

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, source of evidence, scope of reasoning, and temporal orientation). 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. Our related prior work and supplementary materials, including the interview protocol, are available at <https://...>

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. How-

ever, the term carries distinct connotations across disciplines and often varies by context, lacking a unified definition [5]. In ecology and the social sciences, for instance, coexistence describes the sustained co-presence of different actors sharing resources and environments, which is an inherently ongoing, dynamic process rather than a fixed arrangement [6], [7]. 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 [8], [9], and spatial organization, such as human–aware social navigation [10] or layout design in shared environments [11]. Yet, this spatially-centered conception is increasingly inadequate in light of the three-level shift aforementioned. In our prior co-design study, participants’ understandings of robots evolved as they moved from abstract ideation to high-fidelity prototyping over a 14-week process [4]. Human–robot coexistence is therefore more than a spatial state; it is an evolving process shaped by multiple actors over time.

Here, we 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 [12]); (2) *temporal evolution*: human–robot relationships evolve over time as users accumulate experience and continuously update their understanding of robot capabilities [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 [13].

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 [14] or rely on qualitative interviews to catalog perceived potentials (e.g., reducing burden) and concerns (e.g., technical unreliability) [15]. 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 stakeholders’ impressions of robots form and through what attributions, how these perceptions evolve as exposure deepens, and what active roles humans play in

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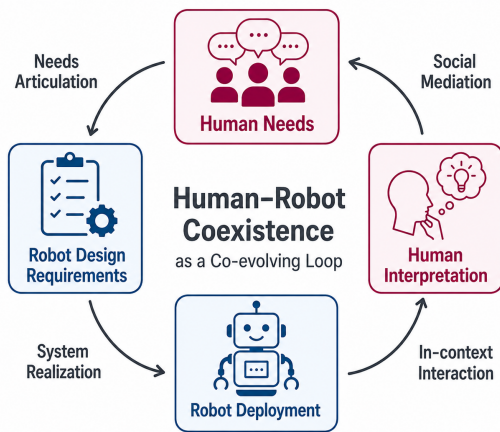


Fig. 1. We conceptualize human–robot coexistence as a **co-evolving loop** between robot design and human perception. **Human needs** are articulated into **design requirements**, which are realized into **robotic systems deployed in context**. Through deployment and situated interaction, these systems 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.

shaping coexistence beyond passively evaluating it.

To address these gaps, we build on this prior co-design work and pivot from robot design to human perception. We investigate 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 completed 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?

The central contribution of this paper is to reconceptualize human–robot coexistence not as a static spatial arrangement but as a *co-evolving loop* between robot design and human perception. Concretely, this paper makes three contributions:

- **Human perception space.** We identify the human perception space—the previously underexamined, human-side counterpart to the **robot design space** established in our prior work [4]—through four interpretive dimensions: *degree of decomposition*, *source of evidence*, *scope of reasoning* and *temporal orientation*. Grounded in our longitudinal data, these dimensions form a multifaceted continuum that shapes how stakeholders organize information, attribute risks, and evaluate the functional and normative boundaries of healthcare robots in practice (see Fig. 2).

- **Dual-space co-evolving loop.** We further show that these two spaces are not static counterparts: their mutual shaping unfolds over time 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).
- **Design implications for long-term coexistence.** Using *considerate coexistence* as a lens, we derive implications for its realization across deployment stages, arguing 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 making design rationales legible before deployment, supporting ongoing interaction and mediation during use, enabling gradual engagement, and respecting professional boundaries.

II. METHODOLOGY

To examine whether and 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 #: IRB0145631).

Study Context. Participants had previously completed a 14-week co-design process across three healthcare settings: an emergency department, a sleep disorder clinic, and a long-term rehabilitation facility [4]. The process progressed from needs identification and iterative prototyping to high-fidelity, full-scale robot prototypes envisioned as active participants in care workflows. Participants also attended educational sessions on healthcare workflows, the history of robotics, and relevant robot technologies. These sessions fostered a shared understanding among stakeholders with different backgrounds and supported informed co-design process.

Participants. We recruited nine participants (5 male, 4 female; ages 20–70) who had completed the co-design process described above. They spanned diverse backgrounds, including healthcare workers (HCWs), patients, engineers, makers, and artists, offering heterogeneous perspectives on healthcare robots. Table I summarizes their demographics. Participation was voluntary and uncompensated.

