

More-than-human Concepts, Methodologies, and Practices in HCI

Coskun, Aykut; Cila, Nazli; Nicenboim, Iohanna; Giaccardi, Elisa; Forlano, Laura; Frauenberger, Christopher; Hassenzahl, Marc; Mancini, Clara; Wakkary, Ron

DOI

[10.1145/3491101.3516503](https://doi.org/10.1145/3491101.3516503)

Publication date

2022

Document Version

Final published version

Published in

CHI 2022 - Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems

Citation (APA)

Coskun, A., Cila, N., Nicenboim, I., Giaccardi, E., Forlano, L., Frauenberger, C., Hassenzahl, M., Mancini, C., & Wakkary, R. (2022). More-than-human Concepts, Methodologies, and Practices in HCI. In *CHI 2022 - Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems* Article 150 (Conference on Human Factors in Computing Systems - Proceedings). Association for Computing Machinery (ACM). <https://doi.org/10.1145/3491101.3516503>

Important note

To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.

More-than-human Concepts, Methodologies, and Practices in HCI

Aykut Coşkun
Koç University, Department of Media
and Visual Arts
aykutcokun@ku.edu.tr

Elisa Giaccardi
Delft University of Technology,
Department of Human-Centered
Design
e.giaccardi@tudelft.nl

Marc Hassenzahl
University of Siegen, Business
Informatics
marc.hassenzahl@uni-siegen.de

Nazli Cila
Delft University of Technology,
Department of Human-Centered
Design
n.cila@tudelft.nl

Laura Forlano
Illinois Institute of Technology,
Institute of Design
lforlano@id.iit.edu

Clara Mancini
The Open University, Department of
Computing
clara.mancini@open.ac.uk

Iohanna Nicenboim
Delft University of Technology,
Department of Human-Centered
Design
i.nicenboim@tudelft.nl

Christopher Frauenberger
University of Salzburg, Center for
Human-Computer Interaction
christopher.frauenberger@sbg.ac.at

Ron Wakkary
Simon Fraser University, School of
Interactive Arts & Technology,
Eindhoven University of Technology,
Department of Industrial Design
rwakkary@sfu.carl.wakkary@tue.nl

ABSTRACT

The last decade has witnessed the expansion of design space to include the epistemologies and methodologies of more-than-human design (MTHD). Design researchers and practitioners have been increasingly studying, designing *for*, and designing *with* nonhumans. This panel will bring together HCI experts who work on MTHD with different nonhumans as their subjects. Panelists will engage the audience through discussion of their shared and diverging visions, perspectives, and experiences, and through suggestions for opportunities and challenges for the future of MTHD. The panel will provoke the audience into reflecting on how the emergence of MTHD signals a paradigm shift in HCI and human-centered design, what benefits this shift might bring and whether MTHD should become the mainstream approach, as well as how to involve nonhumans in design and research.

CCS CONCEPTS

• **Human-centered computing**; • **Human computer interaction (HCI)**; • **HCI theory, concepts and models**;

KEYWORDS

More-than-human, posthuman, human-centered design, design research methods

ACM Reference Format:

Aykut Coşkun, Nazli Cila, Iohanna Nicenboim, Elisa Giaccardi, Laura Forlano, Christopher Frauenberger, Marc Hassenzahl, Clara Mancini, and Ron Wakkary. 2022. More-than-human Concepts, Methodologies, and Practices in HCI. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI '22 Extended Abstracts)*, April 29–May 05, 2022, New Orleans, LA, USA. ACM, New York, NY, USA, 5 pages. <https://doi.org/10.1145/3491101.3516503>

1 INTRODUCTION

Recently, we are witnessing the expansion of design space from a narrow human-centered perspective to a more-than-human design (MTHD) orientation. Design researchers and practitioners have been increasingly interested in approaches, methodologies and practices to study, design for and design with non-human stakeholders, such as things, animals, or robots. While the work on MTHD has engaged with post-human prepositions from philosophy of science and critical studies, along with actor-network theory and new materialism, design has also developed its own ways of framing the scope and methods of more-than-human (MTH) approaches.

We see two main developments contributing to the flourishing of MTH within design. One stems from the pressing environmental crisis, which leads scientists to question the human dominancy over other species residing on earth [7, 14, 30]. Design, which gives crucial importance to sustainability, is searching for alternative design approaches to support the wellbeing of the entire planet without necessarily prioritizing one species over the others. MTH theories help to re-consider the basic unit of reference for humans in the “Anthropocene” and the basic tenets of interaction with both human and nonhuman agents on a planetary scale [5].

