

Jun 8th, 9:00 AM - Jun 12th, 5:00 PM

More-than-human data practices

Elisa Giaccardi

Department of Design, Politecnico di Milano, Italy

Sara Lenzi

Ikerbasque Basque Foundation for Science, Bilbao, Spain; Deusto Tech, Faculty of Engineering, University of Deusto, Spain

Chris Speed

RMIT, Melbourne, Australia

Vasiliki Tsaknaki

IT University of Copenhagen, Denmark

Jiwei Zhou

KTH Royal Institute of Technology, Sweden

Follow this and additional works at: <https://dl.designresearchsociety.org/drs-conference-papers>



Part of the [Art and Design Commons](#)

Citation

Giaccardi, E., Lenzi, S., Speed, C., Tsaknaki, V., and Zhou, J. (2026) More-than-human data practices, in Simeone, L., Gray, C. M., Verhoeven, A., de Götzen, A., Bakırlioğlu, Y., Zohar, H., Stead, M., and Buwert, P. (eds.), *DRS2026: Edinburgh*, 8–12 June, Edinburgh, United Kingdom. <https://doi.org/10.21606/drs.2026.118>

This Research Paper is brought to you for free and open access by the DRS Conference Proceedings at DRS Digital Library. It has been accepted for inclusion in DRS Biennial Conference Series by an authorized administrator of DRS Digital Library. For more information, please contact library@thedrs.org.

Editorial: More-than-human data practices

Elisa Giaccardi^a, Sara Lenzi^{b,c}, Chris Speed^d, Vasiliki Tsaknaki^e, Jiwei Zhou^f

^aDepartment of Design, Politecnico di Milano, Italy

^bIkerbasque Basque Foundation for Science, Bilbao, Spain

^cDeusto Tech, Faculty of Engineering, University of Deusto, Spain

^dRMIT, Melbourne, Australia

^eIT University of Copenhagen, Denmark

^fKTH Royal Institute of Technology, Sweden

*Corresponding author e-mail: elisa.giaccardi@polimi.it

doi.org/10.21606/drs.2026.118

Abstract: Grounded in post-anthropocentric and post-humanist perspectives, this track explores more-than-human data practices that challenge dominant data paradigms and cultivate alternative modes of engagement with the world, from the microbial to the planetary. Rather than treating non-human life as objects of measurement and classification, as *data subjects*, the contributions in this track ask what it would mean to recognize organisms, systems, and processes as *data co-producers*, whose perceptual worlds, temporal rhythms, and relational entanglements actively participate in what counts as knowledge. This reorientation carries profound consequences for the designer. Co-producing data with more-than-human others is a political, epistemic, and ontological commitment that goes beyond inclusivity: it unsettles human authority, disrupts extractive infrastructures, and demands new forms of response-ability in how knowledge is gathered, represented, and put to use. If data has long spoken for the world, this track asks: how might it begin to listen?

Keywords: more-than-human design; multispecies worlds; data practices; data as relation

1. Introduction: Why data needs reworlding

Crucial to knowledge production, data is largely collected, classified, and mobilized through dominant frameworks that determine what counts as knowledge, whose experiences and relations are legible, and which worlds are rendered visible or invisible. These frameworks actively shape reality, defining what can be known and what remains excluded. They do not simply describe it. But how can data be troubled, transformed, or made to speak otherwise in ways that support pluriversal ways of knowing and becoming?

In this theme track, we explore more-than-human data practices, an emergent area in design research that critically interrogates dominant data paradigms and seeks to foster relational,



This work is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International Licence](https://creativecommons.org/licenses/by-nc/4.0/).

situated, and diffractive engagements with data across multispecies lifeworlds. Spanning scales from the microbial to the planetary, these practices challenge the assumption that data is a neutral representation of the world to foreground instead its role in shaping relations within it.

