

I LAND HERE

An Exploration of Material Boundaries

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ABSTRACT

In a search for new understandings of the relationship between the maker and the made, this practice-based research explores the conceptual threshold of material boundaries through a lens of eco-philosophical thought. Reflective mappings of autoethnographic inquiry and a symbiotic design approach investigate the interplay of mind and matter, and the agency of both in the formation of experimental biofabricated materials made from starch-based bioplastics and symbiotic cultures of bacteria and yeast (SCOBY). Theories of eco-philosophical thought, eco-logic, and material ecocriticism are used further to explore a mutualism between the maker and the made, a symbiosis focused on moving towards the synergy of human and non-human creation. Final reflections suggest the potentiality of symbiotic design practice as a way forward for ethical creation orientated toward an eco-logical awareness for design and material futures.

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ATTESTATION OF AUTHORSHIP

“I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the Acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.”

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This exegesis is dedicated to;

The lost seekers, the Solar-Punk daydreamers and the 'tomorrowers'

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Figure 01. AUGUSTA, E. (2022). S.C.O.B.Y./Touch. photograph

INTRODUCTION

Can a symbiotic design approach, engaging eco-philosophical perspectives, expand notions of material boundaries and facilitate new understandings of ecological conversation through practice?

The project *I Land Here* explores the conceptual threshold of material boundaries through a symbiotic design approach in search of material ‘lands’ that repositions the maker within a symbiotic relationship with materials. It explores theoretical perspectives in relation to creative practices in the situated, unavoidable “now” of ecological awareness. The textiles produced in this project are conceived as the ‘lands’ surveyed in the journey towards establishing an ecological design ethos. Conceiving the biomaterials used in this research as metaphysical ‘lands’ allowed the re-imagining of thresholds beyond what is known by considering a new dialogue with materials. The interplay between materials, processes, mind and agency is investigated through the lens of autoethnographic inquiry and eco-philosophical thought, immersing the designer wholly within the creative process. This method of making creates a mutualism between the maker and the made, a symbiosis focused on moving towards the synergy between human and non-human creation.



Figure 02. AUGUSTA, E. (2022). S.C.O.B.Y /Lands. photograph



Figure 03. AUGUSTA, E. (2022). Bioplastic /EX5 . photograph

The journeying of this exegesis is laid out in three sections. The first establishes the genesis of ideas that inspired this research and the methodological framework that has informed the development of the project. A reflective and intuitive process of wandering, sensing and ‘growing-by-design’ is developed through autoethnographic inquiry, immersive *worlding*, and experimental biofabrication to create symbiotic bodies of bio-textile materials. The second section expands on the contextual knowledge that surrounds this project. I consider conversations around the ethics of textile design practices, material ecologies, and biofabrication in relation to eco-philosophical thought and notions of material ecocriticism, which in turn inform the foundations of my symbiotic design praxis. The final chapter documents the ‘wanderings’ across experimental material ‘lands’ that embody reflections of a symbiotic design process and the interplay of the maker and the made.



Figure 04. AUGUSTA, E. (2022). starch experiment 5 detail /gs. photograph

METHODOLOGICAL FRAMEWORK

Beginning at the end, *I land here.*,

This statement holds two meanings; the first is acknowledging the designer situated in time. To be a designer today is to be confronted with the ecological realities of the 21st century. The second meaning reflects on how personal experiences bleed into one another, where the learning from one affects the next through the considered employment of reflective thought. In this practice, I have engaged a symbiotic design approach employing a bricolage of autoethnographic and eco-philosophical inquiry to immerse the self within a world of ecological imaginings in order to become “more conscious of the multiple layers of interconnections between the knower and the known, perception and the lived world, and discourse and representation.”^{1,2} The researcher-as-bricoleur seeks out new ways of knowledge production beyond disciplinary boundaries through an undisciplined and experimental approach.³

1 The terms *ecological imaginings* /*imagination* and *environmental imagination* have been used by scholars to describe a literary genre concerned with the interrelationship of humans and natures. Steven Fesmire contextualises *ecological imagination* as a type of rational imagination fundamental to ecological thinking, as it requires metaphor, narrative, images, semantic and semiotic framing. For this project, I have used the term to describe the reflective state of ecologically-oriented thought.

2 Joe E. Kincheloe, “Describing the bricolage: Conceptualising a new rigour in qualitative research,” *Qualitative Inquiry* 11, no. 3, (December 2001): 688.

3 Joyce Yee and Craig Bremner, “Methodological Bricolage: What does it tell us about Design,” (May 2011): 3-4



Figure 05. AUGUSTA, E. (2022). 'The Mind's Horizon Line'. digital collage



The theoretical world this research inhabits is conceived as a form of mind-mapping. Where the process of turning inwards is mapped out, unfolding a mind's-world of eco-philosophical thought. As the boundaries between the internal and external self dissolve, the barriers of perception break open, leaving me free to wander amidst realms of abstraction and revelation. Navigating this terrain informs my methodology. With this process, symbiotic design seeks to immerse the maker in an ecosystem of thought and practice to evolve the notion of “learning from nature to learning with-in nature.”⁴ The following details the methods I have used in the pursuit of an *eco-logic(ally)*-conscious, symbiotic approach to textile design.

Figure 06. AUGUSTA, E. (2022). S.C.O.BY/Cranium. photograph

4 David S. Ruano, “Symbiotic Design Practice: Designing with-in nature,” (July 2016): 20

Autoethnographic Journaling:

Autoethnographic inquiry allows the researcher to use self-reflection and the recording of ideas to explore their own experiences of a particular phenomenon before examining their experiences as part of a culture and environment.⁵

Using an autoethnographic approach to research enabled me to explore *curious territories* reached through entering the mind's-world. The methods used to access *this 'land'* included wandering, wondering, observing and marking. Submerged within this environment, I have documented my findings through text and images.

⁵ Tony E. Adams, Stacy Holman Jones, and Carolyn Ellis, *Autoethnography: Understanding Qualitative Research* (NY, Oxford University Press, 2014), 1-2



Figure 07. AUGUSTA, E. (2022). A gathering. photograph

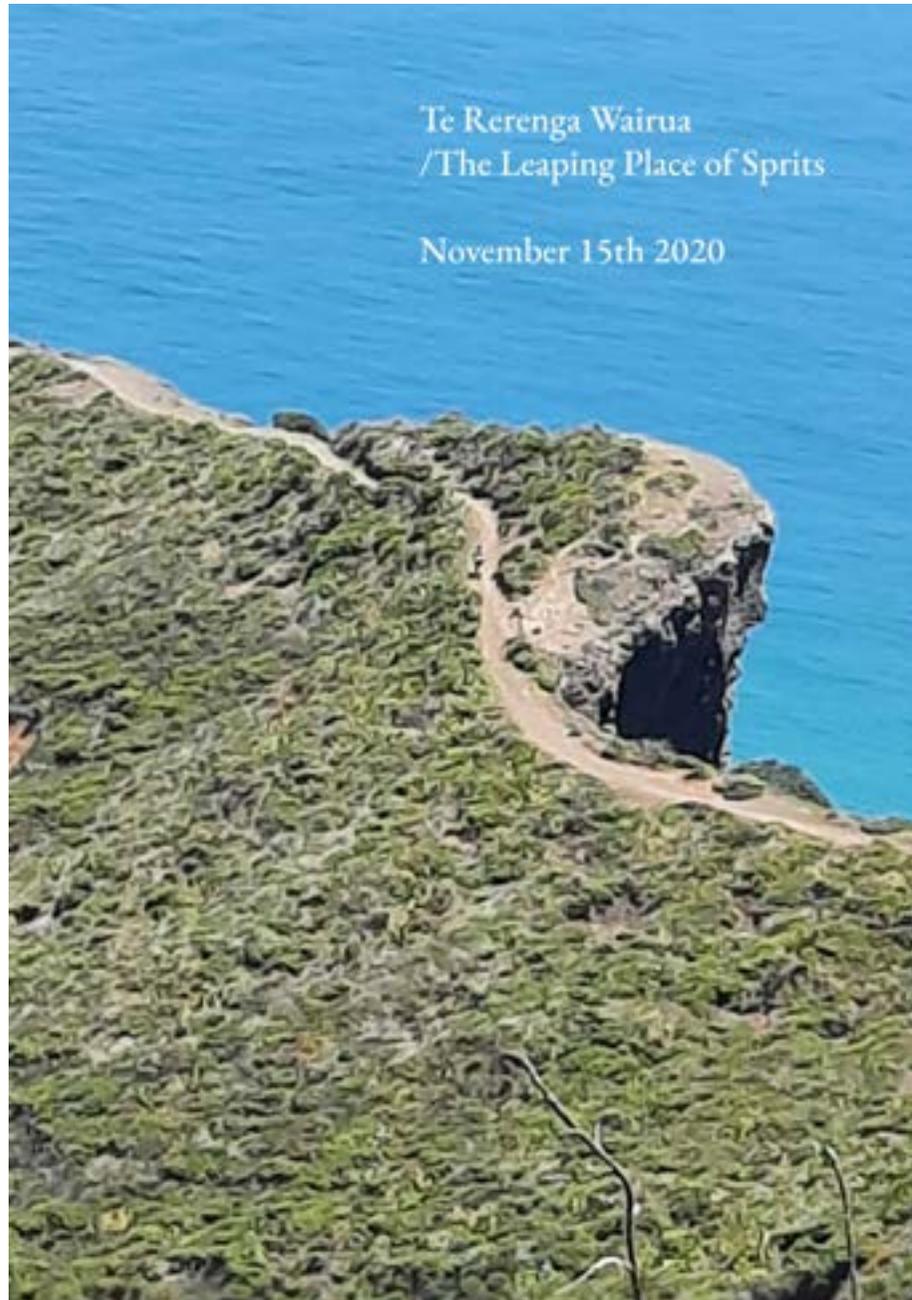


Figure 08. AUGUSTA, E. (2020). Te Rerenga Wairua /The Leaping of Spirits

Prior to beginning this project, I spent one hundred twenty-seven days walking the length of Aotearoa along the Te Araroa trail (*the long pathway*).⁶ This experience was the catalyst of a desire to better understand the interconnectivity of earth's life forms, the precariousness of our shared existence and the position of the designer situated within this ecology. During the four months spent wandering alone across the trails of Aotearoa's backcountry, my imagination was free to wander as the scenes of natural beauty and never-ending horizons extended the boundaries of my mind's eye. My walking body was immersed in a multi-sensory experience with the natural environment where the walking itself became a method of discovery, embodying the imagination in motion, which inspired this qualitative research inquiry.⁷ Being immersed in thought and nature unlocked a world of ecological imaginings. As I journeyed through the curiosities and desires of the mind's-world, actively listening, seeing and feeling my external and internal landscapes intertwined, cultivating thought, reflections and creation. This reflective process was the impetus for chronicling my ideas and thoughts to later expand and re-imagine through practice. This first phase of the inquiry, that of "the imaginative logic of discovery", was recorded in my trail notebooks.⁸ (Fig. 09)

⁶ Te Araroa - *The Long Pathway* <https://www.teararoa.org.nz/>

⁷ Sarah E. Truman and Stephanie Springgay, *Walking Methodologies in a More-than-human World: WalkingLab* (Oxfordshire: Routledge, 2017)

⁸ Michael Taussig, *I Swear I Saw This: Drawings In Fieldwork Notebooks, Namely My Own* (Chicago: University of Chicago Press, 2011), 11

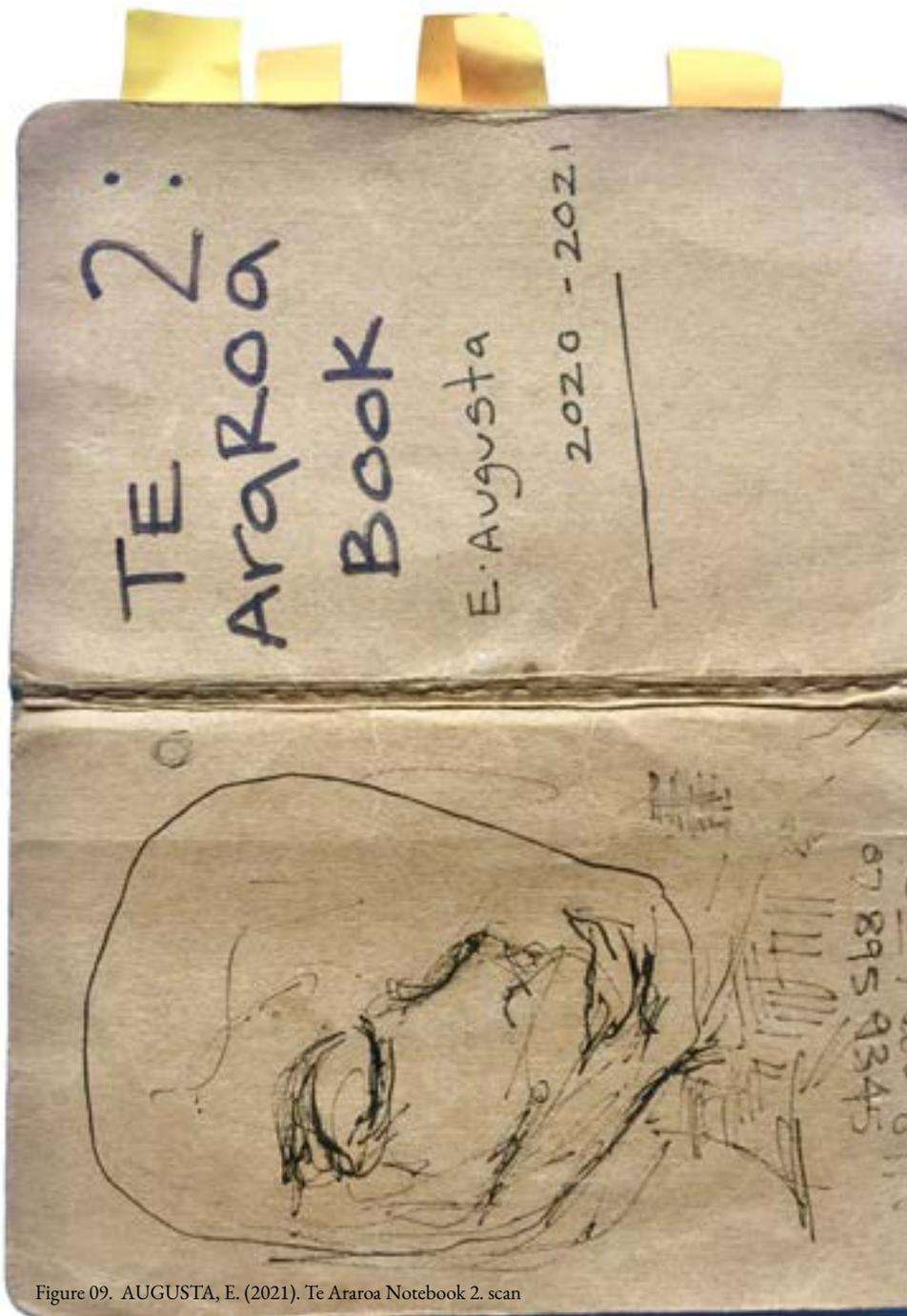


Figure 09. AUGUSTA, E. (2021). Te Araroa Notebook 2. scan

“Markings” of my visual and physical explorations were captured using observational and abstracted imagery techniques, merging the internal and external experiences in order to capture “a world beyond [...] pointing away from the real to capture something invisible and auratic.”⁹ Re-visiting my trail journal was important in the early stages of this project, as it allowed me to ‘return’ in a sense to the scenes and feelings of being present within an environment in a way that is harder to maintain in the industrial landscapes of the city. Gestural line drawings became memories of movement, feelings, impressions and changes in the body and mind that occurred along the trail. The *line* I made by walking was neither additive nor reductive, but its impression was left on both land and mind.¹⁰ The *line* made by drawing then traced a map between past and present, memory and imagination and became the starting point to navigate literally, contextually and metaphorically the conceptualisation of my project. (Fig. 10, 11) Following this *line* became a mapping of thought used to visualise and understand the interconnections between ideas. The autoethnographic, the theoretical and philosophical were mapped out, bringing together a multiplicity of perspectives which then informed the ‘worlding’ of this project.

