# The Robot in the Room: Performing Human-Robot Interactions through Augmented Reality Situated Encounters

Wilbert Tabone
Delft University of Technology
Erasmus University Medical Centre
The Netherlands
w.tabone@tudelft.nl

Ellen Algera
Erasmus University Medical Centre
The Netherlands
e.algera@erasmusmc.nl

Marco C. Rozendaal
Delft University of Technology
The Netherlands
m.c.rozendaal@tudelft.nl

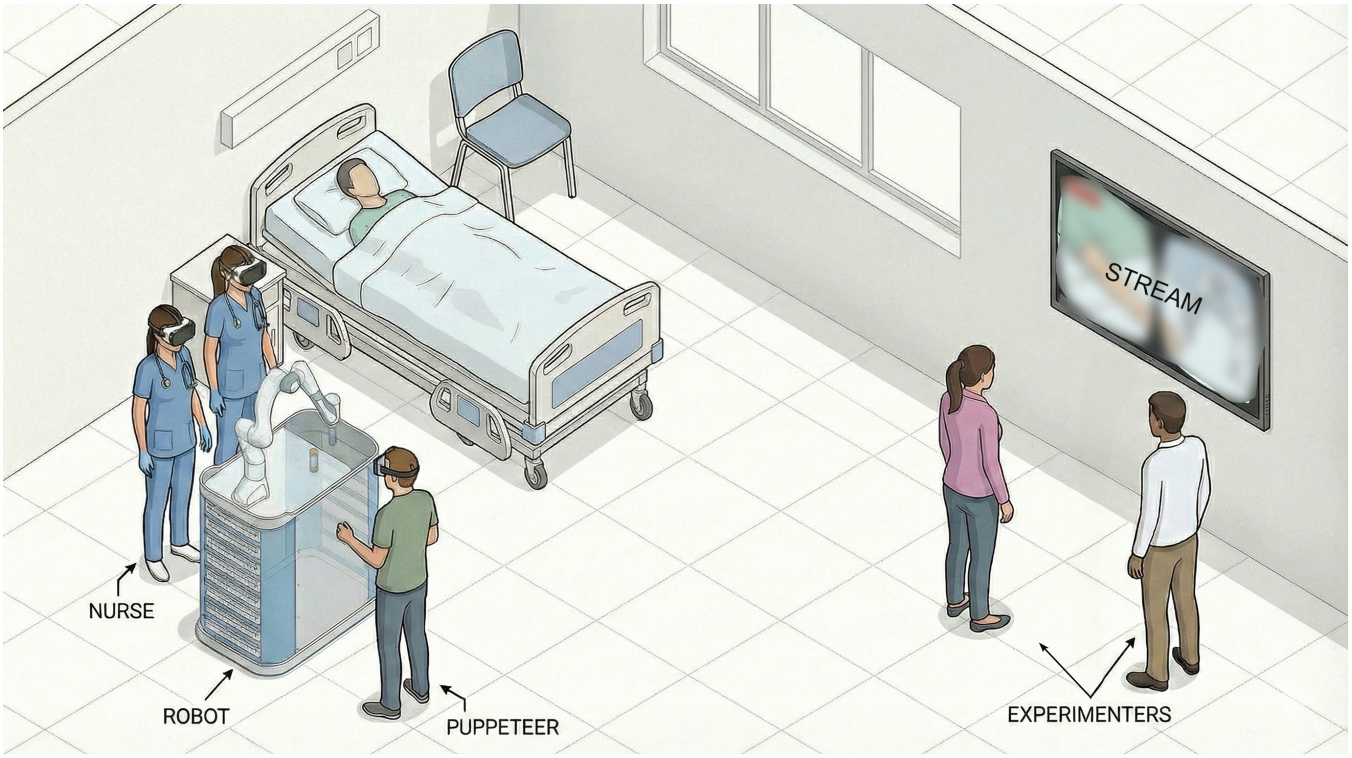


**Figure 1: An overview of the planned workshop. The situated encounter takes place on one side of the patient room, whilst the rest of the experiment team observes from the other side of the room. The team can also observe what the nurses are seeing via a stream from the headsets.**

