Tōia Mai:

Speculating art and reality

at the hyphen

in Aotearoa-New Zealand

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Lodgement statement

An exegesis submitted to Auckland University of Technology in the fulfilment of the requirements for the degree of Doctor of Philosophy (AK 3518).

Abstract

This practice-led creative research is located at the intercultural hyphen space (Fine, 1994) between Māori and Pākeha in Aotearoa-New Zealand. It attempts to explore some potential parallels and synergies between the metaphysics of te ao Māori and te ao Pākehā through the interactive public artwork *Tōia Mai*, which is located on the Western bank of the Waikato River at Hamilton's Ferrybank Reserve, in Aotearoa-New Zealand. As a Pākehā attempting to be guided by a kāupapa Māori methodology within the context of a polytechnical tertiary educational setting, the practice has been in partnership with the Māori achievement office of the Waikato institute of technology (Wintec). Its theoretical framing is located between recent posthumanist critique from speculative realist and new materialist positions, and contemporary Māori scholarship. This research is speculative, as it does not attempt to answer a question or address a specific issue (Haseman, 2006). Instead, this inquiry was conducted through a collaborative and creative-led practice that acknowledges how multiple collaborations, myself, my creative arts research, and my creative arts practice, were all inextricably inter-related in a performative manner (Barnacle, 2009).

By exploring how performativity departs from the idea that 'things' are bounded and discrete and focusing on how practices happen are as important as what happens, this research traverses performativity's interconnection with inter-relationality and emergence to reveal how different metaphysical frameworks, can themselves, conditionally exist relationally. Western humancentric claims of objectivity are not universal, but informed by Cartesian and Kantian frameworks that position matter as being atomistic and substantial, in distinction to ideas and representations that lack substantiality. Informed by different traditions, Māori metaphysical approaches have much that could inform contemporary posthumanist concerns, with fundamental differences precluding any claims of correspondence.

Western culture's assumption that reality beyond human finitude is both knowable and accessible is found to be untenable from many Māori perspectives, as it doesn't acknowledge the world's volition or how spirituality and materiality are threaded through each other. Recognising the agency of nonhuman entities challenges the primacy of human exceptionalism as a predicate for objective truth and disrupts the claim that 'knowledge' is exclusively human. A materialist assertion by Barad (2007), recognises how different practices enact agential cuts within the performativity of matter as phenomena. Applied to Austin's (1976) original conception of performativity, this informs how language practices can co-constitute reality and operate as acts of discovery.

Attempting to practice at the intercultural hyphen has also prompted reassessment of the idea that potentiality lacks tangibility, and can now be considered in relation to the quantum discontinuity and how the unknown is part of the human condition. This non-causal understanding informs my notion of *Pull* - which occurs when sufficiently complex co-constituted phenomena produces its own drift, or tendencies. Similarly, digitality and materiality are found to exist in continuum with each other, as digitality always has a relationship with the tangible. Finally, the domain of ‘Art’ requires reassessment in relation to taonga, as well as these recent posthumanist understandings, as the primacy of humans as meaning-makers can no longer be taken for granted.

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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.

Joe Citizen

Declaration of Collaboration

This practice-led creative research has involved multiple collaborations. Unless stated otherwise, the creative design, interactive design, interactive lighting programming, and production management, have been undertaken by myself (Joe Citizen). It should be noted that this doctoral research is distinct from, but ran in parallel to, research that I undertook in my role as a Wintec academic and researcher. The purpose of that research was to explore how Wintec's Māori capability framework Te Ngāwhā Whakatupu could be embedded into real-world student learning through a multidisciplinary, collaborative art project. The following is a summary of key roles and contributions, but given the scale of the project, it is not extensive:

Mātauranga Māori and guidance	Waikato-Tainui kaumātua Tame Pokaia
Primary project partner	Wintec Māori Achievement Office, led by Director-Māori Hera White
Tertiary education provider	Waikato Institute of Technology (Wintec)
City Council partner	Hamilton City Council
Mechanical engineering, engineering design, fabrication and student mentorship	Longveld Ltd
Structural engineering	MechEng Ltd
Civil engineering	BCD
IT architecture and programming	Jourdan Templeton and Aware Group
Initial digital 3D modelling and signage graphic design	Luke McConnell
Initial CAD design	Tully Billett
Sound design and production	Horomona Horo, Jeremy Mayall, and Norefjell Davis
Technical lighting support	ACLX Ltd
Electrical engineering lead	Brent Phillips
Electrical support	Paul Nagels and Totally Wired 2010 Ltd
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Longveld	$30,000 in-kind + materials at cost + student mentorship
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AUT	$12, 500
ACLX	$6000 in-kind services
MechEng Ltd	$3000 in-kind services
DV Bryant trust	$2000

Introduction

Attempting to identify potential parallels and synergies between the metaphysics of te ao Māori and te ao Pākehā might seem to be impossible at first glance. It is certainly erroneous to assume that different cultures might inherently have common ground, which invariably leads to universalisms that privilege one culture's framework over the other. Similarly, engaging with essentialisms is a fraught exercise that reduces the subtleties of understanding into rhetoric. At best, these devolve into 'tick the box' generalisations, and at worst, marginalised tokenism and patronising stereotypes occupying a thoroughly Othered position. Yet neither are cultures hermetically sealed in isolation to one another and in a Pacific-rim country like Aotearoa-New Zealand, some cross-pollination between the different cultural frameworks is apparent in day-to-day life. Here it is also necessary to acknowledge our shared but different histories of colonialism; how Western settler culture have historically presumed a position of paternalistic superiority; where the forceful application of ideology in relation to what is or is not the nature of truth and reality has been part of that violence. Nonetheless in contemporary society it has become increasingly common to experience mātauranga Māori and scientific knowledge as existing side-by-side, particularly in the health, education, and cultural sectors. An example of this is Matariki, which marks the end and start of the Māori New Year and refers to a framework that acknowledges the interconnected nature of the universe. This event has become increasingly popular since the 1990s, with calls for it to become a national holiday. (Matamua, 2017)

Cultures, plural, are untidy affairs. They cannot be reduced into insulated singularities, yet neither do they form a homogenous whole. They meet and retain their differences, having affect or influence like oceans meeting each other. By necessity this practice-led research has taken a broader-brush approach, and acknowledges the fundamental tensions and contradictions that exist 'in-between' the Pākehā-settler and Māori-indigenous cultures. As someone who identifies as Pākehā I am intensely aware of some of my own cultural presuppositions, whilst being aware that I remain unaware of others. Borrowing from Michelle Fine (1994), I attempt to operate within an intercultural space that is represented by the grammatical line located within the word 'Māori-Pākehā'. I acknowledge that "working the hyphen" (Fine, 1994, p. 72) is a liminal space and one where my own metaphysical assumptions cannot be taken for granted. To an extent this is a pragmatic strategy, one that does not seek to hybridise or make claims of sameness, both of which are impractical:

> To those Pākehā researchers who would collapse the Māori-Pākehā' hyphen into 'us', there is one, harshly pragmatic, response: it does not work. A research approach to Māori, whether as research collaborators

> or subjects, that *assumes* a mutual interest, minimal difference, and a set of shared assumptions, is doomed to practical failure. However much Pākehā might assert, desire, or assume the 'us' in modern life, Māori usually insist on a difference; the hyphen is un-negotiable.
>
> Jones, 2017, pp. 185-186

As a Pākehā researcher I do not stand at a distance as if removed from the nitty-gritty of cultural ways of being, but remain implicated within the research (Barnacle, 2009). When the nature of the research is speculative then this hyphen space is not so much a straight line, it becomes relational, interstitial, even transformative, sometimes. It is another space, both within and without, it skirts the edges of things without ever fully being cognisant of what they might be edges of, because attempting to traverse metaphysical understandings at the intercultural hyphen "touches on the infinite, the philosophical depths, the mystery of existence, the transcendent experience that cannot be measured." (Stewart, 2018, p. 770)

As a practice-led art researcher in the context of Aotearoa-New Zealand, attempting to operate within the intercultural hyphen space means acknowledging the principles and practices of our nation's founding document Te Tiriti o Waitangi. Whilst a full discursive description is beyond the scope of this research, what lies at the heart of this concord between Māori and Pākehā cultures is an acknowledgement of Māori tino rangatiratanga (chiefly authority) and kawanatanga (governership). This research acknowledges and affirms these principles and has attempted through a partnership practice with Wintec's Māori achievement to embed them into our kaupapa.

