Article

A Responsible Futuring Approach to Create Spaces of Transdisciplinary Co-speculation

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Abstract

This essay elaborates on how design research education can play a pivotal role in fostering futures-oriented competences through the provision of transdisciplinary spaces of co-speculation in learning trajectories. These spaces bring communities together around societal challenges, encouraging active engagement in the exploration of potential futures, aware of the controversial, ambiguous and complex nature of our pasts, presents and futures. In particular, we propose 'Responsible Futuring' as a methodological framework for communities of learners to scaffold their own spaces for transdisciplinary co-speculation. We describe how we put Responsible Futuring into practice in the learning trajectory 'Shaping Responsible Futures', at the University of Twente to develop key competences such as 'controversing', sensemaking, collective imagination, 'tangibilization' and reflexivity.

Keywords

Introduction

Eyebrow-raising visions like EctoLife's baby-growing facility (Zeitoun, 2022) or the extensive use of facial recognition in the public space (Lohr, 2018) highlight ethical and societal concerns that urge us to rethink how our decisions today shape our futures. Today's societal challenges are more tangled than ever, emerging from the interplay between society, technology, and the environment. Let's take, for example, embodied AI -robots and smart products that governments and corporations deploy to support sustainable agriculture, provide low-cost healthcare diagnostics, and improve urban traffic flow. While these technologies address some urban and societal challenges, their impacts extend beyond the solutions they offer. Forms of discrimination, perpetuating racial and gender stereotypes, or increasing power imbalances by gatekeeping access to services and jobs (Zaga and Lupetti, 2022), are among the unintended consequences of adopting these solutions without a careful assessment of their long-term effects.

The examples above illustrate how traditional disciplinary silos fail to address and critically reflect on the networks of responsibilities and impacts of our actions. We often see that top-down future visions developed by corporations or governments prevail, acting as self-fulfilling prophecies that influence the course of events in our world (Meyer, 2019). Techno-solutionism promotes optimistic futures that fail to acknowledge power structures (Milan, 2020; Carr, 2013), and the often-unforeseen ways solutions influence our experiences, norms, and values (Verbeek, 2011). On the other side of the spectrum, dystopian future visions fail to realize that other futures are possible, obviating society's collective capacity to imagine and act (Slaughter, 1998).

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There is an urgent need to develop the skills required for co-creating visions that inspire and encourage active participation of different sectors of society in shaping futures, rather than passively assuming that futures will unfold in a predetermined way, or that we are at the mercy of external forces (Mulgan, 2020). This essay argues that addressing societal challenges calls for long-term thinking grounded in dialogue across multiple perspectives, where exploring different worldviews opens up new possibilities for change. Fostering collaboration among researchers, educators, practitioners, policymakers, and citizens is essential. Such collaboration helps to develop alternative visions that challenge the status quo, and creates spaces to speculate, critique, and reflect on the ethical and long-term implications of our collective actions.

In this context, design education can play an important role in fostering futures-oriented competences. We propose achieving this through the creation of what we call 'transdisciplinary spaces of co-speculation' within educational settings, as we elaborate on the next section. These spaces bring communities together around societal challenges, not only to discuss them but to make future possibilities tangible through visual, material or performative means. Through these spaces, learners develop key capacities such as 'controversing', sensemaking, collective imagination, 'bringing ideas to life', and reflexivity.

This essay introduces our approach, Responsible Futuring, as a framework for facilitating such spaces for transdisciplinary co-speculation. We position it as a pedagogical complement that integrates established futures methodologies with design-based educational practice to foster imagination, reflexivity, and value-driven reflection and action. While principles such as participatory speculation, value-based exploration, and systemic framing are well-established in futures studies, our contribution lies in translating these into a structured, adaptable model tailored to design education.

Transdisciplinary Co-Speculation and Futures-Thinking

In this essay, we argue that transdisciplinarity can facilitate the co-creation of "alternative visions" that transcend existing frameworks and assumptions that limit our ability to imagine. Transdisciplinarity consists of the integration of academic, experiential knowledge, and other non-academic ways of knowing (i.e. indigenous and spiritual) by forming communities of stakeholders across science, government, industry and civil society (van der Bijl-Brouwer et al., 2021; van der Bijl-Brouwer, 2022). Rather than focusing on predetermined solutions, it seeks a deeper understanding of societal challenges, moving away from traditional hierarchical roles of experts and focusing on expressing a diversity of values. *In* and *through* transdisciplinarity, communities engage in a reflective dialogue, embracing social learning processes that highlight power structures, shared responsibilities and challenge assumptions.