⁹ Taussig, *I Swear I Saw This*, 13

¹⁰ Tim Ingold, *Lines: A Brief History* (Oxfordshire: Routledge, 2007), 43

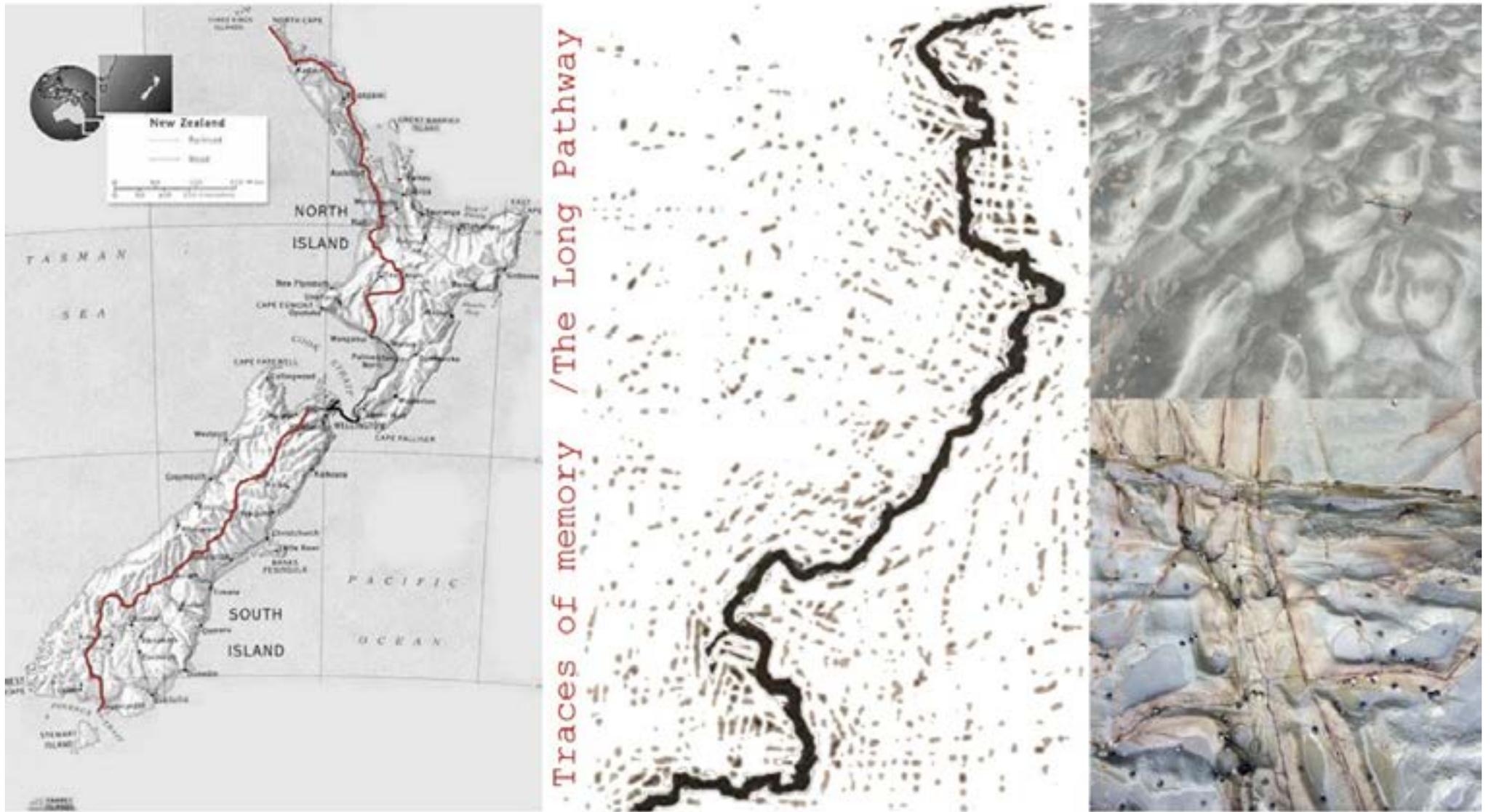


Figure 10. AUGUSTA, E. (2022). Traces of Memory /The Long Pathway. collage

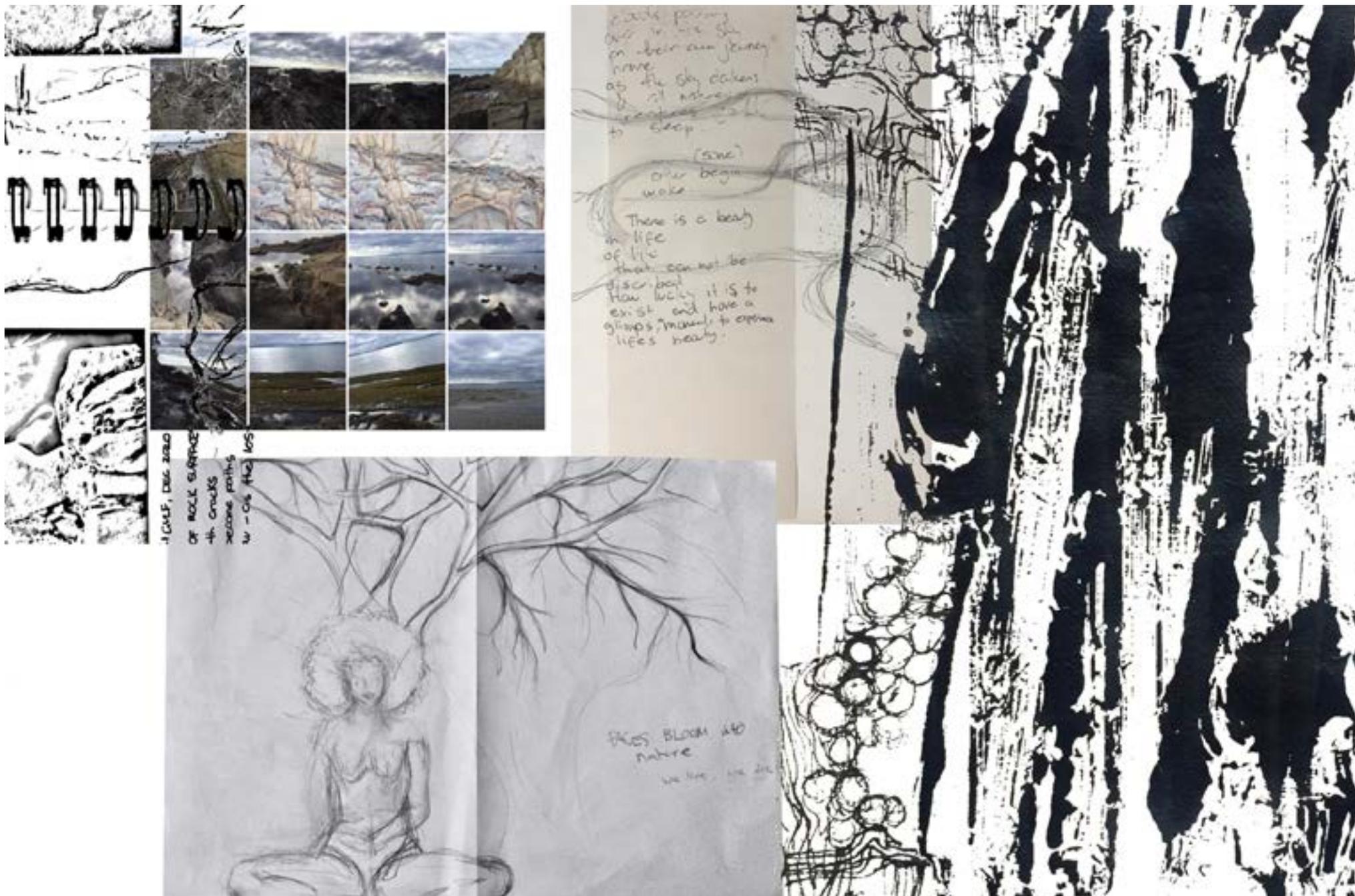


Figure 11. AUGUSTA, E. (2022). Journaling Method. collage

Worlding:

The reflections drawn from the autoethnographic inquiry expanded into a process of *'worlding'* in which awareness is drawn to how different species, technologies and forms of knowledge interact, and the maker immerses themselves within an environment where “they can reconcile the life that surrounds them with the life that floats like a dream before them.”^{11,12} In other words, my studio space became a blend of the material and the semiotic and the inspiration for metaphysical thought and expression. Drawings, notes, *mappings*, photographs, music and a gathering of biomaterial samples were used to cultivate this space. Through this manipulation of the maker’s environment, the ecological imaginings of the mind’s-world are manifested by merging the material and the metaphysical and dissolving the boundaries between subject and environment, internal and external, mind and matter. (Fig.) In this way, *'worlding'* provides a lens through which the enmeshment of human-non-human creation can be explored, subverting habitual temporalities and design practices.¹³

11 Helen Palmer and Vicky Hunter, “Worlding”, *New Materialism*, March 16, 2018, <https://newmaterialism.eu/almanac/w/worlding.html>

12 Hamilton W. Mabie, *Under the Trees and Elsewhere* (1891), 268

13 Helen Palmer and Vicky Hunter, “Worlding”, *New Materialism*, March 16, 2018, <https://newmaterialism.eu/almanac/w/worlding.html>

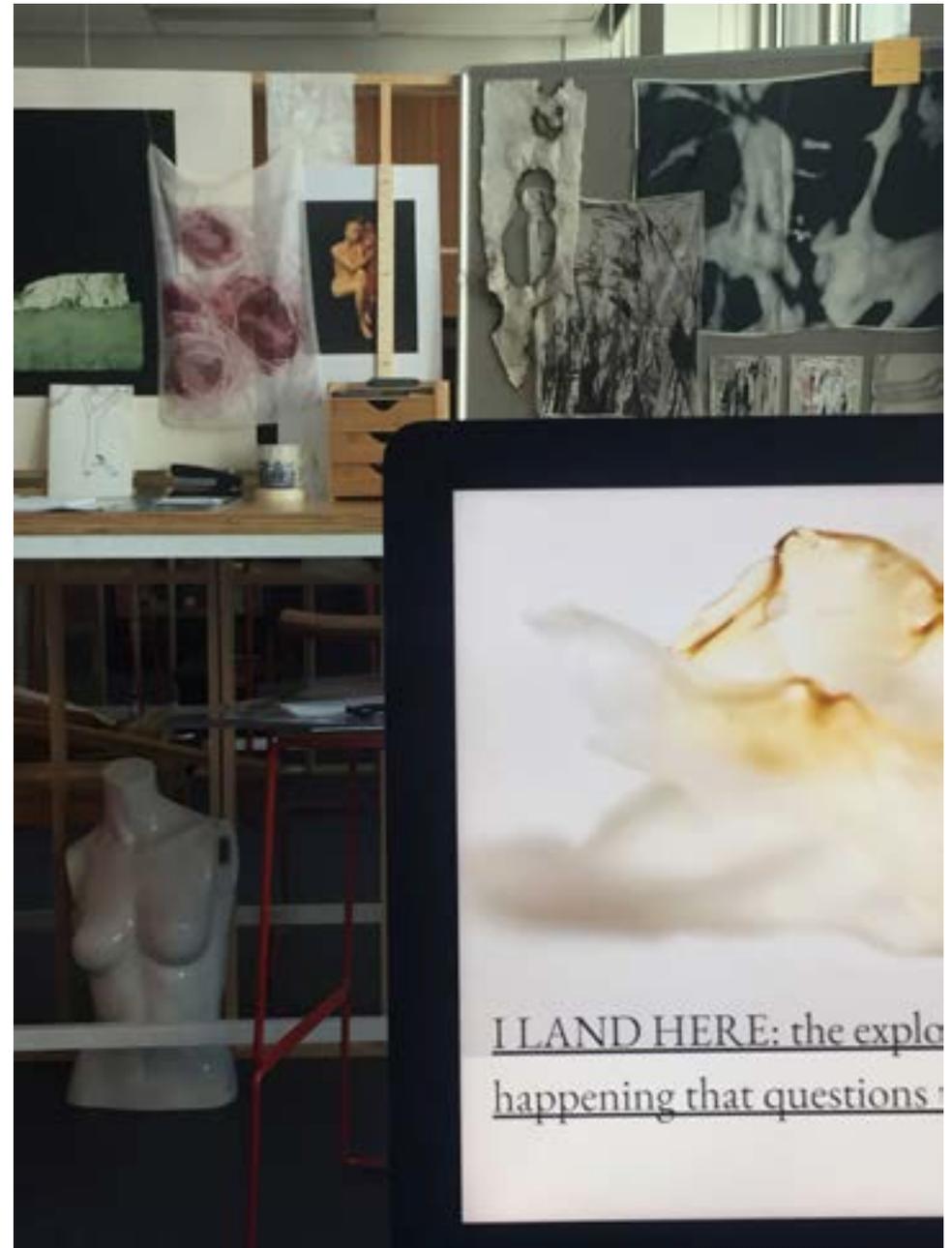
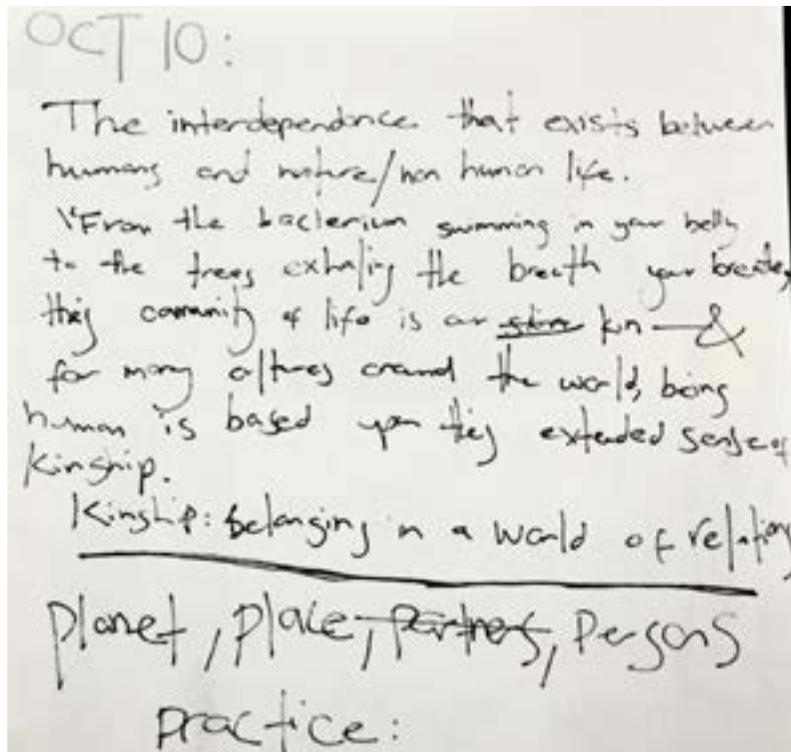


Figure 12. AUGUSTA, E. (2021). Studio Space: 1. photograph

In terms of *I LandHere*, worlding was an active ontological process where the self was immersed wholly within the context and materiality of the project to ‘make kin with, become-with, compose-with’ the biomaterials to facilitate a symbiotic relationship in a shared environment to explore notions of material boundaries.¹⁴



OCT 10:
The interdependence that exists between humans and nature/non human life.
From the bacterium swimming in your belly to the trees exhaling the breath you breathe, this community of life is an ~~extra~~ kin — & for many others around the world, being human is based upon this extended sense of kinship.
Kinship: belonging in a world of relation
planet, place, partners, persons
practice:

Figure 13. AUGUSTA, E. (2021). Oct 10/note. scan



Figure 14. AUGUSTA, E. (2022). Studio Space: 2. photograph

14 Donna Haraway, *Staying With The Trouble: Making Kin in the Chthulucene*, (Durham, Duke University Press, 2016), 102



Figure 15. AUGUSTA, E. (2022). Studio Space detail: 1. photograph

BioFacturing:

Influenced by the effect of *'worlding'*, perspectives of and engagement with, materials were realigned and rebalanced to be one of care, patience and curiosity. Entering the evolving world of biofabricated materials, the creation begins with the morphogenesis of matter into new forms that self-organise into bodies of fabric.¹⁵⁻¹⁶ The starch-based bioplastics and symbiotic cultures of bacteria and yeast (SCOBY) guided the experimental process. In this way, the formation of the materials was informed by matter and not designed by the maker alone.¹⁷ Which is to say that in this project, materials were not subordinate to the will of my design; rather, they were the progenitors of the forms produced. Biofabrication has emerged as a potential way forward in integrating living systems into design practices to create alternative biomaterials that can reduce the ecological impact of design processes and manufacturing.¹⁸ Cultivating and growing materials by working with symbiotic cultures generated an experimental process of trial and error whereby adaptive methods and *'making-do'* were informed by *'listening'* and responding to the materials and their reactions to our environment.

¹⁵ Suzanne Lee, "Why "biofabrication" is the next industrial revolution," February 1, 2020, 6:04, <https://youtu.be/7pMhqyR5g>

¹⁶ Neri Oxman, "Material Ecology," *Theories of the Digital in Architecture*, (2013): 1

¹⁷ Oxman, "Material Ecology," 1

¹⁸ Suzanne Lee, "Why "biofabrication" is the next industrial revolution," February 1, 2020, 10:15, <https://youtu.be/7pMhqyR5g>



Figure 16. AUGUSTA, E. (2022). S.C.O.B.Y /Body. photograph

Adaptations included noticing the effect heat would have on the drying process of the bioplastics or how weather and temperatures would affect the fermentation of the SCOBY and making the necessary changes to the environment we were working in together. With this notion of creating and becoming *with* the biomaterials in a shared environment enhanced by active *worlding*, we can acknowledge the interplay of agency that occurs when the maker, the material and the environment are engaged in a dynamic, ongoing conversation.¹⁹

During the completion of this research project, Covid19 lock-downs restricted access to technological equipment; however, the restrictions did offer an opportunity to investigate a low-tech approach to cultivating biofabricated materials. In the pursuit of these experimental material ‘lands’, I used adapted common tools and ingredients and consulted public online resources, including; the *Bioplastic Cook Book* by Margaret Dunne, *Recipes for Material Activism* by Miriam Ribul, and the *Kombucha Fabric Guide* by Andrea Blum, to support the exploration of alternative material-making.^{20, 21, 22}

19 Joanne Cassar, “Becoming”, *New Materials*, July 4, 2017, <https://newmaterialism.eu/almanac/body/becoming.html>

20 Margaret Dunne, *Bioplastic Cook Book: A catalogue of bioplastic recipes*, (FabTextiles: experimental digital open source culture, 2018),

<http://fabtextiles.org/bioplastic-cook-book>

21 Miriam Ribul, *Recipes for Material Activism: Part 1*, (2013), <https://www.miriamribul.com/recipes-for-material-activis2>

