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KU LEUVEN

FACULTEIT SOCIALE WETENSCHAPPEN

Responding to climate challenges with multispecies arts

Co-creating speculative worlds with the other-than-human

Antje JACOBS

Proefschrift aangeboden tot het verkrijgen van de graad van
Doctor in de Sociale wetenschappen (KU Leuven) and
Doctor in de Educatieve wetenschappen (The University of Melbourne)

Promotor: Prof. Dr. Karin Hannes [KU Leuven]
Promotor: Prof. Dr. Marcia McKenzie [The University of Melbourne]
Copromotor: Prof. Dr. Steven Devleminck [KU Leuven]
Copromotor: Prof. Dr. Sarah E. Truman [The University of Melbourne]

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Responding to climate challenges with multispecies arts

Co-creating speculative worlds with the other-than-human

Antje JACOBS

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Doctor of Philosophy

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> *"When I came to write science-fiction novels, I came lugging this great heavy sack of stuff, my carrier bag full of wimps and klutzes, and tiny grains of things smaller than a mustard seed, and intricately woven nets which when laboriously unknotted are seen to contain one blue pebble, an imperturbably functioning chronometer telling the time on another world, and a mouse's skull; full of beginnings without ends, of initiations, of losses, of transformations and translations, and far more tricks than conflicts, far fewer triumphs than snares and delusions; full of space ships that get stuck, missions that fail, and people who don't understand. I said it was hard to make a gripping tale of how we wrested the wild oats from their husks, I didn't say it was impossible. Whoever said writing a novel was easy?*
>
> (Le Guin, 1986, p. 4)

Writing this doctoral thesis has felt a little like Ursula K. Le Guin's *carrier bag*. Throughout my doctoral degree, I have collected and carried an ever-growing bag of things: encounters, creations, conversations, readings, places, people, and ideas. Gathered throughout the years, these things accumulated and connected in various, messy ways, guiding not only the research process but also shaping who I have become. Some have been part of my bag long before this journey began; others I encountered along the way. Yet all have contributed to the creation of this dissertation. Let me unpack this bag for you and acknowledge everyone's contributions.

I first turn to my supervisors. Doing a joint degree with a supervisory team spread across different parts of the world and at different universities was challenging, to say the least, but it provided me with a research trajectory filled with learnings that I will take with me into future career paths. Karin, the guidance I have received from you over the past four years has been invaluable. I consider you a mentor I hope to return to, randomly walking into your office when I encounter challenges or have questions, or to share little wins, as I have done the past four years. Your out-of-the-box thinking has pushed me to explore and experiment, and has given me the freedom to be creative, even when a more straightforward option was available. Needless to say, we had a lot of fun along the way. I also want to thank my co-supervisor, Steven. When I had more art-related or creative questions, our conversations made me excited and eager to dive back into where my passion lies: the arts.

Doing my PhD partly at the University of Melbourne also changed my perspective. Marcia, I really enjoyed learning from you. I could always reach out or walk into your office when I had questions or doubts and was met with a friendly face. Your guidance on including place in my research has really shaped the dissertation I present today. Together with Sarah, you made me feel at home in a new research group during my time in Melbourne. Sarah, I also want to thank you for your openness and your critical questions, which really guided me in the right direction, particularly when using research-creation as my methodological approach.

My guiding committee and chair have been part of these conversations as well. Kristof, I enjoyed your creative outlook on my project, which pushed me to delve deeper into its artistic focus. Kate, your own research projects have served as great examples and inspired my research. I would also like to thank you for inviting me into StudioFive to do a residency, from which I learned a lot.

I really valued the external jury's perspective on my work, and your comments have significantly improved my dissertation. Riikka, your multispecies-focused perspective has made me delve deeper into the temporalities and multiplicity of multispecies worlds. Lynn, your comments have made me more attentive to theoretical tensions, transparency, and accuracy in research, as well as to issues related to justice, ethics, and difference.

My work would not have been possible without all the people who decided to participate in the Labs. Without your engagement, my work would not have been possible, or would have taken a different form. Thank you for your time, your efforts, your creative brains that curated multispecies worlds, and your enthusiasm. It is through my engagements with you in the Labs that I have learned the most.

There is a never-ending list of colleagues on whom I was able to count. I want to start by thanking my dear friend and colleague, Angie, for the endless talks, our creative intermezzos, the generative collaborations, and the never-ending support I was lucky to receive from you. But also for inviting me into your family, and, most importantly, for being my friend from the very start. I also want to thank Charlotte, Cato, Elien, and Elif, for being the best office mates one could wish for and for the random thoughts and questions you had to keep up with; Hanne, Natalia, and Koen, for our exciting walking-related conversations and brainstorm sessions; Sidra, Katarina, and Subaita, for our discussions and lunch dates. I also want to thank Yannis and Koenraad for their enthusiasm and contributions to the Living Lab project. And to my colleagues and friends in Melbourne, Keara, Stef, Rita, and Siqing thank you for making me feel at home. Throughout the PhD and during the last stages, the doctoral school and admin support of KU Leuven, more particularly Kristien, Charlotte, and Martine, have helped and guided me. I know it was not an easy process, and one filled with urgency, but your kind welcomes and advice really pulled me through.

My carrier bag was, of course, not empty when I started my doctoral journey. In fact, I had already been carrying things long before this journey began. To my friends and family, your support has carried me and continues to do so. Particular thanks go to my good friends Lotte, Pauline, and Ellen.

It is through the support of my parents, in particular, that I was given so many of the things I carry with me today. Often taken for granted, they have given me a range of opportunities that otherwise would not have existed, brought me to places I otherwise would not have visited, and generated thoughts I otherwise would not have thought. So, thank you, Mom and Dad, for the endless support I am privileged to receive from you every single day. This would not have been possible without you, and I will continue to carry what you have given me with great care and attention along my way. Joachim and Lieze-Lotte, you are without a doubt part of this too.

And lastly, yet the one dearest to my heart, this doctoral thesis, including its bumpy and cheerful process, would not have been possible without Kobe, who made sure my carrier bag would not become too heavy or, in case it was, helped me carry it to the very end. Thank you for helping me carry it overseas for extended periods of time, sometimes together, other times apart, which I know was a lot to ask. But also for unpacking every step together with me: from reviewing slides and listening to my presentations, proofreading papers, to living in Leuven and figuring out life, most of the time with keen enthusiasm, but always with great support. I cannot express how much I enjoy sharing my bag with you. It is needless to say that you are not merely part of my carrier bag, but the one I share life with.

To the reader,

I hope you enjoy rummaging through my bag, of which you have probably been a part all along. May this thesis spark your imagination of worlds that move you beyond the ideas that keep us stuck. Perhaps this thesis will find its way into your carrier bag of life, too.

ABSTRACT

This doctoral research is structured around three guiding anchors. The first anchor is the *climate crisis*. I consider anthropogenic climate change and its associated challenges as the general context in which my research takes place and to which it responds. Second, I engage with *multispecies relationality* as an ontological lens through which to explore climate change. And third, I use *creation and speculation* as practices to engage with climate change and multispecies relationality. Bringing these anchors into dialogue, this doctoral research examines how multispecies worlds can be imagined in response to contemporary climate challenges. It further considers how reimagined and reconfigured multispecies relationalities might inform more liveable climate futures, and how these speculative possibilities can be created by and shared with wider publics through creative and participatory engagements.

I began this exploration by engaging with artistic practices that foreground multispecies relationality across diverse aesthetic, material, and conceptual modalities (Chapters 1-2). These artistic practices informed the empirical work of the research. Adopting participatory research-creation as its methodological approach, the empirical work unfolded through research-creation Labs, presenting generative and creative spaces to think, make, and speculate collectively. In two of these Labs, those held in Belgium and Australia, participants were invited to envision forms of multispecies collaboration in the face of climate change (Chapters 3-4). In these Labs, creative and speculative methods were employed to elicit participants' imagination, leading them to produce visual artworks and fiction stories. In addition, a third Lab in Belgium was organized to rethink and reimagine participatory research approaches, with a particular focus on the living lab method, exploring how this approach might be used in crisis contexts such as (but also beyond) climate change and climate disasters (Chapter 5).

The research-creation Labs generated critical perspectives on participatory research methods and the significance of place in speculative ethnographic research (Chapter 6). This work is accompanied by range of creative contributions (e.g., an exhibition and a climate fiction story) that further unfold critical dimensions of speculative thinking (Chapter 7). By organizing and living through the research-creation Labs, this doctoral research emphasizes the need for critical accounts of speculative inquiry that recognize speculation as inherently political, carrying an ethical responsibility to the worlds one brings into being and the relations these worlds reconfigure. Critical speculative inquiry, then, provides tools to recognize issues of fairness, question underlying assumptions, or actively work toward more just possibilities. In advocating for critical speculative inquiry, particularly in the context of climate change, this thesis contributes theoretically to environmental humanities and multispecies studies, and methodologically to speculative inquiry, futures studies, and research-creation.

SAMENVATTING

Dit doctoraatsonderzoek bevindt zich op het kruispunt van drie centrale en onderling verbonden dimensies. De eerste is de huidige *klimaatcrisis* waarmee we in diverse vormen en intensiteiten te maken krijgen. Ik beschouw antropogene klimaatverandering en de daarbij horende uitdagingen als de algemene context waarop mijn onderzoek reageert en die het noodzakelijk maakt. Ten tweede fungeert het concept *'multispecies relationaliteit'* als de ontologische lens om deze problematiek te benaderen. Het verwijst naar de intieme en wederkerige verwevenheid tussen mens en natuur. Ten derde worden *creatieve en speculatieve methoden* ingezet om voorgaande dimensies niet enkel te beschrijven, maar ook actief te her-configureren en her-verbeelden. Door deze drie dimensies in dialoog te plaatsen, onderzoekt dit doctoraat hoe multispecies werelden kunnen worden verbeeld als respons op de hedendaagse klimaatcrisis. Meer concreet wordt onderzocht hoe dergelijke her-verbeelde multispecies relaties kunnen bijdragen aan een meer leefbare klimaat toekomst. Het bekijkt daarnaast ook hoe deze nieuwe mogelijkheden via creatieve en participatieve methoden kunnen worden gearticuleerd door en gedeeld met een breder publiek.

Ik begin dit onderzoek met het bestuderen van artistieke praktijken die multispecies relationaliteit centraal stellen in diverse esthetische, materiële en conceptuele kunstwerken (hoofdstukken 1 en 2). Deze conceptualisering vormt de basis voor het empirische luik van dit onderzoek, waarbij ik 'participatieve research-creation' hanteer als methodologische benadering. Het empirische werk ontvouwt zich via de organisatie van research-creation Labs of workshops die functioneren als generatieve en experimentele ruimtes voor collectieve kennisproductie, waarbij samen doen, denken en speculeren centraal staan. In twee van deze Labs, georganiseerd in België en Australië, werden deelnemers uitgenodigd om nieuwe vormen van multispecies samenwerking te verbeelden (hoofdstukken 3 en 4). Binnen deze Labs werden creatieve en speculatieve methoden ingezet om de verbeeldingskracht van deelnemers te stimuleren, wat resulteerde in de productie van visuele kunstwerken en fictieverhalen. Daarnaast werd een derde Lab georganiseerd in België met als doel participatieve onderzoeksmethoden zelf te herdenken. Met bijzondere aandacht voor de living lab methode werd collectief onderzocht hoe die methode kan worden ingezet in crisissituaties zoals (maar ook buiten) klimaatverandering en klimaat gerelateerde rampen (hoofdstuk 5).

Het empirisch onderzoek in de research-creation Labs leidde tot nieuwe inzichten omtrent participatieve onderzoeksmethoden enerzijds, en het belang van plaats in speculatief etnografisch onderzoek anderzijds (hoofdstuk 6). De empirische component werd aangevuld met een reeks creatieve bijdragen (bv. een tentoonstelling en fictieverhaal) die de kritische dimensies van speculatief denken over multispecies relationaliteit verder uitdiepen (hoofdstuk 7). Doorheen dit doctoraatsonderzoek wordt speculatief denken onthult als inherent politiek. De praktijk van speculatief denken vraagt daarom om een kritisch-ethisch perspectief dat verantwoordelijkheid neemt voor de nieuwe mogelijkheden en relaties het helpt genereren. Door the pleiten voor *kritisch speculatief onderzoek*, in het bijzonder in de context van klimaatverandering, draagt dit doctoraat bij aan de environmental humanities en mulispecies studies op

theoretisch vlak, en aan speculatief onderzoek, futures studies en research-creation op methodologisch vlak.

DECLARATION

This thesis comprises only my original work towards the Degree of Doctor of Philosophy. Due acknowledgement has been made in the text to all other material used. The thesis is fewer than 100,000 words in length, inclusive of footnotes, exclusive of tables, figures, bibliography, and appendices.

_____

Antje Jacobs

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PREFACE: CO-AUTHORSHIP STATEMENT

I write this thesis as a 'thesis with publication,' meaning that parts of this research have already been published. Below, an overview is provided of the publications included and how they are included in my thesis. In case of co-authorship, the specific contributions of each author are described.

Introduction contains parts of: Jacobs, A. (2025). Speculating-with other-than-humans in multispecies climate fiction: Canopy of the Hidden Alley. *Australian Journal of Environmental Education, 41*(3), 616-632. https://doi.org/10.1017/aee.2025.10069

The general introduction of this thesis incorporates a paragraph on relationality from the article “Speculating-With Other-than-Humans in Multispecies Climate Fiction: Canopy of the Hidden Alley." In addition, the chapter overview section draws, in part, on the abstracts of the published articles included in this thesis (see below).

Chapter 1 contains parts of: Jacobs, A. (2025). Speculating-with other-than-humans in multispecies climate fiction: Canopy of the Hidden Alley. *Australian Journal of Environmental Education, 41*(3), 616-632. https://doi.org/10.1017/aee.2025.10069

Chapter 1, entitled "Multispecies Arts for the End of Anthropocentric Worlds" draws partly on material from the solo-authored article "Speculating-With Other-than-Humans in Multispecies Climate Fiction: Canopy of the Hidden Alley," published in the *Australian Journal of Environmental Education,* as part of a special issue on climate fictions of the Anthropocene (Jacobs, 2025). In particular, the sections on "Theory: Becoming-With the Multispecies Contact Zone," "Art as a Mode of Becoming- and Speculating-With the Other-than-Human," and "Conclusion: Art as a Practice to Imagine Multispecies Possibilities" are adapted from this publication.

Chapter 2 is published as: Jacobs, A., Devleminck, S., Hannes, K. (2023). Co-creatively producing knowledge with other-than-human organisms in a (bio)technology-controlled artistic environment. *Social Inclusion, 11*(3), 51–64. https://doi.org/10.17645/si.v11i3.6609

Chapter 2, entitled "Bio Art: Co-Creatively Producing Knowledge with Other-than-Humas in a (Bio)Technology Controlled Artistic Environment" was published in the journal *Social Inclusion* under the same title (Jacobs et al., 2023). For this publication, Jacobs conceived the research idea and developed the research design. Jacobs collected and processed the data. Jacobs, Devleminck, and Hannes analyzed the data. Jacobs, with contributions from Devleminck and Hannes, wrote significant parts of the article.

Chapter 3 is published as: Jacobs, A., Anthoni, E., Busseniers, E., Claes, S., Huybrechts, L., Van Leemput, M., Vrancken, K., Carriera, L., Colson, N., Dorn, C., Hostetler, A., Janssens, A., Kabendela, G., Kose, A., Luo, D., Majogoro, M., Sanchez, L. R. J., Stepanovic, J., Swillen, A., Vrebos, H., Wan, X., Weytjens, H., Zygmunt, M., Devleminck, S., & Hannes, K. (2024). Co-designing multispecies speculations through biofuturing. *Qualitative Inquiry*, *31*(2), 122-135. https://doi.org/10.1177/10778004241231919

Chapter 3 on the BioFutures Living Lab in Belgium has been published in *Qualitative Inquiry* as "Co-Designing Multispecies Speculations through Biofuturing" (Jacobs et al., 2024). In this publication, Jacobs, Anthoni, Busseniers, Claes, Huybrechts, Van Leemput, Vrancken, Devleminck, and Hannes conceived and planned the reseach-creation event. All authors were part of the research-creation event. Jacobs took lead in theorizing the concepts and writing substantial parts of the manuscript, with input from Carriera, Colson, Dorn, Hostetler, Janssens, Kabendela, Kose, Luo, Majogoro, Sanchez, Stevanovic, Swillen, Vrebos, Wan, Weytjens, and Zygmunt. All authors provided critical feedback and helped shape the manuscript.

Chapter 4 is submitted as: Jacobs, A., McKenzie, M., & Truman, S. E. (2026). *Emplaced speculation: Imagining multispecies worlds in the colonial ruins of the Anthropocene.* [Manuscript submitted for publication].

Chapter 4 on the Multispecies City Lab in Australia has been submitted to the journal *Futures* under the title "Emplaced Speculation: Imagining Multispecies Worlds in the Colonial Ruins of the Anthropocene" (Jacobs et al., 2026). In this publication, Jacobs, McKenzie, and Truman engaged in the conception of the research and developed the research design. Jacobs collected and processed the data, and analyzed the data with support from McKenzie and Truman. Jacobs took the lead in writing the manuscript, with contributions from McKenzie and Truman.

Chapter 5 has been published as: Jacobs, A., Hostetler, A., Hinnekint, K., Perifanos, Y., Centeno, J. P., Cruz, R., Keskin, E., Mazet, L., Navarro, G., Parion, C., Sels, A. J., Vrebos, H., & Hannes, K. (2026). Living the Lab: Rethinking Collaborative Practices in Living Lab Contexts amid Polycrisis. *Social Inclusion, 14*, 1-19. https://doi.org/10.17645/si.12026

Chapter 5, entitled "Living the Lab: Attentive Collaboration amid Polycrisis," has been accepted for publication in the journal *Social Inclusion* under the same title (Jacobs et al., in press). Jacobs initiated the research idea together with Hostetler, Hinnekint and Perifanos, who all engaged in the design and development of the research-creation event. All authors took part in the research-creation event and

contributed to the research conducted. Jacobs and Hostetler wrote significant parts of the manuscript with input from Hinnekint, Perifanos, Centeno, Cruz, Keskin, Mazet, Navarro, Parion, Sels, Vrebos, and Hannes.

Chapter 7 contains parts of: Jacobs, A. (2025). Speculating-with other-than-humans in multispecies climate fiction: Canopy of the Hidden Alley. *Australian Journal of Environmental Education, 41*(3), 616-632. https://doi.org/10.1017/aee.2025.10069

Chapter 7 on "Propositions for Further Speculation" includes materials from the article "Speculating-With Other-than-Humans in Multispecies Climate Fiction: Canopy of the Hidden Alley," published in the *Australian Journal of Environmental Education* (Jacobs, 2025). More specifically, parts of the Introduction, as well as the section on "Climate Fiction Story: Canopy of the Hidden Alley" are adapted from this publication.

Appendix 1 contains parts of: Jacobs, A., & Hannes, K. (2026). *An extended futures wheel workshop* [Workshop tool]. https://doi.org/10.13140/RG.2.2.21086.09280

The Appendix is based on an unpublished workshop tool developed by Jacobs and Hannes. Jacobs and Hannes contributed to the design and implementation of the tool and to the writing of the text.

PROLOGUE

While often overlooked in (re)presentations of research, the practical conditions and circumstances of research often play a more significant role than researchers generally tend to admit. They are often downplayed or neglected in favour of emphasizing the relevance or urgency of a study. Yet, these practical arrangements actively shaped my research. The doctoral thesis you are about to dive into was profoundly shaped by the fact that I undertook a *joint* doctoral trajectory between KU Leuven in Belgium, my home country, and The University of Melbourne, located roughly 15,000 kilometres away in Australia. As part of this joint degree, I was required to spend at least one year of my doctoral studies at each institute, which provided me the opportunity to visit The University of Melbourne twice: once for a period of ten months, and again for about three months. The joint dimension also means that my research is positioned in both the field of Sociology and the field of Education. This required me to engage with scholars from both disciplines, attend conferences from both perspectives, and continually negotiate how my work is situated across these (and other) fields.

This doctoral thesis is a product of this joint trajectory. Not only did it shape the location and contexts for conducting the empirical work, it also significantly influenced the theorization of the research, and along with it, the methodological approaches. Place became an undeniable agent that steered my thinking in directions I had not foreseen. I came to realize how place affected speculative thinking about climate change: climate change in Belgium and Australia are, of course, very differently experienced, both contexts have different ecosystems and other-than-human relations to speculate-with, as well as varying histories that shape what alternatives one imagines. As a response, I began engaging with critical place-based inquiry, and through this engagement, place emerged as one of the central concepts of my research. My thesis would likely have developed differently had I not undertaken this PhD jointly. It illustrates that my research process was open to emergence: it allowed ideas to arise from interactions with place (and people, of course), showing that research is relational, situated, and cannot be fully predicted.

TABLE OF CONTENTS

ACKNOWLEDGMENTS i
ABSTRACT v
SAMENVATTING vii
DECLARATION ix
FUNDING ix
PREFACE: CO-AUTHORSHIP STATEMENT xi
PROLOGUE xv
TABLE OF CONTENTS xvii

BEGINNINGS 1
Anchoring this research 3
Climate: An anthropocentric "world on fire" 4
Multispecies responses to "live on a damaged planet" 6
Creative and speculative research practices 8
Overview of the research and guiding questions 11
Where is theory? 14
Methodology and methods 16
Research design: Participatory research-creation 16
Artistic data creation in research-creation Labs 19
Data tracings and dialogues 24
Ethics of collective thinking and making 25
Chapter overview 27

PART I: MULTISPECIES ARTS 31

CHAPTER 1: Multispecies arts for the end of anthropocentric the world 33
Introduction 35
Theory: Becoming-with in the multispecies contact zone 36
Multispecies arts: Multispecies relationality in/through creative practices 38
Art as a multispecies contact zone 38
Art as a mode of becoming- and speculating-with the other-than-human 40
Conclusion: Art as a practice to imagine multispecies possibilities amid climate change 41

CHAPTER 2: Co-creatively producing knowledge with other-than-humans in a (bio)technology-controlled artistic environment 45
Introduction 47
Objectives and research questions 48
Theoretical framing 48
Methodology 50
Setting 50
Sample 51
Analysis 51
Findings 55
Formal characteristics and artistic inquiry 55
Positional stance of bio art 55

Posthuman concepts and practices 58
Discussion and conclusion: New epistemology through bio art's relational ontology 59
Before moving on: A methodological and theoretical reflection 61

PART II: RESEARCH-CREATION LABS 63

CHAPTER 3: BioFutures Living Lab
Co-designing multispecies speculations through biofuturing 65
Introduction 67
Biofuturing in theory: A creative ecology for research and creation 68
Biofuturing in practice: Biofutures Living Lab methodology 70
Setting 70
Participants 70
Living lab methodology 70
Findings: Co-designing multispecies speculations 73
Problematizing contemporary energy and connectivity (Phase 1) 73
The co-designed speculative prototypes and storylines (Phases 2 and 4) 73
Evaluating and reflecting upon multispecies speculations (Phase 3) 80
Discussion 81
Conclusion 82

CHAPTER 4: Multispecies City Labs
Emplaced speculation: Imagining multispecies worlds in the colonial ruins of the Anthropocene 85
Introduction 87
Background and theory: Multispecies speculation in the colonial ruins of the Anthropocene 89
Speculating in settler-colonial urban geographies 89
Speculating about multispecies geographies 90
Methodology and methods: The Multispecies City Labs 91
Speculative thinking practices in the Labs 91
Tracing colonial ruins and multispecies alternatives in participants' speculations 93
Tracing ruins and counter possibilities 93
Colonial ruins in multispecies speculations 93
Emerging multispecies counter cities 96
Emplaced speculation amid ruins 98
Concluding thoughts: Potentialities of emplaced speculation in and about the Anthropocene 100

CHAPTER 5: Living Labs in Times of Crisis
Living the lab: Rethinking collaborative practices in living lab contexts amid polycrisis 103
Introduction 105
Living labs amid complexity 106
Designing and living the lab 108
Workshop 'Living Labs in Times of Crisis' 108
Creative outcomes of the workshop 110
Towards a praxis of attentive collaboration in living lab contexts 111
Temporal tensions: The urgency of crisis, living labs, and attentive collaboration 112

Ethical tensions: Stakeholder inclusion and real-life challenges 113
Epistemic tensions: The challenge of being stuck and a practice of 'unlearning' 115
Affective tensions: Building affective relationships in collaborative processes 117
Concluding remarks 118

PART III: CREATIVE AND METHODOLOGICAL REFLECTIONS 121

CHAPTER 6: An emplaced speculative ethnography of worlds to come 123
Introduction: Cross-case reflections 125
Speculative ethnography 126
Four enabling constraints 128
Imagining (otherwise) 128
Moving and walking 129
Making and doing 130
(Sensory) storytelling 131
A placed-based approach of speculative ethnography 132
Concluding thoughts: Moving toward worlds to come 134

CHAPTER 7: Propositions for further speculation: Creative research outcomes 137
Introduction: Further speculations 139
Exhibition: *'Multispecies Testimonies of Climate Change'* 140
The multispecies testimony and the challenge of anthropomorphizing the other-than-human 141
Climate fiction story: *'Canopy of the Hidden Alley'* 143
Canopy of the Hidden Alley 145
Speculating multispecies interactions in 'Canopy of the Hidden Alley' 152
Summary 154

ENDINGS 155
Dragging anchors and frictional encounters 157
Emplaced speculation: Speculative thinking of/on *terror*formed lands 158
Speculation prompts: Building multispecies worlds 160
Bringing the other-than-human into speculation processes 162
Evaluating speculative worlds 163
Future research and speculations 165
Implications across fields and practices 166
Research trajectories in the making 167
Ending, for now 168

REFERENCE LIST 171

APPENDIX 193
1. Workshop tool: *'An extended futures wheel approach'* 195

BEGINNINGS

ANCHORING THIS RESEARCH

One of my early memories takes me back to a small coastal town in Belgium, visiting with my parents and collecting seashells while wandering through the sand. Alternating my gaze from the sand to the North Sea, to my mom who is holding my hand, and to the sand again, I was searching for intact seashells to add to my personal collection at home. I remember my mom mentioning "when I was a child, there were many more seashells on the beach, and really big ones too." This fleeting moment of reflection from my mother meant nothing more than a simple memory at the time. In fact, I remember being disappointed that I could not find more of these big and beautiful shells myself. It was only years later that I began to reflect on this moment as a lived testimony of environmental change. It struck me that such climate experiences often remain untold and unrecognized, while they could present a big part of the affective and embodied understandings of environmental change.

This childhood memory had faded, almost like a small wave coming ashore. I was reminded of this memory during a workshop I attended in which I was prompted to share my first experience of climate change.[1] The memory of shell-searching beach days quickly resurfaced, and ever since, this memory has stayed closely with me. It has informed my doctoral research in which I focused on collecting personal stories and perspectives on climate change through the imagination of alternative climate worlds. Due to my background in Art Studies, it did not take long for me to consider art's role in this equation. Yet, the idea that art can teach us anything relevant has long been rejected in Euro-Western academia, where dominant discussions on "knowledge" foreground rationality, reason, and objective truths (Vaage, 2020). In response, I started wondering, reflecting, and researching how the arts could be used as a mode of inquiry to help us understand climate change differently. While sitting with this question for the past four years, I not only came to realize the seashells are not souvenirs you can simply collect to display on your designated shell-shelf, but also that the arts, including its creation, exhibition, and perception, can become a means to explore untold stories (of climate change) and create new (speculative) ones.

My doctoral research focused particularly on the latter: I have explored ways of imagining alternative worlds in times of climate change from a multispecies perspective. Through this exploration, I aimed to attend to the relationality between the human and other-than-human, while being attentive to matters, structures, and histories of place. In this work, three anchors guided me, whose chains are always knotted together. Throughout this thesis, I take various directions, explore hidden alleys, wander off on methodological and creative side pathways. Yet, these three anchors have always grounded my work and I have always returned back to them. The first one is the *climate crisis*. I consider anthropogenic climate change (i.e., caused by human activity) and its associated challenges as the general context in which my research takes place and to which it responds. Second, I engage with *multispecies relationality* as an

[1] This workshop, entitled "More Than Just Sustainability! Let's Hack the Anthropocene," was organized and facilitated by SWISP Lab under guidance of A/Prof. Kathryn S. Coleman and Dr. Sacha Healy at Science Gallery Melbourne.

ontological lens through which to explore climate change. It refers to the intimate and reciprocal entanglement between the human and other-than-human. And third, I use *creative and speculative practices* to engage with climate change and multispecies relationality. Epistemologically, adopting this approach also entails problematising dominant conceptions of methodology and research practice. While these anchors are explored throughout the chapters, I briefly introduce them and their entanglements below.

Climate: An anthropocentric "world on fire"

As I write this introduction, the news is filled with reports of the heatwave-driven wildfires sweeping Victoria, Australia, and extreme floodings affecting South Africa's northeastern provinces Mpumalanga and Limpopo, and its neighbouring country Mozambique (Mistry & Lewis, 2026). This is not exceptional. In the past years, climate-related disasters such as wildfires, extreme weather, floodings, droughts, among others, have not only increased in frequency but have also intensified in severity. This causes the loss and displacement of human and other-than-human lives, economic disruption, and heightened vulnerability for populations that are already disadvantaged, such as lower income populations, BIPOC (Black, Indigenous, and People of Colour) communities, women and girls, and LGBTQ+ communities, leading towards increased subsequent inequality (Islam & Winkel, 2017; Frege et al., 2023; Pearse, 2017; Kilpatrick et al., 2024; Parsons et al., 2024). In a time troubled by such severe climate disasters, we have controversially entered a new geological epoch titled the 'Anthropocene,' characterized by the destructive and lasting impact of humankind on the Earth (Davis & Turpin, 2013). The extraction and consumption of fossil fuels, along with deforestation and agricultural industries, have been identified as major drivers of anthropogenic climate change (UN, n.d.), contributing to global warming, ocean acidification, biodiversity loss, and rising sea levels, among others. While these environmental transformations and the climate disaster they bring about constitute a central dimension of the current 'climate crisis,' they do not capture its full scope, as climate change unfolds far beyond environmental impacts alone.

As Rachel Morgain once mentioned, it is a "more-than-climate" crisis we find ourselves in, one that is simultaneously social, cultural, and political (R. Morgain, personal communication, November 26, 2025). This resonates with the notion of polycrisis, in which multiple emergencies, disruptions, and violences are systemically entangled (Lawrence et al., 2024). The crises currently confronting us (e.g. climate change, racial and gender-based violence, political conflict, gendered oppression, pandemics, and so on) are mutually constitutive, continually reinforcing and amplifying one another (Rakowski et al., 2025; Mark et al., 2025). Their cumulative effects often produce more profound and far-reaching harm. Kathryn Yusoff, for instance, reminds us of the colonial origins attached to today's understanding of the Anthropocene that continues to control climate-related discourses. In *A Billion Black Anthropocenes or None,* Yusoff (2018) emphasizes that the anthropocentrism in the Anthropocene portrays the human as a "mythic geological maker/destroyer of worlds" (p. 25). This perspective constructs a notion of a universal humanity that fails to differentiate and acknowledge the racial origins of the Anthropocene, even though these origins are constitutive of it.

Such understandings of a ‘universal humanity’ have been addressed and opposed by Sylvia Wynter. Wynter (2003) counteracts the construction of ‘Man’—being white, masculine, Western, heterosexual, abled, and urbanized—as a representative for the entire human species, having dominance over all species inhabiting the planet. This has resulted in practices of discrimination and suppression of the so-called ‘Other,’ referring to anyone that does not fall into the rigid boundaries of this universal human: non-whites, non-males, non-Westerns, non-heterosexuals, people with disabilities, other-than-humans (Wynter, 2003). As discussed by Braidotti (2013), "the dialectics of otherness is the inner engine of humanist Man's power, who assign difference on a hierarchical scale as a tool of governance" (p. 68). In a world “where only one world fits” and Whiteness is enclosed to the centre, the Anthropocene’s “we” is not a homogeneous group (Blaser & de la Cadena, 2018, p. 3; Watts, 2013; Yusoff, 2018). At the same time, colonialism brought about significant ecological transformations, including the introduction of non-native species and diseases, as well as the exhaustion of soil through intensive plantation-based mass production (Yusoff, 2026). In this context, Yusoff (2018) argues that “[t]he centrality of race to the production of humanity in the Anthropocene requires a reconfiguration of the subject at the centre of white liberal ethical accounts and an acknowledgement of the role of race in the production of the global spaces that constitute the Anthropocene” (p. 61).

These colonial origins of the Anthropocene persist in contemporary climate-related discourses and strategies used to address environmental issues. Whyte (2019) specifically reminds us of the colonial afterlives that linger in top-down nature conservation approaches. While spotlights shine bright on the conservation movement and its commitment to preserving nature, the narratives of conservation refugees frequently go unnoticed. In the construction of conservation parks, hydropower dams or wind energy parks for renewable energy, Indigenous communities are systematically displaced from their territory (Watson, 2014); “That's how colonial power has been wielded in the past, that is, by using real or perceived urgencies to mask or justify privilege, harm, and injustice” (Whyte, 2019, p. 5). At the same time, the current climate crisis is often portrayed as a novel emergency, an emergent and unprecedented condition that introduces apocalyptic challenges that we need to overcome. Those narratives often neglect the long and ongoing struggles of racialized ‘Others,’ especially Indigenous peoples, for whom “genocidal disaster has already come, decades and centuries ago, and has not stopped and the people have not ceased ongoing worlding either” (Haraway, 2017, p. M44). Whyte (2019) argues that "the hardships many nonindigenous people dread most of the climate crisis are ones that Indigenous peoples have endured already due to different forms of colonialism: ecosystem collapse, species loss, economic crash, drastic relocation, and cultural disintegration" (p. 226).

As this doctoral research engages with the issue of climate crisis, it is imperative to acknowledge the abovementioned racial origins and consequences of environmental change, which continue to shape today's climate-related discourses and contemporary socio-economic inequalities. In this thesis, I use ‘climate crisis’ as an umbrella term to encompass a range of interconnected environmental, socio-political, and cultural issues related to anthropogenic climate change. This complexity asks for new ways

to approach intertwined challenges that the climate crisis generates. For instance, Koro and Wolgemuth (2023) argue that we need to learn how to live with the uncertainty of "an apocalyptic world on fire" (p. 652). This "apocalyptic world on fire" often centres human lives and consumption over all else. The anthropocentrism that is entrenched in Euro-Western thinking has created binary divides between the human and non-human or nature and culture, highlighting human exceptionalism (Braidotti, 2013). However, to be able live on "a damaged planet" (Tsing et al., 2017), a growing community of scholars has argued that we need to move away from binary human-centric understandings and towards a mode of being and knowing that is grounded in the premises of relationality, yet without becoming blind to differences (Barad, 2018). In this context, multispecies perspectives have emerged that emphasized relationality between the human and other-than-human.

Multispecies responses to "live on a damaged planet"

In the context of the increasingly pressing climate crisis, the study of multispecies relationality has gained increasing attention, offering new ways to think about the relationship between humans and other-than-human species. In such studies, multispecies relationality refers to the intimate entanglements that exist between various human, other-than-human, and non-human agents (Braidotti, 2013). Here, and throughout this thesis, the term 'non-humans' refers to non-living matters (e.g., material infrastructures, objects, etc.), and 'other-than-human' refers to non-human beings and environmental and biophysical forces and phenomena (e.g., animals, plants, landscape elements, weather, etc.). I chose the term 'other-than-human' instead of other variants such as '*more*-than-human' to acknowledge difference on the one hand, and to avoid reproducing hierarchies that risk obscuring the historical and ongoing treatment of many human communities as "*less*-than-human" on the other hand (Price & Chao, 2023). The usage of these different terms does not aim to reinscribe a binary between the human, other-than-human, and non-human. Its usage aids the aim for decentring the human by recognizing the different positionalities within the historical hierarchical binary and it acknowledges the harm generated through those hierarchies, instead of creating a universal being that ignores differences (Isaacs & Otruba, 2019). The term "multispecies" presents an umbrella term that combines the human and other-than-human and acknowledges their entanglement. Multispecies entanglements essentially take a relational perspective, highlighting that things come into being and transforms through their relationships with each other (Barad, 2007; Riley et al., 2024).

Fields such as multispecies studies and multispecies ethnography underscore the profound interconnection between human and other-than-human worlds (Kirksey et al., 2014; van Dooren et al., 2016). In these fields, researchers have become attentive to multispecies entanglements in which beings (both human and other-than-human) co-exist, co-emerge, and co-configure through relational processes (Kirksey, 2014; Pacini-Ketchabaw et al., 2016; van Dijk, 2021; van Dooren et al., 2016). Such relational processes encompass not only organisms such as plants, fungi, bacteria, human and other-than-human animals, but extend to biophysical entities such as mountains, rivers, the sky, a lagoon, the soil, and so on (de la Cadena, 2015; Ogden et al., 2013). Multispecies ethnographic studies have ranged from examining

flying foxes and penguins in urban environments (van Dooren & Rose, 2012) and coyotes as urban dwellers (van Patter, 2023), to researching-with and storying-with maple forests (Kimmerer, 2013; Manning, 2023) or matsutake mushrooms (Tsing, 2015), among others.

The importance of the multispecies concept has been further amplified in many fields. In education, scholars have increasingly been looking into pedagogical approaches that address multispecies living and being in the world. Hohti and Tammi (2019, 2024), for instance, have explored child-animal caring relations in a greenhouse with students in lower secondary school, arguing elsewhere that multispecies storytelling as a pedagogical practice can be used to "become critically attentive to complex, multispecies worlds" (2024, p. 595). Similarly, Pacini-Ketchabaw et al. (2016) have experimented in decentring the human in multispecies encounters in early childhood education, illustrated by children's encounters with kangaroos, earthworms, an urban forest, and ants. In planning theory and urban studies, multispecies entanglements have also entered the conversation to rethink how urban spaces might be designed to welcome other-than-human life (Houston et al., 2019; van Dooren & Rose, 2012; van Patter, 2023).

These multispecies entanglements are characterized by multispecies relationality, emphasizing other-than-human agency as the capacity of other-than-human organisms and phenomena to influence and shape reality. Not only has the concept of relationality been explored in multispecies, posthuman, and feminist materialist scholarship, but it has long been articulated within Indigenous traditions and contemporary scholarship. Indigenous relationality can be understood, among diverse understandings, as "the multiplicity of relationships that humans have with each other and the natural world" (Wildcat & Voth, 2023, p. 476). In their search for new reading pedagogies to engage with Indigenous climate fiction, Phillips et al. (2022) describe Indigenous relationality as something that "allows for imagining ways of knowing, being, and doing beyond invasions and colonization, beyond the legacies of those devastating phenomena that have produced and reproduced the ecological and social precarity we variously and unequally live through" (p. 176). They draw on Graham (2014) who addresses Aboriginal relationality as "an elaborate, complex, and refined system of social, moral, spiritual and community obligations that provided an ordered universe for people" (p. 2). The Euro-Western academy has a long history of condemning and dismissing Indigenous knowledges (Kimmerer, 2013), and in this context, Euro-Western scholarship on multispecies relationality has only recently begun to acknowledge and engage with Indigenous epistemologies.

My understanding of multispecies relationality builds on these insights as something that opposes the dualistic humanist and anthropocentric worldviews in which agency is reserved solely for human beings (Kopnina et al., 2018). In multispecies relationality, the "multiplicity of relationships" (Wildcat & Voth, 2023, p. 476) carry agency as well, shaping and transforming humans and other-than-humans as they interact. Relationality becomes a shared, ongoing process in which relationships and agents are never fixed but constantly emerging, shifting, and adapting (Braidotti, 2013; Haraway, 2016). Bennett's (2010) invitation to develop a "cultivated, patient, sensory attentiveness to nonhuman forces operating outside

and inside the human body" (p. xiv) can be understood as a call to move away from blind anthropocentrism that has polluted Euro-Western thinking, and instead become more attuned to non-human and other-than-human agencies that actively shape us. In this context, Ursula K. Le Guin argues that “one way to stop seeing trees, or rivers, or hills, only as ‘natural resources’ is to class them as fellow beings—kinfolk" (Le Guin, 2017, M16). Yet, to story and build such new multispecies perspectives and relationships, we need to be able to imagine them first (Kimmerer, 2013).

Creative and speculative research practices

It is in the arts specifically that we find some creative translations of such multispecies lenses. In fact, the methodological premises of multispecies ethnography emerged in parallel with *The Multispecies Salon,* an art exhibition taking place in various cities of the USA in 2008 and following years (Kirksey et al., 2014). As such, the arts can be considered foundational in the emergence of contemporary multispecies research approaches. For instance, various configurations of multispecies relationality appear in climate fiction (cli-fi) stories, visual and digital artworks and installations, bio artworks, and so on. They tend to question humanist and neoliberal perspectives, addressing issues of environmental and social justice. As discussed by Flores et al. (2024), "[w]orks of art and objects of visual culture have the potential to make us question established frameworks but may also reinforce them" (p. 10). Such artistic can make us attentive to the radical possibilities that lie at the horizon but remain out of reach. This makes me wonder what we can learn from these creative responses, specifically in relation to their practices of imagining alternatives. Yusoff and Gabrys (2011) discuss that the "radical potential of the arts and humanities is the ability to constitute alternative possibilities to neoliberal approaches to environments, which actively attempt to disable the imagination of alternatives, outside of economic systems of environmental governance and the valuation of natures that capital can ‘see’" (p. 519). However, within dominant Euro-Western understandings, the assumption that art can produce meaningful knowledge has long been overlooked or sidelined in favour of representational and objective truths (Vaage, 2020).

In response, over the last several decades, many scholars have reflected on and begun to challenge empirical research approaches in humanities and social sciences that claim to represent their encounters, conversations, and observations *as they are*. These concerns challenge Euro-Western scientific ideals of objective findings or universal truths. Objectivity in research, as many now contend, masks the positionality and subjectivity of the researcher. In answering to the demands for neutrality, objectivity, validity and rigour, Dewsbury (2010) argues that "the research (not just findings but the modes of engagement) inevitably becomes reductive of the world" (p. 4). The complexity of the world is not to be simply capturable and representable as it occurs. In fact, it has been argued that such realist and representational research approaches "tend to leave a sizeable portion of the world unrepresented, particularly the many subtle, unspoken and often unintentional micro performances and practices" (Gorman & Andrews, 2022). At the same time, the chosen research questions, methods and epistemic frameworks, the positionality of the researcher, and reporting style all *matter*, guiding the research and its outcomes into specific directions (Barad, 2007). In other words, "[k]nowledge projects entail the drawing

of boundaries" (Barad, 1996, p. 183). In the light of these tensions, critical attention has begun to question Euro-Western knowledge systems, the rigid boundaries of what knowledge is considered valuable, who is able to produce knowledge, and how knowledge should be created and (re)presented (Tytler, 2025).

To address and rupture such fixed boundaries on knowledge production, Vannini (2015) asserts "to embrace experimentation, to view the impossibility of empirical research as a creative opportunity (rather than a damming condition), to unsettle the systematicity of procedure, to re-configure (rather than mimic) the lifeworld" (p. 139). Challenging existing methodological approaches and engaging in methodological experimentation allows for thinking differently, to approach research and knowledge production otherwise, and engage with alternative and creative research approaches (Knight, 2023). As Myers argues, "we need to rearrange our sensorium and sense-making practices and disrupt disciplinary thought styles and ways of seeing so that other worlds within this world can come into view" (Myers, as cited in Truman et al., 2019, p. 232). This has resulted in a growing emphasis on practice-based, embodied, performative, and (co-)creative approaches to research, that enable the researcher to relate to, instead of capturing, the complexity and multiplicity of reality.

Towards 'more-than' research forms

Non-representational approaches to research have argued against reductive and schematic representations of reality, emphasizing that "there is more to the world than we can represent" (Boyd & Edwardes, 2019, p. 3). In response, non-representational methodologies do not aim to represent reality, but rather "flirts with" it (Vannini, 2014, p. 319): "non-representational ethnographers consider their work to be impressionistic and inevitably creative, and although they are inspired by their lived experiences in the field, they do not claim to be able, or even interested in reporting on those in an impersonal, neutral, or reliable manner" (p. 318). Considering research to be a performative endeavour, non-representational methods focus on the embodied, material, and affective aspects of research. Instead of being restricted by scripted contemplation, such approaches embrace open-ended complexity and engage with its difficulties through creative experimentation. In this context, research does not present a fixed trajectory but a fluid, ongoing process that can evolve into multiple directions (Dewsbury, 2010). As such, non-representational approaches respond to the multiplicity and openness inherent to research encounters.

While the tenets of non-representational methods might be useful to think-with, such as their focus on affect, practices, and embodiment (Vannini, 2015; Thrift, 2008), Tuck and McKenzie's reflections linger: "Efforts to get beyond representation are in danger of being solipsistic and apolitical, and seemingly impossible" (Tuck & McKenzie, 2015, p. 19). That is to say, while non-representational methods often emphasize self-reflection and experience, they may risk disconnecting from broader social and political realities, even though all research is inherently political. At the same time, the notion of fully escaping representation is inherently flawed, as all efforts to communicate, share, or reflect require writing, visuals, performances, sounds and so on. Additional critiques of non-representational methods have focused on its universalist reduction of things. More appropriate might be the notion of 'more-than-representation,'

which, rather than completely rejecting representation, recognizes that the act of sharing research inevitably generates something new: "new concepts, new ethico-political concerns, new problems" (Springgay, 2022, p. 16; Truman, 2022). In that sense, Truman (2022) argues that "a more-than-representational approach to research focuses on animation rather than representation, creation rather than reports, and fosters new constellations of meaning-making" (p. 25). At the same time, such 'more-than' approaches not only seek to more effectively engage with forms of research presentation that exceed the textual, but also aim to respond to other-than-human and multisensory worlds (Lorimer, 2005). This doctoral research builds on this aim and turns to speculative thinking and making practices that activates the epistemological perspective of more-than-representational research.

Speculative thinking and making

Responding to the challenges of dominant epistemic approaches and the call for methodological experimentation, a growing community of researchers now turns to research practices grounded in imagination and speculation. Scholars in humanities and social sciences have increasingly turned their attention to how people imagine, anticipate, and enact possible futures (Hannes et al., 2022; Pink, 2025). The field of futures studies is concerned with studying possible, probable, and preferable futures. Rather than predicating what will happen, it emphasizes imagining what desirable futures might look like and identifying the steps needed to move toward such futures (Bell, 1996). Anthropology, for instance, has increasingly intersected with this field, mobilizing ethnographic approaches such as observation and interviews to examine how individuals and communities envision, anticipate, and enact possible futures (Willow, 2021). So-called 'future anthropologies' generally trace expectations, speculations, anticipations of the future and what they tell us about everyday life (Bryant & Knight, 2019). More recently, some anthropologists have advocated studying "in and with possible futures" (Pink, 2025, p. 4), focusing on how people experience imagined futures and what it means to live within them. These more embodied insights are then used to support change or guide decisions about the future.

Speculative thinking, however, is not concerned with what might happen, what one hopes for, or what one expects in the future alone. Parallel realities, past worlds, alternative, or atemporal ones also emerge through imaginative processes, opening possibilities to break from the fixity of certain events and experiences of past and present worlds (Rifkin, 2019). Although recognizing various conceptions of time, in which time is not necessarily consider linear, scholars working in the field of futures studies do often set a particular timeframe in which the imagination takes place, say in twenty or fifty years from now (Dator, 2019). This differs from more general approaches in speculative fiction that are concerned with imagining alternative worlds across conventional perceptions of times. Here, speculative worlds can include futures worlds, as well as parallel ones, alternative realities or universes, or past worlds. Time is multiple. It is neither static nor stable, but continually evolving, which results in the movement of imaginaries through time. Imaginaries adapt, change, and shift course. There is no single or fixed imaginary, as they are always in flux. This relates more to critical and speculative design and art practices that focus on exploring

alternative scenarios through which "reality will become more malleable" (Dunne & Raby, 2013, p. 6). In line with this, more performative and creative research practices have emerged, which are less concerned with uncovering what people believe the world will look like twenty years from now and are more focused on actively creating new imaginaries as/in research.

Among these, de Freitas and Truman (2020) explore literary speculative fiction to challenge and rethink traditional empirical methods and methodologies. Such speculative thinking and making practices, as Tytler (2025) observes, "allow us to attend to the conditions in which knowledge is produced, mediated, and resisted" (p. 3). In the same light, Rifkin (2019) argues that speculative thinking "enable[s] forms of conceptual and representational experimentation" (p. 7). That is, in imagining alternative possibilities, the speculative generates more than a referential account of reality:

> [F]uturist narratives allow us to see divergent ways of conceiving and perceiving, variable frames of reference through which to understand how things work in the world. Seeing them as framings—as possible ways of describing what was, is, and could be—allows for the potential for there to be multiple modes of understanding that all may be true while also being nonidentical" (Rifkin, 2019, p. 7)

Exploring alternative possibilities can challenge dominant assumptions. Accordingly, critical futures studies, as discussed by Inayatullah (2013), "asserts that the present is fragile, merely the victory of one particular discourse, way of knowing over another" (p. 44). In this context, dominant future images actively produce a social and historical reality (Pels, 2015). Critical speculative thinking, therefore, does not seek to validate the present, but aims to disrupt how we understand the past and reconfigure identity in the present (Bryant & Knight, 2019). At the same time, such critical perspectives also emphasize that speculation in not neutral, as it can be mobilized as a means of capture, erasure, or shoring up white supremacy (Truman, 2026a; Carroll, 2024). As discussed by Tytler (2025), "the speculative offers an approach that engages both critique and possibility. It allows for a feminist vision of a fairer future, a future critique that speaks to the now of political trajectories, or the what-if of future worlding" (p. 3). Adopting the speculative as a methodological approach does not only allow for the challenging of dominant discourses, but also the explorations of alternative possibilities. That is, speculative fiction helps us to discover multiple temporalities, spaces, and relations (Edwards & Pettersen, 2023). In this sense, I consider the imagination practices used in speculative fictions and futures studies as a more-than-representational mode of inquiry that is always creating and animating new worlds, and in this process, opening up new pathways for meaning-making.

OVERVIEW OF THE RESEARCH AND GUIDING QUESTIONS

In bringing together the three anchors (i.e., climate crisis, multispecies relationality, and creative and speculative practice), this doctoral research examines how we might imagine *alternative* multispecies

possibilities that respond to the multifaceted challenges of climate change. In this context, the word "alternative" signals a break from what is taken as normal or dominant, creating space to think and act otherwise and creating openings for choice of different possibilities. To imagine such multispecies alternatives, this research adopts a participatory research-creation approach, which involved the organization of three Labs (or research-creation events). In two of them, one in Belgium and one in Australia, where participants were invited to envision forms of multispecies collaboration in the face of climate change. In these Labs, creative methods and speculative inquiry were used to elicit participants' imagination, leading them to produce visual artworks and fiction stories, which serve as the primary empirical material of this research. Additionally, a third Lab in Belgium was organized to rethink and reimagine participatory research approaches, with a particular focus on the living lab method, exploring how this approach might be used in crisis contexts such as (but also beyond) climate change and climate disasters.

The central question guiding this work is: *In what ways might multispecies arts spark collective imagination of multispecies worlds in which the human and the other-than-human become partners in approaching climate change differently?* This overarching question is further divided into three sub-questions, each serving related objectives. While these questions each have their own focus, be it theoretical, methodological, or creative, they cannot be understood in isolation. Similar to the three anchors of this research; theory, methodology, and creativity are always intertwined.

> *Sub-question 1: How might multispecies arts re-imagine relationality between the human and other-than-human?*

The first sub-question takes a *theoretical orientation,* aiming to provide a conceptual understanding of what multispecies arts entail. At the same time, this first question explores the epistemic potential of (multispecies) art and speculation to move away from human-centric understandings of reality and to tell different stories about climate change. I particularly explore how those artistic and speculative practices open space for the imagination and creation of new relational configurations between humans and other-than-humans. These insights inform a methodological approach that I developed and employed during research-creation Labs organized across various contexts (relating to SQ2).

> *Sub-question 2: In what ways can multispecies arts help to imagine alternative multispecies worlds that engage with climate change differently?*

The second sub-question adopts a *methodological focus* and centres the empirical component of this doctoral research. Here, I brought multispecies arts and speculative thinking into a participatory research-creation methodological design by inviting various publics to workshops, or Labs, to collaboratively imagine multispecies worlds. This approach allowed me to experiment with speculative thinking and making practices in participatory settings. By engaging publics in the imagination of alternative possibilities amidst climate crisis, this doctoral research aims to examine and develop creative methodologies that encourage thinking otherwise about what climate crisis is and how it might be

addressed. Concurrently, this part of the research aims to critically challenge conventional, anthropocentric, and Euro-Western responses to climate crisis by using multispecies relationality as a starting point.

> *Sub-question 3: In what ways can participant-generated multispecies imaginaries be disseminated within wider societal contexts?*

Finally, the third sub-question turns towards the *creative trajectories* of this doctoral research. It focuses on both the creative dissemination of participant-generated multispecies imaginaries and the development of creative modes of engaging *with* these imaginaries, placing emphasis on public outreach. Through the organization of an exhibition and the writing of speculative fiction, this doctoral thesis explores a range of analytical and dissemination practices aimed at mobilizing multispecies imaginaries within wider public contexts.

Ultimately, this doctoral research aims to envision and create alternative worlds (sub-question 2) grounded in reconfigured multispecies relationalities (sub-question 1), and to share these multispecies possibilities to wider publics through creative forms of engagement (sub-question 3). In doing so, this doctoral research can be understood as part of a broader environmental movement in research and activism that frames climate change as a justice-related issue rather than solely a scientific, technological, or financial one. Climate justice attends to who is affected by climate change, and how these effects are experienced, foregrounding the uneven and disproportionate distribution of its impacts (Sultana, 2021). In this context, significant efforts and collective actions are taking place across different fields and scales, offering beacons of hope amid often apocalyptic visions of climate futures that can lead to feelings of eco-anxiety (Pihkala, 2019). In line with these efforts, this research contributes by exploring what other, more positive possibilities can be imagined. After all, how can sustainable futures be realised if they cannot first be imagined (Kimmerer, 2013)?

As a response, the primary contribution of this doctoral research is methodological in nature and lies in arguing for *critical speculative inquiry* which treats the act of imagination of multispecies worlds not as a neutral exercise, but as an inherently political practice. From this perspective, imagining alternative multispecies worlds is emplaced and entails an ethical responsibility to critically attend to the worlds one brings into being and the relations these worlds reconfigure. In this context, this research also contributes to broadening the methodological scope of multispecies studies by arguing that critical speculative inquiry provides a means of examining multispecies relationality while bringing questions of power, politics, and ethics more explicitly into view.

While critical speculative inquiry constitutes the primary contribution of this doctoral research, its methodological contributions extend to rethinking participatory approaches such as *living labs*, further developing *speculative ethnography* as an emplaced practice, and experimenting *with creative approaches to disseminating* research findings. At a theoretical level, this doctoral research synthesises, develops, and extends scholarship on multispecies arts, further articulating their relevance for engaging

with climate change. It also introduces the theoretical notion of *attentive collaboration*, which provides a basis for rethinking collaboration within living lab approaches, but also extends conceptualisations of collaborations across species.

WHERE IS THEORY?