In futures-thinking, transdisciplinarity connects diverse perspectives on pasts, presents, and futures. It brings together scientists, policymakers, industry experts, and community members to consider how our actions may shape tomorrow. Rather than assuming a linear progression from a single present, as often implied by the futures cone, this plurality invites what we might call "futures cylinders": frameworks that acknowledge the multiple assumptions, perspectives and perceived future potentialities that coexist in the present.

Our approach to futures thinking embraces this diversity by engaging stakeholders in collaborative and participatory speculation (Light, 2021; Farias et al., 2022). It is situated within participatory futures practices that draw upon different epistemological foundations (De Vos et al., 2024), employ design-integrated methodologies that merge foresight with Research through Design (Ollenburg, 2019), and organize collective processes to identify areas of opportunity and transformation (Paniagua and Cornejo, 2024). Aligned with transformational foresight (Ramos, 2017; Wilkinson et al., 2014), our approach emphasizes co-creation, supporting communities in collectively imagining, reflecting on, and shaping their preferred futures.

These transdisciplinary and participatory processes enable participants to move beyond passive anticipation toward active and collaborative engagement. By integrating multiple perspectives and forms of knowledge through co-speculation, participatory futuring fosters critical thinking and creativity, broadens the range of ideas and possibilities considered, and amplifies the voices of those most impacted by future-oriented decisions (Raleigh and Heinonen, 2019).

While transdisciplinary and participatory approaches hold great promise, their applicability in real-world settings

is not without challenges; particularly when it comes to fostering collaboration across diverse worldviews and addressing underlying power dynamics. This raises a central question: how can we foster competences that enable power-aware partnerships, mindful of differences, and capable of leveraging the unique knowledge that each community brings to the collaboration?

Design education provides a foundation for developing such competences. Over the past decades, it has evolved from a focus on delivering products and services to meeting market demands toward fostering reflective, dialogic, and ethically informed practices. Through paradigms like speculative design (Auger, 2013) and systemic design (Jones, 2014), the field now embraces critical approaches that challenge established norms (Jones et al., 2022). In project-based, transdisciplinary learning contexts, learners engage with diverse forms of knowledge and lived experience to explore societal challenges through collaborative experimentation. Sustaining these spaces beyond the classroom (where learners can apply insights within their communities) remains both an opportunity and a challenge. By integrating academic, professional, and experiential knowledge through iterative, situated learning, transdisciplinary design pedagogies support mutual learning and co-evolving relationships (van der Bijl-Brouwer et al., 2021), enabling the co-speculation of desirable futures grounded in shared responsibility.

Establishing spaces of transdisciplinary co-speculation through Responsible Futuring

We propose 'Responsible Futuring' as a methodological framework to guide communities in creating their spaces for transdisciplinary co-speculation. Given the name we chose for the framework, one might wonder what '*Irresponsible* Futuring' would entail. To clarify, we refer to our approach as '*Responsible Futuring*' because, in our view, 'responsibility' is intentional and encompasses not only on the purpose, process, and goals of the futuring process; but also on the active involvement of communities. In contrast, '*irresponsible* Futuring' would involve organizing futuring processes that disregard diversity, relying instead on non-situated insights, while failing to prioritize the needs of the communities involved.

The creation of this approach was a generative process drawing from theory and practice. We built from (1) design thinking as an exploratory frame creation process, (2) transdisciplinarity as a social learning practice, and (3) moral mediation to bring values into play.

We drew from Kees Dorst's (2015) design thinking methodology, which places emphasis on unfolding the diverse perspectives and worldviews involved in addressing societal challenges, rather than solely focusing on solutions. In line with approaches that recognize the absence of a single, absolute, and irrefutable truth (McGregor, 2018), our goal was to support the creation of a shared frame that enables reflection and action. To achieve this, we embraced transdisciplinarity as a continuous practice of social learning that acknowledges the systemic nature of societal challenges (van der Bijl-Bouwer et al., 2021). To promote awareness of the long-term and societal consequences of actions, we drew on Verbeek's (2011) mediation theory to explore how interventions (i.e., technology) shaping not only our perceptions and experiences but also influencing our actions and practices.