22 Andrea Blum, *Kombucha Fabric Guide*, (2015)

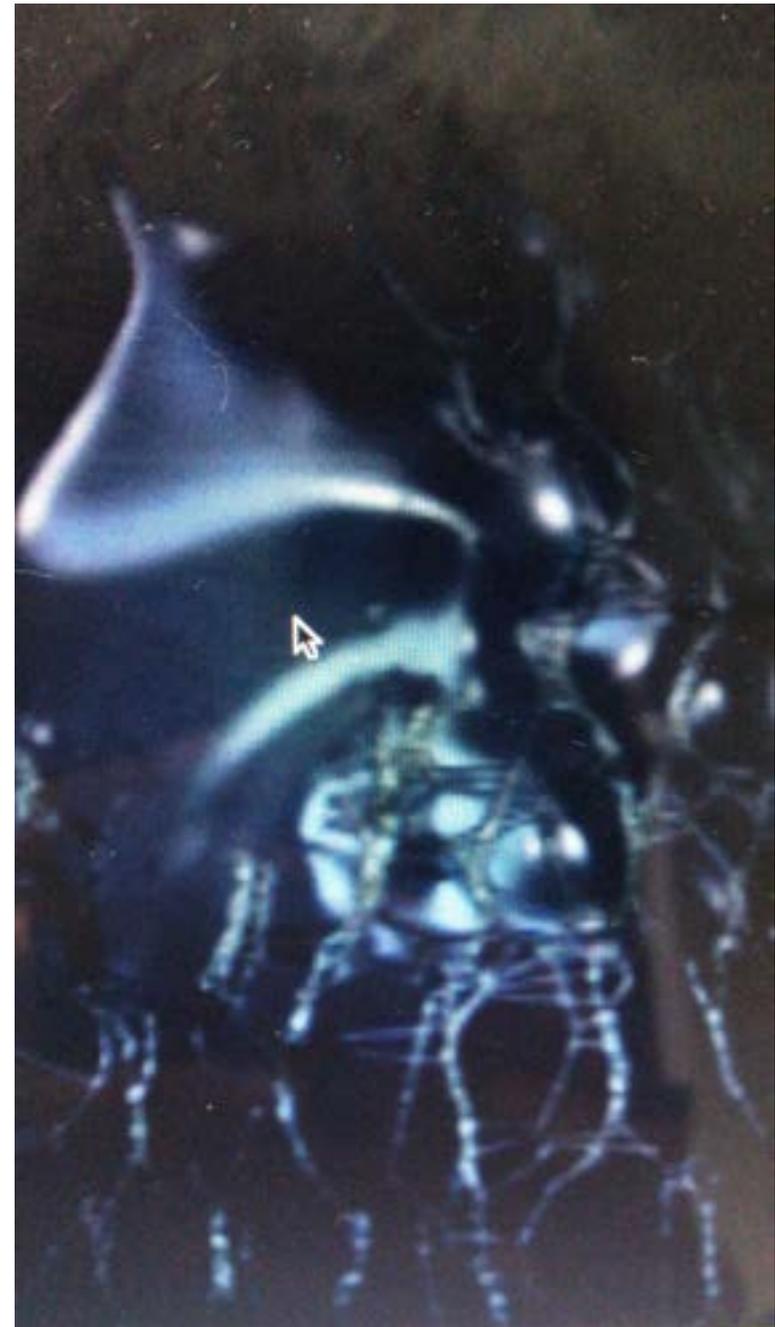


Figure 17. AUGUSTA, E. (2022). Bioplastic Digital. screenshot

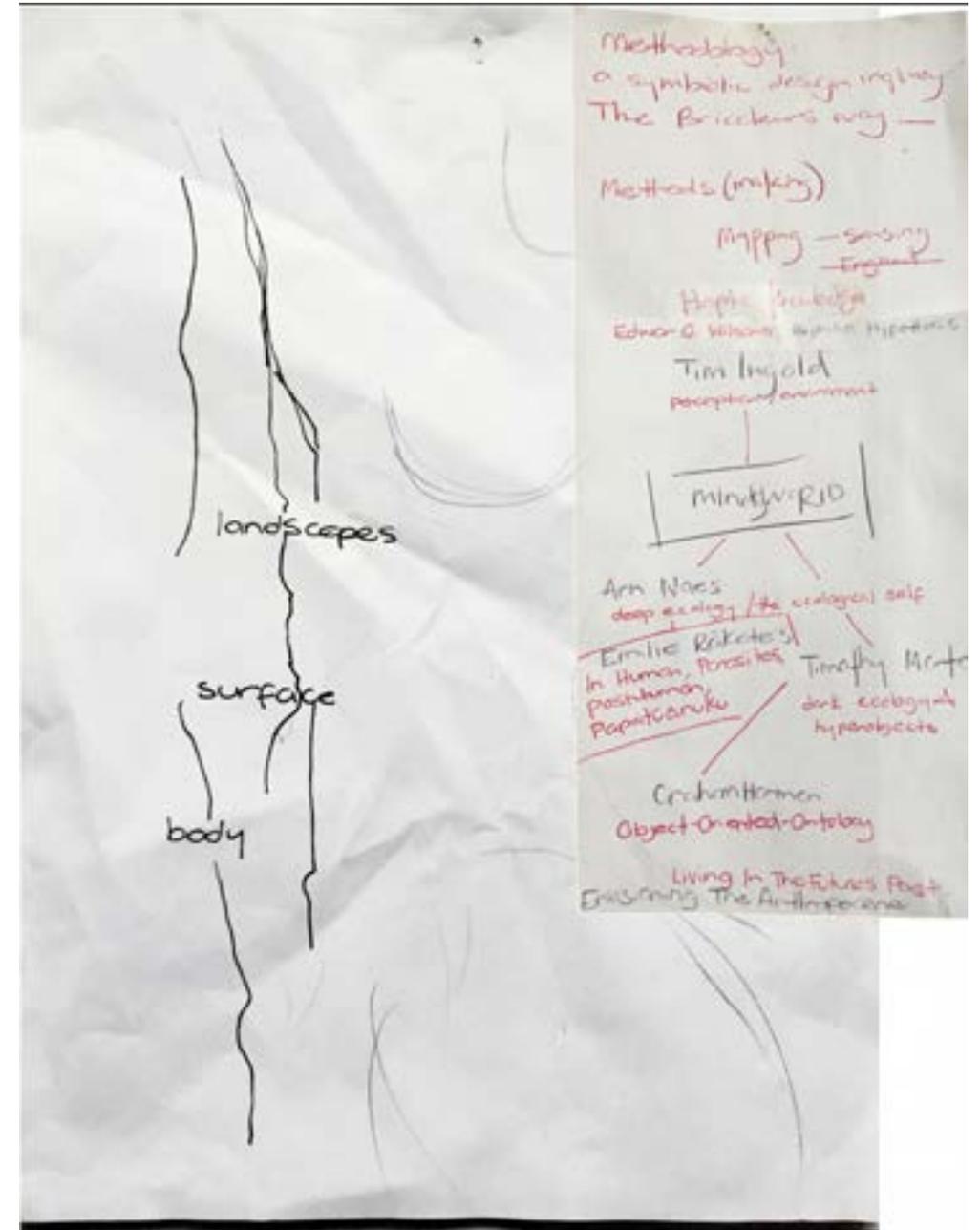


Figure 18. AUGUSTA, E. (2022). Bioplastic Samples /4. photograph

CONTEXTUAL KNOWLEDGE

In this section surrounding knowledge relevant to the project, *I Land Here*, is mapped to establish the theoretical and practical environments informing the conceptualisation of this project. This contextual inquiry investigates ecological conversations linked by what could be described as their underlying “onto-epistem-ological” frameworks, suggesting the innate interconnectedness between being and knowing in theory and practice.²³ The areas discussed trace the connections of eco-philosophical thought and ecological discourse in relation to the emerging area of symbiotic design praxis and notions of an ‘eco-logic’, interpretations of material ecocriticism and the potential of biofabrication.

With the mapping of this contextual knowledge, I was interested in building the foundations of an ecologically-oriented design ethos that would inform the progression of this project.



²³ This term was coined by Karan Barad (2007) and connects ontology and epistemology. They suggest that “Practices of knowing and being are not isolable [...] We know because we are of the world” (185)

Eco-philosophical thought:

Eco-philosophy (Ecosophy) is the practice of reviewing our thinking within an ecological framework to enable the re-evaluation of where the line between human and nonhuman, self and other, is drawn and to question its form.²⁴ In this way, eco-philosophy augments the relational environments in which our sense of self is woven. It is a way of thinking that acknowledges the foundational interconnectedness of everything and senses the entanglement of being that occurs beyond our physical 'knowing'. With this perspective of eco-philosophical inquiry, I developed a dualistic process of thinking past and present, reflection (thought) and response (action). I was simultaneously reflecting on the experience of walking the Te Araroa trail and the emotions it engendered whilst responding to the present and engaging with the biomaterials as metaphysical 'lands' of ecological imaginings. An eco-philosophical perspective acknowledges an interrelated ecosystem where three ecologies, the environment, the social and human consciousness, are inextricably connected, prompting discussions between environment and philosophy.²⁵ Within eco-philosophy, environmental issues are recognised as a result of the evolution of society disconnected from the natural world in its political, social, economic and educational forms.²⁶

²⁴ Simon Levesque, "Two versions of ecosophy: Arne Næss, Félix Guattari, and their connection with semiotics," *Sign Systems Studies*, (December, 2016): 512

²⁵ Félix Guattari, "Remaking Social Practices," in *The Guattari Reader* (Blackwell: 1996), 264

²⁶ Guattari, "Remaking Social Practices," 265-266



Figure 20. AUGUSTA, E. (2021). *Reflecting-Self*: Ohai, Southland. March 2021. TA archive

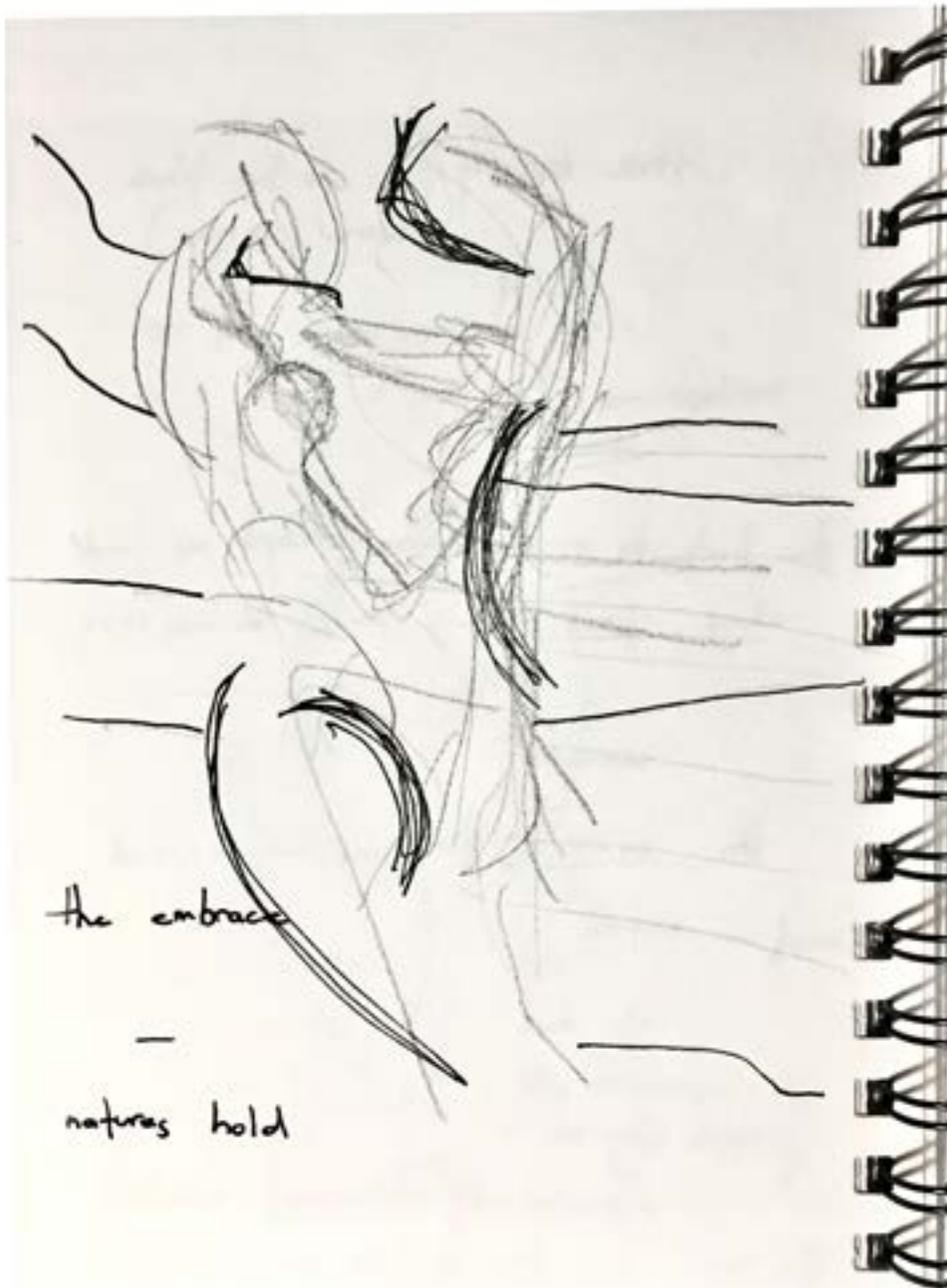


Figure 21. AUGUSTA, E. (2022). Line drawing: The Embrace. scan

In this way, it is possible to understand that eco-philosophy is more than a reflection of ecology and human perception; it is a search for environmental action. It is not possible to continue to disassociate the environment's condition from human existence on earth. In the book "Symbiotic Planet: A New Look at Evolution," Lynn Margulis introduced the perspective that evolutionary theory does not need and shouldn't focus on competition and separatist notions.²⁷ Rather, she emphasises the collaboration and co-evolution of different species as crucial to the origins of evolution. *'Symbiosis can be defined as the living together of two or more organisms in close association.'*²⁸ When Margulis first proposed the notion in 1967 that symbiosis was a key generator of evolution, she was ridiculed as it went against the accepted mechanistic view that life evolved through random genetic mutations and competition. Margulis' symbiotic narrative and the Gaia hypothesis, which says all life is interconnected and interdependent, argued against the predominant, human-centric worldview that has led to the climate crisis: Humans are deluded in thinking they control the planet.²⁹ They are merely a part of a complex cognitive system in which all actions and reactions, both human and non-human, are deeply interconnected.³⁰

²⁷ Lynn Margulis, *Symbiotic Planet: A New Look At Evolution*, (New York, Basic Books, 2008), 2-3

²⁸ Lynn Margulis, "Symbiosis and Evolution," *Scientific American*, 225, No. 2 (August 1971), 49

²⁹ *The Gaia Hypothesis*, proposed by James Lovelock in 1972, suggests that all living organisms and their inorganic surroundings on Earth are integrated to form a synergetic and self-regulating system to maintain the conditions for life on this planet.

³⁰ Sébastien Dubreuil, "James Lovelock's Gaia hypothesis: A New Look at Life on Earth..."
Dreamers, Visionaries, and Revolutionaries in the Life Sciences, (August, 2018): 272-287



Figure 22. AUGUSTA, E. (2021). *Perception Turned*: CDC, Southland. March 2021. TA archive

Philosopher and ecologist Timothy Morton describes humans' inseparable connection and participation in the context of the wider ecosphere as the *symbiotic real*. Morton asserts that ecological awareness must begin by realising that beings are interconnected and that this ecological relationship can best be described in terms of symbiosis, which implies an inseparable and non-hierarchical relationship between humans and nonhumans.

Anthropologist Tim Ingold, in his book *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill*, poses the question as to “what it means for human beings - at once organisms and persons - to *inhabit* an environment.”³¹ Similar to the concept of the *symbiotic real*, he suggests “there can be no organism without an environment and no environment without an organism.”³² He asserts that humans are in active engagement with the constituents of their surroundings and that there should be no distinction between environment and nature. To distinguish between the world we live in and “the natural environment” is to somehow imagine ourselves to be beyond, as opposed to a part of, the environment that is a continual part of our lives; continually shaping us as we shape it.³³

³¹ Tim Ingold, *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill*. (Routledge, 2000), 2
³² Ingold, *The Perception of the Environment*, 20
³³ *Ibid.* 20

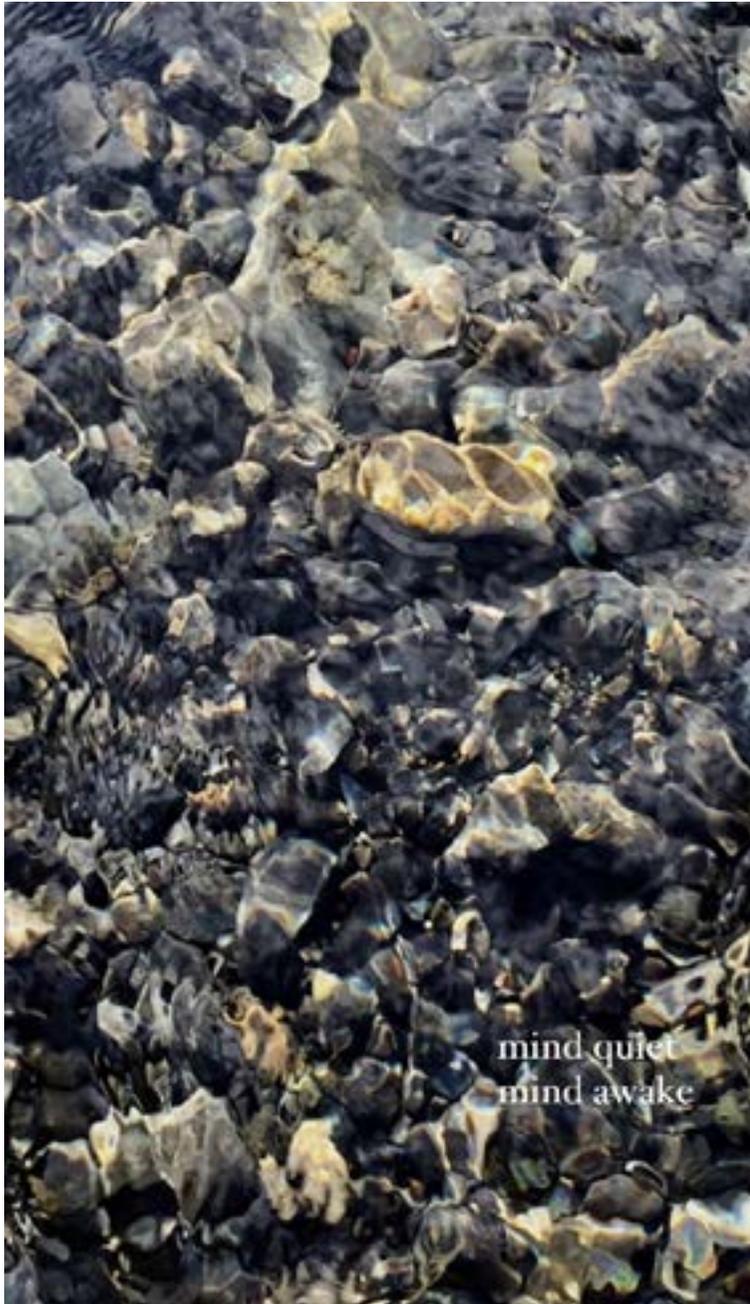


Figure 23. AUGUSTA, E. (2021). Mind Quiet - Mind Awake: Tarapuhi /Arthur's Pass. February 2021. TA archive

Emilie Rākete further explores the symbiotic relationship of living organisms, in her 2016 essay, *In Human: Parasites, Posthumanism and Papatūānuku*, with her analogy of a squashed insect between her fingers and the “horror” of seeing her blood seep from its body. She questions the borders between the subject and object, or rather, questions the illusions of being an individual subject with bounded, inviolable borders. As Rākete says, “*the self is an environment, and conversely, the environment is a self. I am not (only) in me but in everything with which I share whakapapa.*”³⁴

The eco-philosophical reflections expressed by Morton, Ingold and Rākete influenced my thinking around the potential fragility of material boundaries. The parasite is an example of where these boundaries become blurred, and bodies merge into one.³⁵ Morton, too, asks, “Am I simply a vehicle for numerous bacteria that inhabit my microbiome? Or are they hosting me?”³⁶ We do not live within a static environment. *We all* create the environments within which other beings thrive. The parasite obscures the boundaries of constructed borders as our bodies are opened to a deeper understanding of our interconnectivity, towards a conception of the self as ecology.

³⁴ Emilie Rākete, “In Human: Parasites, Posthuman, Papatūānuku,” *Potentially Yours, The Coming Community*, (November 2016): 2

³⁵ Rākete, “In Human: Parasites, Posthuman, Papatūānuku.” 2

³⁶ Timothy Morton, *Humankind: Solidarity with Non-Human People* (Brooklyn: Verso Books, 2017), 6

As I stood at the mouth of a valley of hills, I felt myself disappearing into the landscape. Engulfed by the hills, I was a speck of dust - my arms stretched, *embracing, reaching... letting go* as I became the land.

Not of the land but the land itself - a part of the environment, a function of the ecology.

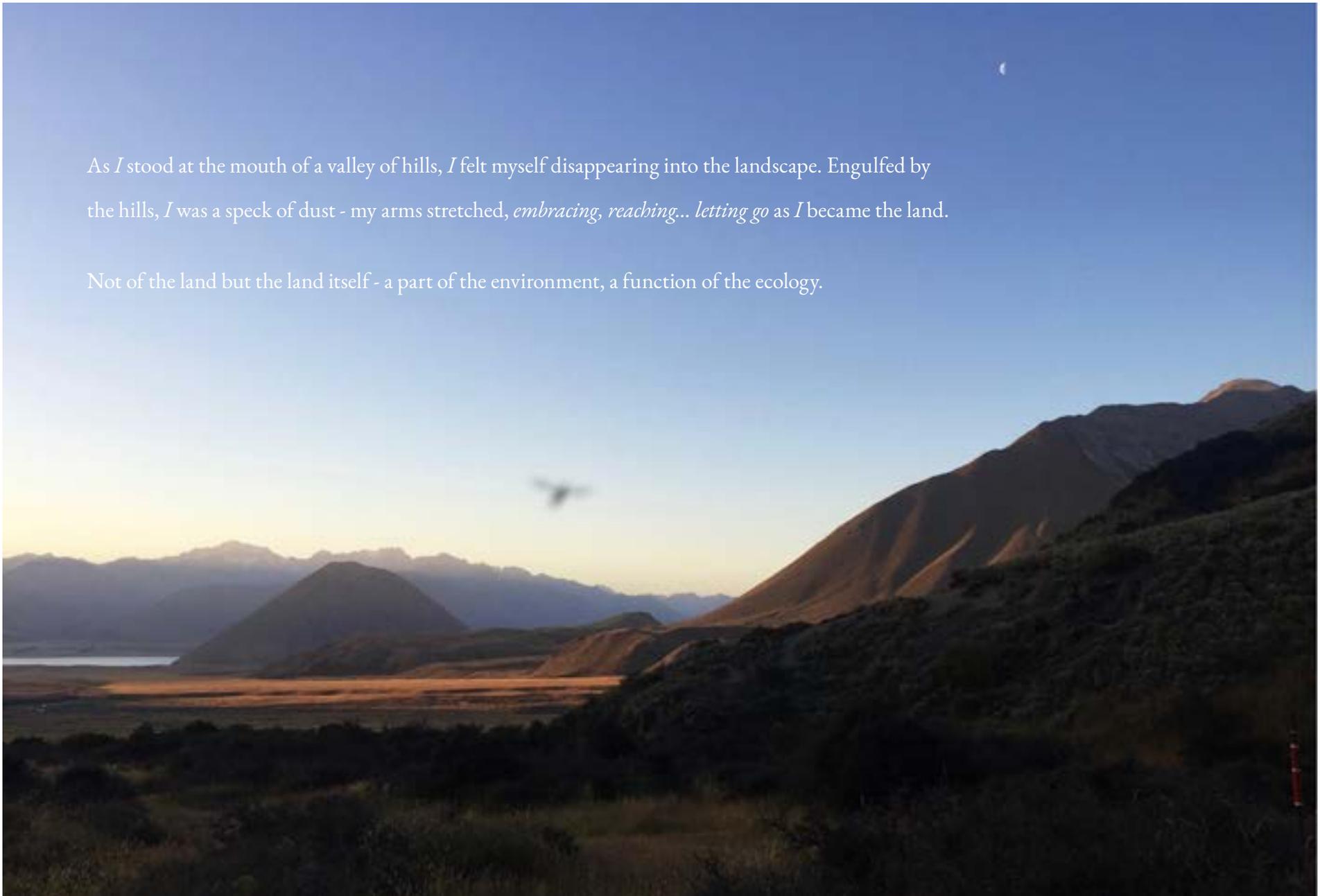


Figure 24. AUGUSTA, E. (2021). A Bird flies towards the crescent moon: Double Hill. February 2021. TA archive

This burgeoning conversation of the symbiotic realm within eco-philosophical thought provided the theoretical framework for my autoethnographic inquiry, allowing me to reflect on the interconnectivity of thought and practice. The work of Agnes Denes, whose notion of an ‘eco-logic’ brings together philosophical concepts and ecological concerns through her art practice, explores the importance of ecological thinking through ‘exercises’ of site-specific sculptural artworks, drawings and writings of ecological orientation.³⁷ (Fig. 25) This idea of an *eco-logic* in practice as an ‘exercise’ of thinking through ideas seemed relevant to the process of ecologically-orientated design as it requires a slowed process of considered and reflective thought. This consideration of ecological concerns realised through creative practice is also evident in emerging notions of symbiotic design, which expands on ecological thinking-through-practice as designing within the ‘symbiotic real’. This emerging eco-pedagogical strategy of symbiotic design facilitates nature-based experiences and behaviour change toward an ecologically conscious design ethos which could be described as becoming within the living world.^{38,39} This metamorphic concept re-establishes the role of the designer within the symbiotic real where the designer’s intention is oriented toward ecological awareness and understanding of the

37 Agnes Denes, “Notes on Eco-Logic: Environmental Artwork, Visual Philosophy and Global Perspective,”

Leonardo 26, no. 5 (1993): 388.