It has become something of a cliché that on the jacket covers on recent books about speculative realism or new materialism, there are claims made about how now more than ever, a reassessment of post-Kantian frameworks is necessary if humans are to avoid what appears to be an imminent global environmental collapse. The back of the paperback version of Steven Shaviro's *The universe of things: on speculative realism* claims for instance: "The stakes of this recent speculative realist thought - of the effort to develop new ways of grasping the world - are enormous as it becomes clear that our inherited assumptions are no longer adequate to describe, much less understand, the reality we experience around us." (Shaviro, 2014) Similarly, the back of Jane Bennett's *Vibrant Matter: a political ecology of things* says that it provokes "our democratic imaginations and interrupts our anthropocentric hubris" (Coles, in Bennett, 2010).

Entirely absent from these decidedly Eurocentric calls, is any acknowledgement of the long history of indigenous scholars providing just such a critique. As industrialised science coupled with consumerism is increasingly being recognised as being

environmentally unsustainable, it appears patently obvious that conversations with indigenous people about indigenous knowledge of the inter-relationality between humans and ecosystems is not just overdue, but thoroughly ignored: “Such an emphasis on relationships has been notoriously absent in the knowledge produced in Western science over the past four centuries (Dei, 1994; Keith & Keith, 1993; Simonelli, 1994).” (Kincheloe & Steinberg 2008, p. 137) Yet if indigenous knowledge has historically been marginalised by a framework that privileges Cartesian-Newtonian-Kantian epistemologies, then recent 'speculative' or 'new materialist' critiques (Dolphijn & van der Tuin, 2012) that also seek to escape these metaphysical foundations are equally problematised. Part of the difficulty is that by attempting to decouple humancentrism from an epistemological framework that takes the division between human thought and a material universe to be self-evident, a Western philosophical history of human exceptionalism is revealed to be grounded in the claim that humans alone have agency in the world. Following Descartes, only humans are capable of the requisite logical thought that determines objective truth from the deceptions of the senses. When speculative or new materialist philosophies posit the agentic capacities of nonhuman entities, then these claims challenge Western notions of objectivity as being the exclusive purview of humans. This in turn contests the authority of Western science, which is predicated by its claims to objective truth as a means to unlock the secrets of an otherwise unknowable universe. Should human exceptionalism or objectivity be revealed to be culturally constructed or simply false, then the dilemma for Western philosophy is that not only does it have a vested interest in maintaining its authority, but that knowledge production cannot be said to belong exclusively to humans.

At the centre of these claims to agency and objectivity is the equally fraught concept that things-in-the-world must have material substance, and that acts of thinking are insubstantial. Carl Mika (2017) describes this situation as the metaphysics of presence, whereby:

> the thing is there to be studied and considered in its abstract form (Miller, 2012), from the perspective of the cognitive self. It is alone; it is divided from other things in the world; and it has permanent, identifiable characteristics that make it possible to be represented as here-and-now.
>
> Mika, 2017, p. 21

Understanding presence in a Western sense, is according to Mika, to position it in relation to its lack thereof - absence. Following the Cartesian ontological bifurcation between being and thinking, claims to an abstracted objectivity rest upon the notion

that information is intangible or without physical form. In the context of digital communications and digitality, this tradition has had significant influence as to how these practices are understood as somehow being without substance, oftentimes with environmental consequences. Appraising what materiality is therefore engages with foundational differences between the metaphysics of te ao Māori and te ao Pākehā. Western thought has, for instance, been traditionally informed by Kantian sensible concepts and Newtonian notions of causality, cultural beliefs that have been rigorously challenged by developments in quantum physics and digitality. A Māori-indigenous approach can be articulated by the term 'worldedness', which refers to a metaphysical framing whereby "one thing is never alone, and all things actively construct and compose it". (Mika 2016, in Mika 2017, p. 4) In the context of a research project that set out to make an interactive sculpture in the public domain, a rapprochement between Māori indigenous knowledge and Pākehā metaphysics was not just inevitable, but vital.

If it is impossible to essentialise cultures, then it is equally impossible to entirely encapsulate all the originating linkages that inform the theoretical framings of this creative practice-led research. When attempting to work in the intercultural hyphen space, the framings that have been used are intended to operate as important reference points, but it should be recognised that they are informed within wider historical contexts. So whilst this research engages with the ideas of Barad (2007), Barnett (2017), Bennett (2010), Delanda (2016), Gratton (2014), Hēnare (2015), Marsden (1965/2003), Meillassoux (2008), Royal (2017), Shaviro (2014), Stern (2013) and others, it is important to recognise that the Western thinkers here have been informed by the ideas of Kant, Heidegger and Deleuze, and that the Māori scholars have often been informed by their own hapū and iwi knowledge sources. As this creative research is practice-led rather than being grounded entirely in theory, such linkages might prove to be fruitful to research in the future, but cannot be included here.

As a Pākehā attempting to be guided by a kaupapa Māori methodology in the educational context of a regionally important polytechnic (tertiary level institution of technology), I've also had to navigate discourses associated with graduate employment outcomes, local politics, and 'innovation'. As a creative practice-led researcher, it quickly became clear that any form of sustained comparison between these different metaphysical frameworks would be untenable. There is a very real danger of Othering the multiplicities of Māori metaphysical knowledges when they are reduced to an artificial singularity and positioned into a binary conversation with humanist project philosophical traditions.

Attempting to be guided by a kaupapa Māori methodology emerged from a series of existing relationships, it did not suddenly arise from a book or taxonomies of knowledge. Living and working in Hamilton, Aotearoa-New Zealand, has entailed seeking advice from the Waikato-Tainui Kaumātua Tame Pokaia, who has been appointed as Kaumātua for the Hamilton City Council by King Tūheitia. That he is also the Kaumātua of the polytechnic (Wintec) where I am employed, has been immensely fortunate for this practice-led research. Deferring to his knowledge on all 'things Māori' means that our shared endeavour is informed from a Waikato-Tainui perspective in the first instance, with reference to academic sources thereafter. It has enabled a partnership practice with Wintec's Māori achievement office, as led by Director-Māori Hera White, to flourish. Emphasis is placed on process rather than outcomes, where the kaupapa with its emphasis on transformative change (Durie, 2017), takes precedence over my needs or wants as researcher.

This process-focussed approach sits in parallel with my initial theoretical framings taken from Barad's concepts of intra-activity and agential realism, as informed by the work of Niels Bohr. Intra-activity recognises that "distinct agencies do not precede their interaction" (Barad 2007, p. 33), which is to say that the agentic capacity of things-in-the-world do not occur prior to their engagement with each other as discrete and isolable entities. Agential realism is founded on the idea that: "Intra-actions always entail particular exclusions, and exclusions foreclose the possibility of determinism, providing the conditions of an open future." (Barad 2007, p.234) Whilst her emphasis is on materiality as co-constituted and continuously unfolding phenomena, there is a surprising degree of synergy between this metaphysical framework and the concepts I encountered through my discussions with Tame Pokaia that relate to mātauranga Māori, particularly with ideas around potentiality, time, and space. This is not to claim any correspondence or equivalence between the metaphysics of te ao Māori and Barad's insights from quantum physics, but simply to identify how these frameworks ran in parallel so that sometimes it became hard to determine which was under discussion. (See also Appendix B). Whilst further research is beyond the scope of this work, it might prove a useful field to explore in the future.

Another parallel between the two frameworks is situated within that has otherwise been described as performativity. Performativity has been described as "a non-autonomous and non-subjectivist idea of acting" (von Hantleman, 2010, p. 19), or in simple terms, that the action of action with or without humans, has agency. The earliest use of the term was in relation to language, where:

> to utter the sentence (in, of course, the appropriate circumstances) is not to *describe* my doing of what I should be said in so uttering to be doing or to state that I am doing it: it is to do it.
>
> Austin 1976, p. 6 [italics in original].

