human action, (3) material enabling reflection and awareness, (4) material enabling transformation and (5) material supporting the design process for (re)creating the existing and the yet-to-exist.

1.1 Material enabling expression

Historically, humanity has utilized materiality as a means for expression. From cultural expressions in adorning bodies and decorating surroundings, to artistic endeavors of portraying an emotional experience and/or a political stance, materials have enhanced and witnessed humans' ability to materialize subjective and intangible aspects of their existence. This relationship with materiality is so ingrained that it allows people, experts, or non-experts, to access and express themselves in more natural and less restrained ways. In HCI, [21] explored the use of materiality as a method to enable body-based expression through the Sensual Evaluation Instrument (SEI). This is an UX evaluation method that allows users to express their emotions through a crafted set of objects in a non-arbitrary manner. In other cases, technology can be brought in to enhance the expressiveness of the materiality of the body; for example, a wearable wig allows the gamer to express their prowess at "headbanging" whilst critically becoming aware of the physical pain involved in playing (i.e., The game wearable controller Headbang

Hero [34]). For this topic, we are interested in works that explore the role of materiality in enabling and enhancing expression of body-based multisensory experiences, or body-based expression of experiences.

1.2 Material as catalyst for human action

The interactive experiences that we create are intrinsically connected to the very materiality of our designs, which establish the possibilities for interaction and foster bodily experiences [16]. Materials, hence, act as catalysts of human action, as we are affected and respond to the sensorial perceptions that a material enables and ascribe meanings and experienced emotions related to it [16]. Material qualities can also prompt and affect bodily behavior, e.g., visual properties of objects can invite users to touch them [27], movement sonification with metaphorical sounds of water or wind have been found to affect how people perform physical activity exercises [30] and changing materiality through sound in multi-touch interfaces have also been found to change touch behavior [52]. For this topic, we are interested in submissions that address material as a catalyst of creativity, particular behaviors, and physical activity, among others.

1.3 Material enabling reflection, awareness, and understanding

Interacting with materials can bring us to reflection and awareness of our own bodily experience. For example, biofeedback technologies using haptic and audio materials augment physiological sensations and parameters in ways that go 'above and beyond the information that is naturally available' to us [17], and hence can help us (re)discover concealed aspects of our bodily experience [36] or help regulate our emotions [12]. Textiles enhanced by force-sensitive resistors brought people to reflect on and to become aware of their embodied knowledge utilized in selecting and designing with textiles [40]. Here, we are interested in submissions that address material as enablers of reflection and awareness of bodily experiences.

1.4 Material enabling transformation

Materiality is also an intrinsic property of bodies, including people's own bodies. Neuroscience and HCI researchers have demonstrated that signals from different sensory modalities, such as sounds [54], haptic [23], visual [23], smell [4], taste and texture stimuli [37] can be used to transform embodied experiences, which in turn may impact on motor, social and emotional functioning (linking to theme 2, e.g., [51]). This is because people's body perceptions are linked to cognitive [49], motor [26], social [11] and emotional [56] functioning, as well as to self-identity [11,53]. Research on sensory engagement with clothing suggests using materials to actively co-construct identity beyond appearance, incorporating biosocial elements into fashion design [7]. Moreover, positive and negative body perceptions are intricated with many health conditions such as chronic pain [57], eating disorders [9], physical inactivity [35], stroke [8], or depression [22]. New developments in multimodal interfaces open unique opportunities to transform materiality. Here, we are interested in works that address how materiality can transform (i.e., enhance, empower, amplify or augment) people's perceptions of bodies, and impact functioning, identity, and health, including the relation between AI, materiality, and people's transformations.

1.5 Material supporting the design process for (re)creating the existing and the yet-to-exist

Hands-on engagement with design materials and with objects has always been key in ideation processes, e.g., prototyping. It allows designers to explore simultaneously design possibilities and constraints, generate ideas, and probe what type of experiences are interesting to design for [32,44,55,58]. Designers often collect physical materials for inspiration or inspection (e.g., textures [14], buttons [31]) and mimic or augment these through various sensory modalities [13,29,39]. Engaging with materials is especially important when designing body-based experiences with technology and when doing so using embodied design activities, i.e., those that strongly

engage the body of designers and other participants to design. The previous themes are behind why this is the case. For example, in a sensitizing design activity [43,59] or a bodystorming activity [33,38,42,43], designers might re-create situations of target users to better understand them [3]. They might craft a scenario, as well artefacts and tools to use, and might engage in role-playing [3,6,19,38,42] what users do in such situations. Materiality can help here to feel like, express, and present oneself like somebody else, through e.g., costumes [2,24,25]. Materials can also be key to transform, re-signify, and (re-) create the space and objects used in these situations, which can be key to reframe and support action, and feel immersed in those situations (e.g., when recreating physical environments in VR/AR [5,10,41]). In this theme we ask: How can materiality help in the design process? In particular, how can materiality support access, and understanding of users, their experiences, and contexts? How can materiality support the design of non-yet-existent experiences, technologies, and designs? How can materiality enable re-creation of existing experiences (e.g., in VR, AR contexts)?

