Body Transformation Experiences: A workshop on How to Elicit, Assess and Support them through Multisensory Technology

Ana Tajadura-Jiménez
Elena Márquez Segura
Marte Roel Lesur
Universidad Carlos III de Madrid
Spain
[atajadur,emarquez,mroel]@inf.ucm3.es

Laia Turmo Vidal
Alice Haynes
KTH Royal Institute of Technology
Stockholm, Sweden
[laiatv,ahaynes]@kth.se

Frédéric Bevilacqua
IRCAM–CNRS–Sorbonne Université
Paris, France
Frederic.Bevilacqua@ircam.fr

Nadia Bianchi-Berthouze,
Aneesha Singh
University College London
London, UK
[nadia.berthouze,aneesha.singh]@ucl.ac.uk

Pedro Lopes
University of Chicago
United States
pedrolopes@uchicago.edu

Jun Nishida
University of Maryland
College Park, United States
jun@umd.edu

Don Samitha Elvitigala
don.elvitigala@monash.edu
Department of Human Centred
Computing, Monash University
Melbourne, Australia

Paul Strohmeier
paul.strohmeier@mpi-inf.mpg.de
Max Planck Institute for Informatics,
Saarland Informatics Campus
Saarbrücken, Germany

Figure 1: Examples of devices employed to induce Body Transformation Experiences (BTEs), provided as inspiration: (a) SoniWeight shoes—transforming body weight via sound [19, 24, 88, 92]; (b) Transforming breathing via thermal feedback [15]; (c) HandMorph—transforming hand dimensions [54]; (d) Me^2—encountering one's child self [51]; (e) vARitouch-transforming tactile material properties [105]; (f) Emopal—emotional connections via brain–muscle interfaces [42]; (g) Movement sonification for rehabilitation [59].

Abstract

Over the last 30 years researchers in HCI, Cognitive Neuroscience, and Interaction Design have shown a growing interest in experiences that engage the moving and sensual body to alter one's body perception. The way one's body is perceived is highly plastic and can be altered through multisensory signals and feedback related to the body. The emerging developments in multisensory interfaces open opportunities to enrich, augment and transform body experiences in the real-world through the senses. This workshop focuses on the theories, approaches, methods, and tools to design multisensory technology that elicit and support Body Transformation Experiences, and on how to best design these for and from a first-person, lived experience. We will explore how to elicit and assess multisensory Body Transformation Experiences, and showcase concrete examples of supporting them with technology. Through technology presentations, panel sessions with experts, and multidisciplinary discussions, this workshop aims to: (i) bring together researchers creating Body Transformation through sensory technology with those studying experiential effects of sensory-body interactions; (ii) map current methods, opportunities, and challenges in designing Body Transformation Experiences; and (iii) envision a road map for this field with future directions by fostering a multidisciplinary community, building collaborations, and inspiring innovative directions for design and research.

CHI EA '26, Barcelona, Spain

ACM ISBN 979-8-4007-2281-3/2026/04
https://doi.org/10.1145/3772363.3778778

CCS Concepts

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

Keywords

Body perception, Multisensory interaction, Embodied interaction, Embodied experience

ACM Reference Format:

Ana Tajadura-Jiménez, Elena Márquez Segura, Marte Roel Lesur, Laia Turmo Vidal, Alice Haynes, Frédéric Bevilacqua, Nadia Bianchi-Berthouze, Aneesha Singh, Pedro Lopes, Jun Nishida, Don Samitha Elvitigala, and Paul Strohmeier. 2026. Body Transformation Experiences: A workshop on How to Elicit, Assess and Support them through Multisensory Technology. In *Extended Abstracts of the 2026 CHI Conference on Human Factors in Computing Systems (CHI EA '26), April 13–17, 2026, Barcelona, Spain.* ACM, New York, NY, USA, 9 pages. https://doi.org/10.1145/3772363.3778778

1 Motivation: Why This Workshop

Our bodies ground us in the world, shaping how we sense, move, and experience our surroundings. Research in diverse and complementary disciplines such as psychology, cognitive neuroscience, and somaesthetics, agree that our understanding, perception and lived experience of the body – our felt bodily sense, awareness, and attunement – is not static, but dynamically shaped through sensory signals and interactions. From neuroscience we learned that perceptions of body appearance (e.g., shape, and size [21, 43]), body configuration [65, 107], location [66], and motor abilities [38, 49], as well as bodily sensations [20, 37], can be altered through interactive and multisensory feedback (including visual [12, 37, 55, 93], auditory [96], or haptic [50, 54, 56, 75, 95] signals between others). In these Body Transformation Experiences (BTE), people report perceptual changes leading to unusual or novel experiences of their body, with the aid of multisensory technologies. Crucially, these perceptual alterations have been found to profoundly impact cognitive [25, 48], motor [34], social [18, 48] and emotional [32, 99] functioning, as well as self-identity [18, 68, 76, 93].

This opens up a vast avenue for technological interventions in health and well-being, including eating disorders [17, 90], physical rehabilitation e.g., in stroke [27, 59] or chronic pain [28, 62, 77, 89, 101], sports [103], dance [102], motor learning and physical (in)activity [11, 39, 40, 78], product design [54–56, 75], mental health [41], interpersonal relations [10], and the arts [9, 23, 26, 68]). From a somaesthetic and soma-based design perspective, such BTEs are not only measurable perceptual alterations but also opportunities for cultivating richer, more nuanced felt experiences of the lived body. By engaging first-person methods of bodily inquiry and aesthetic appreciation, soma-design foregrounds how interactive technologies can sensitively shape awareness, presence, and meaning-making, thereby expanding the transformative potential of BTEs beyond clinical or performance outcomes into everyday life and human flourishing.

In this workshop, we build on our recent CHI workshops related to body and sensorimotor augmentations [8, 58, 71, 83], extending their focus to designing these experiences that engage technologies and the body, and to assessing their impact on people. Our aim is twofold: to map the emerging design space of BTEs across disciplines; and to envision a roadmap for how such experiences might be designed, studied, and embedded in diverse contexts. These explorations will focus on inducing BTEs through sensory feedback, measuring BTEs and their impacts across various dimensions (behavior, emotion, cognition, etc); and supporting BTEs through technology.

1.1 How to Elicit Multisensory Body Transformation Experiences

Multisensory research in HCI and cognitive neuroscience has extensively shown that signals from different sensory modalities can be used to transform the way one's body is experienced. In cognitive neuroscience, this often involves mapping an altered signal in one sensory modality to an unaltered signal in another modality, in ways consistent with prior beliefs and expectations [4, 12, 65]. For example, in the well-known rubber hand illusion [12] the (altered) visual experience of seeing a rubber hand instead of one's own being touched while feeling the (unaltered) touch on the own hand results in feeling that the rubber hand is one's own. Other examples include tapping sounds to induce illusions of arm elongation [91, 94, 96]; creaky sounds to evoke sensations of stiffness [36, 39, 80]; one's voice to induce perspective illusions [66]; haptic feedback for phantom limb experiences [12, 100]; and visual feedback in VR to modulate perceived body weight [60], constitution [35], perspective [38], size [55, 87, 104], or even to induce disembodiment [70]. Such illusions can also be elicited by scents [13, 15, 16, 65, 69], vestibular [33], motor [97], or interoceptive signals [7]. Experiences can be created according to physical properties and conceptual mappings related to the sensory signals. For example, the association between sound pitch and verticality can produce a sense of limb elongation when mapped to somatosensory or motor cues [53, 67, 86], while water or marble sounds linked to one body can elicit sensations of body fluidity [39] or different materiality [74]. Beyond the potential of these BTEs to understand multisensory integration and body perception, BTEs remarkably impact other aspects of experience: embodying a different skin tone can reduce racial bias for prolonged periods [48], embodying a friend can change one's self-concept [84, 85], or hearing one's footsteps with more bass or treble can shift motor patterns respectively towards one consistent with a heavier or lighter body [19, 88, 92]. Cognitive neuroscience thus provides powerful accounts of how multisensory signals shape body perception—typically through controlled experiments and measurable proxies of experience.