Interviews. To capture perception shifts, we asked participants to retrospectively rate their outlook on healthcare robots 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. Each interview lasted approximately 30 minutes and was 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*,

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

which explored expectations and actionable strategies for coexistence in care settings.

Data Collection and Analysis. The first author conducted all interviews, recorded audio, and transcribed and verified all recordings. Transcripts were analyzed using thematic analysis [16], with meaning unit as the unit of coding. 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, and both authors applied it to the full dataset. We computed Cohen’s Kappa to assess the consistency: for RQ1, three themes with five sub-themes ($\kappa = 0.82$); for RQ2, three themes with six sub-themes ($\kappa = 0.86$), indicating high coding consistency.

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 described two recurring patterns.

a) Contextual validation of real needs. Interactions with HCWs shifted three participants’ views by revealing concrete needs rather than abstract assumptions. For example, P7 found robots more promising after noticing moments when HCWs could have benefited from robotic assistance; P9 similarly shifted after recognizing concrete potential use cases in care work.

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 technical challenges and opportunities around healthcare robots, recognizing that active development made these systems more feasible.

Theme 2: Stable Perception Anchored by Pre-existing Frameworks. Stable perceptions drew on prior experience and structured knowledge that anchored participants’ evaluations. **a) Experience-based anchoring.** Three participants anchored their perceptions in prior experience. 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 at a long-term rehabilitation facility, extended lived experience with an assistive wheelchair to healthcare robots, viewing similarly embodied systems as everyday support.

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.” He thus viewed 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. P4 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 may reflect a more grounded engagement.

B. RQ2: Human-Robot Coexistence in Healthcare

Rather than evaluating robots as isolated technologies or expressing simply positive or negative attitudes, participants interpreted them through familiar technological trajectories, institutional signals, and situated expectations about care. These accounts frame coexistence as a contextual, evolving process that requires careful deployment.

Theme 1: Normalization through Technological Trajectories. Five participants framed robots as part of a broader pattern of technological adoption, suggesting that unfamiliarity may diminish with repeated exposure. 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 similarly emphasized gradual adaptation through everyday infrastructures, noting subway systems where people now “get used to these things”. P9 framed acceptance as a matter of time and repeated interaction: “interacting with them more makes people feel more

comfortable”. Together, these accounts framed 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 accommodating individual comfort levels 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, they held that robots should operate within clearly defined professional boundaries, justified by their functional contribution. Participants also stressed the continued importance of human oversight in complex care contexts. As P4 illustrated, “critical conditions” can be overlooked without human judgment, pointing to perceived

limits of 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* or a *holistic* technological entity. At the decomposed end, participants distinguished among sources of problems, including robot hardware, network and data infrastructure, and workflow integration. P1 illustrated this distinction by attributing privacy concerns to broader infrastructure rather than to “the robot” as a whole. At the holistic end, one unreliable aspect could generalize to the robot as a whole: P2’s concerns about data accuracy reflected worry about the robot as a concept rather than about specific sources, such as incorrect data input or analysis algorithms. Accordingly, concerns may be framed as localized, debuggable problems or as global uncertainty about “the robot” itself.

(2) Source of Evidence. This dimension captures the evidence participants drew upon, ranging from *first-hand experience* to *observational* or *socially derived* evidence. Regarding the former, P2 drew on lived experience with an assistive wheelchair, and P1 grounded judgments in direct exposure to healthcare technologies. At the other end, P9 reflected that seeing others grow excited about robots shaped their own sense of the technology’s promise, while acknowledging the possible bias during observation. Whether judgments rest on direct experience or socially mediated signals echoes findings that media and vicarious exposure can anchor robot perceptions without direct contact [17].

(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, participants evaluated specific functions such as patient guidance and supply delivery. At the broader end, participants situated robots within wider concerns such as professional roles, organizational incentives, and job displacement. For example, P3 contrasted organizations that “prioritize efficiency through robots” with workers’ “fears of having their jobs taken away”. This dimension reflects whether robots are interpreted through localized functional utility or wider socio-technical implications.