'Where is theory?' is a question I grappled with while writing this introduction, reflecting on *where* it should reside within this thesis and on *how* to articulate the theoretical underpinnings of my research; not because there is nothing to say, but because there is so much that could be said. If one imagines the three anchors of this research (i.e., climate crisis, multispecies relationality, and speculative and creative approaches) resting on the ocean floor, then the theoretical stance might well be understood as the ocean floor itself, shaping how these anchors are perceived. The theoretical underpinnings of this research recur throughout each chapter, taking on different configurations, while always forming the foundation of this research. Perhaps a more fitting question would have been 'where does theory not reside?' since it is everywhere at once and always present. And yet, it is also intimate: it is deeply entwined with my own ways of sensing and making sense of the world, it is embodied, and because of it, it sometimes becomes invisible, taken for granted even. It is at once an epistemic, ontological, and ethical position (Barad, 2007). In what follow, I attempt to make some of these underlying positions visible by relating them to existing theoretical frameworks. These frameworks have informed my research in various intensities, and the more I engaged with them, the more nuance, complexity, and depth they gained.

When I began this research, I was particularly drawn to posthuman theory and new materialism, informed, though not confined, by the work of scholars such as Rosi Braidotti, Donna Haraway, and Karen Barad, whose writings invited me to rethink research methodology, humanism, and anthropocentrism. Barad (2007) deconstructs notions of objectivity and representationalism in knowledge creation, conceptualizing researchers' choices as "agential cuts," meaning that the decisions a researcher makes produce *phenomena*. This is different from considering research as a neutral process of describing phenomena that exist independently of the research process. Haraway (1988) introduced the concept of situated knowledges to me, emphasizing that knowing cannot be disentangled from being in the world. Their writings suggest that the researcher, or anyone for that matter, is always intimately intertwined with the world and with other entities and beings around them. This entanglement between entities, so is argued, is mutually transformative. Whereas Barad (2007) develops the concept of "intra-action" to articulate how entities emerge and change through their relations, I have primarily engaged with related concepts used by Haraway (2016) and Braidotti (2013), who drawing on Deleuze and Guattari (1987) mobilize the notion of "becoming" or "becoming-with." Becoming-with describes how beings and entities are shaped in and through their entanglements, pointing to shared processes of transformation in which relations reconfigure how each comes to function, disrupting usual roles or structures (Deleuze & Guattari, 1987). Haraway (2016) describes becoming-with as follows: "[o]ntologically heterogeneous partners

become who and what they are in relational material-semiotic worlding. Natures, cultures, subjects, and objects do not preexist their intertwined worldings" (Haraway, 2016, pp. 12-13). In this view, entities do not precede relations but emerge through them.

This notion of 'becoming' not only reconfigures the position of the researcher within research, understood as always becoming-with the research and continuously shaping and being shaped by it, but also rethinks the position of the human in the world. In this context, the turn to matter refuses binary understandings that frame matter as "either a given or a mere effect of human agency," instead approaching it as an "active factor in processes of materialization" (Barad, 2007, p. 183). Within this perspective, Braidotti (2002, 2013) emphasizes the importance of decentring the human, questioning its assumed authority as controller of life, dismantling species hierarchies, and "strik[ing] instead an alliance with the productive and immanent force of zoe, or life in its non-human aspects" (Braidotti, 2013, p. 66). While this doctoral research similarly seeks to move away from anthropocentrism in pursuit of climate justice, such 'beyond the human' perspectives also raise concern about overlooking social injustices. Critiques of posthuman and new materialist approaches have highlighted the risk that a focus on materiality may obscure power relations and inequalities, "recenter[ing] both humanism and Whiteness" (Truman, 2019a, p. 2). This tension led me to engage with feminist and critical perspectives that foreground the inseparability of materiality and power.

Turning to critical perspectives not only shaped how I understood research and methodology, but also how I engaged with the three anchors of this project. It was especially Robin Wall Kimmerer's *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants* (2013) that uncovered for me how Western academia has sidelined 'Other/ed' ways of knowing in favour of objectivity and representationalism. Reading this alongside research-creation scholarship, including work by Stephany Springgay, Erin Manning, Natalie Loveless, and Sarah E. Truman, further scrutinized the rigid boundaries of hegemonic and Western understandings of knowledge. Here, Barad's (2007, 2018) work particularly pointed out the importance of recognizing difference. Kimmerer's (2013) writing also made clear that multispecies thinking and relational approaches are not new, but deeply rooted in Indigenous traditions and scholarship, which called for a more careful engagement with these ideas. Particularly shaping was Kathryn Yusoff's *A Billion Black Anthropocenes or None* (2018), alongside work by Zoe Todd (2013; 2016) and Kyle Powys Whyte (2018; 2019), which foreground how climate crisis is entangled with colonial and racialized histories in both past and present contexts. In this context, Eve Tuck's and Marcia McKenzie's writing about critical place inquiry emphasized the political and ethical significance of place in research entanglements. In relation to speculative thinking (about climate), Donna Haraway's *Staying with the Trouble* (2016), together with Marc Rifkin's *Fictions of Land and Flesh: Blackness, Indigeneity, Speculation* (2019), as well as Sarah E. Truman's work (e.g. 2019b, 2022, 2023) have led me to approach speculative thinking and doing as not only situated, but also inherently political.

Together, these (and other) theoretical gestures encouraged me not only to critically engage with research methodologies, but also to remain attentive to dimensions of justice. In general, my research can

be situated within the theoretical umbrella of 'feminist materialisms,' which foregrounds materiality in relation to intersecting political realities. It emphasizes the researcher's responsibility to be attentive to power, and to take responsibility for what one creates and reproduces (Truman, 2019a). Building on this theoretical underpinning, the following section presents the methodological approaches and methods adopted during this four-year research journey. Each chapter that follows makes increasingly evident how these theoretical gestures shape the methodological and empirical work conducted in this doctoral research.

METHODOLOGY AND METHODS

Research design: Participatory research-creation

For attuning to speculative multispecies worlds in times of climate crisis, I turn to participatory research-creation as a methodological approach. The praxis of research-creation has especially been concerned with the question of what and how we can know, and proposing "new forms of knowledge, many of which are not intelligible within current understanding of what knowledge might look like" (Manning, 2016, p. 133). Research-creation resists the normative discourses that narrow the possibilities of knowing, that are rooted in Euro-Western epistemologies, disciplinary hierarchies, and prescriptive ideas of wat constitutes legitimate knowledge. Often taking a feminist, antiracist and anticolonial focus, scholars argue that "research-creation must expose the violence of settler colonialism and anti-Black racism in order to create more just and flourishing worlds" (Springgay, 2022, p. 19).

To expand the conventional understandings of knowledge and method, research-creation opens up alternative ways of knowing and sensing through artistic practices, which actively informs how thinking develops (Loveless, 2019; Manning, 2016). In response, Springgay (2022) considers research-creation "a methodology of thinking-making-doing" (p. 15). The approaches taken to do so are multiple and diverse; there is no one method or form to rigorously reproduce on each occasion. Instead, the practice is responsive to and shaped by the people, places, and contexts in which they occur. Research-creations have ranged from walking projects (e.g., Springgay & Truman, 2017), creative writing (e.g., Jacobs, 2025), to theatre, performances (e.g., Potter et al., 2022), and songwriting (e.g., Truman et al., 2023). This use of artistic approaches is particularly directed at expanding understandings of knowledge and method, both critically and politically, in order to unsettle dominant epistemologies. The critical and political readings these practices provoke make us carefully attend to heteronormative, racist, ableist, and settler-colonial assumptions. In this sense, research-creations shape social and material conditions, "not by offering more facts, differently figured, but by finding ways through aesthetic encounters and events to persuade us to care and to care differently" (Loveless, 2019, p. 107, original emphasis). As Chapman (2019) puts it, research-creation can be considered "a method and an approach, and a practice and a site of debate and a vast experiment in what counts as knowledge in the academy today" (p. xix). Rather than categorically

separating artistic and text-based academic work, research-creation treats artistic practice as a mode of inquiry in its own right, as a way of "making knowledge and telling stories about both what is known and what remains unknown" (Myers, as cited in Truman et al., 2019, p. 227). The artistic creations are never considered to be the end product one examines. Rather, emphasis is placed on the process and practice of artistic creation, and the tensions, responses, and questions that emerge along the way. As such, the creative process always generates new avenues to explore, new understandings to flesh out, and new learnings to expand upon.

My approach integrates research-creation with participatory research. Although research-creation itself is grounded in collaborative relational meaning-making, the participatory nature of my research and the ethical questions that surfaced call for further attention to participatory and co-creative research practices. In participatory research, 'publics' are invited to engage in processes of inquiry that at the same time may transform their social realities (Flick & Hoppe, 2025). Instead of conducting research about a social group or collective, participatory research involves collaboration with them, making research a shared process. Such approaches move away from the limited perspective of the 'expert' researcher, and create openings for collective agency and knowledge production. Co-creative research extends this orientation by using participatory approaches to generate new ideas, insights, policies, or designs together. It goes beyond participatorily researching what already exists with the public and instead focuses on processes for collective emergence (Harmes-Liedtke & Gianetti, 2019; van Praag, 2021). By combining participatory research and research-creation, this thesis aims to cultivate an inclusive and sensitive research praxis that questions normative understandings of what counts 'valuable knowledge' and unsettles the dominant power dynamics between the so-called ‘researched subjects’ and the ‘researching object.’ It is within the creative practices of speculative thinking and doing that I search for new ways of knowing and relating. Imagining alternative worlds generates insights about present realities and the dominant systems and values that underpin them.

Research-creation Labs

The methodological premises of participatory research-creation invite me to rethink the very nature of research 'data.' Unlike arts-based research approaches that use artistic creation to visually represent or describe past and already existing experiences (such as photovoice or bodymapping methods employed to gain visual insights into participants' lived experiences; Idrees et al., 2024; Wang et al., 2017; Wang & Hannes, 2014), research-creation positions artistic practice itself as a mode of inquiry through which new understandings and experiences are actively generated. It this sense, the focus is not on existing data, but on creating new experiences and insights through the process of artistic making (Manning, as cited in Truman et al., 2019). At the same time, research-creation moves beyond the idea of art as a vehicle for communicating research outcomes creatively. Instead, "we need to forgo data collection/extraction and instead focus on generating events" (Springgay, as cited in Truman et al., 2019, p. 232). Building on this understanding of data, this research has mainly been concerned with setting up generative and creative

spaces to think, make, and speculate collectively, which one can think of as *research-creation events*. I consider research-creation events as moments in time and space in which thinking processes are enacted through creative engagements. Through the conjuction of thinking and doing, research and creation, exploration and experimentation, new thoughts, ideas, and propositions emerge (Manning, 2016; Manning & Massumi, 2014). These conjuctions of "thinking-making-doing germinate and seed" (Springgay, 2022, p. 5). In this context, Manning and Massumi (2014) wonder, "what does it mean to organize for emergence?" (p. 90).

In the context of this thesis, I organized three research-creation event, which I refer to as "Labs." At the outset of this research, I was particularly drawn to the methodological premises of living labs. Living labs present participatory and co-creative research contexts that aim to bring various stakeholder groups together to collectively develop responses to complex challenges. Such groups typically include actors from education, society, the private sector (e.g., industry, businesses), and academia (Hossain et al., 2019). Through this collaboration, the living lab approach aims to discover new strategies suitable to approach complex and real-world challenges (Bergvall-Kareborn & Stahlbröst, 2009; ENoLL, 2026). As my research evolved, however, I came to recognize that the objectives, criteria, and boundaries of the living lab method no longer aligned with the methodological direction my inquiry had taken. Rather than searching for implementable solutions as living labs do, my research sought to speculate alternative worlds and imagine multispecies responses to climate change. Moreover, the Labs in my doctoral research did not encompass the multiple stakeholder representation that the living lab approach demands but focused more on shared curiosity. As a response, I decided to move away from the formal living lab method as a methodological guide, though it continued to inform my thinking, and I remained engaged with its premises. I retained the term Lab as a gesture to that lineage, presenting a temporary, intensive gathering where people come together to think and do otherwise, to explore worlds yet to come.

Before describing the Labs that shaped this research, I want to pause and reflect on the wording of “lab” itself, and the history of living laboratories. The term “living lab” carries with it a troubling resonance, recalling harmful research experiments and practices of the past. Yusoff (2018), for instance, situates the notion of 'living laboratories' in the light of colonial histories of nuclear testing that led to the “displacement and exposure of indigenous peoples in the Pacific Islands and the radiation of Native American and Aboriginal peoples in North America and Australia” (Yusoff, 2018, p. 45). Such nuclear colonialism resulted in contaminated air, water and soil, affecting “bone in brown bodies” (Yusoff, 2018, p. 46). As discussed by Yusoff (2018), these racialized bodies were regarded as ‘living laboratories,’ serving to provide insights into the impact of radiation on human beings. While contemporary living lab approaches discussed above are not directly linked to those histories and practices, it is important to remain mindful and reflective of the words and terms we use in research.

Artistic data creation in research-creation Labs

This research unfolded through the organization of three research-creation Labs (see Table 1). It began with the BioFutures Living Lab organized in Belgium in 2023, followed by the Multispecies City Labs in Australia in 2024. These two Labs responded to the local conditions of their environment, including its specific climate challenges and ecosystems, and explored a shared proposition: How might humans and other-than-humans collaborate to respond to specific climate challenges in this place? Alongside the two Labs focused on speculative thinking and making of multispecies worlds, a third Lab on *Living Labs in Times of Crisis* was organized in Belgium in 2025. This latter Lab specifically aimed to rethink and reimagine how living lab approaches can be applied, or may fall short, in crisis contexts.

The BioFutures Living Lab was a multi-day collaborative space organized in Leuven, Belgium (2023) that brought together a transdisciplinary group of early-career scholars who identified as what we called 'scholars of the post-Anthropocene,' presenting those interested in imagining liveable futures for both humans and other-than-humans. This brought together an international group of 21 scholars, spanning 15 different disciplines (including social sciences, physics, public health, pedagogy, biotechnology, and arts and design, among others) and affiliated to five different Flemish universities. The BioFutures Living Lab took place at BAC ART LAB, a workspace for artists that work at the intersection of art and science. Across three days of collective exploration and creation, the Lab focused on the increasingly urgent issue of energy scarcity, considering how the lack of energy supply disrupts the social and ecological relations that sustain everyday life. Such energy shortages result in short or long-term power cuts that affect essential infrastructures and creates digital blackouts (Daniel, 2016). With such energy-related vulnerabilities becoming increasingly pressing in various contexts (e.g., Ukraine, South Africa, Iran, among other places), we asked: How can we respond to these conditions by thinking and acting-with the other-than-human? Through speculative inquiry and artistic co-creation, we sought to imagine how collaboration with nature, instead of its misuses and exploitation, might open other possibilities for living with energy's unpredictability in ecologically sustainable ways.

The Multispecies City Labs was held in Australia (2024) and involved three workshops in which participants were invited to speculate multispecies urban environments. This process unfolded in Magandjin/Brisbane with artists as part of the International Symposium of Electronic Arts; Narrm/Melbourne with city residents, organized at The University of Melbourne; and Boorloo/Perth with scholars of the Centre of People, Place and Planet of Edith Cowan University, bringing together a total of 55 (human) participants. The Multispecies City Labs sought to re-imagine urban geographies, which are generally depicted as densely populated environments that privilege productivity, consumption and human habitation (Houston et al., 2018; Edwards & Pettersen, 2023). This human-centric organisation of cities has resulted in a range of challenges for the other-than-human inhabiting these spaces: from being haunted by newly introduced species and enduring extreme weather events linked to climate change, to being displaced due to new developments and pushed into hidden spaces as pests (Knight, 2023; van

Dooren & Rose, 2012). The Multispecies City Labs aimed to reimagine the respective cities as relational spaces in which humans and other-than-humans collaborate to address climate challenges.

Across these two research-creation Labs, participants made what Truman et al. (2023) call "artifacts we want to think-with" (p. 88). The artifacts that emerged were collective imaginaries responding to climate challenges, materializing visual and textual artworks, including drawings, collages, installations, performances, and fiction stories. Each imaginary foregrounded multispecies entanglements by integrating other-than-humans into the speculative process. In this way, the Labs became spaces for cultivating care and empathy, where artistic practices helped to tune into alternative ways of imagining and inhabiting worlds to come.

The final Lab on *Living Labs in Times of Crisis* took a different focus. Instead of centring multispecies imagination, it adopted a methodological orientation. Held in Belgium at the University of Leuven (2025), this two-day Lab brought together 15 participants, including students, early-career researchers (i.e., doctoral or post-doctoral), and university staff, as well as one participant coming from the public sector. The Lab aimed to rethink how living lab approaches might be applied in times of polycrisis. While living labs are often valued for their collaborative potential in addressing complex challenges, they also have been criticized for prioritizing productivity and scalability, as well as for their limited capacity to meaningfully involve people who are not typically in positions of power (Kommonen & Botero, 2013; Pfotenhauer et al., 2022). In response, the Lab on *Living Labs in Times of Crisis* created a space to experiment with collaborative research approaches in the context of crisis scenarios. During the workshop, temporal, ethical, epistemic, and affective tensions surfaced, which informed the articulation of *attentive collaboration* as a praxis necessary in the living lab method. Since this final Lab is oriented toward methodological reflection (instead of data collection), the following sections primarily discuss the data generated in the BioFutures Living Lab and Multispecies City Labs, where participants actively imagined and created alternative multispecies worlds.

The choices made regarding the topic at hand, the prompts I used, the construction of workshop phases, the invited participant groups, and other aspects of the research were formative in shaping what emerged through the research. These research decisions actively participated in producing phenomena and directing the research towards particular possibilities. In this sense, these methodological choices can be considered "agential cuts." As Barad (2007) explains, "different agential cuts produce different phenomena" (p. 175). Recognising these decisions as agential cuts highlights that the knowledge produced through the Labs did not simply emerge independently of the research arrangements but was shaped through the arrangements and researcher interventions that constituted the participatory process.

	Belgium BioFutures Living Lab	Australia Multispecies City Labs	Belgium Living Labs in Times of Crisis
Time	2023	2024	2025
Place	Leuven: BAC ART LAB	Magandjin: ISEA Narrm: University of Melbourne Boorloo: Edith Cowan University	Leuven: KU Leuven
Form	A three-day workshop	Three 3-5 hour workshops, one in each city	A two-day workshop
Focus	**Multispecies imagination:** Energy supply challenges	**Multispecies imagination:** Urban climate challenges	**Methodological focus:** Rethinking living lab approaches
Human participants	21 participants: early-career scholars	55 participants: artists, scholars, and city residents	15 participants: students (2), scholars (11), university staff (1), public sector (1)
Recruitment	Universities' and institutes' newsletters, flyers, social media	Flyers in public spaces, newsletters of community centres	Universities' and institutes' newsletters, flyers, social media, events
Selection	Motivation letter and short biography; all applicants were accepted	No selection procedure	No selection procedure
My role & facilitation	Shared facilitation across various researchers and participation in selected activities	Facilitator of all activities	Primary facilitator in a group of facilitators
(Creative) activities	Causal Layered Analysis, artwork creation, story writing, Futures Wheel workshop, storytelling, all conducted collectively	Collaging (individual), walking, artistic creation (collective), story writing, storytelling	Stepwise living lab approach: Identifying, framing, co-creating, reflecting, testing, sharing
Materials generated	Fiction stories, artworks (multimodal), futures wheels, fiction stories	Collages, artworks (multimodal), fiction stories	During the Lab: Prototypes After the Lab: methodological reflections
Retained data	Audio and video recordings, photographs, worksheets, stories, artworks	Photographs, worksheets, stories, artworks	Photographs, worksheets, stories, artworks
Analysis	Sensitising concepts: multispecies relationality and other-than-human agency	Sensitising concepts: colonial ruins and multispecies counter-cities	Attentiveness and slow science
Ethics approval	KU Leuven's Social and Societal Ethics Committee (Ethics ID: G-2023-6226)	The University of Melbourne's Human Ethics Committee (Ethics ID: 29897)	KU Leuven's Social and Societal Ethics Committee (Ethics ID: G-2023-6226)
Consent	Signed informed consent form	Signed informed consent form	Signed informed consent form

Table 1: Overview of the research-creation Labs part of this research, including descriptions of their form, time, space, focus, and human participants.

Two entanglements of place

Place matters in how and what we experience. To include voices from people living in different parts of the world, having various experiences with climate change and climate disasters, and having various situated relationships with the natural world, I have set up and participated in Labs in both Belgium and Australia. Place is often only briefly considered in social science research, reduced to a mere setting or backdrop of inquiry, or framed as a complication related to replication and control of a study (Hunter, 2009; Tuck & McKenzie, 2015). However, as discussed by many place-based researchers, place holds significant influence over the research process (Coemans et al., 2020; Tuck & McKenzie, 2015). In response, critical place inquiry adopts "an approach to place in research which is explicitly political in its intentions and

ethical obligations to land, people, and other species" (Tuck & McKenzie, 2015, p. 208). To research-with place is to acknowledge that research is embedded in and shaped by the environment in which it happens.

In this context, place can be considered an entanglement (Barad, 2007) or meshwork (Ingold, 2011) in which the land itself is deeply considered, together with its historical, political, social and ecological conditions and components. That is, entanglements of place include materiality (e.g., buildings, roads), human socialities (e.g., economies, power, inequality), sensory experiences (e.g. smell, sound, taste, touch), other-than-human species (e.g., trees, animals, plants), biophysical and geological elements (e.g., the weather, clouds, soil, mountains, rivers) and more (McKenzie & Bieler, 2016; Pink, 2011). These elements, as Pink (2011) asserts, "should be understood as being in movement, even if they are moving in rather different ways and at different rates" (p. 349). Instead of considering it to be "a material and stable location" (Coemans et al., 2020, p. 2), place is mobile and dynamic, being influenced by and influencing these various and varying conditions and components that change over time and space (Massey, 2005; Tuck & McKenzie, 2015). In this context, scholars engaged in critical place inquiry have questioned the ability of language to represent emplaced experiences. In response, they have turned to modalities that resonate more closely with the complexity of place, which include visual and art-making approaches (Coemans et al., 2020; Tuck & McKenzie, 2015).

The two Labs that focused on multispecies imagination used creative and speculative approaches to engaged with place, and were organized in two distinct contexts, offering diverse entry points into speculating about climate change from a multispecies perspective. For instance, people living in Australia and Belgium experience the climate crisis through different environmental and social realities. In the past years, people living in Australia have faced many acute climate disasters such as the devastating bushfires during the "Black Summer" of 2019-2020 and major floodings in 2022. Meanwhile, Belgium and nearby regions rarely experience such extreme natural disasters. Still, the 2021 floods in the Walloon region revealed the growing urgency of cultivating resilience and creative ways of responding to environmental challenges. Ecologically, these contexts vary profoundly as well. Australia's remoteness has allowed a high level of endemism, with ecosystems ranging from (sub)tropical rainforests to arid deserts (Crisp et al., 2001). In contrast, Belgium's landscapes have been deeply shaped by human intervention. While the region was once densely forested, socio-economically based environmental changes of cultivation and urbanization have significantly reduced its biodiversity (Hermy et al., 2008). These differing ecosystems provide unique starting points to engage in multispecies imagination.

Alongside their differing climate realities and ecosystems, these regions also carry the weight of distinct histories that continue to shape their contemporary societies. In Australia, settlers reside on the unceded lands of Aboriginal and Torres Strait Islander peoples, presenting an ongoing condition of settler colonialism. Belgium, meanwhile, operated as an extractivist colonial power in the late 19th and 20th centuries. Through its colonies in Rwanda and Burundi, but mainly the Democratic Republic of Congo, Belgium extracted wealth and resources such as rubber through violent exploitation. These histories matter here because colonial practices are inseparable from the making of the climate crisis (Yusoff,

2018), and because speculating about place, as Iovino (2018) reminds us, is always intertwined with its historical layers. The specific climate challenges, ecosystems, and histories of each context generated unique 'entanglements of place' to speculate-with. Organizing the Labs across these geographic contexts allowed for different iterations of speculative thinking and making that helped to reconsider and refine the methodological practices used in this research. More importantly, it invited reflection on how speculative practices can become more attentive to the matters, relations, and histories of place.

Participating collectives

The two Labs that focused on multispecies imagination presented collaborative spaces for shared speculation and exploration, inviting human participants to engage with the specific entanglements of place. I refer to both human and other-than-human participants involved in these Labs as 'participating collectives.' In doing so, I draw on Huybrechts' (2025) notion of 'the collective,' which she distinguished from 'community,' a term that often emphasizes human participation alone. The collective, she suggests, "better articulates the need for shifting relationships between human actors and more-than-human environments" (Huybrechts, 2025, p. 2). In the research-creation Labs, the human participants actively engaged with other-than-humans, which included, among others, cockroaches, nematodes, mangroves, the Yarra River, curlews, algae, cows, mycelial networks, aurora borealis, birds, the Brisbane River, and water. Such multispecies conceptions of 'the collective' allows for an understanding of speculation as a form of collective action, emerging from a shared commitment to address climate change.

As for the human participants, the two Labs brought together what I describe as a 'growing' collective, with a participant composition that evolved across different sites. While the BioFutures Living Lab in Belgium brought together early-career scholars, the Multispecies City Labs in Australia expanded this group with artists and urban residents. Altogether, this resulted in the collective imagination of 76 human participants. The third Lab on *Living Labs in Times of Crisis* added another 15 participants, including students, early-career scholars, university staff, and one person from the public sector. Participants joined the Labs through registering for an open call that I circulated via university and community newsletters, partner institutions, and physical and digital postings (e.g. research institutes, art festivals, art spaces, community centres, and so on). As might be expected, this led to a relatively 'homogeneous' group of people who were already attentive to climate change, interested in multispecies relations, drawn to speculative fiction, or keen to know more about living labs. However, this was not a "pre-existing group" I could easily reach out to. As discussed by Zvonareva and Egher (2025), "[i]nstead of existing 'out there' in a natural form, ready to be consulted on any topic deemed in need of societal input, publics come into being together with the issues of their concern through processes of articulating and addressing these issues" (p. 6). In this sense, the "public" in the Labs emerged through their collective engagement, taking shape around matters of shared concern (Marres, 2005).

I did not collect any demographic data about these human participants, as I was not seeking to produce representational claims about what particular social groups imagine. Yet, I recognize that this

approach means that I cannot assess how participation was shaped by particular social and demographic conditions. Without demographic information, the composition of the participant group remains unknown, making it difficult to identify which social differences were present, absent, or rendered invisible. As a result, this doctoral research cannot adequately examine the social and demographic positions of those who participated, whose situated experiences shaped the imaginaries, or how social difference mattered within the interventions.

Data tracings and dialogues

In discussing the analysis of the generated data, this section primarily focuses on the BioFutures Living Lab and the Multispecies City Labs, where data was actively generated, whereas the third Lab on *Living Labs in Times of Crisis* offers a methodological and reflective account. To think-with what emerged from the BioFutures Living Lab and the Multispecies City Labs, I sought to understand each Lab on its own terms through within-case tracings, before placing the Labs in conversation through cross-case dialogues (Huberman & Miles, 1994). Each context-specific Lab formed a distinct unit of inquiry, composed of speculative imaginaries (i.e., visual and textual artworks) co-created by participating collectives. Through a within-case tracing, I sought to understand how specific imaginaries were shaped by the respective context in which they arose. Rather than 'discovering' or 'analysing,' I adopt 'tracing' (Huybrechts et al., 2022) as an approach for following and reflecting on the creations of the Labs with care and attention. As discussed by Huybrechts et al. (2022), tracing "refers to the ways in which we surface knowledge about human and non-human ways of doing and caring for socio-environmental challenges ... foregrounding a critical reflection on how traditional ways of observing, describing, and explaining are inadequate for dealing with the enormity of factual information about current socio-ecological crises. In addition, this information comes with affective and emotional responses" (p. 176). Through tracing, I sought to make visible the interdependencies and affective threads that shaped the Labs and their emergent speculations. The tracing practices used across the Labs are elaborated in Chapters 3 and 4, where I use tracing to attend to multispecies relational dynamics (Chapter 3) and colonial ruins (Chapter 4).

In these cases, creative data were gathered in the form of visual artworks and fiction stories. The data were digitalized using Padlet, an online platform for creative work and virtual brainstorming supported by the University of Melbourne. This tool allowed me to bring the artworks in connection with the fiction stories that provided a textual description of the artworks. As such, the visual artworks and fiction stories could be analysed in tandem, with theory used as a sensitising device. As discussed by Bowen (2019), using theory as a sensitising device, or as “sensitising concepts,” can provide an “analytic lens or interpretative mechanism” that allows the “analytical process [to] show how people give meaning to the concept in a specific context” (p. 2). Analysis consequently involved moving iteratively between the empirical data and theoretical concepts: concepts directed attention to particular aspects of the artworks and stories, while the data could affirm, complicate, extend, or reframe the concepts.

For instance, in the BioFutures Living Lab, the analysis was mainly guided by tracing the concepts of *multispecies relationality* and *other-than-human agency*, examining how the concepts were articulated through the empirical materials and where participants' contributions extended or challenged existing understandings. In the Multispecies City Lab, the data inductively highlighted the importance of Australia's colonial history and settler-colonial present in imaginary thinking. As a result, I used and elaborated on the concepts of *colonial ruins* and *multispecies counter-cities,* which were developed in dialogue with, and subsequently used to further interpret, the empirical materials. All data produced during the Labs was considered during the analytical process. However, given the volume of material produced, the material included in the written analysis was selected based on its relevance to the sensitising concepts. This selection was made after engaging with the full dataset, rather than by selecting material solely because it confirmed the emerging interpretations.

While understanding the speculations of each Lab individually allows for a deeper connection to the local relations, matters, and histories of place, it also became important to let them speak to one another. Context-specific living labs, for instance, are often critiqued for not reaching beyond their local context. Too often, the outcomes of a living lab remain invisible for those who live elsewhere but might experience similar challenges (Scholl et al., 2022). To address this limitation, this thesis initiates a conversation across the two Labs through cross-case dialogues, inviting their placed-based imaginaries to resonate and respond across distance in space and time. This is not a comparative analysis as the Labs varied too widely in form, speculative thinking approaches, content, and participant groups for such a framing to be meaningful. Instead, the cross-case dialogues serve as reflective encounters that attend to both methodological practices and to the co-created speculations part of the Labs.

Ethics of collective thinking and making

The participatory nature of this research invited ongoing reflection on ethics, not as a fixed set of rules but as something to sit with, negotiate, and reimagine. Together with colleagues, I have written about the limitations of institutional ethical guidelines in co-creative research (Stouten et al., 2025), questioning the often positivist logics and universalist assumptions embedded in many university ethics procedures. In response to the risks of othering, erasing subjectivity, and reinforcing the authority of the "expert" researcher, we proposed the notion of entangled ethics. Rather than merely assessing possible harm in relation to individual participants, entangled ethics attends to the interrelationships between subjects, environments, and matters in research. Drawing on feminist and new materialist theories, it emphasizes relationality between these actors, response-ability to what emerges during the research process, and attentiveness to the situatedness of ethical practice as opposed to fixed, universal principles (Stouten et al., 2025). Organizing and living through the Labs allowed ethical reflections on these matters to emerge, particularly on the building of attentive relationships and collaborations in research. Although dominant crisis narratives often push research toward urgent ad solution-driven outcomes, research practices should "stay with the trouble" (Haraway, 2016), being attentive to both the complexity of the issue and the relationships needed to respond care-fully (Whyte, 2019). In this context, I consider the Labs as explorative

and collaborative spaces in which to critically, creatively, and carefully attend to complex challenges *and* to each other. That is, they prioritize relationship-building over solution development, while accounting for the complexity of the challenges at hand.

Ethical reflections also emerged around the notion of shared knowledges. Participatory and co-creative research practices, such as the Labs, generally focus on generating new understandings about certain topics. Without the involvement of participants, these new understandings would take different forms or would not even emerge. In such contexts, it becomes necessary to rethink conventional approaches to "research data" (as discussed above) and to emphasize the notion of "shared knowledge." While participants are often deeply involved in decision-making, setting out objectives, discussing research approaches, among other things, the intellectual ownership of the research outputs typically remains with the principal investigator or the research team. Treating co-constructed knowledges merely as "data" without including those who co-created them raises ethical questions about intellectual ownership. In the research-creation Labs, the general topic, design, and facilitation of the Labs were determined by the research team, providing the overall structure and direction of the research process. Participants, in turn, determined the research questions (e.g., what types of crisis to focus on or what speculative responses to develop in relation to particular energy challenges), the creative methods through which these questions were explored, the outcomes, and in some cases, the analysis (e.g. the writing-as-analysis used in the BioFutures Living Lab).

As part of these ethical reflections, I have experimented with alternative authorship possibilities. In the BioFutures Living Lab (see Chapter 3), for instance, participating scholars were acknowledged as co-researchers based on the principle of equal intelligence, valuing participants' intellectual and emotional contribution, and acknowledging their situated knowledges and experiences (Dierckx et al., 2021). A similar approach was taken in the Lab on *Living Labs in Times of Crisis* (Belgium, 2025; see Chapter 5). The academic articles published in the aftermath of both the BioFutures Living Lab (Jacobs et al., 2023) and the Lab on *Living Lab in Times of Crisis* (Jacobs et al., in press) conceptualized the collectively developed ideas that emerged throughout their co-creative processes. As such, participants were invited as co-authors on these publications on the condition that they participated in the Lab and contributed to the writing of the articles, as authorship regulation of both institutes demand. The writing participants produced was limited to one page and could be completed either individually (i.e., in the Lab on *Living Labs in Times of Crisis*) or collectively (i.e., in the BioFutures Living Lab), and could also take creative forms (e.g., contributing to a fictional story). The "we" perspective taken in these articles refers both to those who conceptualized and organized the Labs, and to those who participated in it. As such, these articles essentially present (parts of) the shared knowledges that emerged during the Labs.

These reflections also shaped my approach to conventional anonymization or pseudonymization practices. Because participants were not merely "subjects under study" but co-creators of ideas and imaginaries, I choose not to anonymize or pseudonymize their names unless they explicitly indicated a

preference for anonymity in their consent form.[2] For example, during my residency at studioFIVE as part of the *Art Based Research Practices and in the UNESCO Observatory Visiting Scholar Series*, I exhibited participants' research-creations (i.e., visual artworks and snippets of the fiction stories). Based on their consent forms, participants' first names were added (in accordance with their consent forms), taking them out of the shadows of participatory research and recognizing them as contributors whose voices and visions are integral to this research.

CHAPTER OVERVIEW

I write this thesis as a 'thesis with publication,' meaning that parts of this research have already been published. This may result in some overlap across chapters, as each chapter includes elements of theory and method, all organized around the three anchors of climate crisis, multispecies relationality, and creative and speculative practices. Some chapters are written as journal article, while others are written as thesis chapter. At the same time, writing a 'thesis with publication' also means that certain articles were written and published months or years ago, and therefore reflect earlier stages of thinking that have continued to evolve throughout the doctoral trajectory.

Following this introduction, the thesis is divided into three main parts. Part I focuses on multispecies arts, particularly engaging with sub-question 1 that focuses on how multispecies arts re-imagine relationality between the human and other-than-human. Part II discusses the three research-creation Labs, which constitute the primary empirical work of this doctoral research. Part III brings together creative and methodological reflections, examining the methodological approaches and illustrating the creative engagements with data. I what follows, I briefly walk you through the seven chapters to give a sense of what to expect.

Chapter 1 examines how the arts engage with the other-than-human to tell different kinds of stories about climate change. In this context, I use "multispecies arts" as an umbrella term for creative works that engage with the other-than-human in various forms, from engaging living beings, to working with environments, as well as creating critical discourses with/about the other-than-human. By exploring such artistic gestures, this chapter discusses how multispecies arts re-imagine relationality between humans and other-than-humans. In combining art with multispecies studies, this chapter presents a reflexive and

[2] The consent forms also included agreements on publishing (e.g., "I give consent to use the ideas and publish them), taking recordings and photographs, ownership and authorship (e.g., "I understand that I have ownership/authorship of the prototypes and narratives ideated during the Lab, and I acknowledge that I share this ownership with the other participants), sharing of ideas (e.g., "The rights to use the ideas and creations for educational and research purposes is transferred to the research team"), anonymization (e.g., My full name can be mentioned as a contributor or co-author/I want to stay anonymous) along with other agreements on involvement, privacy, and data protection, among others.

conceptual account that brings together theoretical concepts with art (practices), aiming to resist standardized art canons that historically have maintained a Euro-Western focus. By attending to concepts of 'becoming-with' (Haraway, 2016) and the 'multispecies contact zone' (Isaacs & Otruba, 2019), I propose that multispecies arts can be considered as a multispecies contact zone in which one speculates-with other-than-humans. I argue that they re-imagine how the world is co-constituted by human and other-than-human beings and their multispecies entanglements.

Chapter 2 dives deeper into the artistic practice of bio art and explores its epistemic potential to re-imagine our understanding of and connection to the natural world. Drawing on the theoretical stance of philosophical posthumanism, this chapter discusses how artistic co-creation processes involving humans and other-than-humans hold the potential to introduce a shift in our worldview from anthropocentric to ecocentric. It further questions what this shift might imply for how we approach the complex relationship between humans and other-than-humans in our own research. Through a within-case and cross-case analysis of five bio art projects that previously won the Bio Art & Design Award (2018-2020), including a visual analysis of the artworks and qualitative interviews with the makers, this chapter argues that bio art's epistemic significance can primarily be found in its multispecies perspective: By following the wills and ways of bio-organisms, bio art makes the connection between nature and culture visible.

Chapter 3 discusses the BioFutures Living Lab that was organized in Leuven, Belgium. Concerned with the issue of energy supply shortages, energy outages, and digital blackouts, the BioFutures Living Lab brought together 21 scholars in a three-day event, combining a living lab methodology with futures studies techniques and creative practices. During this Lab, we imagined multispecies responses to growing energy-related challenges. In this chapter, we present biofuturing in theory and practice, which is situated at the crossroad of transdisciplinary collaboration, multispecies entanglements, and multitemporal thinking. We discuss how the co-designed futures speculations address existing and emerging challenges from a multispecies perspective and highlight the importance of moving away from "mainstream speculative through" (Truman, 2019b) to generate a more inclusive and just research and creation practice.

Chapter 4 brings speculative inquiry into dialogue with place-based inquiry to explore the potential of multispecies-focused imagination amid the colonial ruins of the Anthropocene. I do so by discussing the Multispecies City Lab in which participants were invited to re-imagine urban spaces as shared habitats where humans and other-than-humans collaborate to address climate challenges. Organized in three Australian cities—Magandjin/Brisbane, Narrm/Melbourne, Boorloo/Perth—the place-based speculative thinking process led to engage with Australia's specific colonial history, settler-colonial present and its ongoing ruins and ruinings. Through the imaginaries created by participants, we demonstrate that the practice of speculation is closely tied to place: instead of perceiving place as a static and passive backdrop for imagining alternative worlds, place co-shaped the emerging imaginaries of participants. Emphasizing the importance of place in speculative thinking, Chapter 4 proposes the concept of emplaced speculation,

an embodied form of speculation that is tied to one's sensorial and material engagement with place and environment.

In Chapter 5, we explore what it means to do participatory research amid crisis through the Lab on *Living Labs in Times of Crisis*. Positioned as a response to the proposition of conducting research in times of polycrisis, this chapter explores attentive collaboration as a theoretical and methodological orientation to these culminative challenges. Attentive collaboration is both a condition and a practice for imagining and enacting more compassionate futures. To attend is to lean in, to direct your awareness; it is not merely registering that something exists but holding space for it. The work presented in this chapter centres on a living lab workshop, designed as a space to experiment with collaborative research approaches in response to crisis scenarios. Rather than framing the workshop as merely a participatory research event focused on studying crisis, we approached it as a generative site of care-full being-with, where epistemic, affective, and ethical relations guide collaboration and co-creation. In this chapter, we trace tensions and potentialities that emerged from dwelling with complexity together in a living lab setting, and we propose attentive collaboration as an orientation for research that thickens relational practices of inquiry within living labs and across wider contexts of crisis.

Chapter 6 discusses the practices and approaches used during the research-creation Labs in Belgium and Australia to elicit speculative thinking about multispecies collaboration in times of climate change. I situate these practices as part of the broader methodological approach of speculative ethnography, defined as a practice-based and more-than-representational approach used to observe and create speculative worlds. This speculative ethnographic process was encouraged by using four 'enabling constraints' which provided structure and guidance while maintaining open to emergent possibilities throughout the process (Manning & Massumi, 2014): imagining otherwise, moving and walking, making and doing, and sensory storytelling. Using these enabling constraints gestured towards place as an undeniable agent that shapes speculation. As such, I suggest a notion of *emplaced speculative ethnography,* highlighting that speculation relies on one's being-in-place, which include attentiveness to the environment and encounters across humans and other-than-human relations.

Finally, Chapter 7 presents a visual and reflective account of the various creative dissemination artifacts and events that are part of this research, including an exhibition and a cli-fi story. I consider these creations as responses to the propositions that emerged throughout the course of this doctoral research. As discussed by Truman et al. (2023), "research-creation invites further speculation … Each finished piece of 'art' is processed into the work's further articulation" (p. 93). Approaching the dissemination moments presented in this chapter as propositions, they essentially present evolving inquiries that continue the research-creation Labs. They offer new speculation or articulation, which in turn, have generated new directions to explore.

This thesis end with revisiting speculative frictions, referring to the situated and sometimes conflicting imaginaries produced by participants on one hand, and to the awkward moments of being

ethically, politically, and culturally stuck on the other. Drawing on these frictions, this doctoral research emphasizes the need for critical accounts of speculative inquiry that recognize speculation as inherently political, carrying an ethical responsibility to the worlds one brings into being and the relations these worlds reconfigure. Critical speculative inquiry provides tools to identify issues of fairness, question underlying assumptions, or actively work toward more just possibilities. In advocating for critical speculative inquiry, particularly in the context of climate change, this thesis contributes theoretically to environmental humanities and multispecies studies, and methodologically to speculative inquiry, futures studies, and research-creation.

PART I

MULTISPECIES ARTS

1

Multispecies arts for the end of anthropocentric worlds

Contains parts of: Jacobs, A. (2025). Speculating-with other-than-humans in multispecies climate fiction: Canopy of the Hidden Alley. *Australian Journal of Environmental Education, 41*(3), 616-632. https://doi.org/10.1017/aee.2025.10069

INTRODUCTION

Building on the three anchors introduced earlier, this chapter explores their entanglement and examines *in what ways the arts engage with multispecies relationality to tell different stories about climate change*. Whereas the introduction to this doctoral thesis addressed each anchor separately, this chapter turns to their interrelations. In their book *Art in the Anthropocene: Encounters Among Aesthetics, Politics, Environments and Epistemologies*, Davis and Turpin (2015) bring the arts in conversation with theory, activism, and science, discussing creative works that address ecological challenges. They argue that "in response to the obvious demands that new ecological conditions are making on people ... the arts can become a way of attuning to new realities" (p. 12). In doing so, they highlight the potential of the arts to develop new understandings on how to relate to other-than-human worlds amid climate crisis. Building on this, this chapter explores arts from a multispecies perspective and considers how it contributes to understandings of climate change and multispecies relationality. In doing so, it develops a conceptual understanding of "multispecies arts." Drawing on the concepts "becoming-with" (Haraway, 2016) and the "multispecies contact zone" (Isaacs & Otruba, 2019; Wilson, 2019), I propose that multispecies arts can potentially be considered a multispecies contact zone in which the artist speculates-with other-than-humans. Such artworks essentially re-imagine how the world is co-constituted by human and other-than-human beings and their multispecies relationality. I consider "becoming-with" and the "multispecies contact zone" as sub-concepts within the broader ontological perspective generated by multispecies relationality. They deepen this perspective by offering more specific ways of engaging with other-than-human relations and clarifying what multispecies relationality entails in practice.

In exploring how multispecies artworks address multispecies relationality, this chapter bridges theory and art. In doing so, it moves away from producing a canonical overview, which generally seeks to identify and represent the most significant, exemplary, or influential works of art that are part of a specific genre, tradition, or historical period. Such canonical practices are fundamentally shaped by processes of selection and exclusion, reproducing hierarchies in the valuation of (art) history. Flores et al. (2024) discusses art history and its institutions as "not only products of colonial legacies, but active agents in the consolidation of empire, the construction of the West, the naturalization of Eurocentrism, and the reproduction of white supremacy, all the while giving the false impression that their authority is somehow neutral" (p. 8). There is a need to critically interrogate the taken-for-granted epistemic authority of the art canon (Modeen & Biggs, 2021). To move away from canonical representation of art, this chapter presents a reflective and conceptual piece that intentionally brings various traces and encounters in conversation with one another, not systematically but diffractively (Barad, 2007; Parion et al., 2026). These traces range from the literatures and the theoretical concepts I have engaged with, to exhibitions, artworks, artists, and scholars I have encountered over the course of this doctoral research. Combining theoretical concepts with artworks allows me to bring multispecies theory and art together as they often share similar objectives of unsettling anthropocentric paradigms (Boyd, 2015b).

In this context, we need to consider art (creation) as something that also, and mainly, unfolds beyond the museum walls and exhibition spaces. The questions "What is art?" and "Who is an artist?" have long animated debate within the art world. While these questions could merit an entire chapter, or even a thesis, these questions offer an opportunity to clarify my position that threads throughout this thesis. To do so, I draw on Flores et al. (2024) who question the "elitist, exclusionary, and out of reach for all but the most privileged" character of the arts. As they discuss, the criteria that distinguished 'good art' from 'bad art,' or 'craft,' or anything 'less-than-art' remain mainly monetary, presenting "a reverence towards individuals deemed exceptional (but who also happen, overwhelmingly, to be white and male)" (p. 8). I agree with Flores et al. (2024) that we gain little from reinforcing yet another hierarchical division that elevates certain creative practices while excluding or diminishing others. Such gatekeeping contributes to the longstanding critiques of the art world as an ivory tower. I use the plural of multispecies *arts* to reflect a more expansive stance; one that includes what others may categorize as arts, crafts, research-creations, designs, and other creative practices. In this context, my focus lies less on the aesthetics of the product (i.e., the final artwork) than on the aesthetics of practice, including processes of making through relational encounters.

THEORY: BECOMING-WITH THE MULTISPECIES CONTACT ZONE

In exploring multispecies entanglements, I build on Haraway's (2016) discussion of the relational practices of "becoming-with," which itself draws on Deleuze and Guattari's (1987) work. Haraway (2016) discusses becoming-with as “[o]ntologically heterogeneous partners become who and what they are in relational material-semiotic worlding. Natures, cultures, subjects, and objects do not preexist their intertwined worldings” (Haraway, 2016, pp. 12-13). Instead, their existence is shaped by the interactions and relationships between them. Such becomings concern alliances between a multiplicity of subjects/objects (Deleuze & Guattari, 1987). This notion of becoming-with closely aligns with what Braidotti (2013) calls "affirmative relationships," which involve broadening the understanding of the self through embracing radical relationality with the other-than-human.

Building on this understanding of "becoming-with," de la Bellacasa (2019) discusses the notion of living-with as a multispecies praxis: "Emphasizing the conditions of *living-with* puts care under the sign of ontological heterogeneity and vulnerability to each other's sort and adds questions such as: How do we build caring relationships while recognizing divergent positions? How do those we study live with the way we think-with them? What are the effects of knowing practices for other than human significant otherness?" (pp. 83-84). In the same vein, Hamm et al. (2023) discuss *learning with* place as a relational praxis that builds "deep relations with the local Place … and these relationships become the catalyst for action and decision-making regarding caring for/with local Place" (p. 35). These notions of becoming-with, living-with, and learning with all present a relational praxis of mutual transformation.

To explore the notion of becoming-with in multispecies relations, the concept of the "contact zone" offers a valuable lens for attending to the complexity and often asymmetrical relational dynamics of multispecies entanglements (Isaacs & Otruba, 2019). Contact zones have been discussed by Pratt (2008) as spaces of imperial encounter, where "cultures meet, clash and grapple with each other, often in contexts of highly asymmetrical relations of power such as colonialism, slavery, or their aftermaths as they are lived out in many parts of the world today" (p. 8). While originally theorized as spaces of encounter specifically in asymmetric *human* relations, this notion of contact zones has been picked up by scholars in multispecies studies to better understand and theorize multispecies relations. Wilson (2019), for instance, discusses multispecies encounters as "events of relation," presenting moments where species meet and relations are built, disrupted, or changed (p. 717). The contact zone, however, presents more than mere encounters. It presents a specific space of multiple relations and affects, drawing attention to "different configurations and forms of power as they reworked to different effects" (Wilson, 2019, p. 726). In this light, Isaacs and Otruba (2019) wonder: "are we ever not in a multispecies contact zone?" (p. 706). They argue that everyday moments are multispecies contact zones, yet they often remain unnoticed or ignored. Although they are always present, dominant anthropocentric and neoliberal systems of thinking and doing suppress and neglect such relationality (Burdon & Alexander, 2023).

Such multispecies contact zones are place and context specific, amplifying Heise's (2019) argument that "species and kinship boundaries are construed differently depending on the cultural community" (p. 200). In this context, Isaacs and Otruba (2019) address that "notions of more-than-human entanglement do not and cannot escape decolonial imperatives and environmental justice critiques; in fact, they reinforce, extend, upscale, and intensify them" (p. 706). To remain attentive to power dynamics in multispecies relations, we need to attend to how multispecies contact zones are differently configured between cultures, and be aware of the risk to value the lives of other-than-humans over human communities that are Othered (Heise, 2016).

In acknowledging power dynamics in multispecies contact zones, it is imperative to highlight that concepts relating to other-than-human agency and multispecies relationality are not new. As highlighted by Todd (2013, 2016) and Watts (2013), among others, Euro-Western scholarship about other-than-human agency and multispecies entanglements often neglects Indigenous traditions and Indigenous contemporary scholarship that have long addressed these issues. Euro-Western knowledge traditions have historically classified the world through isolated taxonomies and have only recently started to think beyond such constructed binaries, for instance, through actor network theory, posthumanism, new materialism. This should not be understood as positioning Indigenous scholarship on relationality as an earlier or as a culturally distinct counterpart of Euro-Western scholarship. Indigenous scholarship on relationality challenges the limits of approaching relationality primarily as a theoretical concept, highlighting its situated connections to sovereignty, land (Tuck et al., 2014; Watts, 2013), and kinship (Kimmerer, 2016), among others. In this context, I am navigating the tensions between acknowledging Indigenous knowledges and avoiding appropriating them. Todd (2016) emphasizes, “Indigenous stories are

often employed without Indigenous peoples present to engage in the application of them in European work. However, there is a risk as well, to Indigenous thinking not being acknowledged at all. How do we hold these two issues in tension and apply them accountably in anthropology?" (p. 9). My understanding of multispecies relationality, among other concepts, is informed by multispecies studies and Indigenous contemporary scholarship on these issues, reading and citing them as I learn and write (Ahmed, 2017). Yet, citing Indigenous scholars, or using Indigenous place names (see Chapter 4), should not be understood as constituting Indigenous participation or governance. Nevertheless, engaging with Indigenous scholarship provided important insights into the silencing of 'Other/ed' knowledges and highlighted the limitations of some of the theoretical underpinnings of this research (Kimmerer, 2013). Rather than incorporating Indigenous scholarship as theoretical support for my own argument, I approach it as scholarship that both informs and challenges my thinking, while recognising that this engagement remains limited.

MULTISPECIES ARTS: MULTISPECIES RELATIONALITY IN/THROUGH CREATIVE PRACTICES

I now turn to the arts and how they can be considered a multispecies contact zone in which the creator becomes-with other-than-humans. After the 2013 exhibition *Intra-Action: Multispecies Becomings in the Anthropocene* in Australia, Madeleine Boyd introduced the term "multispecies art." Boyd (2015a) discusses how such artworks can include diverse forms of life, such as plants, microbes, human and non-human animals, among other, and aim to "disturb anthropocentric value systems" (p. 20). Here, I use "multispecies arts" as an umbrella term referring more broadly to *creative works involving other-than-humans that critically reflect upon anthropocentric understandings of our shared world*. This understanding is not limited to living organisms, as emphasized by Boyd (2015a), and includes biophysical and environmental elements such as the soil, rain, wind, a river, mountain, valley, among many. An important nuance is that multispecies arts is not concerned with representing nature. Boyd (2015a) discusses that "to presume that a human artist can capture the image of another species, is to suggest that we have its measure and have judged its worth" (p. 16). Instead, I consider multispecies arts as creative work where the artist is intertwined in a multispecies entanglement and, in this equation, becomes-with the other-than-humans involved.

Art as a multispecies contact zone

To consider multispecies arts as a contact zone is to considered it a space where humans and other-than-humans meet and where multiple relations and affects are actively shaped. It attend to the multiplicity of relations and affects inherent to the creative process, in which humans (i.e., artists or spectators) are in ongoing relation with other-than-humans: "the artist responds together with the matters engaged and the species involved so as perform and perhaps render a resultant sedimentation, the artwork, which does do

work. Certainly, this is both the goal and the starting point of a multispecies aesthetic" (Boyd, 2015a, p. 18). In this process, the multispecies contact zone can generate both affirmative and problematic relations and affects.

Approaching art as a multispecies contact zone allows to see how the collective Aeroscene addresses multispecies relationality in their work that imagines new infrastructures of planetary mobility and ethics. As part of their project *Museo Aero Solar,* they create floating sculptures that move through the air free from fossil fuels, through heat created by the sun: "Launching a solar sculpture like *Museo Aero Solar* requires a sensitivity to the elements, especially as they are influenced by the sun" (Saraceno et al., 2015, p. 61). Reusing plastic bags, which are washed, have their edges melted, and are fused together, these floating sculptures are created during workshops and social gatherings. In this context, *Museo Aero Solar* (both the artwork and its creation process and environment) presents a contact zone that include, among others, the sun and wind, plastic bags, and human creators, producing new relations and affects: collective creativity in workshops, reconfigures earthly mobility in the artwork, transforming plastic into other possibilities. Most importantly, *Museo Aero Solar* re-imagines ways of relating to and working-with other-than-humans, such as the sun and wind, to provide alternatives ways of living, moving, and relating.

In re-imagining multispecies relationality, Boyd (2015a) emphasizes that multispecies arts not necessarily present utopic accounts of what such relationality could or should look like: "multispecies aesthetics does not hold beauty or perfect balance as the ultimate measure. Rather, the struggles to engage across species worlds, and across disciplines of meaning-making, are inherent and reveal themselves in materials: sometimes brutal, sometimes open ended, but always intriguing" (p. 27). Clinton Naina, for instance, highlights the racial brutality and struggles connected to climate change in his art. In *Stolen Climate* (2020), Naina links colonialism and the cotton industry established through slavery, with fire and climate change (Naina in interview with NGV Melbourne, 2021). The choice of materials reinforces these themes: "Bleach to me is like fire, the fire of colonization. It's destructive, it kills and whitens, destroys and changes. It's connected to a lot of different aspects of our world" (Naina, as cited in Costa, 2024). By using bleach on cotton, Clinton Naina draws a connection between historical exploitation and contemporary environmental and racial injustices. As a multispecies contact zone, *Stolen Climate* does not merely represents those pasts and presents by engaging cotton and fire, but it creates a space (or zone) where histories, colonial forces, fire ecologies, and broader environmental relations intersect, and bring about new affects and understandings about the impacts and origins of climate change.