1.6 Workshop aims and topics of interest

This workshop aims to build a community of researchers, designers and practitioners with interest in three main aspects: (i) designing/creating materials or (multi)sensory experiences and technologies, (ii) supporting people's emotional and physical health and well-being through materiality and sensorial technologies, and (iii) embodied interactions. This session will enable networking and new collaborations and will open the design space for materiality and material-enabled body-based multisensory experiences by integrating research from various perspectives. Participants will share experiences, knowledge and insights into methods and tools by discussing questions of interest, such as:

1. What are the current theories, approaches, methods, and tools that emphasize the critical role of materiality to body-based multisensory experiences and interactions?
2. How to bridge the gap between physical sensory parameters and experience of materiality, i.e., between designing low-level material sensations and the goals of designing for higher level experiences, such as creating different body perceptions through different material qualities?
3. How can materiality support access and understanding of users, their experiences, and contexts?
4. Can materiality enhance, empower, amplify, augment people through their interactions with it? What are the challenges in specific medical conditions (e.g., chronic pain, dementia, ageing, stroke, depression, eating disorders, etc.) and how can we design a framework for supporting people with such conditions and overall health and well-being through body-based technology and material-enabled multisensory experiences?
5. Can materiality be enhanced, empowered, amplified, augmented through technology? How to (re)create different aspects of materials such as texture or stiffness with technology?
6. How can materiality enable the re-creation of existing experiences (e.g., in VR, AR contexts)? How can materiality support the design of non-yet-existent experiences, technologies, and designs?
7. What are the potential ethical issues that arise when doing such research? What kind and level of support needs to be in place? Who are the stakeholders that need to be involved in this space?

2 Organizers

The organising team truly represents the multidisciplinary and international nature of the workshop. Between them, the organisers have expertise in multisensory and embodied experiences and technologies, traditional and innovative design processes, methods, and tools, affective computing, materials experience, textiles and product design and real-life contexts. As conference program committee members, workshop organisers, publication in top-tier conferences (e.g., CHI, IDC), journals (e.g., HCI, TOCHI), special issues and books. They organized related SIGs [27, 44, 45], and a workshop [1, 18, 47] at CHI, as well as hands-on workshops at other haptics and HCI conferences such as at NordiCHI, DIS, IDC, CHIPlay, IEEE VR, and AsiaHaptics – attesting to the interest in this topic in the CHI community.

Bruna Petreca (main contact) is a Research Fellow in Human Experience and Materials at the Materials Science Research Centre of the Royal College of Art. She co-leads the Consumer Experience Research Strand of the Textile Circularity Centre (textilescircularity.rca.ac.uk) and is Co-Investigator on the project Consumer Experience Digital Tools for Dematerialisation, developing new forms of interaction and new methods for materials experience.

Ana Tajadura-Jiménez (main contact) is an Associate Professor at the DEI Interactive Systems Group, Universidad Carlos III de Madrid. She leads the i_mBODY lab (www.imbodylab.com) focused on interactive multisensory body-centred experiences, at the intersection between the fields of HCI and neuroscience. She is currently Principal Investigator of the MagicOutFit and the BODYinTRANSIT projects, which investigate the design of sensorial technology to alter people's body perceptions and drive positive changes in emotional and physical health in populations with body concerns.

Laia Turmo Vidal is an interaction designer and currently a postdoctoral researcher at i_mBODY lab. Her research explores how interactive technologies can be designed and used to improve people's body experiences, particularly in contexts of health and wellbeing. Her research interests include multisensory and wearable technology, embodied learning, social cooperation and the role of materials and materiality in embodied design processes.

Ricardo O. Nascimento is a Postdoctoral researcher in Human Experience and Materials at the Material Science Research Centre of the Royal College of Art. His research explores how new technologies challenge and enhance human perception with focus on on-body interfaces and hybrid environment.

Hasti Seifi is an assistant professor in the School of Computing and Augmented Intelligence at Arizona State University. At the intersection of haptics and HCI, she investigates the design process of haptic stimuli and people's affective and cognitive schemas for haptic sensations. She has developed open-access haptic collections and authoring tools (e.g., VibViz, Haptipedia) as well as educational content (LearnHaptics) that facilitate creation and adoption of haptics by a variety of designers and end-users.

