Kō Rimurimu *'To Be Covered in Seaweed'* - Sensory Knowing, Holistic Understanding, and Meaningful Encounters within a Marine Science Centre

This research report is submitted to the Auckland University of Technology for the degree of Master of Design.

By

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School of Design & Creative Technologies

Abstract

Art+Science collaborations, designed to promote and enhance ecological literacy amongst young people, need to address holistic, sensory and participatory ways of knowing. Through engaging the senses, aesthetics and emotions, deeper more meaningful learning can occur. This research explored how ‘sensory knowing’ can be used to design learning experiences that address our interconnection with the universe, in order to engage primary school children in understanding, adopting and enacting ecological literacy.

The research looked to explore “meaningfulness” for primary school children within the context of a Teaching and Learning Research Initiative (TLRI) funded Mixed Reality (MR) experience at the Goat Island Marine Discovery Centre. I explored meaningfulness through the creation of an immersive, physical experience, as well as a sensory mapping process. The sensory mapping allowed me to explore different ways of engaging the physiological and emotional senses, which lead into the development of the final physical experience, a life size immersive, participatory kelp forest. Art+Science principles were brought together in order to create an aesthetically pleasing and meaningful experience, that addressed the interconnection of all life on earth, and intended to inspire and empower the students to take action and make change.

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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.

Signed: _____ Date: 18/05/2018

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Special thanks to my Mum and Dad, my sister Georgie, and Echo, ya shabi.

Ngā mihi

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Secondary Supervisor	Claudio Aguayo	**Signature**		**Date**	16th May 2018
Additional Supervisor/Mentor		**Signature**		**Date**	

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2.1 Introduction

“All things are connected like the blood that unites us, We did not weave the web of life. We are merely a strand in it. Whatever we do to the web, we do to ourselves.”

~ Chief Seattle, Suquamish & Duwamish tribal leader

Through the creation of a physical immersive experience, and sensory mapping, I have explored meaningfulness in the context of a Mixed Reality (MR) learning experience (see Figure 2.1.). I undertook this exploration as part of the Teaching and Learning Research Initiative (TLRI) funded project ‘Using mobile learning in free-choice educational settings to enhance ecological literacy’. As the process unfolded, the role and place of my research changed from a prosaic investigation of Ecological Literacy promotion, M-learning, and Augmented Reality (AR) app design, toward an evocative exploration of sensory, experiential learning and co-creation, dwelling on materiality, participatory learning, handmade Real Environment (RE) elements of mixed reality, and art+science collaboration.

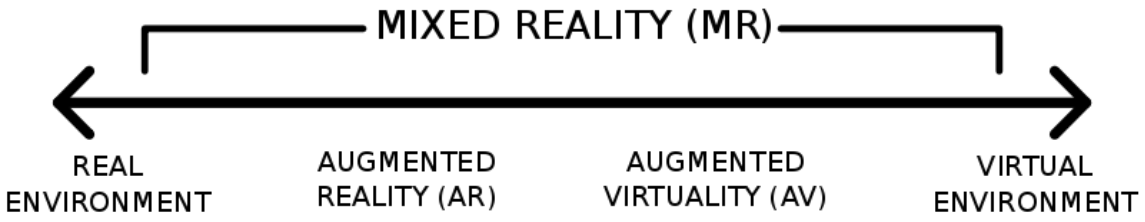


Figure 2.1. Vincenti, G. (c. 1994). Reality-Virtuality continuum in according to Milgram, Takemura, Utsumi and Kishino. From *Wikimedia Commons*, Retrieved from https://commons.wikimedia.org/wiki/File:Reality-Virtuality_Continuum.svg.

An ever increasing understanding of humanity’s impact and toll on the environment has put emphasis and attention on education to promote ecological and sustainability understanding (Aguayo, 2014). Recognition of socio-ecological crises such as deforestation, pollution of water, land and air, as well as the associated environmental and social crises, has driven international research to call for education as a means to promote sustainability (Aguayo, 2014).

In my report, I have outlined the rationale for my approach to the larger set of constraints established by the TLRI project and my critical response to the needs it outlined.

2.2 Contextual Review

My research project explored the pedagogic potential of creating meaningful Art+Science encounters that promote marine ecological literacy. Creating an immersive kelp forest environment enabled me to test and consider the educational impact of immersive experiences, designed to support learning that uses mobile technology. In this research, meaningfulness is defined as providing learning possibilities and experiences that are significant, extraordinary, important, and relevant to individuals and their communities. (Aguayo, 2014).

2.2.1 Meaningful Encounters through the social

In the context of my research, *the social* relates to our shared existence, as opposed to individual thought or action. I have explored the creation of meaningful encounter through connection to others. Educational philosopher, Wally Penetito (Ngāti Haua, Ngāi Raukawa, Ngāti Tamatera), picks up on the notion of connection in his writings about Place Based Education (PBE), informed by a Māori/Tangata Whenua perspective. Penetito's pedagogical approach uses local landscapes, cultures, heritage, opportunities and experiences to educate in an immersive, holistic way ("What is Place-Based Education? | Promise of Place," n.d.). PBE aims to connect the learner to these local features to make the experience more relevant, impactful and generate deeper learning ("What is Place-Based Education? | Promise of Place," n.d.). Through PBE, students can see more connection between themselves and the content being taught, which allows a more meaningful educational experience to occur.

Likewise in her *Te Wheke* framework, Dr Rangimarie Turuki 'Rose Pere', CM, CBE, (Educationalist and Māori elder) outlines a holistic health model in the image of an octopus that promotes a traditional Māori world view of one's health, well being, and development (see Appendices for a diagram of this model). This is a worldview where there is no separation between the mind, spirit, whānau and physical world ("Māori health models – Te Wheke," n.d.). This cosmology promotes a holistic way of connecting people and communities. In terms of my project, thinking through Te Wheke meant taking into account spiritual, physical, emotional and sensory dimensions of the project. Considering how meaningful encounters might enhance the educational experience of the participating children and how design could be used to create integrated, connected approaches to situating technology within the TLRI project.

English artist, designer and researcher, Kate Mclean, also speaks to the idea of holism. Mclean is well known for her *Smellmaps* of different cities around the world. In her own words; "While the visual dominates in data representation I believe we should tap into alternative sensory modes for individual and shared interpretation of place." ("About | Sensory Maps," n.d.). She

develops the idea that senses alternative to sight can trigger unique emotions, memories and experiences (“About | Sensory Maps,” n.d.). Mclean’s mapping encouraged me to explore alternatives to visual ways of knowing the Goat Island Reserve. Mapping through the senses provided a framework for formulating a deeper understanding and interpretation of location, beyond that offered by referring to a cartographic map of Goat Island and its surrounding landforms. Sensing the environment produced unexpected evocative, physical responses and memories which I wanted to replicate in my design for the educational experience, to make the encounter with the kelp forest more meaningful.

2.2.2 Meaningful Encounters through the aesthetic

An influential philosopher for my research into meaning making through the aesthetic has been American educationalist, John Dewey (1859-1952). Although he was writing and conceptualising at the beginning of the 20th century, his ideas about aesthetic experiences, and experiential learning remain relevant, and resonate with the aims and context of my project. As a leader and proponent of *student centred experiential learning* (Tarrant & Thiele, 2015), Dewey argued that there was no way of understanding and truly knowing something unless engaged with by way of doing and experiencing (Tarrant & Thiele, 2015). Dewey’s ideas of learning through experience tie in with Dr Rose Pere’s outlook on education. She states, “A person’s education is based on his or her experiences and understandings. The university of ancient Hawaiiki is the universe. Education in this context knows no boundaries.” (Pere & Nicholson, 1997, p. 5). This focus on experiential learning influenced my thinking around how art and design could be used to create a scientifically based participatory experience. In Dewey’s concept of the ‘aesthetic experience’, emotions, feelings, and thoughts come together to create a connected, fulfilled whole (Hadzigeorgiou, 2016). The imagination, and senses are engaged, and meaning is abstracted from these (Hadzigeorgiou, 2016.). Dewey saw aesthetic experiences as the highest form of experience - where the people involved are aware of connections and effects upon oneself, and also empowered to act upon the world and understand their capabilities to do so (“Aesthetic Experience - Dictionary definition of Aesthetic Experience | Encyclopedia.com: FREE online dictionary,” n.d.). Dewey, led me to wonder, if the TLRI project incorporated the creation of an analogue aesthetic experience that engaged the children would a deeper educational impact be made? I began to to be curious about the potential of creative, haptic encounters with materials, rather than the purely digital experience being explored, to result in a more meaningful, fulfilling experience for the children? The projects aims did not identify analogue or aesthetic encounters which included material conversations as integral to the research. Seeking design responses to these questions led me to challenge other elements of the wider project.

*“*Technology is available to develop either independence and learning or bureaucracy and teaching*.”* (Illich, 2000, p. 104) Western educational and social critic, Ivan Illich’s (1926-2002),

assessment of traditional education has informed my own thinking about the nature of current educational practices in New Zealand (both in school and Education Outside the Classroom). I started to think critically about the emphasis from the stakeholders and researchers on Mobile Learning (M-Learning). It should also be emphasised that this critical thinking goes beyond the TLRI project. It extends to technology and education at a societal level.

> Technology writers like Carr (2010) believe that contemporary machines are changing the way we think, constraining our attention spans and limiting our ability for reflectivity, while neuroscientist Greenfield (2003) has argued that such machines are altering the structure of our brains. And, former artificial intelligence expert Lanier (2010) has created the term 'digital Maoism' to describe how the Internet has become inimical to individual creativity. (MacDonald, 2012, p.122)

Illich advocated for the use of what he termed 'Tools for Conviviality' to achieve a freer and more empowered society and populace (MacDonald, 2012). "By tools, Illich meant physical devices, mental constructs and social forms, arguing for the creation of convivial (sociable, festive etc.), rather than manipulative, institutions, and seeing conviviality as the opposite of industrial productivity." (MacDonald, 2012, p. 122). The idea behind these tools was that they could be used for all manner of social good - democracy, socialising, community building and education among others (Kahn, 2010). Despite Illich's advocacy for convivial tools, he was critical and sceptical about the direction technology was taking in the 20th century. Advocating for the creation of technology that "serve personal, creative, and autonomous interaction and the emergence of values" (Illich, 2000, pp. 8-9).

One of Illich's core arguments was how technology has the potential to foster creativity, imagination, connection and advancement of human actions (Illich, 2000), but the manufacturers and companies creating these products do not have these interests at heart. Instead they promote an agenda of profit making, and addictive rituals and process' (Illich, 2000). Some contend that social media and smart devices represent how we, as a globalised society, have reached an age of 'conviviality' (MacDonald, 2012). We now have the technology to give the masses the ability to create, share and connect (MacDonald, 2012). These concepts tie directly into the affordances of M-learning, that devices offer new, personalised, interconnected, and improved forms for education (Traxler, 2014). M-learning can enhance educational experiences to be more imaginative, adaptive, democratic and cheaper, allowing people from all parts of the world and walks of life to access knowledge and educational experiences (Traxler, 2014).

M-Learning, and the TLRI projects underpinning philosophy should, I believe, be viewed through a critical lens. Does the promotion of learning through devices lock people into certain ways of thinking? Especially impressionable, developing young people. Do mobile devices promote 'addictive' rituals of engagement, whereby the user becomes conditioned into using and needing the software in repetitive, calculated ways? Do the motives and funding for M-learning initiatives stem more from the commercial interests of the likes of Apple or Google, or the

educational researchers and educational philosophy? Although these tools do allow for a certain level of conviviality, and positive benefits, what is the trade off? What are the costs of locking young people into screens for their learning?