## Abstract

Nursing work is complex, as nurses strive to deliver care in a dynamic environment that is both strictly regulated and continually demands improvisation. As demands on this healthcare profession grow in tandem with worker shortages, the need for solutions, such as robotics, is an ever-growing desire. However, it remains difficult to develop robotic systems that integrate into nursing practice. This provocation challenges the prevailing methodologies that tend to adopt a technocentric focus on robotic systems for nursing, treating robots as isolated entities rather than situated and relational ones. We propose that performative approaches to developing robotic systems, i.e., approaches that understand experiences and interactions to emerge from people's situated encounters with robotic artefacts, are critical to create robotic systems that can integrate into nursing practice. In this paper, we also elaborate on our planned study in which we intend to use Augmented Reality (AR) to stage situated encounters between nurses and a mimed assistive robot through speculative enactments. This work provokes a rethinking of how robotics can move beyond rigid control systems that provide predefined functions for nurses to robots as improvisation tools that nurses can use creatively. We argue that by inviting nurses in performative, real ward environments, we can find synergy between


*CHIWORK '26, Linz, Austria*

ACM ISBN 979-8-4007-2598-2/2026/06
https://doi.org/10.1145/3805029.3818294

a robot's physical constraints and people's creative appropriation that is set within the complex reality of nursing work.

## CCS Concepts

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

## Keywords

situated encounters, human-robot interactions, augmented reality

**ACM Reference Format:**
Wilbert Tabone, Ellen Algera, and Marco C. Rozendaal. 2026. The Robot in the Room: Performing Human-Robot Interactions through Augmented Reality Situated Encounters. In *Adjunct Proceedings of the 5th Annual Symposium on Human-Computer Interaction for Work (CHIWORK '26), June 22–25, 2026, Linz, Austria.* ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3805029.3818294

# 1 Introduction

## 1.1 Human-Robot Interaction Research in Nursing

Robots have been implemented in the nursing profession since the 1990s [3]. In the following years, robots have been introduced in a variety of different contexts, including healthcare. Robots have found their way into patient wards to assist with logistical tasks, such as delivering food trays and laboratory specimens, as well as physically demanding tasks, including the lifting and transfer of patients. As healthcare worker shortages and burnout became more acute, greater focus was placed on developing robotic solutions that could serve as co–workers, i.e., collaborative robots (cobots). These systems are designed to handle time-consuming non-clinical tasks, such as assisting in the fetching of materials, such as gauzes, cannulas, and other commonly used medical equipment, allowing the human nurse to focus more on one-to-one patient care.

Integrating collaborative robots into environments where nursing care is provided presents complex challenges. These robots must be able to navigate dynamic human environments, where human movements and other obstacles are unpredictable, while maintaining safety and precision. Moreover, such technology must act transparently, ensuring that its human collaborator is cognizant of its status and intentions, avoiding a black box situation. The robot's operational steps should not be too complex so as not to add extra burden on its human collaborators; the challenge would be to synergise its operation with other technologies that are already part of the nurse's daily routine; e.g., integrate some of the human-robot interfacing, such as calling the robot to a particular ward into a standard hospital issued smartphone that nurses may already be using. A final challenge is organisational misalignment, where many interventions that utilise robots fail to align with the practical daily routines of healthcare staff, leading to the abandonment of the technology. To alleviate this, there would be a shift from a dyadic model, which considers just the technology (robot) and the user (worker/nurse), towards a triadic model, which incorporates the technology, the worker, and the organisation.

Such a perspective resonates with a more recent trend to embrace the relationalities of computing artefacts and robot systems underlying their agency and meaning. Such a relational framing of interaction fits the fourth-wave on HCI (for an overview see [2, 5, 8]). The type of relations they make within their contexts, including the people, things and practices they are situated in, both determine what they do and how they are perceived. This brings out the need to carefully look at their potentials as they emerge from situations by acknowledging their embodiment and materiality, and not (as has been the classical approach) "test" the robot on predetermined functionalities and meanings. Performative methods are well-suited to get a grip on the potential of robotic systems within particular situations. This we will turn to next.

## 1.2 Performative Understandings of Human-Robot Interaction Research

Performative understandings of interaction have been developing (see [7, 9], for an overview). Influential work on this space for robots has been done by Gemeinboeck [6], who explored robotics not from their anthropomorphic framings and a priori designed identities, but explored methods with professional dancers to understand robotic systems from what they bring about in people's encounters with them. What this work highlights is how meanings are not static but depend on the way people are attuned to what a robot's materiality and dynamics afford in relation to our bodies and sensitivities.

Taking such situated encounters as a starting point and bringing more context into the reasoning, Bleeker and Rozendaal suggest a dramaturgy for devices [1], in which knowledge from the theatre, including concepts of *mise-en-scene*, *presence*, and *address*, are useful concepts to both analyse and design computational devices from a performative approach. For example, *mise-en-scene* from the theatre denotes a sensitivity to context and how this is not only background, but an active participant in how a narrative unfolds. Similarly, *address*, a gesture made by technology, has the intent to bring forth a reaction in the audience, and is designed to be read for anticipating a particular response. This thinking was applied in a situated encounter in VR to speculate about the kind of interactions that may result from encountering robots within a supermarket setting [10].