38 David Sánchez Ruano, “Symbiotic Design Practice: Designing with-in nature” (PhD Thesis, University of

Dundee, 2016), 29-30 [10.13140/RG.2.2.36192.23046](https://doi.org/10.13140/RG.2.2.36192.23046)

39 Ruano, “Symbiotic Design Practice, 64,70

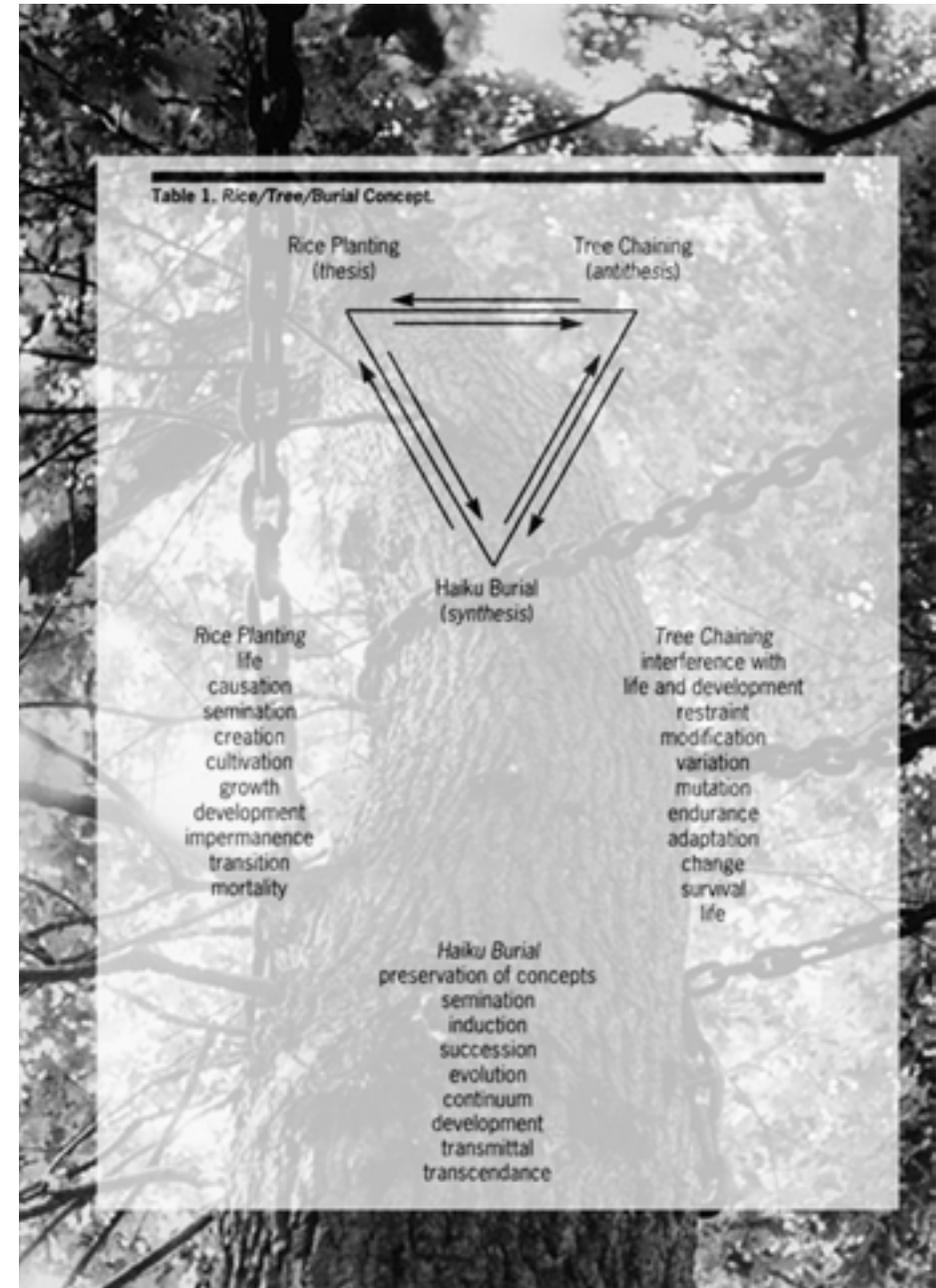


Figure 25. AUGUSTA, E. (2022). Agnes Denes / “Rice/Tree/Burial Project”: 1969. digital collage

interrelationship of mind and matter, enabling symbiotic consciousness to emerge, changing one's perceptions and putting environmental concerns at the forefront of practice. By implementing the biological concept of symbiosis into design practice, creative processes and principles are re-defined and re-imagined towards a more eco-conscious conception. Both the notion of 'eco-logic' and symbiotic design proposes an ecologically-conscious design ethos drawn from eco-philosophical thought. Reflecting on these notions, I have recognised symbiotic design as having the potential to engage eco-philosophical perspectives and ground the intention of my creative practice within the *symbiotic real*.

We are all 'surviving', crawling on the surface of a larger body. Everything exists in relation to everything else - this is the '*symbiotic real*'.

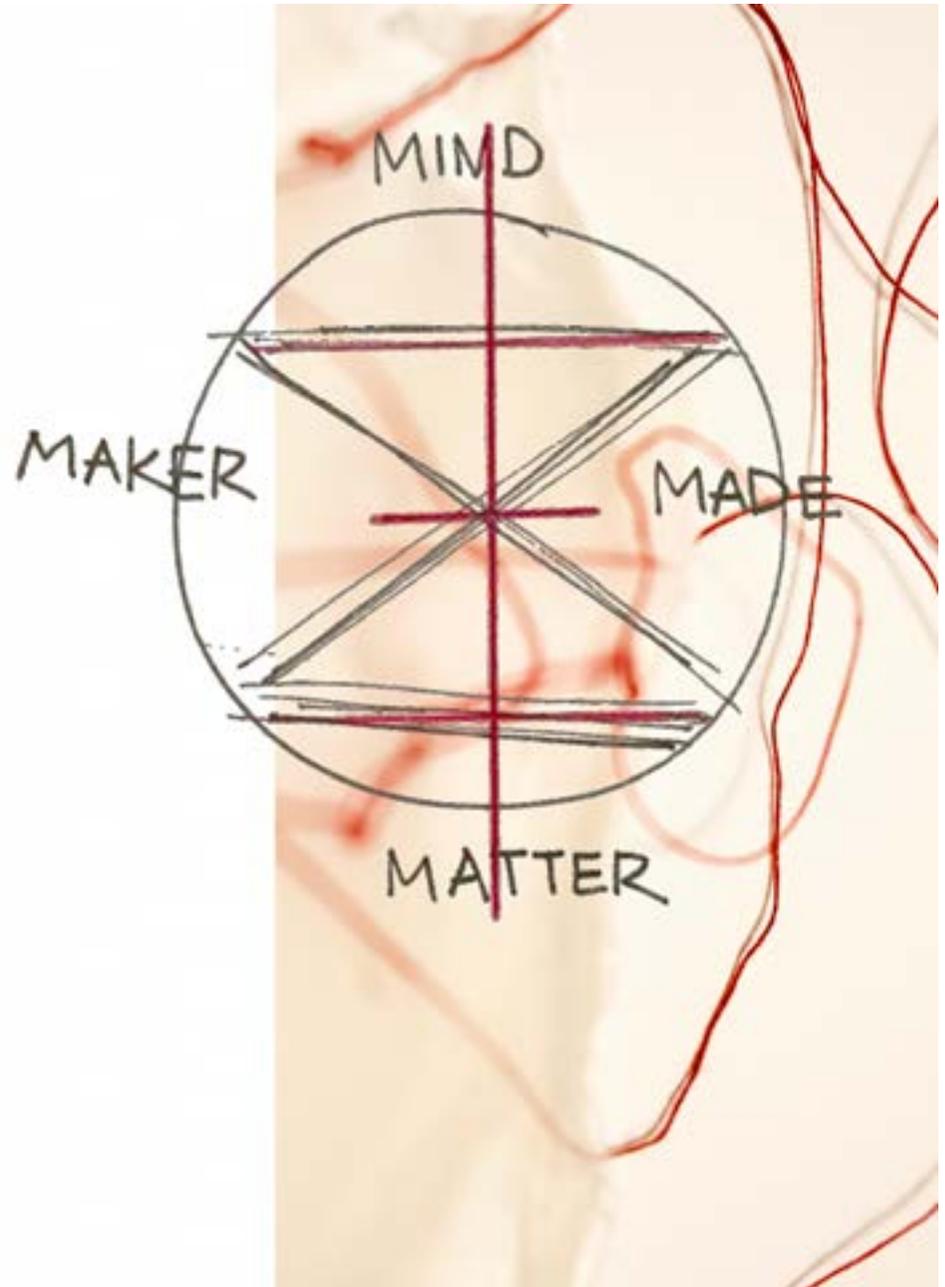


Figure 26. AUGUSTA, E. (2022). /Maker /Made /Mind /Matter. collage

Material ecocriticism:

On the periphery of these eco-philosophical wanderings is the proliferation of academic discourse on ‘new materialism’, which postulates a ‘turn to matter’ as an essential paradigm shift for environmental inquiry.⁴⁰ Matter is addressed in ‘new materialism’ in an open and complex manner, cutting across dualistic boundaries of the social and natural worlds.⁴¹

Situated within the new materialist paradigm, *material ecocriticism* emerges from a re-consideration of concepts such as agency, narrativity, and discursivity.⁴² As a philosophy, it seeks to orientate humans toward a post-anthropocentric discourse, leading to a more integrated view of social, environmental and political practices where “ethical relations extend to the other-than-human” According to material ecocriticism, there are two ways of interpreting the agency of matter; the first is focused on how the agentic capacities of the nonhuman matter are represented and described in the text, be it in cultural, literary or visual form.

40 Diana Coole and Samantha Frost. “Introducing the New Materialisms,” In *New Materialisms: Ontology, Agency, and Politics* (Duke University Press, 2010), 1-44

41 Nick J. Fox and Pam Alldred, “New materialist social inquiry: designs, methods and the research-assemblage,” *International Journal of Social Research Methodology*, 18:4, (June 6 2014): 400

42 Serpil Oppermann, “Material Ecocriticism and the Creativity of Storied Matter,” *Frame: Journal of Literary Studies*, no.26 (November 2013): 55



Figure 27. AUGUSTA, E. (2022). S.C.O.B.Y /Balance 1. photograph

The second explores the narrative powers of matter and its ability to embody meaning intertwined with humans' lives, forming a process of co-emerging interaction.⁴³ 44 In my practice, I have considered both interpretations of this agentic matter, where the material 'lands' are conceived both as a visual text and a dynamic embodiment of symbiotic relations.

Ane Graff is a contemporary artist-researcher based in Oslo, whose process-orientated practice is an example of this consideration of re-thinking material realities through practice. The interplay of living organisms is an essential component in her work where the view of the human is "as part of an expansive, material network, stretching inside and outside of our bodies".⁴⁵ Graff sees the material bodies in her work as a part of an ongoing material experiment, entangled in the emergence of new bodily states.⁴⁶ Similar to my questioning of material boundaries, her practice reflects on assumptions of *fixed identities, solid objects, and discrete entities*.⁴⁷ In the exploration of dissolving these perceptions of individual material bodies, we have both considered the narrative agency of matter, coming into existence through the ongoing and entangled interplay between the human and non-human material processes.

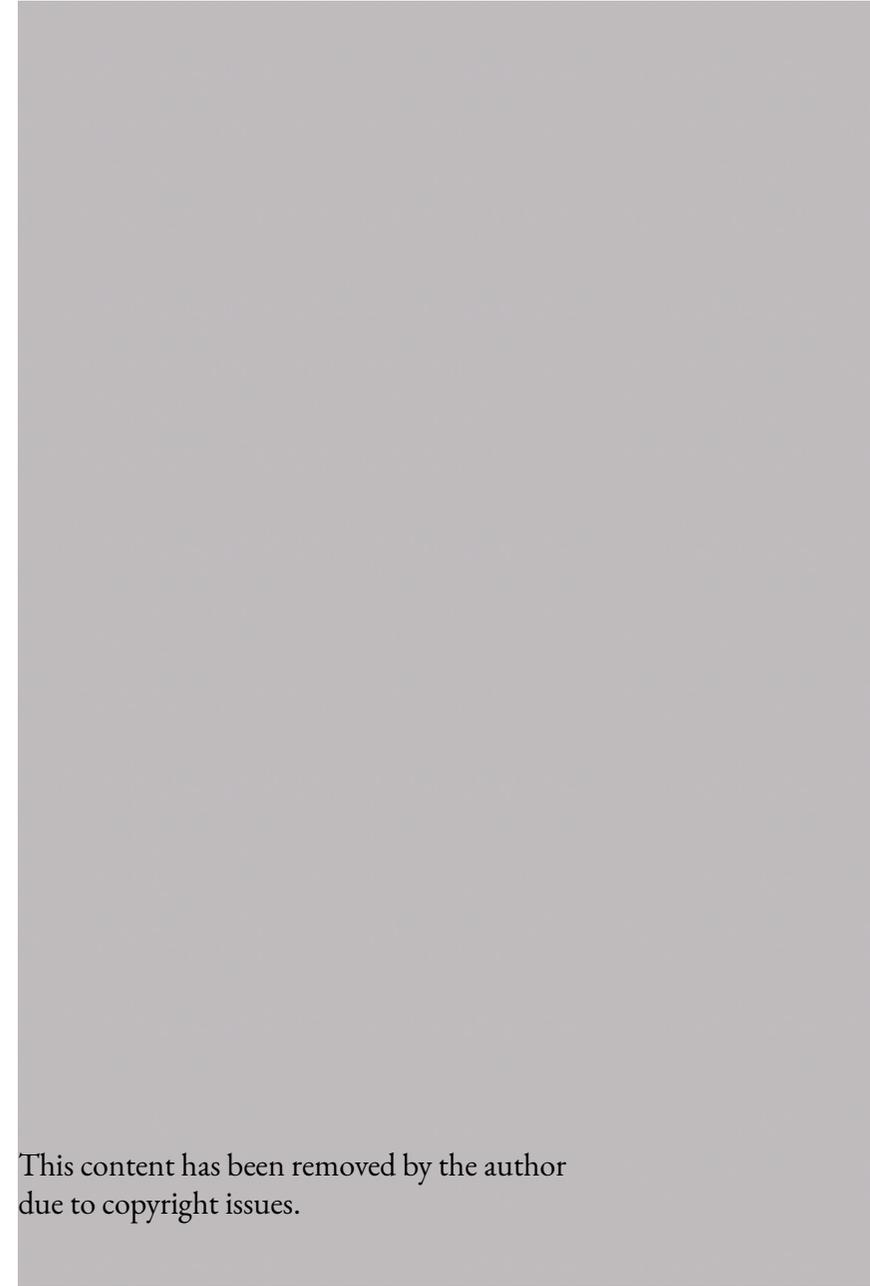
43 Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Duke University Press, 2007), 392

44 Serenella Iovino and Serpil Oppermann, "Material Ecocriticism: Materiality, Agency, and Models of Narrativity," *Ecozon@: European Journal of Literature, Culture and Environment* 3, no. 1 (March 2012): 79-85

45 Ane Graff, "Portfolio", (March 2022): 1

46 Graff, 1

47 Ibid, 65



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Figure 21. Graff, Ane. There Are Others Here With Me: The Cardiovascular System, mixed-media installation, 2020, (OSL, Contemporary, Oslo)



Figure 29. AUGUSTA, E. (2022). S.C.O.B.Y /Balance 2. photograph

Graff states that it is “vital to bring awareness to the interconnectivity of the physical world, and to how all material bodies are affected by what they encounter [...] as all matter can be seen as the realisation of relationships.”⁴⁸

In foregrounding this understanding of material agency and narrativity, our understanding of matter is questioned, and discourse emerges around material expressions embodying notions of our interconnected existence. This concept of the enmeshment of matter and discourse is based on the understanding that interconnections between entities form the basis of life, which Karan Barad—a key figure of the new materials discourse—refers to as a dynamic process of ‘intra-activity’.⁴⁹ Barad maintains that reality is an entanglement of material and discursive processes.⁵⁰ From this perspective, ‘matter’ is not passive or immutable but rather “a congealing of agency”.⁵¹ Matter, Barad asserts, is not fixed, “nor the mere end result of different processes. Matter is produced and productive, generated and generative.”⁵² Based on this premise, Barad is offering an onto-epistemological view of reality, that is, “an ongoing open process of mattering through which ‘mattering’ itself acquires meaning and form in the realisation of different

⁴⁸ Ibid, 65

⁴⁹ Karen Barad, “Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter,” *Signs: Journal of Women in Culture and Society* 28, no. 3 (March 2003): 818

⁵⁰ Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Duke University Press, 2007), 142

⁵¹ Barad, *Meeting the Universe Halfway*, 210

⁵² Ibid, 137



Figure 30. AUGUSTA, E. (2022). S.C.O.B.Y /Balance 3. photograph

agential possibilities”.⁵³ In this way, notions of material boundaries become open and unbound, facilitating new understandings of the discursive interplay between the maker and the made. *Mapping* this ecological conversation, the process of ‘worlding’ can be used to conceptualise the interplay of symbiotic relations. Within my understanding of material ecocriticism, I interacted with materials as a relational being. The formation of the material ‘lands’ of this project are realised as discursive reflections of an ongoing process of human-non-human intra-activity. In order to be present in the process of *becoming with*, it was necessary to engage and acknowledge the agential powers of matter(ing). Within this symbiosis of mind and matter, the imaginative and generative are enmeshed and entangled; ‘worlding’ a conception of new material ‘lands’.