Design research has increasingly contributed to unsettling what counts as data. Drawing on post-anthropocentric and post-humanist imperatives in Human-Computer Interaction (HCI) and design (Forlano, 2017; Frauenberger, 2019; Wakkary, 2020; Giaccardi et al., 2025a), the field has begun to question the assumptions embedded in how data is collected, classified, and made to mean. More-than-human design, in particular, is playing a crucial role in challenging extractivist paradigms of data collection, advancing speculative infrastructures and participatory methods for sensing and interfacing with ecosystems (Dolejsova et al., 2022; Livio & Devendorf, 2022; Westerlaken et al. 2022; Kim et al., 2023; Zhou et al., 2023; Holland & Roudavski, 2024; Lee et al., 2025; Giaccardi et al., 2025b), and opening imaginaries for relational, situated, and multispecies engagements with data (Guerrero Millan et al., 2024; Lee et al., 2024; Koefoed Hansen & Lodahl Rolighed, 2024). These approaches make important strides in decentering the human (Nicenboim et al., 2024), foregrounding other species, and making space for local and Indigenous ways of knowing.

Yet, across academia and industry, data continues to be framed primarily in terms of extraction, singularity, quantification, and static form. In domains such as sustainability, ecological regeneration, and policy-making, this framing is especially consequential in the face of planetary crises. Data often becomes the primary, and sometimes the only lens through which environmental realities are perceived, interpreted, and acted upon. As a result, the limitations of current data paradigms shape and constraint the possibilities for response (Westerlaken et al., 2023).

Despite advances in more-than-human thinking, these perspectives have yet to translate into scalable practices across the fields that structure how data comes to matter in everyday decision-making and environmental governance, including data science, data visualization, data sonification, interaction design, and biodesign. Bridging more-than-human imaginaries with the pragmatics of technological design remains an open and urgent challenge.

Building on theories of situated knowledges (Haraway, 2013) and diffractive methodology (Barad, 2007), this track invites the design research community to explore alternative approaches to data representation, interaction, and infrastructuring. At the core of this track lies a provocation: if data is not taken from the more-than-human world but *emerges* from the complex relations entangled within it, even beyond human control or full comprehension, then what if we understand data not as a *representation* of that world, but as *relations* from within it? How might data be reworlded in response to our current planetary crises?

2. From data as representation to data as relation

Dominant data paradigms are grounded in a representational logic. Data is typically understood as something that captures, describes, and stands in for the world: a set of measurable attributes that can be extracted, structured, and analyzed (Offenhuber, 2020).

Within this framing, the world becomes a source of information to be sampled and abstracted, while data becomes a stable and transportable representation of that reality.

This logic underpins many contemporary data practices, from large-scale sensing infrastructures to machine learning systems. It privileges quantification, standardization, and comparability, often at the expense of context, relationality, and difference (Sanches et al., 2022; Turtle et al., in press). In doing so, it reduces complex, dynamic, and situated lifeworlds into discrete variables that can be processed within computational systems.

Such reductions are not neutral. They involve decisions about what to measure, how to measure it, and what to exclude. These decisions shape not only what becomes visible, but also what becomes actionable. Entire forms of life, modes of perception, and temporalities may remain unaccounted for, not because they do not exist, but because they do not fit within the parameters of existing data frameworks (Westerlaken & Rattay, this track).

In response, a growing body of work across design and adjacent fields has begun to challenge this representational paradigm by re-situating data within the conditions of its emergence. On the one hand, these approaches situate data within specific contexts and relations, as seen in frameworks such as data feminism (D'Ignazio & Klein, 2020), local data (Loukissas, 2019), warm data (Bateson, 2017), data as *capta* (Drucker 2011), and data as *relata* (Barad, 2007). These perspectives emphasize that data is never raw or neutral, but always shaped by situated practices, power structures, and relational entanglements.

On the other hand, complementary strands of research foreground the embodied and material dimensions of data. Concepts such as autographic data (Offenhuber, 2024; Lenzi et al., 2024), somatic data (Höök et al., 2019), biodata (Tsaknaki et al., 2020), and data materialization (Yavuz et al., 2025) draw attention to how data is generated through bodily engagement, sensory experience, and material processes. Here, data is not an abstract representation detached from the world, but something that is lived, felt, and enacted through interaction.

More-than-human data practices extend these lines of research by foregrounding a fundamental shift: from data *from* the world to data *with* the world. Rather than treating data as a detached representation, these approaches understand it as emerging from within ongoing relations among humans, nonhumans, materials, and environments.

