Why Movement-Based Design!? Exploring Methods and Experiences in MBD*

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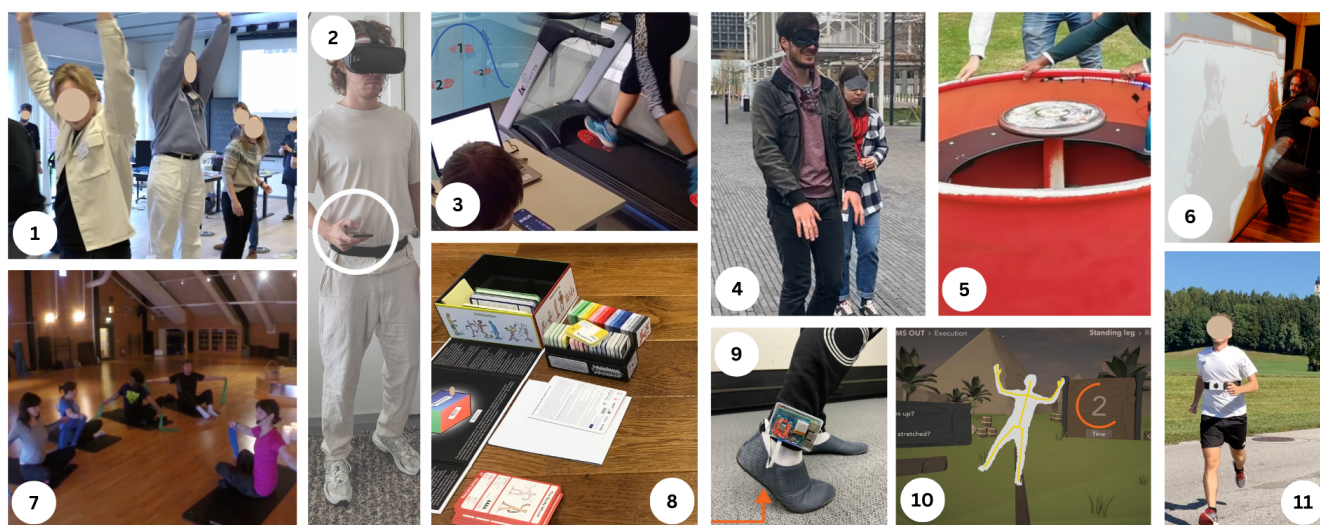floyd@exertiongameslab.org

Figure 1: Movement-based design activities, concepts, and designs. 1: movement-based design workshop [13, 43], 2: exploring body-steering methods for jogging in virtual environments [18], 3: connecting breath and running movements into a rhythm [16, 55–57], 4: exploring the embodied experience of walking meetings through bodystorming [24], 5: movement at the playground to inspire context-sensitive play activities, 6: remote impact: shadowboxing over a distance [34], 7: movement correction in instructed fitness training [51], 8: method cards for movement-based interaction design (MeCaMInD) toolbox [13], 9: walking as a form of interaction with the foot[14], 10: real-time training assistance for balancing on a slackline [9, 26, 27, 38], 11: designing for seamless interaction and capturing breathing movement on the move [5]

*2-day workshop

ABSTRACT

The rise of movement-based design (MBD) is fueled by the integration of computer technology into the movement of the everyday. Departing from traditional interface design, MBD prioritizes natural interaction, SportsHCI, and health promotion through physical activity. This paradigm shift has led to innovations in experimental applications and interaction techniques, including exergames, expressivity in interactions and soma-design. Various guidelines and frameworks have been proposed for specific purposes, from sports to virtual reality. This workshop explores participants' experiences and perspectives on MBD, delving into MBD workshop design and reflect on MBD methods and the current move towards MBD methodologies.

CCS CONCEPTS

• **Human-centered computing → Interaction design theory, concepts and paradigms**.