We also built from the empirical experiences of the authors in research projects related to smart city developments and embodied AI. To create a practical framework that incorporates the elements we identified from empirical involvement and theory, we have developed Responsible Futuring as a five-phase approach. Key competences of Responsible Futuring are not as a set of instructions, but a flexible scaffolding that fosters key competences such as (1) 'controversing', (2) collective sensemaking, (3) imagination, (4) 'bringing ideas to life', and (5) reflexivity to support communities in exploring ways to co-shape desirable futures.

First, 'controversing' (inspired by Baibarac-Duignan and de Lange, 2021) enables productive dialogue through the articulation of controversies in transdisciplinary groups, promoting critical thinking and the exploration of diverse perspectives for inclusive co-speculation.

Second, collective sensemaking enables the construction of shared meaning within a group (Weick et al., 2005), allowing transdisciplinary teams to move beyond siloed thinking and develop a more systemic understanding of complex societal challenges.

Third, imagination is the ability to form new ideas and concepts (New Oxford American Dictionary), essential for envisioning alternative futures and inspiring positive change, as imagined futures become socially performative and self-fulfilling (Oomen et al., 2021; Meyer, 2017). Harnessing the power of imagination, communities generate

new ideas for shaping their desired futures (Bendor, 2018).

Fourth, bringing ideas to life is a capacity focused on making abstract notions concrete, promoting dialogue on relevant issues by 'making things public' (Latour, 2005; Schoffelen et al., 2015). It facilitates structured social interactions and reflection on desired outcomes by making futures or values tangible.

Fifth, reflexivity, as described by Popa et al. (2015), supports upgrading practices through collaboration, critical evaluation and mutual learning. This process leads to the creation of new meanings, heuristics, and stakeholder identities, and promotes a comprehensive understanding of past experiences, present value systems, and future perspectives to achieve desirable outcomes.

Phases of Responsible Futuring

Responsible Futuring brings along learners through 5 phases as shown in figure 1: (0) Articulate the Challenge, (1) Connect and Relate, (2) Understand and Frame, (3) Imagine and Ideate, and (4) Reflect and Reframe. In the last years, we have been putting Responsible Futuring into practice in learning trajectories at the xxx. An example of applying Responsible Futuring is the transdisciplinary program 'xxxx.' Since 2019, this program has been providing a learning ecosystem for students, societal stakeholders, experts and communities to address societal challenges. This learning trajectory provides experimental and collaborative spaces to develop the aforementioned competences. Table 1 summarizes each phase of Responsible Futuring, and the corresponding activities.
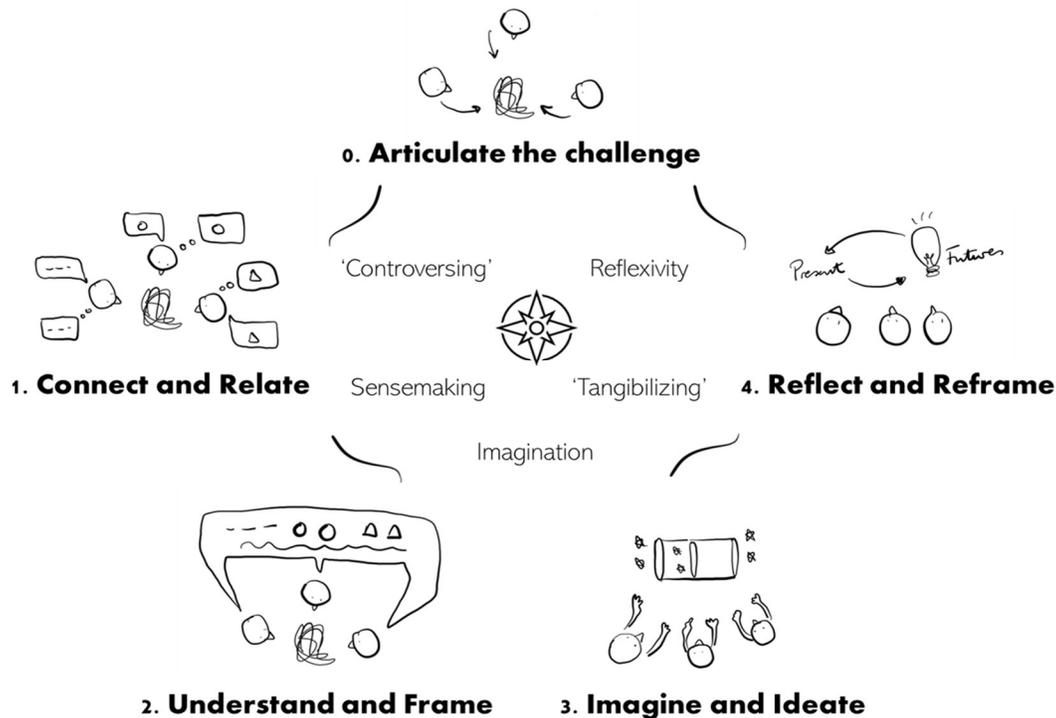