The performativity of language in this original sense is decidedly humancentric inasmuch Austin believed that “Actions can only be performed by persons” (Austin, 1976, p. 60). In the context of contemporary new materialist and speculative realist concerns, this definition has been expanded to include the agency of “materials, things, substances, and processes.” (Salter, 2015, p. 9) This last attribute is critical because it departs from the idea that ‘things’ are bounded and discrete, and instead identifies how practices happen is as important as what happens:

> our knowledge-making practices, including the use and testing of scientific concepts, are material enactments that contribute to, and are a part of, the phenomena we describe.
>
> Barad 2007, p. 32

Apprehending performativity as actions that do things, as actions that have agency in the world in and of themselves, provides a potential meeting place between Pākehā and Māori knowledge frameworks. Performativity has the capacity to inform understandings of Te Reo Māori, materiality as phenomena, art practice, aesthetics, the practices of science and technology, and a host of other fields.

Understanding performativity also informs how writing this document has been a series of iterative acts of discovery. The chapters as presented here are more or less as they were written using voice to text software. Speaking out loud rather than writing with one’s hands helped to challenge a long-held belief – that technology exists as an extension of the mind. Performativity in this sense is inter-relational with what else is already going on in the world, for in speaking out loud one becomes aware that as the words manifest into pixels on the page, the agency of the unexpected and the unknown also make themselves felt. Examples include a software AI that tends towards Eurocentric accents and syntax; interruptions such as the wind across the microphone forming words, or unintended phrases being written upon the occurrence of visiting people, dogs, and other events; those strange sentences that form when the battery runs low on the headset; and above all, that creeping realisation that consciousness may only sit on the surface of much deeper currents. Like a dreamer dreaming, sometimes I watch the words form upon the page and wonder how through that mixture of my utterance and some unknown event, an unexpected salience results. Here too is

the poetry of the moment, more present in speaking than in typing. The cultural expectation of written grammar has a role to play, bending the delivery into tenses and stripping those long pauses of their potentiality. Where cadence, rhythm and tone once were, now there is only punctuation and a flat rendition of their intent.

The first chapter is intended to give an introductory overview of the practical research, including the technologies and processes involved. The second and third chapters were written using a 'critical moment' structure, with the intention being that through such a device the multiple interconnecting threads that inform it might be revealed and discussed. The second chapter 'Between worlds and worlding: Placing the waka foundation' acts as a general introduction to both the practice and the theoretical framing. Nominally located on that day when the foundations for the interactive sculpture that was to become known as *Tōia Mai* were to be dug, it provides an access point to begin understanding the cultural, educational, industrial, governmental, and other entangled agencies that had and would continue to have influence on the unfolding phenomena. The third chapter 'The Antenna' stretches over a week rather than a single day, and starts to unpick some of the assumptions around digitality and materiality. It features a conversation between myself and Jourdan Templeton - who is the chief technology officer of the project's IT industry partner Aware Group - and begins to engage with two critical terms: assemblage, and virtuality.

The fourth chapter 'Performative problems' departs from the critical moment device in order to discuss the problems of trying to engage with performativity whilst using the conventions of representationalism. Starting with a discussion about attempting to research ontological modes using epistemological frameworks, it moves towards posthumanist understandings of the performativity of language, before beginning to engage with Māori and Pākehā differences regarding how language operates in the world. The fifth chapter 'The potentiality of a line' begins with the question: Can a non-Māori attempt to be guided by a kaupapa Māori methodology? It discusses the problematic nature of attempting to work at the intercultural hyphen and introduces the kaupapa of the partnership project. Disputing the Plato–Descartes–Kant metaphysical trajectory as being anything other than universal, it appraises the traditional difficulty for Westerners attempting to engage with mātauranga Māori. Featuring a conversation with Kaumātua Tame Pokaia as an example of different ways of knowing, it outlines some of the initial framings for *Tōia Mai* in relation to later reflections from Mika's discussion of worldedness (2017) and Barad's explanation of the quantum discontinuity (2007). Along the way it introduces the reader to the concept of *the unknown* which acknowledges the simultaneous unknowability and agency of those entities that exist beyond human finitude.

The sixth chapter introduces the reader to the concept of *Pull,* which describes an emergent property that arises from situations that have multiple complexities. It introduces and analyses the work of two prominent speculative realists – Quentin Meillassoux (2008) and Manuel Delanda (2016), and the new materialist Jane Bennett (2010). All three are informed by different relationships to the ideas of Descartes and Kant – Delanda and Bennett both refer to Deleuze who bases his work on Kantian divisions between substantiality and insubstantiality. Meillassoux produces a complex argument whereby Kantian idealism operates in our universe, but perhaps not in others. Along the way Delanda's concepts of assemblage and virtual diagrams as "cartographic strategy" (Delanda, 2016, p. 110) and Meillassoux's notion of facticity, (virtuality) are discussed in detail. Underpinning this critique is an intercultural consideration of the idea of potentiality and how it specifically relates to the Western treatment of 'things-in-the-world' and virtuality in relation to the practice. The Māori concept of mauri is briefly introduced before being discussed more fully in the following chapter.

The seventh chapter 'Confluence: Where rivers meet' re-engages with aesthetics in relation to the concepts discussed so far. It finds the term 'art' problematic both in relation to contemporary realist concerns and the Māori interconnected concepts of mauri, taonga, hau, mana and kaitiakitanga. It acknowledges the embeddedness of a spiritual dimension that is lacking in realist approaches, and considers the interfusion of the spiritual and the material present in Māori metaphysics but otherwise separated in Western traditions. Using filmmaking as a departure point to explore the collaborative aspects of making *Tōia Mai* into a tangible form, it describes how domain culture expectations obstructed experimental practice. This leads to an examination of the concepts of technology and logic and finds them to be forms of different types of cultural practice. It finishes with an assertion that a nonhuman aesthetics can exist at the intercultural hyphen space and that this could inform posthumanist understandings of aesthetics in a wider capacity.

The eighth chapter discusses the contributions made to the field, which can be summarised as finding: That humancentric claims of objective truth that exist within the Western cultural imaginary are far from universal; that forms of Māori metaphysical knowledge can provide non-Western contributions to posthumanist studies; that notwithstanding this, posthumanist approaches provide a means by which to understand the universe in a manner that decentres human centrism; that 'knowledge' arguably does not exclusively reside with humanity; that performative and posthumanist understandings of language co-constitutes types of structural reality; that materiality needs to be considered as continuously evolving and relationally emergent

phenomena; that digitality and materiality exist in continuum with each other; that potentiality requires a sustained and comprehensive reassessment; that time and space as co-emergent performativities require a similar reassessment; that sufficiently complex co-constituted phenomena will produce its own drift or *Pull* towards certain types of potentiality; that the domain culture known as 'art' needs reassessment in relation to posthumanist critique and Māori metaphysical knowledge; and that the unknown is part of the human condition with the implication that finitude is inescapable.

The exegesis ends with a reflection that partly summarises these findings and reflects on some potential areas for further research that others might find useful.

A note on terminology and pronunciation:

The terms 'Māori' and 'Pākehā' are not without contention in Aotearoa-New Zealand. Neither term should be viewed as being self-contained and singular and as noted elsewhere, have pluralist and entwined meanings that nonetheless retain distinctiveness. As tangata whenua, the term 'Māori' refers to being "ordinary" (Royal, 2017, p. 113), whereas the term Pākehā might've originally refered to "the fair-skinned people, who came from the sea" (https://www.rnz.co.nz/programmes/john-bluck-writes/story/2018701081/john-bluck-asks-who-wants-to-be-a-pakeha-episode). This research expands that definition to include all those people who are not Māori, but who might otherwise be informed by Western metaphysics. Similarly, it might seem to some readers that the terms 'Western' and Pākehā are used interchangeably, but this is not the case - Pākehā live in Aotearoa-New Zealand, and it is a term that has an explicit relationship with Māori and should not be confused with the cultural imaginary known as the West. 'Western' in this context refers to a generalised cultural understanding that might be summarised as following the metaphysical trajectory of Plato-Descartes-Kant, as described elsewhere in this research.