Another contributing aspect is that the notion of what a product is has dramatically changed in the past years from being “industrial artefacts” to “fluid assemblages” [18, 40]. This change has started

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

CHI '22 Extended Abstracts, April 29–May 05, 2022, New Orleans, LA, USA

© 2022 Copyright held by the owner/author(s).

ACM ISBN 978-1-4503-9156-6/22/04.

<https://doi.org/10.1145/3491101.3516503>

with the introduction of connectivity and is becoming prominent with the pervasive embedding of machine learning and artificial intelligence into everyday life. With new sensing and processing capabilities, products have become agents that can influence not only how other products respond, but also how humans relate to them and to each other [8]. This conceptual/ontological shift has been challenging the boundaries between humans and technologies. For instance, virtual reality, social robotics, digital assistants, and neuro-implants blur the traditional human-machine division, which raises the question as to where the human ends and where the machine begins. The shift has also highlighted the relational character of design demanding to position intelligence neither in the machine nor in the human, but in their relations [36, 41]. Lastly, it has required designers to expand the scope of their inquiry from a single archetypical user with an archetypical product to multiple products, services, and stakeholders with various roles and relations to each other, which in turns, questions the adequacy of human-centered design [11, 18, 20, 28].

These signal a potential paradigm shift in HCI [18] advancing on the third wave HCI [4]. Yet, the HCI and design discourse on MTHD is still developing. Current efforts in this field can be examined under three categories. The first line of work consists of *theories and concepts* that help us understand what it means to have a MTH approach in design. So far, the theoretical ground for MTHD has been established by introducing and discussing the design relevance of various post-humanistic theories and concepts to the field (see the seminal work of [11], [16], [18], [28], [42]), which refers to various theories including Actor-Network Theory [29], Object-oriented Ontology [25], New Materialism [5], Agential Realism [2], and post-Phenomenology [27]. These pioneering works paved the way for studying and discussing the values and principles underlying a MTH approach to design. Now, the challenge lies in initiating a dialogue among MTH designers and researchers to identify strategies for connecting MTHD theory to MTHD practice, as well as creating a vibrant MTH community within HCI.

The second line of work involves experimenting with the ways of designing for and with nonhumans from a *methodological* perspective. Previously, design researchers created new interactive technologies for animals [e.g., 17, 19, 26], involved living organisms (e.g., animals, insects, and plants) as research partners in their projects [13, 31, 32], and developed new research methods to integrate perspectives of objects into the design process such as thing ethnography [22], interview with things [6], object personas [9] and robotic techno-mimesis [12]. All these approaches require the “decentering of the human” and abandoning the familiar notions of agency and identity, as well as the boundary between an actor and its environment. Furthermore, since the term nonhuman entails various entities like things (e.g., smart products, connected appliances, robots, conversational agents), beings (e.g., animals, plants, fungi, microorganisms), and natural phenomena (e.g., rivers, mountains, rocks), the methodologies researchers use for studying and designing for/with nonhumans, and their experiences working in MTH contexts are quite different. From a methodological perspective, MTHD raises interesting questions regarding which proxies to use for “understanding” the perspectives of the “other” (and whether this might ever be possible) and how to include nonhumans in the

design process without inadvertently extending humans’ hegemony over them.

The third line of work is related to how MTHD is *practiced*, i.e., how to do design and research with nonhumans [24]. This includes developing novel ways of doing research and design engaging nonhumans as active participants [20, 43] and accounting for the multiplicity of agencies [8], temporalities [37], configurations [18, 31, 34, 40, 43], perspectives [3, 21, 22] and roles [28] that are at stake. Work in this area also includes defining new ways of practicing design as “nomadic” [41] and re-conceptualizing social practice theory to include nonhumans [28]. In the last years, MTHD has become part of several teaching programs [15, 23]. Scholars have also highlighted the politics and ethics of MTHD, with issues of participation [10], supporting values such as equality and justice, and including perspectives (humans and nonhumans) that have been traditionally ignored in design processes [1, 16]. Some of these issues were highlighted in various design fictions [11, 34, 35, 38, 39].