Asking these questions, I had to come to some kind of solution for shaping my project. I needed to design an outcome that would attempt to enact, explore and justify these questions, while still fulfilling the requirements of the TLRI project. I decided therefore to focus on the handmade, Real Environment (RE) end of the Mixed Reality (MR) continuum (see Figure 2.3). This meant that I could create something that would contribute to the TLRI project and compliment their ideas, while still addressing some of my own critical enquiries. The kelp forest was primarily an analogue encounter designed to stimulated the senses, emotions and aesthetic reactions of the children, in ways the M-Learning components would not. I focused on engaging the physical and sensorial through active participation, things that current screen based technology struggle to achieve.

Being Ecologically Literate means understanding how people, societies and communities relate and connect to each other, and to natural systems. By fostering sustainable connections and relations and the creation of a sense of empowerment, citizens can have an impact (Orr, 1992). The key concepts of Ecological Literacy can be connected to the ideas of Pere, Penetito and Illich. Penetito's particular emphasis on connecting people to location and landscapes, fits nicely with the aims of ecological literacy. If you emphasise the relationship between students and their environment or surroundings, and make a connection between this and their learning, a higher level of emotional engagement and empowered action will result. This is because the content has been made relevant and meaningful. *Te Wheke's* core principle of holism connects strongly to the goals and key tenets of ecological literacy. Pere's octopus emphasises a holistic outlook of a person or community and how well being and development is intertwined with multiple factors. This idea of looking at connection and interrelationship is at its core relevant to ecological literacy. Illich too can be tied in too. Primarily his overarching concept of wanting to empower and free people and societies to make positive decisions to change. The dimension, *Ranga Whatumanawa / Relating to the Emotions and Senses*, on Rose Pere's, Te Wheke, is particularly relevant. Emotions are an integral part of a child's development and this emotional energy is the foundation of creativity and imagination (Pere & Nicholson, 1997). Encouragement of emotional expression leads to heightened creativity and contributes to the overall wellbeing and development of the individual. Pere's view of the sensory as being more relevant to emotions and feelings, rather than physiological senses (Pere & Nicholson, 1997), provided me with an alternative way of understanding the sensory and ways to approach it in my research. (Pere & Nicholson, 1997).

2.3 Methodology

Research question:

How can 'sensory knowing' be used to design learning experiences that address our interconnection with the universe, in order to engage primary school children in understanding, adopting and enacting ecological literacy?

As part of the wider TLRI project, I was required to have an output ready for early March, 2018. This deadline determined the final projects physical output, and constrained my inquiry during the initial exploratory mapping stage. In spite of this restriction, a large part of the knowledge gained through this research lies in the intuitive approaches I explored during the mapping.

In order to create the required output for this project, I adopted a Design Thinking approach (namely prototyping, defining and implementation) (see Figure 2.2). Design Thinking gave me a systematic way to achieve the practical considerations of the project.

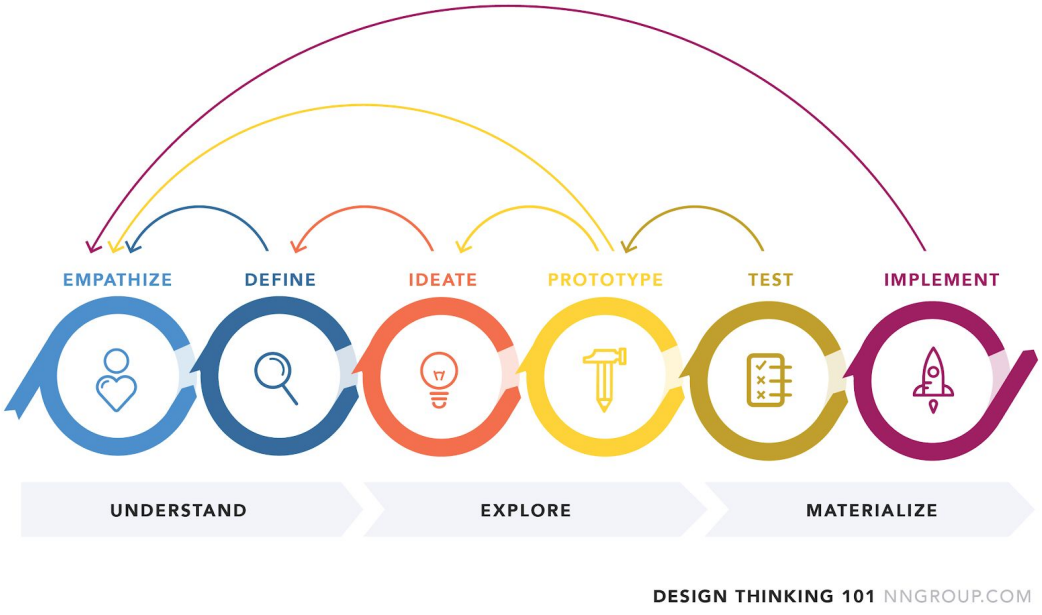


Figure 2.2. Design Thinking 101. From Nielsen Norman Group. Retrieved from https://www.nngroup.com/articles/design-thinking/.

Everything in my contribution to the TLRI project, including the final kelp forest, can be framed as a prototype. This definition allowed me to gather data and explore the potential of different concepts and materials. In the lead up to the creation of the final forest, I made models to determine the best techniques to use and opted to employ hand cutting to ensure the final

outcome would have variance and be aesthetically engaging for the children. Design Thinking provided a robust set of methods I could use to complete my contribution to the TLRI project, however, as a designer and an educator, I wanted to explore an intuitive methodology that privileged knowing through the senses.

Intuition as a methodology provides a basis for exploring the world without a conscious framework. I was able to question what meaningfulness might be in terms of marine ecology and our place within it, drawing on different perspectives in order to gain an understanding of our interconnection with the environment and other living beings.

2.3.1 Methods

1. *Mapping as exploration of the sensory*

The three key senses I engaged with during the mapping were smell, sound, and haptics.

> 1. (a) Smell mapping exercises were undertaken in order to explore the smellscape of Goat Island. This allowed me to understand the location from a smell based perspective and to conceive of potential associations to the smells encountered. This opened up a far deeper and broader meaning about the reserve and marine environments in general.
>
> 1. (b) Sound mapping was another method explored. These experiments involved capturing audio recordings of sounds at the reserve, and led to discovery and understanding about the aural dimension. Through visualising and changing the sensory experience of interacting with the sounds captured, I developed deeper knowing around the holistic nature of the senses (how the senses aren't separated and can be connected and exchanged freely) and how evocative and meaningful sound can be.
>
> 1. (c) The third mapping method I utilised was exploration of haptics. This process was used to create tactile experiments which explored how the touch sense could be engaged to create understanding about location, materiality and evocativeness.

2. The Hand Made

Handmade methods were used throughout the mapping to explore the potential of materials, and to engage the physical. These handmade techniques, explored at the beginning stages of the project, allowed me to experiment with different bespoke process', acting as preliminary explorations which fed into my final outcome. Handmade methods were at the heart of my process in building the kelp forest. Enabling me to create life size kelp. The large scale was necessary because it provided the students with unique touch-based, immersive experiences.

3. Prototyping

Prototyping was a key element in the design and development of the kelp forest experience. This method sat within the overarching Design Thinking approach. I experimented with different styles of kelp, sampled materials, and explored various ways of hanging them. Once I settled on a style and method for creating, I was able to produce a lot of kelp in a relatively short space of time. Prototyping was also utilised in the development of the sea bed rocks, starfish and sea anemone. Rapid prototyping as a method was used throughout the installation process, in order to test and fix issues as they arose.

4. Defining

Defining helped me to understand the educational opportunities inherent in the immersive, participatory experience. I used Defining to determine the parameters of the experience, and the opportunities for using aesthetics, emotions, the sensory and participation to promote ecological literacy.

5. Implementation

Implementation allowed me to realise my ideas and produce the final version of the forest experience. By synthesising all the prototyping and defining work, implementation focused my mindset on building, and the March deadline. Implementation as a method is all about producing an outcome and is the final step of the pipeline to completion. Implementation enabled me to meet the requirements of the TLRI project, and achieve the research goals I had set for myself.

2.4 Concept, Development, Findings, & Discussion

2.4.1 Exploring the potential of ecological literacy

“The environment is not an "other" to us. It is not a collection of things that we encounter. Rather, it is part of our being. It is the locus of our existence and identity. We cannot and do not exist apart from it. It is through empathic projection that we come to know our environment, understand how we are part of it and how it is part of us. This is the bodily mechanism by which we can participate in nature, not just as hikers or climbers or swimmers, but as part of nature itself, part of a larger, all-encompassing whole. A mindful embodied spirituality is thus an ecological spirituality.”

~ George Lakoff, Philosophy in the Flesh: The Embodied Mind and its Challenge to Western Thought

Holism is intrinsically embedded within ecological literacy and its aims. My work reflected and tapped into this, with holistic principles being incorporated throughout my thinking and work wherever possible. As a defining principle it led me to try generate a sensation for the students of being one and interdependent with other living beings and the natural world through the forest.

Figure 2.3. The kelp forest experience. James Smith, 2018.

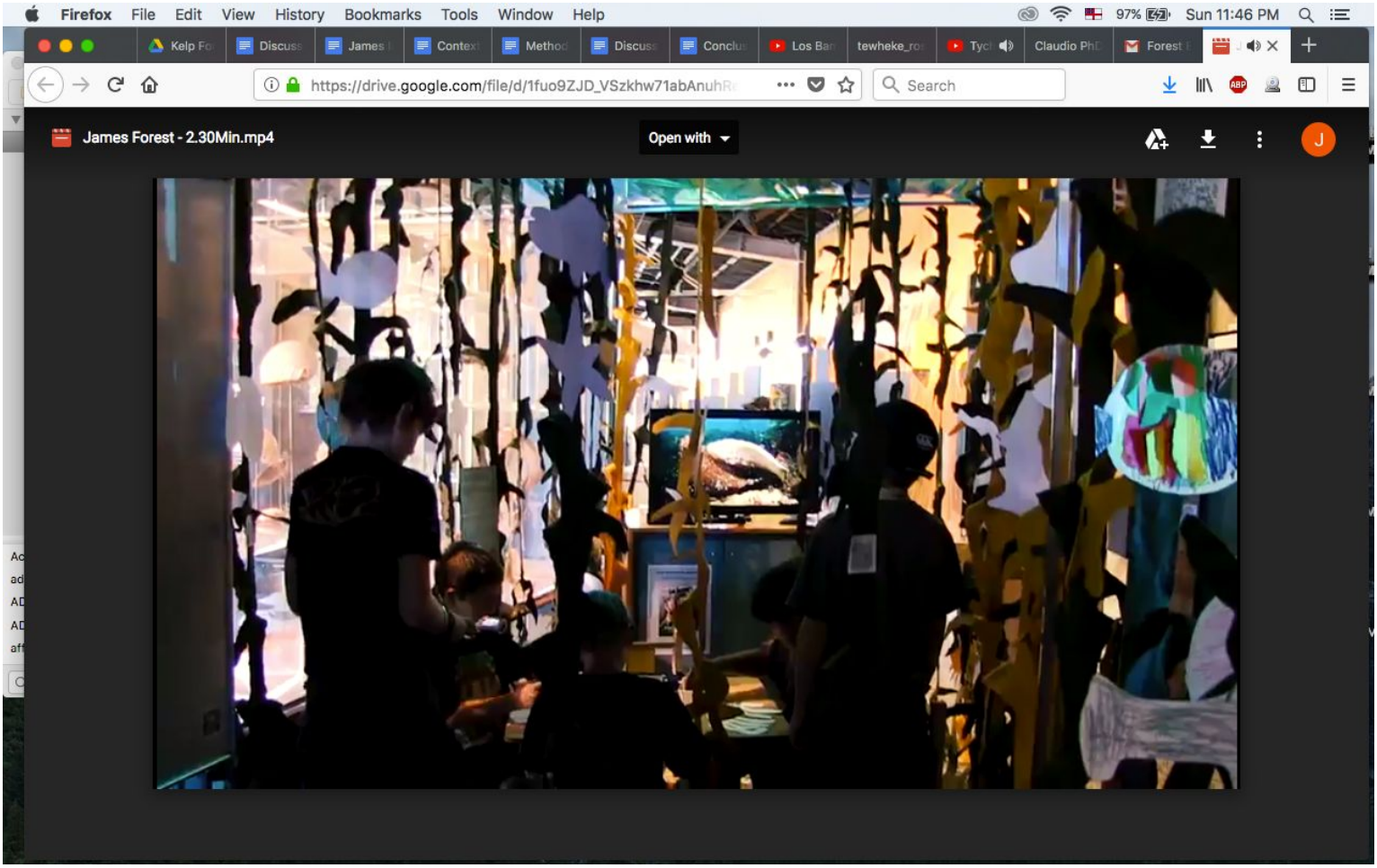


Figure 2.4. Children interacting with the forest. Ali Taheri, 2018.

