

Towards Considerate Human-Robot Coexistence: A Dual-Space Framework of Robot Design and Human Perception in Healthcare

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Abstract—The rapid advancement of robotics, spanning expanded capabilities, more intuitive interaction, and more integration into real-world workflows, is reshaping what it means for humans and robots to coexist. Beyond sharing physical space, this coexistence is increasingly characterized by organizational embeddedness, temporal evolution, social situatedness, and open-ended uncertainty. However, prior work has largely focused on static snapshots of attitudes and acceptance, offering limited insight into how perceptions form and evolve, and what active role humans play in shaping coexistence as a dynamic process. We address these gaps through in-depth follow-up interviews with nine participants from a 14-week co-design study on healthcare robots. We identify the human perception space including four interpretive dimensions (i.e., degree of decomposition, temporal orientation, scope of reasoning, and source of evidence). We enrich the conceptual framework of human–robot coexistence by conceptualizing the mutual relationship between the human perception space and the robot design space as a co-evolving loop, in which human needs, design decisions, situated interpretations, and social mediation continuously reshape one another over time. Building on this, we propose considerate human–robot coexistence, arguing that humans act not only as design contributors but also as interpreters and mediators who actively shape how robots are understood and integrated across deployment stages.

I. INTRODUCTION & RELATED WORK

The rapid advancement of robotics is reshaping the ways humans and robots coexist, manifesting across three interrelated dimensions. First, at the **capability level**, the emergence of large language models and agentic Artificial Intelligence (AI) has enabled robots as embodied agents to develop increasing reasoning, planning, and multimodal perception capacities [1]. Second, at the **interaction level**, these expanded capabilities have inspired more intuitive language-based interaction [2] and more expressive robot behaviors (e.g., social nodding and multi-modal feedback) [3]. Third, at the **contextual level**, robots are progressively being envisioned in real-world workflows, moving from backend support into frontline participation, and from standalone tools to collaborative team members [4].

Against this backdrop, *coexistence* has emerged as a crucial lens for understanding human–robot relationships. However, the term carries distinct connotations across disciplines

and often varies by context, lacking a unified definition [5]. In ecology, coexistence typically describes the persistence of competing species under shared resources [6]; this is often modeled through population growth rates and species resilience [7], or discussed from the perspective of niche separation along environmental axes [8]. In a human social perspective, it refers to the dynamics of diverse livelihood interests within shared resources [9]. Within existing human–robot interaction (HRI) and robotics research, coexistence has been understood more as a state of humans and robots sharing physical space, with a primary focus on safety, efficiency [10], [11], and spatial organization, such as human–aware social navigation [12] or layout design in shared environments [13]. However, this spatially-centered conception is increasingly inadequate in light of the three-level shift aforementioned. The human–robot coexistence is more than a spatial state; it is an evolving process continuously shaped by multiple actors over time.

We here enrich the conceptual understanding of **human–robot coexistence** through the following four features: (1) *organizational embeddedness*: robots act as participants integrated within real-world workflows and organizational structures (e.g., crash cart robots in resuscitation teams [14]); (2) *temporal evolution*: human–robot relationships evolve over time as users accumulate experience and continuously update their understanding of robot capabilities (e.g., participants gradually shift from viewing robots as autonomous tools to collaborative partners through iterative co-design processes [4]); (3) *social situatedness*: the roles and meanings of robots are shaped not only by their technical capabilities, but also by stakeholders’ interpretations and the social contexts in which they are deployed [3]; (4) *open-ended uncertainty*: robot interaction unfolds in dynamic and uncertain environments, requiring adaptive reasoning that transcends pre-defined scripts, particularly in complex domains such as healthcare [15].