All these works demonstrate a proliferation of MTHD concepts, methods, and practices in HCI. To move forward, in this panel we will critically discuss the current state of MTHD research in HCI, identify differences and similarities between existing MTH perspectives and methods, assess the implications of MTHD approaches for HCI theory, research and practice, and discuss ways of advancing this nascent area further. In doing so, we will explore a series of questions grouped under MTHD concepts, MTHD methodologies and MTHD practices. The purpose of such a categorization is rather pragmatic, to have a more structured discussion during the limited time frame of a CHI panel. We consider that concepts, methodologies, and practices in MTHD are indeed interconnected and codependent.

MTHD concepts: This theme is focused on discussing the intellectual and historical path that led to the MTHD and the core concepts of MTH which are relevant for the design research and practice. The questions to be explored in the panel are: i) What are the central qualities of concepts and theories that underpin MTHD perspectives? and ii) What would be the strategies to link these theory and concepts to design practice?

MTHD methodologies: This theme is focused on discussing the methodologies and approaches for understanding, investigating, and imagining the world anew by going beyond the human perception and cognition. The main question to be discussed in this theme is what range of MTH methodologies might help decenter the human and integrate the perspectives of nonhumans in the design process in different contexts?

MTHD practices: This theme will discuss the politics and pedagogies of MTHD, highlighting how different tactics, such as defamiliarization, are used for unsettling assumptions, exposing human biases, and demonstrating that design problems are more uncertain, more nuanced, or more complex than originally assumed. We will unpack some of the struggles and opportunities that designers encounter when bringing MTHD concepts and methods into their practices, and how MTHD responds to rich and messy contexts. The main question to be discussed in this theme is what ethical, political and practical challenges and opportunities do designers, educators, practitioners and other stakeholders encounter with MTHD?

2 PANEL COMPOSITION

The three themes of the panel—concepts, methodologies, practices—will be discussed in a dialogue format by two panelists (six panelists in total). Each duo is composed of experts in that particular theme, while having different approaches and experiences towards MTH. Each dialogue will be moderated by one of the organizers.

2.1 Panel organizers/moderators

Aykut Coskun is an Assistant Professor of Design at Koç University Media and Visual Arts Department. He is also a design researcher at Koç University Arcelik Research Center for Creative Industries (KUAR). His current research focuses on investigating the role of design for promoting behavior change in various contexts including energy consumption, food waste, physical activity and so on. He leads IxD Research Group at KUAR and published at various design research venues including prestigious design journals and conferences.

Nazlı Cila is an Assistant Professor at Delft University of Technology, Department of Human-Centered Design, Connected Everyday Lab. Her research is focused on generating frameworks and methods that could help designers, computer scientists, and policy makers to envision and critically reflect on (new) interactions enabled by AI. She co-directs the TU Delft AI DeMoS Lab and published at premier HCI and design research venues.

Iohanna Nicenboim is a Microsoft-funded PhD candidate at Delft University of Technology, Netherlands. In her research, she investigates AI through more-than-human design. Using design provocations, she focuses on the everyday relations between humans and artificial agents, and how that perspective proposes a shift from explanations of AI to shared understandings. Before starting her PhD, Iohanna worked for several years as a speculative designer, creating design fictions to highlight the ethics of living with smart technologies in future everyday life. She is the author of several award-winning design fictions highlighting the ethics of living with smart technologies in future everyday life. She is a ThingsCon Fellow, and a recipient of the Internet of Things Awards for Design Fiction in 2015/6.

2.2 Panelists

2.2.1 *MTH Concepts* – Ron Wakkary and Christopher Frauenberger.

Ron Wakkary is full professor at Simon Fraser University (Canada) and Eindhoven University of Technology (the Netherlands), and the founder of the Everyday Design Studio. His research investigates the changing nature of interaction design in response to everyday design practices in the home and new understandings of human-technology relations. He aims to reflectively create new interaction design exemplars, concepts, and emergent practices of design that help to shape both design and its relations to technologies. Among many other influential publications, he is the author of the recently published book *Things we could design: For more than human-centered worlds* (MIT Press).

Christopher Frauenberger is full professor for HCI at University of Salzburg (Austria). He investigates and designs interactive digital technology in a wide range of contexts with groups who are often marginalized in mainstream innovation landscapes, e.g.,

autistic children. His research builds on new philosophical perspectives to conceptualize our increasingly entangled relationships with technology, unearthing the ethical, moral, epistemological, and ontological implications for designing technological futures.

2.2.2 *MTH Methodologies* – Clara Mancini and Marc Hassenzahl.