I started my process by creating my own holistic understanding of the Goat Island location. An archive of knowing was created through mapping explorations of different sensory responses and understandings. These sensory experiments were explorations of how to understand and feel connected to the environment on a deeper, more spiritual level. Not in terms of scientific

facts, or historical information, but more in the sense of spiritual reconnection with the land, sea and living beings.

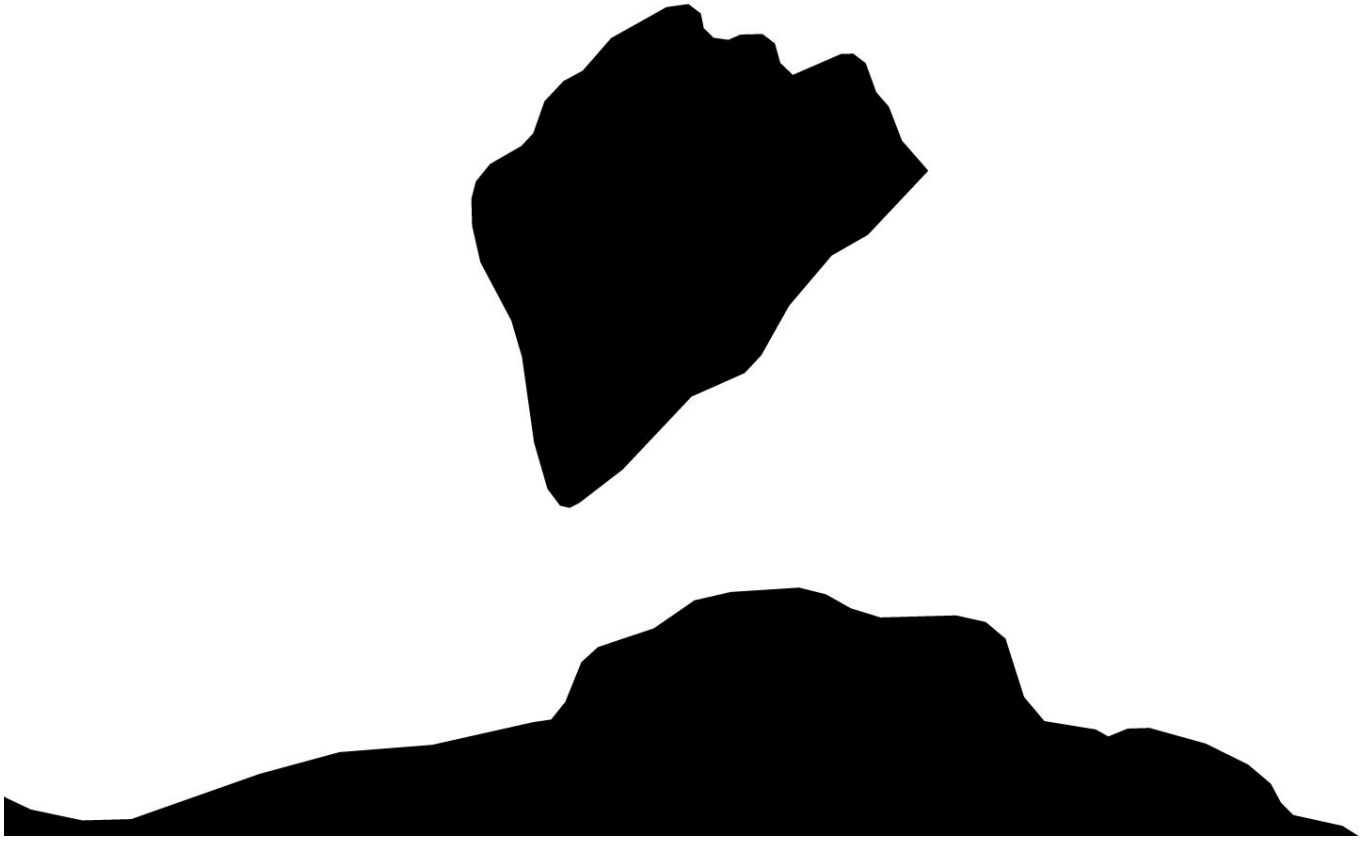


Figure 2.5. Initial Map of Goat Island. James Smith, 2017.

Awe inspiring moments of oneness between myself and the environment allowed me to develop a personal understanding of my own feeling and knowledge about ecological literacy. Such feelings were sparked by closing my eyes and simply breathing in the sea air, observing how it seemed to clear and clean my nostrils and sinuses, or concentrating on listening to the waves crashing against the tide pools, or my shoes scraping and crushing sea shells as I walked. These moments of reflection and meditation could have led to feelings of loss and grief, with the realisation that, as humans, we have become disconnected. Realising the harm that is caused by this lack of connection between humans and nature, and empathy for each other and all living beings and environments. This wasn't necessarily the case for me though. I was more left with a sense of overwhelming joy and calmness. As if I were dead and returned to the sea. I'm

not sure whether this type of response is strictly beneficial for the promotion of ecological literacy, it wasn't a logical or activated sense of empowerment to practice sustainability. It was more a fleeting sublime sensation of being enveloped by nature, but it has stayed with me. These experiences weren't on any kind of information or fact based level, ala climate change communication, but on some deeper unexplainable plane. When I think back to these moments I can return to the sensation of oneness and connection. These experiences connected to Rose Pere's *Te Wheke,* which emplaces knowledge within cosmology.

Figure 2.6. Winter sunset at Goat Island. James Smith, 2017.

Figure 2.7. The Island on a windy day. James Smith, 2017.

Figure 2.8. Clouds above the marine reserve, James Smith, 2017.

The mapping experiments at Goat Island included explorations of smell (see Figure 2.9.), sound and touch. I then enfolding the public's understanding and feelings towards the Reserve through ethnographic process' carried out on Instagram. (these process' are further explained on page 56). The data collected was turned into artistic and evocative representations which provided stimulus for meditating on the information I had gleaned. Through this exploration I gained an understanding of how to use sensory information to generate meaningful encounters within the kelp forest environment. The potential for using this knowledge in an educational context, seemed to me to be how it was situated within the personal space of the child. I needed to create a personal connection to ecological literacy for it to be significant to the learner.

Goat Island Smell Notes

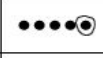
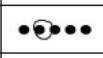
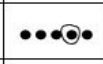
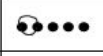
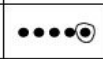
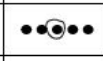
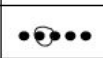
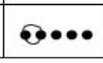
Smell # (locate this smell on a map)	Name of smell	Smell Intensity (Weak Strong)	Smell duration (Short Long)	Smell like/ dislike (Dislike Like)	Expected smell?	Your associations. Your thoughts. Based on this particular smell...
1.	Damp				Yes	New Zealand. Coastline. Winter. Wet. Rain. Drizzle. Mould. Fungi. Musty. Rot. Foliage.
2.	Rain on concrete				Yes	Summer showers. Sun shower. Chemical release. summer holiday.
3.	Fresh				Yes	NZ. Clear. Pure. Healthy. Clean.
4.	Seaweed				Yes	Feet. "Natural" rot. Sea. Ocean. Salt. Plant matter. Sushi. Damp dirty tea towel. Congealed. Gunk.
5.	Tobacco				No	Spliff. Europe. House Party. Club. Bar. football game. Gig.
6.	Weed smoke				No	Gig. Spliff. Joint. Music. Mung out. Band practice. Festival. Party. Dak. 420. Backpackers
7.	Neutral smell				No	The universe. Reset. Default smell. No humans.
8.	Herby				Ye	Mixed spice. Spice drawer. Organic. Natural. Hippy medicine. Healing properties.
9.	Salt up nostrils				Ye	Coastline. The sea. Blast of sea air. Navigation.
10.	Woody/Pine/Bark				Ye	Nature. Forest. Organic. High end design
11.	Dull sweetness				No	Bags of nice smelling stiff for your home. Flowers.
12.	Seafood				Ye	Shell fish. Salt. Sand. Bit off. Stank. Fish n chips. Summer. Sashimi.
13.	Stank water				No	Sewerage. Mud. Poos. Wees. Unclean. Polluted. Toxic. Caution. Undrinkable. Man made.

Figure 2.9. Goat Island Smell Notes, James Smith, 2017.

My mapping process' had a generally positive response from the TLRI team. They saw the potential of the sensory to enhance ecological literacy, complement the M-learning components, and feed into the projects objectives. I presented my mapping explorations and creations to the TLRI team at a planning meeting toward the end of 2017 and received good feedback and suggestions. This was especially true of the teacher of the case study class from Ahuroa school. She saw the potential of engaging the sensory to teach the students about ecology and the environment, and took photos and notes down to try some of the mapping exercises with her class.