Under this richer conception of human–robot coexistence, human perception becomes a crucial variable. Yet, existing work has largely focused on static assessments of attitudes or acceptance towards healthcare robots. Such studies often explore how people anticipate teaming up with robots in imagined scenarios [16] or rely on qualitative interviews to catalog perceived potentials (e.g., reducing burden) and concerns (e.g., technical unreliability) [17]. While these works reveal *what* stakeholders think about robots, they offer limited insight into *how* these perceptions form, interact, and evolve over time. A set of questions, therefore, remains underexplored: How do people’s impressions of robots form,

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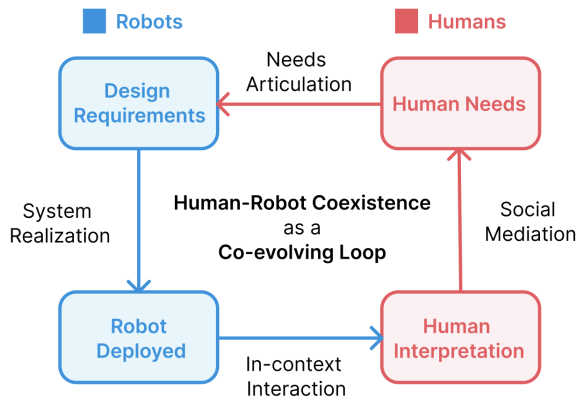


Fig. 1. We conceptualize human–robot coexistence as a **co-evolving loop** between humans and robotic systems. **Human needs** are articulated into **design requirements**, which are realized into **robotic systems deployed in context**. Through deployment and situated interaction, these systems shape **human interpretation**, which is further propagated via social mediation, feeding back into evolving human needs. This loop highlights the dynamic and reciprocal process through which human–robot coexistence is continuously formed and reshaped over time.

and what are the underlying attribution mechanisms? Why do individuals with similar backgrounds arrive at different understandings, and what drives this variation? As exposure to robots deepens, do perceptions change, and if so, what factors drive that change? Furthermore, while existing research often positions humans as passive evaluators, what active role do humans play in shaping the coexistence as a dynamic entity within the system?

To address these gaps, this paper builds on our prior work examining how humans contribute to robot design through multi-stakeholder, interdisciplinary input, and how robotic systems might better accommodate human needs in real-world healthcare deployment (robot design space) [4]. We extend this inquiry by pivoting to the human perception space, investigating how stakeholders’ assessments of a robot’s long-term promise evolve through sustained engagement and how they envision the future of human-robot coexistence in care settings. We conducted in-depth follow-up interviews with nine participants who had been involved in a 14-week co-design study (from abstract ideation to high-fidelity prototyping) to investigate how their understanding and attributions evolved.

This paper addresses the following research questions:

- **RQ1:** How do stakeholders’ evaluations of a healthcare robot’s promise evolve throughout a long-term co-design process, and what underlying factors drive these attitudinal shifts?
- **RQ2:** How do participants conceptualize future human–robot coexistence, what idealized states of coexistence do they envision, and what roles do humans assume within this paradigm?

This paper makes three contributions:

- We identify the **human perception space** via four interpretive dimensions: *degree of decomposition, temporal orientation, scope of reasoning, and source of evidence*.

These dimensions form a multi-faceted continuum that shapes how individuals organize information, attribute risks, and evaluate the functional and normative boundaries of healthcare robots in practice (see Fig. 2).

- We enrich the conceptual framework of **human–robot coexistence** by introducing the **robot design space** and the **human perception space** as two mutually shaping perspectives, and conceptualizing their dynamic relationship as a co-evolving loop in which human needs are articulated into design requirements, realized as deployed systems, and continuously reshaped through in-context interaction, interpretation, and social mediation (see Fig. 1 and Fig. 2).
- We propose the notion of **considerate human–robot coexistence** and derive implications for its realization across deployment stages. We argue that humans act not only as *design contributors* who articulate needs and shape robotic systems, but also as *interpreters and mediators* who continuously influence how robots are understood and integrated in real-world environments. We highlight the need for making design rationales legible before deployment, supporting ongoing interaction and mediation during use, enabling gradual engagement, and respecting professional boundaries.