Judith Ley-Flores is a postdoctoral researcher at the DEI Interactive Systems Group, Universidad Carlos III de Madrid. She is part of the magicOutFit project, and she explores how to use sensory feedback to alter the way people perceive their body, emotional state, and motor behavior. Her research interests are HCI, ubiquitous computing, sound computing for multimodal interfaces like wearable devices in combination with sound feedback to support activities in physical health such as motor therapies or physical exercise.

Aneesha Singh is an Associate Professor in Human-Computer Interaction at the UCL Interaction Centre. She is interested in the design, adoption and use of personal health and wellbeing technologies in everyday contexts, focusing on sensitive and stigmatized conditions. Her research areas include digital health, ubiquitous computing, multi-sensory feedback and wearable technology. She has worked in industry as a software consultant, and as a technical journalist.

Marianna Obrist is Professor of Multisensory Interfaces at UCL (University College London), Department of Computer Science and Deputy Director (Digital Health) for the UCL Institute of Healthcare Engineering. Her research ambition is to establish touch, taste, and smell as interaction modalities in HCI, spanning a range of application scenarios, from immersive VR experiences to health/wellbeing uses. Most recently, she published a book on 'Multisensory Experiences: where the senses meet technology'.

Nadia Bianchi-Berthouze is a Full Professor in Affective Computing and Interaction at the UCL Interaction Centre. Part of her research focuses on how full-body technology and body sensory feedback can be used to modulate people's perception of themselves and of their capabilities to improve self-efficacy and copying capabilities.

Sharon Baurley is Professor of Design & Materials, and Director of the Materials Science Research Centre at the Royal College of Art. Sharon has a 16-year track record of leading UK research council-funded interdisciplinary projects totalling £10m. Her research is focused on interdisciplinary human-centred design methods to develop new 'Product Cultures' that de-couple the use of materials resources from human wellbeing and economic development.

3 Website

The workshop URL is: https://www.rca.ac.uk/body-materials

The website will host the workshop aims and plans, organizers details and accepted submissions.

4 Pre-workshop plans

The workshop will be publicized to HCI and multisensory researchers through relevant email distribution lists (e.g., SIGCHI, Technical Committee on Haptics) and social media groups including a community website for interest in multisensory technologies from our previously organized SIG and workshop (https://sensedbody.org) and the websites of different ongoing research projects such as MagicOutfit (www.magicoutfit.com) and BODYinTRANSIT (https://bodyintransit.eu) exploring the multi-sensory contributions to body perception, and Textiles Circularity Centre exploring haptic and experiential relationship with materials (textilescircularity.rca.ac.uk). We will also share in the project dedicated website (www.rca.ac.uk/body-materials) the workshop structure and aims, snippets from devices and materials brought to our previous workshops for inspiration. a call for participation, prior readings, and a workshop schedule. We will also share the participants' submissions once accepted. We will actively seek submissions from our network and contacts. Potential participants will be invited to submit a position paper or an alternative submission in the form of a conceptual design sketch, presentation slides, poster, or video. A total of up to 25-30 participants will be invited to participate in the workshop based on their submissions. We will accept 10-12 submissions which will be reviewed by the workshop organizing committee.

To facilitate participation and take full advantage of the workshop opportunity, we will offer pre- and post-workshop activities. A planned pre-workshop activity will include a remote meeting where participants will become familiar with the overall scope and idea of the workshop. Participants will be asked to introduce themselves and explain their motivation to take part in the workshop (1-2min, totalling 1h). They will also be asked to briefly introduce the work (e.g., method or prototype) that they will bring and present during the one-day workshop. Based on these presentations, several groups or “stations” will be formed to work on the different workshop themes.

4.1 In person workshop, Asynchronous engagement, and Online considerations

The main workshop will be run in-person, as it is relevant to be able to experience through different senses the concepts, prototypes, methods, and others shared by the workshop participants. The pre-workshop activity will use Zoom, and the timing for it will be decided with the participants. Prior to the workshop, all materials will be shared with participants through email, the workshop website and on shared drive folders.

5 Workshop structure

The one-day workshop will consist of three main activities:

Activity 1: Experience of materials and idea generation. Organized according to the workshop main themes (these will be adjusted if needed based on pre-workshop and the composition of the participants).

Activity 2: Group discussion on salient points.

Activity 3: Mapping up the Design Space for material-enabled body-based multisensory experiences.

