Moving with Machines: A Human-Robot Experience (HRX) Theatre Workshop

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Abstract

This workshop introduces a novel, embodied approach for exploring and reimagining human-robot relationships through a movement-based, experience-centred practice that focuses on the dynamic, emergent meaning-making potential inherent in our social encounters with machines. The Human-Robot Experience (HRX) Theatre Workshop invites participants to reimagine our relationships with robots by creatively exploring the social potential of machinelike artifacts. HRX frames human-robot interaction as a more-than-human encounter, challenging traditional Human-Robot Interaction perspectives. The workshop aims to establish a creative playground for participants to collaboratively develop and enact inclusive human-robot scenarios, harnessing the generative potential of movement dynamics. Our Relational Body Mapping (RBM) method uses robot costumes to facilitate perspective-taking and enable participants to step into the shoes of a robot's unique relational affordances. This immersive, creative approach aims to cultivate inclusive, diverse perspectives that transcend traditional anthropocentric views, opening up new modes of empathy, nonverbal communication, and meaning-making with machinelike artifacts.

CCS Concepts

• **Human-centered computing → Interaction design process and methods**.

Keywords

embodied prototyping, more-than-human design, performance-making, Relational Body Mapping (RBM), transcorporeal empathy

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1 Introduction

Recent advances in generative AI open up new possibilities for social robots, promising more sophisticated human-robot interactions through enhanced communication, emotional intelligence, adaptive behaviours, and personalization [14]. However, these advances often aim to make robots more humanlike by effectively masking the "deep asymmetries" between persons and machines [20]. While AI may further complicate the subject-object boundary, it doesn't address or resolve the underlying assumptions driving efforts to render machines as humanlike as possible.

Mimicking human traits is a common approach in human-robot interaction (HRI), assuming that meaningful encounters depend on what interactors already have in common [16]. The machine's otherness, in these approaches, is viewed as an obstacle, leading to widespread agreement that it requires softening or masking [4, 8, 16, 17]. We argue that this mimicking approach limits both what a robot could be and the kinds of relationships we could have with them. It is thus important to explore alternative approaches that embrace and creatively exploit the differences between humans and machines. This workshop proposes a more-than-human approach that engages participants in embodied, performative practices to reimagine our relationships with robots.

2 From Human-Robot Interaction (HRI) to Human-Robot Experience (HRX)

Suchman observes that humanlike robots may appear to break down rigid subject-object boundaries but instead reaffirm the differences and hierarchies that this boundary is founded on [21]. Furthermore, modelling human-robot relationships after human-human relationships [5, 13] implies that sociality can be reverse-engineered and programmed into robots [1, 11], favouring a notion of sociality that is "amenable to technological intervention" [25]. We argue that a genuine experience-centered approach needs to attend to the dynamics and relational possibilities emerging in the encounter itself [9, 24], rather than relying on imitation [22, 25].

Our Human-Robot Experience (HRX) framework further expands the notion of human-centered design to more-than-human

Figure 1: Relational-Body-Mapping: a series of more-than-human constellations between dance performers and robot costumes captured during our experimental studio practice; with Audrey Rochette and Steph Hutchison, 2023 (top row), and Arabella Frahn-Starkie, Felix Palmerson, and Siobhan McKenna, 2022 (bottom row). Photos: Petra Gemeinboeck.

design by acknowledging the networks of relationships humans are embedded in. This shift from a representationalist to a performative view reframes human-robot relationships as more-than-human experiences. Instead of viewing them as interactions between separate entities with pre-defined agencies, it sees them as dynamic experiences, where both human and nonhuman participants enact meaning and social agency in the encounter [8]. The HRX Theatre Workshop seeks to transcend binary assumptions in HRI by cultivating a more-than-human, experience-centred approach to human-machine interactions.

2.1 Relational Body-Mapping (RBM)

Relational Body Mapping (RBM) uses wearable costumes that stand in for a robot's embodiment and propels our novel performance-making practice for prototyping relationships with machines in creative, embodied ways. It enables dancers to step into the shoes of a robot performer to develop a relational movement language and more-than-human relations with robotic costumes and their unique spatial affordances (Figure 1). Central to this approach is understanding movement as a dynamic, relational, and generative force with "distinctive spatial, temporal, and energic qualities" [18] that unfold relational dynamics that are core to social communication [6]. RBM has shaped our more-than-human performance-making practice, deploying robot costumes to creatively explore relationships with robotic artifacts in novel aesthetic, embodied, and social ways (Figure 2). The HRX Theatre Workshop uses RBM alongside performance-making strategies for participants to develop and experience playful, speculative, and social scenarios with machinelike artifacts.