KEYWORDS

Movement-Based Design, Embodiment, Bodystorming, Interaction Design, Methods

1 INTRODUCTION

Movement-based design (MBD) is on the rise due to the widespread integration of computer technology into everyday items such as wearables, mobiles, and IoT, as opposed to being confined to desks. This "somatic turn" in HCI [23, 29] has required a deeper understanding of embodied user experiences [19]. Beyond technological aspects, movement-based design extends to crafting artifacts, environments, and activities that enhance or utilize human motion. This approach diverges from traditional interface design by prioritizing values like natural interaction [60], inclusion of knowledge from the movement sciences [42], and promoting health through physical activity [41].

In MBD, the body is not just a vessel for interaction but a source of creativity and innovation in its own right. By engaging the body as a source of creativity, we can enrich our interactions with technology, promoting physical activity, health, joy and enhancing the "naturalness" of these interactions. Early phases involve designers moving themselves or observing others for empathizing and understanding, while later stages require movement for ideation and evaluation.

Movement-based design has spurred innovations in experimental applications [25] and interaction techniques [7]. Guidelines and frameworks have been proposed for specific purposes such as sports [42], exergames [35], somaesthetic experiences [21], and virtual reality [15]. Additionally, researchers have explored methods and methodologies to better grasp movement and bodily experiences [17, 18, 28, 31].

This workshop builds upon the outcomes of the Method Cards for Movement-based Interaction Design (MeCaMInD) project that focuses on curating a collection of movement-based design methods, through an accessible and easy-to-navigate method toolbox. The project strives to foster the inclusion of motion in sport, movement, and technology design [12].

In this workshop, participants will be offered a platform to collectively discuss and explore current approaches, methods and tools in movement based design, and exchange insights and experiences regarding key elements in movement-based design methods used in practice. This is approached through hands-on practice: participants will get an introduction to movement-based design and, along with this, use the MeCaMInD toolbox as vehicle for discussions: Why MBD? When (not) to apply MBD? We will explore this in the workshop.

2 BACKGROUND

Movement-based design methods have gained prominence across various domains due to their unique ability to offer insights into the embodied experiences of stakeholders involved in the design process [46, 61]. These methods play a crucial role in different phases of design projects, ranging from sensitization, generative exercises, and testing to evaluations and document movement insights [52]. However, the diversity in design projects necessitates careful consideration of various issues such as requirements, goals, limitations, context, available resources, facilitation, and emerging contingencies [43, 58].

In the realms of design for movement and design of movement, designers are encouraged to utilize the body as a creative resource, incorporating movement as a medium or instrument to design with movement in the design activity [19, 22]. This involves awareness of the silent, fleeting, and immediate movement experience [1, 4, 28]. Notable activities in MBD include bodystorming, embodied sketching, experience prototyping, and others [3, 10, 11, 24, 31–33, 44]. The significance of play in unlocking the creative potential within the body has been emphasized, with Arvola and Artman [2] asserting that the courage to play and be playful is the gateway to creativity.

"Bodystorming", a potential method of unlocking playful creativity, is a situated generative design method that utilizes full-body engagement with objects, space, and people to generate multiple design ideas. This method has evolved with variations proposed by different researchers, highlighting the adaptability of movement-based design methods [32, 40, 46, 53, 59]. "Sensory Bodystorming", introduced by Turmo Vidal et al. [53], incorporates non-digital materials and objects with different sensory qualities to foster exploration and ideation.

Schiphorst [45] advocates for somatic facilitation in technological design processes, labelling it "Somatic Connoisseurship". This practice involves a careful and trained focus on the lived experiences in the body to enrich the design space in the associated practice. "Soma Design", building upon Somaesthetics [47, 48], embraces a

holistic design process that explores and improves sensations, feelings, emotions, and subjectivity in participants' bodies, emphasizing introspection, slowness, and increased awareness.