An extension of cognitive neuroscience inspired approaches builds on O'Regan and Noë's concept of sensorimotor contingencies – the law-like relation between actions and feedback in sensorimotor loops [57]. Manipulating these contingencies, such as adding tactile pulses to an exploratory action, changes how users perceive their bodies and environment. This typically involves high-resolution sensing of body activities that are transformed into audio or tactile feedback in real time [72]. Examples include technologies that estrange users from their bodies [63, 64], systems that modify how movements are experienced (e.g., feeling movement without actual motion [22], or altering the perceived continuity of action [1]), and wearables that change perceived physical properties of the surrounding world [82, 105]. In this approach, BTEs emerge by reshaping the dynamics of action and feedback.

A different approach to BTE can be found in soma-design works which cultivate first-person, felt experience in the design process: for instance, attending to the aesthetics of interaction and the qualities of materialities; working with subtle bodily sensations rather than only overt actions; and fostering slow, reflective modes of engagement that make normally unnoticed sensations available to experience. Through such practices, technologies can be created that invite intimacy (close, affectionate contact with oneself or others) [6, 31, 81], and intimate care practices (e.g., [30]); support attunement to the lived body (e.g., [108]); and ultimately elicit BTEs—where shifts in attention, aesthetics, and relationality reshape how the body is sensed, lived, and understood. In this way, soma-design expands neuroscientific approaches, exploring how underlying processes of body transformation can also be aesthetically cultivated, refined, and extended—opening up new possibilities for designing the felt experience of transformation. Here, we are interested in works addressing how to transform people's body perceptions through multisensory technologies in ways that impact functioning, identity, and health. Works will be selected to have a wide representation of approaches, conceptual and technical paradigms, diverse sensory channels with a focus beyond vision, different materialities, and works concerned with the ethical implications of these BTEs.

1.2 How to Assess Body Transformation Experiences

Body perception is a multidimensional phenomenon that encompasses perceptions of body configuration, position and motor abilities [38, 49], as well as body appearance (e.g., shape, and size [21, 44]), and bodily sensations that can enter conscious awareness [20, 37]. These dimensions form an integrated experience in which sensations, emotions, movements, cognition, and sociocultural interactions continuously co-shape one another, with significant implications for virtually every aspect of human experience (e.g., [3, 25, 37, 61, 73]). Due to its complexity, operationalizing body perception and isolating its various dimensions is often challenging. Within cognitive neuroscience, BTE's are typically assessed by contrasting at least two comparable conditions in which variables are attempted to be controlled in the laboratory. At least one variable is manipulated to confirm that observed effects result from the manipulation rather than other factors. For instance, in the rubber hand illusion, the synchrony of touch on the rubber hand and the participants' own hand is manipulated to confirm that the perceptual changes arise from the congruence between seen and felt touch [12]. Three main sources of data are used to operationalize body experience: questionnaires and scales in which participants report expected experiential changes [2, 12, 45]; behaviors consistent with the induced alteration [12]; and physiological changes corresponding to the elicited illusion [5]. While these methods are useful to identify generalizable relations between specific stimuli and specific operationalizations of BTEs, they do not capture the full richness and breadth of individual experiences.

Design research in HCI offers a significant opportunity to address these challenges. Building on a long tradition of designing for technologically mediated body experiences [29], design research on body experiences aligns with phenomenological and pragmatic stances on body perception, emphasizing nuanced experiences that cannot be reduced to simple parameters or controlled experimental settings. In this approach, participants' own accounts form the core data, while researchers' perspectives and own experiences are active elements in the generation of knowledge. These methods are powerful to underline individual differences and acknowledge complexity, though they might be less suitable for generalization and replication. For this reason, combining the best of both worlds may advance a comprehensive science of body perception. Indeed, by integrating diverse data sources-ranging from interoceptive signals to muscle activation, movement patterns and participants' own accounts- we can gain a richer understanding that allows to model and personalize BTEs. Here, we are particularly interested in work addressing how to assess BTEs both in controlled and real-world settings, across short- and long-term timescales, as well as works focusing on real-time, continuous measures and the modeling of the links between BTEs and changes in emotion, motor and social functions.

1.3 Concrete Examples on How to Support Body Transformation Experiences Through Technology

This workshop explores how technology can support and enrich BTEs through a mix of hands-on exploration and discussion. We will focus on (i) concrete examples and prototypes, experienced first-hand, and (ii) practical methods for making BTEs visible, measurable, and designable (see Figure 1 for inspiration). Our interest includes solutions that enable BTEs to be studied and supported outside the lab in natural contexts, as well as methods for collecting in situ data. Concrete examples will serve as provocations to spark reflection and discussion on the current BTE design space and envision how future technologies can shape meaningful bodily experiences.

1.4 Workshop Aims and Topics of Interest

This workshop aims to build a community of researchers, designers and practitioners interested in two main areas: designing/creating (multi)sensory BTEs and assessing BTEs. It will foster networking, encourage new collaborations, and expand the design space for multisensory BTEs by integrating research from diverse perspectives. Participants will share experiences, knowledge and insights into methods and tools by discussing key questions, such as:

- What theories, approaches, methods, and tools emphasize the role of sensory cues in body experiences?
- How can sensory signals (e.g., audio, pitch) be used to elicit distinct BTEs?
- How affect and sensory signals interact to elicit distinct BTEs?
- How and where can technologies for BTE be worn or integrated in the body?
- What relationships do people develop with BTE technologies (e.g., augmentation, extension of self)?
- How can BTEs enhance or augment people, including creating novel bodily experiences?

- How can BTEs be assessed—through experimental measures and subjective accounts of perception?
- What are the challenges and opportunities in designing BTEs that preserve agency, efficacy, and responsibility?
- How can BTEs be designed for inclusivity?
- What are the challenges of designing BTEs in-the-wild, their sustainability, and long-term effects?
- In what present and future domains can BTEs be applied (e.g., health, well-being)?
- What ethical issues arise when designing and researching BTEs, and which stakeholders need to be involved?

2 Length of the Workshop

Two sessions of 90 minutes.

3 Organizers

The organising team represents the multidisciplinary and international scope of the workshop. Collectively, they bring expertise in multisensory and embodied experiences and technologies, traditional and innovative design processes, methods, and tools, affective computing and real-life contexts. They have served on conference program committees, published extensively in top-tier conferences (e.g., CHI, IDC, DIS, UIST) and journals (e.g., HCI, TOCHI), special issues and books. They have organized related workshops [8, 14, 52, 58, 71, 83] and SIGs [47, 79] at CHI, as well as hands-on workshops at other haptics and HCI conferences such as at NordiCHI, DIS, IDC, CHIPlay, TEI, IEEE World Haptics, UIST [98, 106] – attesting to the interest in this topic in the CHI community. Most, if not all, organizers will attend CHI'26 and support on-site preparations if the workshop is accepted.

Ana Tajadura-Jiménez (main contact) is an Associate Professor at Universidad Carlos III de Madrid (UC3M). She leads the i_mBODY lab (www.imbodylab.com), part of the DEI Interactive Systems Group in the Department of Computer Science and Engineering, working at the intersection between the fields of HCI, neuroscience and AI. She is Principal Investigator of the ERC-funded BODYinTRANSIT project and the SENSEBEAT-DS, both focused on multisensory technologies that alterbody perception and drive changes in emotion, behavior and health.

Elena Márquez Segura is a design researcher in the i_mBODY lab, part of the DEI Interactive Systems Group in the Department of Computer Science and Engineering at UC3M. Her work focuses on designing and studying playful technology-supported experiences for collocated physical and social action; and on embodied design methods facilitating their design. Currently, Elena is working with wearables and immersive technologies in domains related to health and well-being, in particular physical training and rehabilitation.