While art as a multispecies contact zone can be considered a generative space for building new understandings and relations, it is important to remain critical towards the approaches taken. Artist and educator Kayla Anderson warns that not all art projects and exhibitions that address issues of the Anthropocene are raising awareness about environmental challenges in a constructive manner. As discussed by Anderson (2015), urging actionability might indicate that the current ecological crisis is easy to overcome, which reinforces a “heroic, solutionist, and masculinist” attitude of human dominance over the planet (p. 346). Similarly, Cary Wolfe questions the role and added value of using animals in

contemporary art. Wolfe (2010) states that ethical considerations when engaging with animals in art should be taken more seriously, taking Eduardo Kac's *GFP Bunny* as an example. In the year 2000, Kac (2007b) introduced the gene coding for green fluorescent protein (GFP) from a jellyfish into the genome of an albino rabbit, resulting in a glow-in-the-dark bunny. Wolfe (2010) explains that the underlying meaning of the artwork is supposed to subvert humancentric modes of experiencing the world, yet, that is not reflected in its visual aesthetics. To the contrary, according to Wolfe (2010), Kac's work "depends on and in a fundamental sense reproduces an entire set of institutions and practices of scientific research that subject millions of animals a year to distressing, often painful, and usually fatal experimentation, a subjection of non-human beings" (p. 160). In this way, the theatricalization and spectacle of the glow-in-the-dark rabbit does not generate a constructive narrative to rethink multispecies relationality. This example highlights how art as a multispecies contact zone can become a site of deeply asymmetrical relations, generating ethical tensions.

Art as a mode of becoming- and speculating-with the other-than-human

Building on the concept of 'becoming-with,' I argue that the arts as a multispecies contact zone invites one to *speculate-with* other-than-humans. The notion of *speculating-with* presents a relational praxis in which the act of speculating changes the relational dynamics between those involved. I propose that multispecies arts speculate-with other-than-humans by envisioning how the world is co-constituted by human and other-than-human beings and their multispecies entanglements (Heise, 2016). To speculate-with the other-than-human is not simply to tell stories *about* them, but to co-evolve *with* other-than-humans through the story. That is, in multispecies art, the other-than-human, the artist, the human spectator, its surroundings, and the act of speculation emerge together, producing new tensions, materialities, and possibilities. As Bahng (2017) notes in her discussion of Octavia Butler's speculative engagement with slime molds, "one ethical way to reach across to that speculative reality might be to *wonder with* it, rather than *marvel at* it from a distance" (p. 317, original emphasis).

Such speculations foreground various relational configurations between the human and other-than-human, including other-than-human agency, where ecosystems, landscapes, or organisms are sentient and responsive; hybrid beings, where human and other-than-human bodies merge; or multispecies interaction and collaboration, where beings engage with one another or form cooperative relationships of mutual dependence (Heise, 2016). For instance, a cli-fi short story from Ellen van Neerven's collection *Heat and Light*, entitled *Water*, follows Kaden, a young queer woman of Jangigir heritage who works for the government and is tasked with monitoring the plantpeople. The plantpeople are an ungendered species that look like humans, have a green appearance, occasionally connect their roots to the land, and can transform salt water into drinkable water. While exploring themes of identity, heritage, relationships, and political discomfort, van Neerven (2014) speculates an alternative world, one where plants and humans are entangled with colonial histories and presents. The story illustrates how beings co-become and are knotted together with the world and with each other (Phillips et al., 2022). It also shows

how hybrid beings, in which human and other-than-humans merge, ask for different forms of relating to each other and to the environment.

Similarly, in the short film *I Wanna Deliver a Dolphin…*, the artist Ai Hasegawa speculates about women giving birth to endangered species: “With potential food shortages and a population of nearly seven billion people, would a woman consider incubating and giving birth to an endangered species such as a shark, tuna, or dolphin?” (Hasegawa, 2013). By foregrounding a woman-dolphin entanglement and visually presenting what a multispecies collaboration could look like, Ai Hasegawa reimagines ethical and relational accountability towards the other-than-human. Pinar Yoldas extends this speculative inquiry in *An Ecosystem of Excess,* which is a response to plastic particles increasingly entering the ocean. Through an installation, Yoldas shows speculative animals that have adapted to their plastic environment and can now metabolize plastics. The project speculates-with insects, reptiles, fish, and birds that are affected by these changing ocean environments, envisioning how they "can thrive in extreme, man-made environments … that can turn the toxic surplus of our capitalistic desire into eggs, vibrations, and joy" (Yoldas, 2015, p. 359). These creative gestures unsettle the supposedly “fixed” boundaries between humans and other-than-humans by making visible how anthropogenic climate impacts, such as plastic pollution, transform environments and species. The newly created species emerge through speculating-with other-than-humans and environmental changes, generating new frictions, meanings, and materialities that shape our understanding of multispecies relationality and climate change.

CONCLUSION: ART AS A PRACTICE TO IMAGINE MULTISPECIES POSSIBILITIES AMID CLIMATE CHANGE

This chapter provided a conceptual account of multispecies arts, aiming to resist standardized art canons that historically have maintained a Euro-Western focus. It responds to Flores et al. (2024) when they argue that "[t]o forge ahead towards ethically grounded and social justice-driven futures, might art history embrace humility against its assumed authority and open itself up to learning from others, especially those whose knowledge it has devalued and ignored" (p. 3). This chapter asserts that multispecies creative explorations open spaces to become-with. Such practices are not so much concerned with representing the other-than-human through a creative medium, but focus on engaging *with* them, allowing processes of mutual becoming, transformation, and evolvement. In this way, art becomes a multispecies contact zone.

Such artistic processes of becoming-with carry significant epistemic potential when considering or examining climate change and re-imagining relationality between humans and other-than-humans. Through the creation of multispecies arts, artists can encounter and articulate new possibilities for relating to other-than-human beings and environments (e.g., by exploring new multispecies collaborations, hybrid beings, or adapted species) as they actively speculate-with other-than-humans through the artistic

process. As such, artistic practices are not used to elicit, represent, or communicate perspectives or experiences of climate change that exist prior to the artistic process, as is often the case when using creative methods in qualitative research. Rather, the process of making art itself constitutes a mode of inquiry in which new and unexpected relationalities, understandings, and possibilities can emerge. I will elaborate on this perspective in Chapter 2.

The multispecies creative works discussed here speculate about alternative possibilities to the status quo. As discussed by Gibson (2020), such speculations and stories shape how we think of and address climate change. Scientific approaches, for instance, have extensively mapped and analysed species extinction and displacement. While these insights are crucial for understanding the scale and intensity of climate change and its impacts on humans and other-than-humans, they often fall short in evoking deeper emotional connections to climate realities. As McKenzie et al. (2023) argue, climate change education typically centres scientific narratives, sidelining issues of justice and the psychosocial dimensions of climate change. Yet, these aspects are crucial for grasping the full scope and impacts of climate change and for cultivating more affective and relational ways of understanding it. Creative processes make possible such affective and relational readings, for instance, by prompting reflection on how we exist in relation to other-than-humans and to a climate-changing world.

I argue that multispecies arts, as a multispecies contact zone, can foreground these affective dimensions by speculating-with other-than-humans, building care-full and empathetic relationships amid climate change and speculative climate futures. The ways we story climate matters (Gibson, 2020; Haraway, 2016), and taking a creative approaches allows to question anthropocentric views on one hand, and focus on human and other-than-human relationality on the other. However, in speculating-with other-than-humans, there lies a challenge to address multispecies entanglements without assuming that all entities—human and other-than-human—are similar or are given equal agency, thereby neglecting power structures and injustices (Heise, 2016). Instead, multispecies-focused art creation can serve as a lens through which to confront these inequalities.

At the same time, such contact zones are marked by tension. Tsing (2005) highlights the frictions that emerge in those spaces: "the awkward, unequal, unstable, and creative qualities of interconnection across difference" (p. 4). Such frictions, Tsing (2005) argues, always generate "new arrangements of culture and power" (p. 5). As discussed earlier, in bio art, these new arrangements of power might require further reflection, for they risk reiterating violence toward other-than-human beings (Wolfe, 2010). In the next chapter, I explore bio art and its epistemic potential in more depth, particularly its capacity to move from anthropocentric assumptions to ecocentric ones.

Chapter 1 conceptualizes multispecies arts as creative works that involve other-than-humans and critically reflect upon anthropocentric understandings of our shared world. I propose that multispecies arts can be considered a multispecies contact zone in which one speculates-with other-than-humans.

This chapter contributes to answering ***sub-question 1****, which asks* ***how multispecies arts might re-imagine relationality between the human and other-than-human****: the examples featured in this chapter show how multispecies creative works provide illustrations of multispecies collaboration, opportunities to work-with the other-than-human like the sun or wind, reconfigure how we relate to other-than-humans by creating hybrid or adapted species, and generate alternative understandings of climate change. In doing so, they re-imagine conventional understandings of multispecies relationality and the climate crisis.*

Whereas this chapter provides a conceptual understanding of multispecies arts, ***Chapter 2*** *will further explore how the arts have the capacity to move from anthropocentric assumptions to ecocentric ones by taking a closer look at bio art and its epistemic potential. Using interviews with artists and scientists who have experience working-with other-than-humans in creative settings, Chapter 2 provides an empirical account that can complement the conceptual focus of Chapter 1.*

2

Co-creatively producing knowledge with other-than-humans in a (bio)technology-controlled artistic environment

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INTRODUCTION

Since the mid-20th century, the arts have shown an increasing interest in nature and ecology. Artists have taken the natural environment as their playground for artistic ideation and creation. Ecological art, or eco art, gained momentum during the 1960s and refers to artistic practices that center the natural environment, ecology, and sustainable development (Ardenne, 2019; Woynarski, 2020). Eco art can take many forms, from paintings and photography to installations and public interventions, and focuses on sustainable practices. Socially engaged artists, for instance, started creating community-based art interventions to preserve or restore ecology. Joseph Beuys' interventions in which he, together with local communities, cleaned the Elbe River in Hamburg (1962) or planted seven thousand trees in Kassel in *7000 Oaks: City Forestation Instead of City Administration* (1982) are keen examples of ecological works of art in which the social and natural environment collide (Woynarski, 2020). Besides eco art, the emergence of the art movement land art (also known as earth art or environmental art) in the 1960s also raised awareness about nature and ecology. Land artists started using elements and landscapes to create works of art (Ballard & Linden, 2019; Ryan, 2007). Robert Smithson and Richard Long, both land art pioneers, extended the boundaries of the art world by elevating natural materials to the field of the arts (Ballard & Linden, 2019).[3]

Two decades after artists began incorporating nature as a medium in their artistic endeavors, the boundaries of the natural world became resketched through the emergence of biotechnology. Biotechnological progress provided a new perspective on nature because living matter became manipulable and moldable, for example through techniques of genetic engineering, cloning, tissue regeneration, interspecies communication, cross-pollination, and such (Kac, 2007a, 2007b). Artists responded to the biotechnological evolution and took the acceleration in life science and technology as their main source of inspiration (Andrews, 2007; Kac, 2007b; Melkozernov & Sorensen, 2021; Stracey, 2009; Zylinska, 2014). These so-called bio artists engage with "biomedia," living matter such as mammals, plants, tissue, algae, bacteria, viruses, DNA, and so on. As such, bio art fits into the art-nature tendency. Similar to land artists, bio artists create artworks with natural elements. However, in the latter one, the natural elements live, are kept alive, or their liveliness is changed (Kac, 2007a).

The origin of the term "bio art" is ambiguous as it comprises various, hardly distinguishable sub-categories including, but not limited to, transgenic art, art that involves "wet" biology, semi-living art, art together with machine learning and computer modelling, life-modulated art, and so on (Anker, 2014; Catts & Zurr, 2007; Kac, 2007b; Stracey, 2009). Bio art also closely relates to "sci-art," referring to the introduction of scientific processes in the arts (Anker, 2021). Another connected field is bio design. The fields of bio art and bio design are narrowly interwoven, making it nearly impossible to categorize the two practices. Bio designers, for instance, take experimental and conceptual pathways instead of only

[3] Though not recognized here, there are many more artists outside these "genres" that engage with nature in various modalities.

focusing on function. At the same time, many bio artists have stepped away from their *l'art pour l'art* approach to take part in knowledge production and reflections on science and create functional outputs (Mateus-Berr, 2014; Myers, 2018). There is no consensus about what bio art exactly entails, besides including other-than-human organisms in artistic practices.

The current trend to focus on nature and ecology is inseparable from the increasing social awareness about the looming climate crisis (Reiss, 2019). As humankind's destructive force on the planet has become apparent, and technological innovation has even enabled us to interfere with natural processes, major existential questions about our position towards nature and other-than-human living matter have arisen. To move beyond an anthropocentric viewpoint to approach nature, new ways to understand the relationship between the human and the other-than-human are urgently required. As a liminal space between the arts and the sciences, Anker (2021) has argued that bio art and its hybrid practices can redesign contemporary knowledge cultures. Bio art provides insights into our kinship with other-than-human organisms, which might guide us towards a more sustainable and eco-friendly relationship with nature (Radomska, 2016; Van den Hengel, 2012). In this article, we focus on bio art as a potential epistemic vehicle that emphasizes *ecocentrism* in research-oriented explorations of reality.

OBJECTIVES AND RESEARCH QUESTIONS

This study describes the potential of bio art as a multispecies and ecocentric inquiry to study reality. We approach bio art as an epistemic avenue that goes beyond well-established knowledge cultures that render nature manipulable. We aim to acknowledge the agency of other-than-human actors. New ways to understand nature invite us to reflect on how we, as humans, ought to study other-than-human bio-organisms. Therefore, we examine bio art from a posthuman, multispecies perspective as part of the overall goal to develop a relational ontology that works together with nature in developing responses to major social challenges.

We assume that new epistemic approaches for understanding nature as a partner can be found in the methods and approaches bio artists employ when engaging with other-than-human bio-organisms. For this reason, we study *how artistic co-creation processes involving humans and other-than-humans alike hold the potential to introduce a shift in our worldview from anthropocentric to ecocentric*. Furthermore, we question *what this shift might imply for how we approach the complex relationship between humans and other-than-humans in our research*.

THEORETICAL FRAMING

This study draws on philosophical posthumanism to analyze and conceptualize the data. Posthuman theory seeks to dismantle the conventional distinction between humans, other-than-human living beings,

and non-human materials. While other-than-human entities refer to all living matter and organic entities beyond the human body, non-human entities refer to non-living things such as technology (Braidotti, 2013; Haraway, 2016; Latour, 2014). Posthumanism draws on the theoretical and philosophical stance of new materialism which acknowledges the self-organizing capacity of living (i.e., other-than-human) and non-living (i.e., non-human) matter that fluctuates, is dynamic, and meaningful (Braidotti, 2022).

In this article, we specifically focus on humans' relationship with and connection to other-than-human organisms. Posthuman theorists highlight the agency of other-than-humans, meaning that they possess the capacity to co-influence and co-shape reality. Humankind engages in a reciprocal relationship of interdependence with other-than-human organisms. Based on these insights, posthumanism seeks to move beyond anthropocentrism, emphasizes interconnectivity between all matter, and argues for "relational ethics of mutual dependence and care" (Braidotti, 2022). Nature and culture are not two opposites but shape and are shaped by each other (Latour, 2017). Agency is not necessarily linked to intentionality, which can be ascribed to humankind. Rather, all organisms alter the world we are living in, think of bacteria living in our body and trees producing oxygen. Posthumanism acknowledges this intimate entanglement between nature and culture and advocates for a relational approach (Ferrando & Braidotti, 2020).

To obtain a more sustainable and eco-friendly attitude towards nature, the feminist and cultural theorist Donna Haraway argues for storying otherwise: the need for other kinds of stories, for other perspectives to narrate about nature, and for multispecies storytelling (Terranova, 2016). She argues that storytelling about the natural and animal world shape the way we perceive nature and other-than-human organisms: "It matters what ideas we use to think other ideas with....It matters what thoughts think thoughts" (Haraway, 2008, p. 12). Haraway's (2008) writing *When Species Meet* is a compelling example of multispecies philosophy in which the entanglement of the human with other living organisms is discussed. She states that "we have never been human" because our bodies mainly consist of and relate to a range of natural organisms such as fungi and bacteria. She essentially argues that "we are a knot of species co-shaping one another" (Haraway, 2008, p. 42). Humankind engages in "processes of thinking-with, making-with, and becoming-with our other-than-human colleagues" (Tsing, 2015, p. 22). In other words, the human engages in collective ways of doing, meaning that both the human and the other-than-human work together to create reality (Haraway, 2016). We use Donna Haraway's call for storying otherwise as a guiding principle throughout this study as we consider bio art to be a relevant pathway for multispecies storytelling.

Posthumanism has been adopted in various studies as a framework to examine bio art, highlighting bio art's potential to re-imagine humankind's relationship to nature and other-than-human living matter (Radomska, 2016; Van den Hengel, 2012). Many bio artists are inspired by posthuman writings themselves and employ posthuman concepts when engaging living matter in their artistic endeavors (e.g., Baum & Leahy, Michael Sedbon, among others). While learning how other-than- human agency manifests itself, we challenged ourselves to try and avoid anthropomorphizing other-than-human agency (Hornborg,

2021). With our situatedness of being human, the risk of anthropomorphizing bio-organisms remains.[4] What we can do, however, is highlighting and acknowledging other-than-human agency and enshrining rights of nature (e.g., the nine rights of the Magpie river in Canada).

We acknowledge bio art's ambiguous position towards living matter and experimentation which has been critiqued by Wolfe (2010, 2020) among others. Rather than highlighting potential instrumental and problematic associations to other-than-humans, Braidotti (2013) argues for affirmative relationships: broadening the understanding of the self by embracing radical relationality with other-than-human organisms. In line with Braidotti's (2013) reasoning regarding affirmative ethics, we aim to highlight that the experimental nature of bio art can spark imaginative processes that can guide toward renewed understandings of nature and culture.[5]

METHODOLOGY

To study bio art's epistemic value, we used a case study approach. We have conducted in-depth and holistic examinations of specific cases of bio art. Each art project represented a separate unit of inquiry and consisted of a consortium of human and other-than-human actors working together. The art projects were examined by employing various methods for data collection and data analysis in a well-defined setting (Dasgupta et al., 2020).

Setting

The study was conducted in the context of the Dutch Bio Art & Design Award (BAD Award), an international competition that encourages young artists and designers to experiment with living matter and to "push the boundaries of technological and artistic possibilities" (Lagerweij, 2016). The competition wants to urge discussions concerning life sciences by combining cutting-edge research with creative practices. The award further aims to stimulate interdisciplinary collaboration at the intersection of technology/science and art/design, and it intends to explore cultural and ethical dimensions of science through artistic practices (Bio Art & Design Award, 2023). Artists and scientists apply to participate in the BAD Award. After a match-making event in which artists and scientists connect and form duos, they collaboratively write a project proposal. An international, independent jury awards the three most promising and original proposals a grant of 25.000 euros to realize their proposed project within six months. During the collaboration, scientists receive the opportunity to join the ideation and creation process of artistic projects, and artists are welcomed into renowned Dutch science and research centres in life sciences and

[4] In Chapter 7, I engage deeper in to the challenges of anthropomorphism, showing how my thinking about the issue has developed throughout this doctoral trajectory.

[5] However, in some contexts, bio art might also reproduce exploitative practices that emphasize human mastery over nature.

biotechnology to collaborate with experts. The final outputs of the collaboration are displayed to the public during an exhibition at MU Hybrid Art House in Eindhoven (van Donselaar, 2016).

Sample

We analysed five projects that have won the BAD Award between 2018 and 2020. Table 2 demonstrates an overview of the selected bio art projects. To select projects for analysis, we took into account the role other-than-human living organisms played in the artworks, as well as the artworks' foregrounding of the connection between humans and other-than-humans, nature, and culture. The five bio art projects were the units of analysis in this study, essentially representing places where human (i.e., artists and scientists) and other-than-human bio-organisms come together, co-create, and engage in a collaborative process of making-with one another.

Project Title	Year	Artist(s)	Scientist(s)	Other-than-human organisms
Microbiocene: Ancient Ooze to Future Myths (Figure 1)	2018	Baum & Leahy	Stefan Schouten, Julie Lattaud, Laura Schreuder, Gabriella Weiss	Marine algae: Emiliania Huxleyi
CMD: Experiments in Bio-Algorithmic-Politics (Figure 2)	2019	Michael Sedbon	Raoul Frese	Algae: Cyanobacteria
Funkee: Fungal Supercoating (Figure 3)	2019	Emma Van der Leest	Paul Verwije, Sybren De Hoog, Aneta Schaap-Oziemlak	Fungi stemming from a human patient
Fur_Tilize (Figure 4)	2020	Dasha Tsapenko	Han Wösten	Mycelium: Schizophyllum Commune
Becoming a Sentinel Species (Figure 5)	2020	Sissel Marie Tonn	Heather Leslie, Juan Garcia Vallejo	Artist's blood

Table 2: Overview of selected bio art projects.

Analysis

We used a within-case and cross-case analysis of the five selected cases as our overall research design. In the within-case analysis, we intended to understand each case in its own terms by describing the case as a whole entity. We identified various dimensions and examined them to generate an overall explanation of the selected cases. Subsequently, a cross-case analysis was carried out to identify processes and ideas across different cases (Huberman & Miles, 1994). In the cross-case analysis, a comparative approach was adopted, aiming to pinpoint more systemic patterns in bio art. As such, we learned from different cases and provided overarching insights into bio art as an emerging artistic genre (Huberman & Miles, 1994; Khan & Van Wynsberghe, 2008).



Figure 1: *Microbiocene: Ancient Ooze to Future Myths.* Source: Baum & Leahy (2018).

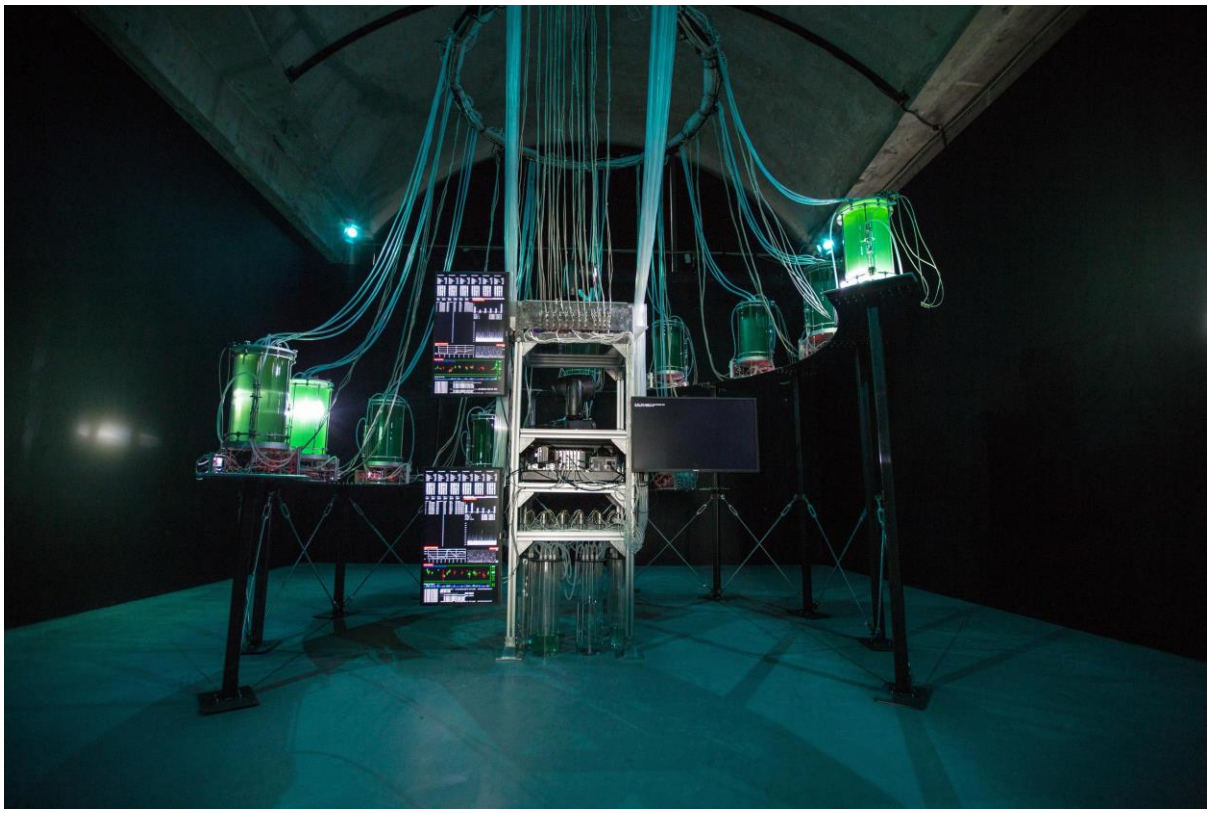


Figure 2: *CMD: Experiments in Bio-Algorithmic-Politics*. Source: Sedbon (2019).



Figure 3: *Funkee: Fungal Supercoating.* Source: Van der Leest (2019).



Figure 4: *Fur_Tilize*. Source: Tsapenko (2020).



Figure 5: *Becoming a Sentinel Species*. Source: Tonn (2020).

We aimed to analyse the art projects from a multispecies perspective in which both human and other- than-human actors were acknowledged to be creators of the projects. In doing so, we combined a visual and con- text analysis with semiotic materialism to approach the data. The visual and context analysis focused on visual imagery and video content of the selected art projects and consisted of three dimensions of appraisal: the formal characteristics of inquiry, the positional stance, and posthuman concepts and practices. First, we examined the formal characteristics of inquiry of the works of art by focusing on what scientific and artistic methods were employed and how humans employ them with other-than-human organisms. Second, we examined the positional stance of the projects. Bio art tends to address certain ethical, political, and cultural challenges in their creation (Stern, 2011; Vaage, 2016). Accordingly, we high- lighted the projects' critical stance and their alternative reasoning. Third, we considered how the projects relate to posthuman concepts and practices such as other-than-human agencies and multispecies entanglement. Understanding these aspects was an essential part of decoding the meaning of the bio-based artwork.

We synthesized this stream of data through material semiotics. Semiotics focuses on how meaning is created, communicated, and decoded. In material semiotics, non-human (i.e., material), and other-than-human (i.e., living matter) actors can be involved in the process of meaning-making: The meaning of the bio art projects comes into being through the intimate entanglement between artist, scientist, bio-organism, and non-living materials (Bettany & Kerrane, 2011; Law, 2009). Material semiotics emphasizes that "no single social structure or form of patterning exists because these material and social webs and weaves come in different forms and styles" (Law, 2019, p. 1). Using material semiotics helped

us to “story otherwise” and to generate a less anthropocentric perspective that allowed us to treat the other-than-human bio-organisms, the artists, and the scientists as co-creators (Law, 2019).

We complemented this hybrid analytical approach with insights generated from qualitative semi-structured interviews carried out with the artists and scientists involved in the creation of the projects. A total of twelve interviews were conducted, five with artists (including one artist duo) and seven with scientists. We focused on how the artists and scientists experienced the co-creation process and how they dealt with the notion of shared agency with other-than-human organisms. The interviews were transcribed, coded, and subjected to a thematic analysis. In the thematic analysis, a range of categories was identified and related to the three dimensions used in the cross-case analysis.

FINDINGS

In this findings section, we make a distinction between descriptive and analytical layers of interpreting the projects. We first describe the formal characteristics and the artistic process of inquiry of the artworks. We then dive into the analytical layer by discussing the projects’ positional stances and their connections to posthumanism. Table 3 shows an overview of these elements in the five selected bio art cases.

Formal characteristics and artistic inquiry

The concepts and processes explored in bio art can be presented or displayed for audiences in a multiplicity of forms. While some projects result in an installation set-up, others present bio-based design or even audio-visual films. To describe different artistic approaches, we have built upon Wang et al.’s (2017) categorization of art and research forms to explain the different artistic pathways the selected bio art projects have taken, including new media, visual art (sculptures, digital storytelling), literary art, and sound art. Whereas most cases engage organisms such as algae or fungi, some use human bodily materials including blood, DNA, cells, and tissue. The scientific fields of study identified in Table 3 relate to the fields of expertise of the collaborating scientists.

Positional stance of bio art

While the analysed bio art projects all take other artistic and scientific pathways, engage different materials, and hold dissimilar goals, each project follows a storyline that counteracts anthropocentric worldviews. The projects oppose humankind’s destructive force on the planet and/or rebel against human attempts to gain mastery over nature. They resist hegemonic, humancentric ways of perceiving reality and aspire to acknowledge the significance and power of other-than-human organisms and the environment at large.

The artist Sissel Marie Tonn and the artist duo Baum & Leahy especially oppose human exceptionalism. Both projects counteracted dominant narratives about humankind’s place on this planet

through storytelling. In *Microbiocene: Ancient Ooze to Future Myths* (see Figure 1), Baum & Leahy constructed a more-than-human narrative about the Microbiocene, a speculative geological epoch in which microorganisms take center stage. The narrative is based on micro-organic biomarkers that store scientific data. In the project, the microorganisms are appreciated as a storage space for the history of the Earth. The artists created a new narrative in which the microorganisms became the main storytellers, aspiring to re-tell and re-imagine planetary history from the point of view of the other-than-human (Baum & Leahy, 2020).

		Microbiocene: Ancient Ooze to Future Myths (2018)	*CMD: Experiments in Bio-Algorithmic-Politics* (2019)	*Funkee: Fungal Supercoating* (2019)	*Fur_Tilize* (2020)	*Becoming a Sentinel Species* (2020)
Descriptive: Formal characteristics and inquiry	Visual presentation	Installation of a future archaeological site in which a microbial monument/sculpture is found with symbolic writings on it ("mycroglyphs"), telling the story of Earth's history from a microbial perspective.	Installation of a series of tubes containing two sets of algae that share one light source connected to a genetic algorithm that is testing various financial systems of collaboration and competition between the algae.	Design of a biological coating to protect biomaterials, presented through a commercial and educational set-up explaining bio-based research process.	Design of five fur-like, living garments out of mycelium and hemp, each representing a different level of symbiosis between the mycelium and the hemp.	Science fiction film about two scientists who inject microplastics into their own blood, resulting in a series of hallucinations and delusions about their watery origins in the primordial sea.
	Material characteristics	Microscopic marine algae: Emiliania Huxleyi Sculpture out of sea sediments	Algae: Cyanobacteria Hardware: tubes for algae, light source, technological infrastructures Software: machine learning algorithm	Fungi, isolated from a human patient Conceptual branding: bottles, commercial	Hemp and mycelium	Microphages in human blood cells Microplastics Hardware and software to present the film
	Intention	Imagining and acknowledging microbes to be the main storytellers of the history of the Earth	Demonstrating the limits of human and technological mediation of nature	Illustrating possibilities of living matter in an approachable manner	Generating a renewed notion of care	Generating an emotional response and reflection on the microplastics flowing through our bodies
	Art form(s)	Literary art (fiction) and visual art (3D sculpture)	New media (AI)	Visual art (3D design and 2D branding)	Visual art (3D design)	Literary art (fiction), visual art (2D digital storytelling), and sound art (soundscapes)
	Scientific field of study	Palaeoclimatology	Biophysics	Mycology	Microbiology	Immunology and ecotoxicology
Analytical: Positional Stance	Critical position	Countering humancentric storytelling about the history of the Earth	Opposing science and technology's attempt to organize the chaos of nature by rendering bio-organisms and nature manipulable	Opposing trends in the fashion industry, such as fast fashion, waste, plastic pollution, mass production, etc.	Opposing trends in the fashion industry and agriculture: mass production and waste	Denouncing hierarchies between humans and other-than-humans, and the unequal distribution of toxicity
	Alternative reasoning	We need to appreciate the agency of microorganisms that have set beneficial conditions for life to thrive on Earth throughout the past, present, and future.	The development of the material world (both hardware and software) should be aligned with the needs of other-than-human entities.	Chemical-free, eco-friendly alternatives for destructive products such as synthetic coating and animal leather should be created.	We must acknowledge and appreciate symbiosis between other-than-human and human actors.	We need to concede that humans are sentinel species too, as our bodies are contaminated as well.
Analytical: Posthuman concepts and practices	Other-than-human agency	The researched sea sediments represent a storage space of the story of the history of the Earth.	The algae determine the other material characteristics and the "speed" of the installation.	The risky, pathological fungus possesses valuable features and can be used to create functional objects.	The mycelium alters and guides the ideas and practices of the artist and scientists.	The macrophages in the blood fight the microplastics outside the artist's body.
	Multispecies entanglement	The project highlights communication across species and envisions ourselves as being part of a greater ecology.	The project demonstrates collaboration between human (i.e., artist), other-than-human (i.e., algae), and non-human (i.e., AI).	The project demonstrates a durable relationship between the human and other-than-human via ecologically friendly alternatives to readily available products.	The project demonstrates a fruitful symbiosis between other-than-human organisms and humans by re-imagining how we care for our clothing.	The project shows that the natural environment is having slow and invisible, yet harmful effects on our bodies, just like humankind has had on the natural environment.

Note: the within-case analysis is represented in the columns of the table and the cross-case analysis is represented in the rows.

Table 3: Overview of the five cases.

This strategy of counteracting dominating human-centric pathways was also adopted by the artist Sissel Marie Tonn. In her science fiction film *Becoming a Sentinel Species* (see Figure 5), the artist highlights issues regarding speciesism:

> The use of sentinel species [in research] indicates a hierarchy: There are always some bodies that are more exposed to, more vulnerable for, and more immersed in our contaminated world than others. Sentinel species are instrumentalized and we do not take into account that they have lives and places in the ecosystem as well. (S. M. Tonn, personal communication, March 30, 2022)

Sissel Marie Tonn approaches sentinel species differently by putting humankind in that exact place. Just like Tonn, the artist duo Baum & Leahy goes beyond one limiting epistemological system by storytelling through another lens. The bio art projects offer a new angle to comprehend the past and the present:

> *Microbiocene: Ancient Ooze to Future Myths* is about a multitude, about existing as many, and about how this creates an inherent earthly connection and responsibility to the planet's past, present, and futures. (Baum & Leahy, personal communication, May 19, 2022)

The underlying reasoning of the analysed bio art projects is to shift towards a more sustainable and ecocentric approach. As one of the interviewed scientists noted, bio art can engender thinking about the urgency to find new ways of approaching the world, and the urgency of a more sustainable and responsible attitude towards the planet:

> Art and design do not need to lead to innovative findings. What it can do is stimulate reflexivity and show that we urgently need to start thinking of alternatives to our current material world....We can start thinking about new alternatives and possibilities. (Scientist, personal communication, April 6, 2022)

While Baum & Leahy and Sissel Marie Tonn use storytelling, Emma Van der Leest and Dasha Tsapenko demonstrate what a durable relationship between the human and other-than-human might look like through the creation of bio-based materials. Both Van der Leest's bio-leather and bio-based coating and Tsapenko's grown garments are a result of making-with other-than-human bio-organisms. In *Funkee: Fungal Supercoating* (see Figure 3), Emma Van der Leest employed a fungus that was isolated from a human being. The artist demonstrates that certain types of fungi might be harmful to humankind but can nevertheless have valuable features, which can change humankind's perspective towards fungi. The project provides a new perspective on fungi: Instead of perceiving the fungi to be dangerous, meaningless, and needless, these attributes are being replaced by new qualities that demonstrate their relevance. In this case, the potentially risky, pathogenic fungus could contribute to sustainable change by making bio-based materials more durable (Van der Leest, 2019). These alternative ways of perceiving other-than-humans can complement scientific knowledge creation. As one of the interviewed scientists noticed:

> An artist or an artwork can show you another angle and, even as a scientist, make you think or feel something different. They stimulate you, trigger your senses, and in this way, they indeed provide

> another type of knowledge that scientific reports cannot provide. (Scientist, personal communication, April 13, 2022)

Bio art does not only provide a different point of view to understand nature, but it also offers a new way of encountering nature and other-than-human bio-organisms.

Posthuman concepts and practices

The agency of other-than-human organisms is a common theme that runs through all of the analysed artworks. As ecocentrism seemingly presents a shared reasoning in the analysed projects, it highlights bio art's aim to acknowledge other-than-human's capacity to shape and influence reality. Ecocentrism is also reflected in the creation process of the projects. The artists align their ideas and practices with the agency of the other-than- human bio-organisms. As one of the scientists notices, "bio artists do not just take a piece of marble and create a sculpture out of it. Instead, the material is guiding them and the way they process it" (scientist, inter- view, April 13, 2022). Indeed, the artists Dasha Tsapenko and Michael Sedbon both emphasize other-than-human agency in their projects. When growing the garments in *Fur_Tilize* (see Figure 4), Tsapenko had clear goals and expectations for the project in mind, but the role of the living organism was much higher. She had to revise her questions and alter her attitude toward the other-than-human living beings:

> I was sure that in two months, we would actually achieve what we told ourselves. But then, when I started to work, I realized that it was far from what I imagined. The role of the living organisms is much higher. (D. Tsapenko, personal communication, March 29, 2022)

Tsapenko started to observe and value what the organisms offered: "According to the organism's behaviour, the story should be told differently" (D. Tsapenko, interview, March 29, 2022). In doing so, the artist experienced a shift in her attitude towards the living beings; instead of perceiving them as materials she was using to carry out her project, the living beings became collaborators. While artists have always been guided by the media they employ, the agency of materials in bio art is particularly evident because the materials happen to live. Even after a bio artist finishes working on the artwork, the living matter will continue to grow and therefore, will continue to shape the piece of art. For instance, Tsapenko's living dresses will look different two months after entering the museum.

While Tsapenko's work highlighted the agency of living organism during the creation process and thereafter, Sedbon ridiculed human mastery over nature in his project. Sedbon brought algae, hardware, and software together in *CMD: Experiments in Bio-Algorithmic- Politics* (see Figure 2). As they all work at different speeds, they needed to find a way to communicate and align: While the genetic algorithm works extremely fast, the growth of the algae is dependent on the living organism itself. Although the controlled environment provides perfect growing conditions for the algae, the artist asserts that other-than-human living organisms are impossible to predict:

> There are always going to be some properties [of the organisms] that you cannot control. Of course, you can engineer biology to go a bit faster, you can grow them in the best conditions as you can. But ultimately, you cannot do magic. (M. Sedbon, personal communication, April 5, 2022)

By showing the complexity of living matter and acknowledging its ability to transform, shape, and influence, Tsapenko's and Sedbon's projects represent a knot of agents (i.e., human, non-human, and other-than-human) that engage in a co-creation process.

The acknowledgment and appreciation of the agency of other-than-human organisms in bio art projects also result in reflections on humankind's position in the larger environment. As we have seen before, bio art reacts against anthropocentric worldviews and means to provide a more ecocentric approach to understanding reality. This approach highlights the entanglement of all planetary inhabitants in a shared and active environment: Humankind is understood as just one species in a knot of other species. This multispecies entanglement is highlighted in Tsapenko's and Sedbon's projects but is also to be found in Sissel Marie Tonn's film *Becoming a Sentinel Species*. Tonn emphasized kinship between the human species and the natural surroundings by turning humankind into sentinel species. Tonn's project demonstrated not only that our behaviour has had destructive effects on the environment, but also that these effects are bouncing back and starting to impact our bodies. In doing so, the artist illustrated the intimate interconnection between nature and culture: Humankind cannot be understood without considering the surrounding environment. Similar to Dasha Tsapenko's and Michael Sedbon's projects, Sissel Marie Tonn breaks down the hierarchy and brings the artist and the living matter, the human and the other-than-human on the same level. They all question human exceptionalism and generate insights into our relational ontology.

DISCUSSION AND CONCLUSION: NEW EPISTEMOLOGY THROUGH BIO ART'S RELATIONAL ONTOLOGY

The aim of this study was to explore bio art's potential to steer toward multispecies futures by generating new, ecocentric ways of knowing. The five bio art projects examined in this study provide compelling examples of new epistemic pathways to understand the other-than-human and nature at large. They acknowledge the agency of other-than-human organisms and highlight our entangled way of being. The cited examples demonstrate that artists are being guided by the living organisms and generate a co-creative outcome. The final art product is the result of a close collaboration between the human and the other-than-human: Other-than-human organisms determine the formal characteristics such as materials that are being used (e.g., to keep them alive), the artistic form, and the methodology of the artist, which all contribute to the artwork's eventual meaning. The organisms are dependent on the artist and vice versa. The organism and artist engage in a co-creative process of becoming-with and making-with one another.

Bio artistic endeavours, therefore, represent physical testimonies of organisms' power to transform, create, and manipulate. They are physical testimonies of other-than-human agency.

As living matter is the protagonist in bio-based works of art, bio art breaks through well-established ways of knowing and provides other ways to understand the world we are living in. Bio art responds to Haraway's (2016) call for storying otherwise: by challenging humancentric ways of perceiving the world, by preparing new pathways to understand our place on the planet, and, essentially, by re-imagining our relationship with other critters and the natural environment at large. In other words, bio art projects narrate differently by breaking down the human versus other-than-human hierarchy and by intensifying a different type of relationship in our study and research work. Since the analysed projects originate from close collaboration between the human and other-than-human, they resist human exceptionalism and highlight that the mind of the artist is impacted and even guided by the materials the artist utilizes.

When exploring reality, we can learn from these new ecocentric stories in which the human and other-than-human are intrinsically entangled. Haraway (2016) keenly questions what would happen "when human exceptionalism and bounded individualism, those old saws of Western philosophy and political economics, become unthinkable in the best sciences, whether natural or social" (p. 30). Located in between the arts, the natural sciences, and posthuman concepts, we believe that bio art provides epistemic potential. Bio artists recognize the other-than-human organisms to be collaborators, which in turn renders interesting perspectives to recast methodological and socially engaged research practices. Including other-than-humans in research-oriented explorations of reality might guide us toward new ways of knowing that intrinsically comprise multispecies entanglement. This is particularly relevant because existing research methods are limited and do not allow us to take all critters on Earth into account (Probyn, 2015). To include other-than-human entities in our research, profound methodological innovation is required.

Finding multispecies methodological approaches to draw inspiration from is challenging. Yet, they are highly needed to respond to a range of questions: How do we translate other-than-humans' agency and include it in our research designs? Can we communicate with other-than-human entities and how do we find a common language? How can we make our research practices as inclusive as possible and go beyond the human? While the epistemological ideas are thoroughly discussed by posthuman scholars, and some of the far-reaching answers to these questions are currently featured in future study research projects (e.g., Hannes et al., 2022), more efforts are required to translate these ideas further into workable research approaches. At the same time, critical questions arise about engaging living matter for aesthetic purposes and about including other-than-humans in socially engaged research practices. New concerns and challenges occur, possibly encouraging critical reflections on contemporary research practices and stimulating the imagination of alternative pathways. The experimental studies "bringing [human and other-than-human actors] together ensure that we keep our eyes down and ears open" (Probyn, 2015). They provide us with options for new methodological approaches to be used in multispecies research.

Based on the examined bio artistic practices, we have taken our very first steps and tried to story otherwise by adopting a multispecies research approach in which humans and other-than-humans were considered to be equal creators of the examined artworks. We, as humans and as researchers, became more acquainted with the notion of collaborative research with other-than-humans. We consider our study of bio art as an invitation to move beyond the idea that the researching object is somehow divided from the researched subject and to approach a study process as a knot, an entanglement, a network in which we are only one actor. Drawing on these insights, we believe that there is much to learn from bio artists on how to engage with living matter. We intentionally have utilized the word "engage" here, and throughout the entire article, to limit and overcome a reductionist approach of "using," "studying," "employing," and "exploiting" living matter. We have learned to go beyond treating other-than-humans as passive entities and we have aimed to highlight them as active agents throughout the article. As Haraway (2016) highlights, "it matters what thoughts think thoughts…what descriptions describe descriptions" (p. 12).

As the life-sustaining boundaries of planet Earth are being crossed one after another and sustainable transformation is urgently required, bio art can pave new pathways for reconnecting with the natural world. These new ways of thinking essentially represent side alleys—speculative or not—that complement the rather human-centric knowledge cultures that depart from hierarchical binaries. Through the inclusion of other-than-human organisms, bio art can give a glimpse of what multispecies relationality looks like, which might engender a renewed sense of responsibility towards the natural world.

BEFORE MOVING ON: A METHODOLOGICAL AND THEORETICAL REFLECTION

Before moving on, I would like to take a moment to reflect on the methodological and theoretical orientations that guided this article. Written at the very beginning of my doctoral trajectory, it reflects an onto-epistemic position that had not yet fully consolidated, meaning that my move toward more-than-representational forms of research was still in formation. The reliance on interviews, schematic analysis, and ways the data were presented signals a more realist epistemological grounding. At the same time, the argument that bio art has epistemic potential was primarily developed through the analysis of five artworks, even though the framing of the argument risks appearing more generalized. In response to these tensions, footnotes were added to introduce perspectives and reflections that emerged in the aftermath of writing and publishing this article. Rather than treating this as a methodological shortcoming, I understand this article as marking an important point of transition in how I position myself as a researcher: the article not only documents an early stage of inquiry but also helps clarify the conceptual and methodological departures that structure the later parts of this doctoral thesis, particularly the move toward more-than-representational approaches, including research-creation.

By studying bio art projects, Chapter 2 illustrates how artists are being guided by living organisms when creating artworks. In doing so, this chapter highlights and illustrates the agency of other-than-humans.

This chapter complements the conceptual understandings of multispecies arts generated in Chapter 1 and further engages with ***sub-question 1,*** *which focuses on examining* ***how multispecies arts might re-imagine relationality between the human and other-than-human****. The bio art projects featured in Chapter 2 demonstrate that relationality is not a uni-directional engagement between an active human (i.e., artist) and passive other-than-humans. Instead, relationality emerges through processes of mutual constitution, in which both humans and other-than-humans shape the creative practices and final artwork. This perspective helps to move away from human-exceptionalist understandings of human–nature relations and towards more ecocentric perspectives that emphasize connectivity and interdependence rather than control over nature.*

Building on this relational and ecocentric perspective, ***Chapter 3*** *will present a first methodological exploration into how to engage the wider public in creating multispecies arts. This exploration aims to gain in-depth insights into the methods, practices, prompts, and other creative approaches that might help society to imagine multispecies worlds that engage with climate change differently.*

PART II

RESEARCH-CREATION LABS

3

BIOFUTURES LIVING LAB

Co-designing multispecies speculations through biofuturing

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INTRODUCTION

The current and significant transformations of the planet necessitate the development of resilient ecologies able to creatively navigate through global warming, ocean acidification, biodiversity loss, rising sea levels, and other climate-related crises (Richardson et al., 2023). Such climate disasters disproportionately affect populations that are already disadvantaged, leading toward increased subsequent inequality (Islam & Winkel, 2017). Amid these growing concerns of global warming and its socioeconomic and ecological consequences, there is an increasing need for new ways of "knowing and being in the natural world" that emphasize a sustainable coexistence between humans and nature (Burnard & Colucci-Gray, 2021, p. 2). Rather than focusing on existing human-centric and techno-fix discourses to solve the wicked problems of the 21st century, it is imperative that we adopt new approaches to navigate through the new kinds of challenges we are exposed to (Huesemann & Huesemann, 2011; Jacobs et al., 2023). In response to this call for alternative modes of knowing and being, we developed "biofuturing" as a new research and creation approach, drawing inspiration from the multispecies entanglements presented in and through bio art.

Bio art offers a significant avenue for exploration as it introduces alternative imaginaries that rethink our relationality to other-than-humans (Radomska, 2017). In its process of co-creating with living organisms such as bacteria, algae, and fungi, bio art establishes new pathways to approach and understand the world we are living in (Melkozernov & Sorensen, 2021; Van den Hengel, 2012). Bio art has proven to foster empathetic and politically sensitive social-technological-environmental imaginaries (e.g., *I Wanna Deliver a Shark* by Ai Hasegawa), it has visualized probable or preferable futures (e.g., *Ecosystem of Excess* by Pinar Yoldas), and it has encouraged ethical discussions regarding biotechnological progress (e.g., *Pig Wings* by Oron Catts, Ionat Zurr, and Guy Ben-Ary; Lie, 2023; Reichle, 2014; Zurr & Catts, 2005). In such multispecies speculations, bio art creates a polylogue between constructed divides (i.e., between nature and culture, between human and other-than-human), provoking critical reflections on futures possibility and sensibility (Albergel & Magnusson, 2014; Williams, 2022).

Through these multispecies speculations, bio art offers potential to reframe methodological and socially engaged research approaches: "Including other-than-humans in research-oriented explorations of reality might guide us towards new ways of knowing that intrinsically comprise multispecies entanglements" (Jacobs et al., 2023, p. 61). As such, we began exploring creative research and creation practices in and for academia inspired by bio art, and we started experimenting with multispecies speculation, aiming to go beyond anthropocentric imaginaries of worlds to come. In this article, we introduce "biofuturing" as a creative research and creation practice. Although the term "biofutures" has recently been employed to discuss renewable energy and related industries (e.g., by the Queensland Government in Australia), it is crucial to underscore that we are introducing biofuturing as a new practice in which various actors and approaches engage in creative, empathetic, and relational entanglements. This entanglement is first and foremost presented in that biofuturing is both conceptual and practical, both theory and methodology, both research and creation. The theoretical and methodological accounts of

biofuturing are interwoven in a reciprocal relationship of forming and informing one another, involving artistic exploration in academic research (Loveless, 2019; Truman, 2022).

We piloted this biofuturing approach in the BioFutures Living Lab, an interuniversity and transdisciplinary workshop series organized in Belgium (April, 2023) with 21 early-career scholars. In this article, we discuss the pilot implementation of biofuturing and we consider what biofuturing, as a methodological research and creation approach, has to offer in stimulating relational creativity toward multispecies speculations. We further question how the co-designed biofuturing speculations address existing and emerging challenges from a relational, multispecies perspective. While exploring biofuturing in—and in between—theory and practice, our ambition is to find a new methodological approach that can help us rethink our position within ecology. We specifically aimed to generate a thought-provoking, reflexive, and creative practice of co-imagination. We acted based on an assumption that biofuturing possesses potential to spark collective creativity, imagination, and experimentation that render alternative strategies to approach futures and its growing demand for balanced relationships and interconnectivity between the human and other-than-human. In this article, we argue that biofuturing embraces the multiplicity of relations within and beyond transdisciplinary collaboration, multispecies entanglements, and multitemporal thinking. In doing so, we hope to demonstrate the potential of creative research practices in academia and we aspire to encourage scholars to seek inclusive, creative, and practice-based pathways for research and education.

BIOFUTURING IN THEORY: A CREATIVE ECOLOGY FOR RESEARCH AND CREATION

Biofuturing is embedded in posthuman theory and feminist materialisms, and in doing so, represents a relational research and creation methodology that acknowledges the interconnectedness of practices and matters. Departing from the idea that agency is not an attribute possessed by human individuals alone, we move beyond human exceptionalism and acknowledge that humankind constantly interacts—or as Barad would say, "intra-acts"—with surrounding forces: the planetary environment, material objects, other-than-human organisms, and such (Barad, 2007; Braidotti, 2013). While positioning biofuturing in this line of thought, we draw on Harris' (2018) recent theorization of "creative ecology" that highlights the agency of diverse entities and the relationality embedded within creativity. Rather than acknowledging creativity as a skill or characteristic inherently linked to a human individual, Harris emphasizes that creativity takes place through processes and practices of thinking-with and making-with a multiplicity of entangled actors, relations, events, and so on, represented as an ecology (Harris, 2018; Harris & Rousell, 2022). Biofuturing, as a creative ecology, recognizes, embraces, and stimulates such relational entanglements within and beyond constructed divides (e.g., human vs. other-than-human, present vs. futures, object vs. subject). Being both theoretical and methodological in nature, the concept/practice of biofuturing is located at the intersection of (a) trans-disciplinary and cross-practice collaboration, (b) multispecies entanglements, and (c) multitemporal speculations.

Cross-practice and transdisciplinary collaboration: By bringing diverse disciplinary fields and approaches together, biofuturing represents a relational research and creation methodology that acknowledges the complexity and entanglement of knowledge (Braidotti, 2013; Chappell, 2022; Loveless, 2019). As a nonlinear approach that takes the environment as "the frame of reference … in all its open-ended, inter-relational, transnational, multi-sexed, and trans-species flows of becoming," biofuturing aims to make new and unprecedented epistemic connections (Braidotti, 2013, p. 89; Haraway, 2016). By moving beyond isolated taxonomies of knowing/knowledge, biofuturing represents a vibrant ecosystem of wisdom that merges conventional research with creative practices of making and doing. By implementing creative and artistic practices in academic research, biofuturing closely connects to the field of research-creation (Loveless, 2019; Truman, 2022).

Multispecies entanglements: In recognizing the world as a complex web of entanglements, multispecies studies specifically guided our thinking. By emphasizing the agency of other-than-humans, biofuturing aims to demonstrate the entanglement of the multitudes of lively agents in sociocultural and economic systems (Kirksey, 2014; Van Dooren et al., 2016): "all species play a part in creating the world. We engage in processes of thinking-with, making-with, and becoming-with our other-than-human colleagues" (Tsing, 2015, p. 22). As such, the world represents a complex web of relations between the human and other-than-human, between nature and culture (Haraway, 2008, 2016). In biofuturing, we speculate about how to collaborate with our natural surroundings, looking for guidance in nature amid contemporary obscurities and societal disruptions.

Multitemporal thinking: In its effort to facilitate the exploration of alternative futures, biofuturing emphasizes the interrelation of specific contexts, cultures, and situated experiences, thereby opening up a wide range of possibilities in how one imagines futures (Anthoni et al., 2020; Inayatullah, 2013; Truman, 2019b). As a participatory and collaborative approach, biofuturing aims to facilitate the development of commonly imagined futures, taking into account the politics of who is involved in this futures-making and who is excluded (Bell, 1996; Bratteteig & Wagner, 2012). Through this participatory process of speculative world-making that includes other-than-human agents, biofuturing serves as a concept/practice to co-design alternative visions. In doing so, biofuturing seeks to disrupt conventional paradigms of knowing and "knowledge creation" within academia, providing futures-oriented and creative thinking strategies.

In bridging transdisciplinary and cross-practice collaboration, multispecies entanglements, and multitemporal thinking, biofuturing represents a creative ecology of a multiplicity of relations, generating a hybrid way of knowing/doing. As a concept/practice, biofuturing aims to expand conventional academic and educational discourses and procedures with multispecies imaginative thought.

BIOFUTURING IN PRACTICE: BIOFUTURES LIVING LAB METHODOLOGY

We conducted a pilot implementation of biofuturing drawing on a collaborative living lab methodology as the overall research design, leading to the development of the BioFutures Living Lab. In what follows, we will delve into the setting of the BioFutures Living Lab, introduce the group of participants taking part in it, and offer a detailed description of the practical application of the biofuturing process in a living lab setting.

Setting

We conceptualized the BioFutures Living Lab as an interuniversity and transdisciplinary training program that invited early-career scholars to a 3-day explorative research and creation event. The event took place in BAC ART LAB, a centre for contemporary art and science that is located in the former Institute of Bacteriology of the University of Leuven (Vanpaemel & Snaet, 2016). The BioFutures Living Lab was an initiative facilitated and financed by the Doctoral School of Humanities and Social Sciences at the University of Leuven. It was organized as an interuniversity grass roots initiative partnering LUCA School of Arts, Hasselt University, and the Vrije Universiteit Brussel. The BioFutures Living Lab consisted of a succession of pitches and workshops of various lengths (1 hour up to 4 hours), provided by experts specializing in futures studies, bio art, participatory and speculative design, creative research methodology, and systems thinking.

Participants

We issued an open call for early-career scholars, including PhD students and postdoctoral researchers coming from a variety of disciplines and affiliated to a Flemish University. We promoted the open call through the communication channels of the institutes and networks of all Flemish Universities. The selection of participants was based on a motivation letter and a short biography. In total, a diverse and international group of 21 scholars applied, coming from various disciplinary backgrounds (social sciences, pedagogy, biotechnology, design, art, architecture, public health, physics, etc.). We had capacity within the program to invite them all. We divided the participants into five groups, taking into account disciplinary variety. Each group consisted of four to five scholars who closely collaborated throughout the 3-day BioFutures Living Lab.