This shift entails rethinking data as *relational*. Data is not simply collected; it is co-produced through interactions, entanglements, and dependencies. It is shaped by the perceptual capacities of different organisms, the affordances of sensing technologies, and the infrastructures through which it is processed and circulated. Recognizing this relationality opens up possibilities for engaging with data in ways that are more attentive to plurality, partiality, and situatedness.

It also requires expanding the sensory and epistemic modalities through which data is encountered. Beyond visual representation, more-than-human data practices explore multisensory, embodied, and affective forms of engagement, including sound, vibration, tactility, and biological processes. These approaches challenge the dominance of visual and quantitative modes of knowing to invite alternative forms of attunement to the world.

Reframing data as relation does not imply abandoning computation or analysis but rather reconfiguring their role. Instead of extracting and abstracting *from* the world, data practices

can be designed to *participate within it*, supporting forms of knowledge that are responsive, situated, and accountable to the relations they emerge from.

3. More-than-human data practices: What is at stake

The turn from data as representation to data as relation is not merely a theoretical reorientation. It names something that is at once cosmopolitical, epistemic, and ontological, and understanding what is at stake across these three registers is essential to situating the contributions that follow.

Cosmopolitically, more-than-human data practices ask who and what count as legitimate participants in knowledge production. Sheikh, Foth and Mitchell (2023) demonstrate how digital biodiversity databases, sensing infrastructures, and algorithmic conservation practices reproduce human exceptionalism even when ostensibly designed in service of environmental care, while Dunbar and Speed (2024) recover the adage "what gets measured gets managed" that encodes a double violence: the exclusion of non-human life from data, and its reduction, when included, to an object of control. Which lifeforms count, which temporalities are legible, which ways of knowing are admitted as evidence, these remain political questions that data infrastructures are never neutral with respect to.

Epistemologically, more-than-human data practices challenge the assumption that knowledge flows through human perception and human categories. Giaccardi and Redström's (2020) account of the paradox of human-centered design identifies how the instrumental relation between person and tool has come to dominate design thinking, rendering invisible the agential capacities of the non-human actors with whom designers are already entangled. Chamaidi and Stavrakis's (2024) BACT framework pushes this further methodologically, demonstrating that even a practice as intimate as beekeeping remains epistemically incomplete when framed around human participants alone; the sensory worlds, communicative repertoires, and behavioral rhythms of bees constitute knowledge that standard design frameworks simply cannot see. What we cannot register, we cannot know; and what we cannot know, we reproduce as absence.

Ontologically, the stakes are hardest to grasp, and here McQuillan's (2018) account of data science as machinic neoplatonism is clarifying. Dominant data paradigms operate as applied metaphysics: they appear to reveal a hidden mathematical order ontologically superior to direct experience, enacted through computational infrastructure that converts predictions into pre-emptions. The result is a "view from nowhere" that accrues authority precisely because it presents itself as neutral, external, and above contest, and this authority is not simply argued but machined into the world. More-than-human data practices challenge this at its root, insisting that the categories organizing dominant data infrastructures are not settled ground but sites of ongoing struggle.

The contributions collected in this track engage these stakes through speculative imaginaries, experimental sensing methods, multispecies ethnography, and critical infrastructure studies. Yet a persistent tension remains: the difficulty of moving from critique into design practice and infrastructuring. The papers that follow do not resolve this challenge, but they advance it, mapping the contours of a practice that is only beginning to find its form.

4. Emerging directions from the track

4.1 Reconfiguring data paradigms

Several contributions converge on the challenge of moving beyond representational and classificatory logics that fix entities into rigid taxonomies, instead pointing toward relational ontologies in which data is not a neutral record but an active participant in the co-constitution of worlds.