"Embodied Sketching" [32] integrates movement-based ideation practices, combining physical engagement in the surrounding context with playfulness to elicit a creative mindset. The concept of estrangement, turning the familiar into the unfamiliar, is a common resource in Soma Design [19, 21, 50]. "Estrangement" serves as a powerful approach in embodied design methods, inspiring new movements, objects, and design concepts [61]. "Moving and Making Strange", proposed by Loke and Robertson [28], employs a choreographic approach to defamiliarize everyday movements and explore interaction possibilities.

"Role-playing", as a method, involves assuming character roles to simulate and improvise various design situations. "Informances" [6, 49] blend performance, scenario-based design, and "Wizard of Oz techniques to simulate future generative-oriented situations. "Live Action Role Playing" provides a more elaborate form of role-play, enabling deeper connections between participants and their characters for testing and evaluating design concepts [30].

Up to now various movement related workshops have taken place, e.g. [8, 37, 39, 54]. We want to highlight the workshop "Move to be Moved" [20], that focused on discussing the emerging landscape that is formed by movement-based design, establishing an academic community in IxD and HCI. Rather than taking a theoretical perspective and discussing exemplars, we direct our workshop towards methods and aim to frame movement-based design methodology.

3 GOALS OF THE WORKSHOP

The workshop goals are as follows:

- Providing an interdisciplinary forum for researchers, practitioners and designers to discuss movement-based design
- Discussing state-of-the-art research on movement-based design, as well as practices and experiences from the field with movement-based design approach
- Getting hands-on experience with movement-based design practice
- Consolidating insights and key elements of movement-based design in practice
- Building an overview of movement-based design methodologies and tools
- Contributing a special issue on movement-based design (e.g., in Interactions)

4 ANTICIPATED OUTCOMES

Through the workshop activities, and building on the expertise of facilitators and participants, the workshop anticipated outcomes are as follows:

- Overview of MBD methods, towards MBD methodology
- Pros and cons of MBDM based on participant experiences
- New movement-based design concepts in the contexts of interests (SportsHCI, education, health)
- Collaboration towards a joint journal contribution
- Academic community interested in MBD

REFERENCES

[1] Sarah Fdili Alaoui, Baptiste Caramiaux, Marcos Serrano, and Frédéric Bevilacqua. 2012. Movement qualities as interaction modality. In *Proceedings of the Designing Interactive Systems Conference* (Newcastle Upon Tyne, United Kingdom) *(DIS '12)*. Association for Computing Machinery, New York, NY, USA, 761–769. https://doi.org/10.1145/2317956.2318071

[2] Mattias Arvola and Henrik Artman. 2007. Enactments in interaction design: How designers make sketches behave. *Artifact: Journal of Design Practice* 1, 2 (2007), 106–119.

[3] Jon Back, Laia Turmo Vidal, Annika Waern, Susan Paget, and Eva-Lotta Sallnäs Pysander. 2018. Playing Close to Home: Interaction and Emerging Play in Outdoor Play Installations. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (Montreal, Canada) *(CHI '18)*. Association for Computing Machinery, New York, NY, USA, 1–11. https://doi.org/10.1145/3173574.3173730

[4] Genevieve Bell, Mark Blythe, and Phoebe Sengers. 2005. Making by making strange: Defamiliarization and the design of domestic technologies. *ACM Trans. Comput.-Hum. Interact.* 12, 2 (jun 2005), 149–173. https://doi.org/10.1145/1067860.1067862

[5] Severin Bernhart, Harald Rieser, Vincent van Rheden, and Rainer Matischek. 2022. Using CAPSENSE in a Wearable Textile Chest Belt for Respiration Sensing and Interaction Possibility. In *Proceedings of the 2nd international "Salzburg Conference for Smart Materials*.