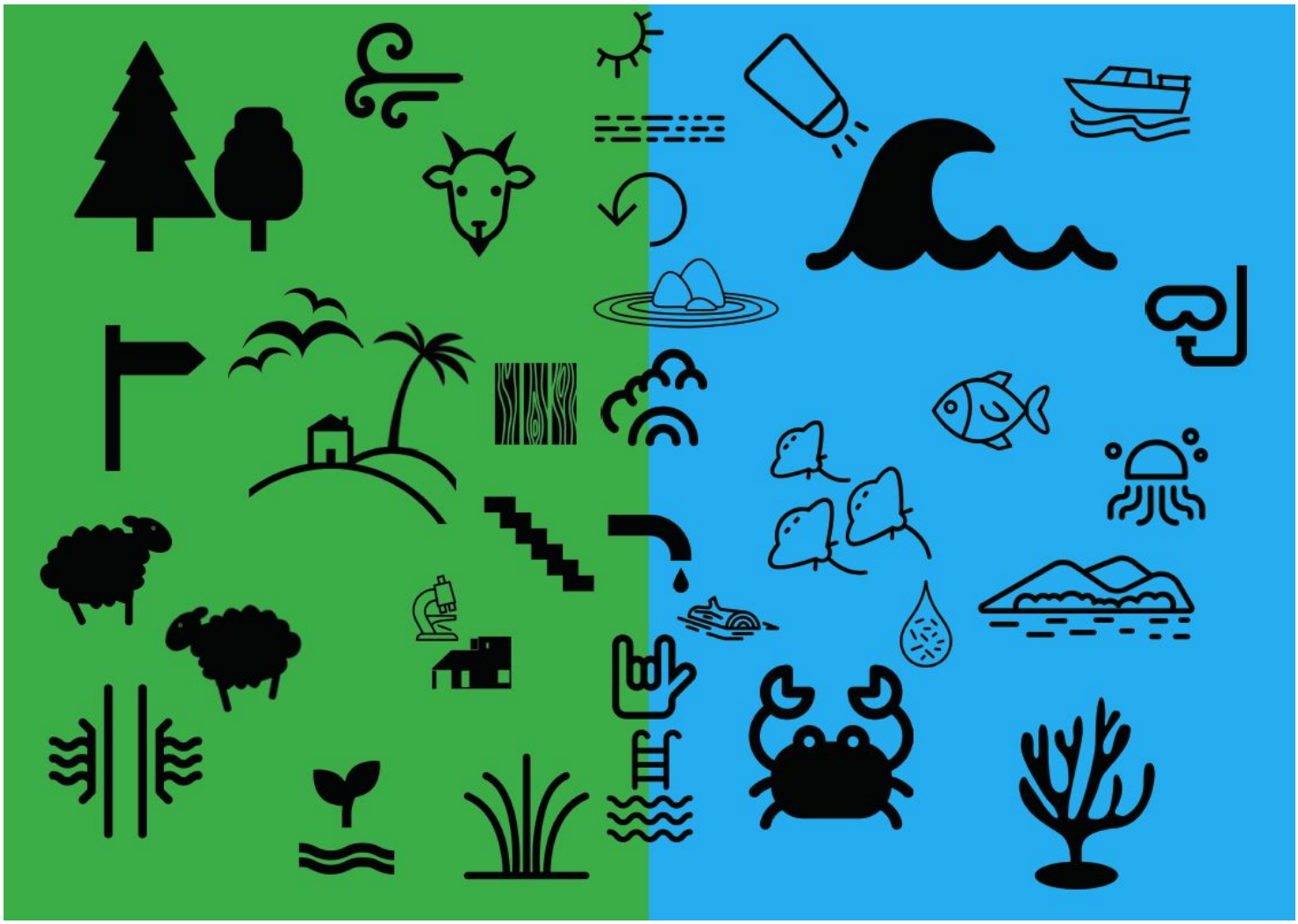


Figure 2.10. Icon Map of Goat Island, James Smith, 2017.

From the explorative mapping process, the design and development of the final kelp forest experience emerged. With the intention of enhancing ecological literacy, the experience engaged the senses, stimulated aesthetic appreciation, and empowered the students to feel inspired and able to practice sustainability in the real world.

The senses were engaged in the kelp forest through touch, sound, lighting and visuals. All of these sensory elements came together to create an evocative, holistic experience. This multi sensory aspect was intended to create memories and impressions that could be lodged in the body, mind and spirit a lot deeper than facts and figures. These sensations and memories then could be connected to the ecological learning that occurred across the TLRI intervention.

Figure 2.11. How is this kelp forest similar to a forest on land? James Smith, 2018.

Aesthetics were used throughout the experience to promote ecological literacy and to try evoke an aesthetic experience.

> Dewey (1934) proposed the term ‘aesthetic experience’. According to him, there is a difference between an ordinary experience and an aesthetic experience. The latter is a holistic and fulfilled experience, in the sense that feelings, thoughts, and actions form a unified whole. (Hadzigeorgiou, 2016, pp. 43-44)

The hope was that the kelp forest would generate an aesthetic experience for the students by tapping into the imagination, senses and emotions (see contextual review, page 13 for more on this). The connected experience of the kelp forest hopefully would have inspired them to to “feel” the values and attitudes of ecological literacy, rather than explicitly absorb facts and information about ecology.

The forest was made in such a way that it appeared kooky, childlike, and psychedelic (see Appendix C & Figures 2.12. & 2.13.). The aesthetic elements combined together to create an imaginative, intriguing, and mysterious life sized kelp forest. Hopefully it stimulated and aroused aesthetic appreciation and enjoyment.

Figure 2.12. Kelp forest projection. James Smith, 2018.

Figure 2.13. Kelp forest creatures. James Smith, 2018.

Participatory aspects of the forest connected to the idea of an aesthetic experience, encouraging and inspiring empowerment and action from the students. The participation that was built into the experience included the clean up and recycling of plastic waste from the kelp (see Figures 2.14. & 2.15.) and the drawing and colouring in of cardboard sea life cutouts for the students to populate the forest with (see Figure 2.16.). This aspect of the experience required the students to actively engage in the environment, having huge impacts on the “health” and core narrative of the intervention. These activities helped to engender a sense of being empowered to act, and make a difference in terms of marine environmental issues.

Figure 2.14. Plastic in the Kelp, James Smith, 2018.

Figure 2.15. Recycling Bin, Claudio Aguayo, 2018.

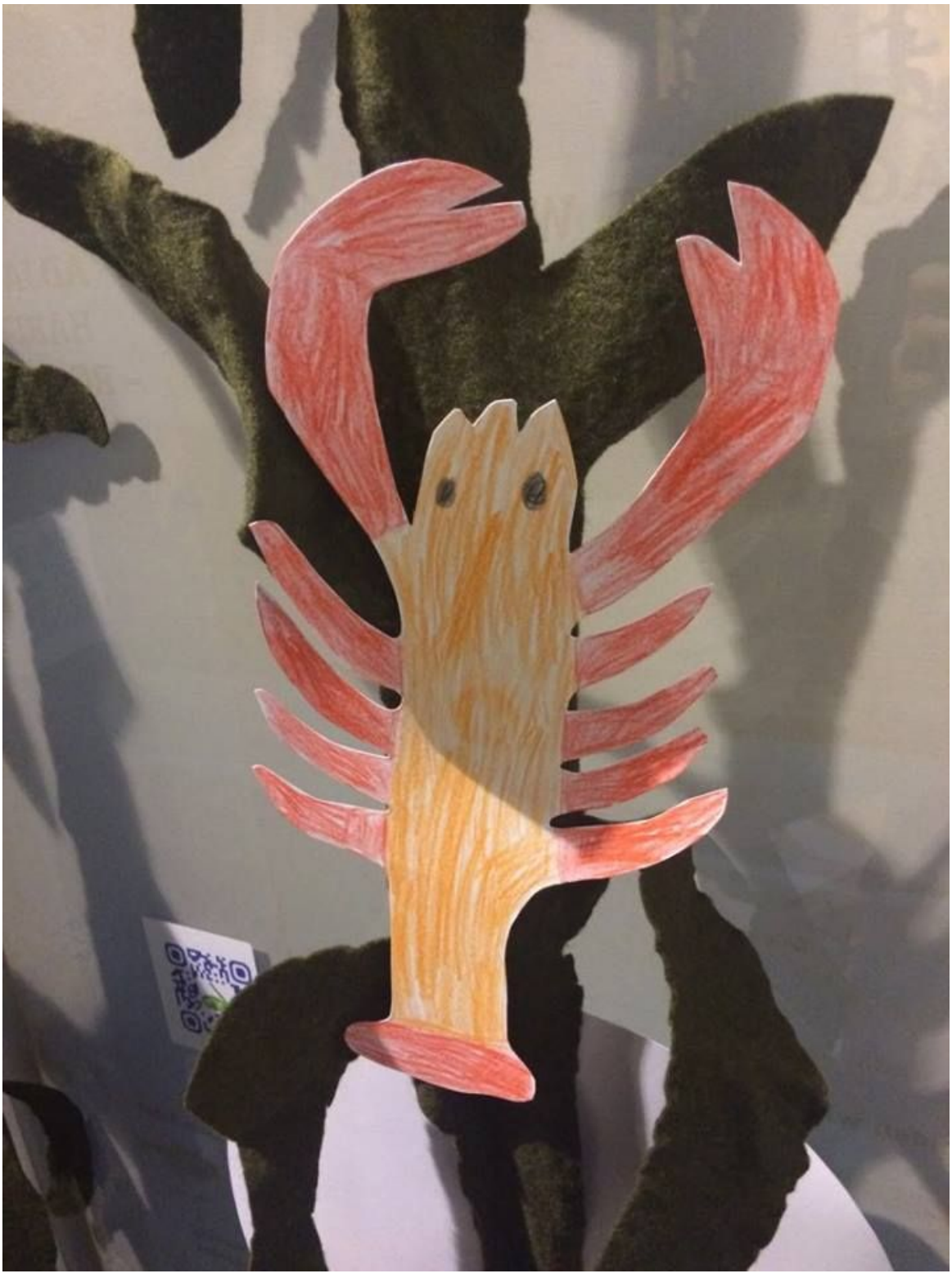


Figure 2.16. Coloured in Crayfish, James Smith, 2018.

2.4.2 Creating Meaningful Art+Science Encounters

“Art and science have long shared a common ground; the ground of boundless inquiry about the nature of our existence.”

~ Julia Buntaine, Sciart Magazine

The kelp forest experience may have achieved the promotion of ecological literacy in many aspects, but was it truly *meaningful* for the students?

Through the cross pollination of art concepts, with those of science, new understandings, solutions and ideas can be generated in both disciplines (Reichellt-Brushett & Cook, 2017). Art+Science collaboration also holds the potential for promoting science and increasing popular interest in it (Reichellt-Brushett & Cook, 2017). The thinking and practice of Art+Science collaboration was embedded throughout my project. This was due to the nature of the research (a collaboration between artists, designers, biologists and educators within a marine science centre), and the effective outcomes that this kind of collaboration would provide. The way the kelp forest was conceptualised, developed and put together was influenced by the real biological and ecological features of macrocystis kelp forests found off the coast of the South Island of New Zealand (see Figure 2.17.). Information about kelp forests came from the educational team at the Discovery Centre, qualified marine biologists and scientists. They were heavily involved in the conceptualisation and development of the forest, acting as science experts to guide and influence the aspects of the ecological learning aspects enfolded into the design.

Figure 2.17. Bladder-kelp forest. From Te Ara: The Encyclopedia of New Zealand. Retrieved from https://teara.govt.nz/en/photograph/4595/bladder-kelp-forest. Copyright Department of Conservation.

This meant that, although the forest was evocative, imaginative and kooky, it still had embedded biological and ecological principles behind it. My artistic thinking took the biological forms as influence, then adapted these, taking artistic licence to make them more relevant and appealing to primary school children. The kelp took on bespoke, childlike, bold, and simplistic forms. These informal qualities made it attractive to the children, while it also implicitly conveyed information about the science and biological make up of kelp. I feel that without both the embedded aesthetic and scientific knowledge, the kelp forest wouldn't have been as successful in creating a meaningful experience.

Figure 2.18. Kelp Blades and Stems, James Smith, 2018.

The different levels and layers of my handmade forest mimicked those of real kelp. The seafloor had rocks, sea anemone, and starfish made out of felt (see Figure 2.19.), similar to a real seabed (see Figures 2.20.), while the felt kelp pieces stretched up all the way to a canopy made

of blue and green cellophane (see previous Figure 2.3.). This canopy was intended to represent the surface of water, evoking the appearance and aesthetics of a macrocystis kelp forest where the stems grow up to and are hit by the light from the sun.

Figure 2.19. Kelp Forest Seabed, James Smith, 2018.

Figure 2.20. Shive, I. (n.d.) *seastars blanket the floor of a kelp forest.* From The Nature Conservancy. Retrieved from https://blog.nature.org/conservancy/2014/09/16/magical-forest-dive-giant-kelp-nature-inspiration/. Copyright Ian Shive.

“I believe in expressing emotion, if it can help me to release tension, or express feelings from the heart.”

~ Dr. Rose Pere, Te Wheke Kamaatu - The Octopus of Great Wisdom

According to Rose Pere, the encouragement of emotional expression leads to heightened creativity and contributes to the overall wellbeing and development of the individual (Pere & Nicholson, 1997).

Emotions were tapped into and connected to scientific knowledge through the provocative, emotive questions printed onto signs and velcroed to the kelp forest (see Figure 2.21.). These signs were put throughout the forest to provoke questions about humanity's connection to marine environments, and how to care for kelp forests as if they were a person or a part of people and society. These questions asked the children to think of the forests health, to ask themselves how the forest makes them feel, and what emotions the experience conjures up in them. The meanings generated from this, were in theory, more personally relevant for the students, in turn being more meaningful.