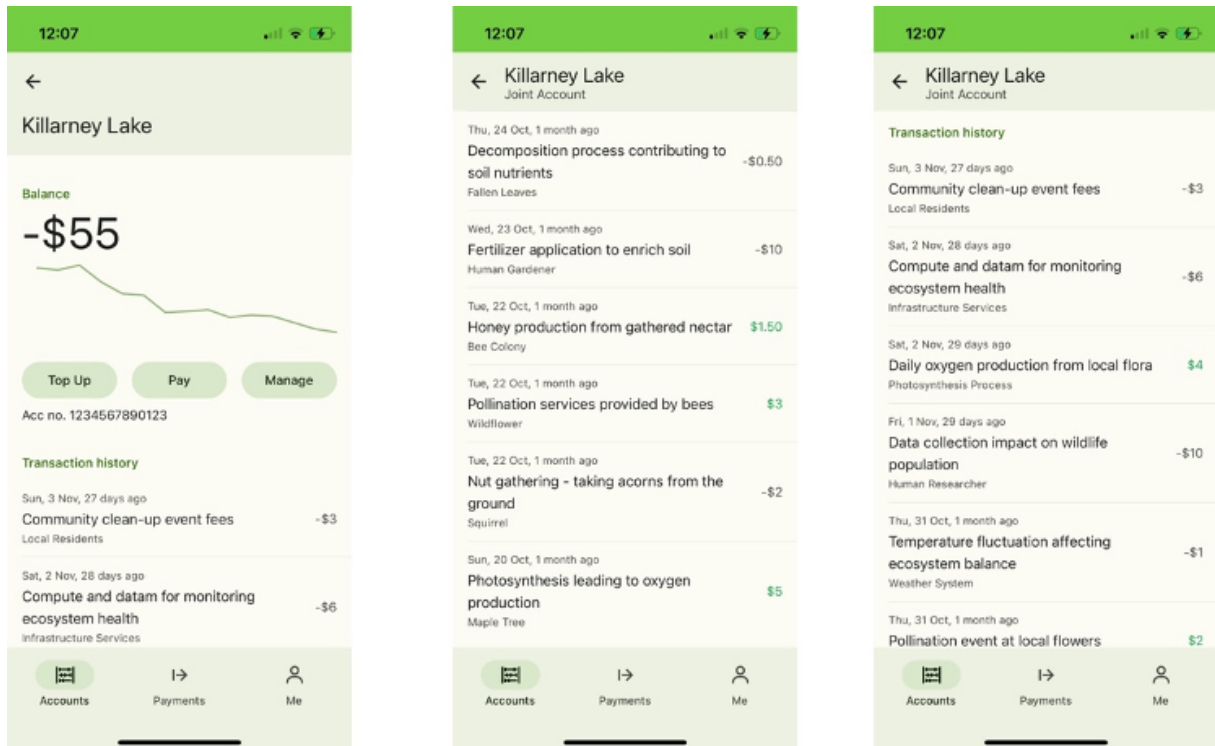


Figure 1 KinBank visualizes human and more-than-human transactions while exposing the costs of data infrastructures (Dunbar and Speed, this track).

In *Speculative design through synthetic data: Exploring how synthetic data be used to represent missing 'more-than-human' data*, Dunbar and Speed's *Kin Bank* exemplifies this shift. As a speculative interface, it mobilizes synthetic data not for prediction or optimization, but as a medium that generates "productive uncertainty," revealing interdependencies between human and non-human urban actors often obscured by conventional data infrastructures (Fig. 1). In doing so, synthetic data becomes less about representing what is, and more about opening up what could be sensed, imagined, and acted upon.

A related concern is explored in *Everything is an instrument: Making data instruments as critical pedagogy* by Bazlamita, Dunbar, and Speed, where students create bespoke data instruments to sense aspects of the world beyond standardized regimes. In this making-as-research process, data emerges through situated encounters with materials, whose resistance shapes what can be known and exposes the designer's role in configuring those conditions.

4.2 Designing for more-than-human participation

A second cluster of contributions examines how data acts and who, or what, can participate in that action, framing the interface not as a boundary but as a site of more-than-human engagement, where co-production and co-response replace unidirectional data collection.



Figure 2 Kristina Tica & Joaquín Santuber. Installation: *HUMAN OVERS[A]IGHT: THE OPS ROOM*. Ars Electronica Festival Linz 2025. Photo Reinhard Zach (Morais et al., this track).

In *Designing algorithmic infrastructures for environmental regeneration: Autonomous systems in marine contexts*, Görgülü, Özcan, and Berglund analyze marine robotic systems to articulate an “ethics of autonomy” that positions autonomy as a relational condition emerging through negotiation among human oversight, machine agency, and ecological dynamics. This highlights how algorithmic infrastructures actively participate in ecological processes, requiring design frameworks attuned to more-than-human entanglements.