[6] Colin Burns, Eric Dishman, William Verplank, and Bud Lassiter. 1994. Actors, hairdos & videotape—informance design. In *Conference Companion on Human Factors in Computing Systems* (Boston, Massachusetts, USA) *(CHI '94)*. Association for Computing Machinery, New York, NY, USA, 119–120. https://doi.org/10.1145/259963.260102

[7] Oğuz Turan Buruk and Oğuzhan Özcan. 2018. Extracting Design Guidelines for Wearables and Movement in Tabletop Role-Playing Games via a Research Through Design Process. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (Montreal, Canada) *(CHI '18)*. Association for Computing Machinery, New York, NY, USA, 1–13. https://doi.org/10.1145/3173574.3174087

[8] Florian Daiber, Michael Jones, Frederik Wiehr, Keith Cheverst, Felix Kosmalla, and Jonna Häkkilä. 2017. UbiMount: 2nd workshop on ubiquitous computing in the mountains. In *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers* (Maui, Hawaii) *(UbiComp '17)*. Association for Computing Machinery, New York, NY, USA, 1022–1026. https://doi.org/10.1145/3123024.3124462

[9] Florian Daiber, Felix Kosmalla, Christian Murlowski, and Antonio Krüger. 2018. Slackliner: Using Whole-body Gestures for Interactive Slackline Training. In *Proceedings of the 2018 ACM Symposium on Spatial User Interaction* (Berlin, Germany) *(SUI '18)*. Association for Computing Machinery, New York, NY, USA, 174. https://doi.org/10.1145/3267782.3274691

[10] Ida Damen, Ingmar Nieuweboer, Hans Brombacher, Pieter van Wesemael, Steven Vos, and Carine Lallemand. 2021. The Office Jungle: Exploring Unusual Ways of Working through Bodily Experimentations. In *Proceedings of the 2021 ACM Designing Interactive Systems Conference* (Virtual Event, USA) *(DIS '21)*. Association for Computing Machinery, New York, NY, USA, 466–477. https://doi.org/10.1145/3461778.3462062

[11] J. P. Djajadiningrat, W. W. Gaver, and J. W. Fres. 2000. Interaction relabelling and extreme characters: methods for exploring aesthetic interactions. In *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods,*

and Techniques (New York City, New York, USA) *(DIS '00)*. Association for Computing Machinery, New York, NY, USA, 66–71. https://doi.org/10.1145/347642.347664

[12] Lars Elbæk, Rasmus Vestergaard Andersen, Robby W. Van Delden, José María Font Fernández, René Engelhardt Hansen, Perttu Hämäläinen, Mats Johnsson, Lærke Schjødt Rasmussen, Søren Lekbo, Solip Park, Dees Postma, Dennis Reidsma, Elena Márquez Segura, Ana Tajadura-Jimenez, Laia Turmo Vidal, Jose Manuel Vega Cebrian, Annika Waern, and Maximus Kaos. 2023. Method Cards for Movement-based Design. https://doi.org/10.21996/08h8-mx91 ISBN: 978-87-94345-70-5.

[13] Lars Elbæk, Rasmus Vestergaard Andersen, Lærke Schjødt Rasmussen, and Maximus Kaos. 2023. Exploring Movement-Modifier Facilitation in Movement-based Sports, Health, and Game Design. In *European Conference on Games Based Learning*, Vol. 17. 162–170.

[14] Don Samitha Elvitigala, Yunfan Wang, Yongquan Hu, and Aaron J Quigley. 2023. RadarFoot: Fine-grain Ground Surface Context Awareness for Smart Shoes. In *Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology* (San Francisco, USA) *(UIST '23)*. Association for Computing Machinery, New York, NY, USA, Article 87, 13 pages. https://doi.org/10.1145/3586183.3606738

[15] Perttu Hämäläinen, Joe Marshall, Raine Kajastila, Richard Byrne, and Florian "Floyd" Mueller. 2015. Utilizing Gravity in Movement-Based Games and Play. In *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play* (London, United Kingdom) *(CHI PLAY '15)*. Association for Computing Machinery, New York, NY, USA, 67–77. https://doi.org/10.1145/2793107.2793110

[16] Eric Harbour, Vincent van Rheden, Hermann Schwameder, and Thomas Finkenzeller. 2023. Step-adaptive sound guidance enhances locomotor-respiratory coupling in novice female runners: A proof-of-concept study. *Frontiers in Sports and Active Living* 5 (2023), 1112663.