Laia Turmo Vidal is an interaction design researcher and postdoc at KTH Royal Institute of Technology developing body-centric and critical approaches to designing for health and well-being. Her work explores how interactive technologies (such as biofeedback devices, soft haptic wearables, and interactive machine learning tools) can positively transform body experiences in contexts of physical activity, rehabilitation, and chronic conditions.

Marte Roel is an interdisciplinary practitioner focused on bodily experience, empathy, and compassion. His academic work pertains to the fields of psychology, behavioral science, and cognitive neuroscience. He is currently affiliated with the i_mBODY lab at UC3M and the Psychology Department of the University of Zurich. Marte is co-founder of BeAnotherLab and the Association for Independent Research.

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.

Aneesha Singh is a Full Professor in HCI and Digital Health at the University College London 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.

Frédéric Bevilacqua is Frédéric Bevilacqua Head Researcher at IRCAM in Paris, leading the Sound Music Movement Interaction team within the STMS lab (IRCAM–CNRS–Sorbonne Université). His research is concerned with the modeling and design of human movement-sound interactions, and with the development of gesture-based musical interfaces. Applications of his research range from artistic creation and education to health.

Alice Haynes is a postdoctoral research fellow in Interaction Design at KTH Royal Institute of Technology, Stockholm. Her focus is on designing body-centered haptic and shape-changing interfaces for well-being and interpersonal connection. She has recently started using soma design and first person methods to design for transforming her relationship to her body, exploring specific bodily experiences and perceptions such as scoliosis and body asymmetry.

Don Samitha Elvitigala is a Senior Lecturer/Assistant Professor from the Department of Human Centred Computing of Monash University. His research focuses on developing novel on-body interfaces that can enhance human capabilities by implicitly understanding humans' physical and mental behaviors. In particular, he explores how we can utilize everyday clothes and clothing accessories to develop human augmentations.

Jun Nishida is an Assistant Professor in the Department of Computer Science at the University of Maryland, College Park, leading Embodied Dynamics Laboratory (https://emd.cs.umd.edu). He explores the dynamics in human embodied experiences—how our bodies, perceptions, and somatic interactions contribute to the formation of physical skills, knowledge, subjectivity, and behavior through the design and engineering of new on-body somatic interfaces.

Pedro Lopes is an Associate Professor of Computer Science at University of Chicago, Director of the Human Computer Integration Lab (https://lab.plopes.org). Pedro focuses on integrating interfaces with the human body [46]—exploring the interface paradigm that supersedes wearables. These devices augment the body, not just cognitively, but also physically.

Paul Strohmeier is a Senior Researcher at the Max Planck Institute for Informatics (MPI-INF) where he leads the Sensorimotor Interaction group and an Associate Fellow of Saarland University. His PhD work was honored with the SIGCHI Outstanding Dissertation Award. He has received an ERC Starting Grant for conducting research on kinesthetic perception, sensory augmentation, and on-body systems.

4 Plans to Publish Workshop Proceedings, Offline Materials and Pre-Workshop Plans

The workshop website (www.imbodylab.com/chi26-body-transformation-workshop) will present the aims, plans, organizers, snippets from devices and materials brought to our previous workshops for inspiration, the call for participation, prior readings, workshop schedule, and accepted submissions. We also plan to publish a collection of the submitted papers as workshop proceedings in our website and via https://ceur-ws.org or ArXiv using report numbers. The workshop will be publicized to HCI and multisensory researchers through mailing lists (e.g., SIGCHI, PhD-Design, NIME, MOCO), social media (e.g., LinkedIn, Bluesky, Instagram), and related project websites (e.g., BODYinTRANSIT https://bodyintransit.eu), including those of previous SIGs and workshops (e.g., https://sensedbody.org). We will also seek submissions through our networks. Potential participants may submit a position paper or an alternative format (conceptual design sketch, presentation slides, poster, or video). The organizing committee will select 10–12 submissions, inviting up to 20–25 participants in addition to the organizers and panelists (see Section 6). To facilitate participation and take full advantage of the workshop opportunity, we will hold pre- and post-workshop activities. The pre-workshop activity will be a one-hour remote session where participants introduce themselves, share their motivation, and provide a short overview of the work they plan to bring (e.g., a method or prototype; 1-2 minutes per participant). This pre-workshop activity will take place on Zoom, with the timing arranged in consultation with the participants. Based on these inputs, groups or "stations" will be formed around themes for the main workshop. Materials will be distributed beforehand via email, the website, and shared drives. The main workshop will be held in person.

5 Diversity and Accessibility

The organizers are committed to the 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 live closed captions of the presentations for any participants who may need them. We will have volunteers at the workshop to facilitate group work and interactions.

6 Workshop Structure and Activities

This workshop will consist of **two 90-minute sessions** (with a break) focused on the existing space of BTE research and the future of BTEs. The workshop will include three main activities, with the following schedule:

Session 1 (90 minutes): Mapping the existing space of BTE research

- Multisensory warm-up, welcome and Introductions (15 minutes).
- Activity 1: Experiencing the prototypes and methods brought by workshop participants (20 minutes).
- Activity 2: Mapping the Design Space for multisensory BTEs, using the prototypes and methods, and the workshop's topics of interest (40 minutes).
- General sharing on salient themes (15 minutes).

–Coffee break–

Session 2 (90 minutes): Moving forward - the future of BTEs

- Conversation/Provocation: BTEs with invited panellists (20 minutes)
- Activity 3: Future next steps of BTEs (30 minutes)
- Panel Discussion and Closing (40 minutes)

These activities will be moderated by the organizers and invited experts, building on participants' contributions. In **Activity 1**, participants will showcase their methods, prototypes, or concepts to kick off the discussion in **Activity 2**, focused on mapping the design space. For this, we will jointly physically annotate the prototypes and methods brought by participants using the questions in section 1.4 as prompts. We will end this activity discussing challenges and opportunities behind the prototypes and methods.

After the coffee break, experts will lead a moderated dialogue, designed to provoke and inspire discussion during **Activity 3**. The expert panel will include senior organizers and two distinguished invited experts. We are delighted to announce that our confirmed panelists include Kristina Höök and Mel Slater. Using the provocations as inspirations, participants will revisit the challenges and opportunities identified in Activity 2, to propose future directions for design and research. These will be discussed in a lively panel engaging the panelists, participants, and organizers. Finally, organizers will present communication channels established to continue the conversation, post-workshop plans (see "Post-Workshop Plans"), and opportunities for collaboration.

7 Post-Workshop Plans

The post-workshop activities will focus on continuing the construction of a multidisciplinary community to study/design BTEs and related technologies. We will set up communication channels (e.g., mailing list, dedicated website, or Discord) to share ideas, foster collaborations, and explore funding opportunities. The organizers plan to coordinate 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 participants will be invited to contribute. The article will summarize the workshop's themes, outputs, and reflections, mapping current work and outlining future directions. We anticipate that this continued exchange will raise awareness across domains and advance understanding of how to design and evaluate multisensory BTEs. Our goal is to bring the discussion to a point where we can organize a follow-up Dagstuhl seminar, bringing together HCI researchers and practitioners from real-life application contexts.