Native English speakers should note that notwithstanding regional differences, te Reo Māori has 10 vowels, and instead of 'A, E, I, O, U' these should be read as 'Ah, Eh, EE, Oh, OO', with the additional five vowels having a longer sound. Contrary to traditional Waikato-Tainui practice that uses a double letter to denote these long vowels, the use of a macron is used here to enable international readers to more easily parse unfamiliar words. e.g. 'ā' is used instead of 'aa'. Additionally, the 'wh' at the beginning of words should be read as 'f'.

A glossary has also been included to further aid understanding.

A note on image credits:

All images by Joe Citizen, unless otherwise credited.

Whakapapa of *Tōia Mai*

This chapters provide an introductory overview of *Tōia Mai*, in relation to its many layered aspects. The term 'whakapapa' is used here despite it not being easily translated into English. Often referred to as 'genealogy', this explanation renders flat its deeper layers of interconnectivity and imprisons non-linear conceptions of time into chronology. What time is, and how it interrelates, are perhaps the most salient and problematic aspects in attempting to provide a description to *Tōia Mai.* Inevitably, this summary is somewhat artificial, as it attempts to describe the co-constitutively woven, entangled, and multiplicitously layered strands that are found at the intercultural hyphen(s) between te ao Māori and te ao Pākehā (the Māori world/view and the Pākehā world/view).

This chapter includes seven main sections that describe the following: a brief description of the tangible structure found at the Ferrybank reserve in Hamilton, Aotearoa-New Zealand; a discussion of the main collaborators and what their roles and functions are; a workflow diagram and commentary; a larger diagram which details some of the 'aesthetic voices' of the work with accompanying discussion; a series of notes which describe the technical details of the work; a description of the sound design which emerged from a series of other processes already in play, and finally, a short discussion which considers the problematic nature of attempting to identify specific knowledge as 'belonging' to one culture or another.

Description:

Tōia Mai is a continuously evolving phenomena, co-constituted by many contributing strands; a confluence of changing agencies. To traditionally Western thought there are two easily recognisable aspects – that which is commonly recognised as a being sculpture, located at the Ferrybank reserve beside the Waikato River, at Hamilton, Aotearoa-New Zealand. (See figure 1). There is also its digital architecture, which is located both locally and globally, a combination of 'Internet of things' (IoT) devices, a software application that scrapes environmental data from 'local' websites (for example water temperature from the river is taken from here: https://www.waikatoregion.govt.nz/Environment/Natural-resources/Water/Rivers/Water-temperature-levels-in-the-Waikato-region/Waikato-River-Victoria-Bridge/), and cloud-based applications that run wheresoever its host considers it is most efficient to do so.

Such a description is informed by a Western metaphysical trajectory that positions 'things in the world' as self-contained objects. Acknowledging *Tōia Mai* as a taonga which again, is usually inaccurately translated in English as being a 'treasure', but is elsewhere described as being "subjectless objects that call for conscious engagement, [which] perform and are performed" (Barnett, 2017, p. 30), problematises this conception. This problematic is discussed in further detail in the main body of this thesis in a speculative manner, and could inform other post-humanist understandings.

Yet if the majority of this research is situated in the context of a public art project that requires ongoing institutional, financial, and promotional support, other descriptions which align to existing techno-cultural and educational discourses are a necessity. Weaving together "ancient knowledge" (personal communication, Rahui Papa, 20th February 2018) with a tertiary polytechnic's innovation discourse, requires more straight-forward language. It becomes necessary to emphasise how students can learn 'real-world skills' to prepare them for industry. An example of this strategy can be found in figure 2, which was one of several promotional summary documents produced.

Fig. 1 The tangible sculpture *Tōia Mai,* located at Hamilton's Ferrybank reserve beside the Waikato River, as seen at after its unveiling on 23rd November 2018

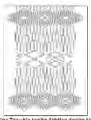
He waka eke noa:

The Matariki Waka

Concept image by 3rd year Illustration student Jakarn Smith

Summary of project

Illustrative student's impression of the waka with sensors



King Tauwhio tanika lighting design for corten steel cladding

Hīto Tauwhio access bench with lighting design

Matariki lighting pattern design for corten steel cladding

He waka eke noa refers to a research partnership that seeks to create a public artwork with the working title 'The Matariki Waka'. It is being built with a stainless steel skeleton and clad in 3mm corten plate, and will utilise an interactive design that engages with the seven stars of Matariki through LED lighting and ambient soundtracks. These will be informed by the movements of participants contained with an internet of things environmental sensor network, and will primarily operate at dawn and dusk.

This work will be situated at Hamilton's Ferrybank Park, having gained unanimous consent from the Hamilton City Council at both its concept and siting stages. It is a collaborative, consultative, multidisciplinary partnership with Wintec's Māori Achievement office, with guidance being provided by local kaumatua Tame Pokaia. Students from across Trades, Engineering, Early Childhood Education, and Media Arts, have worked on the project to date, and next year will see this happen again on a greater scale. This project it being made with the support and partnership of Wintec researchers, ITS, and PhD candidate and artist Joe Citizen.

The aims of the project are multiple, and include: Celebrating the importance and interconnected nature of the Waikato river – in all its physical, spiritual, historical, and mental capacities – through the movements, vibrations and temperatures of human and non-human participants (such as animals, the weather, the seasons, phases of the moon, plant growth, the river itself etc.); helping students gain industry ready skills through a unique collaborative project that values their contributions so that they become co-creators in the work; and providing new opportunities for long term relationships between Wintec and Hamilton City Council, industry, mana whenua, and the people of Hamilton.

Current industry partnerships include Longfield, ACIX, Meshing, and aware Group. Over $100,000 of funding has been secured so far, with donations, grants, and in-kind received from Perry's, Trust Waikato, WEL Trust, Longfield, and Wintec.

The primary audience/ participants of this endeavour are rangatahi and young families, both in the finished work and in its process of becoming a reality.

Student engagement 2018

Confirmed:

- *Electric Acoustic* sound class (Media Arts) to create atmospheric sound tracks
- Internationally acclaimed Taonga Puoro practitioner Horomona Horo to mentor our students
- PR internship to run social media campaign with Wintec Communications manager
- Electrical trades and engineering students to complete electrical fit out of Waka in May
- Independent learner electrical engineering (3rd year) student to work with CBITE researcher Andy Fendall, on IoT sensor design and infrastructure
- CBITE student designing sound streaming app, in collaboration with Media Arts *Advanced Internet design* and sound students
- *Advanced Internet design* class to produce data visualisation assets for public access website, made by CBITE researcher Andy Fendall
- Media Arts new degree programme 2018 has a 3-week multi-disciplinary project focussed on Matariki – multiple student co-creation opportunities in progress

In progress:

- ECE independent learner students engaged in Matariki and Waikato river research
- PR and Journalism students (Media Arts) expected to write stories as install event draws closer

In concept:

- Horticulture students to work with mana whenua and parks and gardens staff on planting around waka site, as informed by IoT environmental sensors
- Ongoing CBITE engagement, as Wintec retains ownership of IT infrastructure

Student engagement 2017

Manufacturing Production and Processes (CEID)

CAD Engineering (CEID)

CAD Design (CEID) with Longfield

Applied Computational Modelling (CEID)

Matariki self directed research (ECE)

MATARIKI

MATARIKI

2nd year Graphic design (Media Arts)

Printing and Sculpture (Media Arts)

PR (Media Arts)

(Sem 1 & 2) Power and Distribution (CDD)

(Sem 1 & 2) Electrical engineering - IoT (CDD)

Illustration (Media Arts)

Web design (Media Arts)

Pre Trades students at Longwhi

Matariki interactive aspects (1)

Concept illustrations as painted by 3rd year painting and sculpture (Media Arts) student, Juliette Smith

Concept for motion tracking

Concept for environmental data using Cookian sensors

Matariki interactive aspects (2)

Star	Domain	Emphasis	Sensors/ measurements to use
Matariki	'Eyes of God' Interconnnectedness with the environment	Wave energy – as waves permeate all things in the physical realms	• Radio signature of Matariki star • Thermal imaging cameras (heat) for motion tracking on the waka sculpture itself • Mobile phones app
Waitii	Fresh water	Emphasis on kai	• Tracking the movements of fish, eels, koura etc. • Also, the river: Currents, speed, volume, temperature, turbidity (clearness)
Waitaa	Salt water	Emphasis on kai	• Tracking the movements of fish, edible seaweed, shellfish etc. • Also, the ocean: Tides, lunar cycle, salinity, possibly the currents at Port Waikato, Whaingaroa, and Kawhia.
Waipuna-aa-rangi	Water that pools in the sky	Emphasis on rain and mist, also steam	• Rain gauges – both volume and acoustic • Humidity
Tupu-aa-nuku	That which grows in the ground	Emphasis on kai	• Vibrations of root growth • pH, moisture, temperature etc. • Vibrations of the earth using geophone
Tupu-aa-rangi	That which grows in the sky	Emphasis on kai	• Tracking the movements and sounds of birds • Measuring the growth of fruits, berries and nuts • Growth and movement of tree branches
Ururangi	Connected to the wind	Emphasis on weather	• Wind speed and direction • Temperature • Pressure etc.