Living Lab Methodology

We initiated a pilot of biofuturing by employing a collaborative living lab methodology, resulting in the development and organization of the BioFutures Living Lab. Living labs are a commonly used approach in participatory design in which multiple actors come together and engage in an exploratory journey to co-create new strategies suitable to approach complex challenges (Bergvall-Kareborn & Stahlbrost, 2009; Björgvinsson et al., 2012; ENoLL, 2023). Through an active participation process, living labs aim to foster citizen-centered, sustainable, and innovative developments (Følstad, 2008; Pallot et al., 2011). Drawing

on this living lab methodology, the BioFutures Living Lab presented a creative ecology of exploration and exchange. Yet, while the living lab methodology is generally concerned with generating citizen-centered real-life design outcomes, the BioFutures Living Lab focused on the process of multispecies speculations of alternative realities.

In the BioFutures Living Lab, we used "multispecies energy and connectivity" as a prompt for speculative thinking, relating to, among other things, sustainable energy supply, power outages, digital blackouts, online connectivity, as well as the power of nature, and connectivity between the human and other-than-human. To dive into the topic of multispecies energy and connectivity and its related challenges, we divided the BioFutures Living Lab into four phases that guided the participatory imaginative journey: (a) problematizing contemporary energy and connectivity and exploring new approaches to energy and connectivity; (b) co-researching and co-designing alternative, multispecies pathways; (c) evaluating and reflecting on these new pathways; and, finally, (d) sharing and discussing these alternative possibilities through storytelling (The Bristol Approach, 2023). Futures studies techniques were embedded in each of these phases. In Figure 6, a visual representation is provided that depicts the four phases. Although these phases present the BioFutures Living Lab as a linear process, it is crucial to emphasize the complexity and messiness of co-creation that included parallel processes of thinking and doing, of going back and forth, of discussion and consensus, of individual and group conversations, and so on.



Figure 6: From left to right, brainstorming session in CLA-process (phase 1); speculative co-design process, using collecting and collaging (phase 2); a futures wheel of consequences of the designs (phase 3); and the collaborative futures writing process (phase 4).

Phase 1: Problematizing contemporary approaches and exploring alternatives. During the first day of the BioFutures Living Lab, we problematized contemporary energy and connectivity and explored alternative strategies via the futures technique Causal Layered Analysis (CLA). CLA is used to break down underlying problems, causes, worldviews, and myths of particular issues (Inayatullah, 1998). In this process, we discussed, brainstormed, and imagined answers to a range of futures-oriented questions. Our discussion began with the question, "In 2043, what could be a news item about energy and connectivity?" We continued with wondering "What kinds of experts engage with these facts in the news and what might they want to learn about these facts?" After that, we were encouraged to speculate about "Which stakeholders look at this news with interest and how do they feel about this news?" And finally, we dived into the assumptions of our imaginations by discussing "What images and deeply rooted narratives we recognize in each news item?" By imagining newspaper headlines that would be published in 2043 and by

deconstructing them and their associated assumptions, the first phase opened up space for alternative pathways to address energy and connectivity. This prepared the group for collective action and creation in the next phase.

Phase 2: Co-researching and co-designing. On the second day of the BioFutures Living Lab, participants co-researched and co-designed alternative, multispecies possibilities for energy and connectivity. Using a speculative design approach, the second phase meant to stimulate hands-on, creative, and strategic thinking toward speculative prototype development (Dunne & Raby, 2013). Starting with a role-play of two researchers facing global energy system challenges in the year 2117, we were prompted to speculate about new approaches to address this pressing crisis. As we began brainstorming to clarify the possible challenges, we started mapping out potential multispecies responses. Through discussion and debate, writing, drawing, collaging, collecting, sculpting, and other creative practices, we drafted futures worlds in which new prototypes, models, and/or strategies would emerge. While some groups started sculpting clothes, others collaged and drew their futures prototypes, or started collecting materials to visualize their speculations. This process eventually led to speculative prototypes, models, and/or strategies that emphasized multispecies entanglement, meaning that other-than-human species were included into our imaginaries.

Phase 3: Evaluating and reflecting. After co-designing and co-researching alternative prototypes, models, and strategies, we continued with evaluating and reflecting upon these multispecies speculations. On the third and last day of the BioFutures Living Lab, we engaged in a futures wheel workshop to anticipate the potential benefits and risks of the multispecies speculations (Bengston, 2015). Here, we procured pens and paper, and we commenced mapping out first-order positive and negative consequences of our speculated worlds using sticky notes. Once we had mapped out the direct impact of our speculative prototypes, we continued with thinking about the consequences of these direct impacts by identifying second-order and third-order consequences. This process of discussing and brainstorming on paper visualized our thinking process and yielded a relational mind map resembling a wheel or web of consequences. This method has been further developed and expanded throughout the doctoral trajectory, and has been used to engage with a range of topics across various contexts (see Appendix 1).

Phase 4: Sharing storylines. Finally, the identified consequences were embedded in fictional storylines about the prototypes, models, and strategies. Through a mental time travel exercise and a role-playing game, each group speculated about the prototypes and models, and their users, taking into account potential conflicts or tensions this may introduce in society, for instance, on the level of multispecies integration. Through collaborative writing within the small groups, we created fictional storylines that we shared with each other, enhancing the engagement and bringing a new level of understanding of the developed ideas (Zaidi, 2019). Here, we used a writing-as-analysis approach to encapsulate the speculations that surfaced throughout the creative biofuturing process. By using writing as a form of inquiry, we aimed to break down generated knowledge and make sense of what is known (Rolfe, 1997). Instead of perceiving the act of writing merely as a tool for conveying information and telling

a story, the act of writing itself is a means of uncovering and analyzing the world (Richardson, 2003). We identified chief characters, spatial settings, main events, and so on, and poured these elements into a fictional story. Within the participatory biofuturing contexts, this collaborative writing exercise encompassed the creation of a shared space to write in which authors write oneself into each other's stories, sharing imaginaries (Wyatt et al., 2014). Finally, the co-created fictional storylines were shared with other groups through a reading session.

FINDINGS: CO-DESIGNING MULTISPECIES SPECULATIONS

Problematizing contemporary energy and connectivity (phase 1)

As we embarked on the biofuturing process, we began with problematizing contemporary approaches toward energy and connectivity and started exploring potential alternative pathways. In this first phase, the CLA-brainstorming prompted ideas relating to cloud-wars in the solar energy era, new linguistic systems, sustainable food production, hydropower in times of drought, the development of power-generating bacteria, and the risk of electricity addictions, to name but a few. This lead to the speculation of futures news media headlines such as "PowerBact Puts Water Supply of New York at Risk," "Back to Paper: Smell and Touch the News Again," "Cloud War: Atlantis Blocks Sun Above the New Solar Park of Wakanda," and "10 Reasons Why Power Cuts Are Making Us Healthier."

The co-designed speculative prototypes and storylines (phase 2 and 4)

In this section, we discuss the co-designed futures prototypes and models, and their fictional storylines, which can be found in the "Speculative Scenario" text boxes below. In the co-design process, some groups focused on the creation of speculative material artifacts for potential futures, such as the development of living skinwear in *Algae Suits* (see Speculative Scenario 1 and Figure 7). As protective clothing crafted with algae, the suits provide protection against intense heat and radiation. As living organisms, the algae adapt and grow, synergizing with humans and microscopic tardigrades. The intersection of algae, tardigrades, and humans creates a unique hybrid interspecies co-living scenario, fostering a profound journey toward mutually beneficial coexistence. Amid future challenges of adapting to continually changing and extreme environments, this union also addresses collective trauma, ultimately guiding us on a path of healing and a more harmonious existence.



Figure 7: Illustration of *Algea Suits*. Prompt: "A Future Human Wearing Algae as a Protective Suit, Full Body Is Covered With Algae" Via deepai.org.

Speculative Scenario 1: Algae Suits

The Algae Suits present protective apparel composed of resilient algae, speculating about a compelling multispecies answer for precarious futures. Designed to shield against scorching heat and radiation, and rejuvenated through water absorption, these living garments hold promise in an increasingly hostile world.

The cataclysmic climate change led to the collapse of Earth's ecosystem. Humans retreated to subterranean cities to survive extreme temperatures and deadly radiation, hoping to return to the surface one day. Meanwhile, some humans started to repair the surface. After years of relentless research, they created resilient algae suits with us, algae, capable of shielding wearers from the surface's wrath for a limited time, while providing vital resources. In the subterranean, we embarked on a journey toward the blinding light. While traveling upward, the heat intensified, and an unrelenting and mysterious itching became unbearable. "Noooooooo!" Panic gripped us as screams echoed. Fire consumed everything, leaving us in chaos. As someone approached, we succumbed to searing agony before we were veiled in darkness.

Consciousness returned with only a fuzzy memory of the accident. Concern gnawed at us, as Derek's voice crackled. "Thanks for coming, Dan. Something is awry with the suits, and the algae are in critical condition." Dan took us, eventually passing to a woman as darkness shrouded our existence. Weeks passed by with examinations under the microscope. "I've made a significant discovery about the suits!" Professor Susame exclaimed. Together with one of the designers, she was looking for a solution not to kill us, algae, but to co-exist with the tardigrades, which apparently had been living among us and provide

an excellent radiation shield. The designer's trembling hands applied an unfamiliar substance to us. It felt cold, sticky, and unpleasant. Miraculously, the itching ceased, and was soon replaced by a delightful sensation. We were revitalized. Tardigrades, hidden but ever-present, resurfaced. We were back, together, stronger than ever.

Similar to Algae Suits, the speculation of *TeleFungi* represents a multispecies design for worlds to come (see Speculative Scenario 2 and Figure 8). *TeleFungi* is a telecommunication system involving mycorrhizal networks, able to send messages in the form of chemical signals, which can either contain larger badges of information that are sent through slow communication processes, or electrical signals are sent way faster, but can only contain simple information. Trees give a signal when they receive a message from the mycorrhizal networks, for instance, by blossoming. By tapping the trees, the message will reveal itself. *TeleFungi* builds upon the growing knowledge about mycorrhizal networks (i.e., Sheldrake, 2020) and sprouted out of the liminal space in between various disciplines, which enabled us to join already existing knowledges and establish new ways of knowing.



Figure 8: Picture taken during the BioFutures Living Lab event, representing the speculative co-design process of *TeleFungi* through collecting and sculpting.

Speculative Scenario 2: TeleFungi

TeleFungi is a multispecies communication system based on the network of fungi and trees, allowing us to speak and interact with others without any form of electricity. Building on the biological qualities of Mycorrhizal networks, TeleFungi transfers messages to and from dense ecosystems.

"Hey! How are you? You look a bit tired. Have the kids been keeping you busy?" Mochella stands up and greets her friend with two kisses. They go way back and their connection has proved to be very useful.

Mochella works as the second-in-command of Mucor, the Mushroom Master of Brussels. This means that she works in the Mushroom center where the TeleFungi mushrooms are located that allow messages to be sent and received. Mucor taught her the ChemL language and she has been sharing this knowledge with Emel. "Always," he responds, "but there are bigger things that kept me awake last night. Mucor invited me for a beer, right? You know we always have had our disagreements but this time was intense. We started talking about how the public access to TeleFungi is still very limited. I was telling him about this new project we are starting where we are trying to bring the TeleFungi system inside the homes of people, but he basically told me it would be useless anyways. Apparently, the government has other plans as they want to privatize TeleFungi because it is too expensive for the city. What he told me horrified me: he wants to destroy the balance and is planning to crush TeleFungi with an army of insects."

Being a promising and efficient new energy source in 2100, *Aurora Benergy* uses the unlimited energy of the sun, harvested and transported through the environment without the necessary infrastructure (see Speculative Scenario 3 and Figure 9). Yet, *Aurora Benergy* introduces unforeseen consequences on the environment and other-than-humans, as the electron waves disturb the natural navigation systems of whales. Therefore, it was decided that a relational and multispecies approach to policy making was necessary that might lead to new forms of ontologies, epistemologies but also communication. In speculating-with the Northern Light as an Earthy system, the story of *Aurora Benergy* is positioned in the in-betweens of living and non-living, animate and inanimate, demonstrating that these taxonomies of knowledge are intertwined. Speculating-with other-than-humans such as algae, fungi, or aurora borealis in this sense fractures the binary way of thinking that reinforces humankind's idea of exceptionalism (Haraway, 2016).

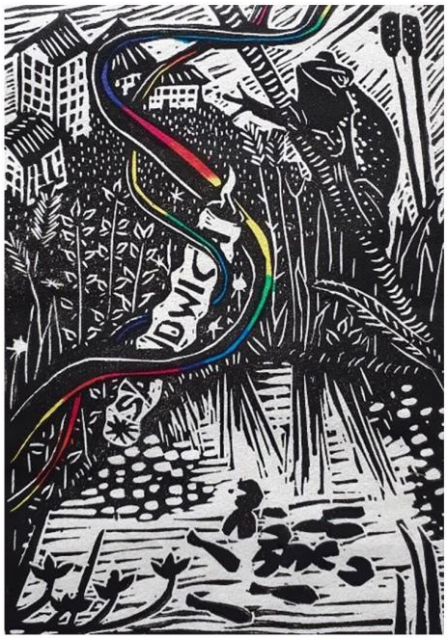


Figure 9: Linography as a visual representation of the storyline about *Aurora Benergy*.

Speculative Scenario 3: Aurora Benergy

Aurora Benergy, a new multispecies sustainable energy concept, channels the power of the Aurora Borealis or the Northern Light, allowing a completely sustainable and pollution-free energy production. The constant flow of Aurora Benergy provides energy access to all.

Lunch break, finally, what a day—air-conditioned bus stops, particle accelerators, and aluminum casting, not to forget the shiny electric cars in the parking lot. The consumption of my energy flow seems to increase day by day. So, this lunch break is well deserved. I make my way to the ponds just out of the city. It is a quiet day at the pond, my reflections shimmer blue and green between the water lilies. The sounds of the pond relax me—the chirping of birds, the ruffling of the trees, and the croaking of the leopard frog family. I finally managed to reduce my wavelength and amplitude to find some peace.

My frog friend Gregor greets me and asks about my day. I cannot avoid sighing: "The pressure is increasing, there is more and more work, but it is still just the five of us for the entire city. Every evening when I get home, I just fall asleep, drained, empty. They want more and more: larger devices, faster vehicles, more advanced robots. . . It is a never-ending demand for energy. I am close to a burnout. I am so looking forward to the holidays, a weekend away. We're going to see the pyramids. I just hope my boss doesn't make me stay at home, with the plans of the mayor you never know."

While *TeleFungi*, *Algae Suits*, and *Aurora Benergy* represented speculative material infrastructures, the stories of *GreenTown* and the "Infinite Game" were more invested into imagining alternative ways of living and being in societies. *GreenTown*, for instance, rethinks contemporary urban living characterized by resource consumption and speculates about a more sustainable way of living in urban areas (see Speculative Scenario 4 and Figure 10). As part of *GreenTown's* robust design, integration with local flora and fauna is central to its ethos. However, in the context of this new societal frame, novel conflicts arise making multispecies compromises necessary for an inclusive society. *GreenTown* speculates-with recent legal theory of "Rights of Nature," which suggest inherent legal rights of ecosystems and species to "exist, thrive, and regenerate," creating a more ecocentric way of human–other-than-human coexistence (Ipbes, 2023).



Figure 10: Picture taken during the BioFutures Living Lab event, representing the speculative co-design process of *GreenTown* through collecting, collaging, and drawing.

Speculative Scenario 4: GreenTown

GreenTown is a new concept for a low energy-usage and highly integrated urban environment, opposing large cities that depend on voracious resource consumption and fragile infrastructures. The multispecies town appeared after ecological and societal collapse as extreme droughts affected hydroelectric power plants that were developed to sustain human settlements. This massive challenge forced us to reconsider urban living and lifestyles.

Back in 2117, the sugar glider community took warm and inviting refuge in GreenTown. The sacrifices they had endured to establish their nests and raise their families filled them with a deep sense of resentment for the challenges they faced in the present. Many fellow gliders had been driven out of the city, or even met worse fates.

GreenTown runs on a unique system that harnesses the movements of sugar gliders to generate energy, creating harmony. However, human greed began to escalate, putting a strain on this delicate balance. Hank, the Gardener responsible for the city's greenery, recklessly used the energy generators, which eventually led to a catastrophic explosion. This incident led to the tragic loss of sugar gliders and served as a wake-up call for action. A diverse coalition of beings, human and other-than-human, united to protest for their rights within GreenTown. The government took decisive action to regulate electricity consumption and to ensure fair representation for all. This decision brought immense relief to other-

than-human communities, putting an end to the exploitation they had endured and reemphasizing the importance of sustainable living in GreenTown.

Similar to *GreenTown*, *The Infinite Game* presents new ways of living and being in worlds to come (see Speculative Scenario 5 and Figure 11). As a mobile app that steers toward sustainable climate futures, *The Infinite Game* seeks to foster a relational and empathetic connection between humans and other-than-humans. With the game's customized AI coaching, players are able to gradually transition from lifestyles of overconsumption, individualism, and injustice to embodying practices that are more sustainable, relational, and equitable. The game has quickly evolved into a feature-rich platform that connects people from across the world to share knowledge and build grassroots communities. The resulting local benefits motivate larger intergovernmental systems to get on board, and future updates build sustainability at the global level. Taking into account society at large, the Infinite Game represents a complex entanglement of the political, cultural, economic, and the technological.



Figure 11: Picture taken during the BioFutures Living Lab event, representing the speculative co-design process of *The Infinite Game* through drawing and writing.

Speculative Scenario 5: The Infinite Game

Designed as a preventative measure, The Infinite Game is a mobile app that works as a catalyst for systemic change, to mitigate or avoid altogether destruction caused by future climate-related catastrophes.

It's my turn to cook breakfast for the household. I can't imagine it any other way anymore; still, I set my phone to activity tracking. Breakfast duty is big points, and the competitive spirit in me wants to level up before the end of the month. The chickens peck about as I gather enough eggs for the meal and pick a few handfuls of nettles to fill out the omelets. I listen to a podcast as I work, the hosts joking about pre-gamer Millennials, sucking up power, producing tons of carbon with their insistence on newer, faster, blah, blah. . . addiction to growth.

The comedy is cathartic, but it hits a bit too close to home as I think of my mother's habits, driven by compulsions she cannot fully control, no matter how many points she might get. When one of the hosts says how utterly useless these people are without electricity, I turn it off. My mother suffers panic attacks just thinking about electricity rationing, never mind putting it into practice. She can't tolerate an analog lifestyle, as if it causes her physical pain. It's not sustainable, but it's not fully her fault either. As I boil water for tea, my phone rings.

"—Again?" My mom is calling. I'm not sure I can handle another argument about her new SmartCouch.
"How's your LocalSupports PointFund, Mom? Isn't there someone closer who can help you with the delivery?"
"Forget the points, there's been an electro-disaster!"
"A what? Slow down!"
"It's coming here! We've only got—"
"Mom?" The call's been dropped. I open the junk drawer and set my phone inside, sliding the drawer shut again. Pulling on my coat, I head for my bike and set off to my mom's house.

Evaluating and reflecting upon multispecies speculations (phase 3)

Following the ideation of these prototypes, models, and strategies, the evaluation and reflection resulted in more critical concerns related to the co-created multispecies speculations: How do *Algae Suits* create harmonious coexistence between humankind, algae, and tardigrades? Can rights for nature influence our perception of sustainability in *GreenTown*? What if *Aurora Benergy*'s electron waves disturb the natural navigation senses of whales? And what if *The Infinite Game* creates a generational divide in the context of technology and sustainability literacy? In this phase, we also started noticing a risk of commodifying living matter, resulting in the potential reestablishment of hierarchical relationships that are characterized by exploitation and control (Radomska, 2017): What if *Aurora Benergy* inadvertently leads to the privatization of the northern light, controlled by corporations for profit? And what if the integration of *TeleFungi* in urban environments has restricted access, creating a new form of inequality based on one's financial means to engage with other-than-humans? More generally speaking, we wondered how to go from a mindset that approaches nature as property, capital, and resource toward a mindset in which nature is everything: "identity, the home of our nonhuman kinfolk, our pharmacy, our library, the source of all that sustains us" (Kimmerer, 2013, p. 17). Through speculative worlding, questions arose about heteronormative practices

and values inherent to neoliberal capitalism of today's societies. These questions were integrated and highlighted in the fictional storylines mentioned above (see Speculative Scenarios 1–5).

DISCUSSION

Amid the shifting planetary conditions and its catastrophic consequences, the imagination of constructive futures trajectories becomes increasingly challenging. As Robin Wall Kimmerer (2013) points out, "how can we begin to move toward ecological and cultural sustainability if we cannot even imagine what the path feels like?" (p. 6). To rethink our position in this world and imagine alternative futures, we moved toward creative ways of thinking and doing in academia. Drawing inspiration from the field of bio art, it was our aim to reimagine humankind's relationship to the other-than-human and to discover new ways of "knowing and being in the natural world" (Burnard & Colocci-Gray, 2021, p. 2). As an other-than-human (speculative) space, bio art guided us to tune into multispecies worlds to come, breaking away from well-known, heteronormative, and often human-centric perspectives and practices to create new understandings of the word (Jacobs et al., 2023).

Leveraging bio art's potential for alternative modes of knowing and being in this world, this study has introduced and discussed biofuturing as a creative research and creation approach that fosters the co-design of multispecies speculations. The biofuturing theoretical conceptualization and practical implementation led to a series of speculative prototypes and fictional storylines, including *Algae Suits, TeleFungi, Aurora Benergy, GreenTown,* and *The Infinite Game*. The biofuturing learning environment is an example of what Harris (2018) has conceptualized as a "creative ecology," representing an exploratory, creative space where a wide range of relations creatively engage with each other. In particular, biofuturing's creative ecology consists of three main conditions and is reached by (a) bridging a multiplicity of perspectives, practices, and disciplines (cross-practice and transdisciplinary collaboration), (b) by positioning ourselves in an agential environment closely connected with the other-than-human (multispecies entanglements), and, finally, (c) by exploring connection between past, present, and futures (multitemporal thinking).

First, biofuturing welcomed a multiplicity of perspectives, approaches, disciplines, and relations. Rather than building upon the isolated and "self-referential disciplinary purity," biofuturing became a place for connection, rewiring, and interplay in which disciplinary conventions are being questioned and negotiated (Braidotti, 2013, p. 145; Schnugg, 2019). By involving artistic explorations (speculative thinking, speculative design, collaging, collecting, drawing, etc.) in academic research, by blending creative and scholarly methods, by bridging theory and methodology, biofuturing reached new and unprecedented epistemic connections. In *TeleFungi, Algae Suits,* and *Aurora Benergy*, for instance, we artistically started thinking-with the biological qualities of other-than-humans. Such multispecies thinking experiments, where one speculates-with the characteristics of other-than-humans—in this case, mycorrhizal networks,

algae, or aurora borealis—create connection between the present and alternative futures, between existing scientific knowledge and creative practices, between human and other-than-human entities.

Second, the biofuturing process decentered the human and induced the rethinking of humankind's position toward the natural world. The co-design of *GreenTown* and *The Infinite Game* and their fictional narratives, for instance, presented alternative storylines about how to relate to the other-than-human in a societal context: As contemporary urban living and ownership are reimagined in *GreenTown* and *The Infinite Game*, both instances speculate about alternative futures' societies. To tell such narratives about the environment and the other-than-human significantly influences our understanding of and positioning on Earth. As Haraway (2008) argues, "it matters what thoughts think thoughts" (p. 12). While storying otherwise and actively blending our humanness with speculative multispecies encounters, biofuturing became an exploratory space within academia to speculate about ecocentric onto-epistemologies. The story of *Algae Suits*, for instance, is told from the perspective of the algae themselves and provides an alternative perspective on knowledge creation through imagination: "The designer's trembling hands applied an unfamiliar substance to us. It felt cold, sticky, and unpleasant. Miraculously, the itching ceased, and was soon replaced by a delightful sensation" (Extract from Speculative Narrative 1).

Finally, biofuturing became a tool to move beyond past and present and experimented with the lens of futures thinking. However, the critical questions centered on profit and progress that emerged during the evaluation and reflection phase underscore the difficulties of thinking beyond sociocultural and economic systems that dominate today's societies. This was, among others, clearly highlighted in *TeleFungi*'s story: "The government has other plans as they want to privatize TeleFungi because it is too expensive for the city" (Extract from Speculative Narrative 2). These capital-oriented questions inherently also question biofuturing as a practice: Can biofuturing evolve into a practice entirely disentangled from contemporary anthropocentric norms and values, systems of exploitation, and capital? While this query remains elusive, we assert the significance of challenging contemporary sociocultural and economic frameworks and seeking alternatives through the lens of imagination and creative, speculative thinking and doing. In doing so, biofuturing helped us to navigate through emerging challenges—in this case, specifically relating to multispecies energy and connectivity: Speculative thinking and futures imagination deliberately shifted away from seeking heroic, solutionist, and absolute answers to the complexities of present and futures challenges.

CONCLUSION

As we introduced and delved into the practice/theory of biofuturing, we aimed to broaden the conventional academic and educational discourses and processes by including creative practices in research. More specifically, we incorporated multispecies speculative thought in an academic learning environment. As

we reported on what multispecies speculative thought in academia looks like, our article served as an invitation for scholars and educators to seek creative and practice-based approaches for research and education that address today's and tomorrow's complex challenges from a relational perspective. Just as biofuturing resides at the crossroads of transdisciplinary collaboration, multispecies entanglements, and multitemporal thinking, relational research and creation approaches that bridge, fuse, combine, and reconcile have the potential to nurture novel ways of understanding and connecting with the Earth's blasted landscapes.

Amid the vast challenges of climate change and its far-reaching ecological and socioeconomic consequences, the outcome of a speculative thinking process and the co-design of imaginary scenarios might appear trivial at first sight. Yet, it is precisely within such exploratory, imaginary research environments where new and empathetic ideas are fostered, symbiotic collaborations are formed, and provocative thoughts become the subject of in-depth reflection and engagement. The powerful experiences that participants had in the BioFutures Living Lab culminated in a series of events in the aftermath of the program. One of the groups continued their collaborative research efforts and kept investing in their co-designed speculations involving the *Algae Suits* to optimize their prototype. Two involved researchers decided to set up a spin-off project that investigates how the living lab concept used in the program could be optimized to include vulnerable voices for the purpose of making biofuturing more inclusive. Some participants advanced the theoretical notion of multispecies engagement into their ongoing scholarly work. This resulted in a series of artworks and an online article (i.e., Dorn, 2023). These new iterations continue to pursue a more ecocentric and balanced relationship with nature and include speculative thinking as a research approach.

In these new iterations, it is imperative to be and continue to be mindful of power dynamics that are at play. As pointed out by Truman (2019b), we need to be aware of the risk that "mainstream speculative thought" often operates within a Western paradigm characterized by progress and linearity. Here, we agree with Henriksen et al. (2022) that "trans-epistemologies are also needed to enable a more inclusive view of creativity. Such a move to decolonize creativity acknowledges and values posthuman perspectives and explicitly non-Western Indigenous knowing" (p. 470). Bridging various epistemic frameworks in biofuturing does ask for a rethinking of the concept of "multispecies entanglements" from an intercultural perspective. Indigenous populations and their connection to the natural surroundings have been overlooked, not only in this study but within Western tradition of knowledge production at large (Henriksen et al., 2022; Kimmerer, 2013). With their long-standing tradition of looking at "earth-beings" for guidance, First Nation peoples hold imperative knowledge that can guide us to harmonious futures pathways (de la Cadena, 2015). At the same time, decolonizing biofuturing also calls for a rethinking of temporality that "resist the heteronormative (progress oriented, reproductive futurist, biologically ordered) linear time" (Truman, 2019b, p. 39).

As an ever-evolving ecology where various practices and matters dynamically meet, there lies an opportunity for biofuturing to mature by engaging communities in various geographical locations around

the world. By including trans-epistemologies into the entanglement, we can complement transdisciplinary and cross-practice collaboration, multispecies entanglements, and multitemporal thinking. Involving diverse epistemic frameworks is needed to counteract Eurocentric perspectives in retelling the story of potential futures. In doing so, biofuturing carries potential to become a more inclusive and just research and creation practice that can guide us through the ever-changing landscape of climate change and its catastrophes.

Chapter 3 presents a first methodological exploration of participatory research-creation practices used to elicit the imagination of multispecies worlds. By combining cross-practice and transdisciplinary collaboration with conceptual understandings of multispecies entanglements and practices of multitemporal thinking, this chapter creates a creative ecology in which new multispecies imaginaries respond to the challenges related to power outages and digital blackouts.

Chapter 3 contributes to ***sub-question 2*** *which asks* ***in what ways multispecies arts can help to imagine alternative multispecies worlds that engage with climate change differently.*** *This chapter brings living lab approaches in connection with creative methods, including futures studies and speculative thinking techniques. A central methodological insight in this chapter is that speculative thinking is often constrained by the sociocultural and economic systems that structure contemporary life. In response, it argues for the need to find practices that enable participants to unsettle dominant norms and values, systems of exploitation, and capitalist logics.*

Chapter 4 *will continue to explore practices that support the emergence of more just multispecies imaginaries. As the research in Chapter 4 is conducted in another part of the world, it also examines how imaginative thinking is shaped by and grounded in place.*

4

MULTISPECIES CITY LABS

Emplaced speculation: Imagining multispecies worlds in the colonial ruins of the Anthropocene

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INTRODUCTION

This article explores the potential of multispecies speculations to generate critical engagement with structures, histories, and matters of place. In a climate-changing world, speculative thinking practices offer alternative ways of engaging with the climate emergency, moving away from human-centric discourses and towards new possibilities for "living on a damaged planet" (Tsing et al., 2017). Multispecies speculations, in particular, elicit interaction with multiple other-than-humans and recognition of the ways the world involves deep entanglements with such other-than-humans. 'Other-than-humans' not only refers to living organisms such as plants, fungi, bacteria, other-than-human animals, but is understood more broadly as including biophysical entities such as mountains, rivers, the sky, lagoons, the soil, the weather, and so on (de la Cadena, 2015; Ogden et al., 2013). These other-than-humans are deeply connected to the places they inhabit; they shape and are shaped by the environment (van Dooren & Rose, 2012). Here, we understand place as "manifesting contested histories and spatial relationships, and also composed of everyday objects, names, relations, and stories" (McKenzie & Bieler, 2016, p. 63). To speculate-with other-than-humans is to engage deeply with the environments they live in, including their histories, structures, and social and material realities. In doing so, multispecies speculations can challenge us to reimagine place itself, along with its socio-political structures that define—and at times constrain—our capacities to relate with the other-than-human (Heise, 2015; van Dooren et al., 2016).

Our exploration of speculative fiction involving other-than-humans and place has been especially informed by the recent work in multispecies studies. This field challenges human-centred worldviews, instead exploring the complex entanglements between humans and other-than-humans and emphasizing how both coexist and evolve together through dynamic relational processes (Kirksey et al., 2014; van Dijk, 2021). While this emphasis importantly centres other-than-human agency, the field has also been criticized for assuming that agency is evenly shared among beings. Such an ontological flattening neglects uneven power dynamics in the real world and may inadvertently prioritize other-than-human lives over the lived realities of disadvantaged human populations (Heise, 2016). Similar critiques are made of conventional understandings of the Anthropocene. As pointed out by Yusoff (2018), among others, the common understanding of the Anthropocene as a geological epoch characterized by human impact on the Earth—such as caused by resource extraction, energy production, industrialized agriculture, petrochemicals, and so on—fails to differentiate and acknowledge the racial and colonial origins of the Anthropocene (Yusoff, 2018; Gómez-Barris, 2017). These critiques on multispecies studies and the Anthropocene call for more nuanced approaches that acknowledge the complex interconnection of environmental exploitation and social injustices. In response, we ask how multispecies speculations can potentially move away from such an ontological flattening and instead address both environmental harm and social injustices through speculative thinking and making practices.

We have been exploring this question through a participatory project conducted in Australia in 2024 entitled the Multispecies City Labs. In this project, participants were invited to workshops or 'Labs' in which they re-imagined urban spaces through a multispecies lens, envisioning cities as shared habitats

where humans and other-than-humans collaborate to face climate challenges.[6] The Labs began with a brief warm-up activity, where participants created a testimony (e.g., story, drawing, collage, poem, of sorts) of an other-than-human experiencing a climate challenge. Participants then went on a city walk, prompted to imagine ways of human and other-than-human collaboration in specific places that address climate challenges. Following the city walk, participants translated their speculative ideas into visual artworks and wrote fiction stories about the multispecies city they imagined, which were then shared during a concluding storytelling session. This process unfolded during three Labs organized in three Australian cities: Magandjin/Brisbane, Narrm/Melbourne, and Boorloo/Perth.

Imagining Australian urban geographies as relational spaces for human and other-than-human entanglements led us to engage with Australia's specific colonial history and settler-colonial present. The question of how multispecies speculations can address both environmental exploitation and interlinked social injustices found particular grounding when speculating with/about/on stolen lands. As Tuck & McKenzie (2015) explain, "place and our orientations to them are informed by, and determinants of, history, empire, and culture" (p. 1). In other words, place is deeply tied to settler colonial histories and ongoing power structures. Speculation, as we will demonstrate in this article, is situated in place. And place—and speculations thereof—is not neutral; they are shaped by social practices of the everyday, which, in turn, are shaped by place itself (Tuck & McKenzie, 2015).

Emphasizing the importance of place in speculative thinking, we begin this article with unpacking what it means to speculate within a settler-colonial context, examining both potentialities and challenges of multispecies-focused speculation amid the colonial ruins of the Anthropocene. We then outline the methodological process for speculating multispecies possibilities with participants in the Multispecies City Lab, culminating in the co-creation of artworks and fictional stories. In discussing these outcomes, we trace ruins of the Anthropocene by examining the material and social afterlives of the settler-colonial project that were addressed in participants' speculations. These ruins retain their significance in contemporary societies, while simultaneously creating space for imagining alternative possibilities. Thus, alongside the ruins, we discuss the multispecies counter cities that were imagined during the Labs. Our discussion of participants' speculations show how speculative thinking and making practices are shaped by sensorial and material engagements with place and environment. Accordingly, we conclude this article by exploring the potentialities of emplaced speculation of and about the Anthropocene.

[6] Although other-than-humans encounter significant challenges in urban environments—including displacement caused by urban developments, being labelled as pests, and increasing exposure to extreme weather conditions—it is important to acknowledge that other-than-humans have adapted to the conditions of urban life. This is illustrated by a range of multispecies ethnographies on more-than-human urbanism (e.g. van Patter, 2023; Pacini-Ketchabaw et al., 2016). In response, I have argued elsewhere, "the city is and has always been a multispecies space, even though anthropocentric discourses and understandings of the city suggest otherwise" (Jacobs, 2025, p. 617).

BACKGROUND AND THEORY: MULTISPECIES SPECULATION IN THE COLONIAL RUINS OF THE ANTHROPOCENE

The Anthropocene is widely described as a new geological epoch marked by human impacts on the Earth and planetary systems. However, this conceptualization of the Anthropocene generates a human-centric narrative, portraying the human as a "mythic geological maker/destroyer of worlds" (Yusoff, 2018, p. 25; Todd, 2013). At the same time, such perspectives construct a notion of a 'universal humanity,' lumping all humankind together and overlooking how those who contribute least to climate change are frequently the ones most deeply affected by it. It further neglects the racial and colonial origins of the Anthropocene (Yusoff, 2018; Gómez-Barris, 2017). As discussed by Gómez-Barris (2017), colonial capitalism first rendered territories and peoples as extractible commodities, "discursively constructing radicalized bodies within geographies of difference, systematically destroying through dispossession, enslavement, and then producing the planet a corporate bio-territory" (p. 4). Yusoff (2018) argues there can be no address of the climate emergency without acknowledging histories of oppression and dispossession that have made it possible in the first place. Yet, these legacies of colonial exploitation and destruction continue to be neglected in contemporary climate-related discourses. We need to recognize the colonial practices of the Anthropocene, and the ruins it is creating (Watts, 2013; Yusoff, 2018).

Although the common usage of 'ruin' might imply an abandoned remnant of the past, the verb 'to ruin' indicates an active process in which "agencies of decay and deterioration are still active and formative" (DeSilvey & Edenson, 2012, p. 466). We build on Stoler's (2008) work on 'ruins of empire,' where she describes ruins not as "memorialized and large-scale 'leftovers' or relics, but [as] to what people are 'left with:' to what remains, to the aftershocks of empire, to the material and social afterlives of structures, sensibilities, and things" (p. 194). These remnants matter in contemporary societies and their afterlives shape the present and future (Stoler, 2008; Yusoff, 2018). When discussing the power and potency of ruins, DeSilvey and Ederson (2012) distinguish fast and slow ruins, the former being the result of abrupt transition, the latter referring to gradual process that includes socio-economic change. In the context of the climate emergency, we anticipate major climate disasters (i.e., fast ruins), while the ruining processes of the Anthropocene such as colonial extraction and their remnants are ongoing (i.e., slow ruins; Whyte, 2019). We define these 'colonial ruins of the Anthropocene' as ongoing processes that serve the colonial project. These ruins continue to construct social inequalities and leave behind material traces in urban landscapes (e.g., material infrastructures and sites such as parks, buildings, trees, etc.). Thinking about the Anthropocene's ruins "offers opportunities for constructing alternative versions of the past, and for recouping untold and marginalized stories" (DeSilvey & Ederson, 2012, p. 471).

Speculating in settler-colonial urban geographies

The settler-colonial city itself presents a colonial ruin of the Anthropocene as it represents a material and social remnant of coloniality that continues to be active and formative. With settlers permanently residing

on the lands of Aboriginal and Torres Strait Islander peoples, Australia is a settler-colonial state (Lefevre, 2015). As discussed by Tuck and McKenzie (2015), through settler colonialism, "land is remade into property, and human relationships to land are redefined/reduced to the relationship of owner to this property" (p. 64). Urban settlement has been pivotal in this process, and in the establishment of European settler-colonial societies form the outset: "The establishment of towns and cities are synonymous with 'development' and 'progress' in the colonialist endeavor and constitute a distinct activity literally building the settler-colonial nation" (Porter & Yiftackel, 2019, p. 177). The settler city symbolized the 'new world,' being a hub of globalization, the center of civilization, a space of democracy and liberalism, and corporate power, however, being established through normalized and violent dispossession and displacement of the Other/ed (Blomley, 2004; Porter & Yiftackel, 2019).

Speculative thinking in/about these urban geographies is deeply intertwined with their pasts and presents, and comes with its own set of challenges. Kerr and Andreotti (2018), for instance, argue that the "imaginative limits of modernity" allow colonial legacies to shape and restrict imaginaries of possible futures (p. 55). Relating to this, Truman (2023) argues that "a crisis of (human) imagination over time has configured, represented, and re-affirmed the world into this humanist image so convincingly that it may appear to many of us to be the 'natural' or 'universal' order of things" (p. 3). This "colonial crisis of imagination" (Truman, 2023) reinforces dominant societal narratives and structures that produce inequality. Speculative thinking and making practices, then, need to move beyond the imagination of a world "where only one world fits" and that reproduces colonial ruins (de la Cadena & Blaser, 2018, p. 3).

Speculating about multispecies geographies

For speculating in/about settler-colonial urban geographies, we have taken a multispecies focus. Multispecies studies has become attentive to the complex entanglements of other-than-human species with human societies (Van Dooren et al., 2016; Pacini-Ketchabaw et al., 2016; Kirksey, 2014). As discussed by Watts (2013), "all elements of nature possess agency, and this agency is not limited to innate action or causal relationships. [...] Non-human beings are active members of society. Not only are they active, they also directly influence how humans organize themselves into that society" (p. 2). Instead of adopting a human-centric perspective, multispecies studies broadens its scope to include the other-than-human in producing understandings of the world. However, focusing on the concept of multispecies extends beyond merely exploring and caring for animal lives. Rather, it focuses on recognizing relational co-existence among human and other-than-human beings and their interactions (Heise, 2016a).

More recently, multispecies scholars have been actively exploring and redefining what justice means in multispecies entanglements. Having received critique for assuming that agency is evenly shared among beings—ignoring power inequities and disempowering action in the climate crisis—multispecies studies began emphasizing the importance of acknowledging histories and practices attached to specific geographies in multispecies research: As discussed by Heise (2016), "different cultures [have] ideas about what an ethically responsible relationship between species should look like, provided that we keep in mind

that species and kinship boundaries are also understood differently depending on the cultural context" (p. 208). It recognizes the power differences at play in top-down nature conservation or climate mitigation approaches (e.g., the systematic displacement of Indigenous communities from their territories for the construction of conservation parks, hydropower dams, wind energy parks, etc.; Watson, 2014; Whyte, 2019). Multispecies justice connects the well-being of other-than-humans with that of human communities, taking into account the specificities of place and its social and cultural contexts (Heise, 2016; Tschakert et al., 2020). Adopting such a justice lens to re-imagine Australian urban geographies requires attentiveness to the colonial ruins in which these re-imaginings are situated.

METHODOLOGY AND METHODS: THE MULTISPECIES CITY LABS

With the aim of collaboratively imagining multispecies cities in which humans and other-than-humans coexist and coevolve, we set up the Multispecies City Labs, inviting the public to workshops—or 'Labs'—to speculate alternative urban geographies. In the Multispecies City Labs, we used participatory research-creation as our methodological approach. Research-creation is a transdisciplinary praxis in which artist-scholars combine scholarly investigation with artistic expression and "create the artifacts they want to think-with rather than analysing existing cultural productions" (Truman, 2023, p. 88; Loveless, 2018). We combine this research-creation praxis with a participatory research approach in which the wider public is invited into the research process (Centre for Social Justice and Community Action, 2022). In the Multispecies City Labs, participatory research-creation serves as a practice for collaborative speculative thinking on multispecies urban geographies in Australia.

We organized the Labs in three Australian cities: Magandjin/Brisbane with a group of artists (June 2024), Narrm/Melbourne with a group of city residents (October 2024), and Boorloo/Perth with a group of scholars (November 2024). The Labs were organized in collaboration with institutes and/or events happing in the respective cities (e.g. the International Symposium of Electronic Arts 2024 in Magandjin/Brisbane, the Centre for People, Place & Planet of Edith Cowan University in Boorloo/Perth, the University of Melbourne in Narrm/Melbourne), bringing together a total of 55 participants, and resulting in the co-creation of 15 multispecies speculations.

Speculative thinking practices in the Labs

The Labs began with a brief (a) warm-up activity in which participants were prompted to create a testimony from the perspective of an other-than-human (e.g. a mountain, a tree seed, a kangaroo, wetlands). This testimony conveyed the other-than-human's personal account or experience of a climate challenge and could take the form of a written story, collage, drawing, or painting. Van Dooren and Rose (2012), among others, assert the importance of storying places with the other-than-human, highlighting "its ability to provide new perspectives on the world, and in so doing, to draw us into deeper and more demanding accountabilities for nonhuman others" (p. 2). This exercise allowed participants to bring the other-than-

human they regularly engage with into the speculative space, such as the species at risk of extinction in their hometown or those they often encounter in a nearby creek or valley. The speculative warm-up exercise aimed to open possibilities for learning-with and speculating-with other-than-human in the Anthropocene.

After sharing and discussing the testimonies, (b) participants formed smaller groups of 3 to 5 people and continued with a city walk during which they imagined multispecies collaborations—such as multispecies interactions, encounters, shared objects, communications, traces—in urban spaces. As noted by walking theorists and methodologists Springgay and Truman (2017), the practice of walking is particularly attuned to place, enabling one to become more aware and responsive to their surroundings. Through the city walk, we sought to make the speculative process more grounded and relational, creating a multi-sensory and embodied connection to the places in which they emerged (McKenzie & Bieler, 2016). Springgay and Truman (2017) further discuss walking as an embodied practice that fosters reflection on "the local environment, particularly in relation to values and attitudes related to place, how walkers use place, or identify themselves in relation to place, create stories of place" (p. 20). By becoming attuned to the urban landscapes in this way, we hoped participants would become more attentive to both humans and other-than-humans inhabiting the city, including those rendered invisible, ensuring that their imaginaries were "grounded, situated and entangled" within their surroundings (Truman, 2019b, p. 37). The field of multispecies ethnography emphasizes this kind of attentiveness, advocating for the close observation of multispecies relationships that "shape and are shaped by political, economic and cultural forces" (Kirksey & Helmreich, 2010, p. 545; Ogden et al., 2013).

Following the walk, (c) participants transitioned into an artistic creation exercise to further explore the multispecies collaborations they had imagined. The art-making process encouraged participants to critically examine the ethical, relational, and socio-environmental aspects of their speculations using question-cards designed to guide the process: "Which human and other-than-human groups are most affected by your speculation? What positive and negative impacts might they experience? In what ways does your multispecies speculation address specific climate challenges? How does your multispecies speculation ensure that both humans and other-than-humans, especially those most affected by climate change, can live safely and fairly in the city?" Participants translated their reflections into visual artworks, including drawings, collages, brainstorming maps, or sculptures. The artistic creation and guided reflection slowed down the speculative process, encouraging participants to engage more deeply with the ideas and speculations that emerged during the city walk.

After visualizing their multispecies speculations through artistic creations, (d) participants moved on to writing a fictional narrative about their imagined multispecies city. The story was written from a "we" perspective and had to include thick descriptions of emotions, sounds, smells, shapes, textures, and colours. We draw on Swanson et al. (2017), who argue that "creative writing invites us to imagine the world differently, to listen beyond newspaper headlines, to hear those quit stories about the Anthropocene whispered in small encounters" (p. M9). Storying the city otherwise allowed participants to generate

alternative ideas about what is and what might be. As van Dooren and Rose (2012) discuss, "no place is produced by a singular vision" (p. 2). The creative writing process enabled participants to further refine their speculations, drawing on insights from the city walk and the critical reflections already developed during the earlier artistic creation phase. Finally, (e) the labs concluded with an oral storytelling session where participants shared their written narratives. While these phases may seem linear, they were, in fact, interconnected and continually shaped by ongoing dialogue.

Tracing colonial ruins and multispecies alternatives in participants' speculations

This article mainly discusses the visual and textual creations that emerged during the warm-up activity (i.e., phase a), the art-making process (i.e. phase c), and the writing of fictional stories (i.e., phase d). These creations, of course, were informed by insights and conversations that took place in between and across all phases. We analysed participants' creations by tracing colonial ruins and multispecies counter cities in their speculations. Huybrechts et al., (2022) describe the practice of 'tracing' as "the need to describe and making visible the invisible interdependencies we have ignored so far" (Huybrechts et al., 2022, p. 176). Unlike colonial practices tied to terms such as 'discovering,' tracing implies that researchers "do not discover the world, but rather engage with the traces of multiple worlds."

To analyse participants' creations, we began searching for traces of colonial ruins and multispecies counter-cities by closely reading and observing each group's creations. The identified traces were then linked back to the respective city in which the participant groups operated. Here, we consider place to be a significant actor in the formulation of these speculations, with each imaginary being intimately connected to the city in which it emerged. To underscore its significance, we present participants' speculations alongside thick descriptions of the places participants encountered during their city walks.

TRACING RUINS AND COUNTER POSSIBILITIES

Turning to the speculative worlds that were imagined during the Multispecies City Labs, we now delve into a range of artworks and fictional stories (co-)created by participants. We begin by "tracing the ruins" of the Anthropocene, exploring the material and social afterlives of and in settler-colonialism as reflected in participants' speculations. While these ruins continue to shape how we perceive the world, they also offer opportunities for imagining otherwise. Thus, alongside these ruins, we discuss the speculation of multispecies counter cities imagined in the Labs, which prioritize multispecies relationality and justice.

Colonial ruins in multispecies speculation

Participants' speculations explored how other-than-humans are increasingly facing challenges while inhabiting old and new urban spaces, such as enduring climate-related challenges. This was, for instance, illustrated in a testimony created by one of the participants in the workshop in Narrm/Melbourne. The story

presents a testimony of an invasive tree species being brought to Australia, planted next to the river and experiencing city developments over the past 100 years:

> "I was just a small seed, carried here by humans on big ships. They planted me in this spot to provide shade. … But you wouldn't believe the things I've seen growing along the waterway they call Yarra. They built things; first small, then bigger. Now there is never full darkness where I am planted, and I can't see the stars anymore. My roots have increasing issue to find water, yet it is right there" (Narrm/Melbourne participant, October 5, 2024).

This testimony identifies the invasive trees that inhabit the city as colonial ruins, while at the same time linking urban developments and infrastructures to the colonial project. These developments have increasing impact on the environment, such as light pollution (i.e. "there is never full darkness … I can't see the stars anymore") and drought (i.e. "my roots have increasing issue to find water"). At the same time, the testimony addresses the issue of language and place-naming as a colonial ruin (i.e. "waterway they call Yarra"); The river was originally called Birrarung but became known as the Yarra after settlers misinterpreted its name.

Similar to this testimony, a speculative story created about the Botanical Gardens of Magandjin/Brisbane also addresses invasive plant and tree species. The gardens were located near the workshop venue and one of the groups started challenging its colonial origins. Botanical gardens emerged as a reflection of colonial ambition to dominate knowledge and power over and domesticate Indigenous plant species or introduce new ones, acting as "key sites—physical, intellectual, social, and cultural—in which colonial power was literally rooted" (Baber, 2016; p. 676; Gibson & Sandilands, 2021). Established in 1828, the botanical gardens in Megandjin/Brisbane were created to provide food for early penal colonies. Today, the "original botanic gardens" continue to shape the urban landscape in Magandjin/Brisbane, manifesting as a visual and material remnant of coloniality (Brisbane City Council, 2025).

In response to this colonial ruin in the urban landscape of Magandjin/Brisbane, one of the participating groups began speculating about re-foresting the gardens with native plant species. Their fictional story explores what this reintroduction of Indigenous plants would mean for other other-than-human species that have moved away from the area. In this group's speculation, the Eastern Curlew finds its way back to its old hatching space in Magandjin after leaving it: "What's that sound? We got closer, our feet on soft soil in excitement to find signs that we were on the right track. We could see … a single small round shape: A baby curlew. Its long and curved beak pointing at us, a fruit of Megan dangling. … Curlews are not known to hatch here" (Excerpt of fictional story written by participants in Magandjin/Brisbane, June 22, 2024). While the story revolves around the disappearance and reappearance of the Eastern Curlew, it essentially involves the deconstruction of the "colonial Botanical Gardens" (Personal communication with participants in Magandjin/Brisbane, June 22, 2024).

Both imaginaries discussed above explore plant species being part of colonial ruins in urban spaces. As discussed by Gibson and Sandilands (2021), "plants are not neutral: They are rich in stories of

power, identity, change, economics, movement, exploitation, and care, or lack thereof" (p. 4). The speculations make visible the entanglement between human movement and action, and the other-than-human. Multispecies justice offers a lens to make sense of such ongoing entanglements, by recognizing plant domination and domestication as an integral part of the socio-economic and cultural exploitation of the colonial project. Speculating-with plant species allowed participants to replace narratives of natural beauty and tourist appeal (i.e. botanical gardens) with narratives of harm and violence that continue to affect both humans and other-than-humans.



Figure 12: Artwork 'BananaCorp TM X Queen Vic Market' created by participants in Narrm/Melbourne (2024).

Building on the exploration of plant species and their entanglement with colonial ruins, the speculation of *BananaCorp TM X Queen Vic Market* created during the workshop in Narrm/Melbourne, shifts focus to the commercialization of sustainability effort and the uneasy intersection of environmental initiatives and corporate influence. *BananaCorp TM X Queen Vic Market* tells the story of how Queen Victoria Market (QVM)—the famous food court in Narrm/Melbourne—is undergoing remodeling (see Figure 12). The reform includes a purpose-built banana canopy to provide sustainable alternatives to single-use packaging, as well as the introduction of genetically engineered worms to reduce food waste:

> "A disconnecting feeling creeps up on us; the sound of wet writhing giant worm bodies fills the air, and we can see the tunnels created in the compost. Is this disgust? ... As we start to leave, we notice the BananaCorp Logo plastered on all surfaces. The colour of compost and manure. Has BananaCorp ultimately green-washed us?" (Excerpt of fiction stories written by participants in Narrm/Melbourne, October 5, 2024).

While addressing environmental challenges such as food waste and pollution, BananaCorp renders the other-than-human worms—and perhaps even nature at large—as controllable entities serving the

continuation of capitalist systems. As a response to the climate emergency and its urgency-centred discourses, the *BananaCorp TM x Queen Vic Market*-story reminds us of how supposedly environmentally friendly or nature-based solutions continue to serve the status quo instead of moving towards more relational practices (Whyte, 2019). As discussed by Whyte (2019) regarding conservation practices, such urgency-centred discourses reinforce colonial practices: "That's how colonial power has been wielded in the past, that is, by using real or perceived urgencies to mask or justify privilege, harm, and injustice" (p. 5).

Emerging multispecies counter cities

Having traced ruins of coloniality in the (co-)created multispecies speculations, we now turn to multispecies counter cities that were imagined during the Multispecies City Labs. This turn does not imply leaving the ruins behind, for the ruins remain deeply entwined with both our present and future worlds. Following DeSilvey and Ederson (2012), we think of ruins as potential counter sites where new possibilities can be envisioned. In tracing multispecies counter-cities, we searched for records of multispecies relationality and justice in participants' speculations.

During the workshop in Magandjin/Brisbane, some participants encountered the mangroves during their city walk. With the river cutting right through the urban centre of Magandjin/Brisbane, the riverbanks present dynamic spaces for lively interactions between the water, the bushes, the highway, insects, mangroves, ferries, fish, soil, bikers and pedestrians, fungi, clamps, and others. It is this vibrant ecosystem one of the groups in Magandjin used as their canvas for imagining multispecies urban spaces: "witnessing the Mangroves caged in by freeways, grilled walkways, and designed river shores, we speculated what it would be like to listen deeply and design for the mangroves" (excerpt of fictional story; Magandjin/Brisbane).



Figure 13: Artwork 'Mangrove Listening Path' created by participants in Magandjin/Brisbane (2024).

Speculating-with the mangroves steered these participants towards the imagination of a new *Mangrove Listening Path* (see Figure 13): a multispecies re-design of a boardwalk that engages in practices of deep listening to the cycles of the water and river, the mangroves, the soil, and other other-than-humans inhabiting near the riverbanks. The path is responsive to the natural surroundings, and it continuously composes and de-composes itself based on the needs of the surroundings: "As the path breaks down, we set into a feeling of survival. The mangroves, the silt, the tide, the mushrooms, the fish... They are all adjusting to the push and pull of the environment. They envelop, support, and listen" (Excerpt of fictional story; Megandjin/Brisbane). When walking the path, one is compelled to be responsive: The path disappears and reappears based on the environmental conditions.

In Boorloo/Perth, a similar multispecies counter-city was imagined, as one of the groups started speculating-with wetlands. The story *Living as Wetlands* envisions a 100-year project involving the deconstruction of concrete buildings to make space for wetlands to heal and regenerate (see Figure 14). This re-design of Boorloo's urban space responds to the dying of wetlands by establishing protocols for reciprocal care and peaceful relations: "Deep breathing and listening as petrichor. Living as wetlands, living as kin" (Excerpt of fictional story written by participants in Boorloo/Perth, November 15, 2024).