[17] Martin Hedlund, Cristian Bogdan, Gerrit Meixner, and Andrii Matviienko. 2024. Rowing Beyond: Investigating Steering Methods for Rowing-based Locomotion in Virtual Environments. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems (CHI '24)*. Association for Computing Machinery, New York, NY, USA. https://doi.org/10.1145/3613904.3642192

[18] Martin Hedlund, Anders Lundström, Cristian Bogdan, and Andrii Matviienko. 2023. Jogging-in-Place: Exploring Body-Steering Methods for Jogging in Virtual Environments. In *Proceedings of the 22nd International Conference on Mobile and Ubiquitous Multimedia* (Vienna, Austria) *(MUM '23)*. Association for Computing Machinery, New York, NY, USA, 377–385. https://doi.org/10.1145/3626705.3627778

[19] Kristina Höök. 2018. *Designing with the body: Somaesthetic interaction design*. MIT Press.

[20] Kristina Höök, Martin Jonsson, Anna Ståhl, Jakob Tholander, Toni Robertson, Patrizia Marti, Dag Svanaes, Marianne Graves Petersen, Jodi Forlizzi, Thecla Schiphorst, Katherine Isbister, Caroline Hummels, Sietske Klooster, Lian Loke, and George Poonkhin Khut. 2016. Move to be Moved. 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, 3301–3308. https://doi.org/10.1145/2851581.2856470

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

[22] Caroline Hummels, Kees CJ Overbeeke, and Sietske Klooster. 2007. Move to get moved: a search for methods, tools and knowledge to design for expressive and rich movement-based interaction. *Personal and Ubiquitous Computing* 11 (2007), 677–690.

[23] Kristina Höök, Martin P. Jonsson, Anna St\a ahl, and Johanna Mercurio. 2016. Somaesthetic Appreciation Design. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 3131–3142. https://doi.org/10.1145/2858036.2858583

[24] Mélodie Jacob, Ida Damen, and Carine Lallemand. 2023. Exploring the Embodied Experience of Walking Meetings through Bodystorming – Implications for Design. 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 24, 14 pages. https://doi.org/10.1145/3569009.3572795

[25] Raine Kajastila, Leo Holsti, and Perttu Hämäläinen. 2016. The Augmented Climbing Wall: High-Exertion Proximity Interaction on a Wall-Sized Interactive Surface. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (San Jose, California, USA) *(CHI '16)*. Association for Computing Machinery, New York, NY, USA, 758–769. https://doi.org/10.1145/2858036.2858450

[26] Felix Kosmalla, Christian Murlowski, Florian Daiber, and Antonio Krüger. 2018. Slackliner - An Interactive Slackline Training Assistant. In *Proceedings of the 26th ACM International Conference on Multimedia* (Seoul, Republic of Korea) *(MM '18)*. Association for Computing Machinery, New York, NY, USA, 154–162. https://doi.org/10.1145/3240508.3240537

[27] Felix Kosmalla, Christian Murlowski, Florian Daiber, Frederik Wiehr, and Antonio Krüger. 2017. Slackliner: an interactive assistant for slackline training. In *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous*

Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers (Maui, Hawaii) *(UbiComp '17)*. Association for Computing Machinery, New York, NY, USA, 1056–1061. https://doi.org/10.1145/3123024.3124448

[28] Lian Loke and Toni Robertson. 2013. Moving and making strange: An embodied approach to movement-based interaction design. *ACM Trans. Comput.-Hum. Interact.* 20, 1, Article 7 (apr 2013), 25 pages. https://doi.org/10.1145/2442106.2442113

