

Applied Speculation in Work-Centered Socio-Technical Transitions: Converging Trajectories and Unresolved Gaps

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Abstract

This critical commentary offers a reading of trajectories we intercepted when trying to apply speculative design in labor context, and within a transdisciplinary research setting. These trajectories point toward forms of speculation that can intervene more directly within ongoing transformations in socio-technical arrangements, by building collective capacity to negotiate technological change; fostering collective agency; and redistributing power across different actors. We present these trajectories in dialogue with adjacent traditions, such as Scandinavian participatory design and participatory futuring, recognizing both shared contextual conditions and commitments, particularly in relation to imagining alternative futures. This reading further enables us to highlight convergences and unresolved gaps across these fields, pointing to possible directions for future research at the intersection of participation, design, and futures.

Keywords

speculation, participation, design process(es), design theory, design research

Our Point of Departure

In this critical commentary, we reflect on trajectories we intercepted when trying, often unsuccessfully, to *apply* speculative design (SD) in real-world contexts both as a research method and a tool for empowering marginalized perspectives, workers' in our case. We read these reflections in dialogue with relevant work in SD, as well as with adjacent traditions such as Scandinavian participatory design (SPD) and participatory futuring (PF), acknowledging proximity between them with regard to imagining alternative futures. By doing so, we identify convergences and unresolved gaps across these traditions that point toward possible future research.

Before turning to the main argument, we want to situate our reflections in the context from which they emerge. We are design researchers working with speculative design practices to study socio-technical systems. Because of this focus, the first author was included in a transdisciplinary research group working on the *future of work*, bringing together researchers and practitioners from robotics, engineering, cognitive sciences, and design.

Here, our collective work (Ianniello et al., 2026; Mol et al., 2025; Prendergast et al., 2025; Tabone et al., 2026) investigates possible socio-technical arrangements among workers, robots, and organizations, through which labor can be reimagined, negotiated, and governed. These arrangements are situated within organizational contexts and shaped by norms, values, and structures that define and

legitimize forms of labor. Therefore, labor is not neutral terrain, but a site structured by power relations, hierarchies, and ethical stakes that render any intervention inherently political (Budd and Bhawe, 2008). A central commitment of our work is to engage workers in processes related to technological development and deployment, with the aim of expanding their capacity to influence decision-making.

Engaging with these conditions has led us to reconsider how SD can be mobilized. While this practice has traditionally offered powerful tools for critique, its provocative and often detached nature can sit uneasily within sensitive domains such as labor. In our case, technological futures are already shaped through organizational strategies, managerial decisions, and technical constraints, often without meaningful involvement of those most affected (Giebel and Lammers, 2025).

This tension motivates the central question of this critical commentary: *how can SD be mobilized within current socio-technical arrangements, in ways that meaningfully affect participation and future decision-making?*

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Some Preliminary Considerations

On the Contextual Proximity With SPD

The description of our research context reveals a proximity to the conditions that have characterized SPD, and to its commitments (see among others [Bødker et al., 1987](#)).

Both are grounded in workplace contexts, oriented toward the redistribution of agency and power, and concerned with the role of design in supporting more democratic forms of technological development ([Bødker et al., 2000](#)). Furthermore, SPD is engaged with imagining technological alternatives as a means of empowering workers ([Gregory, 2003](#)).

However, these similarities unfold under different conditions. While SPD emerged within contexts supported by strong labor unions and institutionalized forms of worker representation, participation in our context must be more often negotiated within fragmented organizational settings. As a result, it becomes less stable, more contingent, and more easily constrained by managerial and technical agendas. In the following sections, we return to this point.

On SD and Labor

From our background, we define SD as a *practice that engages critically and materially with possible futures through artifacts, scenarios, and experiences, functioning as a form of socio-technical inquiry that surfaces the social, political, and ethical tensions embedded in technological change* (see among others [Dunne and Raby, 2013](#); [Auger, 2013](#); [Tharp and Tharp, 2019](#); [Bendor and Lupetti, 2025](#)).

As SD has expanded across contexts, it has attracted criticism for its circulation within privileged settings, its tendency to aestheticize futures, and its distance from those most affected by the implications it interrogates, revealing the limits of speculation when detached from the socio-technical conditions it seeks to engage ([Ward, 2019](#)).

Labor is a context that amplifies these limits. Work is structured through institutional constraints, productivity logics, and asymmetries of power, where technological futures are not hypothetical but already unfolding ([Burchell et al., 2024](#)). Time is organized in often misaligned cycles that reflect unequal distributions of responsibility and agency, for instance between management and workers ([Orlikowski and Yates, 2002](#)).