II. METHODOLOGY

To examine how participants’ perceptions of healthcare robots have evolved following an extended co-design process, and how they envision human–robot coexistence in care settings, we adopt a qualitative approach based on in-depth semi-structured interviews, incorporating a retrospective attitudinal assessment. The study was IRB approved (IRB #: XXXXXXX).

Study Context. Participants in this study had previously taken part in a 14-week co-design process conducted across three healthcare facilities, including an emergency department, a sleep disorder clinic, and a long-term rehabilitation facility [4]. The process progressed from needs identification through iterative prototyping to high-fidelity full-scale robot prototypes envisioned as active participants embedded within care workflows. To support co-creation, participants participated in a series of educational sessions on healthcare workflows, the history of robotics, and robot technologies. These sessions were designed to foster shared understanding across diverse stakeholders and support more informed engagement in the co-design process.

Participants. We recruited 9 participants who completed the longitudinal co-design engagement described above, consisting of 5 males and 4 females, ranging in age from 20 to 70 years. Participants represented diverse backgrounds, including healthcare workers (HCWs), patients, engineers, makers, and artists, enabling exploration of heterogeneous perspectives on healthcare robots and their integration into care environments. Table I summarizes participant demographics and backgrounds. All participants volunteered to take part in the study and received no compensation.

TABLE I
PARTICIPANT DEMOGRAPHICS AND BACKGROUND.

ID	Gender	Age	Background
P1	Male	30–40	Programmer/Maker
P2	Male	60–70	Maker/Patient
P3	Male	60–70	Artist
P4	Female	50–60	HCW/Artist
P5	Male	20–30	Programmer/Maker
P6	Female	60–70	Artist
P7	Male	20–30	Programmer/Maker
P8	Female	30–40	Maker
P9	Female	30–40	HCW/Programmer

Interviews. To capture perception shifts, we asked participants to retrospectively rate their outlook on healthcare robots both before and after the co-design experience on a 5-point scale (1 = not promising, 5 = very promising). Given the subjectivity of retrospective ratings, we focus on *directional trends* (increase, decrease, or no change) rather than absolute score differences. The interviews were structured around two guiding topics: *Evolution of Perceived Promise*, which investigates the factors that lead participants to view healthcare robots as more (or less) promising and the underlying reasons for these attitudinal shifts, and *Envisioned Human–Robot Coexistence*, which explores participants’ perceptions of coexistence in care settings, including their expectations and actionable strategies.

Data Collection and Analysis. We recorded audio during interviews and took notes when necessary. Recordings were transcribed and analyzed using thematic analysis [18]. The first author developed the initial codes. The third author independently coded a subset of the data. Following collaborative discussions, a shared codebook was developed. Both authors then applied this codebook to the full dataset, and inter-coder agreement was assessed using Cohen’s Kappa. For RQ1, the analysis resulted in three themes with five sub-themes ($\kappa = 0.82$); for RQ2, the analysis resulted in three themes with six sub-themes ($\kappa = 0.86$). Both values indicate almost perfect agreement.

III. RESULTS

A. RQ1: Perceptual Shifts in Healthcare Robots’ Promise: Increase, Stability, and Calibrated Decrease

We observed changes in participants’ perceptions of the promise of healthcare robots: five increased, three remained stable, and one decreased.