8 Call for Participation

We invite researchers, practitioners, and designers interested in designing and evaluating sensory-driven Body Transformation Experiences (BTEs) and technologies to submit position papers of up to 4 pages (single-column SIGCHI template, including references). Submissions should describe existing work, a conceptual design, or a position on the workshop topic, and include a concept, prototype or method to be showcased at the workshop, along with up to two discussion points participants would like to explore in the workshop. Alternate submissions in the form of slides, design sketches, videos, or posters are also welcome. Works will be selected to ensure diverse approaches, conceptual and technical paradigms, sensory channels and considerations of ethics. Authors must follow the SIGCHI Accessibility Guidelines (https://sigchi.org/conferences/author-resources/accessibility-guide/) to ensure accessibility. This workshop, consisting of two 90-minute sessions, aims to build a community and open the design space for sensory-driven BTEs by integrating research from multiple perspectives. It builds on recent CHI workshops related to body and sensorimotor augmentations, including Body×Materials (CHI '23), Walking the Future (CHI '25), and Sensorimotor Devices (CHI '25). Submissions are due February 12, 2026, via the workshop website (www.imbodylab.com/chi26-body-transformation-workshop) through a pre-questionnaire including demographic questions to help organizers establish authors' backgrounds. Submissions can be individual or collective. If accepted, at least one author must attend the pre-workshop activity, register and participate in the in-person CHI2026 workshop, and bring and showcase their contribution (concept, prototype, method). All accepted submissions will be published on the website and as workshop proceedings.

9 Expected size of attendance

35 people, including 20-25 invited participants, 8-12 organizers and 2 invited speakers.

Acknowledgments

We acknowledge funding from the European Research Council (ERC) under grant agreement ID 101165100 for Paul Strohmeier and also under the European Union's Horizon 2020 research and innovation programme via ERC grant agreement No 101002711 for Ana Tajadura-Jiménez. Further funding is provided to Ana Tajadura-Jimenez by the Agencia Estatal de Investigación MICIU/AEI/10.13039/501100011033 and by the European Union (Project grant PID2023-150259OB-C21). Laia Turmo Vidal and Alice Haynes are funded by postdoctoral grants from Digital Futures, Sweden. Frédéric Bevilacqua acknowledges financial support from the CNRS through the MITI interdisciplinary programs.

References

[1] Easa AliAbbasi, Nihar Sabnis, Yuran Ding, Nadine Wagener, and Paul Strohmeier. 2025. Haptic Redirection: Modulating Hand Movement Speed with Vibrotactile Feedback. In *Proceedings of the Mensch Und Computer 2025 (MuC '25)*. Association for Computing Machinery, New York, NY, USA, 631–636. doi:10.1145/3743049.3748585

[2] Easa AliAbbasi, Gabriela Vega, Dennis Wittchen, and Paul Strohmeier. 2025. Physical Compliance and the Compliance Illusion: The Importance of Action for Perception. In *2025 IEEE World Haptics Conference (WHC)*. 349–356. doi:10.1109/WHC64065.2025.11123193

[3] Rachel Andrew, Marika Tiggemann, and Levina Clark. 2016. Positive body image and young women's health: Implications for sun protection, cancer screening, weight loss and alcohol consumption behaviours. *Journal of Health Psychology* 21, 1 (Jan. 2016), 28–39. doi:10.1177/1359105314520814

[4] Matthew A J Apps and Manos Tsakiris. 2014. The free-energy self: A predictive coding account of self-recognition. *Neuroscience and Biobehavioral Reviews* 41 (2014), 85–97. doi:10.1016/j.neubiorev.2013.01.029

[5] K. Carrie Armel and V. S. Ramachandran. 2003. Projecting sensations to external objects: evidence from skin conductance response. *Proceedings of the Royal Society of London. Series B: Biological Sciences* 270, 1523 (2003), 1499–1506. doi:10.1098/rspb.2003.2364

[6] Ilhan Aslan, Andreas Seiderer, Chi Tai Dang, Simon Rädler, and Elisabeth André. 2020. PiHearts: Resonating Experiences of Self and Others Enabled by a Tangible Somaesthetic Design. In *Proceedings of the 2020 International Conference on Multimodal Interaction* (Virtual Event, Netherlands) *(ICMI '20)*. Association for Computing Machinery, New York, NY, USA, 433–441. doi:10.1145/3382507.3418848

[7] Jane Elizabeth Aspell, Lukas Heydrich, Guillaume Marillier, Tom Lavanchy, Bruno Herbelin, and Olaf Blanke. 2013. Turning Body and Self Inside Out: Visualized Heartbeats Alter Bodily Self-Consciousness and Tactile Perception. *Psychological Science* 24, 12 (Dec. 2013), 2445–2453. doi:10.1177/0956797613498395

[8] Maryam Bandukda, Aneesha Singh, Catherine Holloway, Nadia Berthouze, Emeline Brulé, Ana Tajadura-Jiménez, Oussama Metatla, Ana Javornik, and Anja Thieme. 2021. Rethinking the Senses: A Workshop on Multisensory Embodied Experiences and Disability Interactions. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (CHI EA '21)*. Association for Computing Machinery, New York, NY, USA. doi:10.1145/3411763.3441356

[9] Philippe Bertrand, Daniel González-Franco, Arthur Pointeau, and Christian Cherene. 2014. The Machine to be Another—Embodied Telepresence using Human Performers. In *Proceedings of the Eighth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '14)* (Munich, Germany) *(TEI '14)*. Work-in-Progress Demo on interactive embodied telepresence.

[10] Philippe Bertrand, Jérôme Guegan, Léonore Robieux, Cade Andrew McCall, and Franck Zenasni. 2018. Learning Empathy Through Virtual Reality: Multiple Strategies for Training Empathy-Related Abilities Using Body Ownership Illusions in Embodied Virtual Reality. *Frontiers in Robotics and AI* 5 (2018). doi:10.3389/frobt.2018.00026

[11] Frédéric Bevilacqua, Eric O Boyer, Jules Françoise, Olivier Houix, Patrick Susini, Agnès Roby-Brami, and Sylvain Hanneton. 2016. Sensori-Motor Learning with Movement Sonification: Perspectives from Recent Interdisciplinary Studies. http://journal.frontiersin.org/article/10.3389/fnins.2016.00385 ISBN: 1662-453X Pages: 385 Publication Title: Frontiers in Neuroscience Volume: 10.

[12] M. Botvinick and J. Cohen. 1998. Rubber hands 'feel' touch that eyes see [8]. *Nature* 391, 6669 (1998), 756. doi:10.1038/35784 ISBN: doi:10.1038/35784.

[13] G. Brianza, A. Tajadura-Jiménez, E. Maggioni, D. Pittera, N. Bianchi-Berthouze, and M. Obrist. 2019. *As Light as Your Scent: Effects of Smell and Sound on Body Image Perception*. Vol. 11749 LNCS. doi:10.1007/978-3-030-29390-1_10 ISSN: 16113349 Publication Title: Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics).

[14] Jas Brooks, Pedro Lopes, Judith Amores, Emanuela Maggioni, Haruka Matsukura, Marianna Obrist, Roshan Lalintha Peiris, and Nimesha Ranasinghe. 2021. Smell, taste, and temperature interfaces. In *Extended abstracts of the 2021 CHI conference on human factors in computing systems*. 1–6.

[15] Jas Brooks, Alex Mazursky, Janice Hixon, and Pedro Lopes. 2024. Augmented Breathing via Thermal Feedback in the Nose. In *Proceedings of the 37th Annual ACM Symposium on User Interface Software and Technology*. 1–11.

[16] Jas Brooks, Steven Nagels, and Pedro Lopes. 2020. Trigeminal-based temperature illusions. In *Proceedings of the 2020 CHI conference on human factors in computing systems*. 1–12.