[29] Lian Loke and Thecla Schiphorst. 2018. The Somatic Turn in Human-computer Interaction. *Interactions* 25, 5 (Aug. 2018), 54–5863. https://doi.org/10.1145/3236675

[30] Elena Márquez Segura, Katta Spiel, Karin Johansson, Jon Back, Phoebe O. Toups Dugas, Jessica Hammer, Annika Waern, Theresa Jean Tanenbaum, and Katherine Isbister. 2019. Larping (Live Action Role Playing) as an Embodied Design Research Method. In *Companion Publication of the 2019 on Designing Interactive Systems Conference 2019 Companion* (San Diego, CA, USA) *(DIS '19 Companion)*. Association for Computing Machinery, New York, NY, USA, 389–392. https://doi.org/10.1145/3301019.3320002

[31] Elena Márquez Segura, Laia Turmo Vidal, and Asreen Rostami. 2016. Bodystorming for movement-based interaction design. *Human Technology* 12 (2016).

[32] Elena Márquez Segura, Laia Turmo Vidal, Asreen Rostami, and Annika Waern. 2016. Embodied Sketching. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (San Jose, California, USA) *(CHI '16)*. Association for Computing Machinery, New York, NY, USA, 6014–6027. https://doi.org/10.1145/2858036.2858486

[33] Florian Mueller, Martin R. Gibbs, Frank Vetere, and Darren Edge. 2014. Supporting the creative game design process with exertion cards. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Toronto, Ontario, Canada) *(CHI '14)*. Association for Computing Machinery, New York, NY, USA, 2211–2220. https://doi.org/10.1145/2556288.2557272

[34] Florian 'Floyd' Mueller, Stefan Agamanolis, Martin R. Gibbs, and Frank Vetere. 2008. Remote impact: shadowboxing over a distance. In *CHI '08 Extended Abstracts on Human Factors in Computing Systems* (Florence, Italy) *(CHI EA '08)*. Association for Computing Machinery, New York, NY, USA, 2291–2296. https://doi.org/10.1145/1358628.1358672

[35] Florian 'Floyd' Mueller, Darren Edge, Frank Vetere, Martin R. Gibbs, Stefan Agamanolis, Bert Bongers, and Jennifer G. Sheridan. 2011. Designing sports: a framework for exertion games. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Vancouver, Canada) *(CHI '11)*. Association for Computing Machinery, New York, NY, USA, 2651–2660. https://doi.org/10.1145/1978942.1979330

[36] Florian 'Floyd' Mueller, Carine Lallemand, Dennis Reidsma, Elise van den Hoven, and Maria F. Montoya. 2024. SportsHCI (Dagstuhl Seminar 23292). *Dagstuhl Reports* 13, 7 (2024), 108–151. https://doi.org/10.4230/DagRep.13.7.108

[37] Florian Floyd Mueller, Joe Marshall, Rohit Ashok Khot, Stina Nylander, and Jakob Tholander. 2015. Understanding Sports-HCI by Going Jogging at CHI. In *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems* (Seoul, Republic of Korea) *(CHI EA '15)*. Association for Computing Machinery, New York, NY, USA, 869–872. https://doi.org/10.1145/2702613.2727688

[38] Christian Murlowski, Florian Daiber, Felix Kosmalla, and Antonio Krüger. 2019. Slackliner 2.0: Real-time Training Assistance through Life-size Feedback. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, UK) *(CHI EA '19)*. Association for Computing Machinery, New York, NY, USA, 1–4. https://doi.org/10.1145/3290607.3313250

[39] Stina Nylander, Jakob Tholander, Florian 'Floyd' Mueller, and Joseph Marshall. 2015. HCI and sports. *Interactions* 22, 2 (feb 2015), 30–31. https://doi.org/10.1145/2729712

[40] Antti Oulasvirta, Esko Kurvinen, and Tomi Kankainen. 2003. Understanding contexts by being there: case studies in bodystorming. *Personal and ubiquitous computing* 7 (2003), 125–134.