As a result, speculation here acquires greater material and political weight: workers experience technological change directly, with tangible effects on roles, well-being, and agency ([Giebel and Lammers, 2025](#)), while their capacity to resist or reinterpret systems remains constrained ([Scott, 1985](#)). In this context, speculation shifts from a tool for critique toward a potential site for collective negotiation and empowerment ([Le Dantec and DiSalvo, 2013](#)).

Trajectories

In our recent work, we have been pushed to reframe SD as a *participatory practice that explores present and near-future*

alternatives grounded in existing technological possibilities and lived experience. This shift calls for a more pragmatic orientation aimed at building collective capacity to negotiate technological change; a more relational approach that treats people, technologies, and organizational contexts as interdependent; and a more responsible stance to work in contexts where futures are already shaped by specific agendas.

This reorientation, aimed at fostering collective agency and redistributing power within immediate technological transitions, informs the trajectories that emerge from our reflections and the contextual conditions outlined above. We introduce them below and read them against relevant work in SD, SPD, and PF to surface convergences and differences.

Participation and Situatedness

The first trajectory concerns participation and situatedness, and serves as the foundation for the others. In this framing, workers are not subjects of speculation but active participants in shaping it. Their lived experiences guide the inquiry, ensuring that speculative processes remain grounded in real conditions and constraints.

Recent work at the intersection of SD and labor reflects a shift in how participation is realized. Being traditionally a designer-led practice, SD has often positioned audiences primarily as interpreters. More recent contributions ([Cheon and Khovanskaya, 2024](#); [Kirman et al., 2022](#); [Ma et al., 2025](#)) move toward more direct involvement, foregrounding workers' perspectives and exploring alternative configurations of labor. This aligns with a broader shift toward shared authorship within SD ([Farias et al., 2022](#)), moving from spectatorship to collaboration and leadership.

In SPD, participation is enacted as co-decision and shared power, supported by institutional arrangements that enable workers to directly influence technological development. As [Gregory \(2003\)](#) notes, "discussions of values in design and imagined futures" are central to this tradition (p. 62), linking futuring to participatory methods that critique the present and envision change. Within this context, imagined futures function as sites of agonistic dissensus ([Björgvinsson et al., 2012](#)), where participants articulate and negotiate values embedded in technological systems ([Halpern and Forlano, 2016](#)), as exemplified by the Utopia project ([Bødker et al., 1987](#)).

PF enacts participation differently, positioning participants as co-imaginors of possible futures. Approaches such as experiential futures ([Candy and Dunagan, 2017](#)) engage people in envisioning, materializing, and prototyping alternatives, fostering collective imagination.

Temporalities

Opening speculative practices to participation in contexts such as labor requires a shift in temporal orientation. Rather than projecting distant imaginaries, speculation should engage with alternative presents and near futures, where technological change is already unfolding and directly experienced. This shift is not only methodological but political: temporalities are unevenly distributed, with some

actors defining long-term trajectories while others are constrained to adapt to their immediate effects.

Reorienting speculation toward the present becomes a way to intervene in these asymmetries.

SD has traditionally privileged alternative futures. While this enables critical distance, it can also displace urgency, detaching inquiry from lived conditions. Some contributions call for broader temporal engagements. Auger (2010), through the notion of domestication, traces how extraordinary technologies become ordinary over time, suggesting that intervening in these trajectories allows speculation to address both emerging developments and existing conditions. Forlano and Halpern (2023) similarly propose reworking historical conditions to envision alternatives, and working with alternative notions of the present.

In SPD, temporal orientations are more closely tied to ongoing practices and decision-making. Futuring is oriented toward what is possible and desirable within present and near-future socio-technical arrangements. Works such as the AT project aimed to be visionary with existing technologies, and to develop imaginaries recognizing the inadequacy of relying solely on problem-solving (Bødker et al., 2000).

In PF engagements with temporality are more heterogeneous. A range of methodologies and tools (see among others Inayatullah, 2023; Inayatullah, 2009) work across pasts, presents, and futures to look into or reframe socio-technical realities. This flexibility enables multiple temporal perspectives and links long-term imaginaries to present concerns (Inayatullah, 2023).

Methodological Orientation

We acknowledge a degree of repetition, but opening speculative practices to participation in contexts such as labor requires not only a shift in temporal orientation. It demands a stronger methodological grounding. This shift entails prioritizing the development of intermediate-level knowledge (Löwgren, 2013) over simply co-producing artifacts. Such knowledge may take different forms that support collective sense-making, reframe decision-making during technological transitions, and enable the materialization of speculations. In this way, speculative practices create spaces where collective agency can be cultivated and mobilized.