Fig 1. Illustrated phases of Responsible Futuring

Table 1. Phases of Responsible Futuring and examples of pedagogical activities

Phase	Description	Example of pedagogical activity applied in our program
Articulate the Societal Challenge	Participants articulate their matters of concern in relation to societal developments, identify challenges, and form communities around them.	*Parliament of Challenges:* A pedagogical activity where participants assume roles to articulate challenges using metaphors and tangible representations created with low-tech materials.
Connect and Relate	This phase explores the values, power relations and diverse worldviews of actors involved in the challenge.	*Theatrical Technology Assessment* (TTA): Role-play simulations that provide insights into values, responsibilities, and socio-technical dynamics.
Understand and Frame	Participants examine conflicts and complementarities within the societal challenge to gain a holistic understanding and develop a new frame.	*Identity Wheel and Matrix of Domination:* Activities to reflect on personal identities and power dynamics within societal challenges and reframe the challenge. *Value mapping activities*: Activity to identify networks of conflicts and explore diverse perspectives to inform a new frame.
Imagine and Ideate	Participants engage in creative activities to envision future scenarios, emphasizing the creation of provocative prototypes (provotypes) that foster reflection and dialogue on desirable futures.	*Design Fiction:* Creation of provotypes.
Reflect and Reframe	This phase focuses on backcasting and generative ethics to formulate guiding principles and actions.	*Letter to the Future Cities*: Participants write personal letters expressing their desires related to urban challenges and reflect on their perspectives through collaborative sharing and discussions.

Phase 0- Articulate the Societal Challenge

Articulate the Societal Challenge focuses on forming communities around societal challenges. In Responsible Futuring, this process begins with a shared inquiry not only into the challenge itself, but also into the deeper phenomena that give rise to societal impact and meaning. Often, established stakeholder groups take for granted what societal challenges mean and entail, obviating a collective sensemaking process that is the basis to explore relevant knowledge flows, power relations, and values at stake. Besides, articulating the challenge involves giving a voice to communities that might not be usually involved in defining and prioritizing societal challenges. This is relevant since how groups frame challenges steers responses and solutions. In our approach, we actively engage diverse groups to collectively explore challenges that communities want to proactively address. This enables them to articulate their matters of concern in relation to societal developments, identify challenges, and form communities around them. The emphasis is on the active formation of 'publics 'around challenges (DiSalvo, 2009), and, as Dewey (1954) suggests, on bringing together a plurality of perspectives, knowledge-flows, and positions bound by confronting a shared issue. This process resonates with Causal Layered Analysis (Inayatullah, 1998), as it invites participants to explore beyond surface-level problem articulations to shed light into systemic causes, worldviews, and the imaginaries that shape how societal challenges are understood. In doing so, articulating the societal challenge becomes a reflective and generative act that opens the door to explore new relations, commitments and possibilities.