Similarly, *More-than-human oversight: Designing a somaesthetic space for high-risk AI systems* by Morais and colleagues critiques the limits of human-centered AI regulation through an installation that shifts from “human-in-the-loop” to “body-is-the-loop,” enabling a more affective and situated engagement with AI data operations (Fig. 2).

Extending participation further, *Plant biographies: Expanding more-than-human modes of relating* by Koppela and colleagues use seasonal data to construct narrative accounts of *Rhododendron* plants, fostering empathetic, first-person connections with botanical lifeworlds and addressing plant awareness disparity.

4.3 Embodied and multisensorial data

A third group of contributions moves beyond the flatness of the screen to explore how data can be felt, heard, and physically inhabited. Challenging the detached, ocularcentric perspective of traditional data visualization (Latour, 2012), these works foreground embodied and multisensorial modes of knowing through the sonic, tactile, and biological.



Figure 3 Documentation of organisms that came to inhabit and co-opt the HydroMoth field recording device in the waters of the Charles River, Boston, MA (Gonzalez Quintero & Offenhuber, this track).

Central to this shift is the recognition that ecosystems are not computers, prompting a move from “dispassionate learning” to what Poikolainen Rosén, in *More-than-human self-tracking: An uncertain account of urine monitoring, protein excess and ecological entanglements*, describes as “rituals of careful noticing.” Through an autoethnographic account of monitoring urine protein, self-tracking becomes a situated practice that reveals the entanglement between personal metabolic health and the ecological nitrogen crisis in the Baltic Sea.

In *Occupying the sensors: Underwater sound in an urban river*, Gonzalez Quintero and Offenhuber use the underwater life of the Charles River in Boston, MA to foreground overlooked urban dynamics and reflect on sensor-organism interactions (Fig. 3). Finally, *Scaffolding ocean futures: Design for embedded, embodied, and emergent thinking* by Russel and colleagues demonstrates how futures scaffolding can transform citizen data into an embodied design material that fosters imaginative, relational engagement with anthropogenic pollution.

4.4 Bridging scales

A final set of contributions addresses the scalar dissonance inherent in contemporary data practices, where microchips are entangled with geological extraction and microbial health signals planetary change. These works explore how design can bridge such scales, moving beyond the flatness of globalized data to engage the hyper-local, the geological, and the temporalities of the Earth.

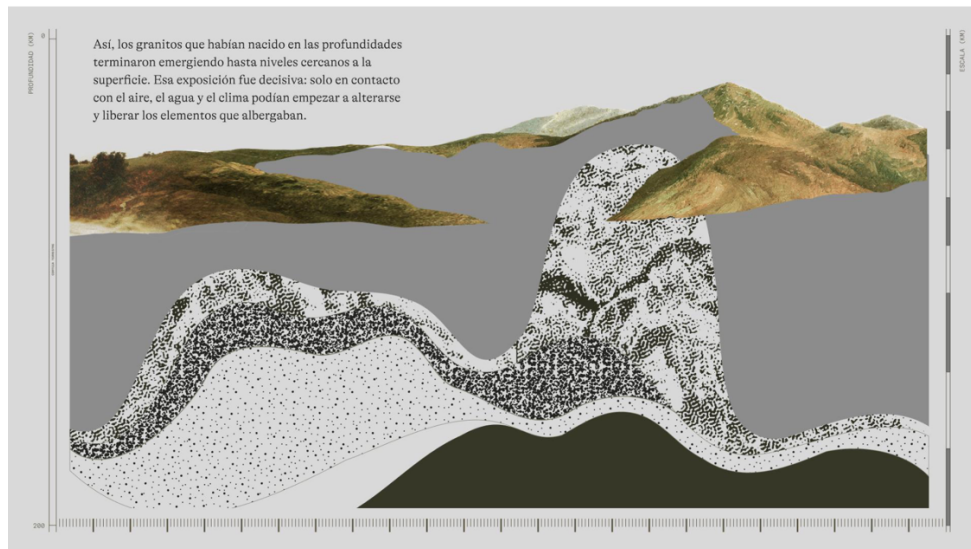


Figure 4 Section from the geological history of rare earth elements (c. 100 million years ago), illustrating how individual stories are articulated across depth (Tironi and Garretón, this track).