Theme 1: Increased Perceived Promise Through Contextual Validation and Demystification. Participants whose perceptions increased were influenced by two mechanisms.

a) Contextual validation of real needs. Three participants shifted their perceptions by recognizing concrete needs for robots through interactions with HCWs, rather than relying on abstract assumptions. For example, P9 noted that the robots’ “potential uses” changed her perspective, and P7 described healthcare robots as more promising after observing that there were “times for the HCWs” when “it would have been nice if they had a robot helping around”.

b) From uncertainty to feasibility awareness. Two participants moved from vague uncertainty to a more grounded understanding of what robots could realistically achieve. Through technical demonstrations, P9 learned that “the application of large language models and machine learning algorithms might help to enhance robot capabilities” and make movements “more seamless”. Similarly, P5 reflected: “[Previously,] I didn’t know people were developing robots for healthcare settings. I felt it was doable, but I didn’t know if people were actually working on it.” Through the workshop, P5 gained clarity about “the challenges” and “the opportunities”, recognizing that active development made these systems more feasible.

Theme 2: Stable Perception Anchored by Pre-existing Frameworks. Participants whose perceptions remained stable drew on established frameworks that grounded their evaluations from the outset.

a) Experience-based anchoring. Three participants relied on prior experience to anchor their perceptions, maintaining a consistent view of the potential of healthcare robots. P1, with a strong technical background and direct experience across multiple healthcare facilities, could readily identify situations where robots would be useful, such as “filling out forms” and “reducing errors or miscommunication”. He also noted that surgical robots can support precision by helping “correct how a doctor moves their hands”. P2, a patient from a long-term rehabilitation facility, drew on lived experience with an assistive wheelchair and extended this embodied understanding to healthcare robots, viewing similarly embodied systems as helpful forms of support in daily life.

b) Knowledge-based reasoning. Two participants used structured knowledge to interpret challenges as solvable rather than discouraging. P1 framed technological maturity as an ongoing process, suggesting that systems can progressively improve over time: “Turning immature technology into mature technology is exactly what you’re doing. It doesn’t just happen.” This perspective led him to view current limitations as part of a trajectory toward greater capability. Similarly, P6 contextualized safety concerns by comparing robot errors to human fallibility: “People can also pick up the wrong thing and give it to somebody. Some employees are not trustworthy.” Rather than viewing mistakes as a reason for concern, she emphasized that systems “just need proper protocols to function properly”.

Theme 3: Calibrated Decrease as Grounded Reassessment. One participant showed a slight decrease in perceived promise, reflecting a shift from idealized expectations to a more realistic appraisal of constraints such as cost. P6 explained: “It got reduced because I came in imagining robots doing everything. My imagination was outside the frame of reality.” She added, “I just bring it down a four because there are real possibilities, but you have to put reality into it”. Rather than indicating disillusionment, this recalibration reflects a more grounded and potentially more stable engagement with the technology.

B. RQ2: Human-Robot Coexistence in Healthcare

Our analysis reveals that participants did not evaluate healthcare robots as isolated technologies, but made sense of them through familiar technological trajectories, institutional signals, and situated expectations about care. Rather than expressing purely positive or negative attitudes, participants articulated coexistence as something that unfolds over time, is interpreted through context, and requires careful deployment strategies.

Theme 1: Normalization through Technological Trajectories. Five participants framed robots as part of a broader pattern of technological adoption, suggesting that initial unfamiliarity would gradually give way to normalization. They drew comparisons to smartphones, navigation systems, and automated retail. P1 compared robots to early mobile phones: “it’s like the first time, people just bought it to show off, but now it’s weird not to have a smartphone.” P3 emphasized gradual adaptation: “in the same way that we’ve gradually adapted to all kinds of things. We can see in the subway, ‘oh, the next train is in 12 minutes, and we get used to these things.’” Acceptance was understood as temporal: as P9 noted, “it’s just a matter of time... interacting with them more makes people feel more comfortable,” framing coexistence as an extension of ongoing sociotechnical adaptation.

Theme 2: Robots as Institutional Signals. Seven participants described how robots could shape perceptions of hospitals regarding quality, advancement, and safety, even among those not directly interacting with them. P1 noted that seeing a robot would suggest “cutting edge technology”, and P3 associated it with “a better place” and “a high level care system.” P7 linked robot presence to safety: “the hospital is advanced enough” and that robots might “check things more than once”. P5 anticipated comparative judgments, suggesting that in the future, hospitals without robots might be perceived as lower quality. At the same time, participants acknowledged subjectivity: as P6 noted, perceptions “really depend on your bias as a person”.