For further information, please see *Matariki Waka Interactive Design summary.*

Work in progress

Proposed site

Following meeting with Hamilton City Council's Park and Garden's unit who informed us that our preferred site below the museum is prone to flooding and that proposed work to the area will not occur for a few years, we've engaged in a process of considering alternatives. We have recently received confirmation from Hamilton City Council that the proposed site 'C' as indicated above, would be the best alternative site.

Phase 1 completed

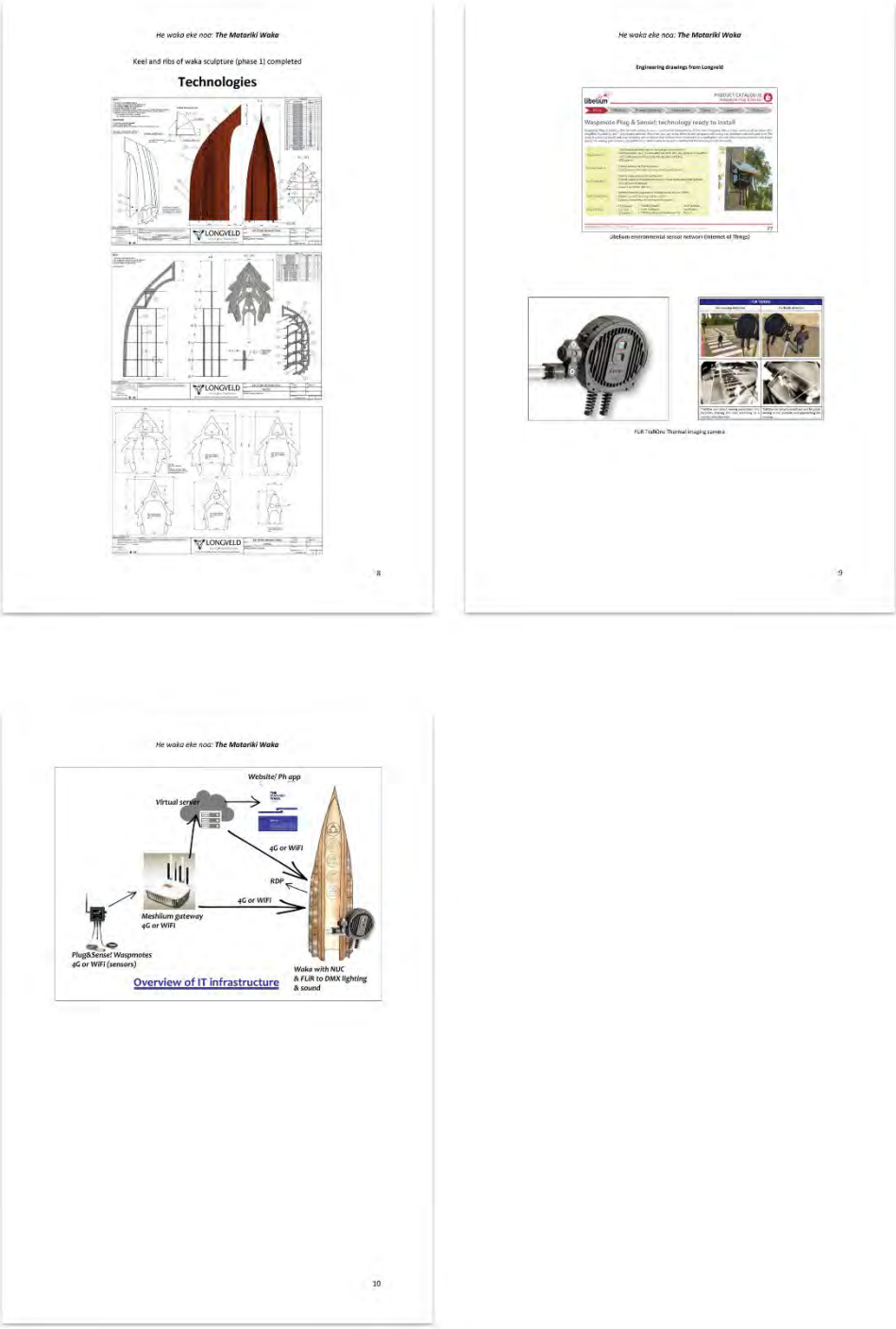


Fig. 2 Pages 1-11 of March 2018 promotional summary document.

Further images that document the metal construction, the electrical and mechanical fit out, the crane and siting procedures, and prototyping processes, can be found in appendix C. A document such as this is decidedly humancentic, inasmuch as the intangible aspects of *Tōia Mai* are hidden. Also missing are the roles and functions of the nonhuman collaborators, influencers, and agencies, a situation that the following section attempts to rectify.

Roles and functions of collaborators

There is a fundamental difficulty in using representation to convey co-constituted phenomena. This is not just because acts of inscription have their traditional difficulties with depicting time, nor solely due to semiotic conventions and their distinctions between signified and signifier, nor indeed because of an assumed separability between epistemological and ontological modes - although these are all contributory factors – but because of an underlying Western metaphysical trajectory that presumes human exceptionalism to be the primum mobile (first cause) of what knowledge is and in what direction it travels. Whilst this is discussed more fully in the rest this thesis, it is useful here to note that such exceptionalism is the predicator of human-centric understandings of who or what operate as collaborative contributors, and the nature of their contributions. An example of a human-centric understanding of the main collaborative partners involved in the creation of *Tōia Mai*, can be found in figure 3

Roles & functions: Main (human) collaborative partners involved in Tōia Mai

Wintec Māori achievement (primary partner)	
Tame Pokaia	Kaumatua
Hera White	Director Māori
Korikori Hawkins	Events
Kingi Kiriona	Manager (2017)
Hagen Tautari	Manager (2018)
Jamie Lambert	Research leader

Longveld (engineering & fabrication)	
Pam & Les Roa	Co-directors
Jemoal Lassey	Project lead (fabrication)
Garry Johnston	Lead fabricator
John Martin	Operations manager
Susan Beange	Student engagement manager
Leanne Summers	Executive assistant

Tangata whenua	
Te Hā o Roopu o Kirikiriroa	
Wiremu Puke	Ngāti Wairere
Rāhui Papa	Waikato-Tainui executive
Muna Wharawhara	Ngāti Haua (and on behalf of HCC)

Hamilton City Council (access, permissions etc)	
Joanna van Walraven	Primary contact/ co-ordination
Zeke Fiske	Parks & reserves team leader
Maria Barrie	Parks & reserves manager
Tracey Wood	Communications

Aware Group (IT architecture)	
Jourdan Templeton	IT Architecture & programming
Brandon Hutcheson	Director

ACLX (Lighting mentorship)	
Aaron Chesham	Director
Michael Lamusse	Primary contact

Researcher/ Creative architect	
Joe Citizen	PhD candidate

Wintec students / classes (co-ordination)	
Joe Citizen	Project manager
Luke McConnell Jordan Foster	Graphic design
Debbie Page	PR and Communications
Brent Phillips	CEID / Electrical engineering
Matt Foulkes Cormac Flynn	Mechanical engineering
Aidan Bigham	Civil engineering
Alison Marshall	CBITE / IT
Shilo Bluett-Hayes Tracey Hooker	ECE

Additional support	
Luke McConnell	3D modelling & sign design
Gerhard van der Westhuizen	Civil engineering advice
Andy Fendall & Gert Hattingh	IT advice
Louise Belay	Communications
Olivia Mead	PR

Sound team	
Dr Jeremy Mayall	Primary contact/ co-ordination
Horomona Horo	Taonga pūoro mentor
Norefjell Davis	Taonga pūoro student
Brad Morgan	Recording

AUT (Supervision)	
Dr Frances Joseph	Primary supervisor
Dr James Charlton	Secondary supervision

Fig. 3 Main human collaborative partners and their roles.