Figure 2.21. How Can We Help to Protect Kelp Forests? Claudio Aguayo, 2018.

The emotions emanating from the forest could be described as tranquil, peaceful, meditative, or mysterious. The mood in the experience was changeable, depending on the time of day and lighting situation. The forest could appear sad and depressive before the plastic was picked up and recycled, or joyous, uplifting, and full of life once the plastic was cleaned and replaced with the coloured in fish. This emphasis on emotions created meaning on a deeper level than simple facts and information ever could for the visitors.

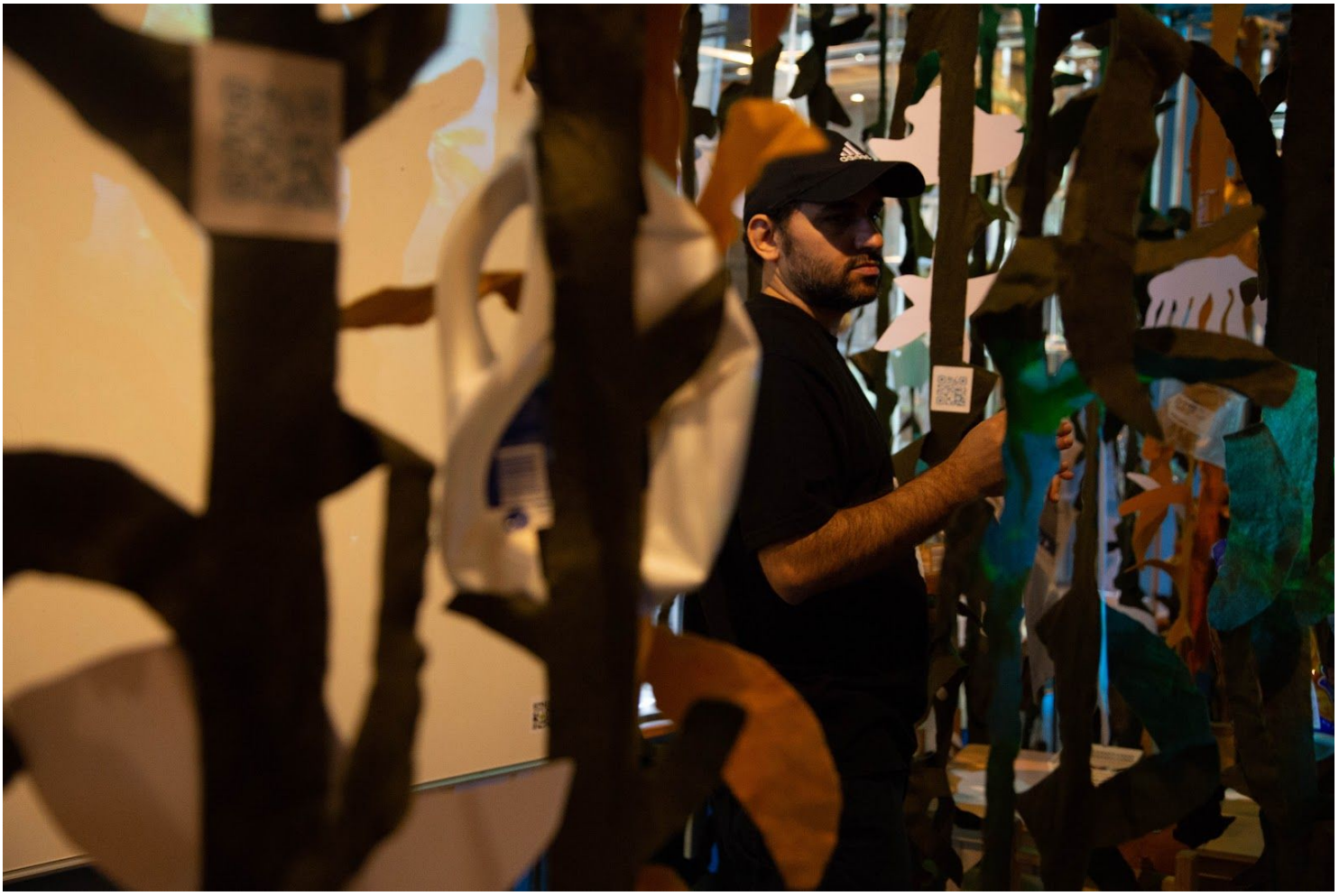


Figure 2.22. Visitor in the Kelp Forest, Claudio Aguayo, 2018.

The visual style of the experience evoked children's book illustration aesthetics, and related to the drawings that the children themselves did that were used as references for the project (see Figure 2.23.). This was conceptualised so the imagination and creativity of the children could

run wild. The fact that the kelp, rocks, and starfish weren't very detailed or anatomically correct allowed for a more open interpretation from the students to put their own meaning or feelings onto them.

Figure 2.23. Monkey Face the Snapper, 2017.

The semi transparent green and blue sheets of cellophane acted as both an evocative visual of the surface of the water, and as a light filter to change the tone and colour of the lights in the kelp forest area (see previous Figure 2.3). This created a sense of being underwater. The colours blue and green have calming, peaceful, tranquil, harmonious, trustworthy, and natural connotations. They can also connect to ideas of refreshment, love and environmental

awareness (Psychological Properties Of Colours - Colour Affects. (n.d.)). This was good for setting a “vibe” within the experience that would influence the students to want to spend time in the forest, have an impact on their mood and energy, and to transmit implicit, emotional meaning about environmentalism, love and caring for marine ecosystems.

Figure 2.24. Kō Rimurimu ‘To Be Covered in Seaweed’ instructions. James Smith, 2018.

Figure 2.25. Pipi the Snapper, 2017.

Figure 2.26. Pipi's World AR App. Ali Taheri, 2018.

Before the plastic recycling challenge was completed, the pieces of waste, scattered and haphazardly thrown through the kelp, gave a sense of an ecosystem out of balance (see Figure 2.14.). Of a sick and hurting forest, that needed attention, care, and healing. The harsh, unnatural plastic rubbish, contrasted with the round edged, more organic and naturally coloured kelp. This created a juxtaposition of aesthetics which conveyed meaning to the students that something was out of balance in the environment. It wasn't beautiful or pleasant to look at, instead it looked sick and unnatural. This aesthetic element hopefully would have inspired an

emotional response from the students, to “feel” for the forest. Feelings of sorrow, anger, pain, or guilt for humans impact on the forest.

The children's hand drawn and coloured in sea life (see Figures 2.27 & 2.28.) contributed to the imaginative, and child like feel of the forest. The sea animals helped to foster personalised, emotional and artistic meaning, with the participatory nature of this activity having narrative, empowering and creative meaning embedded within it.

2.27

2.28

Figure 2.27. Spiral Faced Fish, 2018.
Figure 2.28. Colourful Jelly 2018.

The feeling of felt is soft, fibrous, stretchy, slightly porous, and somewhat hairy. From touching the kelp, the students got an understanding of the shape and appearance of the forest, understanding the ecological elements not just through vision.

By stroking the felt, brushing past it, pulling on it, rubbing it, and feeling it on the face, meaning was generated. This meaning was evocative. In the sense that through the touch sense the students gained an understanding of what a real kelp forest potentially feels like, but at the same time knowing full well that this kelp forest is a fabricated imaginative version. The feeling of felt could be considered akin to real kelp, but only in a very lenient sense. The way the felt was treated (see Figure. 2.29.) (soaked in PVA glue water and dried in the sun) made the material feel potentially like dried out real kelp pieces.

Figure 2.29. Drying the PVA Soaked Kelp, Claudio Aguayo, 2018.

By engaging the touch sense, a memory was hopefully formed in the mind of the children about touching the fake kelp and this experience sparked an interest or wonderment to find some real seaweed to interact with. In theory, the feeling of felt would be connected to the memory of the overall kelp forest experience, the concepts of marine ecology and the empowerment aspects (recycling plastics and repopulating the forest). This would be an example of the haptic sense making a deep, memorable impression.

> Perhaps the most important educational outcome associated with an aesthetic experience is the change of one's outlook on the world. This means that one sees the world differently as a result of an aesthetic experience. Such change or transformation as a result of learning goes beyond an 'artistic expansion of

> perception' (i.e. seeing details and nuances) even though the latter can often lead to the former. (Hadzigeorgiou, 2016, p.49)

The activity which got the students to draw and colour in the cardboard cut out fish and other sea life activated their imagination, hands on art making skills, and allowed them to create a visible, structural change to the kelp forest environment. This was a meaningful experience in the sense that it gave the students the power to make a change in the kelp environment, allowing them to implicitly understand what makes a healthy ecosystem, and actively contribute to creating one.

The sense of empowerment from both these activities hopefully gave the children a deep sense of understanding of their own ability, power, and free will to act. They as children, don't need adults to save or help them. They are capable and responsible as much as anyone else for looking after and taking action in natural environments.

Figure 2.30. Children engaging with the recycling challenge, Ali Taheri, 2018.

2.4.3 Toward an Evocative Exploration of the Sensory

“While the visual dominates in data representation I believe we should tap into alternative sensory modes for individual and shared interpretation of place.”

~ Kate Mclean, Artist, Designer, and Creator of Smellmaps of Cities Around the World.

The personal mapping process’ and evocative exploration of my own senses that I undertook at the beginning of my research, influenced the engagement of the sensory in the final kelp forest.

Haptic

I used 3D printing to create raised versions of maps of the Goat Island Marine Reserve area (see Figures below). The thinking behind this was that by having raised contours and outlines, a touch based understanding of the landforms, coastline and island could be made. By running your finger along the surface of the map, an understanding of place could be generated. Acting much the same as braille for blind people, these maps tap into the touch sense to give a more information rich experience.

The tactile was also investigated through going to Goat Island and actually touching the different textures, organic matter, objects and minerals that make up the environment there. This process was modeled off Mcleans smell mapping exercises. The different feeling of the textures and materials at Goat Island were noted down, then connected through brainstorming to other man made materials and turned into a collage map (see Figure 2.33.). This was done to explore different materials that could be used in an indoor, marine science centre context that wouldn’t smell, and would be durable to lots of touching. It also allowed me to further conceptualise the idea of evocative meaning through the senses.