Clara Mancini is professor of Animal-Computer Interaction (ACI) and founding head of the ACI Lab at the Open University (UK), and co-founder of the ACI International Conference. She has led or supervised a range of ACI projects, including ubiquitous and ambient interfaces for mobility assistance and medical detection dogs, interactive enrichment for captive elephants, and wearable animal biotelemetry. Clara is interested in the design, methodological and ethical challenges and opportunities presented by more-than-human-centred interaction design and is committed to demonstrating its potential to contribute to animal and human wellbeing, multispecies social inclusion, interspecies cooperation and environmental restoration.

Marc Hassenzahl is professor of Ubiquitous Design/Experience and Interaction at the University of Siegen (Germany). As a Doctor of Psychology, he combines his empirical background with a passion for interaction design. The focus is on the theory and practice of creating joyful, meaningful, and transformative experiences. He is the author of the book *Experience Design. Technology for all the right reasons* (Morgan Claypool) and other influential articles at the interface between psychology, design research, interaction, and industrial design.

2.2.3 *MTH Practices* – Elisa Giaccardi and Laura Forlano. **Elisa**

Giaccardi is Chair and Professor of Post-Industrial Design at Delft University of Technology. Her research interests reflect a persistent concern with design as a shared process of cultivation and management of opportunity spaces, and the transformative role technology can play. After pioneering work in metadesign, networked and open design processes, her current research engages with how digital things ‘participate’ in design and use in ways that previous industrially produced objects could not, experimenting with novel design approaches that look at computational artefacts as co-performers of practice, and thus as potential co-ethnographers and co-designers in the design process. Her work has contributed significantly to the development of post-industrial and post-humanist approaches in the field of design through more than one hundred peer-reviewed conference and journal papers and book chapters. Elisa is director of the MSc program Design for Interaction at the Faculty of Industrial Design Engineering, Associate Editor for Springer HCI, and Coordinator of the international DCODE Network (www.dcode-network.eu).

Laura Forlano, a Fulbright award-winning and National Science Foundation funded scholar, is a writer, social scientist and design researcher. She is an Associate Professor of Design at the Institute of Design and Affiliated Faculty in the College of Architecture at Illinois Institute of Technology where she is Director of the Critical Futures Lab. Forlano’s research is focused on the aesthetics and politics at the intersection between design and emerging technologies. She is an editor of three books: *Bauhaus Futures* (MIT Press 2019), *digitalSTS* (Princeton University Press 2019) and *From Social Butterfly to Engaged Citizen* (MIT Press 2011). She received her Ph.D. in communications from Columbia University.

3 PANEL FORMAT AND AUDIENCE ENGAGEMENT

Due to COVID-19 restrictions, we plan the panel to be fully virtual. The organizers will provide a brief overview of the rationale behind the panel, its aim and structure, and introduce the panelists (5 mins). Each theme will be moderated by one of the organizers and discussed as a dialogue between two experts in around 15 minutes. To ground the discussions, the panelists will be encouraged to share a few slides (possibly as a Zoom background) about their projects when they respond to questions. We will start introducing each theme with a poll to canvas the opinions of the audience about a debatable statement related to that theme (e.g., Is MTH a niche field in HCI or can it be mainstream?) and the panelists will be asked to reflect on the poll results. During the panelists' talks, the audience is invited to use the chat feature of Zoom for questions and comments. Moderators will simultaneously organize these questions to be discussed with the entire panel in the last 10 minutes. Furthermore, we intend to utilize the conference's hashtag to invite questions and support broader audience participation via Twitter. To ensure wider dissemination of the insights discussed during the session and building a community of researchers interested in MTHD, we first will create a Slack channel to encourage the audience and panel members to continue discussing the future of more-than-human design after the panel. Second, after the session we aim to write a short position paper to be submitted as an ACM magazine piece (e.g., Communications, Interactions), which summarizes the insights from the dialogues and propose an alternative HCI agenda that would include MTH perspectives.