[17] Thomas F Cash and Edwin A Deagle III. 1997. The nature and extent of body-image disturbances in anorexia nervosa and bulimia nervosa: A meta-analysis. *International Journal of Eating Disorders* 22, 2 (sep 1997), 107–126. doi:10.1002/(SICI)1098-108X(199709)22:2<107::AID-EAT1>3.0.CO;2-J

[18] Sunje Clausen, Ana Tajadura-Jiménez, Christian P. Janssen, and Nadia Bianchi-Berthouze. 2021. Action sounds informing own body perception influence gender identity and social cognition. *Frontiers in Human Neuroscience* (2021). doi:10.3389/fnhum.2021.688170

[19] Amar D'Adamo, Marte Roel, Laia Turmo-Vidal, Dehshibi Mohammad M., Daniel De La Prida, Joaquín R. Diaz-Durán, Luis Antonio Azpicueta-Ruiz, Aleksander Väljamäe, and Ana Tajadura-Jiménez. 2024. SoniWeight Shoes: Investigating Effects and Personalization of a Wearable Sound Device for Altering Body Perception and Behavior. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems (CHI '24)*. Association for Computing Machinery, New York, NY, USA. doi:10.1145/3613904.3642651

[20] Frédérique De Vignemont. 2018. *Mind the body: An exploration of bodily self-awareness.* Oxford University Press.

[21] Frédérique De Vignemont, Henrik H Ehrsson, and Patrick Haggard. 2005. Bodily illusions modulate tactile perception. *Current Biology* 15, 14 (2005), 1286–1290.

[22] Yuran Ding, Nihar Sabnis, and Paul Strohmeier. 2024. Motionless Movement: Towards Vibrotactile Kinesthetic Displays. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '24)*. Association for Computing Machinery, New York, NY, USA, Article 418, 16 pages.

doi:10.1145/3613904.3642499

[23] Joaquín Roberto Díaz Durán, Laia Turmo Vidal, and Ana Tajadura Jiménez. 2023. Joakinator: An Interface for Transforming Body Movement and Perception through Machine Learning and Sonification of Muscle-Tone and Force. In *Proceedings of the International Conference on New Interfaces for Musical Expression (NIME 2023)*. NIME, 1–4. https://e-archivo.uc3m.es/handle/10016/38906 Accepted: 2023-11-20T10:24:02Z.

[24] Amar D'Adamo, Angel Sánchez, Lize De Coster, and Ana Tajadura-Jiménez. 2025. Sound effects on body perception vary with the social support network of individuals. *iScience* 28, 8 (2025), 113091. doi:10.1016/j.isci.2025.113091

[25] Shaun Gallagher. 2005. *How the Body Shapes the Mind*. Oxford University Press, Oxford. doi:10.1093/0199271941.001.0001

[26] Andrea Giomi. 2020. Somatic Sonification in Dance Performances. From the Artistic to the Perceptual and Back. In *Proceedings of the 7th International Conference on Movement and Computing*. ACM, Jersey City/Virtual NJ USA, 1–8. doi:10.1145/3401956.3404226

[27] Alba Gomez-Andres, Jennifer Grau-Sánchez, Esther Duarte, Antoni Rodriguez-Fornells, and Ana Tajadura-Jiménez. 2020. Enriching footsteps sounds in gait rehabilitation in chronic stroke patients: a pilot study. *Annals of the New York Academy of Sciences* 1467, 1 (May 2020), 48–59. doi:10.1111/nyas.14276 Publisher: John Wiley and Sons, Ltd.

[28] Jasmine Tian Ho, Peter Krummenacher, Marte Roel Lesur, Gianluca Saetta, and Bigna Lenggenhager. 2022. Real Bodies Not Required? Placebo Analgesia and Pain Perception in Immersive Virtual and Augmented Reality. *The Journal of Pain* 23, 4 (April 2022), 625–640. doi:10.1016/j.jpain.2021.10.009

[29] Kristina Hook. 2018. *Designing with the body: Somaesthetic interaction design*. MIt Press.

[30] Dianya Mia Hua, Jeffrey Bardzell, and Shaowen Bardzell. 2023. Embodied Embroidery: Somaesthetic Interaction Design for Women's Masturbation. In *Proceedings of the Seventeenth International Conference on Tangible, Embedded, and Embodied Interaction* (Warsaw, Poland) *(TEI '23)*. Association for Computing Machinery, New York, NY, USA, Article 32, 15 pages. doi:10.1145/3569009.3572803

[31] Kristina Höök, Martin P. Jonsson, Anna Ståhl, and Johanna Mercurio. 2016. Somaesthetic Appreciation Design. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. Association for Computing Machinery, New York, NY, USA, 3131–3142. doi:10.1145/2858036.2858583

[32] Kathryn Jackson, Imke Janssen, Brad Appelhans, Rasa Kazlauskaite, Kelly Karavolos, Sheila Dugan, Elizabeth Avery, Karla Shipp-Johnson, Lynda Powell, and Howard Kravitz. 2014. Body image satisfaction and depression in midlife women: The Study of Women's Health Across the Nation (SWAN). *Archives of women's mental health* 17 (03 2014). doi:10.1007/s00737-014-0416-9

[33] Kensuke Katori, Yudai Tanaka, Yoichi Ochiai, and Pedro Lopes. 2025. Vestibular Stimulation Enhances Hand Redirection. In *Proceedings of the 38th Annual ACM Symposium on User Interface Software and Technology (UIST '25)*. Association for Computing Machinery, New York, NY, USA, Article 62, 10 pages. doi:10.1145/3746059.3747776

[34] Anouk Keizer, Monique A M Smeets, H. Chris Dijkerman, Siarhei A. Uzunbajakau, Annemarie van Elburg, and Albert Postma. 2013. Too Fat to Fit through the Door: First Evidence for Disturbed Body-Scaled Action in Anorexia Nervosa during Locomotion. *PLoS ONE* 8, 5 (2013), 1–7. doi:10.1371/journal.pone.0064602 ISBN: 1932-6203.

[35] Konstantina Kilteni, Jean-Marie Normand, Maria V Sanchez-Vives, and Mel Slater. 2012. Extending Body Space in Immersive Virtual Reality: A Very Long Arm Illusion. *PLOS ONE* 7, 7 (July 2012), e40867. https://doi.org/10.1371/journal.pone.0040867 Publisher: Public Library of Science.

[36] Yosuke Kurihara, Taku Hachisu, Katherine J Kuchenbecker, and Hiroyuki Kajimoto. 2013. Virtual Robotization of the Human Body via Data-Driven Vibrotactile Feedback. In *Proceeding of the 10th International Conference on Advances in Computer Entertainment - Volume 8253 (ACE 2013)*. Springer-Verlag, Berlin, Heidelberg, 109–122. doi:10.1007/978-3-319-03161-3_8

[37] Ferenc Köteles. 2021. *Body Sensations. The Conscious Aspects of Interoception*. doi:10.1007/978-3-030-63201-4

[38] Bigna Lenggenhager, Tej Tadi, Thomas Metzinger, and Olaf Blanke. 2007. Video ergo sum: manipulating bodily self-consciousness. *Science (New York, N.Y.)* 317, 5841 (2007), 1096–1099. doi:10.1126/science.1143439 ISBN: 1095-9203 (Electronic).

[39] Judith Ley-Flores, Laia Turmo Vidal, Nadia Berthouze, Aneesha Singh, Frédéric Bevilacqua, and Ana Tajadura-Jiménez. 2021. SoniBand: Understanding the Effects of Metaphorical Movement Sonifications on Body Perception and Physical Activity. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI '21)*. Association for Computing Machinery, New York, NY, USA, 1–16. doi:10.1145/3411764.3445558

[40] Judith Ley-Flores, Laia Turmo Vidal, Elena Márquez Segura, Aneesha Singh, Frédéric Bevilacqua, Francisco Cuadrado, Joaquín Díaz Durán, Omar Valdiviezo-Hernández, Milagrosa Sánchez-Martín, and Ana Tajadura-Jiménez. 2024. Co-Designing Sensory Feedback for Wearables to Support Physical Activity through Body Sensations. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 8 (03 2024), 1–31. doi:10.1145/3643499

[41] Philip Lindner. 2021. Better, Virtually: the Past, Present, and Future of Virtual Reality Cognitive Behavior Therapy. *International Journal of Cognitive Therapy* 14, 1 (March 2021), 23–46. doi:10.1007/s41811-020-00090-7

[42] Siyi Liu, Barrett Ens, Nathan Arthur Semertzidis, Gun A. Lee, Florian 'Floyd' Mueller, and Don Samitha Elvitigala. 2025. "My Happiness Makes You Smile": Beginning to Understand Telepathic Superpower Design Via Brain-Muscle Interfaces. In *Proceedings of the 2025 ACM Designing Interactive Systems Conference (DIS '25)*. Association for Computing Machinery, New York, NY, USA, 3455–3472. doi:10.1145/3715336.3735699

[43] Matthew R Longo and Patrick Haggard. 2012. Implicit body representations and the conscious body image. *Acta Psychologica* 141, 2 (2012), 164–168.

