First International Workshop on Worker-Robot Relationships
Exploring Transdisciplinarity for the Future of Work with Robots

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DOI
10.1145/3610978.3638156

Publication date
2024

Document Version
Final published version

Published in
HRI 2024 Companion - Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction

Citation (APA)
Zaga, C., Lupetti, M. L., Forster, D., Murray-Rust, D., Prendergast, M., & Abbink, D. (2024). First International Workshop on Worker-Robot Relationships: Exploring Transdisciplinarity for the Future of Work with Robots. In *HRI 2024 Companion - Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction* (pp. 1367-1369). (ACM/IEEE International Conference on Human-Robot Interaction). IEEE. https://doi.org/10.1145/3610978.3638156

First International Workshop on Worker-Robot Relationships

Exploring Transdisciplinarity for the Future of Work with Robots

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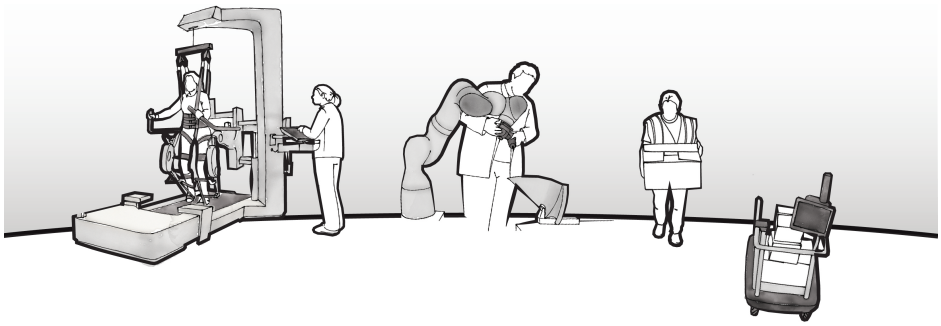

Figure 1: A visual overview of the settings of workers-robot relationships.

ABSTRACT

In Industry 5.0, cognitive robots and workers will engage in evolving and reciprocal relations, which we call worker-robot relationships (WRRs). To enable evidence-based work futures with workers, we must co-develop WRRs and understand their impact on work, workers, management, and society. To this end, we posit that the HRI field should work beyond disciplines and include value-driven and plural perspectives through transdisciplinary research done with and for workers. However, WRRs and transdisciplinarity pose unique technical, design, and methodological challenges yet to be explored. We propose a workshop to engage the HRI community working on Industry 5.0, aiming at 1) taking stock of current WRR-related challenges in relevant disciplines, 2) collectively kick-off the exploration of a joint research agenda, 3) preliminary examining if and how transdisciplinarity could help the HRI community, and 4) start discussing how to deal with such complex knowledge integration in practice.

HRI '24 Companion, March 11–14, 2024, Boulder, CO, USA

ACM ISBN 979-8-4007-0323-2/24/03.
https://doi.org/10.1145/3610978.3638156

CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**.

KEYWORDS

worker-robot relationships, transdisciplinarity, future of work with robots

ACM Reference Format:
Cristina Zaga, Maria Luce Lupetti, Deborah Forster, Dave Murray-Rust, Micah Prendergast, and David Abbink. 2024. First International Workshop on Worker-Robot Relationships: Exploring Transdisciplinarity for the Future of Work with Robots. In *Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction (HRI '24 Companion), March 11–14, 2024, Boulder, CO, USA.* ACM, New York, NY, USA, 3 pages. https://doi.org/10.1145/3610978.3638156

1 INTRODUCTION

Cognitive robots [6] will venture outside the laboratory into real-world settings thanks to their ability to deal with complexity and variability. In industry, cognitive robots set out to become part of the future of physical work (e.g., manufacturing, logistics, healthcare services, etc.), potentially assisting workers with physical tasks, supporting workflows, and improving productivity by learning in dynamic environments.