These activities will be moderated by organizers and invited experts. These will be complemented by an intervention in the form of moderated dialogue by experts on the workshop theme aimed to provoke and inspire discussions during activities. The activities will build on the participants' contributions, as in Activity 1 they will be asked to showcase their method, prototype, concept to kick-off the workshop discussion, which will focus on the challenges and experiences highlighted in the participants’ submissions related to the workshop themes. Following the afternoon coffee break, the organizers will moderate a panel discussion with invited experts on the outcomes of the activities and future research directions. Our confirmed invited panellists include Elvin Karana,

Paul Strohmeier, Kristi Kuusk and Pedro Lopes. The workshop will close with a brief presentation of the communication channels set to continue the conversations, the post-workshop plans (see post-workshop plans) and other future opportunities for collaboration.

5.1 Workshop schedule

The suggested workshop schedule is presented below.

09:00 - 09:15 – Welcome and Introductions

09:15 - 10:45 – Activity 1: Experience of materials and idea generation. Organized following the workshop main themes

10:45 - 11:15 – Coffee break

11:15 - 12:00 – Activity 2: Discussion on salient themes mixing groups

12:00 - 13:00 – Conversation/Provocation: Material Experiences with invited panellists

13:00 - 14:00 – Lunch

14:00- 15:30 – Activity 3: Mapping the Design Space for material-enabled body-based multisensory experiences

15:30 - 16:00 – Coffee break

16:00 - 17:00 – Panel Discussion and Closing

6 Diversity and accessibility

The organizers are committed to inclusion of participants across abilities, gender, ethnicity, location, institution, seniority, and research background. The participants will be asked to make workshop submissions fully accessible and include alt-text image descriptions. We will attempt to have a sign-language interpreter and live closed captions of the presentations for any participants that may need it. We will have volunteers at the workshop to facilitate group work and interactions.

7 Post-workshop plans

The post-workshop activities will focus on continuing building a multidisciplinary community to study/design material-enabled body-based multisensory experiences and technologies. We will establish a means of communication to share ideas and identify potential collaborations and funding opportunities (e.g., through an email list, a dedicated website, or a slack channel). The organizers aim to organize a collaborative research article to be published in a journal (depending on how systematically the outcomes cover the themes, we will decide on a submission) and to which interested workshop participants will be invited to contribute. The article will be related to the workshop themes and will summarize the main workshop outputs and reflections with the aim of mapping up current research and opening future research directions. We anticipate that the fostered communication and collaboration among researchers will promote awareness of research and practice from different domains and lead to a more comprehensive understanding of design and evaluation of material-enabled body-based multisensory experiences. We aim to get the discussion to a point where we can organise a follow-up Dagstuhl seminar to bring together HCI researchers and voices from real-life application scenarios.

8 Call for participation

We invite researchers, practitioners, and designers with an interest in designing and evaluating material-enabled body-based multisensory experiences and technologies, to submit position papers of up to 4 pages in single-column SIGCHI submission template (including references) stating their existing work, a conceptual design, or their position with respect to the workshop topic. Submissions should also describe a concept, prototype or method that will be brought and showcased at the workshop and include up to two discussion points and issues that participants would like to discuss in the workshop. We also welcome alternate submissions in the form of

presentation slides, design sketches, videos, and posters. Authors must ensure the accessibility of their submission by following the SIGCHI Accessibility Guidelines (https://sigchi.org/conferences/author-resources/accessibility-guide/). This workshop aims to build a community and open the design space for materiality and material-enabled body-based multisensory experiences by integrating research from various perspectives. Submissions can be made, by February 20, 2023, on the workshop website (https://www.rca.ac.uk/body-materials) by completing a pre-questionnaire which includes demographic questions to help the organizers establish authors' background. The submissions can be individual or group. If accepted, at least one author must attend the pre-workshop activity, the workshop at CHI2023 (in-person) and bring and showcase at the workshop their contribution (concept, prototype, method). All accepted submissions will be published on the website.

ACKNOWLEDGMENTS

We acknowledge funding by: the Spanish Agencia Estatal de Investigación (PID2019-105579RB-I00/AEI/10.13039/501100011033) and the European Research (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No 101002711); EMS is funded by the Madrid under the Multiannual Agreement with UC3M in the line of "Research Funds for Beatriz Galindo Fellowships" (MovIntPlayLab-CM-UC3M), and in the context of the V PRICIT (Regional Programme of Research and Technological Innovation). This work was funded by UKRI grants [EP/V011766/1 and EP/V042289/1]. For the purpose of open access, the author has applied a Creative Commons Attribution (CC BY) licence to any Author Accepted Manuscript version arising.

DATA ACCESS STATEMENT

We acknowledge that no new data were generated or analyzed for this extended abstract.

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