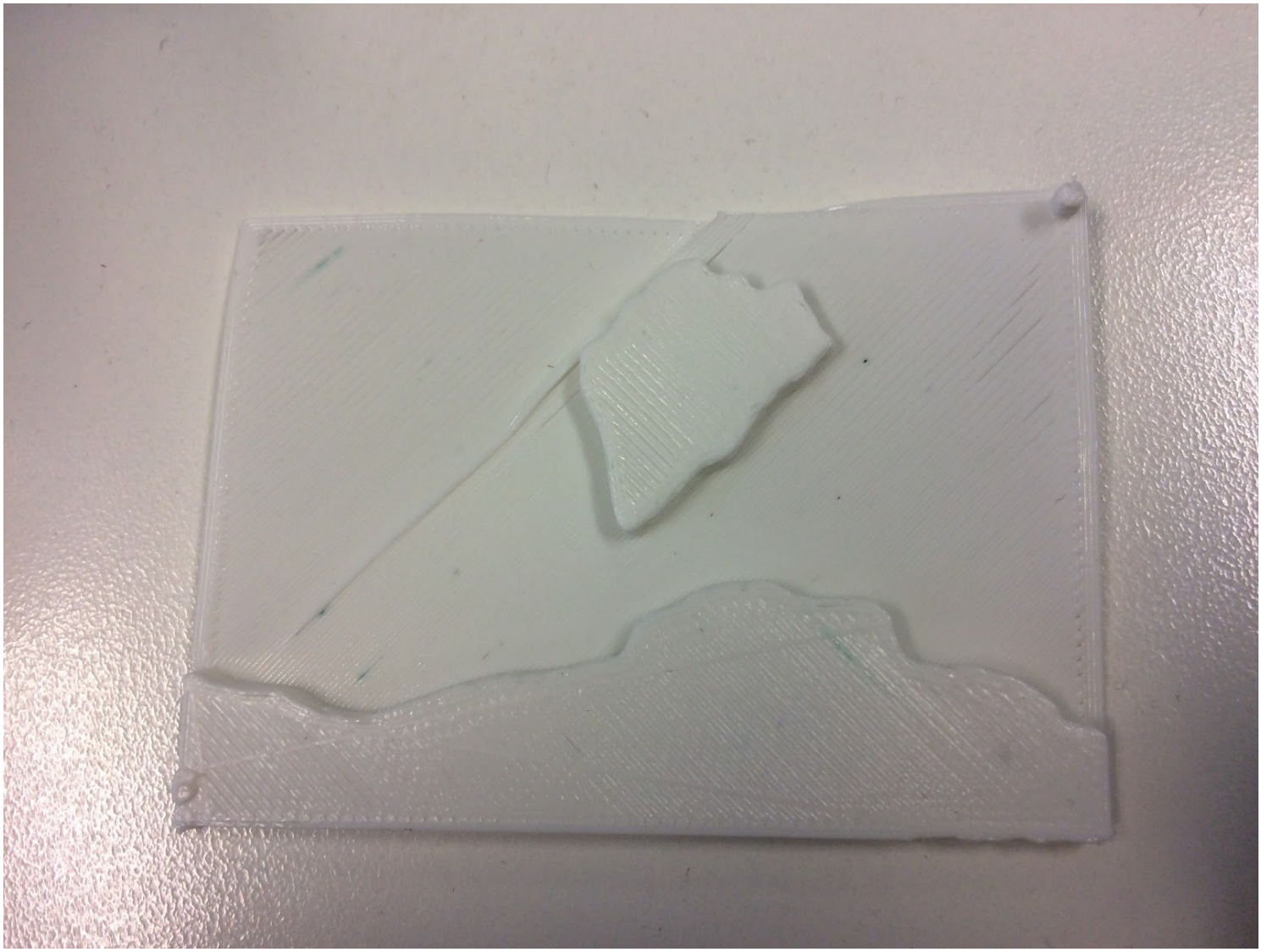


Figure 2.31. 3D Printed Goat Island Map 1, 2017.

Figure 2.32. 3D Printed Goat Island Map 2, 2017.

Figure 2.33. Tactile Touch Map, 2017.

Sound

The mapping of sound involved another visit to Goat Island, this time with a portable audio recorder. I walked around the beachfront area and hills inside the reserve and recorded short sound clips of various phenomena. These included the sounds of sea birds squawking, feet on sand and gravel, waves crashing against rocks, cars pulling up into the car park, and wind rushing through trees and bushes. These audio clips were then used as inspiration for creating visuals to understand the soundscape of the Reserve. Below are some examples of the audio clips I captured at Goat Island, run through a processing software which produces a visual representation of the waveforms. Figures 2.36. and 2.37. show the waveforms integrated with photos I took at the reserve.

Figure 2.34.

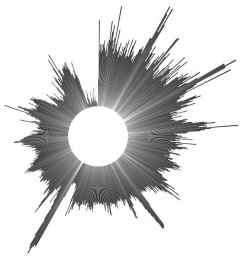


Figure 2.35.

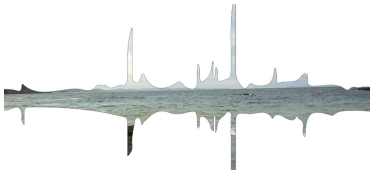


Figure 2.36.

Figure 2.34. Goat Island Sound Visualisation 1, 2017.

Figure 2.35. Goat Island Sound Visualisation 2, 2017.

Figure 2.36. Goat Island Sound Visualisation 3, 2017.

Figure 2.37. Goat Island Sound Visualisation 4, 2017.

These explorations converted different sensory elements into one another. A form of synesthesia. Sound was also explored by taking the soundwaves, and 3D printing them. This created a tactile sound experience. Where the dips and troughs of the sound could physically be “felt” by the touch sense (see Figures 2.38. & 2.39.). The 3D printed soundscapes tied into the concept of the haptic. Using the touch sense to understand and create deep impressions or understandings on the mind and body.

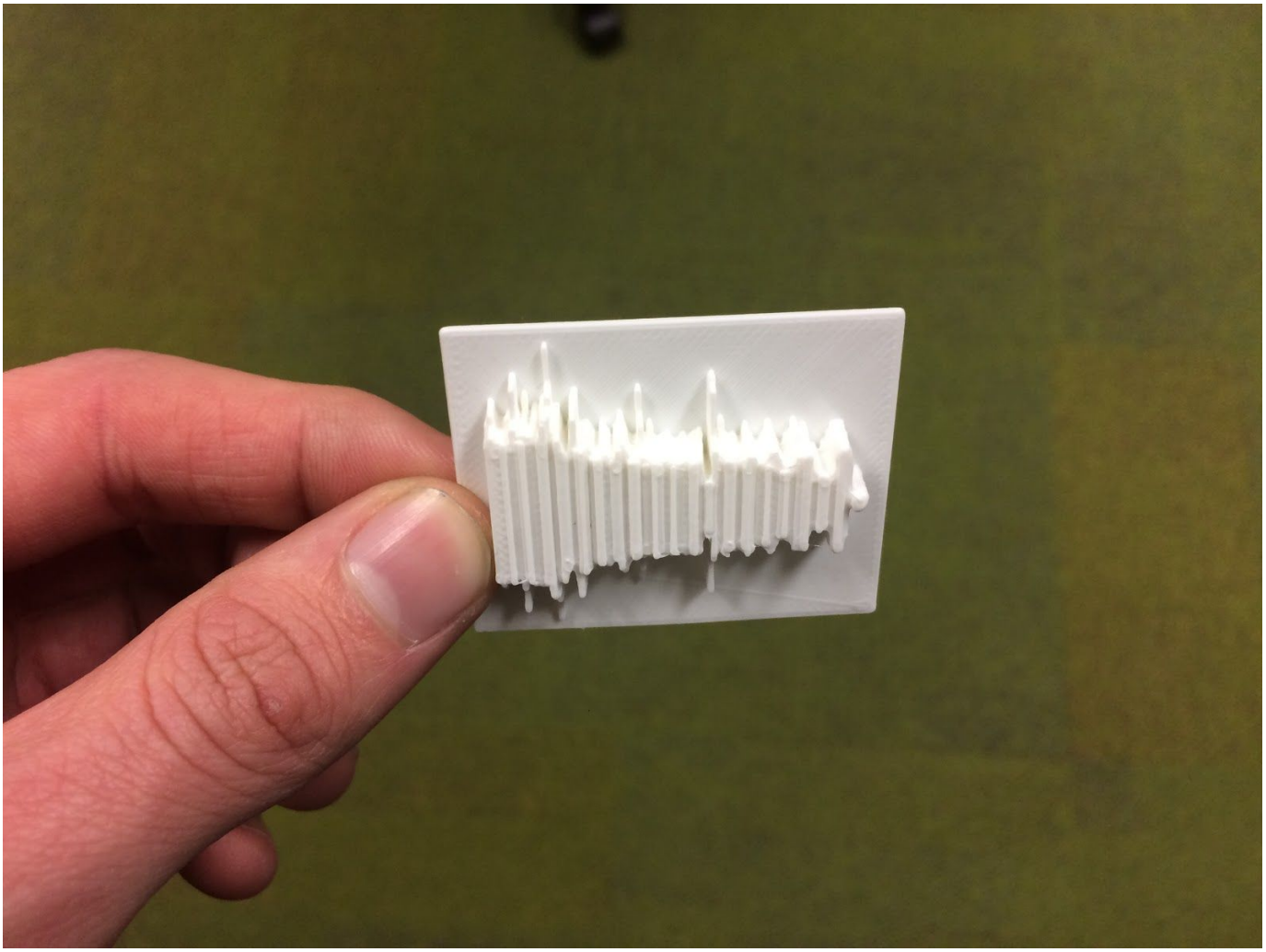


Figure 2.38. 3D Printed Sound Visualisation 1, 2017.

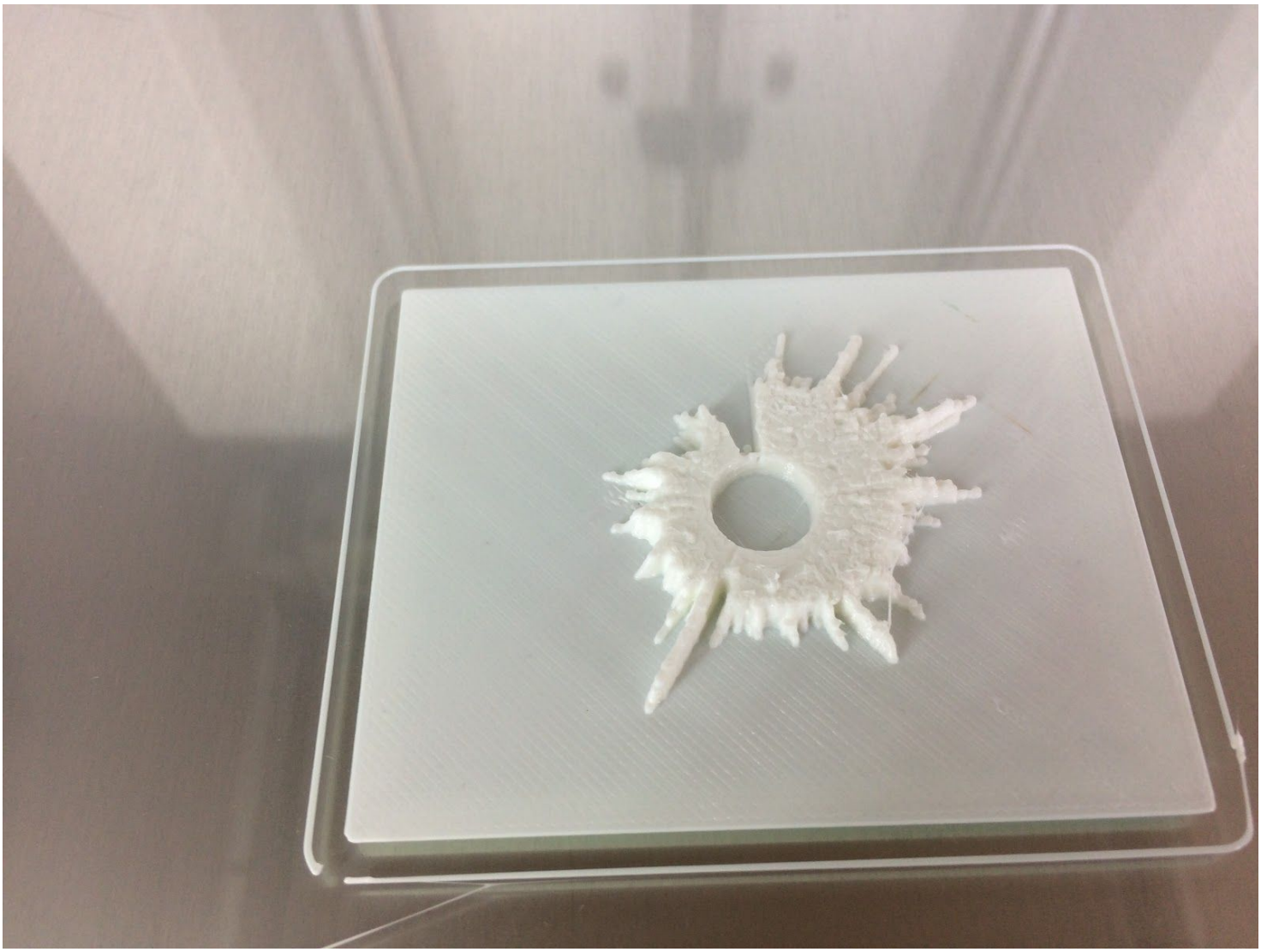


Figure 2.39. 3D Printed Sound Visualisation 2, 2017.