The 'Parliament of Challenges is an example of a pedagogical activity we used to engage diverse stakeholders in articulating the societal challenge. Inspired by Latour's 'Parliament of Things (Latour, 1993) and in a workshop setting, participants engage in simulation and role-play to enter a fictional parliament space and take the role of a human or non-human parliament representative. In this process, students and societal stakeholders 1) examine positionality, values and power dynamics and 2) jointly articulate a societal challenge by jointly framing and reframing it.

In 2022, students and stakeholders from the public and private sectors explored challenges in social justice and healthcare. As fictional representatives, they discerned how their positions in society (and intersections thereof) influence how they articulate frames, mindful of the interdependencies of values and responsibilities co-existing in and co-evolving with the challenges. The participants used metaphors to describe and understand a challenge they had agreed upon collectively. They then made this understanding tangible by using low-tech materials like LEGOs, paper, and cardboard as figure 2 illustrates. The resulting tangible representation reflected the evolving understanding of the challenge as expressed through shared metaphors. In the final stage, they developed proposals to address the challenge and the potential assumptions embedded in the metaphors.

Fig 2. Metaphors created during the *Parliament of Challenges* workshop (2022): *"The race to have access to healthcare"* and *"The fallen"*, visualizing participants' reflections on inequity in healthcare access.

Phase 1- Connect and Relate

Connect and Relate deepens the understanding of societal challenges by fostering self-awareness and mutual understanding among all actors involved, including humans and non-humans. Students experiment with techniques to understand and to create awareness of power relations, diverse worldviews, and motivations. In this phase, the focus is on exploring who the involved actors are, what matters to them, and why they collaborate. As a result, these activities support understanding how values and norms shape perspectives, responsibilities, and relations.

A section of the program focused on societal leadership incorporates Theatrical Technology Assessment (TTA) techniques (Visscher, 2024), which blend Constructive Technology Assessment and improvisational theatre. Participants in TTA engage in role-play simulations on healthcare technologies and gain unique and impactful insights into how to anticipate and transcend complex socio-technical dynamics. These insights not only benefit the educational curriculum projects but also contribute to the professional development of students in addressing technological and societal challenges.

While these activities already encourage critical reflection on power and identity, future iterations of Responsible Futuring could benefit from integrating complementary methodologies like the Three Horizons Framework (Sharpe et al., 2016). This framework makes temporal dynamics explicit, helping participants to explore how different systems and power relations might evolve over time. It therefore encourages relational understanding of the challenge by mapping different actors, motivations, and forms of influence interact and evolve across horizons.

Building on the groundwork established in Articulating the Societal Challenge (phase 0), this phase could be complemented by methods inspired by Causal Layered Analysis (Inayatullah, 1998) to examine how underlying narratives and worldviews shape relationships among actors. Together, these approaches could enrich the *Connect and Relate* and *Understand and Frame* phases by making structural dynamics, temporal evolution, and value tensions more explicit, helping participants identify leverage points and pathways for transformation.

Phase 2- Understand and Frame

Understand and Frame explores the interdependencies among actors in relation to societal challenges. Using techniques from systemic design (Jones, 2014) and frame creation (Dorst, 2015), this phase encourages to examine any conflicts or complementarities, and to gain a holistic understanding of the system they generate. This process of collective sensemaking allows for an exploration of how to upgrade an understanding of the system and create a new frame.