53 Karen Barad, “Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter,” *Signs: Journal of Women in Culture and Society* 28, no. 3 (March 2003): 817

Biofabrication:

In modern design, machine-based textile manufacturing and mass production has seen a growing separation between form and matter.⁵⁴ Design processes have become independent and separated from the knowledge of material sources.⁵⁵ In this way, contemporary design has seen materiality become an agency secondary to the consideration of form. This secularisation of form generation and the perversion of the material realm limits innovation and the creative process. The maker and the made are detached from ecological perspectives and environmental influence, consequently broadening the divide between matter and form and perpetuating the designer's role in the ecological crisis.⁵⁶ However, with growing recognition of the need for change in design practices, manufacturing and education, design culture is witnessing a renaissance of ecologically aware processes and craft. Over the past decade of growing environmental concern and consideration, a new body of knowledge has been emerging across all design disciplines that looks to a partnership with the living world "to design and biofabricate a new material world that moves away from exploitation of nonrenewable life to working with original, renewable life."^{57, 58}

⁵⁴ Neri Oxman, "Material Ecology," *Theories of the Digital in Architecture*, (2013): 1-2

⁵⁵ Richard Sennett, *The Craftsman Book*, (Yale University Press, 2008)

⁵⁶ Oxman, "Material Ecology," 2

⁵⁷ Fabrizio Cashin and Idil Gaziulusoy, "Evolution of design for sustainability: From product design to design for system innovations and transitions," *Design Studies* 47 (November 2016): 118-142

⁵⁸ Suzanne Lee, "Why "biofabrication" is the next industrial revolution," February 1, 2020, 9:50, <https://youtu.be/7pMhqyteR5g>



Figure 31. AUGUSTA, E. (2022). S.C.O.B.Y /Glass Bowl. photograph

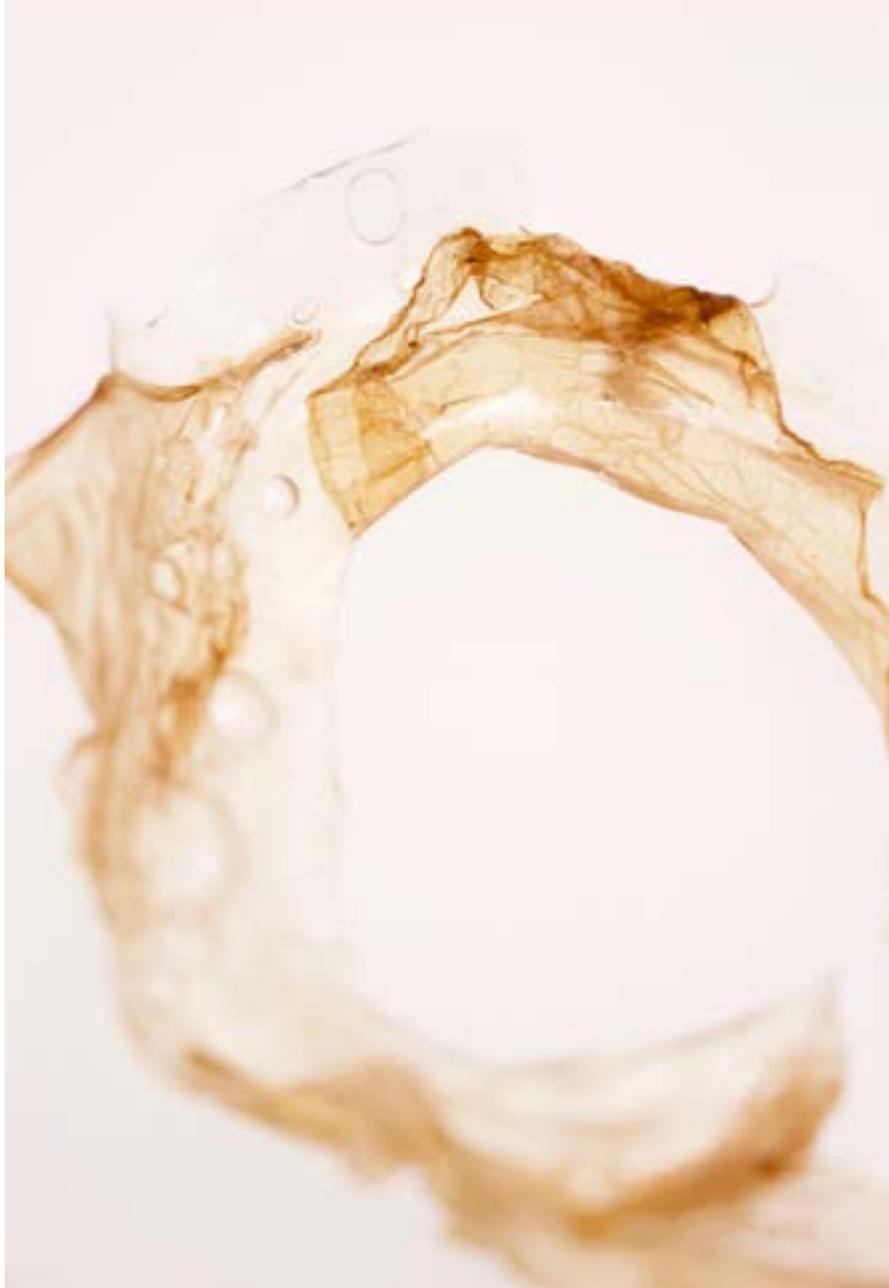


Figure 32. AUGUSTA, E. (2022). S.C.O.B.Y /EX17. photograph

In the same way that manufacturing is essentially manmade, biofabrication is making with biology. Instead of producing consumer materials with plants, animals or oil, living organisms are growing materials that use less land, less water, less energy, less manpower and generate less waste. Bacteria, algae, fungi, and yeast are the factories of the next industrial revolution.⁵⁹ Living cells ferment to form self-organised bodies of biomaterial, which then can be used across different areas of production, including architecture, furniture, fashion, product and textile.

⁵⁹ Suzanne Lee, "Why "biofabrication" is the next industrial revolution," February 1, 2020, 1:41, <https://youtu.be/7pMhqteR5g>



Unlike conventional textile design practices, where a designer works with a material and applies various techniques to produce a particular pattern, biofabrication of materials results in morphogenesis of the material as it grows. The biofabricated material's agency works to produce its own patterns with no intervention from the designer other than the initial conditions for growth.⁶⁰ The designer then needs to engage with this living system in a more symbiotic way that asks them to consider new design perspectives around the boundaries of materiality. Suzanne Lee, a biomaterial pioneer, has been exploring the use of living cultures of microorganisms (yeast and bacteria) to grow biomaterial like cellulose into sustainable, compostable clothing. (Fig. 33)

Lee established a research protocol to harness bacterial cellulosic material and produce a leather-like range of fabrics and argues that there is no choice but to "biofabricate our future".⁶¹ Biofabrication expands the notion of material boundaries as instead of designing out life, the maker is required to design with it and for it, through a symbiotic design approach.

⁶⁰ Carole Collet, "Designing our future bio-materiality," *AI & Society*, 36, no. 4 (September, 2020): 1336

⁶¹ Suzanne Lee, "Why 'biofabrication' is the next industrial revolution," February 1, 2020, 11:25,

<https://youtu.be/7pMhqyteR5g>

Figure 33. Lee, Suzanne. BioCouture: sleeve detail image, bacterial cellulose, 2010, (London, Science Museum)



Figure 34. AUGUSTA, E. (2022). Bacterial-skin sample. photograph

DOCUMENTATION OF PROCESS

I began this project seeking a way to establish a textile design practice orientated towards ecological concern, which would involve a better understanding of the precarious interconnections of earth's life forms.

The questioning began whilst I was walking the length of Aotearoa, roaming from place to place, following an invisible line along the Te Araroa trail (*the long pathway*). This section charts the development of ideas and the investigation of theoretical research undertaken to immerse myself in a world of reflexive experimental biofabrication. The aim of this research was to discover how a symbiotic design approach could engage ecological conversations and expand notions of material boundaries through an experimental process of biofabrication as a medium for exploring eco-philosophy. The unfolding of the mind's-world took place during my physical and mental wanderings leading to interconnections between the ideation process, contextual knowledge and the exploration of biofabrication. Writing the exegesis exploited autoethnographic journaling as the source for the "imaginative logic of discovery", reflected upon within the *'worlding'* of this project.⁶²

⁶² Michael Taussig, *I Swear I Saw This: Drawings In Fieldwork Notebooks, Namely My Own* (Chicago IL: University of Chicago Press, 2011), 11

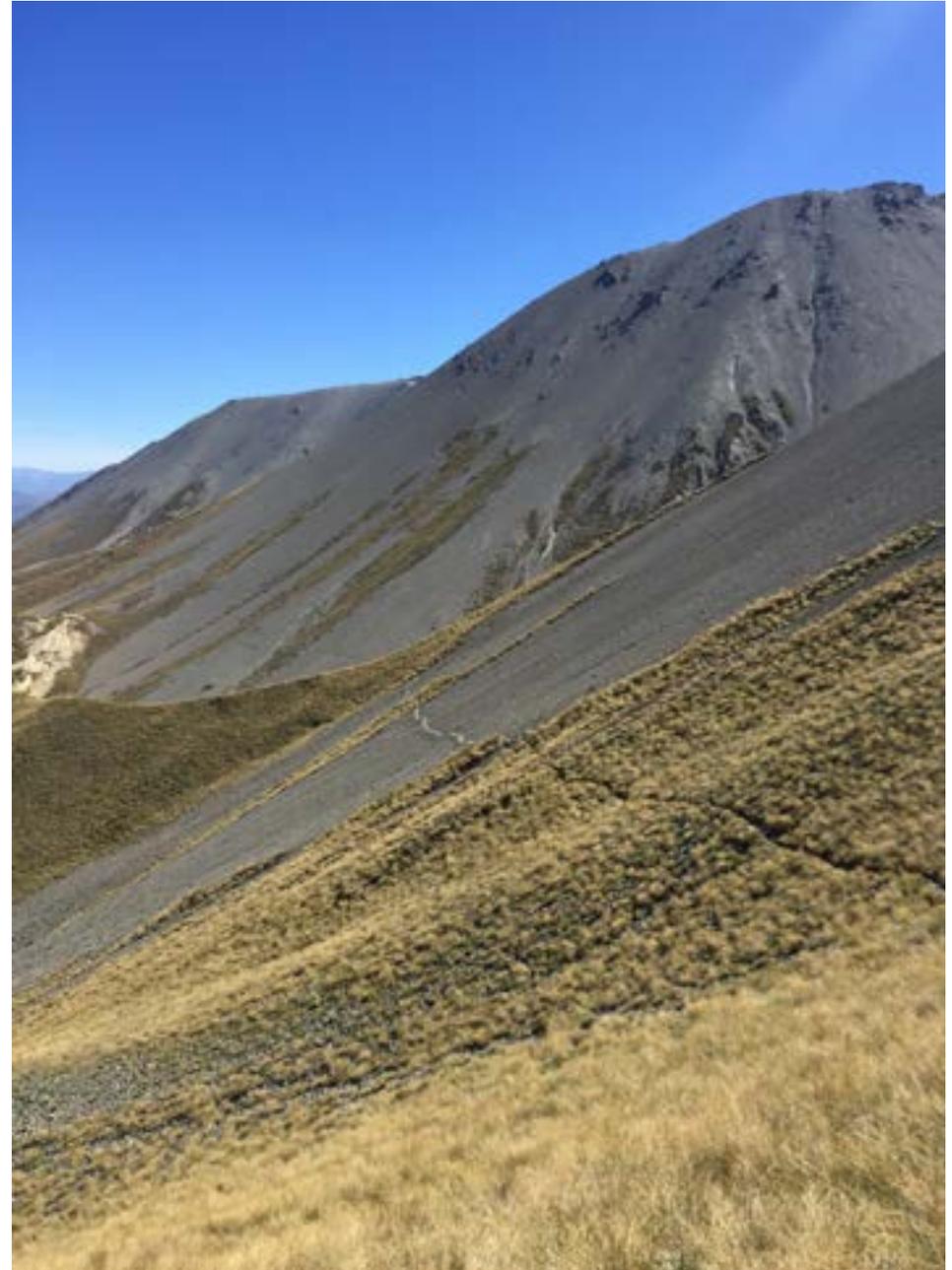


Figure 35. AUGUSTA, E. (2021). "A Line Made by Walking": Double Hill. February 2021. TA archive 33

Guided by a material ecocritical perspective, this project considers materiality as relational and process-oriented, characterised by an interplay of human and nonhuman agency. *I/Land/Here* is not about solving a problem by producing a product-based solution but rather exploring material narrativity to embody reflective eco-philosophical thought, questioning the material boundaries of human-non-human coexistence. Positioning the maker as a meeting place contained within a larger system, the material 'lands' are entangled within a discursive interplay of co-creation both conceptually and materially.

There is no separation between the maker and the made, as symbiotic morphing occurs through the formation of biofabricated materials.



Figure 36. AUGUSTA, E. (2022). S.C.O.B.Y /sample 1. photograph

IMAGINATIVE LOGIC of DISCOVERY



Figure 37. AUGUSTA, E. (2022). Markings: Symbiosis and Self. collage

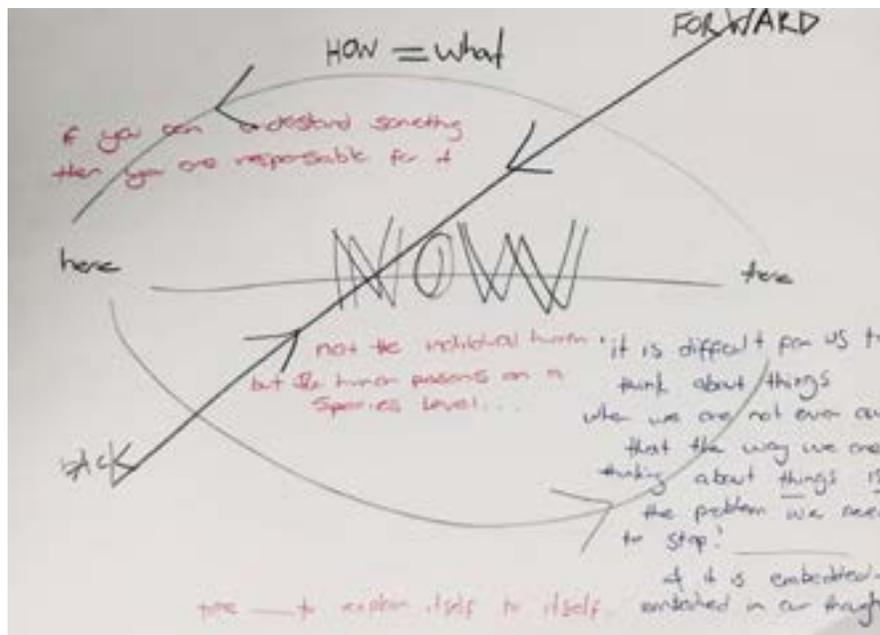
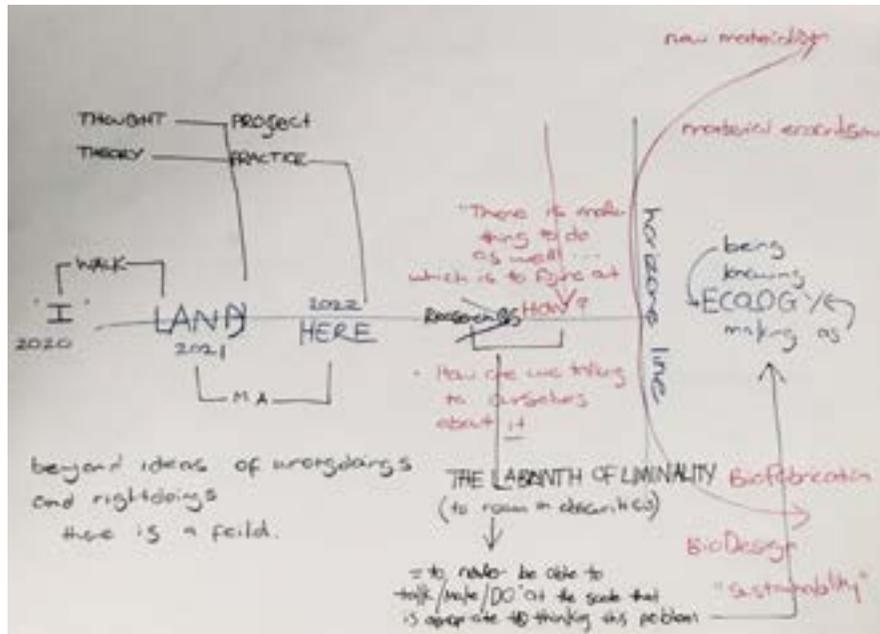


Figure 38. AUGUSTA, E. (2022). Mapping Thought. scan

To begin at a place of reflection, I looked back at my journal from my time spent on the Te Araroa trail, reflecting on my mental and physical journey chronicled through diary entries, notes, photos and sketches and exploring the beginnings of the eco-philosophical thought that the trail engendered within me. From my reflections in notes, drawings and annotations, I created mappings of thought that would then be placed on the walls of my studio, with key information being logged in a digital journal that I updated monthly. (Fig. 38) Following this line of thought, I also began adding to my maps the contextual knowledge drawn from theorists, philosophers, artists and designers whose work and thinking informed the expansive web of ecological discourse now occurring with urgency across many different disciplines.

This process of unravelling the mind's-world from the "imaginative logic" of my journaling and connecting it to the eco-critical perspective of theorists allowed me to consider new ways of thinking about the relationship of being and making. I sought knowledge from the fields of; ecology, philosophy, anthropology, art and design. The intention of this search was to engage in current ecological conversations, both academic and non-academic, concerning the human-non-human relationship from an eco-philosophical perspective. The result was an amalgamation of reflections, theories and terminology that helped situate the foundations of my inquiry. I continued journaling and mapping ideas and

findings, seeking connections and identifying commonalities between ecological and eco-philosophical thought across an unravelling body of knowledge. Making connections between theorists and theories, some seemingly obvious, others more subtle and obscured, was a recursive process that felt central to the navigation of the eco-logical, eco-philosophical terrain that would inform the development of my research into practice. As my understanding and interpretation of the breadth of knowledge grew, I would return over and over again to readings, interviews, films, music and articles and find new understanding and perceptions each time. Although this process took time and was often strenuous, confusing and frustrating, it felt important to stick with it, “to stay with the trouble” and face the concerns because the themes of inquiry seemed urgent.⁶³ Navigating the expansive theoretical terrains of ecological discourse became my personal *Pandora’s box*, whereby the more I read, the more I engaged and the deeper I fell into a realm of ethical contemplation, confusion and contradictions. Lost in the web of thought, my mind was consumed by whispers of *trouble* it was impossible to ignore. I could no longer separate my mind’s-world from the external realities of the ecosphere as I became immersed in the ecological imaginings of this project. I went deeper, embracing the *trouble*, seeking to understand and finding an orientation towards the new material horizon of biofabrication.