The final experiment with sound was a transfiguration process where the sounds were listened to, then drawn into forms of abstract representation (see Figures below).

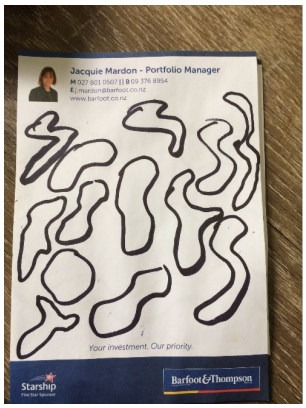


Figure 2.40.

Figure 2.41.

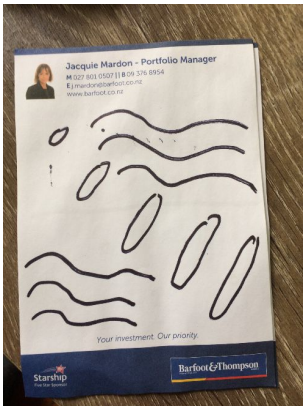


Figure 2.42.

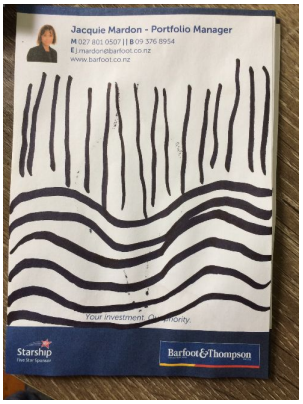


Figure 2.43.

Figure 2.40. Sound Drawing 1, 2017.

Figure 2.41. Sound Drawing 2, 2017.

Figure 2.42. Sound Drawing 3, 2017.

Figure 2.43. Sound Drawing 4, 2017.

Although it may seem like a novel or unique idea to take sensory information and transform or transfer it to be experienced by other senses, it is in fact not an unusual concept. Understanding is interrelated, and senses are interconnected in individuals and across communities of people. We don't experience the world in separated sensory components. Our sensory organs work together in one holistic whole to understand our environments and the universe. My experiments with sound looked at how to exploit the potential of this holistic understanding of the senses. I obscured the boundaries of the auditory sense, blending it and transforming it to be experienced with other senses. This created new meaning and experiences, enriching and enhancing the sense of hearing in novel and unexpected ways.

Instagram Ethnography

eth·nog·ra·phy - n. the scientific description of the customs of individual peoples and cultures.

~ The New Oxford American Dictionary 2nd Edition.

The final exploration for the mapping process looked into how people feel about, and experience Goat Island. This was done through ethnographic procedures on Instagram (IG).

I started by collecting as many photos on IG with the Goat Island location tag as possible. These photos were used to detect patterns and recurring images and ideas. It became apparent which types of images were most popular amongst the visiting public to Goat Island (see Figures 2.44. & 2.45.). It also gave me an overall sense of colour palette, vibe and tonal quality of peoples photographic representation of the reserve. Rather than being an individual, creative expression through the platform, it was obvious that the majority of people took photos of similar things and from similar vantage points.

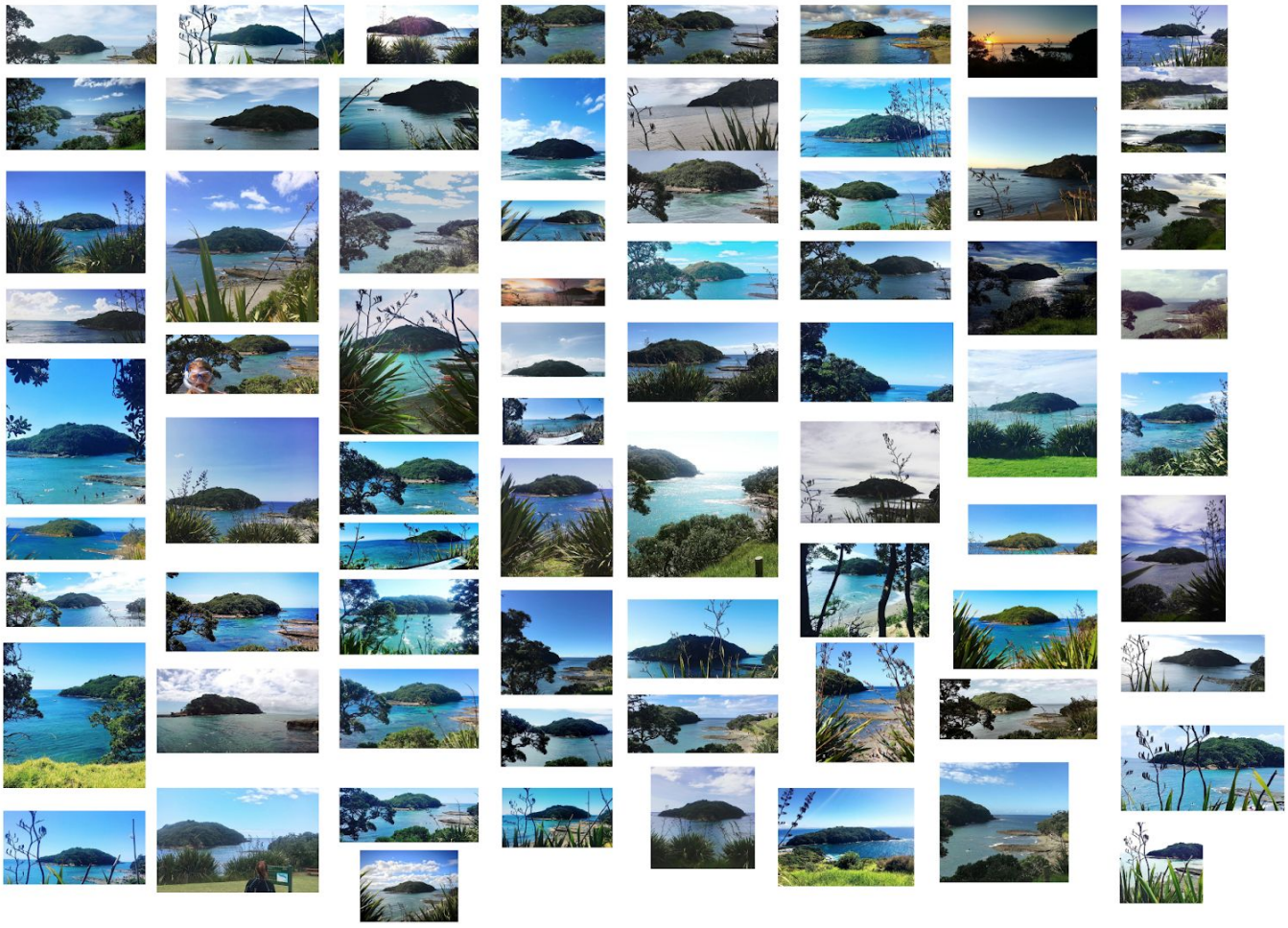


Figure 2.44. Instagram Collage 1, 2017.

Figure 2.45. Instagram collage 2, 2017.

The second part of the IG mapping involved the documentation of captions and emojis visitors were using in connection with their images. This process gave me insight, albeit surface level, into how people felt about, connected to, emotionally engaged, and publicly expressed their feelings about Goat Island (see Figure 2.46.). Out of this exercise it became apparent that words such as ‘gorgeous’, ‘beautiful’, ‘swim’, and ‘ocean’ were widely used by all kinds of different people. These recurring words gave me a view of potentially how people see or experience Goat Island on a meta level, but again it could be a case of simply people writing and expressing what is expected, or what they’ve seen in other people's posts.

The emojis collected gave me some insight into how people used pictograms to give emphasis to what they are saying about the location. Out of collecting the emojis the creation of an ‘emoji map’ in the shape of Goat Island developed (see Figure 2.47.). This explored both the landmass, contours and shapes of Goat Island, while also showing the emojis people used on IG to express their understanding, views, feelings and thoughts about the location. In a sense, it explored the relationship between a physical location, and peoples psychographic understandings of that space.

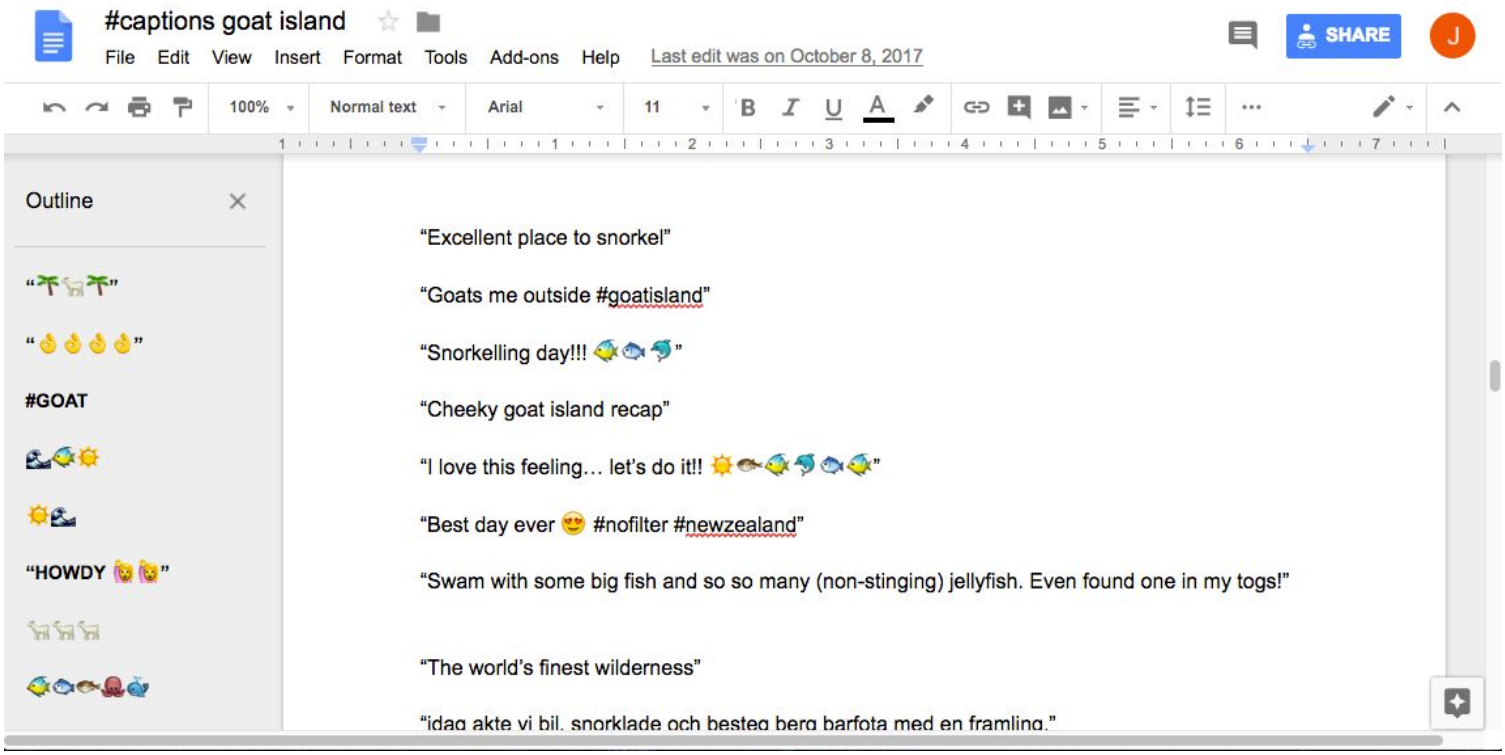


Figure 2.46. #captions goat island, 2017.