A similar orientation emerges in recent methodological work. Zaga et al. (2023) introduce a futuring toolkit for diversity, equity, and inclusion in Human-Robot Interaction, using scenario building and material engagement to support participants in envisioning alternatives and reflecting on underlying values and biases. While effective in surfacing ethical tensions, their approach highlights the need for stronger scaffolding to prevent speculation from collapsing into utopian or dystopian extremes. Similarly, Matos-Castaño et al. (2025) propose Responsible Futuring as a method for collective sense-making and reframing within organizations. Their approach enables participants to identify values at stake, envision alternatives, and reflect on actions toward desirable outcomes. However, they also

point to persistent limitations, including tendencies toward solutionism, exclusion of key stakeholders, and speculations that remain abstract or disconnected from organizational realities.

While (S)PD does not always articulate futuring as a distinct methodological concern, acts of futuring are embedded within its infrastructural logic (Bødker et al., 2022; Le Dantec and DiSalvo, 2013). They sustain participation over time, enabling participants to continuously negotiate and reconfigure desirable directions. In this sense, futuring acts as a structuring condition that supports enduring engagement and collective agency.

As a strand within an already structured field, PF draws on a range of existing methodologies, methods, and tools. For instance, the previously mentioned experiential futures (Candy and Dunagan, 2017) is a structured methodology, organized into distinct phases with defined goals and outcomes.

Multi-Perspective Grounding

Connecting to sections Participation and Situatedness and Methodological Orientation speculative practices should support collaborative forms of knowledge production that bring multiple perspectives into dialogue, reconfiguring how different forms of knowledge are valued and mobilized. Speculation should thus be treated as a relational practice, aimed at countering forms of epistemic injustice that often characterize labor contexts. This perspective reflects our transdisciplinary endeavor as a research group.

Recent studies increasingly connect SD with transdisciplinary inquiry. Peukert et al. (2020) position SD as a tool for collaborative futures-making across disciplinary and stakeholder boundaries. Sustar et al. (2020) and Geenen et al. (2022) highlight its capacity to unpack socio-technical complexity and mediate collaboration within heterogeneous groups. Matos-Castaño et al. (2023) and Mejía et al. (2023) further emphasize its role in fostering social learning through collective reflection and thought experiments. Finally, Zaga and Lupetti (2022) show how integrating SD within a transdisciplinary framework can enhance equity and inclusion in the deployment of technologies such as robotics and AI.

Given the contexts in which it emerged and is applied, SPD operates within interdisciplinary environments, collaborating with computer scientists, engineers, social scientists, practitioners, as well as workers, managers, and unions (Bødker et al., 2000). Like our approach, SPD works within interdisciplinary and transdisciplinary environments as a mechanism for knowledge production. In our case, however, this engagement also enabled other disciplines to actively reframe and reshape our speculative approach (see next section).

PF inherits the interdisciplinary and multi-perspective grounding of futures studies, positioning it as a precursor to our approach. Its methods and tools are explicitly designed to engage diverse disciplinary perspectives, often drawing on fields such as sociology, anthropology, and systems thinking (Kristóf and Nováky, 2023). This orientation

enables the integration of heterogeneous forms of knowledge, while also foregrounding the value of dialogue across disciplinary boundaries.

Final Considerations, Unresolved Gaps, and Future Directions

On Participation and Situatedness

In SD, participation has expanded from passive engagement toward more direct forms of involvement (Farias et al., 2022). However, this expansion has not been matched by a corresponding shift in how it influences decision-making. This limitation is particularly visible in contexts such as labor. When used to shift agency and power, speculative practices frequently remain at the margins of organizational processes, struggling to translate insights into actionable change and to intervene in managerial and institutional dynamics (Cheon and Khovanskaya, 2024). In our own work, this manifests as recurring misalignments between managerial agendas, workers' routine, and the scope of activities. Or as the challenge in making clear and understandable the value of investing time in such activities. We encounter barriers, for instance, in organizing sustained activities when those would have disrupted too much the workflow.

PF encounters similar constraints. While effective in generating situated insights and fostering engagement, participation is often selective and insufficiently inclusive (Barendregt et al., 2024). It further struggles to remain connected to people practices, and lacks the institutional grounding required to influence technological trajectories (Matos-Castaño and Baibarac-Duignan, 2025).