2.2 A Growing HRI Community Supporting Embodied and Participatory Design

There is a growing community in and around HRI emphasizing embodied knowledge and alternative ways of making meaning with robots. Relevant research includes Seibt et al.'s "sociomorphing" [17], LaViers and Maguire's approach foregrounding kinaesthetic attunement and movement notation [12], Bacula et al.'s "dance prototyping" [2], Jochum & Derks' dance improvisation framework [10], and Sirkin and Ju's "embodied design improvisation" [19].

Figure 2: Alloyed Bodies [BNE-3-3-1] by Petra Gemeinboeck and Rob Saunders, 25-27 June, ISEA 2024, Brisbane, with three dance performers (Audrey Rochette, Siobhan McKenna and Felix Palmerson), three cube costumes, and one cube robot. Photo: Jade Ellis.

In addition to embodiment and empathy-focused approaches, experience-centred design strategies [23] promote embodied interaction with a focus on empathic perspective-taking [23, 24]. There is a growing recognition of the need to broaden participation in robot design, with Gasteiger et al. [7] demonstrating the benefits of stakeholder involvement throughout the design process. Šabanović [25] notes a lack of methods for involving end-users early in the process and accommodating their imaginations and experiences.

3 HRX Workshop Objectives and Embodied Strategies

HRX aims to cultivate a more-than-human, transcorporeal empathy that extends intercorporeal resonances shaping our human social relationships [6] to the network of nonhuman entities we're embedded in. This approach challenges the notion that we are separate from the world [3] and that boundaries between subjects and objects are given and fixed [21]. Instead, it seeks to establish a horizontal playground for reimagining our social relationships with machines. The workshop aims to help building a community around the key principles of HRX, including the generative potential of movement dynamics, kinesthetic attunement and transcorporeal empathy, and the horizontal ethics of a more-than-human approach to human-robot relationships.

The workshop's objectives are to:

- establish an inclusive, more-than-human playground for embracing and creatively considering the differences between humans and machines,
- generate a deeper, embodied understanding of more-than-human experiences by attending to emergent, nuanced resonances between human and nonhuman embodiments, and
- harness this sensitivity to movement qualities and kinaesthetic attunement to reimagine human-robot relationships.

To do this, we will engage participants in:

- gentle movement explorations to expand bodily and kinesthetic awareness,
- embodied encounters with abstract, machinelike artifacts using RBM, and
- collaborative development and enactment of diverse human-robot scenarios through embodied role-play.

Our experience-centred, movement-driven process builds on creative robotics and choreographic knowledge [8, 9, 15], supporting participants in playful, embodied role-play to explore agency, affect, trust, and dependency with robots. The team's performance-making expertise with RBM will support participants in engaging with this role-play to explore questions of meaning-making, affect, and trust with robots. This playful, movement-oriented approach is designed to be accessible and inclusive, without requiring prior dance experience. Participants will be encouraged to engage at their own comfort level and within their individual abilities.

Discussions, reflections, and the use of a novel 'more-than-human body-map' tool will capture participants' bodily sensations and more-than-human experiences, further deepening our exploration of human-robot relationships. By inviting participants to explore how we bodily resonate and make meaning with machinelike entities, the workshop seeks to open human-robot interaction design to new modes of empathy and more-than-human communication.

4 Workshop Organizers

Dr. Petra Gemeinboeck is a Future Fellow and Associate Professor at Swinburne University of Technology and co-founder of the Machine Movement Lab (MML). Her transdisciplinary, practice-based approach brings together creative robotics, choreography, performance-making, and feminist new materialism. Petra's ARC Fellowship project in Human-Robot Experience (HRX) seeks to expand and diversify our relationships with robots by promoting creative, embodied, and participatory ways of engagement. Recently, she led the FWF PEEK artistic research project 'Dancing with the Nonhuman' at the University of Applied Arts Vienna, investigating relational dynamics between humans and robots through more-than-human performance-making. Focusing on questions of agency, embodiment, and performativity, Petra's work expands conventional HRI research by deeply integrating embodied knowledge and performative practice with technology-driven exploration.