We now bring this technique to the next step by using AR, in which we can speculate on the future deployment of a robotic system that is feasible and considering the technology as it is developing today (e.g. robot carts and robotic arms). Additionally, we actively involve nurses to join these enactments together with theatre professionals (puppeteers with mime training backgrounds) and researchers. This combination is expected to lead to new insights regarding the possibility of such robots becoming embedded in the complex work of nursing.

## 1.3 Mixed Reality Approaches to Human-Robot Interactions

The use of spatial computing technology to create mixed reality approaches in human-robot interaction (HRI) is gaining traction. There are, for example, instances in the commercial sector, where industry leaders are integrating mixed reality headsets with industrial cobots to allow workers to visualise the robot's invisible safety zones and or planned movements and tasks. Such headsets also allow workers to place holographic anchors in world space to define the robot's path. In the same vein, the technology can be used in

prototyping and co-designing new robot systems in situ and more efficiently, in contrast to building high-fidelity physical prototypes, which are constrained by higher overhead costs in time and labour. These prototypes could then be evaluated in human-robot interaction contexts much more easily, efficiently, and safely. Hence, the use of an AR robot rather than a physical prototype in HRI studies offers advantages in terms of technical and economic feasibility, while also providing sufficient ecological validity [10, 11]. In the context of situated encounters, combining AR with a performative approach to interaction, in contrast to a physical prototype, would be interesting because an AR robot prototype allows efficient manipulation of the robot design during the experiment, with minimal effort.

## 2 The Advantage of Situated Encounters

Design and innovation processes that tend to adopt a technocentric focus of robotic systems for nursing treat robots as isolated entities rather than situated and relational ones. Hence, running the risk that the newly introduced technology does not fully fit the scope or needs of the nurses, or issues arise quite late into the development or design cycle. Using embodied experiences for interaction with a robot in AR offers an advantage because it allows for early co-design with the nurses, as they can interact with the robot on the go while situated within actual patient rooms. The virtual robot invites the nurses to experiment and imagine specific situations during the interaction itself, and sparks conversations between nurses and experimenters about what would and wouldn't work for them within their actual work context (in this case, the patient rooms).

How we conceive the contribution of this is that such an approach allows for consensus or divergence to arise before any further development ensues or a physical prototype is piloted, thus informing the technology development team in responsible and viable ways. Here, relationality is key: the setup we propose invites the relationship to surface as something that is welcomed when considering future design and deployment of technology, rather than hiding it as a trope of blind techno optimism. The virtual robot is also an affordance in itself in that it allows nurses to explore what actions are possible, in a similar way that actors can explore the several affordances which a prop on stage offers in their current situated context. Therefore, we can state that the combination of these elements renders the robot in the room a fiction that is grounded in real-world contexts and practices, constituting a novel contribution to designerly approaches in HRI and allowing conversations from transdisciplinary research on the future of work to emerge.

## 3 Planned Experimental Exploration

As a motivation to this provocation, in the context of nursing work, we plan to use the speculative enactments methodology [4] to explore the potential of introducing assistive robots that can fetch and deliver materials to a nurse working within a ward setting, which is an opportunity that achieved substantial votes in favour of exploration on an impact vs. effort matrix during a transdisciplinary workshop involving nurses, hospital management, and technologists. In this subsequent study, we will invite 12 nurses to participate in a situated encounter with a robot presented in AR

**Figure 2: The 3D model of the robot that will be presented in AR during the planned situated scenario workshop.**

(Figure 2) and manipulated using a performative technique as part of a speculative enactment setup involving several participants (see Table 1).

In our method, we will place two nurses at a time together with the theatre professional within a training ward setup. The nurses and the theatre professional will be situated on the side of the patient bed, while the rest of the experiment team will be situated on the other side of the patient room environment, to observe (Figure 1). Each nurse and the theatre professional will wear an XR headset, which will allow them to simultaneously see the assistive robot in AR. The theatre professionals, both with a background in mime, will also be able to puppeteer the virtual robot's behaviour using the handheld XR controller.

During the situated encounter, the nurses will be invited to come up with a scenario where they feel a robot would be of help, and would then together with the virtual robot on the task of their choosing, while using a think-aloud protocol to offer feedback to the experiment team and suggest how the robot could behave differently in that particular scenario. Whilst they are communicating the feedback, the theatre professional will change elements in the robot asset, such as the speed it operates in, the movement of the robotic arm, and expressivity, to reflect the feedback of the nurses. During this process, the rest of the experiment team will take notes as they observe what is taking place, while also viewing a stream on a screen which shows what the participants are seeing via their XR headsets.