A recurring provocation concerns the “grounding” of technology. Artificial intelligence is often framed as an ethereal, cloud-based abstraction, obscuring its material and energetic costs. In *Grounding artificial intelligence: Terrestrial cartography and rare earths in Chile*, Tironi and Garretón use terrestrial cartography to expose the geological and social impacts of AI (Fig. 4), calling for a “diplomacy” of design that interweaves heterogeneous temporalities and more-than-human agencies.

Similarly, in *When data systems meet ecosystems: Tensions between AI platforms and vitality in corporate sustainability*, Westerlaken and Rattay examine AI in corporate sustainability, identifying tensions between computational demands for certainty and the instability of ecosystems. They propose a “technosymbiotic” design space and frame bridging scales as translation without reduction, resisting the simplification of complex ecological dynamics into neat data points.

5. Closing: Toward pluriversal data futures

The contributions gathered in this track do not argue for better data. Better data, within the terms of dominant paradigms, means more complete, more accurate, more granular: a finer-grained representation of a world that remains, fundamentally, the same. That is not what is at stake here.

Data is not a mirror held up to reality. It is a practice through which realities are made, stabilized, contested, and unmade (Stengers, 2010). Every data apparatus, every infrastructure, embeds decisions about what counts, who counts, and at what scale. The work assembled here makes this visible, and it goes further. They ask what it would mean to design data practices that are answerable to the full complexity of the relations from which they emerge, including the microbial, the geological, the felt, and the not-yet-legible.

In opening this research space, this track calls for expanding what *rigor* means, to include *accountability* alongside accuracy, *attunement* alongside abstraction, and *participation* alongside representation. The speculative interfaces, multispecies methods, embodied sensing practices, and earth-oriented design practices gathered in this track each demonstrate, in different registers, that this expansion is already underway.

A “pluriversal” data future is not a single alternative paradigm waiting to replace the one we have (hence the plural in the title). It is a multiplicity of situated practices, each accountable to the specific relations, lifeworlds, and temporalities within which it operates (Escobar, 2018). It does not promise universality but “response-ability” (Haraway, 2016), understood as the capacity to be affected by and answerable to the worlds that one’s data practices help make. In other words, the challenge is no longer to make data more accurate, but more accountable to the many forms of life it affects, and to enable those forms of life to participate in shaping it. That is, at its core, a design problem.

Acknowledgements: Sara Lenzi’s work is partially funded by the Marie Skłodowska-Curie Cofund Programme of the European Commission (H2020-MSCA-COFUND-2020-101034228-WOLFRAM2). Jiwei Zhou’s research is funded by a Digital Futures (DF) postdoc fellowship, supported by the Swedish Government’s Strategic Research Area initiative. The authors acknowledge using Claude Sonnet 4.6 and GPT-5.3 to assist in developing and refining language and phrasing throughout the writing process. This included drafting, restructuring sentences, and improving clarity of expression. The authors reviewed all AI-assisted output critically and revised it using their own words and judgment. The conceptual framing, the identification and articulation of contributions, and all critical and analytical claims presented in this paper are entirely our own. No AI-generated content has been presented as the authors’ original intellectual work.

6. References

- Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.
- Bateson, N. (2017). Warm data: Contextual research and the evolution of science. *Rocznik Naukowy Kujawsko-Pomorskiej Szkoły Wyższej w Bydgoszczy. Transdyscyplinarne Studia o Kulturze (i) Edukacji* 12(1), 35–40.
- Chamaidi, T., & Stavrakis, M. (2024). A multispecies interaction design approach: Introducing the Beings Activities Context Technologies (BACT) framework. *Multimodal Technologies and Interaction*, 8(9), Article 9.
- D’Ignazio, C. & Klein, L.F. (2020). *Data Feminism*. MIT Press.
- Dolejsova, M., Choi, J. H., Botero, A., et al. (2022). Open forest: Data, stories, and walking-With. *In Proceedings of the 16th Participatory Design Conference (PDC 2022), Vol. 2* (pp. 309–312). ACM.