[44] Matthew R Longo and Patrick Haggard. 2012. What Is It Like to Have a Body? *Current Directions in Psychological Science* 21, 2 (March 2012), 140–145. doi:10.1177/0963721411434982 Publisher: SAGE Publications.

[45] Matthew R. Longo, Friederike Schüür, Marjolein P. M. Kammers, Manos Tsakiris, and Patrick Haggard. 2008. What is embodiment? A psychometric approach. *Cognition* 107, 3 (2008), 978–998. doi:10.1016/j.cognition.2007.12.004

[46] Pedro Lopes. 2025. What if the "I" in HCI stands for Integration?. In *Adjunct Proceedings of the 38th Annual ACM Symposium on User Interface Software and Technology (UIST Adjunct '25)*. Association for Computing Machinery, New York, NY, USA, Article 16, 5 pages. doi:10.1145/3746058.3762829

[47] Pedro Lopes, Lewis L Chuang, and Pattie Maes. 2021. Physiological I/O. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–4.

[48] Lara Maister, Mel Slater, Maria V. Sanchez-Vives, and Manos Tsakiris. 2015. Changing bodies changes minds: owning another body affects social cognition. *Trends in Cognitive Sciences* 19, 1 (Jan. 2015), 6–12. doi:10.1016/j.tics.2014.11.001 ISBN: 13646613 (ISSN).

[49] Angelo Maravita and Atsushi Iriki. 2004. Tools for the Body (schema). *Trends in cognitive sciences* 8 (03 2004), 79–86. doi:10.1016/j.tics.2003.12.008

[50] Denys JC Matthies, Don Samitha Elvitigala, Annis Fu, Deborah Yin, and Suranga Nanayakkara. 2021. Mobilld: Exploring the detection of leg length discrepancy and altering gait with mobile smart insoles. In *Proceedings of the 14th PErvasive Technologies Related to Assistive Environments Conference*. 37–47.

[51] Me2̂. 2025. Me to the Power of 2. https://poweroftwo.me/. Accessed: 2025-12-01.

[52] Robb Mitchell, Jun Nishida, Enrique Encinas, and Shunichi Kasahara. 2017. We-Coupling! Designing New Forms of Embodied Interpersonal Connection. In *Proceedings of the Eleventh International Conference on Tangible, Embedded, and Embodied Interaction* (Yokohama, Japan) *(TEI '17)*. Association for Computing Machinery, New York, NY, USA, 775–780. doi:10.1145/3024969.3025051

[53] Elena Nava and Ana Tajadura-Jiménez. 2020. Auditory-induced body distortions in children and adults. *Scientific Reports* 10, 1 (2020), 3024. doi:10.1038/s41598-020-59979-0

[54] Jun Nishida, Soichiro Matsuda, Hiroshi Matsui, Shan-Yuan Teng, Ziwei Liu, Kenji Suzuki, and Pedro Lopes. 2020. HandMorph: a Passive Exoskeleton that Miniaturizes Grasp. In *Proceedings of the 33rd Annual ACM Symposium on User Interface Software and Technology* (Virtual Event, USA) *(UIST '20)*. Association for Computing Machinery, New York, NY, USA, 565–578. doi:10.1145/3379337.3415875

[55] Jun Nishida, Soichiro Matsuda, Mika Oki, Hikaru Takatori, Kosuke Sato, and Kenji Suzuki. 2019. Egocentric Smaller-person Experience through a Change in Visual Perspective. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, Scotland Uk) *(CHI '19)*. Association for Computing Machinery, New York, NY, USA, 1–12. doi:10.1145/3290605.3300926

[56] Jun Nishida and Kenji Suzuki. 2017. bioSync: A Paired Wearable Device for Blending Kinesthetic Experience. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver, Colorado, USA) *(CHI '17)*. Association for Computing Machinery, New York, NY, USA, 3316–3327. doi:10.1145/3025453.3025829

[57] J. Kevin O'Regan and Alva Noë. 2001. A sensorimotor account of vision and visual consciousness. *Behavioral and Brain Sciences* 24, 5 (Oct. 2001), 939–973. doi:10.1017/s0140525x01000115

[58] Bruna Beatriz Petreca, Ana Tajadura-Jiménez, Laia Turmo Vidal, Ricardo O Nascimento, Hasti Seifi, Judith Ley-Flores, Aneesha Singh, Nadia Berthouze, Marianna Obrist, and Sharon Baurley. 2023. Body x Materials: A workshop exploring the role of material-enabled body-based multisensory experiences. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI EA '23)*. Association for Computing Machinery, New York, NY, USA, Article 334, 7 pages. doi:10.1145/3544549.3573807

[59] Iseline Peyre, Agnès Roby-Brami, Maël Segalen, Alain Giron, Baptiste Caramiaux, Véronique Marchand-Pauvert, Pascale Pradat-Diehl, and Frédéric Bevilacqua. 2023. Effect of sonification types in upper-limb movement: a quantitative and qualitative study in hemiparetic and healthy participants. *Journal of NeuroEngineering and Rehabilitation* 20, 1 (2023), 136.

[60] Ivelina V Piryankova, Hong Yu Wong, Sally A Linkenauger, Catherine Stinson, Matthew R Longo, Heinrich H Bülthoff, and Betty J Mohler. 2014. Owning an

overweight or underweight body: distinguishing the physical, experienced and virtual body. *PloS one* 9, 8 (Aug. 2014), e103428–e103428. doi:10.1371/journal.pone.0103428 Publisher: Public Library of Science.

[61] Olga Pollatos and Rainer Schandry. 2008. Emotional processing and emotional memory are modulated by interoceptive awareness. *Cognition and Emotion* 22, 2 (Feb. 2008), 272–287. doi:10.1080/02699930701357535

[62] Kyrill Potapov, Nicolas Gold, Temitayo Olugbade, Amanda C de C Williams, Christopher Dieter Overbeck, Danielle Lynch, Minna Nygren, and Nadia Berthouze. 2025. Movement Sonification of Familiar Music to Support the Agency of People with Chronic Pain. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI '25)*. Association for Computing Machinery, New York, NY, USA, Article 765, 13 pages. doi:10.1145/3706598.3713601

[63] Courtney N. Reed and Andrew P. McPherson. 2023. The Body as Sound: Unpacking Vocal Embodiment through Auditory Biofeedback. In *Proceedings of the Seventeenth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '23)* (Warsaw, Poland). Association for Computing Machinery, New York, NY, USA, Article 7, 1–15. doi:10.1145/3569009.3592217

[64] Courtney N. Reed, Sophie Skach, Paul Strohmeier, and Andrew P. McPherson. 2022. Singing Knit: Soft Knit Biosensing for Augmenting Vocal Performances. In *Augmented Humans 2022* (Kashiwa, Chiba, Japan) *(AHs 2022)*. Association for Computing Machinery, New York, NY, USA, 170–183. doi:10.1145/3519391.3519412

[65] Marte Roel Lesur, Helena Aicher, Sylvain Delplanque, and Bigna Lenggenhager. 2020. Being Short, Sweet, and Sour: Congruent Visuo-Olfactory Stimulation Enhances Illusory Embodiment. *Perception* 49, 6 (2020), 693–696. doi:10.1177/0301006620928669