63 Donna Haraway, *Staying With The Trouble: Making Kin in the Chthulucene*, (Duke University Press, 2016), 1

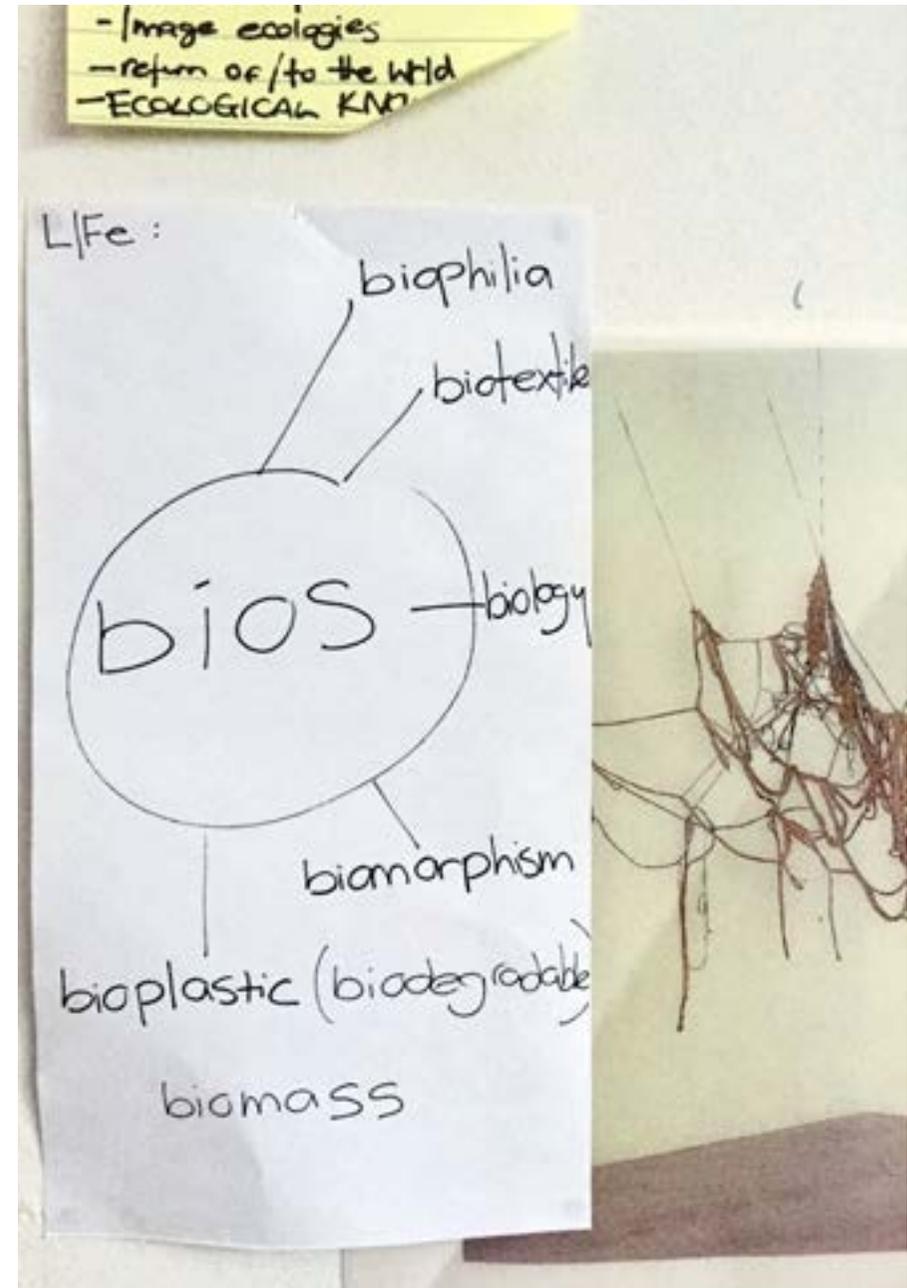


Figure 39. AUGUSTA, E. (2022). Mappings: bios. scan



Figure 40. AUGUSTA, E. (2022). Mappings: wall collage

CREATING the ENVIRONMENT



Figure 41. AUGUSTA, E. (2022). Studio Space: stare. photograph



Figure 42. AUGUSTA, E. (2022). Growth. photograph

Being immersed within the ‘world’ of this project was crucial to the development of a deeper understanding of the implications of the theories and ideas I was exploring. My studio space became a living, morphing reflection of the mind’s world. The conceptualisations and mappings of ideas grew out around me on the walls and windows as the boundaries between the internal and external worlds dissolved, and I wandered deeper into abstractions. The rearranging of the studio space was a reflection of the ongoing ecological wanderings cultivated by a merging of the material and metaphysical, subject and environment, mind and matter. The visual ‘imagination’ of my ideas for *I Land Here* became a cerebral, internalised process where elements of thought began to take shape in the form of figures and scenes that would play over in my mind like a dream or a whisper of thought spoken back to me by another voice *wandering into the ecological imaginings of the mind*. *Worlding*, as Haraway refers to it, is the co-operative coexistence of different species, technologies, knowledge and forms interacting and recognising the agency and symbiosis of organisms and things within a shared space.⁶⁴ This is not a worlding of self-creation, order or control; it is one of co-creation, exploration and intra-action. It is an ongoing process to situate the body and mind with-in the world. This entanglement is mutual as it affects the external and internal.

64 Haraway, *Staying With The Trouble*, 13

The worlding cultivated within my studio environment was not only for myself but to establish a co-creative partnership with the living organisms and biomaterials used in the exploration of material boundaries. I had to provide a suitable environment for the growth to occur so that the living organisms would form material. The studio became a space for the growth of ideas, perceptions and understanding, as well as the cultivation of biofabricated materials.

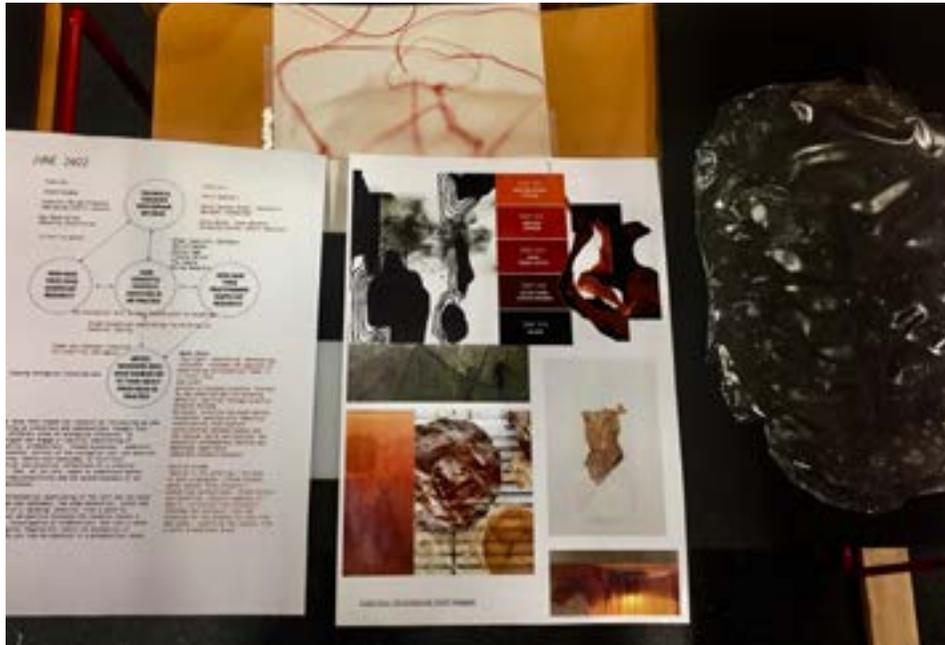


Figure 43. AUGUSTA, E. (2022). Studio Space detail: 2. photograph



Figure 44. AUGUSTA, E. (2022). Studio Space detail: 3. photograph



Figure 45. AUGUSTA, E. (2022). Studio Space detail: 4. photograph

MATERIAL EXPERIMENTATIONS



Figure 46. AUGUSTA, E. (2022). S.C.O.B.Y /sample 2. photograph



Bio-fabrication: Following the themes, I realised through the ideation process and *worlding* of this project working with bio-materials seemed to be the appropriate next step in embodying the journey from theory to practice. The investigation into the world of biofabricated materials began with agar and starch bioplastics. Using a material such as plastic, which is traditionally made from petroleum by-products, generally generates negative responses due to its effect on the environment. However, with bio-based plastics, the malleable, flexible and biodegradable material can be explored without negative environmental impacts. The bioplastic materials are formed through an active process of bringing together a combination of ingredients under heated conditions where they are stirred to form a bio-solution which, as it cools, becomes a malleable, moldable plastic material. Searching for materials that further expanded material boundaries, I began cultivating an environment conducive to the fermentation of symbiotic cultures of bacteria and yeast (SCOBY). The bioplastics were birthed by bringing together reactive ingredients, whilst the *bacterial skins* (SCOBY) were mothered in their growth. Both processes of biofabrication, albeit differently, allowed for the interplay of agency between the maker and the maker to be explored.

Figure 47. AUGUSTA, E. (2022). Bioplastic /EX5b . photograph

Bioplastics are an alternative to petroleum-based plastics made from renewable biomass resources such as agar, algae or starch. The bioplastic materials I have used in my experiments are plant-based and can be broken down in water and composted by microorganisms under the right conditions due to their bio-based origin. The different combinations of ingredients and the atmospheric changes in the *temperature or air pressure*, which can be affected by both human and non-human activities, have a direct effect on the outcome of the material samples. The experimental process was a lot of making do with what I had, without specialised tools or equipment. Making with what was readily available was part of the co-creation between myself and the biomaterials. The re-appropriation of familiar tools and ingredients for alternative use encouraged reflection on how accustomed one can become to viewing the non-human in confined and conformed ways; negating agency and creative powers. The initial recipes I experimented with were from a range of publicly shared online resources, such as the FabTextiles Bioplastic CookBook by Margret Dunne.⁶⁵

⁶⁵ Margaret Dunne, *Bioplastic Cook Book: A catalogue of bioplastic recipes*, (FabTextiles: experimental digital open source culture, 2018), <http://fabtextiles.org/bioplastic-cook-book/>



Figure 48. AUGUSTA, E. (2022). Bioplastic /EX16. photograph

Directions: all ingredients can be combined cold and then heated on low heat until the solution becomes a transparent paste. Stirring continuously helps to keep an even consistency.

I would then transfer the bio-solution to a prepared surface and leave the material to dry and form.

The drying time would depend on several factors:

- the amount of water, glycerol or powder ingredient (agar or starch) used
- the thickness /consistency of the solution
- the temperature and humidity of the drying environment.

The bioplastic samples would take between 3-6 days to dry. I chose not to use any frames or moulding apparatus because I wanted to see what forms the samples would take for themselves without my interference.

Tools / equipment used: stainless steel pot, spoon, stove and a measuring cup

Ingredients: water, glycerol, agar /or starch powder, vinegar (optional), pigment (varying) and different material substrates (varying)



Figure 49. AUGUSTA, E. (2022). agar-agar pot: 1. photograph



AGAR

AgarAgar is a biopolymer made of polysaccharide agarose found in the cellwalls of some species of red Algae. Agar bioplastic materials were made by AgarAgar powder + Glycerol + Water.

Material qualities:

Prone to shrinkage: samples with less than 3g of glycerol shrink considerably over time and can crack, with little flexibility once dried. Conversely, add too much glycerol, the texture would be slimy and take a longer time to dry.

Material Composition:

Agar (powder) - 70% agarose, a linear polymer made up of repeating units of agarobiose

30% agaropectin - a heterogeneous mixture of smaller molecules

Glycerol /polyol compound - non-toxic, viscous liquid

Formula: $C_3H_8O_3$ Boiling piont: $290\text{ }^\circ\text{C}$ Density: 1.26g cm^{-3}

Water (H₂O)

Melting point: $0\text{ }^\circ\text{C}$ Boiling piont: $100\text{ }^\circ\text{C}$ Density: 997 kg/m^3

The agaragar experiments were produced in July, 2021- the following is photo documentation of the samples produced and changes seen over a three week period.



agar experiment one: agar 3.2g, glycerol 5.4g, water 80 ml /the solution was brought to the boil twice and left to dry at 1.5cm thick

Figure 51. AUGUSTA, E. (2022). agar-agar experiment 1. photograph



1WEEK /left in a container with the lid on -
mould has begun to appear

Figure 52. AUGUSTA, E. (2022). agar-agar experiment 1/w. photograph



1MONTH /mould increased substantially due
to the thickness of the agar experiment and being
kept in a closed container.

Figure 53. AUGUSTA, E. (2022). agar-agar experiment 1/m. photograph



(re)liquidised in boiling water /image: mould
residue

Figure 54. AUGUSTA, E. (2022). agar-agar experiment re(liquidised)



Figure 55. AUGUSTA, E. (2022). agar-agar experiment 2 b/w. photograph.



agar experiment two (left): agar 3.4g, glycerol 5.4g, water 100ml w/soil
the solution was brought to the boil, once cooled it was then poured
onto a surface with soil - the bioplastic acting as glue, holding the pieces
of earth together
[photo taken one week after the solution was set]

agar experiment three: agar 3.4g, glycerol 5.4g, water 100ml w/turmeric
once the solution was transparent and cooled it was poured onto a tray
w/ turmeric powder added after creating a sand-like texture on its surface
[photo taken one week after the solution was set]

Figure 56. AUGUSTA, E. (2022). agar-agar experiment 3. photograph



Figure 57. AUGUSTA, E. (2022). agar-agar experiment 4. photograph



agar experiment four (left): agar, glycerol, water and mixed-spice blend
texture: top side - coarse due to the spice powder, under side - rubbery with an adhesive quality

agar experiment five: agar, glycerol, water (colouring: steeped rooibos tea and turmeric powder)
texture: lumpy surface with rubbery feel

Figure 58. AUGUSTA, E. (2022). agar-agar experiment 5. photograph

agar experiment six: agar, glycerol, water w/ diluted black tea, turmeric and mixed spice blend

texture: grainy /leathery feel in the areas where the spice powder is more concentrated - this also caused the sample to have an inconsistent thickness and flexibility.

In the darker areas, the texture is brittle and has little flexibility. Whereas in the lighter areas, the texture is more rubbery and is also very thin.

This would be due to the uneven surface the sample was drying on.

dimensions: 10cm x 60cm



Figure 59. AUGUSTA, E. (2022). agar-agar experiment 6. photograph



Figure 60. AUGUSTA, E. (2022). agar-agar experiment 7 /detail. photograph



agar experiment seven: agar, glycerol, water
w/ diluted black tea and cayenne pepper
texture: grainy around the areas of concentrated pepper

Figure 61. AUGUSTA, E. (2022). agar-agar experiment 7. photograph



Figure 62. AUGUSTA, E. (2022). agar-agar experiment 7 /side view. photograph



agar experiment eight: agar, glycerol, water w/ diluted black tea
texture: firm /gritty surface - moderate flexibility



agar experiment nine: agar, glycerol, water w/ cayenne and turmeric powder
texture: granular, glossy feel - highly flexible and adhesive to glass



agar experiment ten: agar, glycerol, water w/ bacterial 'skin'
encased within the bioplastic shell

texture: rubbery, uneven surface with rough edges

dimensions: 6.5cm

Figure 65. AUGUSTA, E. (2022). agar-agar experiment 10 /r: front view. photograph



agar experiment eleven: agar, glycerol, water w/ diluted tea-blend and bacterial 'skin' encased

texture: smooth surface - rubbery feel with firm edges (bubbles occurring in the area around the bacterial 'skin')

dimensions: 6cm

Figure 66. AUGUSTA, E. (2022). agar-agar experiment 11 /r: front view. photograph



agar experiment twelve: agar, glycerol, water w/camellia sinensis tea
texture: smooth with some air bubbles

dimensions: 7cm

Figure 67. AUGUSTA, E. (2022). agar-agar experiment 12 /r: front view. photograph



agar experiment thirteen: agar, glycerol, water w/ spice-blend powder

texture: one side grainy the other glossy (the coarser surface being the side that was faced up during the drying period)

dimensions: 6cm

Figure 68. AUGUSTA, E. (2022). agar-agar experiment 13 /r: front view. photograph



agar experiment fourteen: agar, glycerol, water w/ hibiscus tea
and cayenne pepper
texture: grainy surface with a firm edge

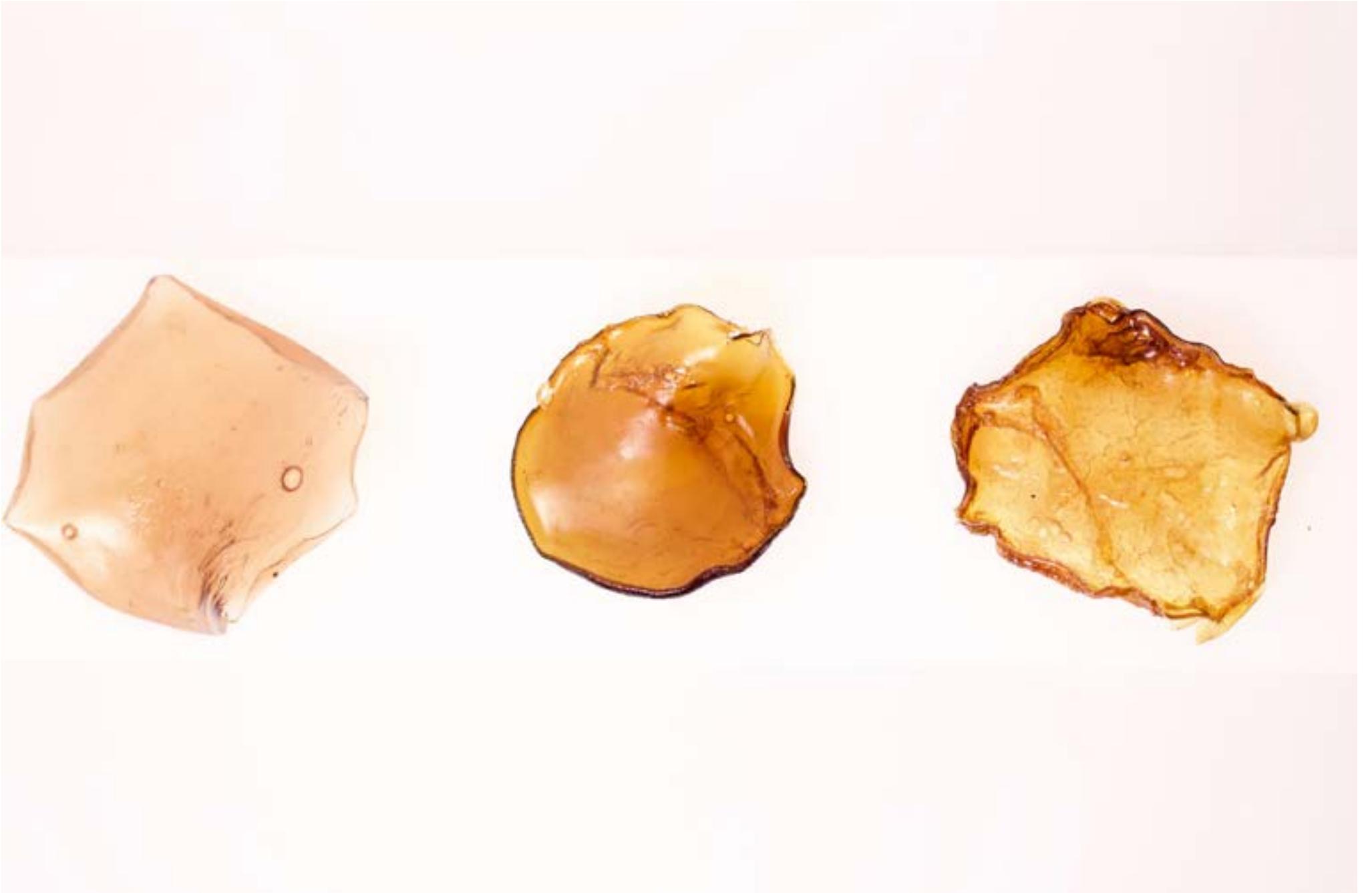


Figure 70. AUGUSTA, E. (2022). Bioplastic Samples /3. photograph



Figure 71. AUGUSTA, E. (2022). starch set-up. photograph

Bioplastic: STARCH

Starch is a natural compound produced in the leaves of plants during their photosynthesis derived from maize, wheat, corn or tapioca.⁶⁶

For these starch-based bio-experiments, I have used Tapioca Starch + Vinegar (optional) + Glycerol + Water.