- Drucker, J. (2011). Humanities approaches to graphical display. *Digital Humanities Quarterly* 5(1).
- Dunbar, M., & Speed, C. (2024). Data sets for regenerative futures: Cultivating relational ontologies. *Proceedings of the Halfway to the Future Symposium*, 1–4.
- Escobar, A. (2018). *Designs for the pluriverse: Radical interdependence, autonomy, and the making of worlds*. Duke University Press.
- Forlano, L. (2017). Posthumanism and design. *She Ji: The Journal of Design, Economics, and Innovation*, 3(1), 16–29.
- Frauenberger, C. (2019). Entanglement HCI The next wave? *ACM Trans. Comput.-Hum. Interact.* 27(1), Article 2, 27 pages.
- Giaccardi, E., & Redström, J. (2020). Technology and more-than-human design. *Design Issues*, 36(4), 33–44.
- Giaccardi, E., Redström, J., & Nicenboim, I. (2025a) The making(s) of more-than-human design: Introduction to the special issue on more-than-human design and HCI, *Human–Computer Interaction*, 40(1-4), 1-16.
- Giaccardi, E., Nam, S., & Nicenboim, I. (2025b). Diffractive interfaces: Facilitating agential cuts in forest data across more-than-human scales. In *Proceedings of the 2025 ACM Designing Interactive Systems Conference* (135–147). ACM Press.
- Guerrero Millan, C., Rattay, S., & Lee, Y. (2024). A manifesto for other-than-human imaginaries of data. In *Companion proceedings of the 2024 ACM Designing Interactive Systems Conference* (253–256). ACM Press.
- Haraway, D. J. (2013). Situated knowledges: The science question in feminism and the privilege of partial perspective. In M. Wajcman & J. Wajcman (Eds.), *Women, science, and technology* (pp. 455–472). Routledge.
- Haraway, D. J. (2016). *Staying with the trouble: Making kin in the Chthulucene*. Duke University Press.
- Höök, K., Eriksson, S., Juul Søndergaard, M.L., et al. (2019). Soma design and politics of the body. In *Proceedings of the Halfway to the Future Symposium 2019* (pp. 1–8). ACM Press.
- Holland, A., & Roudavski, S. (2024). Participatory design for multispecies cohabitation: By trees, for birds, with humans. In S. Heitlinger, M. Foth & R. Clarke (Eds.), *Designing more than human smart cities: Beyond sustainability, towards cohabitation* (pp. 95–127). Oxford University Press.
- Kim, R., Risseuw, C., Groutars, E.G., et al. (2023). Surfacing livingness in microbial displays: A design taxonomy for HCI. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (pp. 1-21). ACM Press.
- Klein L.F., & D'Ignazio, C. (2024). Data feminism for AI. In *Proceedings of the 2024 ACM Conference on Fairness, Accountability, and Transparency* (100–112). ACM Press.
- Koefoed Hansen, L. & Lodahl Rolighed, M. (2024). Encountering human-plant relations: A discussion on interaction design can encourage human sensibility to more-than-human plants. In *Proceedings of the 2024 ACM Designing Interactive Systems Conference* (1400–1411). ACM Press.
- Latour, B. (2012). Visualization and cognition: Drawing things together. In H. Kuklick (Ed.), *Knowledge and society: Studies in the sociology of culture past and present* (Vol. 6, pp. 1–40). Emerald Group Publishing.
- Lee, Y., Pschetz, L., Karyda, M., et al. (2024). Ecological Data for Manifesting the Entanglement of More-Than-Human Livingness. In *Companion Publication of the 2024 ACM Designing Interactive Systems Conference* (377–380). ACM Press.