We use tools like the Identity Wheel and Matrix of Domination to help students reflect on their identities and understand the power dynamics at play while addressing societal challenges. Value mapping activities also allow for a deeper exploration of conflicting values and perspectives. In 2020, during a program module called *Futurism*, we provided students with future scenarios for smart cities to examine the complexities and controversies of using technology in cities. By assuming different stakeholder roles and participating in value-mapping exercises, the students created a network of conflicts that encouraged dialogue and aimed to find common ground as shown in figure 3 (Geenen et al., 2021; Geenen et al., 2022). This activity helped the students to understand the conflicts and dilemmas that emerge from the use of technology. It enabled them to break down controversies into their individual components, revealing the nuanced, multifaceted nature of the issue. By exploring the diverse values and perspectives of stakeholders, students were able to develop a new, more informed frame for understanding the problem.
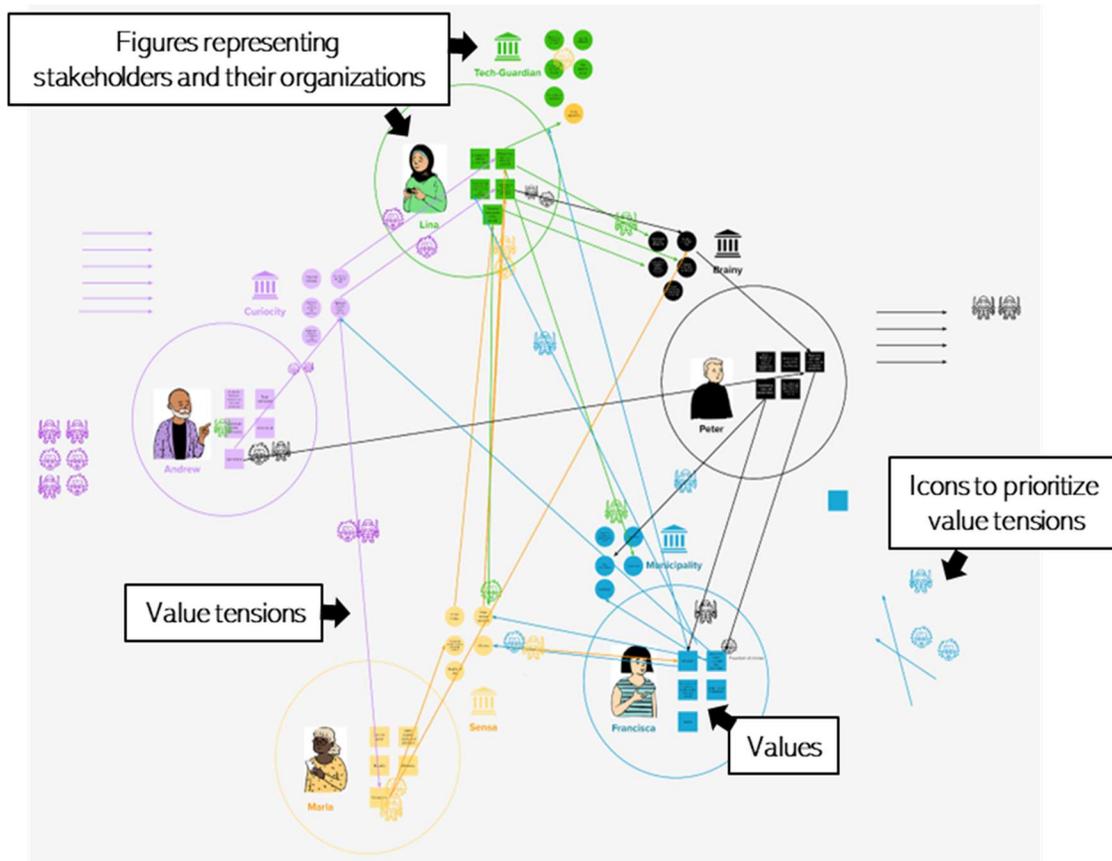
Fig 3. Network of conflicts created by students in the context of a smart city scenario

Phase 3- Imagine and Ideate
Imagine and Ideate invites students to engage in creative and generative activities to make futures tangible. Through exposure to speculative design (Auger, 2013) and design fiction (Bleecker, 2022), students learn to create relatable and impactful narratives, artifacts, and experiences that provoke reflection and dialogue. These activities help to explore the values that could shape our futures; the ones we wish to pursue, as well as those we hope to avoid. At the core of this phase is the creation of 'provotypes'(provocative prototypes) that highlight the diverse perspectives and values surfaced in previous phases. This phase is both playful and reflective, encouraging students to represent potential futures in low-fi but meaningful ways that invite critique and imagination.

For example, during spring 2022, we brought together students, mobility and sustainability experts, and practitioners from the municipality of Enschede to explore ways to decrease car usage in the city. The students engaged citizens in a simulated morning commute, visualizing CO2 emissions, and asking them to consider 'compensation 'options such as exchanging emissions for showers or vegetarian meals. Using design fiction, the team created communication prototypes, including a speculative newspaper and an interactive app, to deliver an immersive experience that highlighted the individual and collective impact of mobility, shown in figure 4. The project aimed to raise awareness not only of environmental costs, but also of how climate emergencies might influence everyday life and future policy decisions.