Theme 3: Strategies for Supporting Human–Robot Coexistence. Participants articulated practical strategies for supporting coexistence in real-world care settings.

a) Social blending. Three participants emphasized that robots should blend into care environments socially and aesthetically. P3 highlighted environmental fit: “in a sleep environment, you want it to be calming. Natural materials would be nicer for people.” P6 suggested making robots feel “less like plastic and more organic to give a comforting feeling”. Institutional alignment also emerged as important, with P9 proposing “giving the robot a uniform”.

b) Respecting user preferences. Four participants emphasized that robots should not be uniformly imposed on all patients. Instead, they highlighted the importance of accommodating individual comfort levels, for example, through pre-screening and flexible alternatives. As P5 suggested, patients could be asked, “are you comfortable with robots—yes or no? If not, they would not be included”. Similarly, P9 noted that “we can offer an option if some people need

more time to adapt to the robots”.

c) Human mediation as a bridge. Five participants highlighted the role of humans in introducing and contextualizing robots. P1 described incorporating robots into communication practices: “tell a patient that we have this robot here. It does all these things and everything is secure.” P4 emphasized clarifying intent, for example, explaining that robots are “not there to replace you, but to assist you”. Participants also stressed education and staged introduction: P8 noted that “you need to educate the public. Whenever something new is introduced, there’s always going to be misconceptions about it,” while P7 suggested “a test run to see how people are feeling”.

d) Maintaining professional and contextual boundaries. Seven participants emphasized that robots should not be introduced for their own sake, but to meaningfully improve care and workflows. As P5 noted, “the point of a hospital is to take care of patients, not to teach them that robots are cool”. Accordingly, robots should operate within clearly defined professional boundaries, where functional contribution justifies their role. Participants also stressed the continued importance of human oversight in complex care contexts. As P4 illustrated, “critical conditions” can be overlooked without human judgment, highlighting limits in purely automated systems.

IV. DISCUSSION

A. Human Perception Space: Four Interpretive Dimensions

We found that participants interpreted robots through a set of **interpretive dimensions** that shaped how they organized information, attributed risks, and judged what robots could or should do in care settings. These dimensions form a continuous perception space. (see Fig. 2).

(1) Degree of Decomposition. This dimension captures whether participants interpret the robot as a *decomposable system* of components or as a *holistic* technological entity. At the decomposed end, participants distinguished among different sources of problems (e.g., robot hardware, network, data infrastructure, or workflow integration). P1 illustrated this when discussing privacy, arguing that certain concerns should be attributed to broader infrastructure rather than “the robot” as a whole. At the holistic end, participants treated the robot as a single entity, such that one unreliable aspect generalized to the whole: P2’s concerns about data accuracy reflected worry about the robot as a concept rather than any specific sub-component like incorrect data input or analysis algorithms. This dimension shapes whether concerns are read as a debuggable engineering problem or as global uncertainty attached to “the robot” itself.

(2) Temporal Orientation. This dimension reflects whether participants evaluate robots from a *state-based* perspective focused on current capabilities, or a *developmental* perspective that treats limitations as part of an evolving trajectory. At the developmental end, P5 noted their perception became more positive upon realizing researchers were actively “working on healthcare robots”, shifting their view from vague possibility to grounded feasibility; P1