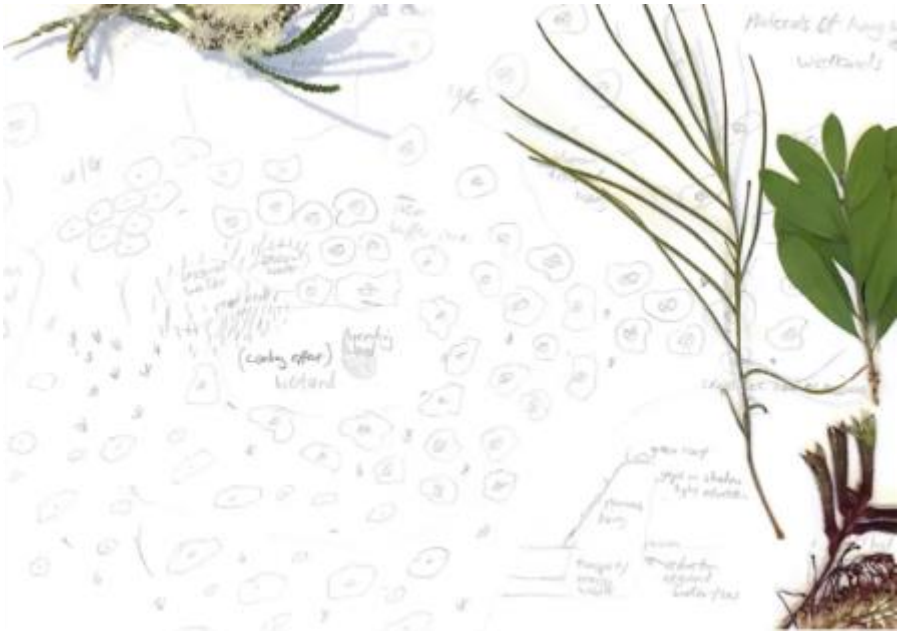


Figure 14: Artwork 'Living as wetlands' created by participants in Boorloo/Perth (2024).

The wetland speculation, similar to the mangrove one, advocates for responsive approaches that prioritize caring for other-than-humans. It counters static urban designs and instead focuses on dynamic, ever-changing relationships with ever-changing needs. This focus on care and responsiveness found resonance in another speculation created in Boorloo, about the rediscovery of an ancient water totem, "from a time when humans learned the language of water and how to harness the knowing within to collaborate with other-than-human beings" (Excerpt of fictional story; Boorloo/Perth). In this fictional story, the totem "reflects the time when we prioritized all water bodies, an awakening of the future

remembrance of our deep cultural knowing" (Excerpt of fictional story; Boorloo/Perth). This *Water Totem* speculation emphasized the interconnectedness of human societies with water.

A similar speculation emerged during the workshop in Magandjin/Brisbane, where a participant group imagined "learning the language of" other-than-humans as well. The speculation of *Supersensory Communication System* at the riverside of the Brisbane River focused on performative ways of communicating between trees and humans: "We were drawn to the riverside by the soft hum of the reverberating choruses of many voices" (Excerpt of fictional story; Magandjin/Brisbane). These speculations about communication with other-than-humans highlight the importance of generating deep understanding of each other's lives and needs. These understandings are created through affective and performative encounters.

EMPLACED SPECULATION AMID RUINS

The speculations we discussed above emerged from a multispecies-focused prompt (i.e., "how can humans and other-than-humans collaborate in the city to address specific climate challenges?"). While the city walk fostered a place-based approach, participants were not specifically prompted to engage with aspects of (settler-)coloniality in their speculations. Nonetheless, their speculations organically highlighted the complex histories and ongoing legacies of coloniality in/of Australian urban spaces. Participants wove colonial remnants into their imaginaries, speculating-with ruins they encountered during the city walk—whether botanical gardens, invasive and disappearing species, language, or urban infrastructures. In so doing, participants' speculations reveal the significance of place in speculative thinking practices: Instead of perceiving place as a static and passive backdrop for imagining alternative worlds, place was considered a living agent, rich with histories, relations, and stories (McKenzie & Bieler, 2016, p. 63). This included the histories, relations, and stories of mangroves and Botanical Gardens in Magandjin/Brisbane, Queen Victoria Market and invasive tree species in Narrm/Melbourne, and wetlands in Boorloo/Perth.

Place, as discussed by Pink (2015), is closely connected to how we learn, know, and move through the world. She discusses the concept of 'emplaced knowing,' where knowledge arises through "sensorial and material engagements with the environment" (Pink, 2009, p. 34). Similar to the concept of 'emplaced knowing,' the apparent presence of colonial ruins in participants' speculations suggests speculative thinking and making practices to be emplaced too. Accordingly, we propose *emplaced speculation*, presenting an embodied form of speculation that is tied to one's sensorial and material engagement with place and environment. This concept of 'emplaced speculation' situates an imaginary in a particular place and moment, closely tied to the individual or collective who is speculating, which is always changing and emergent (Pink, 2016; Truman 2019b). As discussed by Iovino (2018), "place imagination [...] entails memory and identity" (p. 105); One does not merely create speculations of place, but with it, allowing its memory and identity to be entrenched in (and potentially be challenged by) new imaginaries.

The visual artworks and fictional stories created by participants essentially represent narrations of emplaced speculation, being shaped by the varying climate challenges of each city and the other-than-humans that inhabit these places. In Magandjin/Brisbane, for instance, speculations focused on the Brisbane River, white ibises, and mangroves, all of which are visibly inhabiting the city's landscape. By contrast, participants in Boorloo/Perth speculated-with other-than-humans that were disappearing or no longer visible due to metropolitan expansion, such as wetlands. Accordingly, the climate challenges addressed in Boorloo/Perth centered on water- and ecosystem-related issues, such as "wetland dying" and water security. In Narrm/Melbourne, the challenges identified included heat waves and the urban heat island effect, deforestation, and waste, with speculations featuring a wide array of other-than-humans, such as insects, plants, trees, and birds.

Within these emplaced speculations, participants organically brought remnants of coloniality in, recognizing them as sensory and material aspects that shape the urban environments they encountered. In discussing how invasive species shape urban landscapes, such as narrated with the botanical gardens of Magandjin/Brisbane or through the invasive tree inhabiting the riverbanks of the Yara River in Narrm/Melbourne, participants take a multispecies lens to address coloniality and its connection to the climate crisis. In the story about Queen Victoria Market in Narrm/Melbourne on the other hand, participants speculated with newly created other-than-humans, including a living banana canopy and genetically modified worms. The story illustrates how colonial power continues to shape contemporary approaches that deal with climate change, such as solutions for food packaging and waste. These multispecies speculations further identified language and place-naming (i.e., the Yara River), urban infrastructures (i.e., botanical gardens, Queen Victoria Market), invasive and newly created other-than-humans as colonial ruins, presenting ongoing "material and social afterlives of structures, sensibilities, and things" of empire (Stoler, 2008, p. 194). While essentially focusing on other-than-humans inhabiting urban spaces, they tell different kinds of stories or reveal hidden stories about past and contemporary urban geographies.

The multispecies counter-cities that participants imagined further engage with these ruins in multiple ways, by providing alternative imaginaries of what the city *could* be. DeSilvey and Edenson (2012) argue that "ruins rarely lend themselves to representation in seamless narratives and [...] their indeterminacy and openness invites the testing of playful and experimental methods which attempt to articulate their complexity, and treat the ruined spaces both as 'a way of seeing' and as a material site for practice and action" (p. 479). Accordingly, participants' speculations were not aimed at producing objective, historical representations of the colonial ruins in Australian urban landscapes. Instead, they offered new narratives, new understandings, and new perspectives to look at the city, opening up space to imagine otherwise. The multispecies counter-cities imagined by participants, in turn, do not simply 'move beyond' or ignore these ruins, for they engage with them by providing new avenues for building relationships within urban spaces differently.

Haraway (2016) invites us to "stay with the trouble" and be truly present to engage with the world as "mortal critters entwined in myriad unfinished configurations of places, times, matters, meanings" (p. 1). The imaginaries of multispecies counter-cities stay with the ruins, recognizing their continued significance in our contemporary and future worlds. The identified ruins created openings for disrupting normalized structures and chains of legitimacy. De la Bellacase (2016) argues that "a politics of speculative thinking also is a commitment to seek what other worlds could be in the making through caring while staying with the trouble of our own complicities and implications" (p. 2014). The ruins are not abandoned or forgotten, but they actively shape imagined multispecies counter possibilities. The imaginaries of the *Mangroves Listening Path* and the *Supersensory Communication System* both illustrate how to build urban infrastructures that enable and promote responsiveness and relationality. The story *Water Totem* envisioned new ways of relating and communicating with one another by imagining what it would mean to learn the language of water. These speculations provide alternative and affective readings of place.

While staying with the ruins in speculative thinking and making, participants' speculations make us wonder what place (and/in speculation) can mean for the concept of multispecies relationality. Multispecies relationality refers to the ways in which humans and other-than-humans co-exist in relation to one another. These relationships always contain and reproduce political, social, and economic structures, which are inevitably contingent to place. The multispecies counter-cities—including those about the *Water Totem,* the *Mangroves Listening Path*, and the *Supersensory Communication System*—gesture towards relationality and responsiveness as a key praxis that needs to be performed with(in) place. Brisini et al. (2015) mention that such co-performances present "patterns of changeable, impactful being-with that foreground a dialogical approach to the world that exceeds a purely linguistic paradigm" (p. 146). The speculations discussed here suggest ways of (co-)performing relationality, through embodied and emotional practices that are responsive to place and its ruins. That is, they illustrate that multispecies relationality is deeply dependent on and shaped by place and is inherently specific to it.

CONCLUDING THOUGHTS: POTENTIALITIES OF EMPLACED SPECULATION IN AND ABOUT THE ANTHROPOCENE

While the concept of the Anthropocene has raised critique and questions on what it means to be 'human' in times of climate crisis, Heise (2016) argues that the concept "can serve both to complicate what we usually mean by 'human' and to offer opportunities for redefining it" (p. 234). Dwelling through its ruins, the Anthropocene has proven to be a generative site for speculation in the Multispecies City Labs, allowing participants to address colonial ruins while also opening pathways for imagining alternative possibilities. The Multispecies City Labs used speculative fiction as a critical approach to engage with the colonial ruins of the Anthropocene. In the project, we engaged with ruins already here (i.e., material and social remnants of coloniality) and those to come (i.e., possible climate challenges and disasters). Engaging with those

ruins through speculative fiction allowed participants to generate new narratives to understand the past and present, while thinking of possible alternatives. In this context, speculative fiction can "break from concrete events and experiences, allow[ing] its imaginative spaces and relations to be understood as something other than a referential account of reality" (Rifkin, 2019, p. 7). This allows multiple understandings and narratives of place to co-exist, creating a "world where many worlds fit" (Blaser & de la Cadena, 2018). And yet, in speculative thinking and making practices, the challenge remains to think—or speculate—critically and carefully about and outside the rigid boundaries of humanist frameworks, avoiding the simplification of all of humanity into a homogeneous "we" (Yusoff, 2018).

In bringing the practice of speculative fiction together with place-based inquiry and multispecies relationality, this article explored possible ways of connecting the noble intention of multispecies studies—i.e., moving away from strict anthropocentric understandings of our shared world—with structures, histories, and matters of place through speculative thinking and making practices. In this context, the concept of multispecies relationality and justice allowed us to speculate not only about how one can 'build' better understandings of and relationships with other-than-humans, but also how these understandings and relationships are inextricably linked to place. Scholars in critical place inquiry, such as Tuck and McKenzie (2015), advocate for engaging explicitly and politically with place in research methodologies to generate more just approaches. We would argue that the same is true for speculation: the very act of re-imagining reality for more just worlds is always grounded in, and shaped by, the place in which the speculative process unfolds. In this context, Truman (2019b) stresses the necessity of recognizing one's situated knowledge when imagining; It is vital to acknowledge how intersectional factors—such as race, class, gender, sexuality, ability—shape one's speculation, contributing to the emergence of more just futures. Our argument for emplaced speculation builds on this; as with situated speculation, emplaced speculation is embedded in the lived, material, and historical realities of place.

While addressing place, colonial ruins, and climate challenges, the speculations discussed in this article do not provide objective representations of reality, historical narratives about coloniality, or solutions for climate challenges, nor are they intended to do so. What they can do, though, is disrupting dominant practices and compelling us to rethink how we build relationships in the present. Thaler (2022) argues that "utopianism's main goal is not the escapist design of static blueprints for a perfect world, but rather a critical interrogation of the present that paves the way for systemically transforming the status quo" (p. 258). Critical speculative thinking and making practices do not seek to escape or idealize the world and its complexities. Rather, it interrogates, questions, and rethinks. Imagining other-than-humans such as mangroves, wetlands, and trees to seamlessly integrate into the urban fabric, for instance, can question "the long western tradition of thinking in terms of an urban/rural dualism in which the city is seen as a strictly human space" (van Dooren & Rose, 2012, p. 16). At the same time, imagining this to happen is a specific place—with stories, structures and histories being unique to it—can generate alternative, affective, and situated readings of reality and tell different kinds of stories about climate and coloniality.

Chapter 4 continues the methodological exploration of participatory research-creation practices used to elicit multispecies imagination. Thinking with the concept of "colonial ruins of the Anthropocene," this chapter highlights the capacity of multispecies speculation to address coloniality and its connections to climate change. Through the creation of multispecies counter-cities, the chapter opens up alternative imaginaries of urban life, generating new narratives, understandings, and perspectives on what cities could become.

Chapter 4 builds on the methodological reflections developed in Chapter 3. It particularly relates to ***sub-question 2*** *on* ***the ways in which multispecies arts can help to imagine alternative worlds that engage with climate change differently,*** *by suggesting that speculative thinking and doing are emplaced. As such, its main methodological contribution lies in the introduction of 'emplaces speculation' as an embodied form of speculation that is tied to one's sensorial and material engagement with place and environment.*

Chapter 5 *will continue to explore participatory methodologies for engaging with climate and other crises. Whereas Chapter 3 and Chapter 4 explored methodological approaches for imagining otherwise, Chapter 5 will examine the methodological potentialities and tensions of living lab approaches.*

5

LIVING LABS IN TIMES OF CRISIS

Living the lab: Rethinking collaborative practices in living lab contexts amid polycrisis

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INTRODUCTION

In this article, we respond to the proposition of conducting research in times of polycrisis. While a crisis emergency can be considered a sudden and harmful (series of) event(s), polycrisis presents the interconnection between such disruptive happenings (Lawrence et al., 2024). The various crises we are struggling with (e.g., political conflict, climate change, pandemics, racial inequality, gender-based violence) are so deeply intertwined that they constantly reinforce one another: one crisis seems to exacerbate another, which in turn creates new problems. The combined impact of such entangled crises is often more severe than that of one crisis alone. As such, polycrisis can be understood as the entanglement and mutual reinforcement of problems, crises, and harmful processes (Mark et al., 2025; Rakowski et al., 2025). In this context, we should also consider the notion of slow violence: those harmful, invisible, and ongoing processes that cross time and space, which are often not considered violent, yet bring about systemic harm (Dowler et al., 2024; Nixon, 2011, p. 2). In their book *A Billion Black Anthropocenes or None,* Yusoff (2018), for instance, shows how environmental harm is rooted in racialized histories, linking climate change to extractive and colonial powers. Polycrisis, as we understand it here, does not merely present the entanglement of several crisis events, but also considers the slow violences that underly and further deepen those crises.

Whereas a single emergency might require urgent responses, this notion of polycrisis calls for a rethinking and undoing of entire systems, asking for different research approaches to better account for the complex and cumulative challenges of our time. In the midst of polycrisis, Knight (2023) argues that methodological experimentation "provides openings for different ways of thinking about the rights and responsibilities of knowledge and how this responsibility is as much about rethinking the modes of information gathering as the theories informing those methods" (p. 38). Koro and Wolgemuth (2023) use the "apocalyptic world on fire" as an opportunity to rethink methodologies and consider what such new methodologies should do in apocalyptic times. Experimental methodologies that are responsive to the apocalypse, Koro and Wolgemuth (2023) contend, should "generate spaces for reparative methodological actions, which could lead toward less siloed, irrelevant, and efficient/rapid/simplified scholarship and practice" (p. 652). While dominant crisis discourses often steer research toward quick solutions in the name of urgency (Patterson et al., 2021), we argue that research practices must resist premature resolution and instead "stay with the trouble" (Haraway, 2016). That is, we need to learn "to be truly present, not as a vanishing pivot between awful or edenic pasts and apocalyptic or salvific futures, but as mortal critters entwined in myriad unfinished configuration of places, times, matters, and meanings" (Haraway, 2016, p. 1). Research practices must cultivate attentiveness not only to the complexity of issues, but also to the relationships necessary for responding care-fully (Bringhurst & Zwicky, 2018; Whyte, 2019).

Drawing on those insights, this article sits with the question of w*hat research (methodologies) could be and do amid the complexity of polycrisis*. As a response, we suggest the need for care-full

research approaches to better account for the culminative challenges we are experiencing. To do so, we explore *attentive collaboration* as a theoretical and methodological orientation to address the culminative challenges of our time, as well as an ethical and ontological stance for engaging attentively in collaborative relationships in research and beyond. We consider attentive collaboration as a praxis for imagining and enacting more compassionate futures. To *attend* is to lean in, to direct your awareness; it is not merely registering that something exists but holding space for it. We explore this notion of attentive collaboration in the context of the methodological premises of living lab approaches. Living labs are generally considered collaborative and explorative research contexts that involve multiple stakeholder groups in early stages of research and innovation processes, aiming to address complex challenges (Følstad, 2008; Hagy et al., 2017; Pallot et al., 2010). Yet, their potential to include the voices of people facing crises remains underexplored. Whereas some describe the living lab as an approach, methodology, or tool to find solutions to so-called 'wicked problems,' such as climate change, energy transition, food insecurity, or pandemics (Schuurman & Leminen, 2021), we consider living labs as explorative and collaborative spaces in which to critically and carefully attend to complex challenges and to each other, both within and beyond the living lab context.

This understanding of living labs and attentive collaboration evolved out of a living lab workshop that invited a group of early-career scholars to think-with the proposition of "living labs in (times of) crisis." Rather than framing the workshop as merely a participatory research event focused on studying and addressing crisis, we approached it as a generative site of care-full being-with, where temporal, ethical, epistemic, and affective frictions guided collaboration and co-creation. The workshop process, collaborative practices, and generative discussions during the workshop made us reflect on *how and when living labs can(not) be considered as spaces that elicit attentive collaboration*. Here, the notion of attentive collaboration was not the starting point of the workshop, but one of its outcomes. We mainly draw on feminist theories and scholars that attend to care, complexity, and research (methodology) to unpack what attentive collaboration might mean in living lab contexts. In what follows, we discuss living labs and the workshop, highlighting the tensions that emerged and how the notion of attentive collaboration provides a response to these tensions.

LIVING LABS AMID COMPLEXITY

We begin our exploration of attentive collaboration as a research praxis by tuning into the methodological premises of living labs. Living labs present participatory and co-creative research contexts that aim to bring various stakeholder groups together to collectively develop responses to complex challenges through (iterative) experimentation of potential solutions in real-life conditions (Hossain et al., 2019). Those diverse stakeholder groups often cover the actors from the Quintuple Helix model for innovation (Carayannis & Campbell, 2012), including education and research, society, the private sector (e.g. industry, businesses),

the public sector, and the environment (Baccarne et al., 2016). By bringing those actors together, the living lab approach has mainly been employed to discover new strategies suitable for approaching complex and real-world challenges (Bergvall-Kareborn & Stahlbröst, 2009; ENoLL, 2026). Such living lab approaches closely relate to participatory and user-centered design practices and have first been utilized in the development of technological and consumer-oriented innovation (Ballon & Schuurman, 2015). As an illustration, the Turin Living Lab actively involved city residents in co-producing and enhancing apps, carpooling services, and techniques for collecting environmental data (Nesti, 2018). Besides technology-based living labs, the methodology has also appeared in urban studies and sustainability research (Radulescu et al., 2022; Vicini et al., 2012), with applications in sectors like agrifood (McPhee et al., 2021) and healthcare (Kim et al., 2020). By including societal actors into the ideation of solutions, living labs aim to move beyond top-down and expert-driven development, fulfilling citizens' unique needs (Ersoy & van Bueren, 2020).

However, as discussed by Pfotenhauer et al. (2022), among others, the dominant focus of living labs as problem solvers and innovation producers might lead to solutionism, guided by hegemonic objectives of efficiency, productivity, and scalability. These normative aims tend to position living labs in support of enterprises and industry rather than users or participants, who are often granted only restricted access to user-generated innovations (Kommonen & Botero, 2013). This focus challenges the idea of living labs as genuinely open and co-creative spaces. At the same time, the 'projectification' of living labs, where "experiments are shaped by a project logic that emphasizes delivery and implementation, strict monitoring of quantifiable outputs, and the expectation of efficient operations in a controllable and cost-efficient manner" (Sachs Olsen & van Hulst, 2024, p. 996), makes the relational dimensions of collaboration hard to realize. Only by rethinking hegemonic principles that privilege efficiency, productivity, and scalability, we can make room for the relational dynamics, care, and compassionate explorations that are indispensable in times of polycrisis. While living labs have been successfully applied across various sectors, the relational capacity of living labs to meaningfully involve people that are not typically in positions of power (Taylor, 2021), as well as those experiencing crisis situations, has often been overlooked. At the same time, living labs cannot simply be used to come up with solutions that respond to all aspects of the complexity of polycrisis. As such, our perspective on living labs had to take a slightly different form, approaching them as a research praxis in which participants collaborate in an attentive and careful way to critically discuss complex challenges. We explored such collaborative practices in living lab contexts by organizing a living lab workshop that gathered a group of scholars to collectively experiment with living lab approaches in crisis contexts.

DESIGNING AND LIVING THE LAB

Workshop 'living labs in times of crisis'

The living lab workshop was directed at thinking-with the proposition of “living labs in (times of) crisis.” Its focus emerged from a collective concern about how to meaningfully engage people experiencing crisis situations in research, particularly in the context of the geopolitical conflict in Ukraine. Such conflicts often make in-person engagement impossible, prompting questions about the ethical responsibilities involved in discussing sites of crisis from the outside in order to contribute to finding answers. More generally, the proposition *'living labs in (times of) crisis'* focused on the challenges of doing research amid polycrisis. Crisis, as we understand it here, takes various forms. On one hand, we were thinking of interconnected crises including but not limited to climate change and social inequality, political conflict and sovereignty, cultural erasure through colonial powers, national debt and socio-economic vulnerability, lack of energy supply and issues of unequal access. At the same time, we also considered the idea that research in itself is in crisis, referring to the growing questioning of the sciences in post-truth worlds where perceptions of 'truth' are more dependent on collective feeling than on research (McIntyre, 2018), to misinformation and fake news seeping into mainstream discourse and understanding (Miró-Llinares & Aguerri, 2023), and to the issue that conventional and dominant approaches in research (methodology) are no longer equipped to respond to the complexity of our time (Vannini, 2015).

The living lab workshop consisted of two days of intensive collaboration to think about the potentialities of living lab approaches in polycrisis contexts. Taking place at the University of Leuven (Belgium), the workshop aimed to immerse participants in a living lab environment, while actively engaging them in the rethinking and reimagining of living lab practices. While the invitation for the workshop was open to anyone interested in joining, specifically addressing "researchers, industry professionals, and community leaders," our group of fifteen people ended up mainly coming from academia, either as student, early-career researchers (doctoral or post-doctoral), or university staff, with only one exceptions (i.e. one participant coming from the public sector). To make relationship building and collaboration easier, our group of fifteen was divided into three smaller groups, each consisting of three to five members, that intensively collaborated over the course of the workshop, interspersed with plenary discussions for collective knowledge sharing.

To initiate the collaborative process, we drew on the Bristol Approach for Living Labs and designed a roadmap to guide and structure the workshop activities (Zimmermann et al., z.d). This roadmap outlined six stages we moved through collectively: identifying, framing, designing, reflecting, testing, and sharing (see Figure 15). A deck of guiding cards accompanied each step, prompting the small groups to deepen or redirect their collaborative engagement and shape emerging ideas. These stages were interspersed with plenary discussions on living lab methodologies and processes.

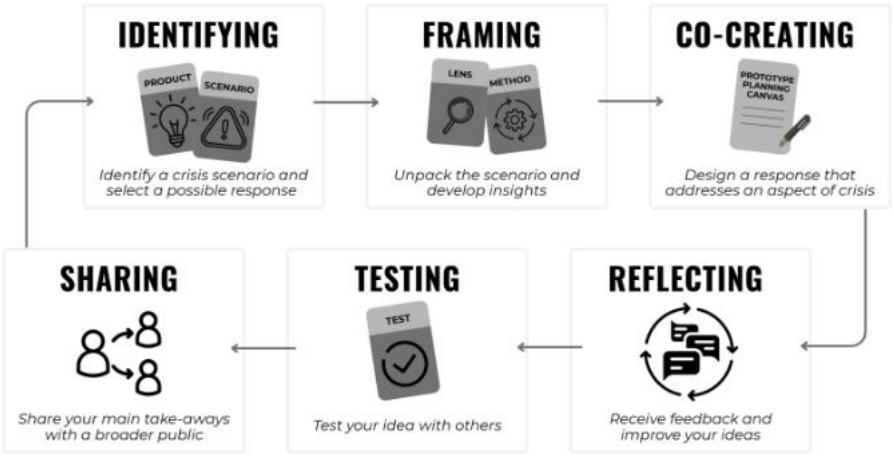


Figure 15: Overview of the six stages of the 'living labs in times of crisis' workshop, based on the Bristol Approach for Living Labs (Zimmermann et al., z.d.)

The workshop began by *identifying* what specific crises we wanted to explore and how we intended to respond. Using scenario-cards and product-cards, each small group selected one of each to define a shared crisis-focus and possible response types, such as designing an intervention plan, running an educational workshop, developing a policy guide, setting up a museum exhibit or artwork, among other possibilities. This first phase helped participants to connect with one another and establish a foundation for collaboration before delving into deeper conversations about crisis. In the *framing* phase, the groups unpacked their selected scenarios to gain a more nuanced understanding of the complexities and challenges of responding to and researching crises. Each group selected a framing lens and method card from the card decks provided. These cards shaped participants' inquiries, suggesting different ways to approach the scenarios, for instance through stakeholders' profiles, systems and relations mapping, speculative storytelling, or media and narrative analysis. In this process, specific emphasis was placed on critically reflecting on who is affected by crises, while remaining attentive to how these voices are often marginalized or unheard.

The resulting insights opened new ways of seeing the problem, which then informed the *design* phase. In this phase, we used a prototype planning canvas that helped groups map their key insights, outline their intended responses, and consider how these addressed aspects of the crisis scenario. Once their responses were formulated and created, each group presented its ideas to the others, who could offer feedback and comments. These comments were used in the *reflecting* phase to generate insights into recurring feedback, potential improvements, underlying assumptions, and unexpected perspectives. Based on these reflections, the groups designed small-scale experiments to test their ideas, which could take the form of roleplays, rapid iterations, brief interviews, or mock-ups. After completing these experiments, each group created a *sharing* or legacy card, summarizing the ideas they had co-created or discussing their key takeaways. Figure 16 illustrates the material dimensions of the workshop.

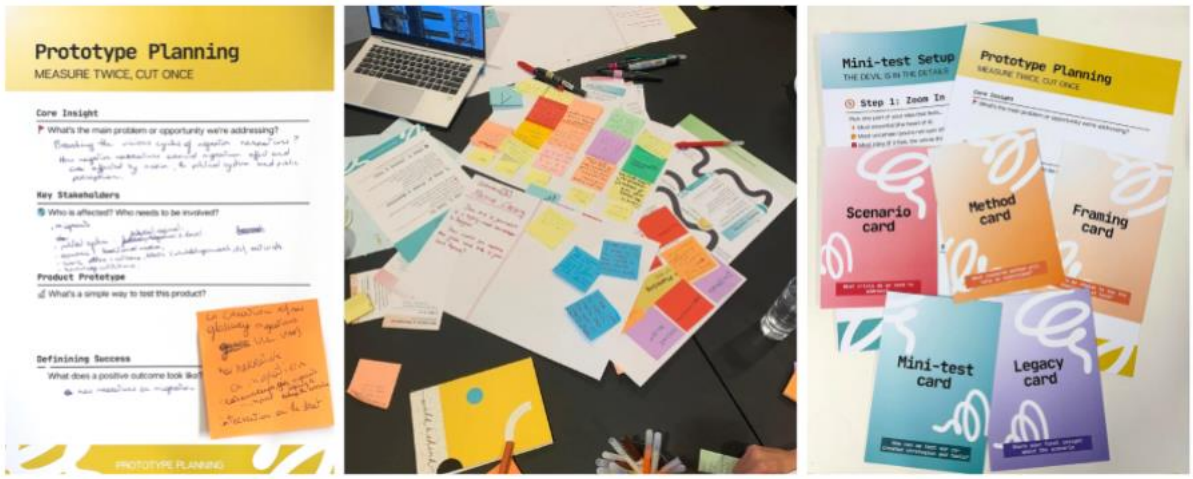


Figure 16: Photographs taken during the Lab on *Living Labs in Times of Crisis*. From left to right: prototype planning canvas, material and creative dimensions of the co-creation phase, and selection of cards used to guide the process.

Creative outcomes of the workshop

The workshop process led to each of the three groups presenting a final design. The first group proposed the creation of a new urban living lab focused on developing a fair migration glossary as a response to the often-negative perceptions of migrants in the media, public discourse, and politics. Another group addressed the lack of national debt literacy by designing an interactive media campaign that visualized what healthy debt might look like in Belgium. In response to the 'cumulative weight' of overlapping crises, a third group developed an affective and performative roleplaying game that used emotions as stakeholders or characters. The three responses did not directly align with the theoretical and methodological proposition of this paper on attentive collaboration. However, the collaborative processes, plenary exchanges, and the thoughts that lingered afterwards made us reflect on the need for and value of collaborative and relational spaces in research, especially when navigating the complexities of polycrisis.

This collaborative reflection also gestured towards rethinking publication practices. Participatory and co-creative research practices, such as presented in the living lab workshop, generally focus on generating new understandings about certain topics. Without the involvement of participants, these new understandings would take different forms or would not even emerge. In such contexts, we should rethink conventional approaches to 'research data' and instead emphasize the notion of 'shared knowledge.' Research data implies something is collected *from* participants, while shared knowledge emerges through collaborative processes *with* them. Simply using co-constructed knowledge as 'research data' and without involving those who co-created it, would raise some serious ethical concerns about intellectual ownership. As discussed by Stouten et al. (2025), participatory and co-creative forms of inquiry require adapted ethical considerations that specifically address the relationality between participants and researchers (if the divide still stands), response-ability to the unpredictability of co-creative research, and acknowledging the situatedness of a research project. In response to these renewed ethical

considerations, this article is not so much concerned with analyzing what participants produced during the Lab. Rather, it conceptualizes the emerging ideas and understandings that we collectively developed throughout the process. The shared knowledge that emerged in this workshop were centered around methodological reflections on living lab approaches. The concept of attentive collaboration is grounded in this shared knowledge, which emerged through the collaborative process and encompassed participants' experiences, reflections, negotiations, ideas, and practices. Rather than treating these materials as a conventional dataset from which the researcher independently derives findings, I understand them as the basis through which methodological knowledge was collectively developed and subsequently conceptualised as attentive collaboration. 'We,' the authors of this article, refer both to those who conceptualized and organized the living lab workshop, and to those who participated in it and continued to collaborate afterwards. As such, this article essentially presents (parts of) the shared knowledge that emerged during the workshop. We extend our notion of attentive collaboration by not only focusing on the relational dynamics part of the collaborative process, but also on the aftermath of presenting and disseminating the outcomes.

TOWARDS A PRAXIS OF ATTENTIVE COLLABORATION IN LIVING LAB CONTEXTS

The concept of attentive collaboration evolved from our collective living lab experience and ongoing discussions thereafter, grounded in concerns that the capitalist institutionalization of ethics in times of polycrisis has reduced matters of care to matters of efficiency, leaving room for slow violences to continue their progress in the meantime (de la Bellacasa, 2017; Nixon, 2011). To trouble the dominant imaginary of living labs as problem solvers and innovation producers, we argue for attentive collaboration as a central characteristic of living lab approaches. This resonates with Stengers's (2018) argument for slow science, where "slowing down means becoming capable of learning again, becoming acquainted with things again, reweaving the bounds of interdependency. It means thinking and imagining, and in the process creating relationships with others that are not those of capture" (p. 82). By naming attentive collaboration as the much-needed relational dimension we need to work toward in living labs, we hope to define an aspect of slow science.

For us, attentiveness means not only paying attention to what demands our attention, but to what matters to those involved and those that remain invisible. Attention is your object of focus, what you are looking at, scrutinizing. To attend is to lean in, to direct your awareness; it is not merely registering that something exists but holding space for it. Attending is closer to care, meaning that it is relational and processual (Mol, 2008). María Puig de la Bellacasa suggests that "relations of thinking and knowing require care" (de la Bellacasa, 2012, p. 198). Care, here, is understood as "vital ethico-affective everyday practical doings that engage with the inescapable troubles of interdependent existences" (de la Bellacasa, 2012, p. 199). Such doings are always context-specific, and an ethics of care calls for situated engagements with

its complex conditions (Williams, 2017). When you attend to something, you do not simply register it, you stay with it and live-with it (de la Bellacasa, 2017). You respond and adjust yourself around it, allowing it to matter in a way that changes you. You must acknowledge, in attentiveness, that your involvement changes what you attend to as well. Whereas attention keeps the subject-object distinction intact, attentiveness dissolves it. It implies ongoing involvement, as a form of collective care that is developed reciprocally, including both human and other-than-human worlds (Rigkos-Zitthen & Granberg, 2024).

Drawing on what emerged during the workshop, our shared experiences, and the discussions and reflections that continued in the aftermath, we identified a set of tensions that prompted us to reflect critically on living lab processes. In the following sections, we flesh out the temporal, ethical, epistemic, and affective frictions we encountered and consider the possibilities of incorporating a notion of attentive collaboration within living lab settings. As such, our exploration of attentive collaboration responds to the identified tensions, offering an alternative lens to engage with them. We highlight these tensions and potentialities through vignettes, presenting brief scenes, experiences, or reflections from participants (e.g., about the workshop, living labs, or personal experiences), which serve as propositions to further conceptualize attentive collaboration. Participants wrote these vignettes in the aftermath of the workshop, presenting methodological reflections that respond to the prompt: “We invite you to reflect on the practices, tensions, and possibilities that can emerge from (doing) living labs in times of crisis. Your response can take many forms: it doesn't need to be highly theoretical or academic, it can also be more affective and experiential.” In what follows, we use these reflections to identify and discuss recurring tensions in participants’ experiences of doing living labs in times of crisis. We present one vignette for each tension and draw on reflections from other participants to further explore these tensions and consider how they inform the conceptualisation of attentive collaboration.

Temporal tensions: The urgency of crisis, living labs, and attentive collaboration

Attentive collaboration draws on Isabelle Stengers' (2018) call to slow down as "speed demands and creates an insensitivity to everything that might slow things down: the frictions, the rubbing, the hesitations that make us feel we are not alone in the world" (p. 81). In other words, speed diminishes our capacity to attend to what truly matters. Yet, when this need for slowness and attentiveness is combined with the urgency of crisis and the practice of living labs, a temporal tension emerges.

Vignette 1: Reflections on temporality

Working with migrants and mobile communities in a living lab setting surfaces tensions: between protection and autonomy, between institutional expectations and lived uncertainty, between the desire for efficiency and the need for trust building. But these tensions can also open other conversations. When researchers and communities co-create tools, stories, or spatial practices, new forms of agency become visible. Crises can generate experimental spaces where solidarity networks strengthen, where

alternative infrastructures appear, and where people reimagine mobility not as vulnerability but as resilience.

Vignette 1 highlights a friction between the desire for efficiency and the need for building trustful relationships. This tension is echoed in a question raised by another participant: "where is the mental space to think beyond survival in this situation to participate in a living lab?" Crises of climate, conflict, economic instability, or health are often framed through urgency, yet within this urgency lie relationships, trust, accountability, and forms of situated knowledge that only emerge through attentive, place-based engagement (Whyte, 2019). In this context, Dowler et al. (2024) emphasize how responses to the COVID-19 crisis produced slow violences rooted in the material and bodily precarity of marginalized communities, including Black, Indigenous, and People of Color, and Queer and Trans communities. Whyte (2019), similarly, discusses how urgency centered discourses in climate change often are used to "justify solutions that ultimately harm Indigenous peoples," such as the dispossession of Indigenous lands in the name of forest conservation (p. 5). In doing so, these discourses neglect the relational qualities necessary for just responses to crisis:

> "Consent, trust, accountability, and reciprocity are qualities of relationships that are critical for justice-oriented coordination across societal institutions on any urgent matter. Yet they are precisely the kinds of qualities of relationships that take time to nurture and develop. That is, they are necessary for taking urgent action that is just, but they cannot be established urgently." (Whyte, 2019, p. 2)

We agree that real-life challenges, such as flooding, do ask for urgent responses, but they *also* and *always* ask for considered, care-full engagements. Rather than positioning urgency and care as oppositional, research in times of crisis might aim to cultivate responses that are ample enough to hold both. In such contexts, different researchers within one team can attend to different temporalities of response, without urgency excusing careless action. From this perspective, the epistemic potential of living labs extends beyond the sharing and creating problem-based knowledge, to include experiential knowledge about relational qualities of consent, trust, accountability, and reciprocity. Such qualities essentially relate to being attentive to multiple needs (both urgency and care) that operate across different interests. Yet, the ability to slow down in research is not a universal privilege, as many scholars, especially those in precarious positions, are compelled to maintain accelerated research and publishing rhythms.

Ethical tension: Stakeholder inclusion and real-life challenges

Living labs are known for their engagement with various stakeholders. One of the greatest concerns for us coming out of the workshop was that, as researchers experimenting with real but removed crisis scenarios in a contained two-day Lab, we were acting as if we were pretending to be “outside the worlds we wanted to see transformed” (de la Bellacasa, 2017, p. 11). Vignette 2 reflects this tension, showing the importance of stakeholder inclusion in real-life crisis contexts.

Vignette 2: Ethical reflections on inclusion

As a former aid worker in Haiti, the notion of attentive collaboration triggers an internal dilemma. In Port-au-Prince, even years after the destructive earthquake hit, mothers are buying mudcakes to feed their children – or at least still their feeling of hunger, as the dried mixture of soil and water does not provide any nutritional value. She moves on to the makeshift shelter her household lives in, a shack that hardly offers any protection against the surrounding violence or the elements, be it the soring sun or the torrential Caribbean rains. ... Water sources polluted, the rich forest disappeared, the coastline full of plastic against a backdrop of polycrisis, including gang-violence, political instability, fragile infrastructure, a high risk to flooding, earthquakes and hurricanes, poverty and public health crisis. It is clear that it is exactly the actors suffering from the consequences from these crisis are to be centrally engaged in addressing them, on both a strategic and practical level, as the communities living in these dire conditions, the organizations working with them and the environments and biodiversity present are exactly the ones holding the knowledge and the key to change the way crises are addressed.

In our workshop, we were concerned that there were not enough entangled stakeholders involved to make the workshop grounded in a sociomaterial reality. Were we basing our speculation on situated knowledge (Haraway, 2016), or acting like “an enlightened outsider who knows better” (de la Bellacasa, 2017, p. 11)? Sitting with this discomfort, we wonder what a living lab would look like that did not center its speculation on out-there scenarios, but the scenarios that affected the lives of the participants directly. Some felt uncomfortable working on topics we are not necessarily an expert in, lacking emotional closeness and situated insights on the complexities. As Tronto (1998) wonders "who gets to articulate the nature of needs and to say what and how which problems should be cared about?" (p. 18). At the same time, and in a cosmopolitical sense, we wonder how we are complicit in being captured by systems we are a part of, rather than being responsible for how we are entangled in causes and capable of change (Stengers, 2018). Maybe we were presuming our own right to judge, or maybe we were denying our ability to respond.

Our unease was not incidental but instructive, signaling that speculation becomes meaningful only when it attends to the realities we are already part of. Perhaps the role of a living lab is not so much about inventing ‘the’ solution for any complex topic in society, but to grapple with themes that are part of our everyday lives and emotionally significant to us. Living Labs do not resolve big unknowns of crises but help participants develop skills to navigate them. In this setting, attentive collaboration can take the shape of co-creating new stories for the future using pieces of the present and fragments of the past. In this way, attentive collaboration is messy, but “what is messy is not defective but simply that with which we have to learn to live in and think with” (Stengers, 2018, p. 120). At the same time, for us, should also be concerned with what matters to those involved or those affected yet unable to participate. This involves but also goes beyond multiple stakeholder inclusion. The European Network of Living Labs (2026) argues that by including citizens, academia, the private sector, and public authorities, "living labs create a neutral and

trust-based environment." We contend, however, that living lab processes are never neutral, nor should they be, and that simply assembling a diverse group of stakeholders does not guarantee just transformation or innovation. Taylor (2021), for instance, argues that living labs risk reproducing power asymmetries by attracting stakeholders "who are already on the receiving end of power" (Sachs Olsen & van Hulst, 2024, p. 996). Attentiveness refers not only to cultivating relationships among those who participate, but also to attend to those who remain uninvited or unable to join the discussion, for example by considering how outcomes of a living lab extend beyond those represented in the room.

This perspective moves beyond a focus on human actors alone and should encompass other-than-humans, such as non-human animals, plants, landscapes, and more. As living labs are not isolated units of inquiry, attentiveness requires considering how their activities and outcomes affect broader human and other-than-human actors and environments. In two labs situated in Australia and South Africa and (co-)facilitated by some of the authors of this paper, attentiveness particularly extended to other-than-human environments, with the aim of eliciting a collective imagination of multispecies urban and community spaces (i.e., Jacobs et al. 2026). Here, attending to the place and context in which the labs unfold also allows engagement with the specific histories and sociomaterial realities that shape these settings. It is exactly this attentiveness that allows for rethinking power dynamics within the living lab itself. In doing so, attentiveness enables living labs to generate more just and care-full practices (Williams, 2017).

Epistemic tensions: The challenge of being stuck and a practice of 'unlearning'

For us, attentiveness means not only paying attention to that which demands our attention, but to what matters to those involved: our values must reflect the here-and-now sociocultural, environmental, affective materialities with which we live. Adjusting that relationship toward some kind of harmony is a part of the messy work. In this way, there is an epistemological aspect to attentiveness as well, because "the answer to the question, 'Is it a fact?', belongs to those for whom this question is a matter of concern" (Stengers, 2018, p. 83). We understand that values and science can go hand in hand when we realize that the facts of the crisis are made up of situated knowledge (Haraway, 2016), rather than deferring to general authority. What matters and what is valued becomes a collective negotiation taking place in context. In this manner, we are trying to learn "what a life worth living demands, and the knowledges that are worth being cultivated" through research in times of crisis (Stengers, 2018, p. 82).

The unease and uncertainty we felt regarding stakeholder inclusion allowed further explorations on living lab approaches and inclusion, providing an opportunity for collective learning. During the workshop, we worked with card stacks to form rearrangeable narratives that encouraged a "sense of multiple subjectivities" (Hostetler, 2022, p. 24). Yet, this multiplicity of possibilities created a delicate balance between offering enough structure for participants to feel confident in their actions and maintaining openness for new ways of thinking and acting. Participants also struggled with uncertainty and

complexity of the issues, group dynamics, and interdisciplinary collaboration. Vignette 3 highlights how collaborative processes generate feelings of difficulty and unease, inviting a practice of unlearning.

Vignette 3: Epistemic stuckness

Coming from diverse backgrounds and experiencing the world in diverse ways, this led to speaking different languages in our group during the workshop. At times, this led me to feel a bit helpless and frustrated, losing the flexibility and playfulness that is so key to untangling such complex crises in living labs.

What is the role of emotions within such more improvised living labs? I wondered not only about my own internalized frustrations of 'not moving forward' and uncomfortableness to work on topics I am not an expert; but also about the level of complexity and 'emotional closeness' a non-expert living lab can and should have. Living labs should provide the room to get 'unstuck' together with fellow worried citizens in those topics we otherwise experience as 'unsurmountable'.

This vignette highlights the difficulties of collaboration, as strangers navigated the delicate process of becoming a possible 'us', often generating feelings of stuckness. Being open to these feelings is not the same as inaction, or as Mol (2008) says, "doubt does not preclude action" (p. 93). Whereas we often expect to address problems in a kind of transactional way, such as by creating a product that can be given or sold as the solution, our conceptualization of attentive collaboration is more in line with Mol's (2008) ethic of care in which care is "an interaction in which the action goes back and forth (in an ongoing process)" (p. 18). Stuckness invites a tolerance for ambivalence and uncertainty, epistemically and affectively. After all, discomfort can be pedagogical (Boler, 1999).

In this context, living labs should offer opportunities for becoming 'unstuck' when faced with topics that otherwise appear unsurmountable, attending to alternative possibilities, generating a space for "learning again, becoming acquainted with things again, reweaving the bounds of interdependency (Stengers, 2018, p. 82). They function as environments for piecing, re-piecing, assembling, constellating, and collaging elements together that may initially seem disparate. From this perspective, living labs align with a rhizomatic mode of inquiry that "[connects] any point in a system in a non-hierarchical way, thereby creating new units ... of meaning and action" (Lapointe, 2020). Attentiveness within living labs, then, involves exploring new or diverse knowledge sources to encourage alternative ways of understanding crises, leveraging existing knowledge to reach shared views on how to address them, and sustaining and valorizing epistemic diversity sources throughout collaboration. This attentiveness to multiple ways of knowing (and being) can guide the development of creative, innovative, and just ideas.

Attentive collaboration strives to hold space for this discomfort with openness, acceptance, and equity by meeting each participant where they are, understanding that each person comes with their own prior experiences which build our understandings and responses in crisis. In this context, stuckness

signals a commitment to care deeply about the issue at hand by attending to its complexity, discomfort, and dilemmas, while avoiding what Whyte (2019) calls "relational tipping points." The stuckness experienced in the collaborative process gestures towards a critical need for unlearning. Natasha Myers suggests that "[s]ometimes we need to forget and unlearn what we think matters. We need to rearrange our sensorium and sense-making practices and disrupt disciplinary thought styles and ways of seeing so that other worlds within this world can come into view" (Myers, as cited in Truman et al., 2019, p. 232). The issue of polycrisis in particular, with its low levels of certainty and agreement on their causes and how to tackle them, resists linear thinking and conventional problem-solving approaches.

Affective tensions: Building affective relationships in collaborative processes

Presenting a space for collective meaning-making, we also consider living labs as an affective site of encounter, both between participants and between participants and the topic or issue at stake. Within these encounters, affect emerged as a central dimension. We understand affect as the relational dynamics that unfold and develop between actors (both human and non-human), which shape living lab experiences and the emotions that emerge from them (Clough & Halley, 2007; Massumi, 1995). As participants collaborated in response to crisis scenarios, affects existed and emotions emerged. These affects and emotions influenced how one builds relationships during the workshop, and how one relates to the topic. Vignette 4 addresses these dynamics by focusing on relationship-building within living lab conditions.

Vignette 4: Building affective relationships

Relations emerge between the members of the group working together in the living lab. These relations can seem to flow naturally, or be more contentious, as for example several members might have a strong personality and harshly disagree during the discussions. This generates other affects that can reinforce or modify our previous state of mind/heart regarding the subject.

In our group, these affects were very much felt, and I think that it is why we created a role playing game where each character was assigned a specific emotion. Instead of socio-economic, political or religious elements constituting the fundamental characteristics of the character, it seemed natural to us to put the emotion central, showing how affects matter. They really matter, in the sense that they have a materiality, an impact. We thought that emotions particularly shape people's reaction to a crisis, and therefore we wanted to use the role play game to encourage people to try and understand others' emotions when dealing with a crisis.

Vignette 4 illustrates how affective relationships within living labs and polycrisis are not static but emerge dynamically through the process. This process shows the relationality and complexity of collaborative spaces, where emotions such as anxiety, hope, frustration, and curiosity among others, shape both the social fabric of the group and the epistemic engagement with the issue at hand. In this

sense, affect operates as a mediating force, influencing how participants position themselves and negotiate meaning collectively. De la Bellacasa (2017) highlights that "[a] politics of care goes against the bifurcation of consciousness that would keep our knowledge untouched by anxiety and inaccurateness. Involved knowledge is about being touched rather than observing from a distance" (p. 93). Attentive collaboration within living labs reflects this stance in that it should generate a space to affect and to be affected (Latour, 2004), whether arising from interpersonal interactions, the topic under discussion, the process itself, the workshop environment, material infrastructures, other-than-human actors, or other affective and embodied intensities that shape the living lab space.

Rather than treating affect and emotion as secondary, some of us made them a central aspect of our inquiry during the living lab workshop. This choice illustrates what living labs can enable. From the perspective of attentive collaboration, living labs become a site of proximity, co-presence, and ongoing interaction that allows us to develop a sensitivity for subtle affective cues and emotional responsiveness. This sensitivity should pick up what remains unsaid. In such a context, emotions become infrastructures of care, supporting collaborative decisions, ethical adjustments, and inclusive knowledge production. Developing a feel for others is not just ethically important, it is a methodological necessity and ontological precondition for engaging in collaborative relationships in times of crisis, both within research and across wider fields of practice, including politics, policymaking, education, and social or institutional engagements.

CONCLUDING REMARKS

Based on our experience in and reflections after the Lab on *Living Labs in Times of Crisis,* we have identified temporal, ethical, epistemic, and affective tensions that helped us conceptualize attentive collaboration. Through these tensions, we came to realize that a notion of attentive collaboration treats knowledge as plural, contextual, and co-emergent, honoring alternative ways of knowing, including affect, as essential rather than incidental. It sustains the relational fabric by building trust across differences in ways that allow people to think, feel, and act together and alongside uncertainty. Attentive collaboration, then, is not simply a method; it is an ethic. It moves away from quick-and-dirty solutionism, and instead, it stays with the discomfort. Building on those insights, we invite readers to engage with the following questions to reflect on attentiveness within (your) collaborative research contexts:

> *Responsible action beyond urgency: Where might intentionally slowing down lead to more responsible and care-full forms of action, even under pressure?* Urgency should not justify careless action, for neither action nor collaboration can ever be neutral. Evaluate which dimensions of practice allow slowness in order to ensure attentive, careful, and relational forms of collaboration. We have considered living labs as a way of redistributing temporal labor rather

than choosing one pace over another. Some work must move fast, and other work must slow down so that speed does not become a form of violence.

Inclusive and reflexive engagement: Whose perspectives or lived experiences can further deepen and steer attentiveness in practice? Actively include stakeholders to meaningfully engage with the issue. But even when one is not directly affected by a crisis, critical reflection is required to examine possible complicity or avoidance of responsibility for transformation. This calls for a critical reflection on one's positionality, since the realities we study are always shaped by our presence as researchers. Such reflections also involve attending to those not present in the room, both human and other-than-human, while critically examining assumptions that define "we" versus "them" and who has the power to decide the "what, when, and how" of the polycrisis.

Embracing discomfort: What assumptions, habits, or dominant practices might I need to unlearn to allow alternative possibilities to emerge? Stay with discomfort rather than rushing to resolve it. During discomfort, create space for 'unlearning:' shift from dominant paradigms and practices, enabling new directions to take shape. Attentive collaboration reframes “being stuck” as an epistemic event, pushing back against methodological norms that equate fluency with rigor. Here, difficulty becomes evidence of ethical attunement rather than incompetence.

Affect as epistemic insight: What emotional and affective dynamics are present in this collaborative space, and what might they be revealing about the situation? Recognize living labs as affective sites of encounters where actors, both human and other-than-human, mutually influence one another. In this context, emotions provide essential epistemic insights. Living labs have always operated affectively, whether acknowledged or not. Prioritizing affective care as a part of attentive collaboration simply makes this explicit and accountable.

These guiding questions can enable attentive collaboration and help activate the 'living' dimension in living labs, which involves cultivating attentiveness and care within its collaborative processes. De la Bellacasa (2017) challenges us to think of research as a form of living-with each other, leading us to ask: What does it mean to live-with polycrisis? As discussed by de la Bellacasa, the notion of living-with attends to building caring and affective relationships amid urgency, uncertainty, and discomfort, both in human relationships and with other-than-humans. The 'living' in living labs, thus, reflects a commitment to interdependency, reciprocity, and compassion, encompassing both living-with each other (i.e., building caring and affective relationships) and with the issue (i.e., attending carefully to it). These ‘living’ qualities become a counter-practice to polarization, individualism, fear, and social fracture that increasingly shape contemporary life. In this way, attentive living labs can become forms of resistance in itself. Activating this notion of living in living labs, and in research more generally, holds potential for shaping more caring and compassionate societies.

We suggest that, in polycrisis, one such act of care lies in cultivating relational capacities rather than prioritizing outputs. Something important is lost when living labs are judged by output alone, and so we wanted to consider, in our workshop and this article, what becomes possible when living labs are treated as 'living' sites of epistemic humility and care. In this sense, it pushes back against the prevailing demands for productivity and efficiency in academia and related fields. In naming attentiveness and attentive collaboration, we aim to offer not a method to be replicated but a stance for research in polycrisis: one that slows down (on occasion), honors situated knowledge, and sustains the relational conditions needed for collective response. Living labs, approached this way, become more than innovation infrastructures; they become spaces where care, imagination, and responsibility can be practiced together. There lies an opportunity here to further flesh out what it means to build meaningful relationships in living lab and polycrisis contexts. In times when crisis demands rapid action yet resists simple solutions, cultivating attentiveness may be one of the most meaningful contributions the humanities and social sciences can make.

Chapter 5 explores methodological possibilities for working participatorily in times of polycrisis. Focusing on the living lab approach, this chapter examines the temporal, ethical, epistemic, and affective tensions that arise when using living labs in situations of crisis.

Chapter 5 has a clear methodological focus and responds to ***sub-question 2,*** *which asks about* ***the ways in which multispecies arts can help to imagine alternative worlds that engage with climate change differently.*** *Its main methodological contribution lies in critiquing living labs' emphasis on efficiency, productivity, and scalability, and proposing 'attentive collaboration' instead as an orientation to research. Attentive collaboration is characterised by slowing down, interdependency, reciprocity, and compassion.*

Following the exploration of participatory research-creation Labs in Chapters 3, 4, and 5, ***Chapter 6*** *brings together these methodological reflections to gesture towards speculative ethnography as an overarching methodological approach. It brings together futures studies and speculation practices piloted in the BioFutures Living Lab, the place-based focus that emerged through the Multispecies City Labs, and the attentiveness highlighted in the Lab on 'Living Labs in Times of Crisis.'*

PART III

CREATIVE AND METHODOLOGICAL REFLECTIONS

6

An emplaced speculative ethnography of worlds to come

INTRODUCTION

Following the empirical chapters that explored what kinds of multispecies worlds participants imagined, this chapter considers *how* the research-creation Labs facilitated processes of imagining speculative worlds to come. Asking 'how' directs attention to the methodological orientations informing the Labs that aimed to elicit speculative thinking and making of multispecies possibilities. This process began with the BioFutures Living Lab in Belgium in 2023 (i.e., Chapter 3), which served as a pilot exploration, where the initial intention was to connect the living lab methodology with futures studies approaches. The methodological practices used in the BioFutures Living Lab were refined and reconfigured in the Multispecies City Labs held in Australia in 2024 (i.e., Chapter 4), which brought together selective speculative practices tested in the earlier iteration. Throughout this process, place became an undeniable agent in shaping speculation about climate change: climate change in Belgium and Australia are differently experienced, both contexts have different ecosystems and other-than-human relations to speculate-with, as well as varying histories that shape what alternatives one images. This led to broader questions concerning the significance of place within speculative processes.