[41] Wei Peng, Julia C Crouse, and Jih-Hsuan Lin. 2013. Using active video games for physical activity promotion: a systematic review of the current state of research. *Health education & behavior* 40, 2 (2013), 171–192. https://doi.org/10.1177/1090198112444956

[42] Dees BW Postma, Robby W van Delden, Jeroen H Koekoek, Wytse W Walinga, Ivo M van Hilvoorde, Bert Jan F van Beijnum, Fahim A Salim, Dennis Reidsma, et al. 2022. A Design Space of Sports Interaction Technology. *Foundations and Trends® in Human–Computer Interaction* 15, 2-3 (2022), 132–316.

[43] Dennis Reidsma, Robby W. van Delden, Joris P. Weijdom, René Engelhardt Hansen, Søren Lekbo, Rasmus Vestergaard Andersen, Lærke Schjødt Rasmussen Rasmussen, and Lars Elbæk. 2022. Considerations for (Teaching) Facilitator Roles for Movement-Based Design. In *Extended Abstracts of the 2022 Annual Symposium on Computer-Human Interaction in Play* (Bremen, Germany) *(CHI PLAY '22)*. Association for Computing Machinery, New York, NY, USA, 233–239. https://doi.org/10.1145/3505270.3558315

[44] Juan Restrepo-Villamizar, Steven Vos, Evert Verhagen, and Carine Lallemand. 2021. Crafting On-Skin Interfaces: An Embodied Prototyping Journey. In *Proceedings of the 2021 ACM Designing Interactive Systems Conference* (Virtual Event,

USA) *(DIS '21)*. Association for Computing Machinery, New York, NY, USA, 1129–1142. https://doi.org/10.1145/3461778.3462055

[45] Thecla Schiphorst. 2011. Self-evidence: applying somatic connoisseurship to experience design. In *CHI '11 Extended Abstracts on Human Factors in Computing Systems* (Vancouver, BC, Canada) *(CHI EA '11)*. Association for Computing Machinery, New York, NY, USA, 145–160. https://doi.org/10.1145/1979742.1979640

[46] Dennis Schleicher, Peter Jones, and Oksana Kachur. 2010. Bodystorming as embodied designing. *Interactions* 17, 6 (nov 2010), 47–51. https://doi.org/10.1145/1865245.1865256

[47] Richard Shusterman. 1999. Somaesthetics: A disciplinary proposal. *The journal of aesthetics and art criticism* 57, 3 (1999), 299–313.

[48] Richard Shusterman. 2008. *Body consciousness: A philosophy of mindfulness and somaesthetics.* Cambridge University Press.

[49] Kristian T. Simsarian. 2003. Take it to the next stage: the roles of role playing in the design process. In *CHI '03 Extended Abstracts on Human Factors in Computing Systems* (Ft. Lauderdale, Florida, USA) *(CHI EA '03)*. Association for Computing Machinery, New York, NY, USA, 1012–1013. https://doi.org/10.1145/765891.766123

[50] Vasiliki Tsaknaki, Madeline Balaam, Anna Ståhl, Pedro Sanches, Charles Windlin, Pavel Karpashevich, and Kristina Höök. 2019. Teaching Soma Design. In *Proceedings of the 2019 on Designing Interactive Systems Conference* (San Diego, CA, USA) *(DIS '19)*. Association for Computing Machinery, New York, NY, USA, 1237–1249. https://doi.org/10.1145/3322276.3322327