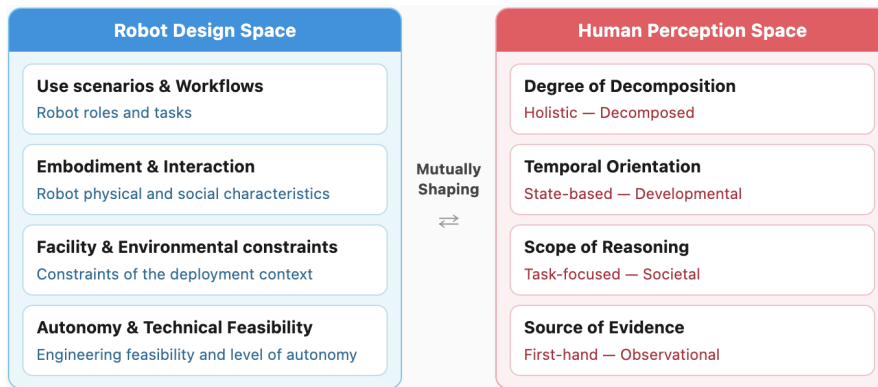


Fig. 2. **Robot design and human perception space for human-robot coexistence.** On the left, the **robot design space** captures key system-level considerations, including use scenarios, embodiment, contextual constraints, and technical feasibility. On the right, the **human perception space** characterizes how stakeholders interpret robots along four **interpretive dimensions**: degree of decomposition, temporal orientation, scope of reasoning, and source of evidence. These two spaces **mutually shape** each other over time: design decisions influence situated experiences and interpretations, while human understanding and social mediation inform future design requirements.

emphasized that “immature technology matures” through continued effort. At the state-based end, current failures and unreliability weigh heavily without being offset by assumed future improvement. For instance, though recognizing the potential of robots, P5 assigned a conservative score of 3, placing greater weight on concerns regarding malfunctions than on inherent promise. This dimension shapes whether robots are seen as currently limited but advancing or judged primarily by present readiness.

(3) **Scope of Reasoning.** This dimension describes how broadly participants framed their evaluation, from *task-focused* to *societal-level* reasoning. At the task-focused end, evaluation centers on whether the robot performs specific functions well (e.g., guiding patients, delivering supplies). At the broader end, participants situated robots within wider concerns such as professional roles, organizational incentives, and job displacement. For example, P3 highlighted a tension: while “organizations prioritize efficiency” and use robots, workers may fear “having their jobs taken away”. This dimension reflects whether robots are interpreted through localized functional utility or wider socio-technical implications.

(4) **Source of Evidence.** This dimension captures what kinds of evidence participants drew upon, ranging from *first-hand experience* to *observational or socially derived* evidence. Regarding first-hand experience, P2 drew on lived experience with an assistive wheelchair to evaluate broader support from robots; P1 grounded judgments in extensive direct exposure to healthcare settings and technologies. At the other end, P9 reflected that seeing others grow excited about robots shaped their own sense of the technology’s promise, though acknowledging the possible bias during observation. This dimension shapes whether judgments rest on direct personal experience or socially mediated signals.

B. Human–Robot Coexistence: Two Spaces (Robot Design & Human Perception), One Co-evolving Loop

The four interpretive dimensions identified above do not emerge in a vacuum. To understand how the perception

space relates to robotic systems more broadly, we situate it alongside a complementary perspective drawn from our prior work [4]: the robot design space.

As shown in Figure 2, the **robot design space** captures how robots are envisioned and constructed through four factors: use scenarios and workflows, embodiment and interaction design, facility and environmental constraints, and autonomy and technical feasibility. The **human perception space**, identified above, describes how stakeholders interpret and evaluate robots along the four dimensions of decomposition, temporal orientation, scope of reasoning, and source of evidence. Together, these two spaces capture the two sides of human–robot coexistence: how robots are built, and how they are understood.

Critically, these two spaces are mutually shaping, a relationship we conceptualize as a **co-evolving loop**, illustrated in Fig. 1. In this loop, human needs are articulated into design requirements, which are realized into deployed robotic systems. These systems generate situated experiences that shape human interpretation, which is further socially mediated among stakeholders (e.g., through the observational sources of evidence identified in Dimension 4), and in turn reshapes expectations, requirements, and future design.