The starch powder needs to be heated to dissolve in water to form a viscous fluid - the vinegar can be used to help this process and create a more flexible material.

Material Composition:

Tapioca Starch - 17% amylose and 82% amylopectin polymers.

Vinegar - 5-8% acetic acid

Glycerol /polyol compound - non-toxic, viscous liquid

Water (H₂O)

⁶⁶ Britannica, T. Editors of Encyclopaedia. "starch." Encyclopaedia Britannica, March 14, 2021. <https://www.britannica.com/science/starch>.

Tapioca Starch + Glycerol + Water

Stirring on a low heat untill solution becomes transparent 3/5minute process



Figure 72. AUGUSTA, E. (2022). starch stirring. quadriptych



Experiment 01: COFFEE GROUNDS & STARCH

Ingredients

glycerol: 0.25 tbsp

starch: 1 tbsp

vinegar: 0.5 tbsp

water: 400mls

substrate: coffee grounds

Flexibility: little flexibility - where the concentration of coffee grounds is denser the sample feels breakable to touch

Texture: dry /coarse texture

Strength: secure

Smell: diluted coffee smell

Colour: warm - tonal browns

Drying time: 48hrs

Shrinkage: over a 4 week periods the sample has 0.5cm shrinkage.

Outlook: the textural nature of this sample is coarse and brittle reacting in the light like a stained glass window - the coffee grounds creating a natural colouring affect that continued to change and react to the enviroment over time

dimensions: 7.5cm x 13cm



Experiment 02: TRANSLUCENT BODY

Ingredients

glycerol: 0.25 tbsp

starch: 2 tbsp

vinegar: 0 tbsp

water: 400mls

Flexibility: inconsistent - in some areas the sample is relatively flexible in others it feels breakable. This inconsistency may be due to this sample having a low amount of glycerol and no vinegar

Texture: smooth

Strength: moderate

Smell: odorless

Colour: translucent

Drying time: 30hrs

Shrinkage: slight shrinkage (0.7cm) over a 4 - 6 week time period

Outlook: the natural formation and bubbling that occurred during the drying period is an intriguing effect as it can not be replicated - you witness the material agency of the ingredients combined creating its own patterns and forms as it slowly shrinks over time

dimensions: 9.5cm x 13cm



Experiment 03: TEA LEAF & STARCH

Ingredients

glycerol: 1 tbsp

starch: 2 tbsp

vinegar: 4 tbsp

water: 400mls

substrate: loose tea leaf

Flexibility: highly flexible /malleable

Texture: rubbery between the loose tea leaf - coarse over the areas where the tea leaf substrate is exposed

Strength: durable

Smell: faint smell of tea + a rubbery undertone

Colour: translucent - brown /fawn

(around the areas of the loose tea leaf pigmentation has bled out)

Drying time: 30 - 43 hrs

Shrinkage: minimal shrinkage has accrued over a 4 /6 week period.

Outlook: using the bioplastic almost as a glue to hold together another substrate /organic material may be implemented in further experimentation

dimensions: 7cm x 13cm



photo documentation: taken one day after sample had dried

dimenions: 8cm x 15cm

Figure 76. AUGUSTA, E. (2022). starch experiment 3a. photograph



photo documentation: taken 8 months after sample had dried

dimenions: 7cm x 13cm

Figure 77. AUGUSTA, E. (2022). starch experiment 3b. photograph



Experiment 04: BLEEDING RED

Ingredients

glycerol: 0.25 tbsp

starch: 2 tbsp

vinegar: 0 tbsp

water: 400mls

Pigment: red (food colouring)

Flexibility: inconsistent

Texture: smooth - glossy on one side

Strength: durable

Smell: odorless

Colour: hot pink - pigmentation from red food colouring

Drying time: 30hrs

Shrinkage: no noticeable shrinkage over a 2-4week period

Outlook: after a 6 week period the sample developed air bubbles on one side and began to crack in the middle (fig

dimensions: 6cm x 12cm



Experiment 05: GOLDEN TWO-TONE

Ingredients

glycerol: 0 tbsp

starch: 2 tbsp

vinegar: 4 tbsp

water: 400mls

Flexibility: no flexibility

Texture: brittle

Strength: firm but breakable with force

Smell: odorless

Colour: Golden translucent colouring. This sample was first made with no pigmentation then dipped (once dried) into a pigmented solution - creating a two-toned affect

Drying time: 24hrs

Shrinkage: after 6 weeks - no visible shrinkage /after 3 months - 2cm shrinkage

Outlook: the exploration of tonal pigmentation through dip dying created an intriguing colouring affect to explore further with larger samples

dimensions: 3cm x 5cm



Form: during the drying period the samples take their own shape, creating spontaneous formations.

For this project it is important that the form /& body of the samples are biomorphic, characteristic of naturally occurring forms - such as organisms, plants and sloping landscapes - to connect visually with an idea of life, beyond the human and non-human...

To go further, representing a state of becoming /(co)existence

Experiment 06: SMALL FORMS

Ingredients

glycerol: 0 tbsp

starch: 2 tbsp

vinegar: 4 tbsp

water: 400mls

Flexibility: low flexibility - due to the sample having no glycerol

Texture: coarse and rigid

Strength: secure /firm

Smell: odorless

Colour: translucent /Note - at the beginning of the drying process parts of the samples had a cream-coloured appearance, over a 48hr drying time the samples became more translucent all over

Drying time: 30 - 48 hrs

Shrinkage: no noticeable shrinkage

Outlook: the fragility of the 0 glycerol samples don't create the tactile qualities I am looking for so moving forward will use minimum of 0.25 tbsp of glycerol in the solutions

dimensions: 9.5cm x 13cm



Experiment 07: RED THREAD

Ingredients

glycerol: 1 tbsp

starch: 3 tbsp

vinegar: 1 tbsp

water: 150mls

substrate: cotton thread

Flexibility: no flexibility /inconsistent density and fragility

Texture: gritty texture

Strength: firm /rigid

Smell: odorless

Colour: off-white /translucent

Drying time: 90 hrs

Shrinkage: no noticeable shrinkage in 3 week time period

Outlook: the material substrate became incased by the bioplastic as it dried - forming around the cotton thread

dimensions: 10cm x 15cm (12hrs after sample had dried)



Experiment 08: PLASTIC NETTING

Ingredients

glycerol: 1 tbsp

starch: 1 tbsp

vinegar: 2 tbsp

water: 200mls

substrate: synthetic mesh

Flexibility: malleable

Texture: thin, rubbery - can feel substrate through the bioplastic

Strength: durable

Smell: odorless

Colour: translucent

Drying time: 48hrs

Shrinkage: no noticeable shrinkage over a 3 - 4 week period

Outlook: combining the bioplastic with a patterned substrate created a conversation between the material /as the bio-solution dried, a bubble-like texture formed around the synthetic substrate

Texture: Adding the different substrate and/or pigmentations react in their own way with the bioplastic solution that during the drying process create different textures that continue to change depending on the environment the samples are kept

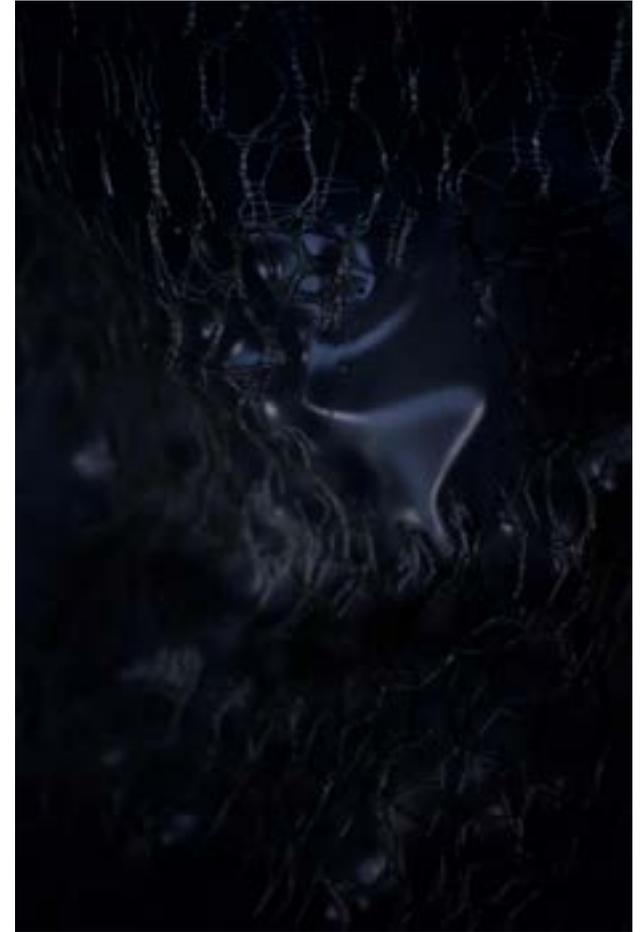


Figure 83. AUGUSTA, E. (2022). starch experiment 8. triptych

Experiment 09: ANGELATING TERRAINS

starch, glycerol and water

texture: rigid /brittle

dimensions: 50cm x 33cm



Figure 84. AUGUSTA, E. (2022). starch experiment 9. photograph



Experiment 10: GOLDEN LANDS

starch, glycerol, turmeric spice and water

texture: smooth, bubbled surface - some flexibility



Experiment 11: OPAQUE HORIZONS

starch, glycerol, diluted tea water

texture: rigid, bubbled surface - little flexibility



Figure 87. AUGUSTA, E. (2022). starch experiment 10 /side view. photograph



Experiment 12: CREATING COLOUR

I combined steeped rooibos tea with turmeric powder which created a 'yellow-ish' liquid that I then added to the bioplastic solution as it was being heated.

Further dip-dyeing experimentation - I took a dried sample of starch-based bioplastic that had reasonable flexibility and coated it with the fresh bio-solution to see how the two bodies would react together. The result of this exploration created a highly textural body - where the original sample was encased and scrunched together as the new layer of bioplastic dried on top of it. This process created a sort of topographical pattern to appear on the surface of the hybrid-bioplastic sample.

Flexibility: low flexibility but not fragile

Texture: smooth and glossy but with a jagged feel

Smell: hints of rooibos tea

Colour: bright /golden-yellow tones

starch, glycerol and turmeric water



Experiment 13: MELANGE TERRAINS

starch, glycerol, spice-blend and water

texture: bumpy surface with moderate flexibility



Experiment 14: THE YELLOW SEA

starch, glycerol, turmeric powder and water

texture: bubbled surface, brittle touch - no flexibility



Experiment 15: TURMERIC SPICE
starch 2tbsp, glycerol 2.5tbsp and water 200mls
texture: rubbery and highly flexible

Figure 91. AUGUSTA, E. (2022). starch experiment 15. photograph



Experiment 16: HIBISCUS TEA
starch 2tbsp, glycerol 1.5tbsp and water 200mls
texture: glossy feel with an inconsistent flexibility

Figure 92. AUGUSTA, E. (2022). starch experiment 16. photograph



Figure 93. AUGUSTA, E. (2022). starch experiment 16 /detail. photograph



Figure 94. AUGUSTA, E. (2022). endosymbiosis. triptych

Experiment 17: ENDOSYMBIOSIS

Endosymbiosis: Lynn Margulis theory - when two becomes one

The endosymbiosis theory happens primarily through the symbiotic interaction of two bodies previously independent of each other coming together and forming a (new) creature. Here (Fig.), two independent bodies were combined together - a dried, thin cellulose-skin sample coated in bioplastic solution to see how the two bodies would react with each other. The result - created a bubbled texture on the surface as the bioplastic dried around the cellulose-skin.



Figure 95. AUGUSTA, E. (2022). experiment 17. photograph



Experiment 18: TWO BODIES CIRCLE

bacterial cellulose-skin x bioplastic

Figure 96. AUGUSTA, E. (2022). experiment 18. photograph



Experiment 19: TWO BODIES BROKEN

Figure 97. AUGUSTA, E. (2022). experiment 19. photograph



Figure 98. AUGUSTA, E. (2022). experiment 17 /detail. photograph

BACTERIAL SKINS:

symbiotic cultures of bacteria and yeast (SCOBY)

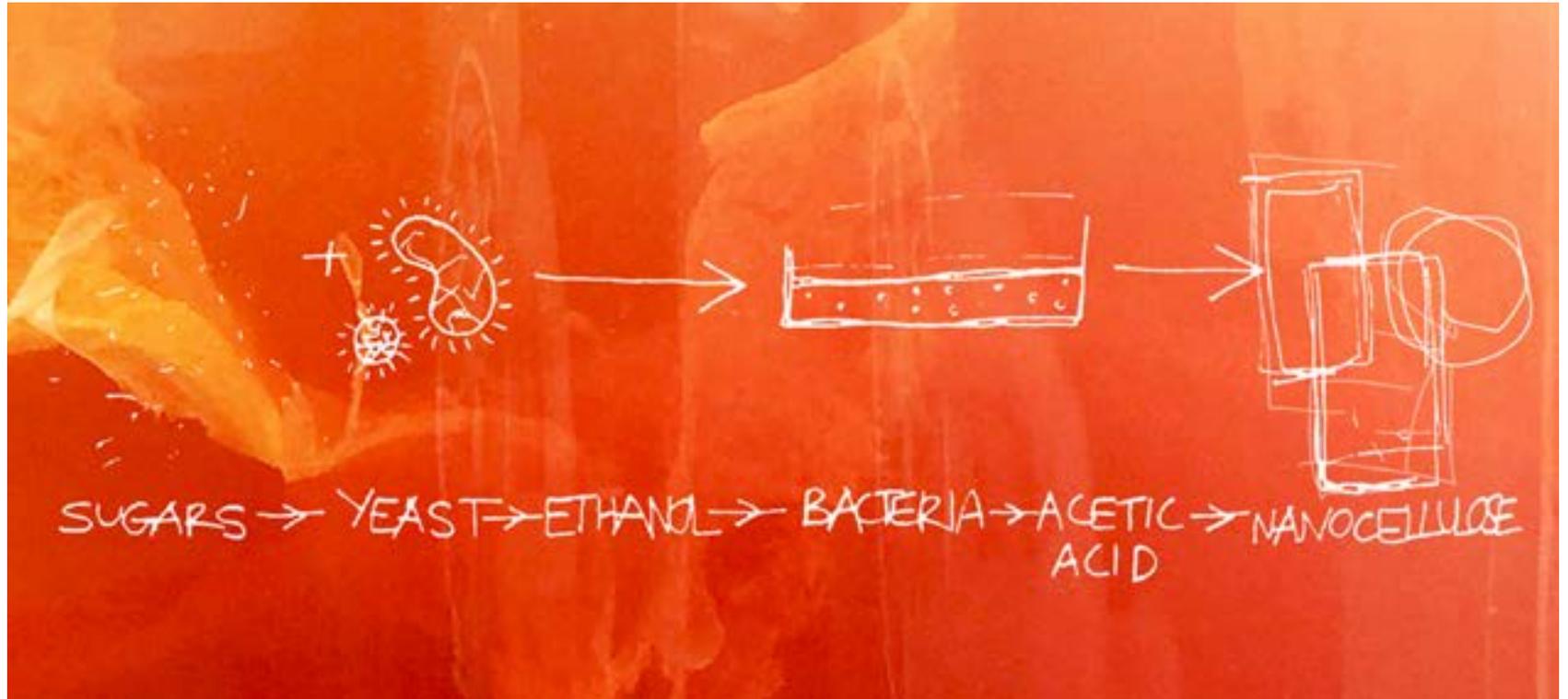
Bacterial-cellulose is a material produced by several different types of bacterium such as *Acetobacter Xylinum*, *Saccharomyces* and *Sarcina Ventriculi*.⁶⁶

The SCOBY is produced through a symbiotic relationship in kombucha, which is an extract formed from the fermentation of black tea and sugar.



⁶⁶ D. Laavanya, Shivanand Shirkole, P. Balasubramanian, "Current challenges, applications and future perspectives of SCOBY cellulose of Kombucha fermentation," *Journal of Cleaner Production*, Volume 295, (February 2021): p1

Figure 99. AUGUSTA, E. (2022). S.C.O.B.Y /Lungs. photograph



Growth composition /process (Fig 63)

S.C.O.B.Y. = Symbiotic Culture of Bacteria and Yeasts *Sugars > Yeasts > Ethanol > Bacteria > Acetic Acid +*



Ingredients: A SCOBY mother - to begin fermentation
black tea brew, granulated (raw) sugar and raw
kombucha from a previous brew to be used as a starter
/help fermentation

Figure 101. AUGUSTA, E. (2022). S.C.O.BY growth - day one. photograph



SCOBY growth: 2 - 4 week process.
The longer the SCOBY is left in its home to ferment in
the sugar-tea brew, the thicker the cellulose-body
becomes.

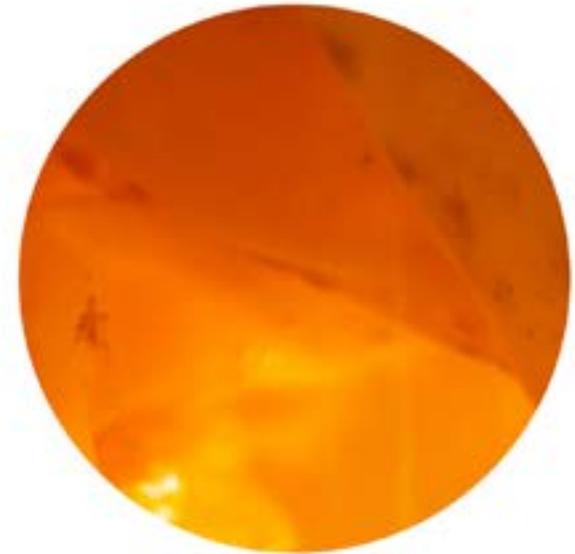
Figure 102. AUGUSTA, E. (2022). S.C.O.BY growth /hotel. photograph



Dried SCOBY /cellulose



Add to culture /sugar-tea liquid



New growth /cellulose skin

Growing with SCOBY /cellulose - a regenerative process



Dry

Colour: dark Texture: coarse Thickness: 1.5mm



Humid

Colour: muted Texture: 'skin-like' Thickness: 3mm



Wet

Colour: light Texture: slimy Thickness: 6mm

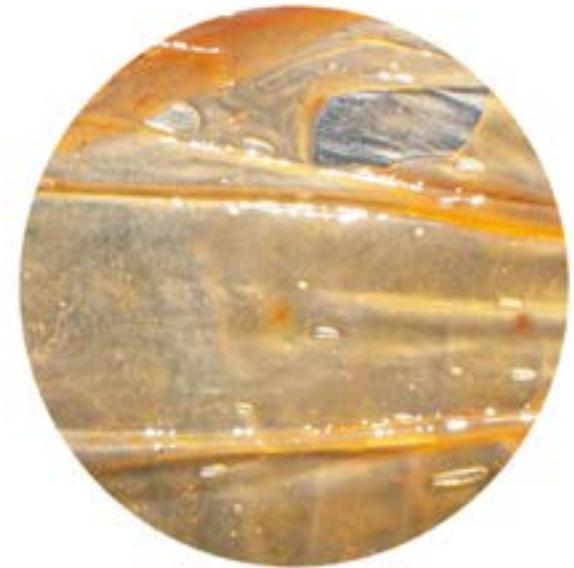
Environmental Response: observing the physical changes that occurred over time in different environmental conditions



Yeast build-up embedded
in new SCOBY layer



SCOBY layers formed together



Tearing in thin cellulose layer

SCOBY /cellulose-skins fermentation: different textures and growth observations

Working with the SCOBY materials was less of an interactive experimentation and more one of observation and patience. In the earlier stages of the project, when the weather was still warm, the fermentation process seemed to happen very easily over a 2-4 week period, but as the weather began to change and temperatures dropped, it became clear that the SCOBY needed help forming the cellulose material. This sense of responsibility and care for the material was a new dynamic I had not experienced working with textiles before.