Unlike SPD, where participation was supported by strong labor institutions and formalized mechanisms of worker representation, contemporary labor contexts are marked by fragmentation and weaker collective infrastructures. As a result, participation becomes even less stable and often limited or directed by instrumental reasons (Cheon and Khovanskaya, 2024). Future work must therefore address how participation in speculative practices can be sustained, stabilized, and made consequential within evolving socio-technical systems, while supporting the inclusion of marginalized groups (Harrington and Dillahun, 2021).

Temporalities

Across SD and PF, engagements with temporality often remain insufficiently connected to the institutional and organizational dynamics through which futures are enacted. While these approaches expand the temporal scope of speculation, they rarely address how temporal asymmetries are produced and maintained within organizations, or how speculative insights can intervene in these processes (Wong et al., 2020).

Future directions should therefore focus on strengthening the connection between temporal exploration and situated action. This entails engaging with the structures that define whose desirable visions are prioritized,

accelerated, or constrained. Without this connection, speculation risks remaining detached from the very processes it seeks to influence.

Methodological Orientation

Our experience points toward the need for structured forms of speculative inquiry that can mediate between exploration and action. Our approach, similarly to experiential futures (Candy and Dunagan, 2017), is organized through interdependent phases, combining the development of technological understanding; the exploration of situated practices through participatory ethnographic methods; and the co-creation of grounded speculative propositions in the form of visuals and narratives. These processes emphasize technological realism while maintaining space for alternative configurations to emerge.

Yet, a more structural limitation must be noted: a lack of mechanisms that can connect speculation to ongoing organizational processes. SD tends to generate outputs that remain external to decision-making; PF structures engagement without ensuring continuity; and SPD does not systematically articulate futuring as a distinct methodological concern, instead embedding it within broader participatory and infrastructural processes.

Addressing this limitation requires shifting attention from outputs to the conditions that allow speculation to travel and persist within organizations. This points toward the development of intermediate-level knowledge (Ianniello et al., 2025; Löwgren, 2013) as a connective layer.

Future work should therefore focus on developing forms of *speculative* intermediate-level knowledge that can work across these dimensions. Such knowledge can support sustained engagement, enabling the translation of speculative insights into decisions, and maintaining alignment with situated practices over time.

Multi-Perspective Grounding

Speculative practices increasingly engage multiple perspectives, drawing on interdisciplinary and transdisciplinary collaborations to address socio-technical complexity. These approaches enable the integration of diverse forms of knowledge, including technical expertise and workers' experiential and tacit understandings. In our case, for instance, technical experts pushed us toward technological realism (Ianniello et al., 2025), and workers' tacit knowledge to ground speculations into their lived experience.

However, structural gaps persist: collaborations often remain shaped by asymmetries in authority, where technical and academic knowledge dominate, and experiential knowledge is incorporated selectively or instrumentally (Godemann, 2008). What we suggest is to engage with multiple disciplines and knowledge not only to expand the range of perspectives involved, but also expose tensions that can actively reshape the speculative practice. In our case, these encounters required ongoing negotiation between conflicting epistemologies, constraints, and priorities,

revealing the act of creating scaffolding for speculation itself as a site of contestation.

Future directions should therefore entail recognizing multi-perspective grounding as a process through which speculative practices are continuously transformed by their engagement with other disciplines, while also addressing the power dynamics that shape how different forms of knowledge are valued, negotiated, and mobilized (Costanza-Chock, 2020).

Conclusion

This critical commentary discusses trajectories intercepted by applying SD in the labor context, and within a trans-disciplinary research group. We read these trajectories in dialogue with relevant work in SD and in adjacent fields, such as SPD and PF, recognizing overlappings between the three, being practices engaged with imagining alternatives and alternative futures.

Across the trajectories discussed, a common limitation emerges: speculative practices often struggle to connect exploration with sustained action, remaining peripheral to decision-making structures shaped by institutional constraints and power asymmetries. Addressing this limitation requires moving toward practices that can intervene within and across socio-technical systems over time.

In this sense, we position speculation not only as a tool for critique, but as a relational and infrastructural practice (Wong, 2025; Wong et al., 2020): one that supports the redistribution of agency and power, enables the negotiation of alternative configurations, and engages with the conditions through which futures are materially enacted.

We want to conclude this critical commentary by arguing for speculative practices to engage more directly with real-world contexts (Wilkie, Savransky, and Rosengarten, 2017) and to enable collective participation in ongoing socio-technical transformations.

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Authors' contribution

The first author drafted the manuscript, which was iteratively revised by and refined in collaboration with the second author. The core ideas and concepts presented in this work emerged from the first author's postdoctoral research, conducted under the supervision of the second author.

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