In the BioFutures Living Lab, we employed and tested a combination of futures methods, including Causal Layered Analysis, speculative design, scenario building, and the Futures Wheel. We noticed that several of the emerging imaginaries continued to reproduce certain norms and values we had initially sought to challenge, such as assumptions of human control over or exploitation of other-than-humans. This reproduction of dominant norms may be linked to our methodological choice to anchor speculation in a particular future year. Although such temporal framings are a common practice in futures studies, they may reinforce linear and progress-oriented modes of imagination, reproducing present day onto-epistemologies and shaping assumptions about what futures are possible or desirable. Consequently, a central question emerged that made us rethink the methods we used: how might we support forms of speculation that do not simply extend the present, yet remain attentive to histories and structural conditions? The BioFutures Living Lab encouraged us to pay greater attention to justice-oriented dimensions of speculative thinking in subsequent iterations. At the same time, the pilot highlighted the significance of temporal framings in speculative thinking, and the ways in which methodological decisions and assumptions about time can profoundly influence the imaginaries that take shape.

In response, the Multispecies City Labs placed greater emphasis on encouraging participants to reflect critically on their own imaginaries, specifically in terms of who is included and how relationships are configured. At the same time, no fixed temporal frame was imposed, allowing a multiplicity of temporal speculations to emerge, including past and future worlds, as well as parallel realities or alternative ones. The new practices used in the Multispecies City Labs culminated in four "enabling constraints," which provided structure and guidance while maintaining openness to emergent possibilities throughout the process (Manning & Massumi, 2014). These enabling constraints included *imagining otherwise, moving and walking, making and doing, and sensory storytelling,* and were directed at eliciting speculative thinking

and making. Though the third Lab on *Living Labs in Times of Crisis* was not directed at imagining multispecies worlds, its emphasis on slowing down to create space for people to think, feel, and act together generated valuable insights that were later incorporated into these enabling constraints.

I situate these enabling constraints as part of the broader methodological approach of speculative ethnography, understood as a practice-based and more-than-representational mode of inquiry focused on imagining alternative possibilities. In what follows, I first offer a conceptual account of speculative ethnography as articulated in contemporary scholarship. I then present the four enabling constraints that guided the speculative ethnographic process in the Multispecies City Labs. Using these enabling constraints in the Labs gestured toward place as an undeniable agent that shapes speculation. As a response, I suggest a notion of *emplaced speculative ethnography,* highlighting that speculation relies on one's being-in-place, which include attentiveness to the environment and to encounters across humans and other-than-human relations.

SPECULATIVE ETHNOGRAPHY

Speculative ethnography is generally considered a practice-oriented research method used to imagine alternative possibilities based on one's long-term engagement with the world. To develop a better understanding of speculative ethnography, it is necessary to reflect on existing ethnographic practices and their connections or disconnections to speculative thinking and making. Ethnography can be considered a qualitative research method primarily concerned with observing social and cultural worlds and generating new understandings of it along the way. As discussed by Walsh and Seale (2018), "ethnography contrasts with 'scientific' methods of positivist social science which, based on a universality model of science, emphasizes its neutrality and objectivity, attempting to generate data untouched by human hands" (p. 258). And yet, Atkinson (1990) notices how literary devices used by ethnographers are often aimed at bolstering scientific authority. Especially traditional and realist ethnographers often claim to offer a truthful rendering of the world, which seemingly reproduces discourses centred on objectivity, authenticity, and truth (Vannini, 2014; Walsh & Seale, 2018). Such representational practices and foci to research are increasingly being challenged in the humanities and social sciences, where scholars have highlighted how they are reductive and schematic, serving Euro-Western ideals of objective findings and universal truths (Dewsbury, 2010; Vannini, 2015).

In response to this critique on representational practices in ethnography, more recently, the methodological notion of "non-representational ethnography" has gained traction:

> "Whereas traditional and realist ethnography more-or-less posit the representation of their research subject(s) as a faithful rendition of the world 'as is,' non-representational ethnographers consider their work to be impressionistic and inevitably creative, and although they are inspired

by their lived experiences in the field, the do not claim to be able, or even interested, in reporting on those in an impersonal, neutral or reliable manner" (Vannini, 2015, p. 318).

Yet, such non-representational ethnographic perspectives have been critiqued for their focus on personal reflections of the ethnographer, risking disconnection from broader social and political realities, and for implying that one can fully escape representation. In response, the notion of "more-than-representational research" recognizes that complete rejection of representation is impossible. Such "more-than" perspectives focus on creation instead of representation (Truman, 2022).

In this context, creative approaches to ethnography have gained momentum, for instance, by including speculative and futures thinking in ethnographic research. For example, Tytler (2025) explores the notion of "speculative documentary" to unsettle epistemic authority often inherent in dominant ideas on ethnography and documentary making. In this context, she argues that "documentary, despite its claims to factuality, inevitably constructs its own world, shaped by selection, framing, and narrative structure ... Speculative documentary opens space to disrupt these epistemologies, foreground entanglement, kinship, and decolonial futurities that challenge territorial, racial, and institutional boundaries" (p. 9). Similarly, in their ethnographic fictions, Helgason and Smyth (2020) use semi-structured interviews in which the interviewee and interviewer co-create a fictional life story. In this instance, the interviewee and interviewer work together to imagine events, situations, relations, and emotions to construct a speculative testimony of one's life. These instances use creative and (more-than)-ethnographic approaches to story alternative worlds.

In this context, the notion of speculative ethnography emerged, described as a creative ethnographic approach that informs stories and designs of speculative worlds (Dong et al., 2020; Bogdanova & Jacobs, 2021). Oman-Reagan (2018) discusses speculative ethnography as “creative engagements with possible futures created using imaginative anthropological approaches toward the aim of building just and ethical relations across spatial and temporal scales" (p.1). A lot of attention is placed on the justice and ethical aspects of envisioning otherwise in speculative ethnography. In *A Speculative Ethnography of War*, Sangarasivam (2022) frames it as an intentional methodology that says "no to neutrality no to objectivity no to participant-observation ... no to colonial logics seeking to rediscover self and other no to the binary predilections" (p. 16-17). With its focus on the imagination of alternative possibilities, speculative ethnography can be considered a creative and practice-based mode of inquiry that actively contributes to world-making. Speculative ethnography is not so much concerned with reporting on and representing future visions that already exist. Instead, it is focused on the actual creation of new imaginaries, allowing one to "be open to alternative possibilities of collective existence, to being vulnerable and being transformed" (Sangarasivam, 2022, p. 32). In this context, I consider speculative ethnography as a more-than-representational approach that interrogates the presumed epistemic authority of dominant representational modes of ethnography.

FOUR ENABLING CONSTRAINTS

To further clarify how speculative ethnography can be used in practice, this section provides thick descriptions of the practices and exercises conducted during the research-creation Labs on multispecies speculation, building on what Manning and Massumi (2014) call "enabling constraints." Rather than constituting a systematic set of actions or an established procedure, enabling constraints generate "opportunities for creative participation, which would be encouraged to take on their own shape, direction, and momentum in the course of the event" (Manning & Massumi, 2014, p. 92). In participatory research contexts, enabling constraints provide structure and direction, while simultaneously maintaining openness and allowing for experimentation. Since such enabling constraints are decided upon beforehand, they enable the researcher to guide the overall research process while leaving participants freedom to explore, experiment, and make creative decisions. Such enabling constrains are carefully curated and necessary for navigating the inherent messiness of possibilities. Without any direction, participants might freeze, unsure of where to begin; include everything that comes to mind, drifting far beyond the topic at hand; or think ‘anything goes’ which undermines the rigour and structure research-creation practices (Truman, 2023). In the sections that follow, I explore the enabling constraints in detail, combining conceptual reflections with (visual) examples from the Multispecies City Labs to show how these constraints shaped and guided the creative processes in practice.

Imagining otherwise

I propose "imagining otherwise" as a first enabling constraint. Donna Haraway argues for the need to story otherwise (Terranova, 2016), which involves telling different kinds of stories about the world than those we are accustomed to. This requires processes of unlearning and relearning how stories and understandings are formed, rendering dominant paradigms and perceptions "seriously unthinkable: not available to think with" (Haraway, 2016). As Rifkin (2019) suggests, imaginary thinking "allows us to see divergent ways of conceiving and perceiving, variable frames of reference through which to understand how things work in the world" (p. 7). To story otherwise, we must first learn to imagine alternative possibilities. Yet, leaving behind what one already knows and imagining the world from an entirely different perspective is a challenging task. The openness of speculative thinking offers multiple directions, but also the uncertainty of not knowing where to begin.

A practice I used to elicit imagining otherwise during the Labs in Australia was multispecies storytelling. Focused on the creation of multispecies testimonies of climate change, imagining otherwise involved inviting participants to create a postcard that tells a story from the perspective of an other-than-human experiencing a climate-related challenge (see Figure 17). The testimonies did not necessarily have to be textual but could also take visual forms through drawing or collaging, depending on personal preferences. While this act of imagining otherwise lasted only a few minutes, it sought to build alternative understandings of climate change: rather than focusing on the abstract transformations of the planet and the often disastrous consequences it might generate, the multispecies testimonies invited attention to the

embodied experiences of other-than-humans within such contexts. Some of these multispecies testimonies considered how it might feel for a tree's roots to reach for water yet never find it, or what and how a river feels when water levels are going down. This created more empathetic and relational ways of understandings climate change and its challenges. Essential in imagining otherwise is the need to remain responsive to the specific relations, places, and people that shape each Lab. While the goal of imagining otherwise is to break with the status quo, it does not intend to simply forget or erase the situated experiences of everyday life. It needs to remain grounded within them.

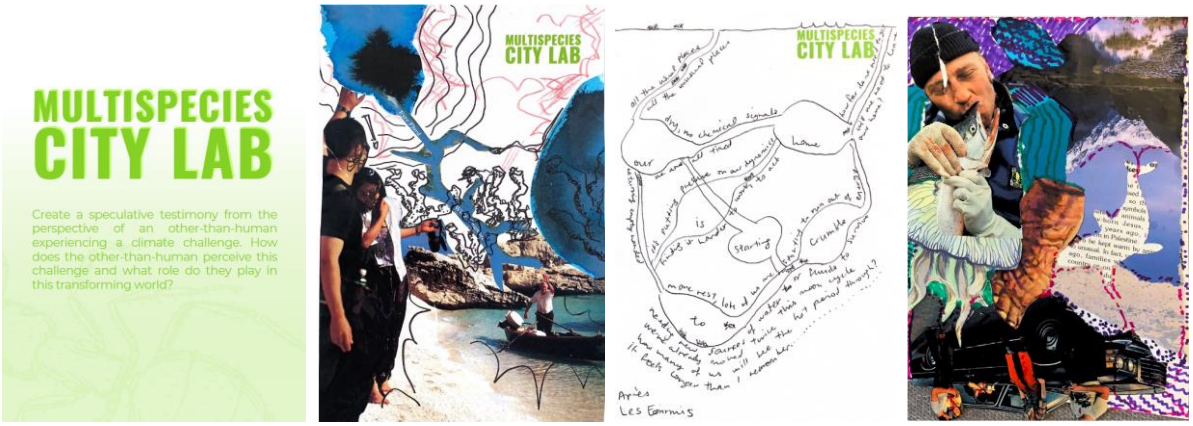


Figure 17: Imagining otherwise prompt and responses by participants in the Multispecies City Lab in Australia in 2024.

Moving and walking

To further elicit speculative thinking, I began paying greater attention to the role of the environment. In this regard, Ingold (2015) argues that knowing unfolds as we go, rather than preceding it. Extending this to speculative inquiry, imagination can be understood as something that emerges through movement, in relation to the environment. To do so, many scholars have turned to walking methods. As an "embodied and embedded activity taken up in relation to particular locations, times, and geographies" (Taylor, 2020, p. 5), walking and moving through space considers the intersection of body, mind, and environment (Coemans et al., 2020). From a feminist perspective, Springgay and Truman (2017), alongside Taylor (2020), frame walking as a political and ethical practice that can disorient and unsettle "humanism's structurings," such as those that divide the human and the other-than-human (Springgay & Truman, 2017, p 14). Attending to such structurings through walking enables political and ethical engagements with the environment. In this context, we can consider artists that have mobilised walking as a method of political and ethical resistance and reorientation (Shepherd & Ernsten, 2022). In 2004, Francis Alÿs, for instance, walked the division of East and West Jerusalem while dripping green paint (a reference to the Green Line of 1949) as a performative gesture confronting Israeli colonial powers (Fisher, 2011). Such creative instances illustrate the embodied, affective, and political potential of walking as research and artistic practice.

I turned to walking methods to attune the Multispecies City Labs to the environment. Attending to the specific places and contexts in which the Labs unfolded, enabled engagement with its ecological,

social, and political dimensions, prompting attention to hegemonic assumptions, power, and injustices shaping the environment. The Labs incorporated a walking activity to ground the emerging imaginaries in the places where they were generated. The walk involved unstructured wanderings: Instead of following a fixed plan or path that guided participants from point A to point B, participants allowed the environment to guide their movement, following moments of curiosity. Without a predefined destination, participants walked until something drew their attention; whether a building, bench, tree, or puddle. In that encounter, we worked from the proposition: "how might humans and other-than-humans collaborate here, in this very spot, to respond to climate challenges?" This enabled an affective immersion in place, making the presence of environment and other-than-humans more tangible. And as a result, the site-specific imaginaries often resonated closely with ecological, social, and political matters of the immediate environment.

Making and doing

Based on the walking experience, the enabling constraint of "making and doing" is focused on enacting and materializing speculative thought through artistic creation. In this sense, imaginaries are not merely thought but are activated and formed through creative processes. Such processes embody what Springgay (2022) calls "thinking-in-movement." As she explains, research-creation does not simply reflect on what has already taken place; rather, "thinking-in-movement is to think in the act; it is thinking saturated with rhythm and affect" (p. 17). While this notion shares similarities with walking approaches, here it is specifically oriented toward artistic practices. Through the open-ended and often messy engagements of art creation, imaginaries take shape, evolve, and expand. As a result, imagination unfolds in multiple directions, and its outcomes cannot be predicted beforehand (Manning & Massumi, 2014).



Figure 18: Photographs taken during the making and doing in the Multispecies City Labs

In the Labs, participants were asked to create an artwork that reflected or visualized the imaginaries that emerged during the walking exercise. This process of artistic making and doing materialized through collages, drawings, sculptures, or installations (see Figure 18). As participants developed their artistic creations, I introduced propositions that invited them to think, make, or sense differently. These propositions took the form of open-ended question cards designed to re-orient the

imaginaries. Questions included: “What are the consequences of your speculation? Which human and other-than-human groups are most affected by it? What positive and negative impacts might they experience? And how are the relational dynamics between these groups?” Participants were invited to use the question cards freely, provided that they actively engaged with them: Some participants used the cards simply to generate discussion while creating, others responded to each card explicitly, while others integrated the cards directly into their visual artwork. These questions encouraged a mode of "thinking-in-movement" (Springgay, 2022, p. 17), allowing participants to slow down, revisit, refine, and further develop their imaginaries throughout the creation process. In this way, artistic creation served as a companion to make sense and think through the emerging imaginaries.

Sensory storytelling

The "making and doing" processes evolved into a practice of storytelling. As discussed by McKenzie and Bieler (2016), "narrative speech acts do not emanate from people's minds, but rather emerge out of material processes" (p. 26). In this sense, the material and creative practice of "making and doing" lay the groundwork for storytelling. However, the goal was not to craft a linear or logically structured narrative, since imaginative thinking unfolds in unpredictable ways. Hohti and Tammi (2024) emphasize that "feminist and critical storytelling inspires us to experiment with careful (true to detail) and careless (not concerned with the coherence and linear progression of the story) dimensions of storytelling" (p. 599). Combining such a careful and careless approach with an emphasis on the senses generated a mode of sensory storytelling (Pink, 2015). Guided by sensory engagements with environments and place, the storytelling practice became more embodied and affective. Importantly, attending to sensory details was not intended to produce a coherent narrative, but to allow unexpected yet detailed elements to surface, even if they did not neatly align.

In the Multispecies City Labs I prompted participants to articulate the sensory qualities of their imagined worlds, including *colours, textures, shapes*, as well as how these worlds might *smell, sound,* and *feel*. Imagining how these sensory qualities are manifested in their imaginary worlds presented a creative exercise in which the sensory elements were approached as forms of affective and narrative meaning-making. Based on these sensory elements, participants were invited to write an open-ended, short fiction story exploring what it means to live and move within such worlds (see Figure 19). This sensory storytelling exercise aimed to imagine speculative worlds through the body, instead of merely talking about them (Pink, 2015). This allowed imaginaries to become more tangible and vivid, shifting from abstract visions to affective and embodied spaces. The storytelling then continued through oral sharing, where each group read their story aloud and invited others to respond. These responses allowed the stories to evolve collectively.

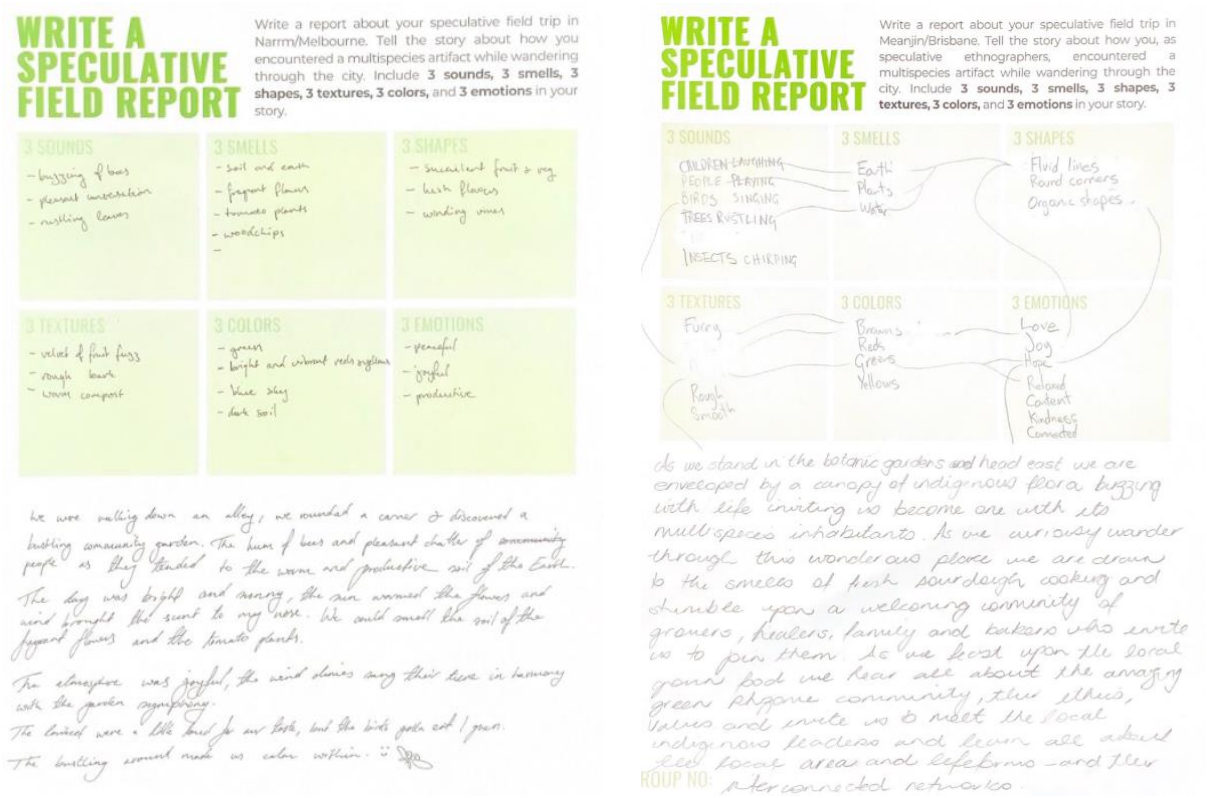


Figure 19: Storytelling prompt and responses by participants in the Multispecies City Lab in Australia in 2024.

A PLACE-BASED APPROACH OF SPECULATIVE ETHNOGRAPHY

The enabling constraints developed through and applied in the Multispecies City Labs prompted a critical engagement with the practice of *speculative ethnography,* generating a more nuanced understanding of its relation to conventional ethnographic approaches. In this context, I came to notice the tensions inherent in bringing *speculation* and *ethnography* together. Ethnographic practices are traditionally associated with detailed, long-term, and observation-based accounts of social and cultural realities, whereas speculation is often linked to uncertainty, imagination, and the exploration of possible futures that do not yet exist and therefore cannot be studied through conventional empirical methods. At the same time, the temporal exposure conventional ethnographers expect as a marker for good and truthful ethnographic research (e.g., through observations) is often one of long duration. Speculative ethnography, in contrast, does not necessarily take months or years to complete, and often resembles just a brief intervention but the imaginaries that emerge are grounded in one's long-term being-in-the-world. Though conventional ethnography and speculation differ significantly, ethnography brings a focus on studying how people make sense of speculative worlds. I retain ethnography for its focus on situated and contextual understandings (e.g., understanding speculative worlds in connection to particular social, cultural, material, or environmental contexts), its use of thick descriptions (e.g., providing detailed accounts of the speculative worlds by outlining contexts, practices, relationships, and sensory experiences), and its relational approach (e.g., developing knowledge through interactions with participants). In this way,

combining speculation with ethnography brings together one's lived experiences with imaginary thought. Speculative ethnography blends fact and fiction, merging what already is and what could be.

To bridge fact and fiction, the speculative ethnography practice proposed in this chapter used enabling constraints, including *moving and walking* to actively engage the environment in the speculative ethnographic process. Through the walking exercise, other-than-humans as well as socio-political and historical conditions of the environment became part of the imaginaries. In similar ways, *imagining otherwise* encouraged participants to consider the other-than-human and the climate issues shaping the environment. Through artistic creation, the *making and doing* exercise invited participants to critically consider the implications their speculative ideas could have if realized in the respective locations. Finally, the *sensory storytelling* further promoted attentiveness to place by foregrounding sensory qualities. These sensory observations and experiences were subsequently woven into the fictional narratives, making the stories more embodied and intimately connected to the affective and sensory dimensions of the environment. In this way, the enabling constraints encouraged speculative ethnography to become more embedded in and responsive to the environmental and historical specificities of *place*.

As a response, I suggest a place-based approach to speculative ethnography that remains grounded in embodied and material experiences of social realities, which are inseparable form the places in which they occur (Tuck & McKenzie, 2015). From this perspective, I propose the notion of *emplaced speculative ethnography,* which stresses that imaginaries are formed through the specific environments in which they are produced rather than emerging independently from them. Such an approach aligns with broader academic discussions that increasingly foreground the significance of place in research entanglements. Tuck and McKenzie (2015) and their work on *Place in Research: Theory, Methodology, and Methods*, in particular, aims to “develop complex and historicized orientations to place in research” so that “research can more fully consider the implications and significance of place in lived lives” (p. 1). In the context of speculative inquiry, Truman's (2026b) work on speculative fiction and mining nostalgias illustrates how place operates as "both a material and imaginative agent" (p. 10). In addition, Iovino (2018) has discussed the significance of telling speculative stories as “a cultural-educational practice that consists of restoring the ecological imagination of place by working with place-based stories” (p. 106).

In line with this thinking, an emplaced speculative ethnographic approach encourages attentiveness to ethical, political, and material conditions that shape place. From this perspective, emplaced speculative ethnography is inseparable from the sensory, spatial, and socio-material realities of environments as it draws attention to land, weather, other-than-human species, and material infrastructures, and along with it, its histories and socio-political contexts. In emplaced speculative ethnography, participants essentially become-with, learn-with, and speculate-with these conditions and ecologies of place. This orientation toward place highlights that, similar to more conventional forms of ethnography, emplaced speculative ethnography remains anchored in lived experiences and observations of reality. Yet, whereas traditional ethnographic approaches typically rely on observations, interviews, and other collaborative practices to gather data (Pink, 2010), emplaced speculative ethnography relies on

one's being-in-the-world, and more particularly, *being-in-place*; this includes one's embodied presence in and attentiveness to the environment (as an alternative to observations) and one's encounters across human and other-than-human relations (as an alternative to interviews). Such embodied attentiveness and encounters can be obtained by, for example, combining speculative thinking with moving and walking, creative making and doing exercises, and attentiveness to the senses, as illustrated in the Multispecies City Labs. Such embodied approaches make sure that the speculative thinking and doing "stays with the trouble" of existing worlds (Haraway, 2016), while speculating new ones.

CONCLUDING THOUGHTS: MOVING TOWARD WORLDS TO COME

This chapter positions the research-creation Labs that focused on the speculation of multispecies possibilities within the methodological orientation of speculative ethnography. Working with enabling constraints led me to expand understandings of speculative ethnography as a more-than-representational and practice-based approach that is *deeply entangled with place*. In this light, I have suggested *emplaced* speculative ethnography as a mode of inquiry grounded in material and embodied experiences, and social and ecological conditions connected to place and environment. Emplaced speculative ethnography can be practiced individually or collectively. In participatory settings, imagining alternative worlds becomes a process through which shared concerns are discussed, situated experiences are exchanged, and speculative possibilities are negotiated together (Light, 2021). In this context, it is imperative to attend not only to speculation processes themselves, but also to the cultivation of attentive relationships among participants. The Lab on *Living Labs in Times of Crisis* suggest that this involves creating space to slow down, build trust, and nurture compassionate and care-oriented connections.

The enabling constraints support this process of slowness in different ways. Through *imagining otherwise,* participants are encouraged to wonder “what assumptions, habits, or dominant practices might need to be unlearned to allow alternative possibilities to emerge” (Chapter 6). The *moving and walking* practices deepened speculative engagement by connecting the process to lived experiences and environmental surroundings. Similarly, *making and doing* activities enabled participants to pause and reflect while creating art, and to intentionally slow down to create more responsible and care-full speculations. *Sensory storytelling* further invited considerations of what sensory, “emotional and affective dynamics are present” in the speculations and what they might reveal about place (Chapter 6). In this way, the enabling constraint provide guidance, allow slowness, and remains open to the situated character of emplaced speculative ethnography.

Chapter 6 introduces emplaced speculative ethnography. The method is conceptually explained by building on scholarly work in speculative fiction, futures studies, ethnography, and anthropology. The suggested four enabling constraints (i.e., imagining otherwise, moving and walking, making and doing, and sensory storytelling) provide a practical framework for enacting emplaced speculative ethnography in practice.

Chapter 6 brings together insights from previous chapters into a re-worked methodological approach. In doing so, it contributes to ***sub-question 2*** *concerning* ***the ways in which multispecies arts can help to imagine alternative worlds that engage with climate change differently****. Emplaced speculative ethnography is introduced as a practice-based and more-than-representational approach for observing and creating speculative worlds, relying on one's being-in-place, which includes attentiveness to the environment and encounters across humans and other-than-human relations.*

Chapter 7 *will discuss the creative contributions developed alongside the empirical and methodological explorations that were discussed in Chapter 3, 4, 5, and 6. These creative explorations resulted in a range of outputs that have significantly shaped the research trajectory.*

7

Propositions for further speculation: Creative research outcomes

Contains parts of: Jacobs, A. (2025). Speculating-with other-than-humans in multispecies climate fiction: Canopy of the Hidden Alley. *Australian Journal of Environmental Education, 41*(3), 616-632. https://doi.org/10.1017/aee.2025.10069

INTRODUCTION: FURTHER SPECULATIONS

This chapter documents and discusses the creative contributions developed during the course of this research. While the research design was inherently creative, I also engaged in creative practices alongside the empirical work, using creative practices as a mode of research dissemination and as an alternative means engaging with research data. These explorations produced a range of outputs that have significantly shaped the research trajectory. Although presented at the end, these creative outputs were deeply embedded in and have informed the research process throughout.

In discussing these creative outputs, this chapter draws on the field of research-creation. As discussed earlier, research-creation presents a more-than-representational account of research, in which artistic practices and scholarly inquiry are combined (Loveless, 2019; Manning, 2015, 2016; Truman, 2022). It focuses on making and doing instead of on reporting, and as a process-oriented and experimental praxis, research-creation examines present realities through artistic creation: "artist-scholars create the artifacts they want to think-with rather than analysing existing cultural productions" (Truman et al., 2023, p. 88). While exploring existing realities through creativity, research-creation also remains attentive to emergent possibilities and unexpected developments (Manning, 2016). Knight (2021) underscores the epistemic significance of such creative experimentation, arguing that experimentation expands conventional understandings of knowledge and challenges assumptions about who has the rights to produce knowledge and what constitutes "valuable" knowledge. She further argues that creative practices "offer methodological possibilities to maintain a complex reading of the world" (p. 123).

In research-creation, *propositions* are often used as a tool or prompt for creative and theoretical speculation, without asserting that what is speculated is true (Truman et al., 2023; Shannon, 2021). Instead of determining what is true or false, propositions open space for exploration and critical engagement. As Shannon (2021) notes, "employing the proposition as a primary organizing concept is what enables research-creation to be emergent, situated, feminist and responsive" (p. 72). Here, propositions allow for the interrogation of truths and acknowledge the inherent variability within truth itself (Shannon, 2021). As such, a proposition is neither instructive nor pre-determined, but rather emerges through the relational exchanges that are part of the research-creation itself (Manning, 2016; Truman, 2022; Truman & Springgay, 2015).

The relational exchanges that unfolded across the two research-creation Labs allowed a range of new propositions to emerge, generating openings for further speculations: As discussed by Truman et al. (2023), "research-creation invites further speculation … Each finished piece of 'art' is processed into the work's further articulation" (p. 93). The creative outputs documented in this chapter can be understood as evolving inquiries that continue the empirical work conducted in the Labs. This evolving inquiry materialized in the organization of a small exhibition and the writing of a fiction story. For those creative continuations, participants gave their consent through the consent forms, which specified how their

contributions could be used and disseminated.[7] In what follows, these outputs are visually presented, alongside written reflection about what new thoughts and insights these evolving inquiries generated.

EXHIBITION: *'MULTISPECIES TESTIMONIES OF CLIMATE CHANGE'*

For three weeks, I set up a small exhibition entitled *Multispecies Testimonies of Climate Change,* at studioFIVE, part of the Faculty of Education at The University of Melbourne and the UNESCO Observatory Visiting Scholar Programme, supported by SWISP Research Lab. The focus of the exhibition drew on a practice that was implemented in the research-creation Labs, where participants created testimonies of climate change from the perspective of the other-than-human. It featured selected excerpts from the works created during the research-creation Labs (see Figure 20), while also inviting visitors to contribute their own reflections, encounters, or imaginative stories.

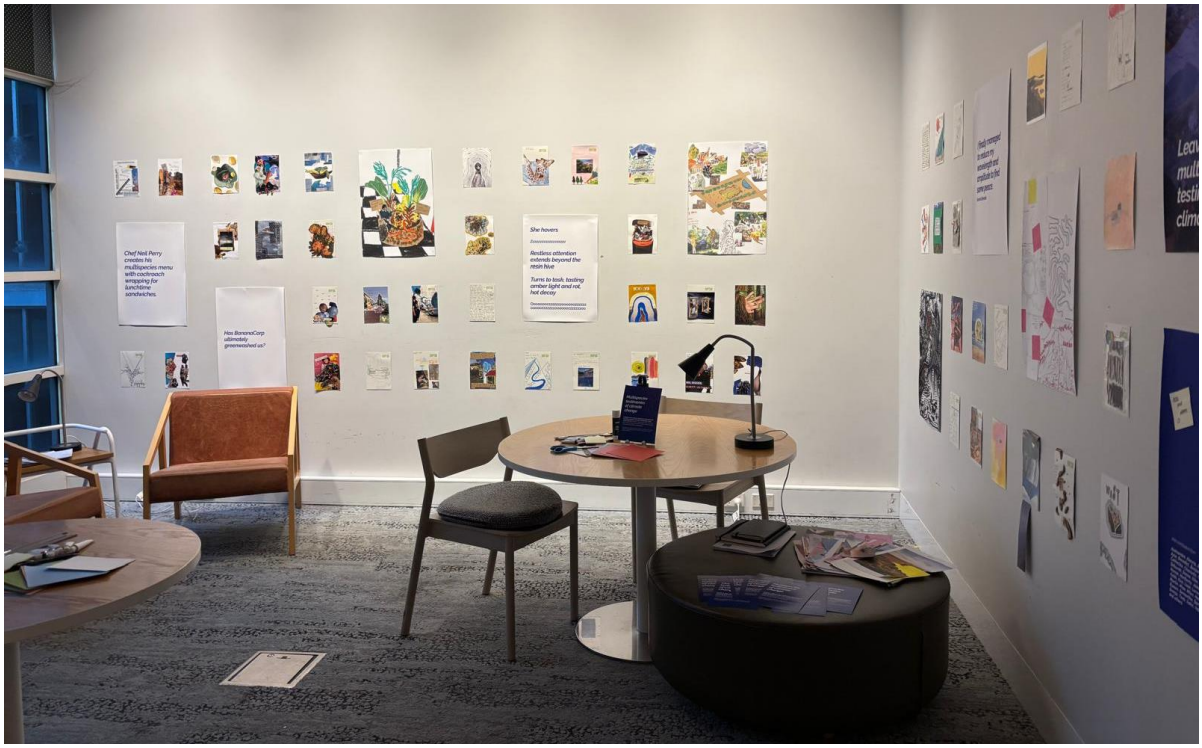


Figure 20: Photograph of the exhibition space *Multispecies Testimonies of Climate Change* at studioFIVE, Faculty of Education, The University of Melbourne.

The exhibition functioned as a participatory space where visitors were invited to contribute to a growing archive documenting how nature experiences and responds to environmental change. Visitors

[7] Consent covered topics such as the transfer of "the rights to use the ideas and creations for educational and research purposes" to the research team; the possibility that "the results of the project will be shared through an exhibition;" and the option to indicate whether participants wanted their names to be published alongside their creative ideas, "in the form of a printed book on a website, or at the exhibition."

were asked to "imagine how nature might be experiencing climate change and the challenges that come with it." The were further invited to "pick up a card and add a multispecies testimony. The testimony could take any form: a collage, drawing, poem, or short story." Artistic materials, including coloured pencils, paint, and collage materials were provided to support this creative process. The resulting contributions were added to a "living" archive of multispecies testimonies (see Figure 21). In this way, the exhibitions emphasized collaborative meaning-making through creative engagement. Through speculative practices of storying and learning with others, both human and other-than-human, the exhibition opened space for shared reflection, creativity, and care across species.

The multispecies testimony and the challenge of anthropomorphizing the other-than-human

The exhibition's focus on multispecies testimonies of climate change aimed to story climate change otherwise. The creation of such testimonies encouraged attentiveness that unfolds across different dimensions. On the one hand, visitors began to consider the other-than-humans they regularly encounter in their daily lives, bringing them from the background into focus. On the other hand, the process cultivated sensitivity to the experiences, temporalities, and environments of the other-than-human raising questions such as: "How does a cloud feel carrying the weight of heavy rain? What might drought feel like for the soil? How does a river endure pollution?" Rather than aiming to represent climate change as an objective phenomenon, this approach attends to its affective and embodied dimensions, opening up alternative ways of understanding climate change.

These testimonies are, of course, speculative and cannot truthfully capture the experiences of another species. In the speculative process, human visitors inevitably project stories onto what *they* imagine an other-than-human might experience. This relates to the issue of anthropomorphizing, understood as the attribution of human traits or qualities to other-than-human animals or entities (Root-Bernstein et al., 2013; Schmitt, 2023). Such practices have been critiqued for their "implicit favour toward human perspectives and the promotion of a human/nature hierarchical relationship. Anthropomorphizing can lead human audiences to misinterpret nonhuman entities and phenomena" (Schmitt, 2023, p. 603). However, to claim that anthropomorphism can be avoided altogether would assume the existence of a neutral standpoint beyond human perception, language, and experience. As Schmitt (2023) suggests, representations of the other-than-human inevitably involve some degree of anthropomorphic reduction, since all knowing is mediated through human experience. Any account of the other-than-human is therefore, to some extent, a projection of human perspective. They are, in a way, inherently speculative. Yet, when approached critically, anthropomorphism can function as a productive tool in environmental education and conservation practices (Root-Bernstein et al., 2013).

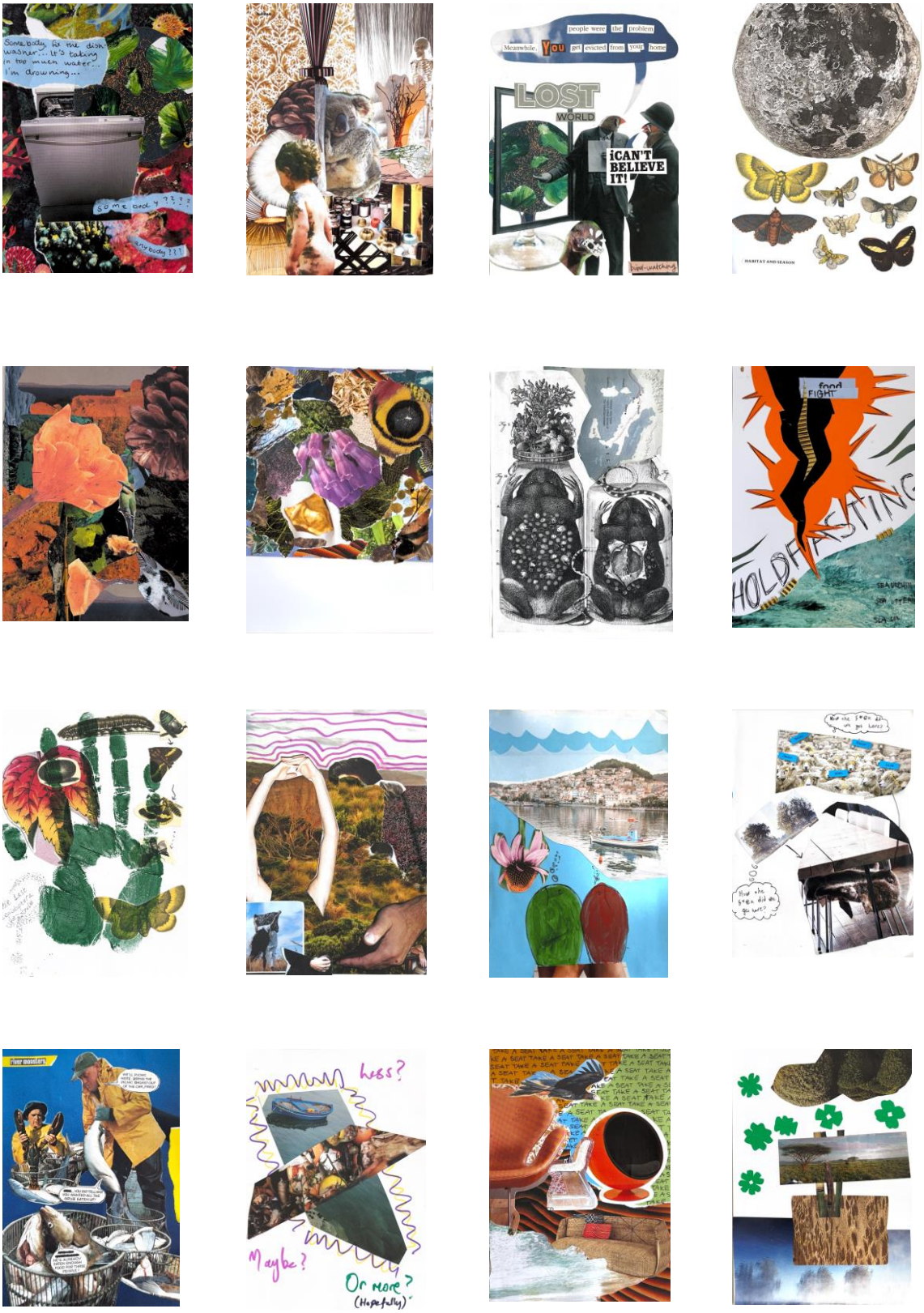


Figure 21: Multispecies testimonies created by visitors during the exhibition *Multispecies Testimonies of Climate Change* at studioFIVE, Faculty of Education, University of Melbourne.

In such careful uses of anthropomorphism, Smitt (2023) emphasizes the importance of avoiding anthropocentrism in order for anthropomorphism to become generative in environmental discourses and to mobilize "care and pro-environmental action" (p. 602). Hankins and Hogarth (2025) further explore the potential of critical anthropomorphism:

> "Critical anthropomorphism may just be the leverage that we need to shift fluidly between differences and likenesses to co-create knowledge that expands response-abilities with and for more-than-human worlds. If we perceive the creative potential for the practice of critical anthropomorphism, we may also expose uneven knowledge-making and power-producing practices, which could inspire us to respond otherwise with climate change." (p. 523).

Hankins and Hogarth (2025) go on wondering: "How might anthropomorphizing make relations? What relations might make anthropomorphism possible? What does it do to the anthropomorphized other?" (p. 523). In the exhibition, adopting an other-than-human perspective was less about attributing human qualities to the other-than-human and more about approaching them with curiosity and compassion. Although scientific research already documents species extinction and the impacts of environmental change, which is crucial for understanding the impacts and scope of climate change, the creative and speculative practice of storying multispecies testimonies aimed to generate more affective and experiential engagements with these issues. For instance, rather than focusing on the decline and potential extinction of bee populations, multispecies testimonies consider what it might mean for a bee to slowly lose its companions. In this context, I would argue that by speculating about what it feels to endure environmental changes from a multispecies perspective, such stories can initiate empathy toward other-than-humans. As Bridle (2022) argues, "only when we see the true extent and scope of non-human life, on its own terms, and accept its reality and value beyond our own … we start to seriously adapt our own ways of living" (p. 296). Seen in this light, imagining multispecies testimonies may act as a first step towards shifting how we as humans think of other-than-humans.

CLIMATE FICTION STORY: *'CANOPY OF THE HIDDEN ALLEY'*

Extending the discussion of multispecies testimonies as a speculative practice, this section turns to speculative fiction as a methodological approach for engaging with participants' creative outputs differently. This creative engagement with research 'data' resulted in the writing of the multispecies climate fiction (cli-fi) story *Canopy of the Hidden Alley*. Written in the aftermath of the Multispecies City Labs in Australia, the cli-fi story was not a predetermined outcome of the Lab. Rather, the idea emerged organically during the research process as it became apparent that participants' imaginaries across different urban contexts gravitated around shared themes and concerns, while involving a variety of other-than-humans and climate challenges. Bringing those imaginaries together in a fiction story enabled a different, more layered, and entangled engagement with the research 'data.' It allowed me to delve deeper

into and internalize participants' contributions, letting them resonate with my own imaginative thought. This meant becoming attuned to the underlying values and assumptions embedded in participants' imaginaries which were not obvious at first, and weaving imaginaries together to explore tensions and relationships, rather than reducing them to simplified categories of data.

In this context, the story *Canopy of the Hidden Alley* is not a representation of the project's findings, but a creative continuation. It is a speculative exploration that embraces the multiplicity and complexity of the imaginative thinking and making process in the Multispecies City Labs. Nor does the story offer a definitive claim about what multispecies cli-fi should be. Instead, it gestures toward what multispecies cli-fi could encompass, and more importantly, how it can function as a methodological tool for speculating-with and theorizing-with ideas and propositions that emerge in research. The creative process of writing the story both shaped and was shaped by my engagement with—or 'analysis' of—the findings of the Multispecies City Labs. In this way, research and creation evolved together, continually informing one another (Chapman & Sawchuk, 2012).

As a continuation of participants' artworks, *Canopy of the Hidden Alley* builds upon their speculations of multispecies interaction, communication, and sensory connectivity. Multispecies interaction and communication were often presented as a performative and sensory act of care and trust, deemed essential for addressing climate challenges. Participants' speculations included, for instance, deep listening to mangroves and a redesign of urban structures as a Rhizomium in Magandjin/Brisbane; acknowledging political agency and decision-making power to trees and birds, and urban greening in the hidden alleys of Narrm/Melbourne; and learning the language of water through a water totem, embodying wetlands, and designing gardens together with feral bees in Boorloo/Perth. In engaging with these speculations, I regarded multispecies interaction and communication as an emergent proposition, carefully curated by participants throughout the various Multispecies City Labs.

While engaging with this proposition curated by participants, the story presented here is closely interwoven with my own imaginative thought, which is inevitably shaped by my positionality: I am a white, abled woman born and raised in Belgium; working within Western academia; visiting Australia as part of my research and, in this context, learning about its colonial history and settler-colonial present. My perspective is also shaped by interactions with project participants (i.e., residents, scholars, artists, both local and international) across multiple Australian cities. The story is entangled with these (and other) intersecting factors. The writing of *Canopy of the Hidden Alley* provided an opportunity to reflect on these factors in relation to speculative fiction as a mode of inquiry. Engaging deeply with participants' imaginaries and interweaving them with my own imaginative responses brought forth tensions that became embedded in the narrative. These tensions speak to themes such as relational and social hierarchies, identity and positionality, and diverse multispecies temporalities. They reflect the multiplicity and complexity of imaginative thinking, while also representing challenges for speculative fiction as a mode of inquiry. The following section further unpacks these tensions through the presentation and reflection on *Canopy of the Hidden Alley*.

Canopy of the Hidden Alley

FIELD NOTES_HIDDEN ALLEY

Interaction registered_

It's an easy one to overlook — I pass it every day on my way to work. But today, with the morning sun, a flicker of blue movement at the edge of the sidewalk caught my eye. My sensors prickle, an unfamiliar static feeling crawling along my hand. A connection request? I haven't had one in months, not since the accident.

I step into the alley, and a wave of discomfort crawls up on me. The darkness is thick and my instincts murmur warnings: a dark, abandoned alley in the middle of the city, not the best place to wander around by yourself as a woman. But look at that canopy! It's living! How have I missed this place for years? Every day, the same route, the same streets and yet, I have never noticed this alley before.

There it is… My hand lights up — a request!

I take a step closer, observing, trying to make out a form, but the alley is impossibly dark, swallowing the morning sun. Looking up, I notice how the blue canopy stretches overhead, blocking out the sky. Just a few shimmers slip through, scattering the ground in fractured light. Roots push through the pavement, climbing all the way up to the sky. Her leaves — deep, electric blue — indicate decay. Something has hurt her. In between the tangled branches, small orange worms light up. Hearing the writhing of their wet bodies against one another makes me shiver. Is this disgust?

I lean in, just slightly, getting close enough to see the worms' glimmer. The canopy moves. I almost feel her, think her.

But… nothing.

The canopy doesn't spark any memories, no recognition. Strange… I'll have to check my memory file when I get home. Perhaps the connection with the server is weak here. The System surely has some details about her — her origin, a record, something to help me decide if I can trust her.

As my hand nears the structure, her damp and warm body immediately connects to mine. My hand flushes purple. The air around me seems to thicken, humid and heavy. In close proximity, my sensors sharpen and can better understand the canopy's needs. She moves, almost unnoticeably. A slow, deliberate movement. My hand darkens — deep blue now, then pain — a sharp, cramping pulse. Something's wrong. I pull away to recover. My fingers stiff, but no steam.

Decline request_

How did I let this happen? So quickly, so easily, after everything that happened last year, I should know better. A random request in a hidden place like this should've set off alarms. Looking down at my hand, the blue is fading from my skin. Still, my fingers twitch as I feel the warmth of my pocket. I need to be more careful. My sensor can't take another injury. And if they fail completely…

At least now I know the canopy is compatible with my sensors. I haven't connected since the accident. I was worried my radicles were too outdated, but they still seem to work. When I get home, I need to check my memory log. Maybe delete this entry? I don't know if she's registered in The System. Better to keep this moment tucked away in my human memory, where no one else can access it. Even if details blur, even if they fade — it's safer this way.

Delete OR edit OR save interaction_
Delete memory_

FIELD NOTES_ILLUMINATIVE NEMATODES

Search registered_

I ran a search. Keywords: "living AND [canopy OR covering OR shelter]," then "blue AND [tree OR bush OR branch OR roots OR twig]." Nothing. I tried "[hidden OR secluded OR secret OR veiled] AND [alley OR lane OR backstreet OR path OR ecosystem]. Still nothing.

No records, no images. My memory has no trace of anything like this blue canopy-like structure. Maybe The System knows her, perhaps she *is* registered. I copy my search history, let The System weave through its archives. Again, nothing… At least she has no criminal record. Relieved, but disappointed, although I was expecting it. A being in a hidden place like this rarely leaves a trace, often stays anonymous by choice. But still, there was a part of me hoping for a sliver of information, some small confirmation of her presence in the city.

Delete search history_

It's been days since visiting the alley, days since the request. And still, she lingers in my mind and sensors.

I miss connection. I haven't shared memory in too long, haven't felt that moment of merging — where self dissolves into something plural, where you get to know other beings through time and space, through memory. You inherit their thoughts, their sensations, their griefs and joys as if they were your own. Instant connection, instant understanding, empathy. You don't get these kinds of connections without sharing. It's a more intimate way of relating, something human language can't quite cover. I've been fortunate — privileged, really — to inherit this authority from my mother, who got it from hers, tracing back to the earliest days of The System. My grandmother, with the right lineage and affiliations, qualified for sharing authority when access was granted selectively, granted only to select families and beings with certain histories.

Losing my sharing-authority would be more than just a personal loss; it would mean being stripped of something that defines how I exist, how I relate. Combined with creative-authority and intellectual-authority, my identity is programmed to think, create, share — a combination that comes with certain perks like land and climate immunities. Soon, I might even qualify for political-authority. And then, perhaps programming-authority, something I once thought unreachable in this lifetime. But all of it hinges on my ability to share. Losing that would jeopardize my position in The System. And once you lose it, there's almost no way getting it back.

I can't afford to make a mistake. I can't risk my authority rights, not without knowing what she wants, not without knowing whether I can trust her.

Search registered_

Let's run a final one. Keywords: "[illuminative OR orange OR yellow OR luminescent] AND [worms OR larvae OR Nematodes OR parasites]."

One result: "Illuminative Nematodes." **Open file_**

Delete search history_
Delete memory_

FIELD NOTES_LIVING CANOPY

Interaction registered_

Passing the alley again, the longing for sharing sharpens. My hand lights up — another request! She sensed my presence. From here? I haven't even stepped inside the alley. My sensors barely reach three meters, four at best if I'd really try.

But she notices me from across the street. I've not even entered the alley and my hand is glowing.

Decline_ Not today… I've back-to-back meetings in half an hour.
Decline_ Decline_ Nothing happens. Am I too far for the signal to process?

I step closer, the alley swallows me once more. Light slips through this time, I can see her now: her hollow branches, filled with glowing worms. **Decline_** It works this time. I let my hand hover, drawn to the substance. I can feel warm radiation coming from the dust. My hand flares up again. Brighter this time.

She's persistent.

What do you want from me? Why do you keep reaching?

The worms unsettle me. There are so many of them. Are they a sign of distress? Decay? The canopy looks as though she hasn't shared in a long time. And to be fair, neither have I. I could use it too. My sensors have grown rusty. I tell myself I've been careful, that I'm just protecting myself, but I can feel the stiffness in my hand, the way my radicles hesitate before syncing. Without regular connection, they grow slow and outdated. Sharing ensures they stay compatible, that they remain functional and well-nourished.

An excuse, maybe. But I reach for the canopy anyway. Touching her now, accepting her request. The physical touch might damage my sensory structure again, but the depth of connection it allows is worth the risk. In that moment, my sensors connect, my hand turning purple, then blue, cramping. My radicles turn blue too, crawling up my arm, spreading through my neck. Rusty, painful — something I expected, but it still hurts.

The connection locks in, the sharing takes off, in flashes, fractured pieces, fragments of a time long before my own.

I can see how she grew to become a small bush in the middle of a dry, open landscape, where she lived most of her life. Then, how she becomes interwoven with the urban fabric: City development; apartment buildings; Cockatoo nests, thirty-six of them; tearing roots, cutting branches; neighboring shrubs; humans finding shelter; traffic noises; too little water, then too much; birds hatching; invasive species; heat; a tram-line cutting off half of her body, growing back after; small critters bringing her goods; fire; worms, so many worms; the erasure of her existence above the Earth's surface; darkness. Below, she endures, while the world above changes: society restructured; The System established; authorities distributed; immunities granted.

Her memories move quickly, too quickly — I can barely process one before another takes its place. I struggle to keep up. I feel the cramp loosening; my hand starts to fade. Trying to keep the connection stable, I hold on to her stronger, but my sensors get disconnected.

She must have reached the end of me.

“Coffee?” My phone buzzes. Right, my meeting. **Cancel_**

FIELD NOTES_LIVING CANOPY AND MEMORY

It’s not fair. My memory file only holds twenty-six years — 208 spanning across three generations, my mother’s and grandmother’s included if she reached for the extended folders. She has reached the end of me while I haven’t even glimpsed a tenth of her memory, haven’t even scratched the surface of who she is.

In the meantime, she has seen it all, seen the accident. Perhaps she shut down the connection then. The moment it surfaced, she withdrew, unwilling to go further, afraid of exposal. If only I could delete that memory, erase it from my file… But The System has locked it in, permanently. No matter how many memories I build, it will always be there, in any interaction. My only choice is to build new memories, to outweigh the old ones, to prove that I can be trusted.

I reach out again, touching her, sending a request of my own. I wait for her to answer, to let me in.

Declined_

I wonder how she saw it — whether it played through my eyes or through the perspective of The System. I haven’t opened the file myself yet.

Try again. Be persistent like her.

Touching her, my hand shifts colour once more — is she accepting? A flood of memories flash by: sprouting; blinded by sunlight; sharing with humans; registered; receiving official authorities and immunities; The System; illuminative Nematodes; sharing with humans; worms, so many worms; pesticides; pesticides. Her distress is tangible. She got registered in The System after years of hiding below, then illuminative worms were introduced into her branches, altering her existence, which got out of control. Pesticides! Pesticides! I can feel her scream it through my sensors — pain seizing my arm.

She slows down now — I think I've reached her more recent memories — the ones they tried to take away from her.

The moment they penetrated too deeply, attempting to steal and erase this past. She was able to withstand, but was forced to leave The System, forced below once more, stripping her of recognition, leaving her in the dark. Only recently, she has reached sunlight again.

She's persistent.

Through her memories, I can feel her grief — it builds a deeper understanding of who she is, has been. I understand her hesitation now. Perhaps she understands mine. More and more reports have surfaced in the black outskirts of The System — incidents where unknown beings reach too deeply, hacking memories, inserting new, never happened ones, or stealing what matters most. It messes with your memory, with your identity.

I never thought it would happen to me. One wrong interaction and you're rewritten. And if The System finds out about your mistake… So far, I have only suffered sensor damage through such an invasion, with minor sanctions from The System, but it could have been a complete memory reset. Adding those memories would have completely changed my identity, would have compromised my being.

They tried to do the same to her. Memory manipulation — erasure, addition.

We share memory.

Disconnect_

FIELD NOTES_LIVING CANOPY

We share memory.

Easing my grip now, my hand fading, cramp loosening. Looking down on my hand: No damage, no steam. My sensors: intact! No hospital, no surgery this time around. No System, no sanctions.

She needed to share her memory, let another being know what happened to her. She trusted me, although her accident, although mine. She moves now, slowly, toward me. I feel embraced by her warm radiance. I wish I could stay here just a little longer. But she knows it too, I need to hurry.

Walking home now, fast, running almost, but I can’t seem panicked, or they’ll know. I need to make sure our interaction is deleted in time. I can’t risk them figuring out I shared with an unregistered being again, and she cannot get registered through me. She trusted me.

Home now. Connecting to the server.

Delete OR edit OR save interaction_
Delete memory_

Search registered_

Tapping into my memory, searching to make sure there are no traces left. Keywords: “accident AND memory AND [manipulation OR invasion OR occupation]”
One result.

Good, only one. Only mine, not hers, I guess.