This co-evolving nature reveals that coexistence depends not only on what robots can do, but on how humans engage with, interpret, and mediate robotic systems across time and context. This raises a question: what qualities should this process have in order to support meaningful and sustainable integration? We argue that the answer lies in cultivating a more considerate form of coexistence, as discussed below.

C. Toward Considerate Human–Robot Coexistence

We use **considerate** to describe a form of coexistence in which both robots and humans actively contribute to shaping how robotic systems are integrated in practice. Our findings show that humans are not only **design contributors** who shape robotic systems, but also **interpreters and mediators** who influence how robots are understood and situated in

real-world environments. Considerate coexistence cannot be achieved through system design alone, but requires continuous human participation across deployment stages. We derive four implications for its realization.

Implication 1: Make design rationale legible before deployment. Even when full co-design participation is not feasible, communicating what the robot is intended to do, how it fits into existing workflows, and why certain design decisions were made provides a foundation for meaningful engagement from the outset. Such transparency helps align expectations, reduces ambiguity around system capabilities, and supports stakeholders in situating the robot within existing practices before encountering it in use.

Implication 2: Reduce misunderstanding and unfamiliarity during deployment. When robots are introduced into real-world environments, people can experience uncertainty, misunderstanding, or a sense of unfamiliarity. Providing opportunities such as test runs, live demonstrations, and informal encounters allows stakeholders to explore, ask questions, and gradually build an understanding of what the robot does and how it behaves. These experiences create space for people to mitigate confusion and form more grounded expectations. In addition, design choices such as material, form, and role signaling can support this process by helping robots feel less intrusive within their environment.

Implication 3: Support gradual engagement and respect individual choice. Stakeholders vary in their readiness to engage with robotic systems, especially during early adoption. Rather than requiring immediate interaction, individuals should be allowed to decide whether, when, and how to engage. Providing flexibility during the transition period helps reduce resistance and accommodates different comfort levels. This approach recognizes that engagement is not binary, but develops gradually over time.

Implication 4: Emphasize functional value while respecting professional boundaries. The goal of robot integration is not to promote acceptance for its own sake, but to meaningfully support existing workflows and care delivery. Respecting professional boundaries means ensuring that robots provide functional contributions rather than serving as a showcase, with clearly defined roles and responsibilities between humans and robots, a point also aligned with prior work on human-robot teamwork in real-world healthcare settings [19].

V. LIMITATIONS AND FUTURE WORK

This study builds on a 14-week co-design process with voluntary participants. The longitudinal nature of the recruitment, which required sustained engagement from early ideation to high-fidelity prototyping, limited the number of participants, resulting in a sample size of nine and potentially affecting generalizability. Future work should extend beyond the co-design window to examine how perceptions and interpretations continue to evolve as robotic systems are further refined and integrated into real-world practice. Expanding participation to include more diverse stakeholder groups and

healthcare contexts would also strengthen the transferability of the identified perception space.