A table such as this is little more than a list of human participants. It is similar to the type of thing that might be found on an accompanying sign beside a public artwork. It provides no insight into the nonhuman collaborative partners, nor indeed any influence that does not assume human agency acting upon discrete, dumb, and inert conceptions of materiality. In contradistinction, Māori-indigenous understandings of the spiritual interfused with the material and Bohranian quantum mechanical descriptions of mutually co-constituted phenomena, provide only two alternative approaches. The key concern here is one of agency, not so much by 'things-in-the-world' as the agentic capacities of actions within an always-already continuously evolving field of relations. Figure 4 attempts to provide an indicative insight into the roles and functions of contributors using an approach that does not intrinsically presume a human exceptionalist position.

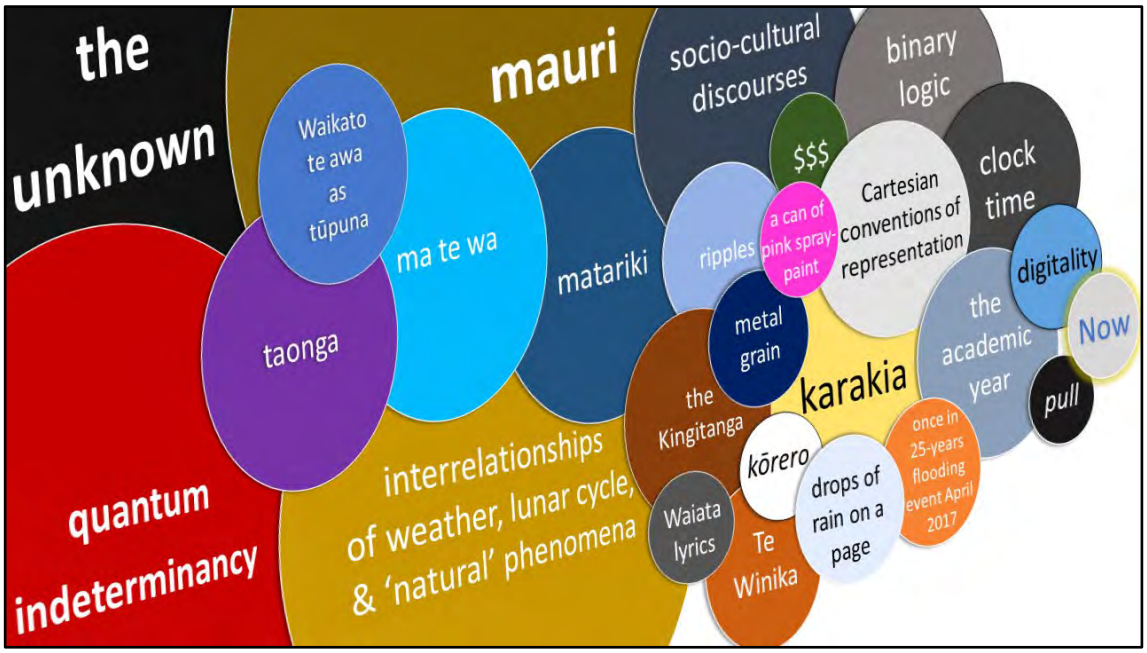


Fig. 4 Attempting to identify collaborators in a non-humancentric manner.

Each collaborator here is what Latour (1999) would call an actant, inasmuch as these are nonhuman and human agencies that "can *do* things" (Bennett, 2010, p. viii) [italics in original]. Borrowing from Deleuze and Parnet (2002), the whole can be taken to be a type of assemblage, which is a "multiplicity which is made up of many heterogenous terms and which establishes liaisons, [and] relations between them" (Deleuze & Parnet, in Delanda, 2016, p. 1). It would be erroneous to attempt to any form of mapping operation here, for this is not a diagram in the sense that Delanda (2016) means it, nor some form of structuralist graph as Dipert (1997), Bird (2007), Oderberg (2011), &

Shackel (2011) et al. might argue. Each of these planes should be considered as always-already having agency, and depending on what else is already going on, co-constitutively and relationally emerge into the continually developing present.

This approach entails a shift away from assumptions about human privilege and exceptionalism, towards an understanding whereby humans are neither the sole arbiters of knowledge, nor are capable of knowing everything. Decentring the human within the continuously emerging field of relations is not to exclude humans – a move that reinscribes the human-nonhuman division – but to acknowledge the agencies that exist beyond human finitude.

In the context of representing the conditions by which *Tōia Mai* came into its present form, a re-engagement with chronologous conventions becomes necessary. The following section therefore deals with workflow processes in relation to a linear conception of time, whilst also attempting to consider how the collaborators as described above might have agency or influence.

Workflows and processes

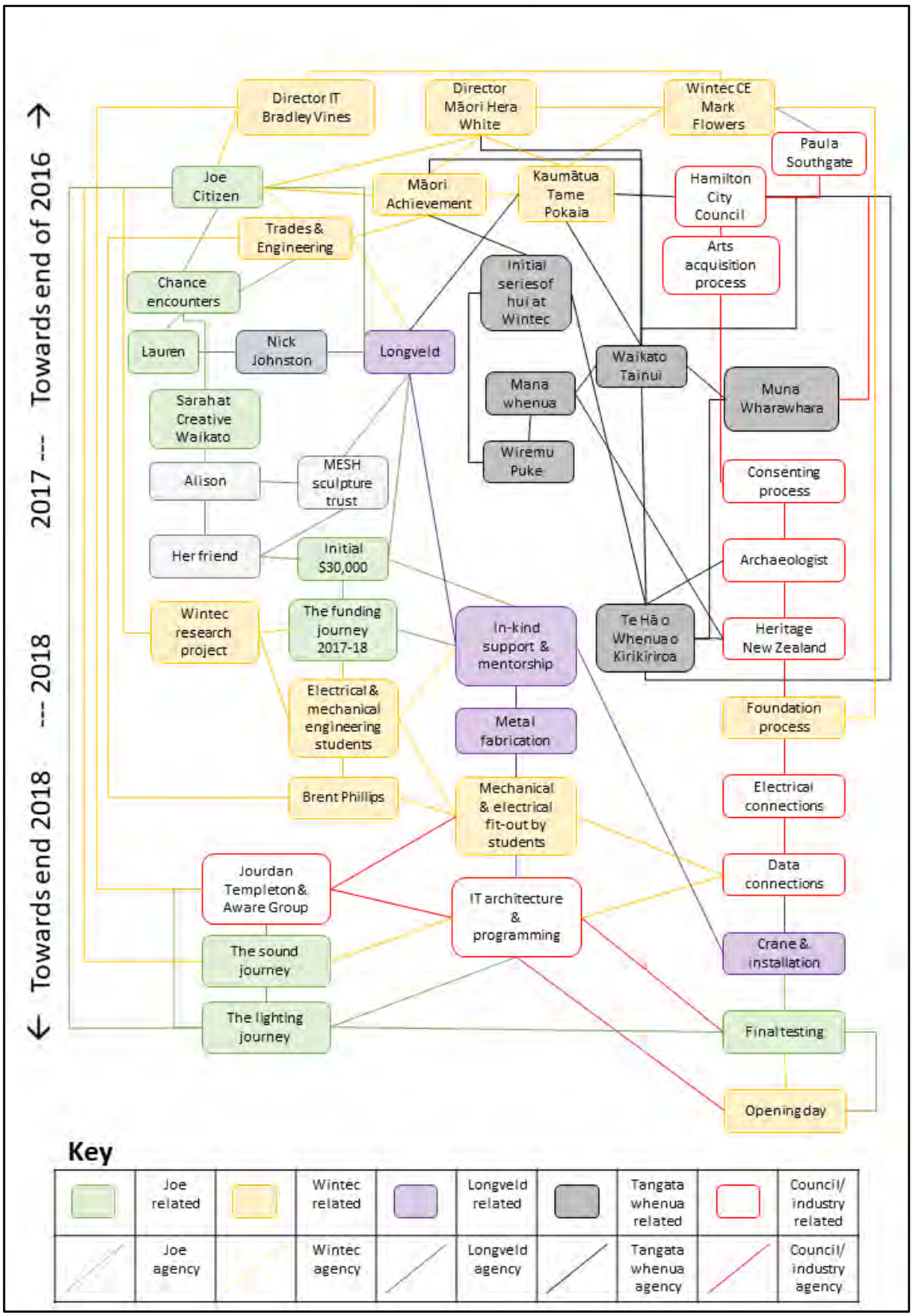


Fig. 5 Workflows and processes

There is a fundamental difficulty in attempting to describe how certain situations came to pass, when the concept of time itself cannot be taken for granted. Traditional Western conceptions of time position it as existing *a priori* so that when considering a diagram like figure 5, the dynamics between the represented agencies are assumed to exist within forms of causal relationships.