[66] Marte Roel Lesur, Elena Bolt, Gianluca Saetta, and Bigna Lenggenhager. 2021. The monologue of the double: Allocentric reduplication of the own voice alters bodily self-perception. *Consciousness and Cognition* 95 (Oct. 2021), 103223. doi:10.1016/j.concog.2021.103223

[67] Marte Roel Lesur, Matthew R. Longo, and Ana Tajadura-Jiménez. 2025. Linking spatial metaphors to body size perception: Different roles of top-down associations and multisensory contributions when mapping auditory cues to finger length. *Cortex* 190 (2025), 178–191. doi:10.1016/j.cortex.2025.06.014

[68] Marte Roel Lesur, Sonia Lyn, and Bigna Lenggenhager. 2020. How Does Embodying a Transgender Narrative Influence Social Bias? An Explorative Study in an Artistic Context. *Frontiers in Psychology* 11 (2020). doi:10.3389/fpsyg.2020.01861

[69] Marte Roel Lesur, Yoann Stussi, Philippe Bertrand, Sylvain Delplanque, and Bigna Lenggenhager. 2023. Different armpits under my new nose: Olfactory sex but not gender affects implicit measures of embodiment. *Biological Psychology* 176 (Jan. 2023), 108477. doi:10.1016/j.biopsycho.2022.108477

[70] Marte Roel Lesur, Marieke Lieve Weijs, Colin Simon, Oliver Alan Kannape, and Bigna Lenggenhager. 2020. Psychometrics of Disembodiment and Its Differential Modulation by Visuomotor and Visuotactile Mismatches. *iScience* 23, 3 (2020), 100901. doi:10.1016/j.isci.2020.100901

[71] Nihar Sabnis, Dennis Wittchen, Ata Otaran, Fatima Badmos, Siyi Liu, Aryan Saini, Georg Regal, Vincent van Rheden, Florian 'Floyd' Mueller, Suranga Nanayakkara, Denys J.C. Matthies, Troy Nachtigall, Paul Strohmeier, Laia Turmo Vidal, and Don Samitha Elvitigala. 2025. Walking the Future: Bridging Foot Augmentation into Next Steps of Human Augmentation. In *Proceedings of the Extended Abstracts of the CHI Conference on Human Factors in Computing Systems (CHI EA '25)*. Association for Computing Machinery, New York, NY, USA, Article 805, 7 pages. doi:10.1145/3706599.3706742

[72] Nihar Sabnis, Dennis Wittchen, Courtney N. Reed, Narjes Pourjafarian, Jürgen Steimle, and Paul Strohmeier. 2023. Haptic Servos: Self-Contained Vibrotactile Rendering System for Creating or Augmenting Material Experiences. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 522, 17 pages. doi:10.1145/3544548.3580716

[73] Ralf Schwarzer. 1992. Self-Efficacy in the Adoption and Maintenance of Health Behaviors: Theoretical Approaches and a New Model. *Self-efficacy: Thought control of action* (01 1992).

[74] Irene Senna, Angelo Maravita, Nadia Bolognini, and Cesare V. Parise. 2014. The marble-hand illusion. *PLoS ONE* 9, 3 (2014), 1–6. doi:10.1371/journal.pone.0091688

[75] Ximing Shen, Youichi Kamiyama, Kouta Minamizawa, and Jun Nishida. 2024. DexteriSync: A Hand Thermal I/O Exoskeleton for Morphing Finger Dexterity Experience. In *Proceedings of the 37th Annual ACM Symposium on User Interface Software and Technology* (Pittsburgh, PA, USA) *(UIST '24)*. Association for Computing Machinery, New York, NY, USA, Article 102, 12 pages. doi:10.1145/3654777.3676422

[76] Kye Shimizu, Santa Naruse, Jun Nishida, and Shunichi Kasahara. 2023. Morphing Identity: Exploring Self-Other Identity Continuum through Interpersonal Facial Morphing Experience. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 500, 15 pages. doi:10.1145/3544548.3580853

[77] Aneesha Singh, Nadia Bianchi-Berthouze, and Amanda CdeC Williams. 2017. Supporting Everyday Function in Chronic Pain Using Wearable Technology. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver, Colorado, USA) *(CHI '17)*. Association for Computing Machinery, New York, NY, USA, 3903–3915. doi:10.1145/3025453.3025947

[78] Aneesha Singh, Marusa Hrobat, Suxin Gui, Nadia Bianchi-Berthouze, Judith Ley-Flores, Frederic Bevilacqua, Joaquin R. Diaz Duran, Elena MÁrquez Segura, and Ana Tajadura-JimÉnez. 2024. Pushed by Sound: Effects of Sound and Movement Direction on Body Perception, Experience Quality, and Exercise Support. *ACM Trans. Comput.-Hum. Interact.* 31, 4, Article 53 (Sept. 2024), 36 pages. doi:10.1145/3648616

[79] A. Singh, A. Tajadura-Jiménez, N. Bianchi-Berthouze, N. Marquardt, M. Tentori, R. Bresin, and D. Kulic. 2016. Mind the gap: A sig on bridging the gap in research on body sensing, body perception and multisensory feedback. In *Conference on Human Factors in Computing Systems - Proceedings*, Vol. 07-12-May-. doi:10.1145/2851581.2886440

[80] Tasha R. Stanton and Charles Spence. 2020. The Influence of Auditory Cues on Bodily and Movement Perception. *Frontiers in Psychology* Volume 10 - 2019 (2020). doi:10.3389/fpsyg.2019.03001

[81] Anna Ståhl, Martin Jonsson, Johanna Mercurio, Anna Karlsson, Kristina Höök, and Eva-Carin Banka Johnson. 2016. The Soma Mat and Breathing Light. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (San Jose, California, USA) *(CHI EA '16)*. Association for Computing Machinery, New York, NY, USA, 305–308. doi:10.1145/2851581.2889464

[82] Paul Strohmeier, Seref Güngör, Luis Herres, Dennis Gudea, Bruno Fruchard, and Jürgen Steimle. 2020. bARefoot: Generating Virtual Materials using Motion Coupled Vibration in Shoes. In *Proceedings of the 33rd Annual ACM Symposium on User Interface Software and Technology (UIST '20)*. ACM, 579–593. doi:10.1145/3379337.3415828

[83] Paul Strohmeier, Laia Turmo Vidal, Gabriela Vega, Courtney N. Reed, Alex Mazursky, Easa AliAbbasi, Ana Tajadura-Jiménez, and Jürgen Steimle. 2025. Sensorimotor Devices: Coupling Sensing and Actuation to Augment Bodily Experience. In *Proceedings of the Extended Abstracts of the CHI Conference on Human Factors in Computing Systems (CHI EA '25)*. Association for Computing Machinery, New York, NY, USA, Article 799, 7 pages. doi:10.1145/3706599.3706735

[84] P Tacikowski, J Fust, and H H Ehrsson. 2020. Fluidity of gender identity induced by illusory body-sex change. *bioRxiv* (Jan. 2020), 2020.01.13.905315. doi:10.1101/2020.01.13.905315

[85] Pawel Tacikowski, Marieke L Weijs, and H Henrik Ehrsson. 2020. Perception of Our Own Body Influences Self-Concept and Self-Incoherence Impairs Episodic Memory. *iScience* 23, 9 (2020), 101429. doi:10.1016/j.isci.2020.101429

[86] A. Tajadura-Jiménez, M. Vakali, M.T. Fairhurst, A. Mandrigin, N. Bianchi-Berthouze, and O. Deroy. 2017. Contingent sounds change the mental representation of one's finger length. *Scientific Reports* 7, 1 (2017). doi:10.1038/s41598-017-05870-4

[87] A. Tajadura-Jiménez, D. Banakou, N. Bianchi-Berthouze, and M. Slater. 2017. Embodiment in a Child-Like Talking Virtual Body Influences Object Size Perception, Self-Identification, and Subsequent Real Speaking. *Scientific Reports* 7, 1 (2017). doi:10.1038/s41598-017-09497-3