Dr. Rob Saunders is Associate Professor at Leiden University, The Netherlands and co-founder of the Machine Movement Lab (MML). His research explores the role of intrinsic motivation in the computational modelling of creativity. His interdisciplinary approach to research spans computational creativity, machine learning, agent-based modelling, human-robot interaction and creative robotics. His research has contributed to establishing new directions for research in the computational modelling of creative individuals and societies, and the development of autonomous and embodied creative agents and co-creative systems. His long-term creative robotic collaboration with Petra Gemeinboeck has contributed to promoting an expanded view of computational creativity that embraces embodied notions of cognition.

Dr. Steph Hutchison is a dance academic at Queensland University of Technology, specializing in contemporary dance, choreography, and dance technology. Her transdisciplinary approach bridges dance and choreography with cutting-edge technological fields like robotics. As co-leader of the Ars Electronica Futurelab Academy @QUT, Steph developed embodied practice activities for creative collaboration. Her recent work as an Associate Investigator at the Australian Cobotics Centre and her ANAT Synapse Residency with Jonathan Roberts focused on cobotic improvisation, exploring how dance improvisation and choreography can advance human-robot collaboration. Steph has expertise in facilitating movement-based explorations with technology and has been a choreographic consultant with the Machine Movement Lab since 2022.

Dr. Kristina Mah is a postdoctoral researcher working with the Machine Movement Lab at Swinburne University and the Design Lab at The University of Sydney. Her research emphasizes disciplined and embodied approaches to investigating human experience, contributing to relational cultural theory in design, HCI and social robotics. Her work bridges ancient wisdom, modern science, and practice-based research-through-design. Here current research aims to more deeply understand transcorporeal empathy in more-than-human contexts and pedestrian experience and gestural communication with autonomous vehicles. Her own body awareness and movement practices inform her work, seeking way of embedding contemplative practice and reflexivity into design practice.

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References

[1] Morana Alač. 2016. Social Robots: Things or Agents? *AI & society* 31, 4 (2016), 519–535. doi:10.1007/s00146-015-0631-6

[2] Alexandra Bacula, Kamron Kayhani, Jennifer McCloskey, Dana Reason, and Heather Knight. 2020. Dance Prototyping: Communicating Group Membership and Relational Attitudes via Multi-Robot Expressive Motion. In *Companion of the 2020 Robotics Science and Systems Conference.*

[3] Karen Barad. 2006. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning.* Duke University Press, Durham, NC. doi:10.1215/9780822388128

[4] Claudia Castañeda and Lucy Suchman. 2014. Robot Visions. *Social Studies of Science* 44, 3 (2014), 315–341. doi:10.1177/0306312713511868

[5] Kerstin Dautenhahn. 2007. Socially Intelligent Robots: Dimensions of Human–Robot Interaction. *Philosophical Transactions of The Royal Society B: Biological Sciences* 362, 1480 (2007), 679–704. doi:10.1098/rstb.2006.2004

[6] Thomas Fuchs and Sabine C. Koch. 2014. Embodied Affectivity: On Moving and Being Moved. *Frontiers in Psychology* 5 (2014), 12 pages. doi:10.3389/fpsyg.2014.00508

[7] Norina Gasteiger, Ho Seok Ahn, Christopher Lee, Jongyoon Lim, Bruce A. MacDonald, Geon Ha Kim, and Elizabeth Broadbent. 2022. Participatory Design, Development, and Testing of Assistive Health Robots with Older Adults: An International Four-year Project. *ACM Transactions on Human-Robot Interaction* 11, 4, Article 45 (2022), 19 pages. doi:10.1145/3533726

[8] Petra Gemeinboeck and Rob Saunders. 2022. Moving Beyond the Mirror: Relational and Performative Meaning Making in Human–Robot Communication. *AI & Society* 37 (2022), 549–563. doi:10.1007/s00146-021-01212-1

[9] Petra Gemeinboeck and Rob Saunders. 2023. Dancing with the Nonhuman: A Feminist, Embodied, Material Inquiry into the Making of Human-Robot Relationships. In *Companion of the 2023 ACM/IEEE International Conference on Human-Robot Interaction (HRI '23).* Association for Computing Machinery, New York, NY, USA, 51–59. doi:10.1145/3568294.3580036

[10] Elizabeth Jochum and Jeroen Derks. 2019. Tonight We Improvise! Real-Time Tracking for Human-Robot Improvisational Dance. In *Proceedings of the 6th International Conference on Movement and Computing.* Association for Computing