Open file_

Memory starts to play, flashes of a tiny bug crawling up my leg. Request; Decline_; request; request; why not?; Accept_; purple hand, then blue; cramp, pain; something is wrong; Disconnect_; Disconnect_; but it isn’t working; I’m being hacked!; inserting new memory; my grandmother; Disconnect_, but still not working; my grandmother, sharing with an unregistered being; one from the black list; The System found out; losing her sharing-authorities; losing her climate-immunity; Disconnect_; it worked! Looking down on my hand, my sensors hurt, damaged, steaming, but still intact. Needs treatment, soon.
Running, steaming home; connect to server; Delete OR edit OR save memory_; Delete_ Just in time…

But I haven’t reached the end of this memory yet and I know it.

My sensors, hurting, steaming; rushing to the hospital, surgery; they know, The System; investigation; connection with an unregistered being; being hacked; The System takes sanctions; locked memory.

Close file_
No delete or edit options available

Shivering. To see it again, live it again — I wish I was able to forget.

Save search history_
Delete memory_

Speculating multispecies interaction in 'Canopy of the Hidden Alley'

Structured as a field report, the story *Canopy of the Hidden Alley* follows a researcher encountering uncanny urban landscapes shaped by multispecies presences, being drawn into sites of abandonment and extraction emblematic of the Anthropocene (Kirksey & Chao, 2022; Gómez-Barris, 2017). Based on the artworks created by participants in the Multispecies City Labs, the story explores themes of multispecies interaction and communication, and sensory connectivity through memory. It further incorporates contextual and environmental elements that were part of participants' imaginaries, such as a hidden alley, a living canopy, memory, worms "so many worms," heat, and water (Speculations by participants in the Multispecies City Lab project in Magandjin/Brisbane, June 22, 2024; Narrm/Melbourne, October 5, 2024; Boorloo/Perth, November 15, 2024).

In the story, beings establish an intimate connection through memory-sharing: a relational exchange that generates empathy, care and trust, "where self dissolves into something plural, where you get to know other beings through time and space, through memory. You inherit their thoughts, their sensations, their griefs and joys as if they were your own." However, building intimate connections through memory-sharing is constrained: not everyone possesses the authority to share memories, doing so might be risky, and The System records every exchange unless one of the sharers deletes it in time. This suggests that certain things are permitted to be remembered, while others are better forgotten or erased. Accordingly, *Canopy of the Hidden Alley* does not present an uncritical ideal of multispecies interaction; rather, it juxtaposes these hopeful imaginings with critiques of systemic control and inequalities.

As part of this juxtaposition, I began thinking-with what Grove et al. (2021) call the "uneven distribution of futurity." Futurity, as Grove et al. (2021) discuss, stands for the hopeful possibility for change, growth, and further development. However, this possibility is not equally available for all. In the context of climate change, hope and opportunity are mainly distributed among privileged peoples and nations that possess the social and material means, and economic and institutional power to mitigate and adapt to climate change. Meanwhile, those more exposed to climate disasters often lack access to such protective resources, although contributing less to global emissions (Heise, 2016). Accordingly, McKenzie et al. (2023) pinpoint this uneven distribution of futurity as a "key injustice at the heart of climate change" (p. 4). While engaging with Grove et al.'s (2021) concept, I began speculating-with futurity in various ways in *Canopy of the Hidden Alley*, exploring the researcher's personal sense of futurity alongside its meaning in multispecies entanglements and questioning how this sense of futurity is manifested in a society where humans and other-than-humans both wield authority.

In the story, futurity is shaped by beings' place within The System. Through authority, the story speculates about social hierarchies and protection against various societal and ecological challenges such as land use and climate impacts, prompting reflection on "who are the subjects of justice in our shared worlds? [...] Who has claimed a monopoly over justice in the past, and in the present, and how might we contest their sense of propriety in the future?" (Kirksey & Chao, 2022, p. 2). In *Canopy of the*

Hidden Alley, other-than-humans, such as the living canopy, are integral to society and its social hierarchies. The 'social' is not conceived as an exclusively human domain; rather, other-than-humans can acquire authority too and occupy positions within the hierarchies that govern communal life. At the same time, the protagonist (i.e., the researcher) embodies aspects of a hybrid existence, equipped with sensors and radicles that allow her to connect with fellow beings, her hands lighting up and her body shifting in colour to purple and blue. Her identity is not strictly human or other-than-human but explores the liminal space in between. She actively reflects on her personal prospects and her position in The System: "Soon, I might even qualify for political authority. And then, perhaps programming authority—maybe even reachable within this lifetime," implying hopeful possibilities for future development. However, this hopeful sense of futurity is fragile. Her future possibilities are jeopardized by the locked memory of her accident, a permanent imprint that affects her relational capacities. At the same time, she risks losing her authorities by connecting and sharing with an unregistered being, the living canopy: "Losing my sharing authority would be more than just a personal loss; it would mean being stripped of something that defines how I exist, how I relate … I can't afford to make a mistake here. I can't risk my authority rights."

This fragile futurity is further represented through the intimate entanglement between the researcher and the canopy, spanning diverse temporalities: "She has reached the end of me while I haven't even glimpsed a tenth of her memory, haven't even scratched the surface of who she is." Working across differing multispecies timescales is, as de la Bellacasa (2017) argues, "not a philosophical or scientific problem, it is an ethical and political one" (p. 176). That is, recognizing diverse temporalities shapes how we live together and form community and connection. In exploring time in multispecies entanglements, Rose (2012) discusses how beings form ethical relationships through sequential and synchronous time: "trees' desire for pollination meet the flying foxes desire for food," they work in tandem across time, and these temporal patterns are "a place of mutuality" that "nurture the flows that sustain the present and work for the future" (p. 136, 137). In *Canopy of the Hidden Alley,* the sharing of memory becomes such a "place for mutuality," something desired by beings across multispecies timescales to flourish and maintain their relational capacities: "She looks as though she hasn't shared in a long time. And to be fair, neither have I. I could use it too. My sensors have grown rusty." The distribution of futurity becomes one of mutual dependence, similar to Rose's (2012) example of the trees and flying foxes. The sharing of memory, then, presents a relational practice underscoring the importance of building care-full relationships and empathetic understandings among beings, across multispecies timescales.

In the process of writing *Canopy of the Hidden Alley,* the act of speculating allowed me to inhabit and embody the perspectives of both the living canopy and the researcher, exploring tensions embedded in their identities and positionality, their entangled social hierarchies and their relation with The System, as well as the diverse temporalities they each embody. Writing multispecies cli-fi became a process of becoming-with (or speculating-with) the characters, whether human, other-than-human, or somewhere in between. At the same time, the imaginaries created by participants in the Multispecies City Labs guided the writing process. Drawing on and connecting these imaginaries raised questions about multispecies

entanglements: What does it mean to share memory with water? How does a living canopy experience urban transformation? What would it feel like to be inhabited by worms, or to be repeatedly exposed to pesticides? As I merged these speculative fragments of participants with my own imagination, the questions evolved into a range of new directions: What assumptions underlie human attempts to communicate with fellow beings? How might multispecies memory take shape? How would it allow new relational practices? Who is included and excluded in these new relational practices? These evolving inquiries served as speculative propositions that allowed me to delve deeper into tensions of identity and positionality, relational and social hierarchies, and diverse temporalities, all contributing to new understandings of multispecies entanglements in the context of climate change and speculative climate futures.

SUMMARY

The creative outputs discussed in this chapter uncovered new tensions and propositions that challenge and reshape my understanding of multispecies relationality and speculative inquiry. The exhibition *Multispecies Testimonies of Climate Change* surfaced questions about the risks of anthropomorphizing other-than-humans, prompting critical discussions about whether imagining from the perspective of a tree, river, or mountain can serve as a constructive tool in environmental education and sustainability discourses. Writing *Canopy of the Hidden Alley,* based on the Multispecies City Labs, led me to consider climate fiction as a methodological practice, offering an alternative mode of engaging with research data beyond interpretation and representation. These creative explorations and outputs were strongly process- and practice-oriented, emphasizing engagement rather than mere reporting or documentation. The methodological premises of research-creation opened opportunities to work creatively with research data and with the research itself, generating openings for emergent possibilities and unanticipated developments. In this sense, the exhibition, cli-fi story, and extended workshop tool present creative responses to the research and creative continuations of it. They present further speculations, highlighting the emergent, situated, and responsive potential of research-creation.

Chapter 7 presents and discusses the creative explorations conducted alongside the empirical research. Drawing on the notion of 'propositions,' as discussed in research-creation, this chapter presents evolving inquiries taking the form of a small exhibition and the writing of a fiction story.

Chapter 7 responds to ***sub-question 3*** *that focuses on* ***the ways in which participant-generated multispecies imaginaries can be disseminated within wider societal contexts.*** *Through the organization of an exhibition and the writing of a fiction story, the chapter demonstrates how creative practices can serve as a mode of analysis, dissemination, and further inquiry.*

ENDINGS

Dialogues across speculative and multispecies frictions

DRAGGING ANCHORS AND FRICTIONAL ENCOUNTERS

This thesis began with anchoring my doctoral research in three key dimensions: *climate change* as the general context to which my research responds, *multispecies relationality* as the ontological lens, and *creative and speculative practices* as epistemic approaches. The chapters that followed have drifted through theoretical explorations of multispecies arts, empirical research in research-creation Labs, and methodological reflections on speculative ethnography and creative forms of public engagement and dissemination. While each chapter resonate with the anchors, they do so in different ways and through different modalities. Yet, much like anchors pulled by a strong current, the many explorations, encounters, and reflections have made me drift in various directions, causing the anchors themselves to shift and drag. And instead of resisting this movement, I have worked with these shifts, attending to the new patterns in the sand they have drawn. That is to say, though they grounded my work, the three anchors have not remained stable. They have created frictions that unsettle the practice of multispecies speculation.

In her book *Friction: An Ethnography of Global Connections,* Tsing (2005) discusses friction as the unequal and shifting dynamics of global interconnection that emerge through difference:

> "Rubbing two sticks together produces heat and light; one stick alone is just a stick. As a metaphorical image, friction reminds us that heterogeneous and unequal encounters can lead to new arrangements of culture and power ... The effects of encounters across difference can be compromising or empowering. Friction is not a synonym for resistance. Hegemony is made as well as unmade with friction" (5-6).

Tsing (2005) understands friction as something that emerges through connections across difference, where the encounter itself is productive and transformative. Building on this understanding, I engage with the notion of *speculative frictions*. On the one hand, speculative frictions refer to the ways in which participants' imaginaries are frictional. Though they may at times resonate, these imaginaries are deeply situated and often conflictual, for they depart from differing norms and values that cannot always easily be reconciled. Participants were not collectively building a single multispecies utopic world, but instead articulated multiple, and at times incompatible, visions of multispecies possibilities. On the other hand, speculative frictions refer to the awkward moments of being stuck, ethically, politically, or culturally. These moments are not themselves speculative but emerged in the practice of speculation, presenting a place “where reality, already saturated with complexity, resists neat narrative resolution” (Rachev, 2026, p. 78). These frictions surfaced as moments of hesitation, discomfort, and ethical uncertainty, pushing me to rethink my approach, change course, or simply reflect and endure. These are the stories that often remain untold in representations of research, yet they present critical sites of learning.

This final chapter works with these frictions as a generative force, bringing speculative and multispecies frictions into dialogue to develop a set of critical reflections that speak to the promise and difficulty of speculation as method, particularly when practiced across various geographical contexts and when exploring multispecies collaboration. These reflections emerged after organizing and living through

the three research-creation Labs. This ending chapter is more an opening for further speculations than a closing. Instead of providing grand conclusions, the following sections turn toward the questions that remain; questions that ask to be carried forward rather than resolved. Though they might seem straightforward, these questions emerged only through the situated practice of the research itself, including the organization of the Labs, the relational moments of working with participants and colleagues, and the moments of uncertainty that required reflection and adjustment. These questions, then, are an outcome of the research too. I would even argue that the questions I pose in this ending chapter are essential for guiding the fields of multispecies research and speculative inquiry into more just directions. In what follows, I dive into four of these frictional encounters that made my anchors drag, further speculating about emplaced speculation, the design and role of speculation prompts, how to bring in the other-than-human, and the challenge of evaluating speculative worlds. These frictions are then translated into implications for future speculations and research, emphasizing the need for a sustained and critical form of speculative inquiry when imagining alternative worlds.

Emplaced speculation: Speculative thinking of/on terrorformed lands

The first friction I turn to relates to the concept of *emplacement*, which highlights how imaginary thinking can be situated in place. In the Multispecies City Labs, I experimented with walking methods to elicit speculative engagements with the environment, whether a botanical garden, the riverbanks, or a nearby park. These methods invited the environment and the other-than-humans to actively become part of the speculative stories that emerged. And yet, something consistently felt off. A tension persisted, becoming increasingly difficult to ignore: emplaced speculation and emplaced speculative ethnography "works out" only when it is assumed to be guided by "good intentions." What precisely counts as "good" or "bad" in this context is, of course, ambiguous and deeply political. In fact, emplaced speculation is not neutral and in certain contexts contributes to exclusion, erasure, or injustice.

Speculative thought can become politicized, particularly when it is strategically aligned to serve values of exclusion, extraction, or acceleration (Bell, 1996; Truman, 2019b, 2026a; Willow, 2021). Gan et al. (2017), for instance, discusses how "anthropogenic landscapes are also haunted by imagined futures" and that "we are willing to turn things into rubble, destroy atmospheres, sell out companion species in exchange for dreamworlds of progress" (p G2). Such progress-oriented speculations also fuel "colonial space fantasies" about making other planets habitable for humankind (Woods, 2019, p. 7). Kilgore (2003), for example, notices how "within the astrofuturism's discursive field, they have no alternative but to follow the course of empire and to prove that they can repeat history without its flaws" (p. 65), particularly "deploying settler topologies of space as a terra nullius or a New World awaiting discovery" (Rifkin, 2019, p. 65). In the same vein, Bell (1996) addresses how "values of national power and social exclusion" pollute futures thinking, using it to expand military, economic, and territorial power (p. 25).

In these instances, speculative thought operates less as a space for ethical possibility and more as "a means of capture" that produces material and epistemic violence (Truman, 2026a, p. 4). The

examples suggest that speculative thought has actively enabled colonial world-building: The imagination that places beyond one's own are open for exploitation, alongside the imaginaries of what can be done with stolen lands, rendered colonization thinkable before it becomes materially possible (Gómez-Barris, 2017). As Rifkin (2019) argues, "speculation itself can be understood as intimately part of antiblack and settler colonial modes of domination. The attempt to secure the future for white supremacy, settlement, and capital involves a range of speculative technologies that project forward current conditions of subjection as the basis for what's to come" (p. 64). Such colonial imaginaries continue to structure geopolitical discourses, power, and action. They not only appear in initiatives by private aerospace companies seeking to terraform other planets and commercialize space travel, but also in contemporary political discourses. For instance, the current president of the USA has imagined Gaza as "the new Reviera" essentially proposing the ethnic cleansing of Palestinian territory (Beaumont & Speri, 2025) and made speculative claims about the USA taking over the land (and with it, the resources) of Greenland (FitzGerald, 2026).

If emplaced speculation presents "an embodied form of speculation that is tied to one's sensorial and material engagement with place and environment" as I have argued in Chapter 4, the examples above highlight how such engagements risk being shaped by extractive ways of seeing and valuing land. Yusoff (2024) considers this extractive logic "white geology," describing it as "a historical regime of material power that used geologic minerals, metals, and fuels, combined with epistemic violence of the category of the inhuman to shape regimes of value and forms of subjective life" (p. 2). The colonial terraformation of the Earth (that is, the systemic transformation of land to serve colonial occupation and profit) was as much a practice of *terror*formation, the terrorizing force that used violent dispossession, and destruction for making earth habitable for the colonizer (Yusoff, 2024).

This tension made me reflect on what it means to speculate on *terror*formed lands, and perhaps more specifically, what it means to invite people to re-imagine their public spaces when, in some contexts, these spaces are not equally accessible in the first place. Here, my positionality as a white scholar coming from Western Europe becomes salient and complex. I found myself grappling with the implications of being a white researcher from Belgium in Australia when doing the Multispecies City Labs: how to account for the fact that I entered a settler-colonial context, proposing acts of re-imagination of places marked by histories I only partially understand and social realities I do not fully inhabit? Attending to my positionality did not resolve this tension, but it made it impossible to ignore and became a methodological necessity. As Yusoff (2026) argues, "[a]cknowledging that theory emerges from particular geographies of power and colonial imaginaries, and is normalized from there into the universal, is a way to examine and reimagine *what* was and *what could be* in environmental futures" (p. 151). It pushed me to ask *for whom* place-based speculation works, and under what conditions. It brought me back to the friction I was stuck with to begin with, that emplaced speculation appears to works out only when grounded in so-called "good" intentions. Sitting with this friction, and with the ethical, political, and cultural unease it generated, emphasized that

in certain contexts and despite "good" intentions, emplaced speculation might still contribute to exclusion, erasure, or injustice.

Speculation prompts: Building multispecies worlds

If place-based speculative thought can be polluted by values of exclusion, extraction, or acceleration, then the design of speculative prompts becomes a critical site of intervention. This doctoral research focused on imagining multispecies worlds, worlds where humans and other-than-humans collaborate in response to increasing challenges relating to climate change. Within this context, I began to question whether inviting participants to imagine multispecies worlds risked projecting my own assumptions about what "good" worlds should look like. The multispecies focus in the research-creation Labs functioned as a guiding topic participants could collectively relate to. At the same time, this did not guarantee that the multispecies worlds imagined would necessarily be fair, as illustrated in the BioFutures Living Lab.

In the aftermath of the BioFutures Living Lab, I sat with the question: How can speculative practices step away from “mainstream speculative thought” (Truman, 2019b) that often operates within a Western paradigm of progress and linearity? (Jacobs et al., 2023). This question emerged after noticing how some imaginaries generated during the BioFutures Living Lab risked re-establishing hierarchical relationships, positioning nature as property, capital, or resource. It was only toward the end of the Lab, during a reflective exercise in which participants were invited to imagine consequences of their imagined worlds, that some began to recognize how their imaginaries had deviated from their initial intentions, reproducing the very practices they aimed to unsettle. This realization was marked by a sense of disappointment among several participants. Reflecting on this afterwards, I began to consider how the BioFutures Living Lab's guiding question may not have sufficiently opened space for imagining otherwise, and instead functioned as a speculative exercise that inadvertently maintained the status quo.

The BioFutures Living Lab focused on the increasingly urgent issue of energy scarcity, considering how the lack of energy supply disrupts not only infrastructures but also the social and ecological relations that sustain everyday life. Looking back, combining multispecies imagination with this issue may have posed an insurmountable challenge. While imaginative thinking can function as a powerful pedagogical tool for imagining otherwise, in the context of responding to energy scarcity it risked serving as a mechanism for maintaining *the status quo of constant energy availability*, which does not readily align with multispecies thinking and climate regeneration. In fact, it even carried the risk that multispecies thinking would be instrumentalized to justify continued energy consumption of humans. At the same time, it is the people that find themselves in precarious situations, think of those living in flood areas, war contexts, or less economic privileged neighbourhoods that are affected most by energy scarcity and outages. Against this backdrop, speculating about multispecies possibilities risked becoming trivial. In retrospect, it was this tension between anthropocentric concerns for energy continuity, deeply unequal access to resources, and the ambition to imagine multispecies responses that made the BioFutures Living Lab particularly challenging.

While the BioFutures Living Lab generated opportunities to re-think the nature-human-technology relationalities of energy supply, multispecies relationality ultimately became constrained by anthropocentric demands. Perhaps a more fitting guiding question might have been "What would it mean to live differently with these conditions by thinking and acting-with nature?", shifting the focus away from problem-solving and toward learning to live-with new uncertain conditions. Translating this reflection into the subsequent iterations, the Multispecies City Labs in Australia shifted attention toward the more open-ended praxis of "imagining otherwise:" a speculative act of imagining something different from what is now, from a multispecies perspective. Rather than being solution- or progress-oriented, these Labs invited participants to imagine what kinds of urban environments they would desire in which humans and other-than-humans collaborate. Still, ethical questions persisted about doing this re-imagination exercise in different contexts: within contexts disrupted by criminality, gender-based violence, racial discrimination, or others, I wondered whether it made sense to ask people to imagine hopeful or desirable worlds, while not having the means to realize those ideas: Might focusing on multispecies imaginaries obscure pressing concerns such as violence, insecurity, or economic precarity? At the same time, assuming that participants are unwilling or unable to engage in multispecies imagination, might well be worse. In fact, part of the strength of participatory research-creation lies in the collective process itself: gathering around a table, sharing and listening to one another's perspectives, and in this process, cultivating attentiveness to the relationships formed within a shared creative space.

Though I am not sure how to answer these questions, they not only pushed me to reflect deeply on the relevance of my research, but also on the fact that prompts should be responsive to the contexts in which they are used. The prompts used in the Multispecies City Labs are not simply reproducible across contexts but require careful reworking in order to open different speculative trajectories. For instance, in differing contexts, the prompt "Create a speculative testimony from the perspective of an other-than-human experiencing a climate challenge" can be reframed as "Listen to a part of nature in your community. What story could it tell about what is happening around it?" Likewise, the invitation to "Imagine a multispecies design/artifact/trace/fragment that demonstrates a collaboration between humans and other-than-humans" can be turned into "What would the community environment look, smell, sound, feel like if we collaborate with nature?" These reframed prompts were used and tested in another Lab that was organized in South Africa and allowed leeway for participants to include personal experiences and stories into their multispecies speculations. Such reorientations echo Haraway's (2016) argument that "[i]t matters what matters we use to think other matters with; it matters what stories we tell to tell other stories with; it matters what knots knot knots, what thoughts think thoughts, what descriptions describe descriptions, what ties tie ties. It matters what stories make worlds, what worlds make stories" (p. 12). Here, it matters what speculative prompts we use to speculate with.

Bringing the other-than-human into speculation processes

Taking speculative prompts seriously, this research was particularly concerned with designing prompts that actively surface multispecies perspectives. Across the research-creation Labs, speculative thinking was guided by the recurring prompt: "How might humans and other-than-humans collaborate to respond to specific climate challenges in this place?" It is particularly the verb "to collaborate" that requires critical attention. I considered "collaboration" as humans and other-than-humans "work[ing] together to create or achieve the same thing" (Cambridge Distortionary, n.d.). This definition resonates with ideas of mutualism, where species engage in a reciprocal relationship from which both benefit, like the often-cited example of the rhino and oxpecker. While the oxpecker enjoyingly snacks ticks and parasites of the rhino's back, the rhino receives a pest-removal treatment. Would such a relationship between humans and other-than-humans be possible? However, if the rhino is wounded, the oxpecker may prevent healing by repeatedly pecking at the wound, shifting from collaborator to parasite. This made me wonder: who defines collaboration, and on whose terms does it take place? Can other-than-humans freely opt into collaborative arrangements with humans, or are these relations framed by human interests only? And is the idea of equal collaboration even possible? In all honesty, I was not convinced that it was. Perhaps, collaboration, as used in the prompt, was less a goal than a speculative device; a way of opening space for participants to become attentive to the other-than-human, imagine beyond current conditions and see what kinds of worlds might begin to surface.

Considering that the act of speculation in the Labs was a practice that necessarily emerged from a human perspective, I also began to wonder how the other-than-human could meaningfully become part of that speculative process as a “collaborator.” How might one ensure that the human participants not simply speculate *about* other-than-humans, but instead start speculating-*with* them (see Chapter 1). Speculating-with presented the relational process in which one co-evolves with other-than-humans through the act of speculation. In a way, speculating-with then becomes a process of mutual transformation, reshaping the relational dynamics between those involved. To involve other-than-humans more directly into the speculative process, I experimented with a range of methods. For instance, in the Multispecies City Labs, greater emphasis was placed on the environment in which the speculation took place and on the other-than-humans inhabiting those environments. Rather than remaining inside a workshop venue, participants moved outside, wandering through their surroundings. Including walking practices allowed participants to become more attuned to environmental conditions, other-than-humans, and material infrastructures, as well as to sensory experiences (e.g., distinct smells, bodily discomfort, sweat, or intrusive sounds) and values embedded in place (e.g., statues, buildings, maintenance). In this way, speculation became grounded, multisensory, and embodied. During these walks, participants were prompted to engage with specific other-than-humans they encountered and to speculate-with them. Through this practice, the direct environment became an active part of the speculation process.

Though other-than-humans gradually became more present in the imaginaries, the walking practice did not yet integrate what might be considered the "perspective" of the other-than-human,

necessary for accomplishing multispecies "collaboration." To address this gap, I experimented with creating multispecies testimonies of climate related challenges (see Chapter 7), asking participants to create visual or textual testimonies of how an other-than-human experiences climate change. The resulting testimonies told stories of trees whose roots struggle to access water, birds displaced from their homes, mountains yearning for the return of animals, and spiders digging deeper holes to withstand heat, among others. These testimonies remain speculative and are inherently limited in their capacity to truly represent other-than-human experiences. However, rather than aiming for accuracy, they worked to generate curiosity and care toward other-than-human lifeworlds. They facilitated relational and affective understandings of environmental change across species. In this way, creating multispecies testimonies became an initial step toward thinking about climate change and other-than-humans differently, revealing what other-than-humans may need from their collaboration with humans.

This notion of multispecies collaboration leads me to reflect on the concept of "attentive collaboration" as previously explored in living lab contexts (see Chapter 5). There, attentive collaboration was understood as the relational practice of cultivating trust across difference, enabling people to think, feel, and act together in ways that remain open to uncertainty. Without simplifying the complexity of crisis, attentive collaboration acknowledges that even in crisis situations, conditions for collective futures can emerge when careful attention is given to how relations are formed and sustained. Extending this concept to a multispecies perspective offers a way to rethink collaboration beyond human relations, and clarifies the intent behind the central prompt used in the research-creation Labs (i.e., "how might humans and other-than-humans collaborate to respond to specific climate challenges in this place?"). From the perspective of attentiveness, multispecies collaboration becomes focused on cultivating trust across difference, acting together alongside uncertainty, attending to complexity in the slow work of imagining collective futures.

Yet, the tension remains: involving other-than-humans in research or artistic practices is inevitably limited. Their inclusion in art-making or workshop activities always remains a human decision. However, this doctoral research explores practices that might create conditions for more attentive and less anthropocentric forms of engagement. While these practices might not constitute “collaboration,” “partnership,” or “co-creation” as we currently understand these concepts or practices, they do make us wonder, experiment, and test what multispecies collaboration *could* be.

Evaluating speculative worlds

If speculations are as dependent on one's intentions as they are on the prompts and constraints that invite re-imagination, then encouraging justice-oriented speculation becomes a central methodological tension. What one considers a desired world is most likely to differ significantly from what others considers desirable. Or, within the context of this research, what I might perceive as a fair form of multispecies collaboration may be experienced as unjust or problematic by others and vice versa. This raises a fundamental ethical concern: Who am I to evaluate and judge a speculative vision as 'unjust' for a

particular place and context, particularly given my positionality as a researcher working in a different geographical and colonial context? Evaluating speculative worlds risks reproducing moral hierarchies and epistemic dominance, rather than opening space for difference. How, then, can speculative inquiry avoid evaluating speculative visions while still guide towards the imagination of just possibilities?

Rather than judging participants' imaginaries, I began to see the importance of creating conditions in which participants themselves critically reflect on what their imaginaries do. In the BioFutures Living Lab, such a reflective moment occurred only after the imagination had largely taken shape, using Glenn's (2009) *Futures Wheel Method*. Some participants were disappointed when they recognized that their well-intentioned speculations ended up reproducing logics of domination over nature. This moment clarified that post-hoc evaluation was insufficient. Reflective engagement needed to be embedded throughout the speculative process, allowing participants to continuously question emerging imaginaries as they unfolded, rather than confronting their implications only at the end.

In the Multispecies City Labs, I begin experimenting with question cards inspired by Glenn's (2009) *Futures Wheel Method*. Similar to the original approach, the cards prompted reflection on the impacts of the imagined worlds. Yet, I not only explored what kinds of consequences might emerge, but also *who* might be affected, *how* different groups (both human and other-than-human) would be impacted, *what groups* might systematically benefit or be harmed, and how relations between these groups are configured. Distributed while participants were visualizing their imaginaries, the cards became part of the making and doing exercise through which their imaginary took a visual form. By discussing the impacts and consequences of their imaginaries during the making and doing process, potential tensions and ethical concerns could be surfaced and responded to immediately, reducing the likelihood that participants would only recognize problematic implications after the Lab had ended. Embedding such reflective moments into creative practice helped ensure that no one would be blinded by enthusiasm or trapped in a seemingly utopic tunnel vision.

This also gestures toward creating spaces to develop competences for imagining otherwise. In the context of climate change, attention often turns to building resilience to the challenges we will face in the future. Futures literacy, as many have argued, is the very skill one needs to deal with such challenges. As put forward by UNESCO, being futures literate "enhances our ability to prepare, recover and invent as changes occur" (UNESCO, n.d.). It focuses on anticipating the future and building skills to respond to it (Miller, 2018), yet it also implicitly assumes a particular skillset, approach, or knowledge system to which one must adhere. While futures literacy might indeed help us to cope with the challenges of tomorrow, this thesis is more concerned with eliciting a notion of imagining otherwise. There lies an opportunity in futures studies and speculative inquiry to further develop critical thinking skills that help us move away from what we currently consider normal in order to open up alternative possibilities. In this way, speculative thinking and doing can be considered a critical climate praxis in which one learns to imagine while asking critical questions. Imagining otherwise is concerned with how to act *differently* amid uncertainties, in ways that diverge from dominant approaches, conventional discourses, and leading systems. In this context, the

practice of evaluating one's own imaginaries can be considered as a practical tool for developing competences to critically examine hidden assumptions within one's own imagination.

FUTURE RESEARCH AND SPECULATIONS

What do these frictions teach us for future speculations and research? Returning to the beginning of this doctoral research, my main research question asked *in what ways multispecies arts might spark collective imagination of multispecies worlds in which the human and other-than-human become partners in approaching climate change differently*. The research began with exploring and developing a conceptual understanding of multispecies arts, which I established as creative works involving other-than-humans that critically reflect upon anthropocentric understandings of our shared world. Over de course of the research, however, I came to approach the main research question primarily as a methodological question, looking into *how* to spark collective imagination of multispecies worlds. The research-creation Labs provided spaces to experiment with multispecies arts and creative and speculative practices in participatory settings. Each Lab generated particular methodological insights: the BioFutures Living Lab was the first experiment in which the living lab approach was combined with creative methods, including futures studies and speculative thinking techniques, and revealed that speculation can remain constrained by dominant structures, ideas, and norms; the Multispecies City Lab highlighted the significance of place in speculative thinking, showing that both place and the ways we speculate about them are political; the Lab on *Living Labs in Times of Crisis* highlighted the importance of slowing down, even when the urgency of crises asks us to move fast, and of cultivating attentiveness to both the problem and each other. Each of these Labs generated methodological learnings, but I believe the main contribution of this research lies in the frictions that emerged through these experiments.

Rather than treating the frictions as isolated moments of uncertainty, personal unease, or doubt, the frictions should be understood as indicators of deeper epistemic and ethical tensions of speculative inquiry. In fact, I believe they can be mobilized as critical entry points for rethinking speculative practices. Working with these frictions required moving between situated encounters and broader structures of power, connecting place-based multispecies imaginaries with global environmental change and geopolitical powers. Attending to these different levels is needed to provide a nuanced perspective on the potentialities, challenges, and limitations of multispecies speculative thinking in times of (more-than-)climate change. The frictions I encountered throughout this research ultimately point to a shared concern with what constitutes a *just speculation practice*. This concern can be formulated into a broader question: How can just worlds be imagined in times of polycrisis? It made me reflect on the assumption I initially held that speculative thinking and making only "works out" when one starts with "good intentions." Rather than locating justice in intention, which is ambiguous and context-dependent, this research suggest that justice emerges through the deliberate embedding of critical reflection on fairness. What is needed, then, is a critical account of speculative inquiry itself. As such, my primary contribution lies in articulating the

need for *critical speculative inquiry* and in experimenting with and developing methodological approaches that demonstrate how critical speculative inquiry can be put into practice.

Critical speculative inquiry involves questioning whether designs, decisions, or systems in one's imaginary are fair, while also opening space to interrogate existing structures rather than simply accepting them. Embedding critical moments of reflection might uncover hidden biases on both a personal and systematic level, recognizing power imbalances that might otherwise go unnoticed. At the same time, it opens possibilities for challenging injustice and for holding oneself accountable. In this way, critical perspectives highlight speculation as an inherently political practice, carrying a significant ethical responsibility to attend to the worlds one brings into being and the relations these worlds reconfigure. Such moments of reflection become possible by slowing down speculative processes, to "[become] capable of learning again, becoming acquainted with things again, reweaving the bounds of interdependency. It means thinking and imagining, and in the process creating relationships with others that are not those of capture" (Stengers, 2018, p. 82). A critical approach to speculative inquiry calls for attentiveness to uncertainty, complexity, and difference in speculative thinking (see Chapter 5), both in human contexts and in multispecies ones.

In this doctoral research, I explored a range of practical approaches for embedding critical dimensions within speculative inquiry. These included linking speculative thought to place through walking methods; adapting speculation prompts to the specific context of the research; inviting other-than-humans to become part of speculative processes; rethinking authorship practices within (speculative) participatory research; and incorporating evaluative moments building on and expanding the Futures Wheel approach. While this work adopted a multispecies perspective and was situated within the context of the (more-than-)climate crisis, the practices developed here are transferable to other lenses, contexts, and fields of inquiry. Yet, it is important to remember that critical reflection alone does not automatically generate just imaginaries. Rather, it gives participants tools to recognize unfairness, question assumptions, and actively work toward more just possibilities.

Implications across fields and practices

Speculative practices are not simply about narrating worlds; they are forms of active world-making: They influence which stories become imaginable, desirable, and legitimate, making speculative practices inherently political. In the words of Haraway (2016), “it matters what stories we tell to tell other stories with. … It matters what stories make worlds, what worlds make stories” (p. 12), highlighting the power of stories in shaping reality. As such, these (speculative) stories cannot be understood as neutral, and therefore, speculative practices demand ethical responsibility for the worlds that are brought into being and the relations these worlds reconfigure.

The idea that speculative thinking is a form of active world-making makes the implementation of a critical orientation necessary across a wide range of fields and practices. In pedagogical contexts, particularly in climate change education, speculative thinking can open space to approach climate change

from multiple situated perspectives (both human and other-than-human), revealing power dynamics that often remain hidden in dominant narratives of climate change. Critical speculation can help to recognise how social, economic, and colonial inequalities are entangled with environmental change, making it easier to grasp climate change as a political and relational issue, rather than a purely ecological one. Critical speculation, then, becomes a pedagogical tool not only for imagining alternative possibilities, but also for generating awareness of the power relations that shape(d) the past, present, and future.

The relevance of critical speculation extends beyond climate- and multispecies focused pedagogies and research. Within design, technology, and innovation, futures studies approaches are increasingly used to ideate new infrastructures, systems, and technological interventions. In these contexts, speculation does not merely explore possibilities but actively informs what and how technologies get built. A critical orientation is necessary to question the assumptions underlying design processes, including normative ideas about scalability and optimisation. Such a critical approach would force designers to examine how innovations may reproduce social inequalities or generate unforeseen social and ecological consequences. In this way, innovation can become a site for questioning dominant technological trajectories instead of uncritically advancing them. In policy research too, speculative inquiry and futures studies approaches are adopted to imagine policy change. Yet, speculation in not neutral and requires critical guidance, particularly when imaginaries are translated into concrete policy recommendations. The practices developed in this research may support scholars and policymakers in using futures thinking to anticipate potential impacts, surface power relations and assumptions, and guide toward more just imaginaries.

The work presented in this doctoral research does not offer a finalized framework, but points to the need for continuing exploring critical speculation practices across various research contexts, be it pedagogy, design, policy, or beyond. Through testing speculative prompts and exercises, iteratively implemented across various geographical contexts in research-creation Labs, this doctoral thesis gestures toward a need for justice-oriented speculation and illustrated some processes and practices that did (not) work. I hope it showed that justice-oriented speculation is an ongoing practice that always needs to be responsive to uncertainty, complexity, and difference, and that the imagination of 'liveable' climate futures differs significantly between contexts, people, and speculative prompts.

Research trajectories in the making

The critical and practical approaches that were generated through this research carry potential to be further explored and adapted across different socio-ecological and cultural contexts. A recent example of this took place during the Community Environments Lab, jointly organized between Stellenbosch University, The University of South Africa, and KU Leuven in February 2026 in Cape Town, hosted at the Iziko South African Museum and the nearby Company's Gardens. Bringing together 38 community members, students, and researchers, the Lab explored interconnected issues of social and environmental (in)justices through intergenerational and participatory engagement. The Lab unfolded in three phases:

telling stories from the pasts, reflecting on environmental justice challenges in the present, and co-creating vision for fair futures. As part of the futures phase, I facilitated a 4-hour workshop focused on collaboratively imagining multispecies possibilities for community-environment, prompting participants to wonder: What would the community environment look like if we collaborate with the other-than-human?

Though not part of this doctoral thesis, my contribution to the Community Environments Lab can be considered an extension of the research trajectories developed here, demonstrating how multispecies speculative thinking and making practices continue to evolve through situated applications. Interestingly, this Community Environments Lab expanded the scope of (human) participants of the already conducted Labs by more actively involving community members and intergenerational participants. A next step would be to further explore the multispecies speculations that emerged during the Lab in South Africa in detail and examine how they resonate with matters, relations, and histories of place. This would contribute to the continued development of both the method of emplaced speculative ethnography and the concept of multispecies relationality, as each situated engagement generates new insights, questions, and frictions. These frictions shape how critical speculative inquiry can be practiced and how multispecies relationality manifests itself and is imagined differently across places marked by specific ecological conditions, climate challenges, and socio-historical realities. At the same time, such work offers opportunities to further investigate how attentiveness can be activated in collaborative research settings.

ENDING, FOR NOW

To end this thesis, I return to a question raised by Robin Wall Kimmerer in her book *Braiding Sweetgrass*. Reflecting on her experience of teaching university students in environmental protection, Kimmerer (2013) describes her surprise at their inability to imagine positive, caring relationships between people and land. In this context, she wonders: "How can we begin to move toward ecological and cultural sustainability if we cannot even imagine what the path feels like?" (p. 6). I found myself returning this question. In moments I was confronted with the lingering question of *why* this research matters, Kimmerer's (2013) reflection grounded me, bringing me back to the interconnected anchors that held my doctoral work together. This rhetoric question reveals a concern about the limited capacity to imagine otherwise, highlighting the importance of speculative thought. It suggests that we need to imagine ecological and cultural sustainability *first* before we can make it possible in practice. Consequently, we better make sure that the speculative practices we use contribute to the imagination and creation of just worlds.

To do so, I chose to work with a multispecies perspective, considering it radically different from the status quo, and from the mainstream, often apocalyptic climate futures we all know. Kimmerer's (2013) question speaks directly to this orientation for both ecological and cultural sustainability are inseparable in the notion of multispecies justice, which centres just relationships between and for humans and other-than-humans. Multispecies justice, in a sense, can be understood as a middle ground between

extreme ecocentric positions that prioritize nature above all else and anthropocentric frameworks that privilege human needs, bringing ecological and social justice into dialogue. Speculating about this balance proved more difficult than initially thought. As illustrated by the research-creation Labs, imaginaries about ecological and cultural sustainability differed significantly between people and place, and they were not inherently just. It is through prompts, questions, and reflective processes that just imaginaries are able to emerge. Robin Wall Kimmerer's question, then, is not only rhetorical for me, one that emerged out of concern, it is also a methodological one that wonders how on Earth (or perhaps more accurately, how *with* Earth) do we imagine otherwise? I considered this an invitation to explore artistic practices and speculative fiction to develop new narratives and images of multispecies justice and what it might make possible.

The chapters compiled in this thesis have engaged with multispecies entanglements, speculative inquiry, and climate change. The thesis began by discussing multispecies arts that open space to speculate-with the other-than-human. Such multispecies creative explorations can be considered a mode of inquiry that aim to move away from anthropocentrism and towards a mode of ecocentrism. Chapter 1 and Chapter 2 highlighted the potentiality of engaging creatively with the other-than-human and what other kinds of stories it can tell about climate change on one hand, and the relationality between humans and other-than-humans on the other. These explorations informed Chapter 3 and Chapter 4, which translated this potentiality into a participatory research design, involving research-creation Labs. Each of these Labs brought about different insights, from uncovering the need for diverse epistemic frameworks to counteract Eurocentric and progress-oriented perspectives that dominate futures visions, to highlighting the significance of place in speculative thought. The Lab described in Chapter 5, in turn, emphasized the importance of attentive collaboration in participatory research settings and how to activate the 'living' dimension in living lab methodologies. Doing these Labs also generated methodological reflections on emplaced speculative ethnography in Chapter 6. Finally, Chapter 7 illustrated what kinds of further speculations and creations the research generated. Throughout this work it became apparent that multispecies speculative thought is emplaced, messy, immanent, and multiple. It is not stable, but always emergent, shifting, and in formation, very much dependent on current trends, situations, encounters, and engagements. And most importantly, it showed that critical reflections need to be built into the speculative thinking process to "begin to move toward ecological and cultural sustainability" (Kimmerer, 2013, p. 6). This thesis has articulated and experimented with what it means to take that commitment seriously in practice.

As I hope this doctoral thesis has shown, multispecies speculative inquiry hold potential for contributing to the field of environmental humanities and multispecies studies, as it creates opportunities by creatively engage with climate change, other-than-humans, histories, and place. It generates new relational possibilities between the human and other-than-human, and “this ethos of demanding the possible, even if it is not realistic,” Shaviro (2026) argues, “is why speculative fiction can be a tool for social change” (p xxii). Though ending here, there are many more speculative fictions to be imagined about multispecies collaboration in times of climate change. I will set my anchors elsewhere, perhaps expanding

the existing tripartite or exploring different configurations. I will continue to explore yet untold stories about (more-than-)climate change, like my mother's seashell-story, and speculate new ones. But for now, I invite you to stick with the multispecies stories that emerged in this research, envisioning what would happen when...

Water remembers life
Mangroves determine urban infrastructures
Ibises return to their original hatching grounds
Wetlands shape how we live
Fungi communicate messages
Trees save humans
Cows go on retirement
We learn the language of water
Aurora borealis loses energy
Beings share memory
Feral bees become our teachers
...

REFERENCE LIST

Ahmed, S. (2017). *Living a feminist life*. Duke University Press.

Albergel, E., & Magnusson J. (2014). The art of (bio)surveillance: Bioart and the financialization of life systems. *TOPIA: Canadian Journal of Cultural Studies, 30,* 237–254. https://doi.org/10.3138/topia.30-31.237

Aloi, G., & McHugh, S. (Eds.). (2021). *Posthumanism in art and science: A reader*. Columbia University Press.

Anderson, K. (2015). Ethics, ecology, and the future: Art and design face the Anthropocene. *Leonardo, 48*(4), 338–347. https://doi.org/10.1162/leon_a_01087

Andrews, L. B. (2007). Art as a public policy medium. In E. Kac (Ed.), *Signs of life: Bio art and beyond* (pp. 125–149). MIT Press.

Anker, S. (2014). The beginnings and the ends of bio art. *Artlink, 34*(3), 16–17.

Anker, S. (2021). Epistemic practices in bio art. *AI & SOCIETY, 36(*4), 1389–1394. https://doi.org/10.1007/s00146-021-01152-w

Anthoni E., Van Leemput M., Schoffelen J., & Hannes K. (2020). Futures studies. In Atkinson P., Delamont S., Cernat A., Sakshaug J. W., Williams R. A. (Eds.), *SAGE research methods foundation* (pp. 1–12). Sage.

Ardenne, P. (2019). Ecological art: Origin, reality, becoming. In J. Reiss (Ed.), *Art, theory and practice in the Anthropocene* (pp. 51–64). Vernon Press.

Atkinson, P. (1990). *The ethnographic imagination: Textual constructions of reality.* Routledge Revivals.

Baber, Z. (2016). The plants of empire: Botanic gardens, colonial power and botanical knowledge. *Journal of Contemporary Asia, 46*(4), 659-679. https://doi.org/10.1080/00472336.2016.1185796

Baccarne, B., Logghe, S., Schuurman, D., & De Marez, L. (2016). Governing quintuple helix Innovation: Urban living labs and socio-ecological entrepreneurship. *Technology Innovation Management Review*, *6*(3), 22-30.

Bahng, A. (2017). Plasmodial improprieties: Octavia E. Butler, slime molds, and imagining a femi-queer commons. In C. Cipolla, K. Gupta, D. Rubin & A. Willey (Eds.), *Queer feminist science studies: A reader* (pp. 310–326). University of Washington Press. https://doi.org/10.1515/9780295742595-027.

Ballard, S., & Linden, L. (2019). Spiral Jetty, geoaesthetics, and art: Writing the Anthropocene. *The Anthropocene Review, 6*(1/2), 142–161. https://doi.org/10.1177/2053019619839443

Ballon, P., & Schuurman, D. (2015). Living labs: Concepts, tools and cases. *Info, 17*(4). https://doi.org/10.1108/info-04-2015-0024

Barad K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press. https://doi.org/10.2307/j.ctv12101zq

Barad, K. (2018). Diffracting diffraction: Cutting together-apart. In Kaiser, B. M., & Thiele, K. (Ed.), *Diffracted worlds-diffractive readings* (pp. 4-23). Routledge.

Baum & Leahy. (2018). *Microbiocene: Ancient ooze to future myths* [Work of bio art]. Bio Art & Design Award. https://www.badaward.nl/artists-scientists/baum-leahy-with-stefan-schouten-julie-lattaud-laura-schreuder-and-gabriella-weiss

Baum & Leahy. (2020). Microbiocene: A microscopic view on matter. *Link Journal, 1*, 167–187.

Beaumont, P. & Speri, A. (2025, September 1). Leaked 'Gaza Reviera' plan dismissed as 'insane' attempt to cover ethnic cleansing. *The Guardian.* https://www.theguardian.com/world/2025/sep/01/leaked-gaza-riviera-plan-dismissed-as-insane-attempt-to-cover-ethnic-cleansing

Bell, W. (1996). An overview of futures studies. *The knowledge base of futures studies: Foundations*, *1*, 28-56.

Bengston D. N. (2015). The futures wheel: A method for exploring the implications of social-ecological change. *Society & Natural Resources, 29*(3), 374–379. https://doi.org/10.1080/08941920.2015.1054980

Bennett, J. (2020). *Vibrant matter: A political ecology of things*. Duke University Press.

Bergvall-Kareborn B., & Stahlbrost A. (2009). Living lab: An open and citizen-centered approach for innovation. *International Journal of Innovation and Regional Development*, *4*(1), 356–370. https://doi.org/10.1504/IJIRD.2009.022727

Bettany, S., & Kerrane, B. (2011). The (post-human) consumer, the (post-avian) chicken and the (post- object) Eglu: Towards a material-semiotics of anti- consumption. *European Journal of Marketing, 45*(11), 1746–1756. https://doi.org/10.1108/03090561111167388

Bio Art & Design Award. (2023). *About*. https://www.badaward.nl/about

Björgvinsson E., Ehn P., & Hillgren P. A. (2012). Design things and design thinking: Contemporary participatory design challenges. *Design Issues*, *28*(3), 101–116. https://doi.org/10.1162/DESI_a_00165

Blaser, M., & de la Cadena, M. (2018). Pluriverse: Proposals for a world of many worlds. In de la Cadena, M. & Blaser, M. (eds.). *A world of many worlds* (pp. 1-22). Duke University Press.

Blomley, N. K. (2004). *Unsettling the city: Urban land and the politics of property.* Routledge.

Bogdanova, E., & Jacobs, A. (2021, June 3). Beyond the human: The Hague's speculative lives. *Stroom: Walking Seminar.* https://walkingseminar.stroom.nl/app/uploads/2021/07/BeyondtheHuman.pdf

Boler, M. (1999). *Feeling power: Emotions and education.* Routledge.

Bowen, G. A. (2019). *Sensitizing concepts*. SAGE Publications Ltd.

Boyd, C. P., & Edwardes, C. (Eds.). (2019). *Non-representational theory and the creative arts.* Palgrave Macmillan.

Boyd, M. (2015a). Towards a performative multispecies aesthetics. *Antennae: The Journal of Nature in Visual Culture*, (31), 9-28.

Boyd, M. (2015b). Multispecies becomings in the Anthropocene. *Antennae: The Journal of Nature in Visual Culture*, (31), 5-8.

Braidotti R. (2013). *The posthuman*. Polity Press.

Braidotti, R. (2022). *Posthuman feminism.* Polity Press.

Bratteteig T., & Wagner I. (2012). Disentangling power and decision-making in participatory design. *12th participatory Design Conference, 1*, 41–50. https://doi.org/10.1145/2347635.2347642

Bridle, J. (2022). *Ways of being: Animals, plants, machines: The search for a planetary intelligence*. Penguin UK.

Bringhurst, R., & Zwicky, J. (2018). *Learning to die: Wisdom in the age of climate crisis.* University of Regina.

Brisini, T., Simmons, J., & Spry, T. (2025). *Posthumanist collaborations in performance: A praxis-based approach to qualitative inquiry.* Routledge.

Bryant, R., & Knight, D. M. (2019). *The anthropology of the future.* Cambridge University Press.

Burdon, P., & Alexander, S. (2023). Earth jurisprudence: anthropocentrism and neoliberal rationality. In Chapaux, V., Mégret, F., & Natarajan, U. (Eds.), *The Routledge handbook of international law and anthropocentrism (*pp. 215-230). Routledge.

Burnard P., & Colucci-Gray L. (2021). Reframing STEAM by posthumanizing transdisciplinary education: Towards an understanding of how sciences and arts meet and matter for sustainable futures. *Convergence Education Review*, *7*(2), 1–29.

Cambridge Dictionary. (n.d.). Collaboration. In *Cambridge Business English Dictionary.* Retrieved May 6, 2026, from https://dictionary.cambridge.org/dictionary/english/collaboration

Carayannis, E. G., & Campbell, D. F. (2012). Triple helix, quadruple helix and quintuple helix and how do knowledge, innovation and the environment relate to each other? A proposed framework for a trans-disciplinary analysis of sustainable development and social ecology. In Carayannis, E. G. (Ed.), *Sustainable Policy Applications for Social Ecology and Development* (pp. 29-59). IGI Global Scientific Publishing.

Carroll, J. S. (2024). *Speculative whiteness: Science fiction and the alt-right.* University of Minnesota Press.

Catts, O., & Zurr, I. (2007). Semi-living art. In E. Kac (Ed.), *Signs of life: Bio art and beyond* (pp. 231–247). MIT Press.

Centre for Social Justice and Community Action. (2022). *Community-based participatory research: A guide to ethical principles and practices* (2nd ed.). Durham University. https://www.durham.ac.uk/media/durham-university/departments-/sociology/Community-Based-Participatory-Research-A-Guide-to-Ethical-Principles,-2nd-edition-(2022)-.pdf

Centre for Social Justice and Community Action. *(2022). Community-based participatory research: A guide to ethical principles and practices* (2nd ed.). Durham University.

Chapman, O. (2019). Foreword. In Loveless, N. (Ed.), *Knowing and knots: Methodologies and ecologies in research-creation* (pp. xv-xxvii). University of Alberta Press.

Chapman, O., & Sawchuk, K. (2012). Research-creation: Intervention, analysis and “family resemblances”. *Canadian Journal of Communication, 37*(1), 5–26. https://doi.org/10.22230/cjc.2012v37n1a2489

Chappell, K. (2022). Researching posthumanizing creativity: Expanding, shifting, and disrupting. *Qualitative Inquiry*, *28*(5), 496–506.

City Botanic Gardens. (s.d.). Brisbane City Council. https://www.brisbane.qld.gov.au/parks-and-recreation/botanic-gardens/city-botanic-gardens

Clough, P. T., & Halley, J. (Eds.). (2007). *The affective turn: Theorizing the social*. Duke University Press. https://doi.org/10.2307/j.ctv11316pw

Coemans, S., Vrebos, H., & Hannes, K., (2020). Emplacement, In P. Atkinson, S. Delamont, A. Cernat, J.W. Sakshaug, & R.A. Williams (Eds.), *SAGE Research methods foundations* (pp.1-13). https://doi.org/10.4135/9781526421036939916

Costa, S. S. (2024, 2 May). *Stolen climate*. Arts Cabinet. https://www.artscabinet.org/interviews/stolen-climate

Crisp, M. D., Laffan, S., Linder, H. P., & Monro, A. N. N. A. (2001). Endemism in the Australian flora. *Journal of Biogeography*, *28*(2), 183-198. https://doi.org/10.1046/j.1365-2699.2001.00524.x

Daniel, F. J. (2016, August 1). Power cut hits millions, among world's worst outages. *Reuters*. https://www.reuters.com/article/india-blackout-delhi-northern-power-idINDEE86U05C20120731

Dasgupta, S., Thomas, G., Atkinson, P., Delamont, S., Cernat, A., Sakshaug, J. W., & Williams, R. A. (2020). *Case-control study*. SAGE. https://doi.org/10.4135/9781526421036927733

Dator, J. (2019). *Jim Dator: A noticer in time.* Springer Nature.

Davis, H., & Turpin, E. (2015). Art & death: Lives between the fifth assessment and the sixth extinction. In Davis, H., & Turpin, E. (Eds.), *Art in the Anthropocene: Encounters among aesthetics, politics, environments and epistemologies* (pp. 3-30). Open Humanities Press.

de Freitas, E., & Truman, S. (2020). New empiricism in the Anthropocene: Thinking with speculative fiction about science and social inquiry. *Qualitative Inquiry, 27*(5), 522–533. https://doi.org/10.1177/1077800420943643

de La Bellacasa, M. P. (2012). 'Nothing comes without its world': Thinking with care. *The sociological review, 60*(2), 197-216. https://doi.org/10.1111/j.1467-954X.2012.02070.x

de la Bellacasa, M. P. (2017). *Matters of care: Speculative ethics in more than human worlds.* University of Minnesota Press.

de la Cadena, M. (2015). *Earth beings: Ecologies of practice across Andean worlds*. Duke University Press. https://doi.org/10.1215/9780822375265

Deleuze, G., & Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia*. (B. Massumi, Trans.).University of Minnesota Press.

DeSilvey, C. & Edensor, T. (2012). Reckoning with ruins. *Progress in Human Geography, 37*(4). 465-485. https://doi.org/10.1177/0309132512462271

Dewsbury, J. D. (2010). Performative, non-representational, and affect-based research: Seven injunctions. In DeLyser, D., Herbert, S., Aitken, S., Crang, M., & McDowell, L. (Eds.), *The SAGE handbook of qualitative geography* (pp. 321-334). Sage.

Dierckx C., Hendricks L., Coemans S., Hannes K. (2021). The third sphere: Reconceptualising allyship in community-based participatory research praxis. *Qualitative Research in Psychology*, *18*(4), 473–497. https://doi.org/10.1080/14780887.2020.1854402

Dong, F., Sterling, S., Schaefer, D., & Forbes, H. (2020). Building the history of the future: a tool for culture-centred design for the speculative future. *Proceedings of the Design Society: DESIGN Conference, 1*, 1883-1890. https://doi.org/10.1017/dsd.2020.63

Dorn C. (2023, September 27). *Speculation. On things and thinking: Design and nature*. https://things-design-nature.net/speculations/#artikel

Dowler, L., Hyndman, J., & Sharp, J. (2024). Feminist geopolitical futures. In Manga, F., Nagel, C., Grove, K., & Peters, K. (Eds.), *Political geography in practice: Theories, approaches, methodologies* (pp. 53-67). Cham: Springer International Publishing.