REFERENCES

- [1] Z. Durante, Q. Huang, N. Wake, R. Gong, J. S. Park, B. Sarkar, R. Taori, Y. Noda, D. Terzopoulos, Y. Choi *et al.*, "Agent ai: Surveying the horizons of multimodal interaction," *arXiv preprint arXiv:2401.03568*, 2024.
- [2] S. Lu, J. Berger, and J. Schilp, "Extracting robotic task plan from natural language instruction using bert and syntactic dependency parser," in *2023 32nd IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*. IEEE, 2023, pp. 1794–1799.
- [3] K. Mahadevan, J. Chien, N. Brown, Z. Xu, C. Parada, F. Xia, A. Zeng, L. Takayama, and D. Sadigh, "Generative expressive robot behaviors using large language models," in *Proceedings of the 2024 ACM/IEEE International Conference on Human-Robot Interaction*, 2024, pp. 482–491.
- [4] Y. Bai, R. Han, N. Parikh, W. Ju, and A. Taylor, "Towards considerate embodied ai: Co-designing situated multi-site healthcare robots from abstract concepts to high-fidelity prototypes," *arXiv preprint arXiv:2602.03054*, 2026.
- [5] J. Knox, K. Ruppert, B. Frank, C. C. Sponarski, and J. A. Glikman, "Usage, definition, and measurement of coexistence, tolerance and acceptance in wildlife conservation research in africa," *Ambio*, vol. 50, no. 2, pp. 301–313, 2021.
- [6] R. A. Armstrong and R. McGehee, "Coexistence of species competing for shared resources," *Theoretical population biology*, vol. 9, no. 3, pp. 317–328, 1976.
- [7] G. Barabás, R. D'Andrea, and S. M. Stump, "Chesson's coexistence theory," *Ecological monographs*, vol. 88, no. 3, pp. 277–303, 2018.
- [8] J. Silvertown, "Plant coexistence and the niche," *Trends in Ecology & evolution*, vol. 19, no. 11, pp. 605–611, 2004.
- [9] P. A. Loring, "Toward a theory of coexistence in shared social-ecological systems: the case of cook inlet salmon fisheries," *Human Ecology*, vol. 44, no. 2, pp. 153–165, 2016.
- [10] E. Magrini, F. Ferraguti, A. J. Ronga, F. Pini, A. De Luca, and F. Leali, "Human-robot coexistence and interaction in open industrial cells," *Robotics and Computer-Integrated Manufacturing*, vol. 61, p. 101846, 2020.
- [11] K. Merckaert, B. Convens, C.-j. Wu, A. Roncone, M. M. Nicotra, and B. Vanderborght, "Real-time motion control of robotic manipulators for safe human-robot coexistence," *Robotics and Computer-Integrated Manufacturing*, vol. 73, p. 102223, 2022.
- [12] Y. Zhang, W. Guan, G. Tian, C.-H. Zhang, G. Zhao, and C. Hua, "Human-aware social navigation with comfort space for mobile robots in human-robot coexistence environments," *IEEE Transactions on Computational Social Systems*, 2025.
- [13] J. Zhi, L.-F. Yu, and J.-M. Lien, "Designing human-robot coexistence space," *IEEE Robotics and Automation Letters*, vol. 6, no. 4, pp. 7161–7168, 2021.
- [14] T. Tanjim, P. Ekpo, H. Cao, J. S. George, K. Ching, H. R. Lee, and A. Taylor, "Human-robot teaming field deployments: A comparison between verbal and non-verbal communication," in *2025 34th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*. IEEE, 2025, pp. 1699–1704.
- [15] A. Taylor, S. Matsumoto, and L. D. Riek, "Situating robots in the emergency department," in *AAAI Spring Symposium on Applied AI in Healthcare: Safety, Community, and the Environment*, 2020.
- [16] A. M. Abrams, L. Plum, and A. M. Rosenthal-von der Pütten, "Teaming up with robots: Analysing potential and challenges with healthcare workers and defining teamwork," *Computers in Human Behavior: Artificial Humans*, vol. 4, p. 100136, 2025.
- [17] P. Smoła, I. Młodziak, M. Wojcieszko, U. Zwierczyk, M. Kobryn, E. Rzepecka, and M. Duplaga, "Attitudes toward artificial intelligence and robots in healthcare in the general population: a qualitative study," *Frontiers in Digital Health*, vol. 7, p. 1458685, 2025.
- [18] V. Clarke and V. Braun, "Thematic analysis," *The journal of positive psychology*, vol. 12, no. 3, pp. 297–298, 2017.
- [19] K. T. Eriksen and L. Bodenhagen, "Understanding human-robot teamwork in the wild: The difference between success and failure for mobile robots in hospitals," in *2023 32nd IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*. IEEE, 2023, pp. 277–284.