> The study of dynamics, as it is generally conceptualised within the natural sciences, is concerned with how the values of particular variables change over time as a result of the action of external forces, where time is presumed to much along as an external parameter.
>
> Barad, 2007, p. 179

To draw a diagram that lists in chronological fashion events as they occurred fails to account for interwoven agencies at play. Informed by the quantum physics of Niels Bohr, Karen Barad (2007) challenges the Western will metaphysical foundations that undergird these chronological conventions, when she reminds us that space and time are iteratively enfolded into each other:

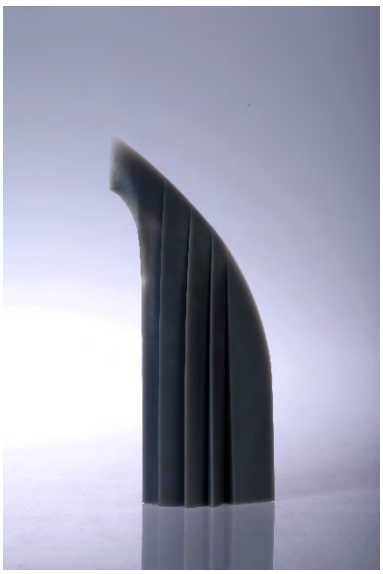
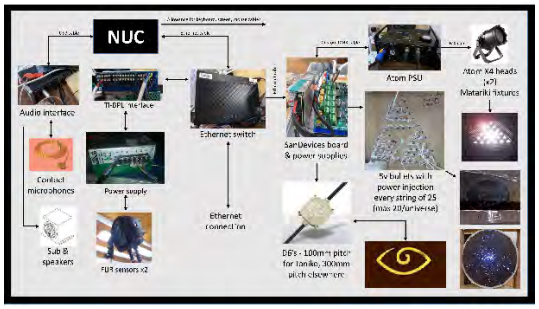
> Techno-scientific and other practices entail space-time-matter-in-the-making. Nothing stands separately constituted and positioned inside a space time frame of reference, nor does there exist a divine position for our viewing pleasure located outside the world.
>
> Barad, 2007, p. 376–377

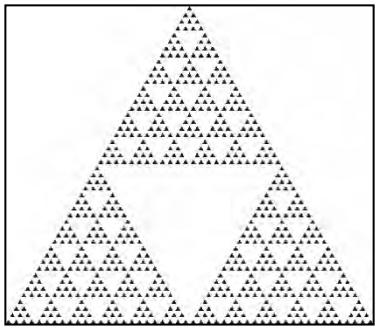
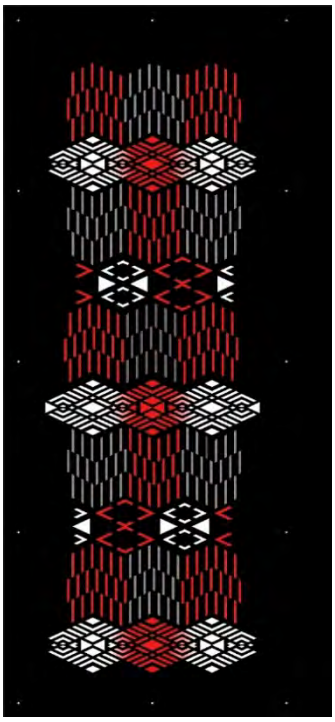
If it is sobering to consider “techno-scientific and other practices” as co-constituting phenomena in the making, then *Tōia Mai* must acknowledge how these socio-cultural discursive agencies inter-relating with each other are integral aspects of its journey towards its current situation. And yet figure 5 remains remarkably humancentric despite attempts to the contrary. What is needed is a way to account for *all* the agentic capacities that have influenced *Tōia Mai*, including the problematic of time. One way of doing this is to consider how the aesthetic voices of its collaborative partners have relationally contributed to its ongoing emergence, as described in the follwing section.

Aesthetic voices

To identify *Tōia Mai* as a sculpture, is to bring it into the orbit of a host of conventions that make various assumptions about objecthood and the appropriateness of combining various aesthetic modes or not. To the extent that there is a tangible object that stands at Hamilton's Ferrybank reserve beside the Waikato river, it might seem odd to some to combine symbolic forms from very different cultural traditions. In an era where cultural appropriation is hotly contested, some clear identification with regards to who suggested what is therefore necessary. Figure 6 provides just such an explanation and as clear a manner as possible.

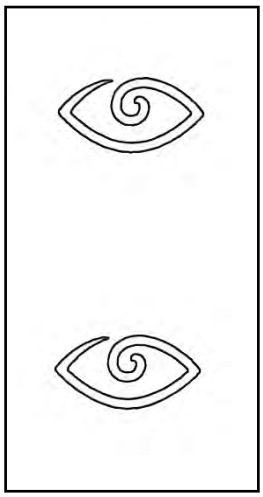
In contrast, figure 7 attempts to provide a less humancentric description the agencies of humans are still apparent, but the voices of other influences begin to make themselves heard.

Aspect	Image	Notes
Sculptural shape		Designed by Joe Citizen after visiting *Te Winika.*
Interactive design		Designed and developed by Joe Citizen 2016-2018

Niho Taniwha		Traditional Waikato-Tainui design. Suggested for inclusion by Wiremu Puke at mana whenua hui at Wintec 11th May 2017. Incorporated into lighting and hatch design by Joe Citizen, after advice by Tame Pokaia. Technical illustration by Luke McConnell. Waterjet design and hatch adaption by Jemoal Lassey (Longveld).
Tāniko		Traditional Waikato-Tainui design, that originates from the embroidered hem pattern of kahu (cloaks). This one was worn by King Tāwhiao, but may be older. Suggested for inclusion by Wiremu Puke at hui with mana whenua at Wintec, 11th May 2017. Incorporated into lighting design by Joe Citizen, after advice by Tame Pokaia. Technical illustration by Luke McConnell. Waterjet design by Jemoal Lassey (Longveld).

Taniwha		Suggested by Wiremu Puke at hui at Wintec 13th November 2017, with reference to local taniwha at Te Moutere o Koipikau Pa. At suggestion of Tame Pokaia it now references the taniwha Paneiraira, which is the central rangatira (chief) and kaitiaki (guardian) for the whole of the Waikato river. The design is by Joe Citizen and references intra-activity through the diffraction patterns of overlapping ripples.