**Table 1: Human Resource Requirements for the Planned Workshop**

| Participants | Background/Training | Role |
|---|---|---|
| HRI Researchers | Human Factors, and AR Interaction Design | Principle Investigator Process documenter |
| AR technician | AR developer for support, and operations | Settings controller |
| Roboticist | Robotics | Process documenter |
| Nurses | Nursing/Nursing Science | Playing the role of the nurse |
| Theatre professional | Puppeteering/Miming | Controlling the virtual robot |
| Social Scientist | Social sciences/Anthropology | Observers, documents, and interprets |
| Innovator | Management/Business Development | Observers, documents, and interprets |

Through several iterations, the robot's behaviour would be re-adjusted on the fly, and further encounters would ensue. Following each session, the experiment team together with the theatre professionals and the nurses, will reflect on the nurses' experiences, needs, and ideas, through which they will explore what the robot could do, what it should not do, and how it can support the nurses' work. In general, the approach would lead to insights about the social desirability, organisational viability, and technical feasibility of this robotic system, as well as social-ethical considerations.

## 4 Conclusion

In this provocation, we argue that a performative approach to human-robot interaction is pivotal for understanding the complexities involved in integrating robotic systems into complex work environments. We further argue that augmented reality is a powerful means for exploring such integrations during technology development, as it enables investigation of the design space while still allowing room for experimentation. Moreover, we propose that enacting robot encounters with nurses and theatre professionals through AR, situated within actual patient rooms, will surface interactions, experiences, and concerns that are meaningful in healthcare contexts, and inform technology development in responsible and viable ways. We conclude that the combination of these elements renders the robot in the room as a fiction that is grounded in real-world contexts and practices, constituting a novel contribution to designerly approaches in HRI and to transdisciplinary research on the future of work.

## Acknowledgments

This work was funded by *The Convergence Sustainable Health Program from the Erasmus University Medical Centre Rotterdam - Project NURTURE (116083)* and executed in collaboration with the *Dramaturgy for Devices* project (NWA.1518.22.080). *Statement on use of AI:* AI tools were used in the creation of the first figure.

## References

[1] Maaike Bleeker, Marco Rozendaal, Betti Marenko, and William Odom. 2021. Dramaturgy for devices: Theatre as perspective on the design of smart objects. (2021). doi:10.5040/9781350160156.ch-002

[2] Susanne Bødker. 2015. Third-wave HCI, 10 years later—participation and sharing. *interactions* 22, 5 (2015), 24–31. doi:10.1145/2804405

[3] Cynthia Breazeal. 2003. Toward sociable robots. *Robotics and autonomous systems* 42, 3-4 (2003), 167–175. doi:10.1016/S0921-8890(02)00373-1

[4] Chris Elsden, David Chatting, Abigail C Durrant, Andrew Garbett, Bettina Nissen, John Vines, and David S Kirk. 2017. On speculative enactments. In *Proceedings of the 2017 CHI conference on human factors in computing systems*. 5386–5399. doi:10.1145/3025453.3025503

[5] Christopher Frauenberger. 2019. Entanglement HCI the next wave? *ACM Transactions on Computer-Human Interaction (TOCHI)* 27, 1 (2019), 1–27. doi:10.1145/3364998

[6] Petra Gemeinboeck. 2021. The aesthetics of encounter: a relational-performative design approach to human-robot interaction. *Frontiers in Robotics and AI* 7 (2021), 577900. doi:10.3389/frobt.2020.577900

[7] Giulio Jacucci. 2004. *Interaction as performance: cases of configuring physical interfaces in mixed media*. University of Oulu.

[8] Victor Kaptelinin and Marco C Rozendaal. 2024. Human actions. In *Foundations and fundamentals in human-computer interaction*. CRC Press, 215–240. doi:10.1201/9781003495109-7

[9] Lenneke Kuijer 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*. 1–13. doi:10.1145/3173574.3173699

[10] Marco C Rozendaal, Jered Vroon, and Maaike Bleeker. 2024. Enacting human–robot encounters with theater professionals on a mixed reality stage. *ACM Transactions on Human-Robot Interaction* 14, 1 (2024), 1–25. doi:10.1145/3678186

[11] Wilbert Tabone, Yee Mun Lee, Natasha Merat, Riender Happee, and Joost De Winter. 2021. Towards future pedestrian-vehicle interactions: Introducing theoretically-supported AR prototypes. In *13th international conference on automotive user interfaces and interactive vehicular applications*. 209–218. doi:10.1145/3409118.3475149