REFERENCES

- [1] AI Now Institute. 2021. "A New AI Lexicon: Human." A New AI Lexicon. October 29, 2021. <https://medium.com/a-new-ai-lexicon/a-new-ai-lexicon-human-cla019f6e60d>.
- [2] Barad, Karen. 2007. Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning. duke university Press.
- [3] Bedó, Viktor. 2021. Catch the Bus: Probing Other-Than-Human Perspectives in Design Research." *Frontiers in Computer Science* (2021): 61.
- [4] Bødker, Susanne. 2015. Third-wave HCI, 10 years later—participation and sharing. *interactions* 22, no. 5: 24-31.
- [5] Braidotti, R. 2013. The Posthuman. Polity, Cambridge, UK.
- [6] Chang, Wen-Wei, Elisa Giaccardi, Lin-Lin Chen, and Rung-Huei Liang. 2017. "Interview with Things" A First-thing Perspective to Understand the Scooter's Everyday Socio-material Network in Taiwan. In *Proceedings of the 2017 Conference on Designing Interactive Systems*, pp. 1001-1012. 2017.
- [7] Cielemecka, O., & Daigle, C. 2019. Posthuman sustainability: An ethos for our anthropogenic future. *Theory, Culture & Society*, 36(7-8), 67-87.
- [8] Cila, Nazli, Iskander Smit, Elisa Giaccardi, and Ben Kröse. 2017. "Products as Agents: Metaphors for Designing the Products of the IoT Age." In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, 448-59. CHI '17. New York, NY, USA: Association for Computing Machinery.
- [9] Cila, Nazli, Elisa Giaccardi, Fionn Tynan-O'Mahony, Chris Speed, and Melissa Caldwell. "Thing-Centered Narratives: A study of object personas." In *Proceedings of the 3rd Seminar International Research Network for Design Anthropology*. 2015.
- [10] Clarke, Rachel, Sara Heitlinger, Marcus Foth, Carl DiSalvo, Ann Light, and Laura Forlano. 2018. "More-than-Human Urban Futures: Speculative Participatory Design to Avoid Ecocidal Smart Cities." In *Proceedings of the 15th Participatory Design Conference on Short Papers, Situated Actions, Workshops and Tutorial-PDC '18*, 1-4. New York, New York, USA: ACM Press.
- [11] Coulton, Paul, and Joseph Galen Lindley. 2019. "More-Than Human Centred Design: Considering Other Things." *The Design Journal* 22 (4): 463-81.
- [12] Dörrenbächer, Judith, Diana Löffler, and Marc Hassenzahl. 2020. Becoming a robot-overcoming anthropomorphism with techno-mimesis." In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, pp. 1-12.
- [13] Ehn, Pelle., 2008. Participation in design things. In *Participatory Design Conference (PDC)*, Bloomington, Indiana, USA (2008)(pp. 92-101). ACM Digital Library.
- [14] Elhacham, E., Ben-Uri, L., Grozovski, J., Bar-On, Y. M., & Milo, R. (2020). Global human-made mass exceeds all living biomass. *Nature*, 588(7838), 442-444.
- [15] Forlano, Laura, and Carla Sedini. 2021. More than human trading zones in design research and pedagogy. In *Routledge Handbook of Art, Science, and Technology Studies*. Rogers, H.S., Halpern, M.K., Hannah, D. and de Ridder-Vignone, K. (eds.). (p.1-16). Routledge.
- [16] Forlano, Laura. 2017. "Posthumanism and Design." *She Ji: The Journal of Design, Economics, and Innovation* 3 (1): 16-29.
- [17] Foth, Marcus. and Caldwell, Glenda Amayo., 2018, November. More-than-human media architecture. In *Proceedings of the 4th Media Architecture Biennale Conference* (pp. 66-75).
- [18] Frauenberger, Christopher. 2019. "Entanglement HCI The Next Wave?" *ACM Trans. Comput.-Hum. Interact.*, 2, 27 (1): 1-27.
- [19] French, Fiona, Mancini, Clara and Sharp, Helen, 2015, October. Designing interactive toys for elephants. In *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play* (pp. 523-528).
- [20] Giaccardi, Elisa, and Johan Redström. 2020. "Technology and More-than-Human Design." *Design Issues* 36 (4).
- [21] Giaccardi, Elisa, Chris Speed, Nazli Cila, and Melissa L. Caldwell. 2016. "Things As Co-Ethnographers: Implications of a Thing Perspective for Design and Anthropology." In *Design Anthropological Futures*, edited by Rachel Charlotte Smith, Kasper Tang Vangkilde, Mette Gislev Kjaersgaard, Ton Otto, Joachim Halse, and Thomas Binder. Bloomsbury Academic.
- [22] Giaccardi, E., Cila, N., Speed, C. and Caldwell, M., 2016, June. Thing ethnography: Doing design research with non-humans. In *Proceedings of the 2016 ACM conference on designing interactive systems* (pp. 377-387).