Fig 4. In the left image figure, we see a speculative future magazine bringing future mobility choices to life and consequences thereof. The right image figure shows the impacts and tradeoffs of future mobility choices.

Phase 4- Reflect and Reframe

Reflect and Reframe centers on identifying collectively desirable futures and co-developing roadmaps of actions to achieve them. Drawing on backcasting and generative ethics, this phase encourages participants to articulate visions that are not only feasible but also ethically grounded and socially inclusive. The outcome is often a set of collaboratively developed guiding principles, strategic roadmaps, or actionable plans rooted in shared values. This phase aligns with Anticipatory Governance (Guston, 2014), since it fosters reflexivity, and the integration of futures thinking activities into decision-making processes.

An example of the activities we use to encourage stimulate reflexivity in Reflect and Reframe is the 'Letter to the Future Cities' exercise. Participants write a personal letter to their city outlining their desires and expectations related to a societal challenge. The letters are then shared and discussed as a group to surface patterns, tensions, and shared values. These reflections often serve as conversational artifacts, that can be revisited with stakeholders to establish dialogue, inspire visions, or inform the early stages of roadmap development. While we cannot claim that all sessions immediately translate into implementation (given the time and commitment such processes require), we use this activity to plant seeds for collaboration. It supports a shift from individual reflection to collective articulation, eventually informing the joint development of pathways for action. In our broader approach, these reflective artefacts function as low-threshold entry points for continued engagement, often feeding into subsequent co-design sessions or strategic dialogues with institutional partners.

Moving forward

Experimenting with ways to create spaces of transdisciplinary co-speculation in educational programs is not exempt from challenges. Ensuring equal participation and representation of stakeholders, particularly marginalized communities, is difficult. Fair involvement requires creating inclusive spaces that value diversity and take power imbalances into account, which are often overlooked in non-transdisciplinary approaches.

A second point of attention is ensuring that co-speculation activities are more deeply embedded within curricula. Rather than isolated moments within workshops, these activities should be sustained across learning trajectories to maximize impact. We have experienced that this requires a shift in current traditional educational paradigms, and a commitment to collaborative and open ways of working. Resistance may arise, particularly from those used to hierarchical and expert-driven problem-solving. Overcoming this resistance calls for clear communication of the benefits and outcomes of co-speculation, and a willingness to engage in continuous dialogue and collaboration with others.

Looking ahead, our experiences with applying Responsible Futuring have shown that a flexible structure, which accommodates methods tailored to each phase, strengthens the framework's adequacy and contextual relevance. While this essay has focused on the activities we developed to support critical reflection, awareness of positionality, and value-based dialogue, we encourage future iterations to experiment with additional approaches from the broader field of futures thinking. For instance, Causal Layered Analysis (CLA) (Inayatullah, 1998) offers ways to critically

examine dominant assumptions and inherited narratives. Likewise, the Three Horizons Framework (Sharpe et al., 2016) could help participants explore how systems and power relations evolve over time. Exploring these frameworks and similar ones further would deepen the power-aware and structural engagement of co-speculation practices.

We encourage further exploration on how to strengthen the actionability of the outcomes generated through Responsible Futuring. The 'Reflect and Reframe 'phase guides participants in moving from 'vision to roadmap ' through activities such as backcasting and generative ethics. At the same time, we recognize the need for deeper insights into how these outcomes translate into concrete strategies, policy contributions, or long-term initiatives. Strengthening this connection would enhance Responsible Futuring not only as a reflective and pedagogical approach, but also as a practical framework for generating meaningful impact in projects and practices.

Despite the challenges, we believe that cultivating spaces of transdisciplinary co-speculation is timely and necessary. These spaces expand our collective capacity to imagine otherwise, challenge dominant assumptions, and reframe what is possible. As a framework, Responsible Futuring does not resolve the challenges of collective futuring but offers a lens through which to critically examine how these challenges are approached, framed, and enacted in practice. We encourage researchers, educators, and practitioners to engage critically with similar frameworks, exploring their potential and limitations as a way of fostering transdisciplinary dialogue and situated experimentation in futuring practices.

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