Robots and workforces will thus engage in evolving, reciprocal, and long-term interactions. Robots' learning capabilities will allow them to respond to and learn from workers, while workers will learn from and adapt to these new robots on the work floor. Understanding how this reciprocal learning [7] evolves requires a new relational perspective that jointly considers change and learning processes between robots, workers, organizations, and other stakeholders. These emerging *worker-robot relations* (WRRs) have various configurations (i.e., single worker, worker-client relation, or a team of workers), are bound to environments with complex sets of protocols where various levels of autonomy may be possible (or not), and where power dynamics at play [15]. While WRRs promise new opportunities for innovation, cost reduction, and productivity, *the impact of cognitive robots on work, workers, and management is yet to be unveiled* [2].

The more WRRs perdure, the more workers' competencies and skills will evolve —some becoming underutilized, others getting stronger, e.g., collaboration and coordination. Operating in service settings will require cognitive robots to be socially competent [3] — but the sophisticated understanding of the social world needed for that is yet to be built. Furthermore, WRRs will also entail work to be performed in team settings while most HRI research in human-robot collaboration remains focused on dyadic interactions [9]. Moreover, workforces are characterized by a high degree of cultural diversity, educational levels, and degree of autonomy in the workplace, all aspects that remain largely unaddressed in HRI research [10].

Therefore, future WWRs bring to the HRI field a *multitude and diversity of challenges* from technical questions of enabling dynamic role allocation to the interactional need to understand emerging phenomena, such as co-adaptation. The unprecedented complexity of WRRs challenges the validity of widely adopted social theories, as learning robots do not adhere to the main assumption that technology can be considered an independent variable. Ultimately, researchers need to untangle the intricacies of the socio-technical systems in which WRRs are embedded to produce insights for the future development of robotic capabilities while breaking free from techno-centric views and power struggles.

In line with the perspective of Industry 5.0 [1], which sees planetary, societal, and workers' well-being as central to the future of work, the notion of WRRs invites the HRI community to rethink how we do research and integrate knowledge from multiple perspectives beyond efficiency and optimization. To this end, roboticists, designers, ethicists, psychologists, and organizational scholars should collaborate with workers to enable evidence-based development of the future of physical work around WRRs. To realize this value-oriented, participatory research requires the community to embrace transdisciplinary research [16], promoting joint learning among academics and practitioners.

However, transdisciplinary ways of doing research are emergent and defined by flows of mutual learning between academics and non-academics, making it a hard process to detail and practice. Therefore, understanding how to produce transdisciplinary knowledge and how to deal with values, pluralism, and participation is yet to be defined in the HRI field.

We propose a workshop to focus on taking stock of current WRRs challenges, explore if and how transdisciplinarity could help the HRI community, and kick off discussing how to deal with such complexity in practice. The ultimate goal is to start identifying and engaging the HRI community working on Industry 5.0 perspectives and collectively attempt first steps to make sense of how we can work beyond disciplinary boundaries for and with workers.

1.1 Workshop Themes

In our workshop, we address the following themes connected with the problem space of WRRs in HRI and the need for transdisciplinarity. Relevant topics include, but are not limited to:

Technical challenges in WRRs. While extensive research exists regarding workers-robot collaboration [4, 14], cognitive robots' capabilities will provide unprecedented opportunities for mutual learning, adaptation, and collaboration. But, *what are the key technical enablers and barriers in this technical design space?* Furthermore, *what technical challenges need to be solved to enable robots to get embedded in workers' teams (beyond worker-robot dyads)?*

Design challenges in WRRs. In WRRs, many values, perspectives, norms, and world views are at play in socio-technical entanglements. Yet, in HRI, efforts that take a critical stance on the social implications of WRRs remain rare [11, 15], and related methodologies are scarce [8]. Thus, *how can we envision desirable novel WRRS regarding emerging entanglements, unfolding values, and plural perspectives? What can we learn from other disciplines to embed values entanglements and plurality in the design process?*