(4) 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 emphasized that “immature technology matures” through continued effort. At the state-based end, concerns about current failures

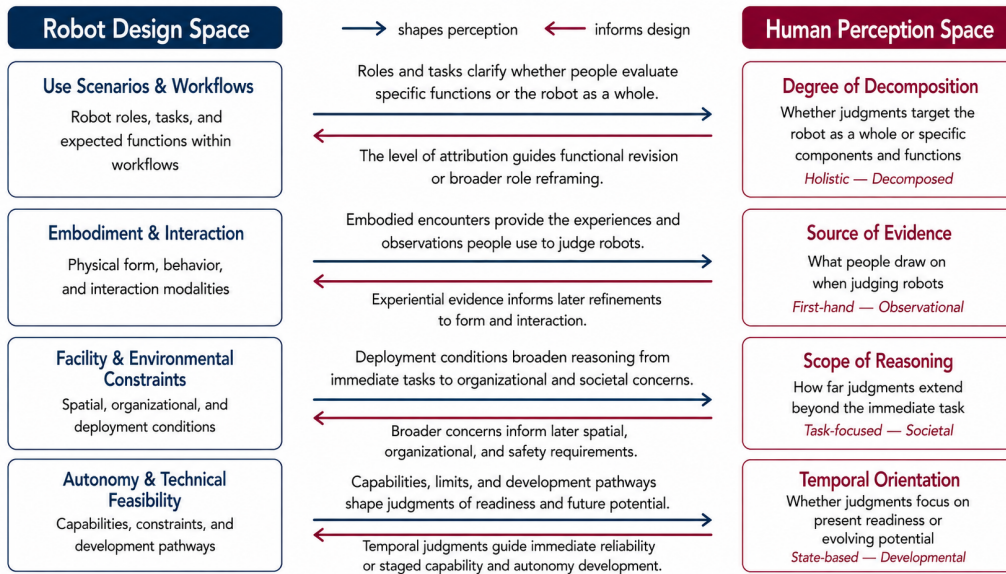


Fig. 2. **Robot design and human perception spaces for human–robot coexistence.** The left side summarizes key design considerations, and the right side characterizes four interpretive dimensions of human perception. Blue arrows indicate how design considerations shape perception, while red arrows indicate how human interpretations inform later design. The aligned pairings highlight recurring cross-space relations rather than exhaustive or exclusive one-to-one mappings.

and malfunctions led P5 to assign a conservative score of 3 despite recognizing the technology’s potential. Robots may therefore be judged primarily by present readiness or interpreted in terms of evolving potential.

B. Two Spaces in a Co-evolving Loop

To connect these interpretive dimensions to robotic systems, we synthesize design considerations from our prior co-design study [4] into a complementary robot design space. Figure 2 presents these four design considerations alongside the four interpretive dimensions identified above. Together, the two spaces capture how robots are designed and situated, and how they are interpreted and evaluated.

Figure 2 specifies four bidirectional relations between the two spaces. First, roles, tasks, and functional boundaries make different units of evaluation visible, shaping whether people judge specific functions or the robot as a whole; conversely, the level of attribution guides localized functional revision or broader role reframing. Second, embodied encounters provide the experiences and observations people use to judge robots, while experiential evidence informs later refinements to form and interaction. Third, deployment conditions broaden reasoning from immediate tasks to organizational and societal concerns, while broader concerns inform subsequent spatial, organizational, and safety requirements. Finally, exposure to capabilities, limitations, and development pathways frames judgments of present readiness versus future potential, while temporal judgments guide immediate reliability priorities or staged capability and autonomy development. These pairings reflect recurring connections identified across the two studies, rather than exhaustive or exclusive one-to-one correspondences.

The two directions draw on complementary evidence:

the present follow-up study examines how robot-design considerations shape human interpretation, while the co-design study documents how participants’ interpretations and situated experiences informed iterative design decisions. Viewed over time, these bidirectional relations operate within the **co-evolving loop** illustrated in Fig. 1. Human needs are articulated into design requirements, which are realized through deployed robotic systems. Situated interaction then shapes human interpretation, which is further socially mediated and articulated back into future design cycles.

This conceptualization builds on the task–artifact cycle in human–computer interaction [18], the duality of technology [19], and work in social robotics on the mutual shaping of robots and society [20]. It also aligns with recent calls for bidirectional human–AI alignment [21]. We extend these perspectives to healthcare robotics by specifying and empirically grounding the relations between robot-design considerations and human interpretive dimensions. This framing shifts attention from whether coexistence emerges to how this evolving relationship should be cultivated, motivating the notion of *considerate human–robot coexistence* discussed below.