Machinery, New York, NY, 1–8. doi:10.1145/3347122.3347129

[11] Raya A. Jones. 2017. What Makes a Robot 'Social'? *Social Studies of Science* 47, 4 (2017), 556–579. doi:10.1177/0306312717704722

[12] Amy LaViers and Catherine Maguire. 2023. *Making Meaning with Machines: Somatic Strategies, Choreographic Technologies, and Notational Abstractions through a Laban/Bartenieff Lens.* The MIT Press, Cambridge, MA. doi:10.7551/mitpress/14060.001.0001

[13] Sven Nyholm, Cindy Friedman, Michael T. Dale, Anna Puzio, Dina Babushkina, Guido Löhr, Arthur Gwagwa, Bart A. Kamphorst, Giulia Perugia, and Wijnand Ijsselsteijn. 2023. Social Robots and Society. In *Ethics of Socially Disruptive Technologies: An Introduction*, Ibo van de Poel, Lily Eva Frank, Julia Hermann, Jeroen Hopster, Dominic Lenzi, Sven Nyholm, Behnam Taebi, and Elena Ziliotti (Eds.). Open Book Publishers, Cambridge, UK, 53–82. doi:10.11647/obp.0366.03

[14] Bojan Obrenovic, Xiao Gu, Guoyu Wang, Danijela Godinic, and Ilimdorjon Jakhongirov. 2025. Generative AI and Human–Robot Interaction: Implications and Future Agenda for Business, Society and Ethics. *AI & Society* 40 (2025), 677–690. doi:10.1007/s00146-024-01889-0

[15] Audrey Rochette and Petra Gemeinboeck. 2022. Dialogues cinétiques : Une expérience somatique, affective et mentale vécue au contact d'un artefact robotique dans le projet Machine Movement Lab [Kinetic Dialogues: A Somatic, Affective, and Mental Experience in Contact with a Robotic Artifact in the Machine Movement Lab Project]. *L'Extension recherche&création* (2022). https://percees.uqam.ca/fr/le-vivarium/dialogues-cinetiques

[16] Eleanor Sandry. 2016. The Potential of Otherness in Robotic Art. In *Robots and Art: Exploring an Unlikely Symbiosis.* Springer, Singapore, 177–189. doi:10.1007/978-981-10-0321-9_9

[17] Johanna Seibt, Christina Vestergaard, and Malene F. Damholdt. 2020. Sociomorphing, Not Anthropomorphizing: Towards a Typology of Experienced Sociality. In *Culturally Sustainable Social Robotics—Proceedings of Robophilosophy 2020 (Frontiers in Artificial Intelligence and Applications, Vol. 335)*, Marco Nørskov, Johanna Seibt, and Oliver Santiago Quick (Eds.). IOS Press, Amsterdam, NL, 51–67. doi:10.3233/FAIA200900

[18] Maxine Sheets-Johnstone. 2012. From Movement to Dance. *Phenomenology and the Cognitive Sciences* 11 (2012), 39–57. doi:10.1007/s11097-011-9200-8

[19] David Sirkin and Wendy Ju. 2014. Using Embodied Design Improvisation as a Design Research Tool. In *Proceedings of the International Conference on Human Behavior in Design (HBiD 2014).* Ascona, Switzerland, 7 pages.

[20] Lucy Suchman. 2007. *Human-Machine Reconfigurations: Plans and Situated Actions* (2nd ed.). Cambridge University Press, Cambridge, UK.

[21] Lucy Suchman. 2011. Subject Objects. *Feminist Theory* 12, 2 (2011), 119–145. doi:10.1177/1464700111404205

[22] Sherry Turkle. 2011. *Alone Together: Why We Expect More From Technology and Less From Each Other.* Basic Books, New York, NY.

[23] Peter Wright and John McCarthy. 2010. *Experience-Centered Design: Designers, Users, and Communities in Dialogue* (1 ed.). Springer, Cham. doi:10.1007/978-3-031-02192-3

[24] Peter Wright, Jayne Wallace, and John McCarthy. 2008. Aesthetics and Experience-Centered Design. *ACM Transactions on Computer-Human Interaction (TOCHI)* 15, 4, Article 18 (2008), 21 pages. doi:10.1145/1460355.1460360

[25] Selma Šabanović. 2010. Robots in Society, Society in Robots. *International Journal of Social Robotics* 2 (2010), 439–450. doi:10.1007/s12369-010-0066-7