Participatory research challenges in WRRs. Developing desirable WRRs that challenge traditional power struggles and respond to workers' needs requires participatory research practices. Participatory practices are extensively used in HRI [5], yet inherent issues of inclusivity and justice, i.e., not acknowledging power dynamics, costs of participation, and paternalistic tendencies [12], remain mostly unaddressed. Therefore, *how can we involve workers and stakeholders in the full WRRs transdisciplinary process? How can we take power dynamics between academics and workers into account?*

Methodological challenges in WRRs. While HRI has already been working in a multidisciplinary and interdisciplinary fashion for many years [13], many methodological challenges remain unanswered, such as *how can we decide on the relevant disciplines and stakeholders to involve? How can we allow for emergent knowledge production? What are the methodological barriers and enablers of knowledge integration in HRI to establish WRRs?*

2 WORKSHOP OVERVIEW

We plan a half-day workshop combining invited speakers' plenary talks and collaborative, hands-on activities (see Table 1). The workshop will be hybrid, allowing for both online and in-person attendance. We invite keynote speakers and diverse panelists from various disciplinary angles related to WRRs to stimulate fruitful interactions and knowledge integration with the workshop participants. We plan two lightning keynotes from different disciplinary perspectives. Each keynote will engage with the audience for a ten-minute talk, followed by twenty minutes of discussions. Participants will share their work in an interactive poster session starting at the coffee break. The session continues with a hands-on reflection on their disciplinary and societal roles in understanding and shaping "how might we" practice WRRs research.

Table 1: Schedule of the 1st International workshop on WRRs

Introduction Workshop and Lightning Keynotes (60 min)
• *Welcome presentation by David Abbink*
• *Lightning keynotes*
• *Discussion*
Poster Session and Hands-On Activity (90 min)
• *Coffee Break and Poster Session*
• *Disciplinary Reflection and How-Might We Work on WRRs*
Panel Discussion (40 min)
• *Panel discussion with invited speakers and Q&A*
Wrap-up and Next Steps (30 min)
• *Next steps and community building and collaborations*

2.1 Audience and Participation

We target HRI researchers coming from various disciplinary traditions and working on WRRs. Participants will be invited to submit a one-to-four-page position paper related to the future of work with robots. We welcome a diversity of angles, engaging with one of the four challenges described in Section 1.1. Position papers articulating specific case studies are also very welcome. Submissions will be subject to a peer-review process and accepted based on originality and topic relevance. At least one author of an accepted paper will be asked to attend the workshop and present. The workshop and the call for contributions will be advertised through community mailing lists, social media, and the personal networks of the organizers. All necessary information and updates will be published on the dedicated workshop website.

2.2 Plan for Documenting the Workshop

The workshop's website will serve as a platform to document the workshop's activities and outcomes. The outcomes of the hands-on activity and the position papers will be published online (with DOI reference for each). The workshop's results will be considered for further dissemination as a position paper on WRRs.

3 WORKSHOP ORGANIZERS

Cristina Zaga is an assistant professor at the Human-Centred Design group at the University of Twente. Her research focuses on transdisciplinary and relational design methods for just futures of work and care.

Maria Luce Lupetti is an assistant professor at the Faculty of Industrial Design Engineering at TU Delft. Her research explores the role of critical design approaches in developing responsible and desirable artificial agents.

Deborah Forster is a cognitive scientist and a researcher in the HRI group of the cognitive robotics department at TU Delft. Currently practicing transdisciplinary research on the potential of worker-robot relations to shape the future of work.

Dave Murray-Rust is an associate professor in Human-Algorithm Interaction Design at the Faculty of Industrial Design Engineering. He explores the messy terrain between people, data, algorithms, and things through making and thinking to build better futures for humans and AI.

Micah Prendergast is an assistant professor in Human-Robot Interaction at TU Delft in the Cognitive Robotics department. His research interests include computer vision, medical device design and robotic sensing, perception, and controls for the future of work.

David Abbink is a full professor in Human-Robot Interaction at TU Delft, at the Cognitive Robotics department at Mechanical Engineering, and Industrial Design Engineering. He focuses on understanding and shaping the future of physical work, with and for workers.

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