Dunne A., &Raby F. (2013). *Speculative everything: Design, fiction and social dreaming*. The MIT Press.

Edwards, F., & Pettersen, I. N. (2023). Speculative design for envisioning more-than-human futures in desirable counter-cities. *Cities, 142,* 1-12. https://doi.org/10.1016/j.cities.2023.104553

Edwards, F., & Pettersen, I. N. (2023). Speculative design for envisioning more-than-human futures in desirable counter-cities. *Cities, 142,* 104553, 1-12. https://doi.org/10.1016/j.cities.2023.104553

Ersoy, A., & van Bueren, E. (2020). Challenges of urban living labs towards the future of local innovation. *Urban Planning*, *5*(4), 89-100. https://doi.org/10.17645/up.v5i4.3226

European Network of Open Living Labs. (2023). *Who we are.* ENoLL. https://enoll.org/who-we-are/

European Network of Open Living Labs. (2026, January 20). *Living Labs.* ENoLL. https://enoll.org/living-labs/

Fenske, M. K., & Elpers, S. (2019). Multispecies worlds in the museum. *Ethnologia Europaea*, *49*(2), 8-14. https://doi.org/10.16995/ee.1886

Ferrando, F., & Braidotti, R. (2020). *Philosophical posthumanism.* Bloomsbury.

Fisher, T. (2011). Aesthetics and the political: An essay on Francis Alys's Green Line. *Cultural Critique, 78*, 1-26. https://doi.org/10.5749/culturalcritique.78.2011.0001

FitzGerald, J. (2026, January 22). Why does Trump want Greenland and what could it mean for Nato and the EU? BBC. https://www.bbc.com/news/articles/c74x4m71pmjo

Flick, S., & Hoppe, K. (2025). Reflexivity beyond identity: The premises, promises and problems of participatory research for critical theorizing. *Constellations*, *32*(3), 517-526. https://doi.org/10.1111/1467-8675.12800

Flores, T., San Martin, F., & Black, C. V. (2023). Introduction. In Flores, T., San Martin, F., & Black, C. V. (Eds.), *The Routledge companion to decolonizing art history* (pp. 3-46). Routledge.

Følstad A. (2008). Living labs for innovation and development of information and communication technology: A literature review. *The Electronic Journal for Virtual Organizations and Network*, 10, 99–131.

Følstad, A. (2008). Living labs for innovation and development of information and communication technology: A literature review. *eJOV: The Electronic Journal for Virtual Organization & Networks*, *10,* 99-131.

Frege, I. A., Bliecke, V., Bradshaw, S., Dijkzeul, D., Funke, C., Kinzl, P., Küsters, K., Masuch, L., Nasreen, M., Radtke, K., Schneider, S., Thielbörger, P., Weller, D., Wiegers, O., Yaman, D. K., & Zennig, K. (2023) *WorldRiskReport.* Bündnis

Entwicklung Hilft. https://weltrisikobericht.de/wp-content/uploads/2024/01/WorldRiskReport_2023_english_online.pdf

Gan, E., Tsing, A. L., Swanson, H., & Bubandt, N. (2017). Introduction: Haunted landscapes of the Anthropocene. In A. L. Tsing, H. Swanson, E. Gan, & N. Bubandt (eds.), *Arts of living on a damaged planet* (pp. G1-G16). University of Minnesota Press.

Gibson, J.D. (2020). Stories we tell about the end of the world: (Post)apocalyptic climate fiction working towards climate justice. *Paradoxa, 31*(1), 205–229.

Gibson, P., & Sandilands, C. (2021). Introduction: Plant performance. *Performance Philosophy, 6*(2). 1-23.

Glenn, J. C. (2009). The futures wheel. *Futures research methodology—version, 3*, 19.

Gómez-Barris, M. (2017). *The extractive zone: Social ecologies and decolonial perspectives.* Duke University Press.

Gorman, R., & Andrews, G. (2022). What role for more-than-representational, more-than-human inquiry? In Lovell, S. A., Coen, S. E., & Rosenberg, M. W. (Eds.), *The Routledge handbook of methodologies in human geography* (pp. 381-394). Routledge.

Graham, M. (2014). Aboriginal notions of relationality and positionalism: A reply to Weber. *Global Discourse: An Interdisciplinary Journal of Current Affairs and Applied Contemporary Thought, 4*(1), 17–22. https://doi.org/10.1080/23269995.2014.895931

Grove, K., Rickards, L., Anerson, B., & Kearnes, M. (2020). The uneven distribution of futurity: Slow emergencies and the event of COVID-19. *Geographical Research, 60*(6), 6–17. https://doi.org/10.1111/1745-5871.12501

Hagy, S., Morrison, G. M., & Elfstrand, P. (2016). Co-creation in living labs. In Keyson, D. V., Guerra-Santin, O., & Lockton, D. (Eds.), *Living labs: Design and assessment of sustainable living* (pp. 169-178). Cham: Springer International Publishing.

Hamm, C., Iorio, J. M., Cooper, J., Smith, K., Crowcroft, P., Molloy Murphy, A., Parness, W., & Yelland, N. (2025). Learning with place as a catalyst for action. *Pedagogy, Culture & Society, 33*(1), 35–48. https://doi.org/10.1080/14681366.2023.2187436

Hankin, C., & Hogarth, H. (2025). The promise for posthumanist-cli-fi: Writing with/in/for/as stormy worlds. *Australian Journal of Environmental Education, 41*(3), 509-532. https://doi.org/10.1017/aee.2025.10074

Hannes, K., Jacobs, A., & Undo, K. (2025). *Using a futures wheel approach to collectively evaluate the consequences of solar PUNK responses to emerging societal challenges.* Eighth European Congress of Qualitative Inquiry, Edinburgh, Scotland. https://ecqi2025.exordo.com/programme/presentation/118

Hannes, K., Vrebos, H., Anthoni, E., & Dierckx, C. (2022). Protected paradise. In Conrad, D., & Wiebe, S. (Eds.), *Educational fabulations: Teaching and learning for a world yet to come* (pp. 367-379). Palgrave Macmillan.

Haraway, D. (1988). Situated knowledges: The science question in feminism and the privilege of partial perspective. *Feminist Studies*, *14*(3), 575-599. https://doi.org/10.2307/3178066

Haraway, D. (2008). *When species meet*. University of Minnesota Press.

Haraway, D. (2016). *Staying with the trouble: Making kin in the Chthulucene*. Duke University Press. https://doi.org/10.1215/9780822373780

Haraway, D. (2017). Symbiogenesis, sympoiesis, and art science activisms for staying with the trouble. In Tsing, A. L., Bubandt, N., Gan, E., & Swanson, H. A. (Eds.), *Arts of living on a damaged planet: Ghosts and monsters of the Anthropocene* (pp. M25-M50). University of Minnesota Press.

Harmes-Liedtke U., & Gianetti S. (2019). *The concept of co-creation and related methodologies for generating urban innovations bibliographic systematization.* Deutsche Gesellschaft für Internationale Zusammenarbeit-German Cooperation for Sustainable Development in Mexico (GIS). https://doi.org/10.13140/RG.2.2.27106.89283

Harris A. (2018). Creative agency/creative ecology. In Snepvangers K., Thomson P., & Harris A. (Eds.), *Creativity policy, partnerships and practice in education* (pp. 65–88). Palgrave Macmillan.

Harris D. X., & Rousell D. (2022). Posthuman creativities: Pluralist ecologies and the question of how. *Qualitative Inquiry*, *28*(5), 427–434. https://doi.org/10.1177/10778004221080219

Hasegawa, A. (2013). *I wanna deliver a dolphin.* Ai Hasegawa. https://aihasegawa.info/i-wanna-deliver-a-dolphin

Hayward, T. (1997). Anthropocentrism: A misunderstood problem. *Environmental Values*, *6*(1), 49-63. https://doi.org/10.3197/096327197776679185

Heise, U. (2016). *Imagining extinction: The cultural meanings of endangered species.* The University of Chicago Press.

Helgason, I., & Smyth, M. (2020). Ethnographic fictions: Research for speculative design. *Companion Publication of the 2020 ACM Designing Interactive Systems Conference,* 203-207. https://doi.org/10.1145/3393914.3395872

Henriksen D., Creely E., & Mehta R. (2022). Rethinking the politics of creativity: Posthumanism, Indigeneity, and creativity beyond the Western Anthropocene. *Qualitative Inquiry*, *28*(5), 465–475. https://doi.org/10.1177/10778004211065813

Hermy, M., Van Der Veken, S., Van Calster, H., & Plue, J. (2008). Forest ecosystem assessment, changes in biodiversity and climate change in a densely populated region (Flanders, Belgium). *Plant Biosystems: An International Journal Dealing with all Aspects of Plant Biology*, *142*(3), 623-629. https://doi.org/10.1080/11263500802411023

Hohti, R., & Tammi, T. (2019). The greenhouse effect: Multispecies childhood and non-innocent relations of care. *Childhood, 26*(2), 169-185. https://doi.org/10.1177/0907568219826263

Hohti, R., & Tammi, T. (2024). Composting storytelling: An approach for critical (multispecies) ethnography. *Qualitative Inquiry*, *30*(7), 595-606. https://doi.org/10.1177/10778004231176759

Hornborg, A. (2021). Objects don't have desires: Toward an anthropology of technology beyond anthropomorphism. *American Anthropologist, 123*(4), 753–766. https://doi.org/10.1111/aman.13628

Hossain, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. *Journal of Cleaner Production, 213*, 976-988.

Hostetler, A. (2022). *Edu-crafting teacher identities: Diffractive auto/ethnography through cartomancy* [unpublished master's thesis]. University of Alberta.

Houston, D., Hillier, J., MacCallum, D., Steele, W., & Byrne, J. (2018). Make kin, not cities! Multispecies entanglements and 'becoming-world' in planning theory. *Planning Theory, 17*(2), 190–212. https://doi.org/10.1177/1473095216688042

Huberman, M., & Miles, M. B. (1994). *Qualitative fdata analysis: An expanded sourcebook* (2nd ed.). Sage.

Huesemann M., & Huesemann J. (2011). *Techno-fix: Why technology won't save us or the environment*. New Society Publishers.

Hunter, J. (2009). Researching as if place mattered: Toward a methodology of emplacement. In Winkle-Wagner, R., Hunter, C. A., & Ortloff, D. H. (Eds.), *Bridging the gap between theory and practice in educational research: Methods at the margins* (pp. 85-96). Palgrave Macmillan.

Huybrechts, L. (2025). Walking alone, together participatory design as orchestrating between remoteness and situatedness in decision-making. *CoDesign*, 1-19. https://doi.org/10.1080/15710882.2025.2457492

Huybrechts, L., Zuljevic, M., Devisch, O., Tassinari, V., Seravalli, A., Light, A., De Blust, S, Panagiotis, A., Bassetti, C., Bidwell, N., Teli, M., Storni, C., Avram, G., Marshall, M., Majetic, F., & Declerck, J. (2022). Reworlding: participatory design capabilities to tackle socio-environmental challenges. *Proceedings of the Participatory Design Conference 2022, 2*, 173-178. https://doi.org/10.1145/3537797.3537870

Idrees, S. S., Hannes, K., & De Andrade, M. (2024). Seeking refuge in South Africa: Navigating power, healing, and co-creation in body-mapping processes. *Social Inclusion*, *12,* 1-24. https://doi.org/10.17645/si.9013

Inayatullah S. (1998). Causal layered analysis: Poststructuralism as method. *Futures*, *30*(8), 815–829. https://doi.org/10.1016/S0016-3287(98)00086-X

Inayatullah S. (2013). Futures studies: Theories and methods. In Junquera F. G. (Ed.), *There's a future: Visions for a better world* (pp. 36–66). BBVA.

Ingold, T. (2015). *The life of lines.* Routledge.

Ingold, T. (2021). *Being alive: Essays on movement, knowledge and description*. Routledge.

Iovino, S. (2018). Restoring the imagination of place: Narrative reinhabitation and the Po Valley. In Barron, P. (ed.), *Towards the river's mouth (verso la foce), by Gianni Celati: A critical edition* (pp. 127-141). Rowman & Littlefield.

Ipbes. (2023, September). *Policy instrument: Rights of nature*. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. https://www.ipbes.net/policy-support/tools-instruments/rights-nature-ron#:~:text=Rights%20of%20Nature%20(RoN)%20is,to%20exist%2C%20thrive%20and%20regenerate

Isaacs, J. R., & Otruba, A. (2019). Guest Introduction: More-than-human contact zones. *Environment and Planning E: Nature and Space*, *2*(4), 697-711. https://doi.org/10.1177/2514848619855369

Islam, N., & Winkel, J. (2017). *Climate change and social inequality.* United Nations: Department of Economic and Social Affairs.

Jacobs, A. (2025). Speculating-with other-than-humans in multispecies climate fiction: Canopy of the Hidden Alley. *Australian Journal of Environmental Education*, *41*(3), 616-632. https://doi.org/10.1017/aee.2025.10069

Jacobs, A., & Hannes, K. (2026). *An Extended Futures Wheel Workshop* [Workshop toolkit]. https://doi.org/10.13140/RG.2.2.21086.09280

Jacobs A., Devleminck S., & Hannes K. (2023). Co-creatively producing knowledge with other-than-human organisms in a (bio)technology-controlled artistic environment. *Social Inclusion*, *11*(3), 51–64. https://doi.org/10.17645/si.v11i3.6609

Jacobs, A., McKenzie, M., & Truman, S. E. (2026). *Emplaced Speculation: Imagining Multispecies Worlds in the Colonial Ruins of the Anthropocene.* [Manuscript submitted for publication].

Jacobs, A., Hostetler, A., Hinnekint, K., Perifanos, Y., Centeno, J. P., Cruz, R., Keskin, E., Mazet, L., Navarro, G., Parion, C., Sels, A. J., Vrebos, H., & Hannes, K. (in press). Living the Lab: Rethinking Collaborative Practices in Living Lab Contexts amid Polycrisis. *Social Inclusion, 14.* https://doi.org/10.17645/si.12026

Jacobs, A., Anthoni, E., Busseniers, E., Claes, S., Huybrechts, L., Van Leemput, M., Vrancken, K., Carriera, L., Colson, N., Dorn, C., Hostetler, A., Janssens, A., Kabendela, G., Kose, A., Luo, D., Majogoro, M., Sanchez, L. R. J., Stepanovic, J., Swillen, A., Vrebos, H., Wan, X., Weytjens, H., Zygmunt, M., Devleminck, S., & Hannes, K. (2024). Co-designing multispecies speculations through biofuturing. *Qualitative Inquiry*, *31*(2), 122-135. https://doi.org/10.1177/10778004241231919

Kac, E. (2007a). Art that looks you in the eye: Hybrids, clones, mutants, synthetics, and transgenics. In E. Kac (Ed.), *Signs of life: Bio art and beyond* (pp. 1–28). MIT Press.

Kac, E. (2007b). Life transformation: Art mutation. In E. Kac (Ed.), *Signs of life: Bio art and beyond* (pp. 163–184). MIT Press.

Kerr, J., & Andreotti, V. (2018). Recognizing more-than-human relations in social justice research: Gesturing towards decolonial possibilities. *Teacher Education, 27*(2), pp. 53-67.

Khan, S., & Van Wynsberghe, R. (2008). Cultivating the under-mined: Cross-case analysis as knowledge mobilization. *Forum: Qualitative Social Research, 9*(1), 1-26.

Kilgore, D. W. D. (2003). *Astrofuturism: Science, race, and visions of utopia in space*. University of Pennsylvania Press.

Kilpatrick, C., Higgins, K., Atkin, S., & Dahl, S. (2024). A rapid review of the impacts of climate change on the queer community. *Environmental Justice, 17*(5), 306-315. https://doi.org/10.1089/env.2023.0010

Kim, J., Kim, Y. L., Jang, H., Cho, M., Lee, M., Kim, J., & Lee, H. (2020). Living labs for health: An integrative literature review. *European Journal of Public Health, 30*(1), 55-63. https://doi.org/10.1093/eurpub/ckz105

Kimmerer R. W. (2013). *Braiding sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants*. Milkweed Editions.

Kirksey E. (2014). Multispecies communities. In Kirksey E. (Ed.), *The multispecies salon* (pp. 145–153). Duke University Press. https://doi.org/10.2307/j.ctv11smsvk

Kirksey, E., & Chao, S. (2022). Who benefits from multispecies justice?. In S. Chao, K. Bolender & E. Kirksey (Eds.), *The promise of multispecies justice* (pp. 1–21). Duke University Press.

Kirksey, E., Schuetze, C., & Helmreich, S. (2014). Introduction: Tactics of multispecies ethnography. In E. Kirksey (Ed.), *The Multispecies Salon* (pp. 1–24). Duke University Press.

Kirksey, S. E., & Helmreich, S. (2010). The emergence of multispecies ethnography. *Cultural Anthropology*, *25*(4), 545-576. https://doi.org/10.1111/j.1548-1360.2010.01069.x

Knight, L. (2021). *Inefficient mapping: A protocol for attuning to phenomena.* Punctum Books.

Knight, L. (2023). Inefficiently mapping extinction: A research-creation, practice-led approach to visualizing biodiversity loss. *Research in Education, 117*(1), 11–25. https://doi.org/10.1177/00345237231200623

Kommonen, K. H., & Botero, A. (2013). Are the users driving, and how open is open? Experiences from living lab and user driven innovation projects. *Journal of Community Informatics, 9*(3), 1-11. https://doi.org/10.15353/joci.v9i3.3156

Kopnina, H., Washington, H., Taylor, B., & Piccolo, J. (2018). Anthropocentrism: More than just a misunderstood problem. *Journal of Agricultural and Environmental Ethics*, *31*(1), 109-127. https://doi.org/10.1007/s10806-018-9711-1

Koro, M., & Wolgemuth, J. (2023). Methodologies for the apocalypse: Unthinking the thinkable. *Qualitative Inquiry, 29*(6), 651-658. https://doi.org/10.1177/10778004221142805

Lagerweij, E. (2016). Award info. In E. Lagerweij (Ed.), *Bio art & design: 2014–2016* (p. 22). ZonMw.

Langfeld, G. (2018). The canon in art history: concepts and approaches. *Journal of art Historiography*, *19*, 1-18.

Lapointe, D. (2020). Du living lab rhizome, des usagers et de la multiplicité du chercheur. In V. Lehmann & V. Colomb (Eds.), *L'innovation collective: Quand créer avec devient essentiel* (pp. 87–94). Presses de l'université du Québec.

Latour, B. (2004). How to talk about the body? The normative dimension of science studies. *Body & Society, 10*(2–3), 205–29. https://doi.org/10.1177/1357034X04042943.

Latour, B. (2014). Agency at the time of the Anthropocene. *New Literary History, 45*(1), 1–18.

Latour, B. (2017). *Facing Gaia: Eight lectures on the new climatic regime.* Polity.

Law, J. (2009). Actor network theory and material semiotics. In B. S. Turner (Ed.), *The new Blackwell companion to social theory* (3rd ed., 141–158). Blackwell.

Law, J. (2019). *Material semiotics.* Heterogeneities. http://w.heterogeneities.net/publications/Law2019MaterialSemiotics.pdf

Lawrence, M., Homer-Dixon, T., Janzwood, S., Rockström, J., Renn, O., & Donges, J. F. (2024). Global polycrisis: The causal mechanisms of crisis entanglement. *Global Sustainability, 7,* e6, 1–16. https://doi.org/10.1017/sus.2024.1

Le Guin, U. K. (2017). Deep admiration. In A. Tsing, H. Swanson, E. Gan, & N. Bubandt (Eds.), *Arts of living on a damaged planet* (pp. M15–M21). University of Minnesota Press.

Lefevre, T. A. (2015). *Settler colonialism*. Oxford University Press.

Lie M. (2023). New techno-natures: The future of human reproduction in sci-art. *Science as Culture*, *32*(2), 169-189. https://doi.org/10.1080/09505431.2022.2141106

Light, A. (2021). Collaborative speculation: Anticipation, inclusion and designing counterfactual futures for appropriation. *Futures, 134*(102855), 1-15. https://doi.org/10.1016/j.futures.2021.102855

Lorimer, H. (2005). Cultural geography: the busyness of being 'more-than-representational'. *Progress in Human Geography, 29*(1), 83-94. https://doi.org/10.1191/0309132505ph531pr

Loveless N. (2019). *How to make art at the end of the world: A manifesto for research-creation*. Duke University Press. https://doi.org/10.1215/9781478004646

Manning, E. (2015). Against method. In P. Vannini (Ed.), *Non-representational methodologies: Re-envisioning research* (pp. 52–71). Routledge.

Manning, E. (2016). Ten propositions for research-creation. In N. Coling & S. Sachsenmaier (Eds.), *Collaboration in performance practice. Premises, workings and failures* (pp. 133–141). Palgrave Macmillan.

Manning, E. (2023). *Out of the clear*. Minor Compositions.

Manning, E., & Massumi, B. (2014). *Thought in the act: Passages in the ecology of experience.* University of Minnesota Press.

Mark, S., Holder, S., Hoyer, D., Schoonover, R., & Aldrich, D. P. (2025). Understanding polycrisis: definitions, applications, and responses. *Global Sustainability, 8*(e35), 1-15. https://doi.org/10.1017/sus.2025.10018

Marres, N. (2005). *No issue, no public: Democratic deficits after the displacement of politics* [Doctoral thesis]. University of Amsterdam.

Massey, D. B. (2005). *For space*. Sage.

Massumi, B. (1995). The autonomy of affect. *Cultural Critique*, (31), 83-109. https://doi.org/10.2307/1354446

Mateus-Berr, R. (2014). Art and design as social fabric. In G. Bast, E. G. Carayannis, & D. F. J. Camp- bell (Eds.), *Arts, research, innovation and society* (pp. 229–268). Springer. https://doi.org/10.1007/978-3-319-09909-5_14

McIntyre, L. (2018). *Post-truth*. MIT Press.

McKenzie, M. & Bieler, A. (2016). *Critical education and sociomaterial practice: Narration, place, and the social*. Peter Lang Publishing.

McKenzie, M., Henderson, J., & Nxumalo, F. (2023). Climate change and educational research: Mapping resistances and futurities. *Research in Education, 117*(1), 3–10. https://doi.org/10.1177/00345237231203073

McPhee, C., Bancerz, M., Mambrini-Doudet, M., Chrétien, F., Huyghe, C., & Gracia-Garza, J. (2021). The defining characteristics of agroecosystem living labs. *Sustainability, 13*(4), 1718. https://doi.org/10.3390/su13041718

Melkozernov, A., & Sorensen, V. (2021). What drives bio-art in the twenty-first century? Sources of innovations and cultural implications in bio-art/biodesign and biotechnology. *AI & SOCIETY, 36*(4), 1313–1321. https://doi.org/10.1007/s00146-020-00940-0

Miller, R. (2018). *Transforming the future: Anticipation in the 21st century*. UNESCO Publishing.

Miró-Llinares, F., & Aguerri, J. C. (2023). Misinformation about fake news: A systematic critical review of empirical studies on the phenomenon and its status as a 'threat'. *European Journal of Criminology*, *20*(1), 356-374. https://doi.org/10.1177/1477370821994059

Mistry, I., & Lewis, O. (2026, January16 January). Extreme rainfall inundates South Africa and Mozambique. *The Guardian*. https://www.theguardian.com/environment/2026/jan/16/weather-tracer-extreme-rainfall-inundates-south-africa-mozambique-flood-warning

Modeen, M., & Biggs, I. (2020). *Creative engagements with ecologies of place: Geopoetics, deep mapping and slow residencies*. Routledge.

Mol, A. (2008). *The logic of care: Health and the problem of patient choice.* Routledge

Myers, W. (2018). What are biodesign and bioart and why should I care? In W. Myers (Ed.), *Biodesign: From inspiration to integration* (pp. 6–8). Nature Lab.

Nesti, G. (2018). Co-production for innovation: The urban living lab experience. *Policy and Society, 37*(3), 310-325. https://doi.org/10.1080/14494035.2017.1374692

NGV Melbourne. (2021, 2 July). *Big Weather | An Interview with Clinton Naina* [Video]. YouTube. https://www.youtube.com/watch?v=GeAFqNj0Fho

Nixon, R. (2011). *Slow violence and the environmentalism of the poor.* Harvard University Press.

Ogden, L. A., Hall, B., & Tanita, K. (2013). Animals, plants, people, and things: A review of multispecies ethnography. *Environment and Society: Advances in Research, 4,* 5-24. https://doi.org/10.3167/ares.2013.040102

Oman-Reagan, M. P. (2018). *First contact with possible futures.* Centre for Open Science. https://doi.org/10.31235/osf.io/7wtmk

Pacini-Ketchabaw, V., Taylor, A., & Blaise, M. (2016). Decentring the human in multispecies ethnographies. In Taylor, C. & Hughes, C. (eds.), *Posthuman research practices in education* (pp. 149-167). London: Palgrave Macmillan UK.

Pallot, M., Trousse, B., Senach, B., & Scapin, D. (2010). Living lab research landscape: From user centred design and user experience towards user cocreation. *First European Summer School "Living Labs",* 1-11. HAL Open Science.

Parion, C., & Hannes, K. (2026). *Relationally scoping the literature on emergent phenomena: A diffractive reading of human augmentation.* Manuscript submitted for publication.

Parion, C., & Hannes, K. (2026). *Demonstrating the futures wheel approach as co-creative method to collectively evaluate the consequences of microchip implants as a form of human enhancement.* Nineth European Congress of Qualitative Inquiry, Athens, Greece. https://www.ecqi2026athens.gr/media/attachments/2026/02/27/ecqi2026-abstracts-book-final.pdf

Parsons, E. S., Jowell, A., Veidis, E., Barry, M., & Israni, S. T. (2025). Climate change and inequality. *Pediatric Research, 98*(4), 1238-1245. https://doi.org/10.1038/s41390-024-03153-z

Patterson, J., Wyborn, C., Westman, L., Brisbois, M. C., Milkoreit, M., & Jayaram, D. (2021). The political effects of emergency frames in sustainability. *Nature Sustainability, 4,* 841-950. https://doi.org/10.1038/s41893-021-00749-9

Pearse, R. (2017). Gender and climate change. *Wiley Interdisciplinary Reviews: Climate Change, 8*(2), e451.

Pels, P. (2015). Modern times: Seven steps toward an anthropology of the future. *Current Anthropology, 56*(6), 779-796. https://doi.org/10.1086/684047

Pfotenhauer, S., Laurent, B., Papageorgiou, K., & Stilgoe, A. J. (2022). The politics of scaling. *Social Studies of Science*, *52*(1), 3-34. https://doi.org/10.1177/03063127211048945

Phillips, S., McLean Davies, L., & Truman, S.E. (2022). Power of country: Indigenous relationality and reading Indigenous climate fiction in Australia. *Curriculum Inquiry, 52*(2), 171–186. https://doi.org/10.1080/03626784.2022.2041978

Pihkala, P. (2019). *Climate anxiety.* University of Helsinki, MIELI Mental Health Finland. http://hdl.handle.net/10138/307626

Pink, S. (2009). *Doing sensory ethnography* (1st ed). Sage Publications.

Pink, S. (2010). The future of sensory anthropology/the anthropology of the senses. *Social Anthropology/Anthropologie Sociale, 18(*3), 331-333. https://doi.org/10.1111/j.1469-8676.2010.00119_1.x

Pink, S. (2011). From embodiment to emplacement: Re-thinking competing bodies, senses and spatialities. *Sport, Education and Society, 16*(3), 343-355. https://doi.org/10.1080/13573322.2011.565965

Pink, S. (2015). *Doing sensory ethnography* (2nd ed). SAGE Publications.

Pink, S. (2025). Futures anthropology for the polycrisis. *Anthropological Forum*, 1-18. https://doi.org/10.1080/00664677.2025.2521750

Porter, L., & Yiftachel, O. (2019). Urbanizing settler-colonial studies. *Settler Colonial Studies, 9*(2), 177-186. https://doi.org/10.1080/2201473X.2017.1409394

Potter, M., Fulcher, D. J., & Barnette, J. (2022). Changing how we make: Research-creation as methodology in changemakers. *Theatre Topics, 32*(1), 1-8.

Pratt, M. L. (2007). *Imperial eyes: Travel writing and transculturation*. Routledge.

Price, C., & Chao, S. (2023). Multispecies, more-than-human, nonhuman, other-than-human: Reimagining idioms of animacy in an age of planetary unmaking. *Exchanges: The Interdisciplinary Research Journal*, *10*(2), 177-193. https://doi.org/10.31273/eirj.v10i2.1166

Probyn, E. (2015). Listening to fish: More-than-human politics of food. In P. Vannini (Ed.), *Non-representational methodologies: Re-envisioning research* (pp. 82–98). Routledge.

Rachev, R. (2026). Performing speculations: Rehearsing futures through speculative f(r)ictions. In Truman, S. E. (Ed.), *Research and teaching with speculative fiction* (pp. 75-80). Bloomsbury Academic.

Radomska, M. (2016). *Uncontainable life: A biophilosophy of bioart.* Linköping University.

Radomska, M. (2017). Non/living matter, bioscientific imaginaries and feminist technoecologies of bio art. *Australian Feminist Studies*, *32*(9), 377–395. https://doi.org/10.1080/08164649.2017.1466649

Radulescu, M. A., Leendertse, W., & Arts, J. (2022). Living labs: A creative and collaborative planning approach. In Franklin, A. (Ed.), *Co-Creativity and Engaged Scholarship: Transformative methods in social sustainability research* (pp. 457-491). Springer Nature.

Rakowski, J. J., Schaan, L. N., van Klink, R., Herzon, I., Arth, A., Hagedorn, G., Rode, J., Creutzig, P., & Peter, G. (2025). Characterizing the global polycrisis: A systematic review of recent literature. *Annual Review of Environment and Resources, 50,* 159-183. https://doi.org/10.1146/annurev-environ-111523-102238

Reichle, I. (2014). Speculative biology in the practice of bioart. *Artlink*, *34*(3), 32–35.

Reiss, J. (2019). Introduction. In J. Reiss (Ed.), *Art, theory and practice in the Anthropocene* (pp. v–ix). Vernon Press.

Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F., Druke, M., Fetzer, I., Bala, G., von Bloh, W., Feulner, G., Fieldler, S., Gerten, D., Gleeson, T., Hofmann, M., Huiskamp, W., Kummu, M., Mohan, C., Nogués-Bravo, D., … Rockström J. (2023). Earth beyond six of nine planetary boundaries. *Science Advances*, *9*(37), 1-16. https://doi.org/10.1126/sciadv.adh2458

Richardson, L. (2003). Writing: A method of inquiry. In Lincoln Y. S., Denzin N. K. (Eds.), *Turning points in qualitative research: Tying knots in a handkerchief* (pp. 375–396). AltaMira Press.

Rifkin, K. (2019). *Fictions of land and flesh: Blackness, indigeneity, speculation.* Duke University Press.

Rigkos-Zitthen, I., & Granberg, M. (2024). Exploring democracy in the Anthropocene: The case of practices of collective care. *Socialism and Democracy, 38*(1), 40-63. https://doi.org/10.1080/08854300.2024.2378397

Riley, K., Jukes, S., & Rautio, P. (2024). Relational ontologies and multispecies worlds: Transdisciplinary possibilities for environmental education. *Australian Journal of Environmental Education*, *40*(2), 95-107. https://doi.org/10.1017/aee.2024.23

Rolfe, G. (1997). Writing ourselves: Creating knowledge in a postmodern world. *Nurse Education Today*, *17*, 442–448. https://doi.org/10.1016/S0260-6917(97)80004-4

Root-Bernstein, M., Douglas, L., Smith, A., & Verissimo, D. (2013). Anthropomorphized species as tools for conservation: utility beyond prosocial, intelligent and suffering species. *Biodiversity and Conservation, 22*(8), 1577-1589. https://doi.org/10.1007/s10531-013-0494-4

Rose, D. B. (2013). Multispecies knots of ethical time. *Environmental Philosophy, 9*(1), 127–140. https://www.jstor.org/stable/26169399

Ryan, L. (2007). Art + ecology: Land reclamation works of artists Robert Smithson, Robert Morris, and Helen Mayer Harrison and Newton Harrison. *Environmental Philosophy, 4*(1/2), 95–116. https://doi.org/10.5840/envirophil200741/28

Sachs Olsen, C., & Van Hulst, M. (2024). Reimagining urban living labs: Enter the urban drama lab. *Urban Studies*, *61*(6), 991-1012. https://doi.org/10.1177/00420980231187771

Sangarasivam, Y. (2022). *Nationalism, terrorism, patriotism: A speculative ethnography of war*. Springer International Publishing.

Saraceno, T., Engelmann, S., & Szerszynski, B. (2015). Becoming aerosolar: From solar sculptures to cloud cities. In Davis, H., & Turpin, E. (Eds.) *Art in the Anthropocene: Encounters among aesthetics, politics, environments and epistemologies* (pp. 57-62). Open Humanities Press.

Schmitt, C. R. (2023). Anthropomorphism, anthropocentrism, and human-orientation in environmental discourse. *Journal of Language and Politics, 22*(5), 601-621. https://doi.org/10.1075/jlp.22123.sch

Schnugg C. (2019). *Creating ArtScience collaboration*. Springer.

Scholl, C., de Kraker, J., & Dijk, M. (2022). Enhancing the contribution of urban living labs to sustainability transformations: Towards a meta-lab approach. *Urban Transformations 4*(7), 1-13. https://doi.org/10.1186/s42854-022-00038-4

Schuurman, D., & Leminen, S. (2021). Living labs past achievements, current developments, and future trajectories. *Sustainability, 13,* 10703. https://doi.org/10.3390/su131910703

Sedbon, M. (2019). *CMD: Experiments in bio-algorithmic-politics* [Work of bio art]. https://michaelsedbon.com/CMD

Shannon, D.B. (2021). What do 'propositions' do for research-creation? Truth and modality in Whitehead and Wittgenstein. *Matter: Journal of New Materialist Research, 2*(2), 50–75. https://doi.org/10.1344/jnmr.v2i2.35891

Shaviro, S. (2026). Foreword. In Truman, S. E. (Ed.), *Research and teaching with speculative fiction* (pp. xiix-xxiii). Bloomsbury Academic.

Sheldrake M. (2020). *Entangled life: How fungi make our worlds, change our minds, and shape our futures*. Vintage.

Shepherd, N., & Ernsten, C. (2021). An Anthropocene journey: Walking as embodied research. In Rogers, H., Halpern, M., Hannah, D., & de Ridder-Vignone, K. (Eds.), *Routledge handbook of art, science, and technology studies* (pp. 563-576). Routledge.

Springgay, S., & Truman, S. E. (2017) *Walking methodologies in a more-than-human world: WalkingLab.* Routledge.

Springgay, S. (2022). *Feltness: Research-creation, socially engaged art, and affective pedagogies*. Duke University Press.

Stengers, I. (2018). *Another science is possible: A manifesto for slow science.* Polity.

Stern, N. (2011). The implicit body as performance: Analyzing interactive art. *Leonardo, 44*(3), 233–238.

Stoler, A. L. (2008). Imperial debris: Reflections on ruins and ruination. *Cultural Anthropology, 23*(2), pp. 191-219. https://www.jstor.org/stable/20484502

Stouten, E., Idrees, S. S., Jacobs, A., & Hannes, K. (2025). From risk-averse to opportunity-led ethics: Renegotiating institutional ethical guidelines for co-creative types of research. *Qualitative Inquiry, 29*(1), 95-104. https://doi.org/10.1177/10778004221098380

Stracey, F. (2009). Bio-art: The ethics behind the aesthetics. *Nature Reviews Molecular Cell Biology, 10*(7), 496–500. https://doi.org/10.1038/nrm2699

Sultana, F. (2022). Critical climate justice. *The Geographical Journal*, *188*(1), 118-124.

Swanson, H., Tsing, A. Bubandt, N., & Gan, E. (2017). Introduction: Bodies tumbled into bodies. In: H. Swanson, A. Tsing, N. Bubandt, & E. Gan (Eds.), *Arts of living on a damaged planet: Ghosts and monsters of the Anthropocene* (pp. 1–13). University of Minnesota Press.

Taylor, C. A. (2020). Walking as trans(disciplinary)mattering: A speculative musing on acts of feminist indiscipline. In C. A. Taylor, J. Ulmer, & C. Hughes (Eds.), *Transdisciplinary feminist research: Innovations in theory, method and practice* (pp. 4-15). Routledge.

Taylor, L. (2021). Exploitation as innovation: Research ethics and the governance of experimentation in the urban living lab. *Regional Studies, 55*(12), 1902-1912. https://doi.org/10.1080/00343404.2020.1826421

Terranova, F. (Producer & Director). (2016). *Donna Haraway: Story telling for Earthly survival* [Motion picture]. Atelier Graphoui.

Thaler, M. (2022). What if: Multispecies justice as the expression of utopian desire. *Environmental politics, 31*(2), 258-276. https://doi.org/10.1080/09644016.2021.1899683

The Bristol Approach. (2023, September). *How does it work?* https://www.bristolapproach.org/

Thrift, N. (2008). *Non-representational theory: Space, politics, affect.* Routledge.

Todd, Z. (2013). Indigenizing the Anthropocene. In H. Davis, & E. Turpin (eds.), *Art in the Anthropocene: Encounters among aesthetics, politics, environments and epistemologies* (pp. 241-254). Open Humanities Press.

Todd, Z. (2016). An indigenous feminist's take on the ontological turn: 'Ontology' is just another word for colonialism. *Journal of Historical Sociology, 29*(1), 4–22. https://doi.org/10.1111/johs.12124

Tonn, M. S. (2020). *Becoming a sentinel species* [Work of bio art]. Bio Art & Design Award. https://www.badaward.nl/artists-scientists/sissel-marie-tonn-with-heather-leslie-juan-garcia-vallejo

Tronto, J. C. (1998). An ethic of care. *Generations: Journal of the American society on Aging*, *22*(3), 15-20.

Truman, S. E. (2019a). *Feminist new materialisms.* SAGE Research methods foundation. http://dx.doi.org/10.4135/9781526421036

Truman, S. E. (2019b). SF! Haraway's situated feminism and speculative fabulations in English class. *Studies in Philosophy and Education, 38:31*(42). 31-42. https://doi.org/10.1007/s11217-018-9632-5

Truman, S. E. (2022). *Feminist speculations and the practice of research-creation: Writing pedagogies and intertextual affects*. Routledge.

Truman, S. E. (2023). Colonial crises of imagination, climate fictions, and English literary education. *Research in Education, 17*(1), 1-16. https://doi.org/10.1177/00345237231183343

Truman, S. E. (2023). Undisciplined: Research-creation and what it may offer (traditional) qualitative research methods. *Qualitative Inquiry, 29*(1), 95-104. https://doi.org/10.1177/10778004221098380

Truman, S. E. (2026a). Introduction: Speculative fictioning across disciplines. In Truman, S. E. (Ed.), *Research and teaching with speculative fiction* (pp. 1-11). Bloomsbury Academic.

Truman, S. E. (2026b). Mining-nostalgias: youth speculative fictions about place and the future. *Children's Geographies,* 1-13. https://doi.org/10.1080/14733285.2026.2621704

Truman, S. E., & Springgay, E. (2015). The primacy of movement in research-creation: New materialist approaches to art research and pedagogy. In T.E. Lewis, & M.J. Laverty (Eds.), *Art's teachings, teaching's art. Philosophical, critical and educational musings* (pp. 151–164). Springer.

Truman, S. E., Shannon, D.B., & Yusoff, K. (2023). Cosmic Beavers: Queer counter-mythologies through speculative songwriting. *Angelaki: Journal of the Theoretical Humanities, 28*(6), 84–96. https://doi.org/10.1080/0969725X.2023.2270357

Truman, S. E., Loveless, N., Manning, E., Myers, N., & Springgay, S. (2019). The intimacies of doing research-creation. In Loveless, N. (Ed.), *Knowing and knots: Methodologies and ecologies in research-creation* (pp. 221-250). University of Alberta Press.

Tsapenko, D. (2020). Fur_tilize [Work of bio art]. Bio Art & Design Award. https://www.badaward.nl/artists-scientists/dasha-tsapenko-with-han-w%C3%B6sten

Tschakert, P., Schlosbert, D., Celermajer, D., Rickards, L. Winter, C. Thaler, M., Stewart-Harawira, M., & Verlie, B. (2020). Multispecies justice: Climate-just futures with, for and beyond humans. *WIREs Climate Change, 12*(2), 1-10. https://doi.org/10.1002/wcc.699

Tsing, A. L. (2005). *Friction: An ethnography of global connection.* Princeton University Press.

Tsing, A. L. (2015). *The mushroom at the end of the world: On the possibility of life in capitalist ruins*. Princeton University Press. https://doi.org/10.1515/9781400873548

Tsing, A. L., Bubandt, N., Gan, E., & Swanson, H. A. (Eds.). *Arts of living on a damaged planet: Ghosts and monsters of the Anthropocene*. University of Minnesota Press.

Tuck, E., McKenzie, M., & McCoy, K. (2014). Land education: Indigenous, post-colonial, and decolonizing perspectives on place and environmental education research. *Environmental education research*, *20*(1), 1-23.

Tuck, E., & McKenzie, M. (2015). *Place in research: Theory, methodology, and methods.* Routledge.

Tytler, C. (2025). Speculative documentary as world-building: Contaminated knowledge and future-making. *Australian Journal of Environmental Education, 4*1(3), 708-718. https://doi.org/10.1017/aee.2025.10054

UNESCO. (n.d.). Futures literacy and foresight: What is futures literacy (FL)? https://www.unesco.org/en/futures-literacy/about?hub=404

United Nations. (n.d.). *Causes and effects of climate change: United Nations*. https://www.un.org/en/climatechange/science/causes-effects-climate-change

Vaage, N. (2020). Wisdom in artistic research: An alternative to the discourse of art as knowledge production. In H. Borgdorff, P. Peters, & T. Pinch (Eds.), *Dialogues between artistic research and science and technology studies* (pp. 61–75). Routledge.

Vaage, N. S. (2016). What ethics for bioart? *Nanoethics, 10*(1), 87–104. https://doi.org/10.1007/s11569-016-0253-6

van den Hengel L. (2012). Zoegraphy: Per/forming posthuman lives. *Biography*, 35(1), 1–20. https://www.jstor.org/stable/23540930

van der Leest, E. (2019). *Funkee: Fungal supercoating* [Bio design]. https://emmavanderleest.com/portfolio/fungalsupercoatingfungkee

van Dijk, L. (2021). Affordances in a multispecies entanglement. *Ecological Psychology, 33*(2), 73-89. https://doi.org/10.1080/10407413.2021.1885978

van Donselaar, W. (2016). Bio Art & Design Award: Introduction. In E. Lagerweij (Ed.), *Bio art & design: 2014–2016* (p. 3). ZonMw.

van Dooren, T., & Rose, D.B. (2012). Storied-places in a multispecies city. *Humanimalia: A Journal of Human/Animal Interface Studies, 3*(2), 1–27. https://doi.org/10.52537/humanimalia.10046

van Dooren, T., Kirksey, E., & Munster, U. (2016). Multispecies studies: Cultivating arts of attentiveness. *Environmental Humanities, 8*(1), pp. 1-23. https://doi.org/10.1215/22011919-3527695

van Neerven, E. (2014). *Heat and light.* University of Queensland Press.

van Patter, L.E. (2023). Toward a more-than-human everyday urbanism: Rhythms and sensoria in the multispecies city. *Annals of the American Association of Geographers, 113*(4), 913-932. https://doi.org/10.1080/24694452.2022.2134838

van Praag, L. (2021). *Co-creation in migration studies: The use of co-creative methods to study migrant integration across European Societies.* Leuven University Press.

Vannini, P. (2014). Non-representational ethnography: New ways of animating lifeworlds. C*ultural Geographies*, *22*(2), 317-327. https://doi.org/10.1177/1474474014555657

Vannini, P. (2015). Non-representational research methodologies: An introduction. In Vannini, P. (Ed.) *Non-representational methodologies: Re-envisioning research* (1-18). Routledge.

Vanpaemel, G., & Snaet, J. (2016). *Medisch laboratorium of universitair bedrijf? Het Instituut voor Bacteriologie te Leuven*. [Medical laboratory or university business? The Institute of Bacteriology in Leuven]. Lipsius Leuven.

Vicini, S., Bellini, S., & Sanna, A. (2012). The city of the future living lab. *International Journal of Automation and Smart Technology*, *2*(3), 201-208. https://doi.org/10.5875/ausmt.v2i3.134

Walsh, D., & Seale, C. (2018). *Researching society and culture.* SAGE Publications.

Wang, Q., & Hannes, K. (2014). Academic and socio-cultural adjustment among Asian international students in the Flemish community of Belgium: A photovoice project. *International Journal of Intercultural Relations*, *39*, 66-81. https://doi.org/10.1016/j.ijintrel.2013.09.013

Wang, Q., Coemans, S., Siegesmund, R., & Hannes, K. (2017). Arts-based methods in socially engaged research practice: A classification framework. *Art/Research International: A Transdisciplinary Journal*, *2*(2), 5-39. https://doi.org/10.18432/R26G8P

Watson, J. (2019). *Lo-TEK: Design by radical Indigenism*. Taschen.

Watts, V. (2013). Indigenous place-thought & agency amongst humans and non-humans (First Woman and Sky Woman go on a European World tour!). *Decolonization: Indigeneity, Education & Society, 2*(1), pp. 20-34.

Whyte, K. (2019). Too late for Indigenous climate justice: Ecological and relational tipping points. *WIREs Climate Change, 11*(e603), 1-7. https://doi.org/10.1002/wcc.603

Whyte, K. P. (2018). Indigenous science (fiction) for the Anthropocene: Ancestral dystopias and fantasies of climate change crises. *Environment and Planning E: Nature and Space*, *1*(1-2), 224-242. https://doi.org/10.1177/2514848618777621

Wildcat, M., & Voth, D. (2023). Indigenous relationality: Definitions and methods. *AlterNative: An International Journal of Indigenous Peoples*, *19*(2), 475-483. https://doi.org/10.1177/11771801231168380

Williams, N. (2022). Waiting for geotropic forces: Bergsonian duration and the ecological sympathies of biodesign. *Qualitative Inquiry*, 28(5), 486–495. https://doi.org/10.1177/10778004211065803

Williams, M. J. (2017). Care-full justice in the city. *Antipode, 49*(3), 821-839. https://doi.org/10.1111/anti.12279

Willow, A. J. (2021). The world we (re) build: An ethnography of the future. *Anthropology and Humanism, 46*(1), 4-20. https://doi.org/10.1111/anhu.12309

Wilson, H. F. (2019). Contact zones: Multispecies scholarship through Imperial Eyes. *Environment and Planning E: Nature and Space*, *2*(4), 712-731. https://doi.org/10.1177/2514848619862191

Wolfe, C. (2010). *What is posthumanism?* University of Minnesota Press.

Wolfe, C. (2020). Coda: Reflections on art and posthumanism. In M. Susan & A. Giovanni (Eds.), *Posthumanism in art and science* (pp. 323–328). Columbia University Press.

Woods, D. (2019). "Terraforming Earth": Climate and recursivity. *Diacritics*, *47*(3), 6-29. https://doi.org/10.1353/dia.2019.0024

Woynarski, L. (2020). *Ecodramaturgies: Theatre, performance and climate change (new dramaturgies).* Palgrave Macmillan.

Wyatt, J., Gale, K., Gannon, S., Davies, B., Denzin, N. K., & St. Pierre, E. A. (2014). Deleuze and collaborative writing: Responding to/with "JKSB." *Cultural Studies, Critical Methodology*, *14*(4), 407–416. https://doi.org/10.1177/1532708614530313

Wynter, S. (2003). Unsettling the coloniality of being/power/truth/freedom: Towards the human, after Man, its overrepresentation-an argument. *CR: The new centennial review*, *3*(3), 257-337. https://doi.org/10.1353/ncr.2004.0015

Yarra River. (2022, 7 December). Melbourne Water. https://www.melbournewater.com.au/water-and-environment/water-management/rivers-and-creeks/yarra-river#:~:text=Did%20you%20know:%20Originally%20called,Yarro:%20%27it%20flows%27.

Yoldas, P. (2015). Ecosystems of Excess. In H. Davis, & E. Turpin (Eds.) *Art in the Anthropocene: Encounters among aesthetics, politics, environments and epistemologies* (pp. 359-370). Open Humanities Press.

Yusoff, K. (2016). Anthropogenesis: Origins and endings in the Anthropocene. *Theory, Culture & Society, 33*(2), 3-28. https://doi.org/10.1177/0263276415581021

Yusoff, K. (2018). *A billion Black Anthropocenes or none*. University of Minnesota Press.

Yusoff, K. (2024). *Geologic life: Inhuman intimacies and the geophysics of race*. Duke University Press.

Yusoff, K. (2026). Broken Earths and building worlds. In Truman, S. E. (Ed.), *Research and teaching with speculative fiction* (pp. 147-151). Bloomsbury Academic.

Yusoff, K., & Gabrys, J. (2011). Climate change and the imagination. *Wiley Interdisciplinary Reviews: Climate Change*, *2*(4), 516-534. https://doi.org/10.1002/wcc.117

Zaidi, L. (2019). Worldbuilding in science fiction, foresight and design. *Journal of Futures Studies*, *23*(4), 15–26. https://doi.org/10.6531/JFS.201906_23(4).0003

Zimmermann, F., Ponomareva, A., &Spagnoli, F. (n.d.). Bristol Living Lab. In *Bristol Living Lab*. https://openlab-project.eu/app/uploads/Bristol-Living-Lab_Bristol-UK.pdf

Zurr I., & Catts O. (2005). Big pigs, small wings: On genohype and artistic autonomy. In H. Rogers, M. Halpern, D. Hannah, & K. de Ridder-Vignone (Eds.), *Routledge handbook of art, science, and technology studies* (pp. 510–522). Routledge.

Zvonareva, O., & Egher, C. (2025). Ambivalence and agonism of public participation in contemporary societies. *Social Inclusion*, *13,* 1-14. https://doi.org/10.17645/si.10095

Zylinska, J. (2014). Taking responsibility for life: Bioethics and bioart. In P. Macneill (Ed.), *Ethics and the arts* (pp. 191–200). Springer.

APPENDIX

1. WORKSHOP TOOL: *'AN EXTENDED FUTURES WHEEL APPROACH'*

Throughout the research, I experimented with a range of approaches and methods drawn from the fields of speculative inquiry and futures studies. One such experiment involved the Futures Wheel, a method developed within the field of futures studies, invented by Jerome C. Glenn in the 1970s. It is used to support the imagination and anticipation of the consequences of events or trends, speculative ideas or designs, policy decisions and other potential societal transformations. Grounded in the question "what would happen if this change were implemented in society?" the Futures Wheel method invites participants to imagine and map both positive and negative (1) first-order (i.e., direct consequences), (2) second-order (i.e., consequences of first-order effects), and (3) third-order consequences (i.e., consequences of the second-order effects; Glenn, 2009; Bengston, 2015).

I applied this Futures Wheel approach in the BioFutures Living Lab to support participants in critically reflecting on their imagined worlds. Through the Futures Wheel, participants were encouraged to identify direct and indirect consequences of their imaginaries, enabling consideration of potential longer-term impacts should these visions be realised in society. Although the BioFutures Living Lab initially aimed to imagine positive futures, the Futures Wheel revealed a range of unexpected negative effects that the new visions might also produce. In this sense, the method functions as a critical tool, allowing participants to interrogate their own speculative ideas. It demonstrates that utopian visions often carry underlying dystopian dimension that remains hidden in dreamworlds and highlights that what counts as a "positive" future is always shaped by situated perspectives that vary across individuals.

While the Futures Wheel method, as applied in the BioFutures Living Lab, proved valuable for exploring broader socio-cultural, economic, and environmental impacts, the original method does not explicitly address the issue of differential impacts across stakeholder groups, including both human and other-than-human actors. This limitation led me to ask: "Who are these identified consequences actually impacting? And what do they tell us about power dynamics between different stakeholders?" To engage with these concerns, I extended Glenn's (2009) original approach by adding two steps: (4) identifying stakeholders, and (5) identifying relational dynamics between them. This extension invites a more critical engagement with the identified consequences by foregrounding *who* is affected and *how*, thereby supporting the imagination of more just futures.

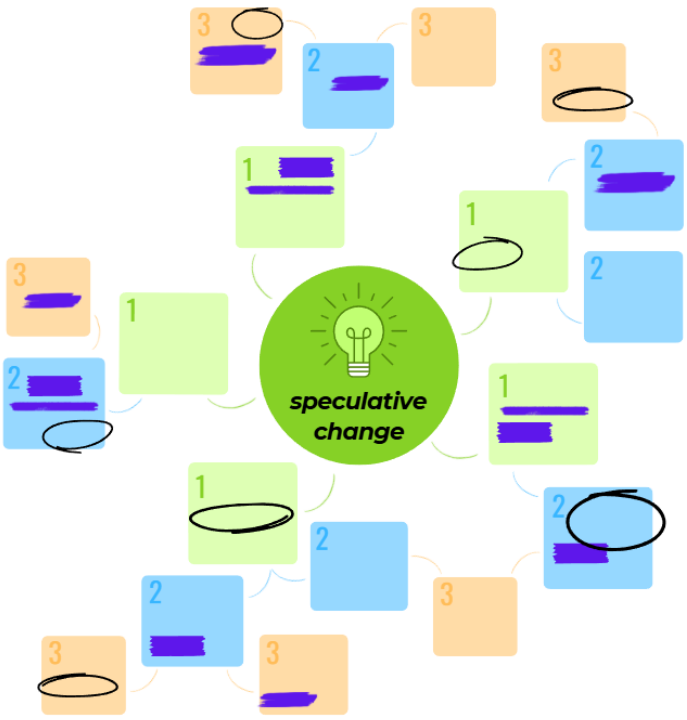


Figure 22: Illustration of a Futures Wheel, where colour-coded sticky notes are used to map first-, second-, and third-order consequences (Glenn, 2009), alongside highlighted stakeholder groups and circled relational dynamics.

Based on the reworking of Glenn's (2009) original Futures Wheel method, I developed a workshop guide for the *Extended Futures Wheel Approach*. This guide presents a pedagogical tool in the form of a booklet intended for workshops or other learning contexts to support the anticipation of impacts of certain events, trends, (speculative) designs, policy changes, or any other (speculative) societal transformations. The extended approach has since been used in various workshops focused on imagining and mapping the impacts of genetic modification of trees in urban spaces (Hannes et al., 2025) and insertable technologies in the workspace (Parion & Hannes, 2026). Below, I present an overview of the different steps of this *Extended Futures Wheel Approach*, as they are introduced in the booklet (Jacobs & Hannes, 2026). Figure 22 presents these steps visually.

> *Step 1: Identifying first-order consequences*. If this change were implemented in reality, what immediate outcomes might occur? Consider both positive and negative consequences. Think about effects across various context, such as social, environmental, or economic impact.
>
> *Step 2: Identifying second-order consequences*. Examine each first-order consequence individually. In case this consequence were to occur, what subsequent effects might it produce.
>
> *Step 3: Identifying third-order consequences*. Now, analyse each second-order consequence individually. If this consequence were to occur, what further effects might it generate? Reflect on how these outcomes could cascade across different systems and contexts.

Step 4: Identify stakeholders. Who benefits from and who is negatively impacted by this speculative change? Examine your wheel of consequences to identify and highlight the affected stakeholder groups.

Step 5: Identifying relationships. What are the dynamics between stakeholders? Use your wheel of consequences and circle descriptions of relational (e.g. collaboration, support, dialogue) and non-relational practices (e.g. conflict, control, exclusion, exploitation).