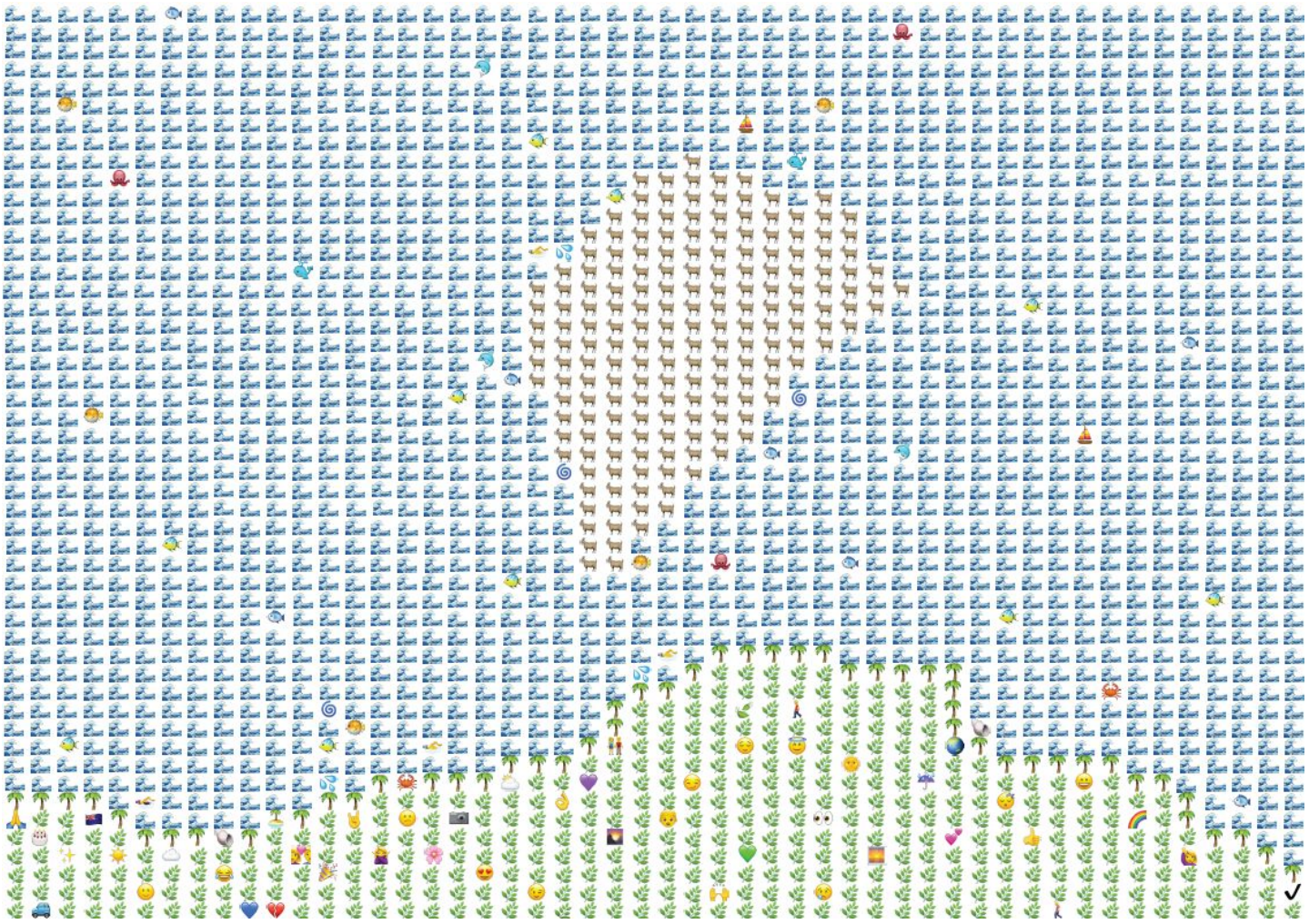


Figure 2.47. Goat Island Emoji Map, 2017.

The sensory mapping influenced my holistic understanding of senses and emphasis on activating multiple senses and ways of feeling in the kelp forest experience.

The ideas generated through the haptic experiments in particular, lead to a specific focus on touch in the final encounter. These experiments influenced the use of felt material, an emphasis on getting the students touching, feeling and engaging with the materials in the forest, and an overall focus on materiality as a core aspect of the experience. This tied into the idea of connecting the concept of a natural, organic organism or mineral, with a man-made material substitute. Thus creating an evocative experience.

2.4.4 Findings

“I want to go to my local beach and pick up plastic to help the sea life and ecosystem there.”

~ Quote from a child participating in the forest experience.

The main argument for the inclusion of my kelp forest experience into the TLRI intervention was that it provided the project with the real world, haptic context, in which the digital learning occurred around and within. In order for a MR learning situation to be effective and impacting for the students, there needed to be a strong real world component to complement and support the digital elements. The digital learning needed to be emplaced within a physical, haptic, sensory context.

Evidence for the kelp forest being meaningful for the students can be observed through the video footage of the children interacting with the experience on the day of the intervention, and from the feedback sessions conducted by the TLRI researchers. From the footage, (see previous figure 2.44.) the excitement observable suggests that the students were fully engaged and absorbed within the experience. They were fascinated and ‘lost’ in the encounter. This total engagement with the kelp forest leads me to believe that the students may be having an aesthetic experience, or at the very least a stimulating, immersive and enjoyable time. The children responded positively to the forest in the follow up feedback session. A few of them even went as far to say that it was their favourite part of the MR intervention, and that it had inspired and affected them deeply enough to want to take action in the real world.

2.4.5 Conclusions

“We see ourselves as ONE with Papatuanuku our Earth Mother, and Rangi our Sky Father of the Far Flung Heavens. I celebrate the similarities and differences I have with other cultures, because I believe we are truly ONE, and are all Family. The “Hongi” (pressing of noses) in greeting, is a tradition that reminds us, that we are interrelated to all living things that exist!”

~ Dr. Rose Pere, Te Wheke Kamaatu - The Octopus of Great Wisdom

Through interacting with my final kelp forest experience, the children were hopefully left with a deeper understanding and sensory knowing about marine ecology. The experience hopefully fostered a sense of empowerment that gave them a feeling of being able and willing to make changes and differences in real world ecosystems. I aimed to transmit feelings of oneness and interconnectedness through my holistic approach to designing a multi sensory encounter that brought to life the forest of the sea. As I was working within the larger TLRI project, I was required to frame my research around the projects objectives, which informed my research question, as well as the scope and time available to develop and test my ideas. It needed to complement the development of their Mixed Reality, M-learning, Ecological Literacy objectives. There was not much room for fluid, personal research.

Future directions for this project are numerous. The kelp forest experience was a prototype for new, enhanced educational experiences to spring out of, for example, a land based context to teach about ecology such as rainforests or deserts. The concept of a holistic, multi sensory experience could also be engaged with outside of a science, sustainability and ecology literacy context. How would the process I undertook, and the experience I designed, be applied in a humanities context? e.g. a social studies project or english class. It is of critical importance to educate young people about the world and their interrelation to it. This is especially true of natural environments, which suffer deeply from a lack of human empathy and connection. Immersive, participatory educational experiences are one way that a deeper, more spiritual connection to the universe can be fostered and promoted in children.

Figure 2.48. Stretched 360 Panorama of the Kelp Forest Experience. Ali Taheri, 2018.

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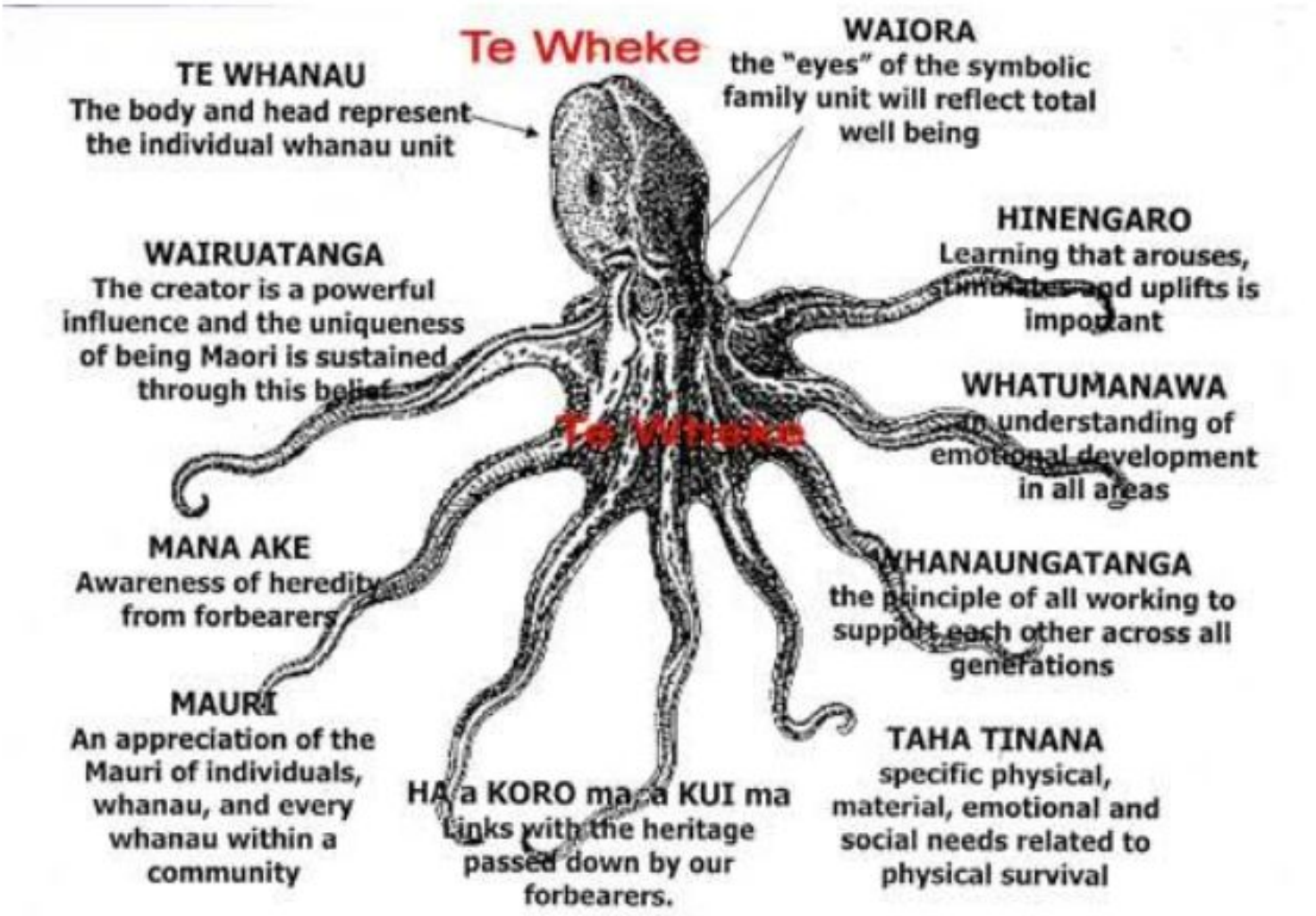
Appendices



Appendix A: Zvyky, M. T. (n.d) Te Wheke Model. Retrieved from http://www.novyzeland.chytrak.cz/Te%20Wheke.jpg.

Appendix B: Kelp Forest Video: https://drive.google.com/file/d/1fuo9ZJD_VSzkhw71abAnuhRelEP2M4ZX/view

Appendix C: Kelp Forest 360 Panorama Link: https://seekbeak.com/v/NAp1PxXO1Xo