C. Toward Considerate Human–Robot Coexistence

We use **considerate** to describe a quality of coexistence in which the design and introduction of robotic systems remain attentive and responsive to the stakeholders in healthcare. This orientation resonates with care-centered value-sensitive design, which emphasizes that robots for care should be designed and evaluated in relation to the real needs and values of care practice [22]. What counts as considerate is therefore specified through stakeholders’ situated needs, responsibilities, and interpretations. Our findings further show that humans are not only **design contributors** but also

interpreters and mediators of how robots are understood, introduced, and refined over time. Considerate coexistence thus requires more than designing robots to be considerate toward humans; it requires participatory processes through which stakeholders articulate concerns, calibrate expectations, and support iterative refinement as robots are integrated into care. In this sense, considerate design extends from a property of the robot [4] to a property of the coexistence process itself. We derive four implications for its realization.

Implication 1: Make design rationale legible before deployment. Even when full co-design is not feasible, stakeholders should be told what the robot is intended to do, how it fits into existing workflows, and why key design decisions were made. Such transparency can align expectations and reduce ambiguity before stakeholders encounter the robot.

Implication 2: Support familiarization during deployment. Once robots are introduced, test runs, live demonstrations, and informal encounters can help stakeholders ask questions, observe robot behavior, and form grounded expectations. Material, form, and role signaling can further reduce unfamiliarity by making robots feel less intrusive and more appropriate to the setting.

Implication 3: Support gradual engagement and individual choice. Stakeholders vary in their readiness to engage with robots, especially during early adoption. Deployment should therefore let people decide whether, when, and how to interact, using staged exposure and opt-in options to accommodate the different comfort levels participants raised.

Implication 4: Emphasize functional value while respecting professional boundaries. Robot integration should support care delivery rather than promote acceptance for its own sake. Participants emphasized that healthcare organizations remain responsible for patient care, especially in critical conditions; robots therefore need clearly defined roles, functional contributions, and human oversight, echoing prior work on human–robot teamwork in healthcare [23].

V. LIMITATIONS AND FUTURE WORK

Because the follow-up relied on voluntary participation from a sustained co-design cohort, the sample comprised nine in-depth interviews, which may limit the breadth of perspectives represented. Future work should examine how interpretations evolve as systems are refined in practice, and include more diverse stakeholders and healthcare contexts to strengthen the transferability of the 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,” in *Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems*, 2026, pp. 1–24.
- [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] 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.
- [8] 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.
- [9] 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.
- [10] 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.
- [11] 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.
- [12] 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.
- [13] 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.
- [14] 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.
- [15] P. Smoła, I. Młodziak, M. Wojcieszko, U. Zwierczyk, M. Kobryn, E. Rzepecka, and M. Dupłaga, “Attitudes toward artificial intelligence and robots in healthcare in the general population: a qualitative study,” *Frontiers in Digital Health*, vol. 7, p. 1458685, 2025.
- [16] V. Clarke and V. Braun, “Thematic analysis,” *The journal of positive psychology*, vol. 12, no. 3, pp. 297–298, 2017.
- [17] S. S. Sundar, T. F. Waddell, and E. H. Jung, “The hollywood robot syndrome media effects on older adults’ attitudes toward robots and adoption intentions,” in *2016 11th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, 2016, pp. 343–350.
- [18] J. M. Carroll and R. L. Campbell, “Artifacts as psychological theories: The case of human-computer interaction,” *Behaviour & Information Technology*, vol. 8, no. 4, pp. 247–256, 1989.
- [19] W. J. Orlikowski, “The duality of technology: Rethinking the concept of technology in organizations,” *Organization science*, vol. 3, no. 3, pp. 398–427, 1992.
- [20] S. Šabanović, “Robots in society, society in robots: Mutual shaping of society and technology as a framework for social robot design,” *International Journal of Social Robotics*, vol. 2, no. 4, pp. 439–450, 2010.
- [21] H. Shen, T. Kneare, R. Ghosh, K. Alkiek, K. Krishna, Y. Liu, Z. Ma, S. Petridis, Y.-H. Peng, L. Qiwei *et al.*, “Towards bidirectional human-ai alignment: A systematic review for clarifications, framework, and future directions,” *arXiv preprint arXiv:2406.09264*, vol. 2406, pp. 1–56, 2024.
- [22] A. van Wynsberghe, “Designing robots for care: care centered value-sensitive design,” *Science and engineering ethics*, vol. 19, no. 2, pp. 407–433, 2013.
- [23] 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.