It wasn't caring about what it would look like in the end or be used for but caring for its health and its Hauora as it grew. In a sense, it became a relationship of "*mothering-the-materials*" - making sure they were warm enough at night or had enough to eat (sugar), worrying about them when I was away, keeping them wrapped in blankets when the temperatures dropped, but then also leaving them be when they didn't need me so that they could continue to grow on their own. In this way, I became very aware that I was working with and interacting with *living* matter and that the cultivation of the material had to be one of care, patience and intrigue. Sensing and listening to the material's needs and discomfort through sight, smell and touch, I supported its potential to grow. Realising the value of this co-creative process has profoundly affected my perspective and understanding of a designers' use and interaction with materials.



Figure 106. AUGUSTA, E. (2022). S.C.O.B.Y /cellulose-skin in liquid



Harvesting Process - *skin to skin*: with clean hands SCOBY-bodies are removed from the liquid and placed to dry. The colouration and textural outcome dependent on the thickness of the SCOBY harvested.

Figure 107. AUGUSTA, E. (2022). S.C.O.B.Y./harvest. photograph



Freshly harvested cellulose-skin left to dry on a uneven surface so that it doesn't stick and become hard to move once dried

Figure 108. AUGUSTA, E. (2022). S.C.O.B.Y./harvest detail 1. photograph 92



SCOBY that is 1-2mm when harvested dries paper thin with a glossy /smooth texture and light colouration

Figure 109. AUGUSTA, E. (2022). S.C.O.B.Y /paper. photograph



Thick SCOBY-bodies (5mm+) when harvested dry with a more leathery texture and darker colouring.

Figure 110. AUGUSTA, E. (2022). S.C.O.B.Y /leather. photograph



Figure 111. AUGUSTA, E. (2022). S.C.O.B.Y /harvest -coconut oil treatment. photograph



Dried SCOBY-skin coconut oil treatment to retain leathery feel /reduce dryness and breaking

Figure 112. AUGUSTA, E. (2022). S.C.O.B.Y /harvest detail 2. photograph 94



Cold brew - causing white dots to appear
on the early SCOBY fermentation



Cleaning the cellulose-skin with soap
to try salvage any usable material



Drying cellulose-skin
Staining visible from the white dots

Winter harvest: the low temperatures having an effect on the SCOBY growth and outcomes



Black spotting on surface
Will stain when dried



Dead insect on surface layer
Not usable



Mould on surface layer
Will stain /not usable

Contamination - during the growth process on the top layers of the cellulose-skin



Two months growth
Texture: leathery /rough
Drying time: 3-4 days



Two weeks growth
Texture: paper-thin
Drying time: 10hrs



Three weeks growth
Texture: coarse /delicate
Drying time: 2 days

Dried SCOBY: textural observations



Figure 116. AUGUSTA, E. (2022). S.C.O.B.Y /self-healing and scaring

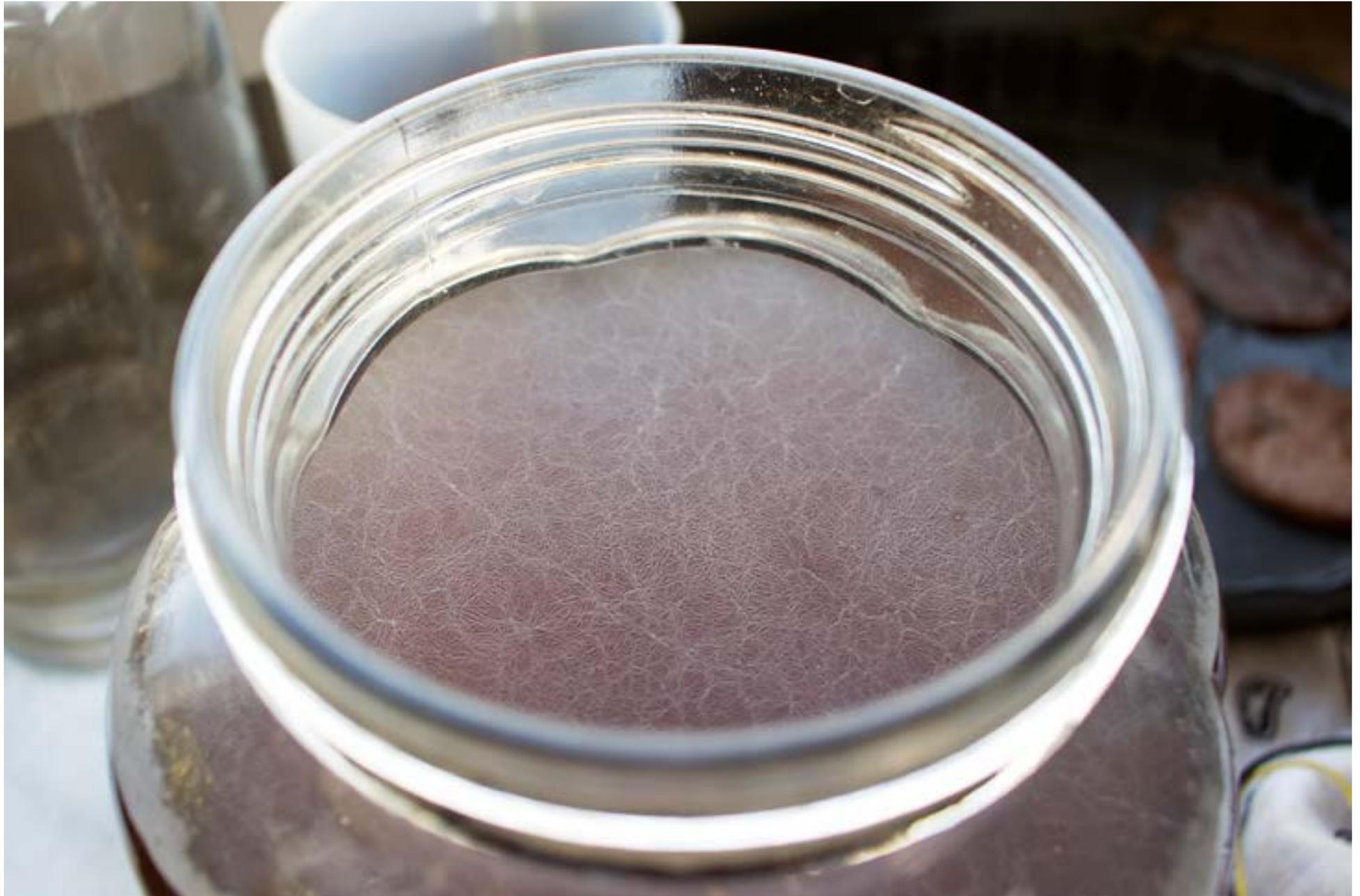


Figure 117. AUGUSTA, E. (2022). S.C.O.B.Y /cellulose layer. photograph

REFLECTIONS on PROCESS

The autoethnographic journey connected to the theoretical inquiry was established at the conception of this project as it informed the direction of the research. The chronicling of notes and ideas is seen in the mappings and *worlding* of the interconnection between the internal and external subject and environment that grew out of the mind's-world. Ideation inspired immersive *worlding*, which generated experimental biofabrication and the *interplay of agency* that revealed the wanderings of eco-philosophical thought across experimental material 'lands'. In the exploration of these biofabricated materials and the conceptualisation of the mind's-world, an indelible understanding was forged of the inextricable interconnectedness of humans and non-humans in our shared ecosystem. Thus, this process of immersion helped to engage the symbiotic relationship between the maker and the made (mind and matter), where a non-verbal, discursive collaborative partnership could occur. Developing this experimental process of biofabrication where the interplay of the agency was at the forefront of the creative process was critical to the inquiry of whether or not this conception of a symbiotic design approach could, in fact, facilitate an eco-philosophical perspective to expand understanding of material boundaries and explore ecological conversations through a textile design practice.



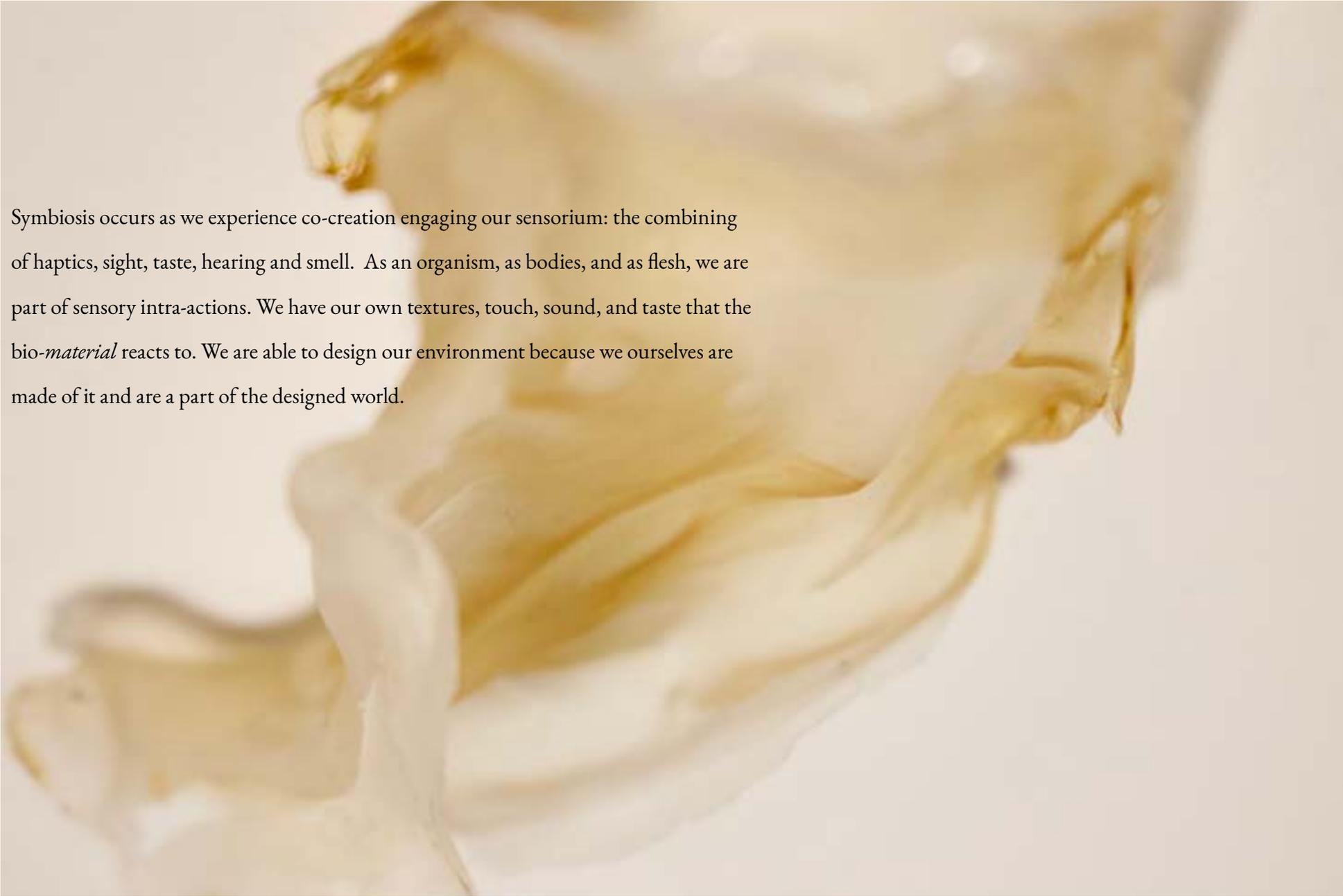
Figure 118. AUGUSTA, E. (2022). Exhibit display. photograph



Figure 119. AUGUSTA, E. (2022). Exhibit display /detail 1. photograph

It should be said that the intention of this work was not to develop biomaterials for functional wear or product use but to orientate the designer towards an understanding of the interplay of agency and the symbiotic relationship between maker and made. It was a process of thinking through notions of agency, kinship, and co-creation through practice; to go beyond the view of the maker, beyond what is made and explore design as the interplay that occurs between both. I believe this is vital in considering the ethics and onto-epistemological reasoning for the use, cultivation and harvesting of biomass intended for human manipulation and the future of biofabrication.

Developing a depth of contextual knowledge from theoretical understandings, philosophical perspectives, and autoethnographic inquiry strengthened my design process and my awareness of the need to have the ability, intention and consideration to engage with and have some understanding of material behaviours. Within this project, the approach to material making was informed by probing into eco-logical and eco-philosophical thinking, which informed my interactions with the materials. In the biofabrication processes, the agency of both the maker and the material merge, whereby the materials unfold the affective life of the maker just as much as the maker fabricates the nature of the work.



Symbiosis occurs as we experience co-creation engaging our sensorium: the combining of haptics, sight, taste, hearing and smell. As an organism, as bodies, and as flesh, we are part of sensory intra-actions. We have our own textures, touch, sound, and taste that the bio-*material* reacts to. We are able to design our environment because we ourselves are made of it and are a part of the designed world.

Figure 120. AUGUSTA, E. (2022). Bioplastic /Body. photograph

CONCLUSION

Throughout the unfolding of this exegesis, I have explored the notion of a symbiotic design approach through an autoethnographic inquiry that stimulated echo-philosophical thought and the investigation of contextual knowledge in order to expand on ideas of material boundaries. By situating the designer within a discursive practice to engage ecological conversation through the experimental process of biofabrication, a reconsideration of the relationship between the maker and the made was explored.

This exploration of experimental material ‘lands’ was informed by navigating the autoethnographic into a realm of ecological imaginings, where the mind’s- world mapped out terrains of eco-philosophical understandings and perspectives of material ecocriticism towards the biofabricated horizons of tomorrow. Through this journeying of thought into practice, I discovered a reconsideration of the agency and narrativity of materials in which the design became a cooperative, co-creative process of worlding. To acknowledge the agential interplay of the maker and the made re-imagines notions of material boundaries, informed by the symbiosis of mind and matter within the *symbiotic real*.

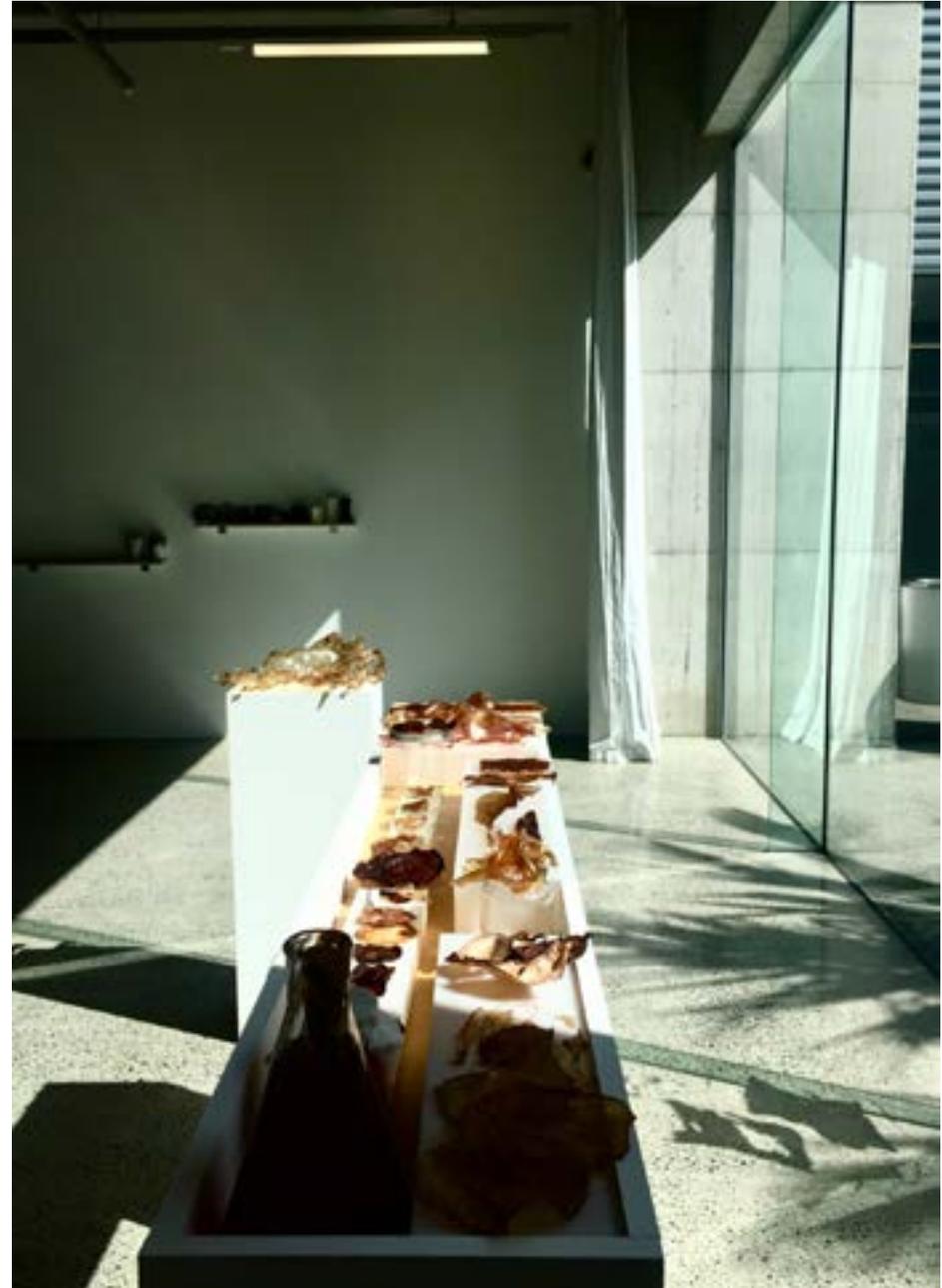


Figure 121. AUGUSTA, E. (2022). Exhibit display /shadow's reflection. photograph

Through the consideration of a symbiotic design approach grounded in an eco-philosophical perspective, I have connected the theoretical, *eco-logic*(cal) and practical to allow myself a broadened understanding of material boundaries that considers the interrelated processes of the maker and the made, in the practice of biofabrication. Biofabrication expands the notion of material boundaries as instead of designing out life, the maker is required to design with it and for it through a symbiotic design approach. This understanding of design as a co-creative process facilitated a deeper understanding of the potential for working with renewable, agential materials.

Through this process of ideation, cultivation and biofabrication, my approach to practice was “un-designed”, and my thinking about what comprises textile materialisation grew, allowing me to consider tangible options for future material directions.

Rather than exploiting non-renewable life, bio-materials’ renewable self-forming potential encourages an eco-orientated theoretical and practical perspective. Engaging in an understanding of care for the how and why we cultivate materials is an implication for the future of not only design but all forms of creation that involve harnessing the energy we exist within.



Figure 122. AUGUSTA, E. (2022). Exhibit display /detail 2. photograph

We need to create a future better oriented toward ecological processes that work *with* natural resources rather than take from and disrupt the fragile balance of the ecosphere of which humans are merely a part. Implications of this for teaching and learning mean the inclusion of material ecology as part of design education is crucial to the ecologically sustainable and ethically responsible future of design.

In conclusion, biofabrication provides the opportunity for designers to engage more fully in collaboration with the living world where renewable life supports a new material world that should not result in the exploitation of the world's resources of land, water and energy. However, the biofabricated future will happen only if we learn to care, not from a place of domination, but in balance, in symbiosis, with the '*worlding*' of this world and all of its lifeforms.

And so, beginning at the end, *We Land Here*



Figure 123. AUGUSTA, E. (2022). Studio Space: 3 / 'we continue'. photograph



Figure 124. AUGUSTA, E. (2022). Exhibit display /detail 3. photograph

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