[51] Laia Turmo Vidal, Elena Márquez Segura, and Annika Waern. 2018. Movement Correction in Instructed Fitness Training: Design Recommendations and Opportunities. In *Proceedings of the 2018 Designing Interactive Systems Conference* (Hong Kong, China) *(DIS '18)*. Association for Computing Machinery, New York, NY, USA, 1041–1054. https://doi.org/10.1145/3196709.3196789

[52] Laia Turmo Vidal, Elena Márquez Segura, Laia Turmo Vidal, and Elena Márquez Segura. 2018. Documenting the Elusive and Ephemeral in Embodied Design Ideation Activities. *Multimodal Technologies and Interaction* 2, 3 (June 2018), 35. https://doi.org/10.3390/mti2030035

[53] Laia Turmo Vidal, Elena Márquez Segura, and Annika Waern. 2018. Sensory bodystorming for collocated physical training design. In *Proceedings of the 10th Nordic Conference on Human-Computer Interaction* (Oslo, Norway) *(NordiCHI '18)*. Association for Computing Machinery, New York, NY, USA, 247–259. https://doi.org/10.1145/3240167.3240224

[54] Vincent van Rheden, Thomas Grah, Alexander Meschtscherjakov, Rakesh Patibanda, Wanyu Liu, Florian Daiber, Elise van den Hoven, and Florian 'Floyd'

Mueller. 2021. Out of Your Mind!? Embodied Interaction in Sports. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI EA '21)*. Association for Computing Machinery, New York, NY, USA, Article 79, 5 pages. https://doi.org/10.1145/3411763.3441329

[55] Vincent van Rheden, Eric Harbour, Thomas Finkenzeller, Lisa Anneke Burr, Alexander Meschtscherjakov, and Manfred Tscheligi. 2021. Run, beep, breathe: exploring the effects on adherence and user experience of 5 breathing instruction sounds while running. In *Proceedings of the 16th International Audio Mostly Conference*. 16–23.

[56] Vincent van Rheden, Eric Harbour, Thomas Finkenzeller, and Alexander Meschtscherjakov. 2023. Breath Tools: Exploring the Effects on Adherence and User Experience of 4 Sounds Assisting Runners with Coupling Breath to Steps. 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 57, 7 pages. https://doi.org/10.1145/3544549.3585736

[57] Vincent van Rheden, Eric Harbour, Thomas Finkenzeller, and Alexander Meschtscherjakov. 2024. Into the Rhythm: Evaluating Breathing Instruction Sound Experiences on the Run with Novice Female Runners. *Multimodal Technologies and Interaction* 8, 4 (2024), 25.

[58] José Manuel Vega-Cebrián, Elena Márquez Segura, Laia Turmo Vidal, Omar Valdiviezo-Hernández, Annika Waern, Robby Van Delden, Joris Weijdom, Lars Elbæk, Rasmus Vestergaard Andersen, Søren Stigkær Lekbo, and Ana Tajadura-Jiménez. 2023. Design Resources in Movement-based Design Methods: a Practice-based Characterization. In *Proceedings of the 2023 ACM Designing Interactive Systems Conference (DIS '23)*. Association for Computing Machinery, New York, NY, USA, 871–888. https://doi.org/10.1145/3563657.3596036

[59] Joris Weijdom. 2022. Performative prototyping in collaborative mixed reality environments: an embodied design method for ideation and development in virtual reality.. In *Proceedings of the Sixteenth International Conference on Tangible, Embedded, and Embodied Interaction* (Daejeon, Republic of Korea) *(TEI '22)*. Association for Computing Machinery, New York, NY, USA, Article 10, 13 pages. https://doi.org/10.1145/3490149.3501316

[60] Daniel Wigdor and Dennis Wixon. 2011. *Brave NUI world: designing natural user interfaces for touch and gesture.* Elsevier.

[61] Danielle Wilde, Anna Vallgårda, and Oscar Tomico. 2017. Embodied Design Ideation Methods: Analysing the Power of Estrangement. 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, 5158–5170. https://doi.org/10.1145/3025453.3025873