- Lee, Y., Speed, C., & Pschetz, L. (2025). Pheno-data: using tomatoes to rethink data and data practice for ecological worlds. *Human–Computer Interaction*, 40(1-4), 249-271.
- Lenzi, S., Ciuccarelli, P., & Offenhuber, D. (2024). Towards a definition of Autographic Sonifications: Listening as an act of knowledge. In C. Gray, E. Ciliotta Chehade, P. Hekkert, L. Forlano, P. Ciuccarelli, & P. Lloyd (Eds.), *Proceedings of the Design Research Society Conference (DRS2024)*, Boston, USA, June 23–28.
- Livio, M., & Devendorf, L. (2022). The eco-technical interface: Attuning to the instrumental. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (pp. 1–12). ACM Press.
- Loukissas, Y.A. (2019). *All data are local: Thinking critically in a data-driven society*. MIT Press.
- McQuillan, D. (2018). Data science as machinic neoplatonism. *Philosophy & Technology* 31(2), 253–272.
- Nicenboim, I., Juul Søndergaard, M.L., Lindley, J. et al. (2024). Unmaking-with AI: Tactics for decentering through design. *ACM Trans. Comput.-Hum. Interact.* 31 (6), Article 82, 20 pages.
- Offenhuber D. (2020) Data by Proxy — Material Traces as Autographic Visualizations. *IEEE Transactions on Visualization and Computer Graphics* 26(1), 98–108.
- Offenhuber, D. (2024). *Autographic design: the matter of data in a self-inscribing world*. MIT Press.
- Sanches, P., Howell, N. Tsaknaki, V., et al. (2022) Diffraction-in-action: Designerly explorations of agential realism through lived data. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (1–18). ACM Press.
- Sheikh, H., Foth, M., & Mitchell, P. (2023). More-than-human city-region foresight: Multispecies entanglements in regional governance and planning. *Regional Studies* 57(4), 642–655.
- Stengers, I. (2010). *Cosmopolitics I*. University of Minnesota Press.
- Tsaknaki, V., Jenkins, T., Boer, L., et al. 2020. Challenges and opportunities for designing with biodata as material. In *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society* (Article 122, pp. 1–3). ACM Press.
- Turtle, G., Kotowski, B., Giaccardi, E., et al. (in press). *Sounding Territories: Dis/identificatory codings as relational worlding*. In *Proceedings of the Design Research Society Conference (DRS 2026)*. Edinburgh, UK, June 8-12.
- Uğur Yavuz, S., Bektaş, M., & Ayala Garcia, C. (2025). Materializing more-than-human data through mapping wools. In *EKSIG 2025: Data as experiential knowledge and embodied processes*. Design Research Society.
- Wakkary, R. (2020). Nomadic practices: A posthuman theory for knowing design. *International Journal of Design*, 14(3), 117-128.
- Westerlaken, M., Gabrys, J., & Urzedo, D. (2022). Digital gardening with a forest atlas: Designing a pluralistic and participatory open-data platform. In *Proceedings of the 16th Participatory Design Conference, Vol. 2* (25-32). ACM Press.
- Westerlaken, M., Gabrys, J., Urzedo, D., et al. (2023). Unsettling participation by foregrounding more-than-human relations in digital forests. *Environmental Humanities* 15(1), 87–108.
- Zhou, J., Kim, R., Doubrovski, Z., et al. (2023). Cyano-chromic interface: Aligning human-microbe temporalities towards noticing and attending to living artefacts. In *Proceedings of the 2023 ACM Designing Interactive Systems Conference* (pp. 820-838). ACM Press.

About the Authors:

Elisa Giaccardi is a Full Professor of More-than-human Design at the Politecnico di Milano, where she leads the Design Intelligences Institute. Her international career spans five countries and 25 years of research at the intersection of design, technology, and post-humanist thought.

Sara Lenzi is an Ikerbasque Fellow (Senior Researcher) at the Basque Foundation for Science and University of Deusto, Bilbao. She is co-founder of the Data Sonification Archive and the Data Sonification Awards, and Principal Investigator of the Deusto Design Research Group. Her research sits at the intersection of soundscape studies, data sonification, and sound-driven design.

Chris Speed is a Full Professor of Design for Regenerative Futures at RMIT, Australia, with extensive experience coordinating interdisciplinary organisational groups, centres and institutes, and applying design methodologies toward environmental challenges.

Vasiliki Tsaknaki is an Associate Professor at the HCI & Design Section, IT University of Copenhagen. She has extensive experience organizing research workshops and applying design methodologies to explore (bio)data as a design material, with a focus on sensory and material experiences.

Jiwei Zhou is a Postdoctoral Researcher at Media Technology and Interaction Design at KTH Royal Institute of Technology in Sweden. She holds a PhD degree from TU Delft, where her research focused on biodesign, more-than-human care, and material practices of mattering. Her current work explores the intersection of biology and feminist posthuman approaches to design and HCI.