[88] Ana Tajadura-Jiménez, Maria Basia, Ophelia Deroy, Merle Fairhurst, Nicolai Marquardt, and Nadia Bianchi-Berthouze. 2015. As Light As Your Footsteps: Altering Walking Sounds to Change Perceived Body Weight, Emotional State and Gait. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM, New York, NY, USA, 2943–2952. doi:10.1145/2702123.2702374

[89] Ana Tajadura-Jiménez, Helen Cohen, and Nadia Bianchi-Berthouze. 2017. Bodily Sensory Inputs and Anomalous Bodily Experiences in Complex Regional Pain Syndrome: Evaluation of the Potential Effects of Sound Feedback. *Frontiers in Human Neuroscience* 11 (July 2017). doi:10.3389/fnhum.2017.00379

[90] Ana Tajadura-Jiménez, Laura Crucianelli, Rebecca Zheng, Chloe Cheng, Judith Ley-Flores, Mercedes Borda-Más, Nadia Bianchi-Berthouze, and Aikaterini Fotopoulou. 2022. Body weight distortions in an auditory-driven body illusion in subclinical and clinical eating disorders. *Scientific Reports* 12, 1 (2022), 20031. doi:10.1038/s41598-022-24452-7

[91] Ana Tajadura-Jiménez, Torsten Marquardt, David Swapp, Norimichi Kitagawa, and Nadia Bianchi-Berthouze. 2016. Action Sounds Modulate Arm Reaching Movements. *Frontiers in Psychology* 7 (2016). doi:10.3389/fpsyg.2016.01391

[92] Ana Tajadura-Jiménez, Joseph Newbold, Linge Zhang, Patricia Rick, and Nadia Bianchi-Berthouze. 2019. As Light as You Aspire to Be: Changing Body Perception with Sound to Support Physical Activity. In *CHI Conference on Human Factors in Computing Systems Proceedings (CHI 2019), May 4–9, 2019, Glasgow, Scotland, UK*. ACM, New York, NY, USA.

[93] A. Tajadura-Jiménez and M. Tsakiris. 2014. Balancing the "inner" and the "outer" self: Interoceptive sensitivity modulates self-other boundaries. *Journal of Experimental Psychology: General* 143, 2 (2014). doi:10.1037/a0033171

[94] Ana Tajadura-Jiménez, Manos Tsakiris, Torsten Marquardt, and Nadia Bianchi-Berthouze. 2015. Action sounds update the mental representation of arm dimension: contributions of kinaesthesia and agency. *Frontiers in Psychology* 6 (2015). doi:10.3389/fpsyg.2015.00689

[95] Ana Tajadura-Jiménez, Aleksander Valjamae, and Kristi Kuusk. 2020. Altering One's Body-perception Through E-Textiles and Haptic Metaphors. *Frontiers in Robotics and AI* (2020). doi:10.3389/frobt.2020.00007

[96] Ana Tajadura-Jiménez, Aleksander Väljamäe, Iwaki Toshima, Toshitaka Kimura, Manos Tsakiris, and Norimichi Kitagawa. 2012. Action sounds recalibrate perceived tactile distance. *Current Biology* 22, 13 (2012), R516–R517. doi:10.1016/j.cub.2012.04.028 ISBN: 1879-0445 (Electronic)\r0960-9822 (Linking) Publisher: Elsevier.

[97] Yudai Tanaka, Hunter G Mathews, and Pedro Lopes. 2025. Primed Action: Preserving Agency while Accelerating Reaction Time via Subthreshold Brain Stimulation. In *Proceedings of the 38th Annual ACM Symposium on User Interface Software and Technology (UIST '25)*. Association for Computing Machinery, New York, NY, USA, Article 82, 9 pages. doi:10.1145/3746059.3747634

[98] Yujie Tao, Tan Gemicioglu, Sam Chin, Bingjian Huang, Jas Brooks, Sean Follmer, Pedro Lopes, and Suranga Nanayakkara. 2025. Toward Everyday Perceptual and Physiological Augmentation. In *Adjunct Proceedings of the 38th Annual ACM Symposium on User Interface Software and Technology (UIST Adjunct '25)*. Association for Computing Machinery, New York, NY, USA, Article 12, 4 pages. doi:10.1145/3746058.3758471

[99] Mary E. Tinetti and Lynda Powell. 1993. 4 Fear of Falling and Low Self-efficacy: A Cause of Dependence in Elderly Persons. *Journal of Gerontology* 48, Special_Issue (Sept. 1993), 35–38. doi:10.1093/geronj/48.special_issue.35

[100] Manos Tsakiris and Patrick Haggard. 2005. The rubber hand illusion revisited: visuotactile integration and self-attribution. *J Exp Psychol Hum Percept Perform* 31, 1 (2005), 80–91. doi:10.1037/0096-1523.31.1.80

[101] A. Tsay, T.J. Allen, U. Proske, and M.J. Giummarra. 2015. Sensing the body in chronic pain: A review of psychophysical studies implicating altered body representation. *Neuroscience and Biobehavioral Reviews* 52 (2015), 221–232. doi:10.1016/j.neubiorev.2015.03.004

[102] Laia Turmo Vidal, Ana Tajadura-Jiménez, José Manuel Vega-Cebrián, Judith Ley-Flores, Joaquin R. Díaz-Durán, and Elena Márquez Segura. 2024. Body Transformation: An Experiential Quality of Sensory Feedback Wearables for Altering Body Perception. In *Proceedings of the Eighteenth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '24)*. ACM, 1–19. doi:10.1145/3623509.3633373

[103] Laia Turmo Vidal, Hui Zhu, and Abraham Riego-Delgado. 2020. BodyLights: Open-Ended Augmented Feedback to Support Training Towards a Correct Exercise Execution. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–14. doi:10.1145/3313831.3376268

[104] Björn van der Hoort, Arvid Guterstam, and H Henrik Ehrsson. 2011. Being Barbie: The Size of One's Own Body Determines the Perceived Size of the World. *PLOS ONE* 6, 5 (May 2011), e20195. https://doi.org/10.1371/journal.pone.0020195 Publisher: Public Library of Science.

[105] Gabriela Vega, Valentin Martinez-Missir, Dennis Wittchen, Nihar Sabnis, Audrey Girouard, Karen Anne Cochrane, and Paul Strohmeier. 2024. vARitouch: Back of the Finger Device for Adding Variable Compliance to Rigid Objects. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '24)*. Association for Computing Machinery, New York, NY, USA, Article 414, 20 pages. doi:10.1145/3613904.3642828

[106] José Manuel Vega-Cebrián, Andreas Lindegren, Mafalda Gamboa, Ana Tajadura-Jiménez, Ylva Fernaeus, and Elena Márquez Segura. 2025. Embodied Ideation, Toolkits, and Sketching. In *Proceedings of the Nineteenth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '25)*. Association for Computing Machinery, New York, NY, USA, Article 128, 6 pages. doi:10.1145/3689050.3708393

[107] Marieke L. Weijs, Jasmine T. Ho, Marte Roel Lesur, and Bigna Lenggenhager. 2022. Is this my foot? Experimentally induced disownership in individuals with body integrity dysphoria. *Consciousness and Cognition* 106 (Nov. 2022), 103432. doi:10.1016/j.concog.2022.103432

[108] Charles Windlin, Kristina Höök, and Jarmo Laaksolahti. 2022. SKETCHING SOMA BITS. In *Proceedings of the 2022 ACM Designing Interactive Systems Conference* (Virtual Event, Australia) *(DIS '22)*. Association for Computing Machinery, New York, NY, USA, 1758–1772. doi:10.1145/3532106.3533510

Received 20 February 2007; revised 12 March 2009; accepted 5 June 2009