- [23] Giaccardi, Elisa. 2020. More-than-human Design in Delft Design Guide, Jaap Daalhuizen and Jelle Zijlstra Anemiek van Boeijen (Eds.), BIS Publishers
- [24] Giaccardi, Elisa. 2020. Casting Things as Partners in Design: Towards a More-than-Human Design Practice. In *Relating to Things: Design, Technology and the Artificial*, edited by H. Wiltse. Bloomsbury.
- [25] Harman, G., 2018. Object-oriented ontology: A new theory of everything. Penguin UK.
- [26] Hirschy-Douglas, Ilyena. and Read, Janet. C., 2018. DoggyVision: Examining how dogs (Canis familiaris) interact with media using a dog-driven proximity tracker device. *Animal Behavior and Cognition*, 5(4), pp.388-405.
- [27] Ihde, D., 1995. Postphenomenology: Essays in the postmodern context. Northwestern University Press
- [28] Kuijter, Lenneke, and Elisa Giaccardi. 2018. "Co-Performance: Conceptualizing the Role of Artificial Agency in the Design of Everyday Life." In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, 125:1-125:13. CHI '18. New York, NY, USA: ACM.
- [29] Latour, Bruno., 1996. On actor-network theory: A few clarifications. *Soziale welt*, pp.369-381.
- [30] Lewis, S. L., & Maslin, M. A. 2015. Defining the anthropocene. *Nature*, 519(7542), 171-180
- [31] Mancini, Clara., Van Der Linden, Janet., Bryan, Jon. and Stuart, Andrew, 2012, September. Exploring interspecies sensemaking: dog tracking semiotics and multispecies ethnography. In *Proceedings of the 2012 ACM conference on ubiquitous computing* (pp. 143-152)
- [32] Mancini, C., Lehtonen, J. (2018). The Emerging Nature of Participation in Multi-species Interaction Design. Proc. of ACM SIGCHI International Conference on Designing Interactive Systems, ACM DIS2018, ACM Press, pp. 907-918.
- [33] Murray-Rust, Dave, Katerina Gorkovenko, Dan Burnett, and Daniel Richards. 2019. "Entangled Ethnography: Towards a Collective Future Understanding." In *Proceedings of the Halfway to the Future Symposium 2019*, 21:1-21:10. HTTF 2019. New York, NY, USA: ACM.
- [34] Nicenboim, Iohanna, Elisa Giaccardi, and Marcel Schouwenaar. 2018. "Everyday Entanglements Of The Connected Home." In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*, 1. CHI EA '18. New York, NY, USA: Association for Computing Machinery.
- [35] Nicenboim, Iohanna, Elisa Giaccardi, Marie Louise Juul Søndergaard, Anuradha Venugopal Reddy, Yolande Strengers, James Pierce, and Johan Redström. 2020. "More-Than-Human Design and AI: In Conversation with Agents." In *Companion Publication of the 2020 ACM Designing Interactive Systems Conference*, 397-400. DIS' 20 Companion. New York, NY, USA: Association for Computing Machinery.
- [36] Pendleton-Jullian, Ann M., and John Seely Brown. 2018. *Design unbound: Designing for emergence in a white water world*. Vol. 1. MIT Press.
- [37] Pschetz, Larissa, and Michelle Bastian. 2018. "Temporal Design: Rethinking Time in Design." *Design Studies* 56 (May): 169-84.
- [38] Reddy, Anuradha, A. Baki Kocaballi, Iohanna Nicenboim, Marie Louise Juul Søndergaard, Maria Luce Lupetti, Cayla Key, Chris Speed, et al. 2021. "Making Everyday Things Talk: Speculative Conversations into the Future of Voice Interfaces at Home." In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*, 1-16. CHI EA '21 23. New York, NY, USA: Association for Computing Machinery.
- [39] Reddy, Anuradha, Iohanna Nicenboim, James Pierce, and Elisa Giaccardi. 2020. "Encountering Ethics through Design: A Workshop with Nonhuman Participants." *AI & Society*, November. <https://doi.org/10.1007/s00146-020-01088-7>.

- [40] Redström, Johan, and Heather Wiltse. 2018. *Changing Things: The Future of Objects in a Digital World*. Bloomsbury Visual Arts.
- [41] Rozendaal, M. C., Boon, B., & Kaptelinin, V. 2019. Objects with intent: Designing everyday things as collaborative partners. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 26(4), 1-33.
- [42] Wakkary, Ron. 2020. "Nomadic practices: A posthuman theory for knowing design." *International Journal of Design* 14, no. 3 (2020): 117.
- [43] Wakkary, Ron. 2021. *Things We Could Design: For More Than Human-Centered Worlds*. MIT Press.