Quote from *He maimai aroha nā Tāwhiao*	 Translated this means “Across the smooth belly of Kirikiriroa, Its gardens bursting with the fullness of good things” (Retrieved from: http://www.teara.govt..nz/waikato-region/1/3)	A quote from *He mai mai aroha* was suggested by Wiremu Puke at a hui with mana whenua on 13th November 2017. This particular phrase was chosen by Tame Pokaia for a number of reasons, including the reference to Te Kōpū Mānia o Kirikiriroa, which is

		the name of the marae at Wintec.
Eyes		Designed by Joe Citizen. References 'the thing in itself' and all that is not human.
Takarangi		'Taka' (to fall) + 'Rangi' (sky) = 'to fall from the sky'. Inspired by Hani and Puna conversation with Tame Pokaia 21st February 2017, and subsequent conversation with Jamie Lambert towards the end of March 2017. Designed by Joe Citizen after reading Pei Te Hurinui Jones' *He tuhi mārei-kura: A treasury of sacred writings - a Māori account of the creation, based on*

		the priestly lore of the Tainui people. (2013)
Sound design		Composed and performed by Horomona Horo, Dr Jeremy Mayall and Norefjell Davis

Fig. 6 Symbolic forms and their sources

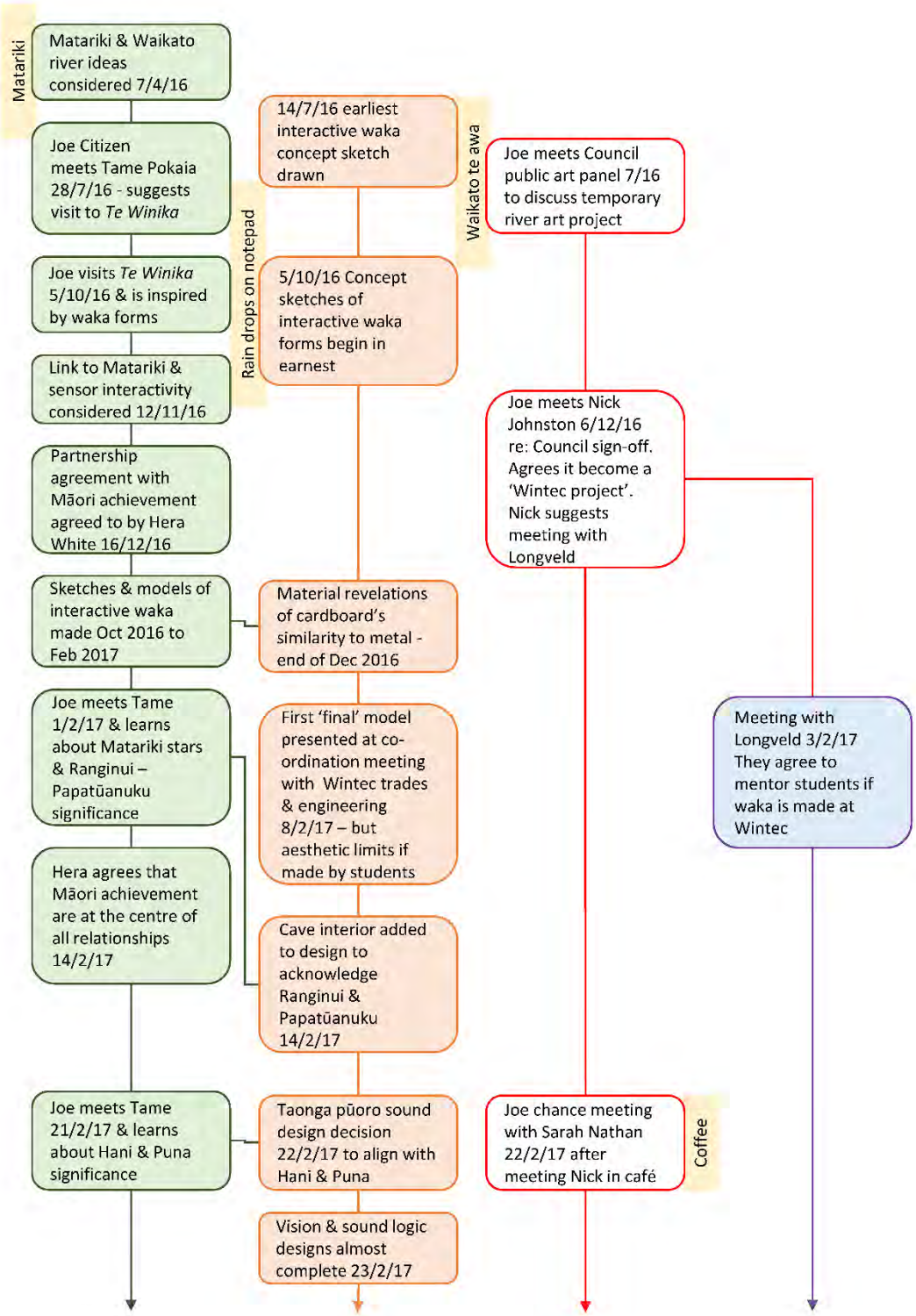


Fig 7 (a) Aesthetic voices

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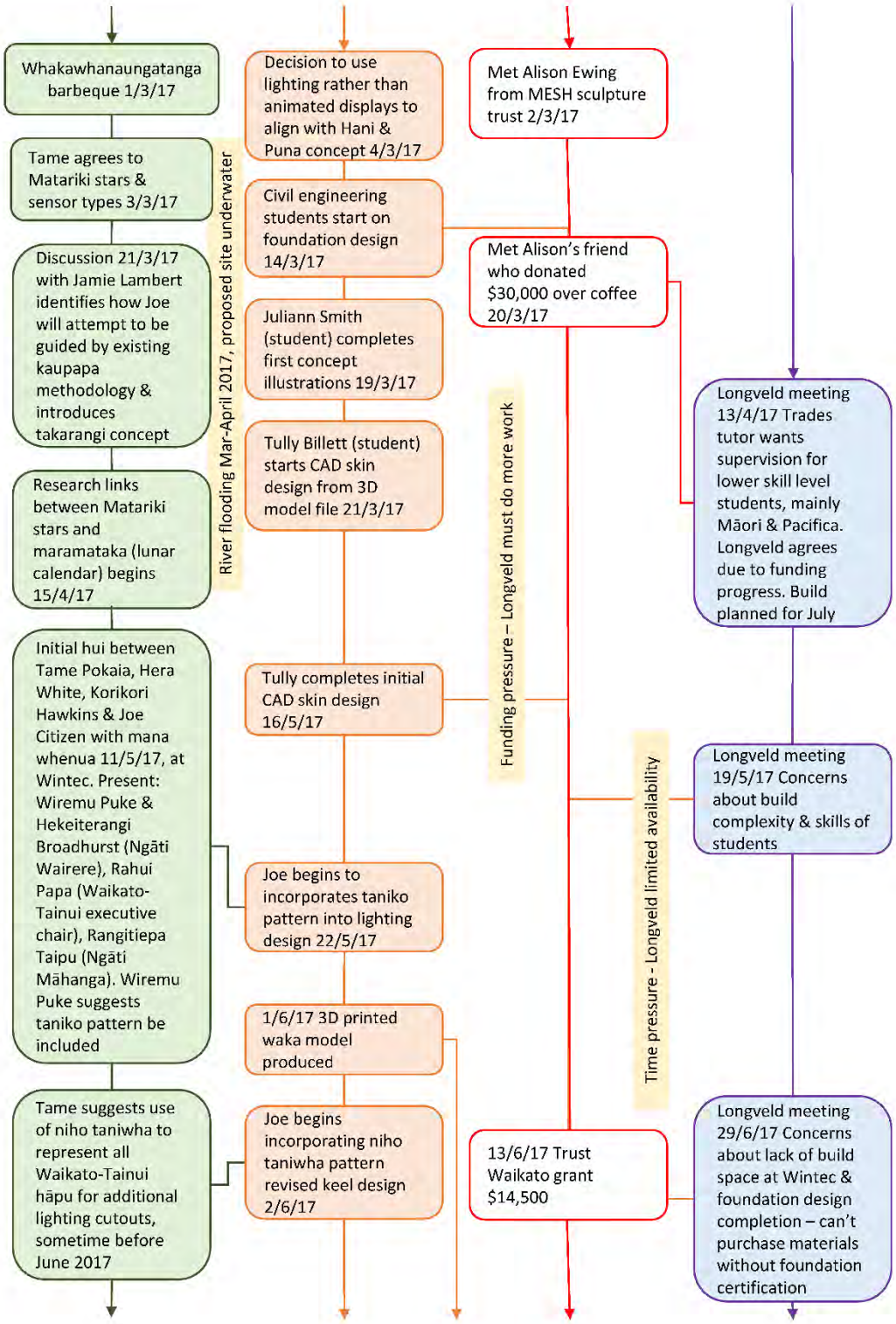


Fig 7 (b) Aesthetic voices

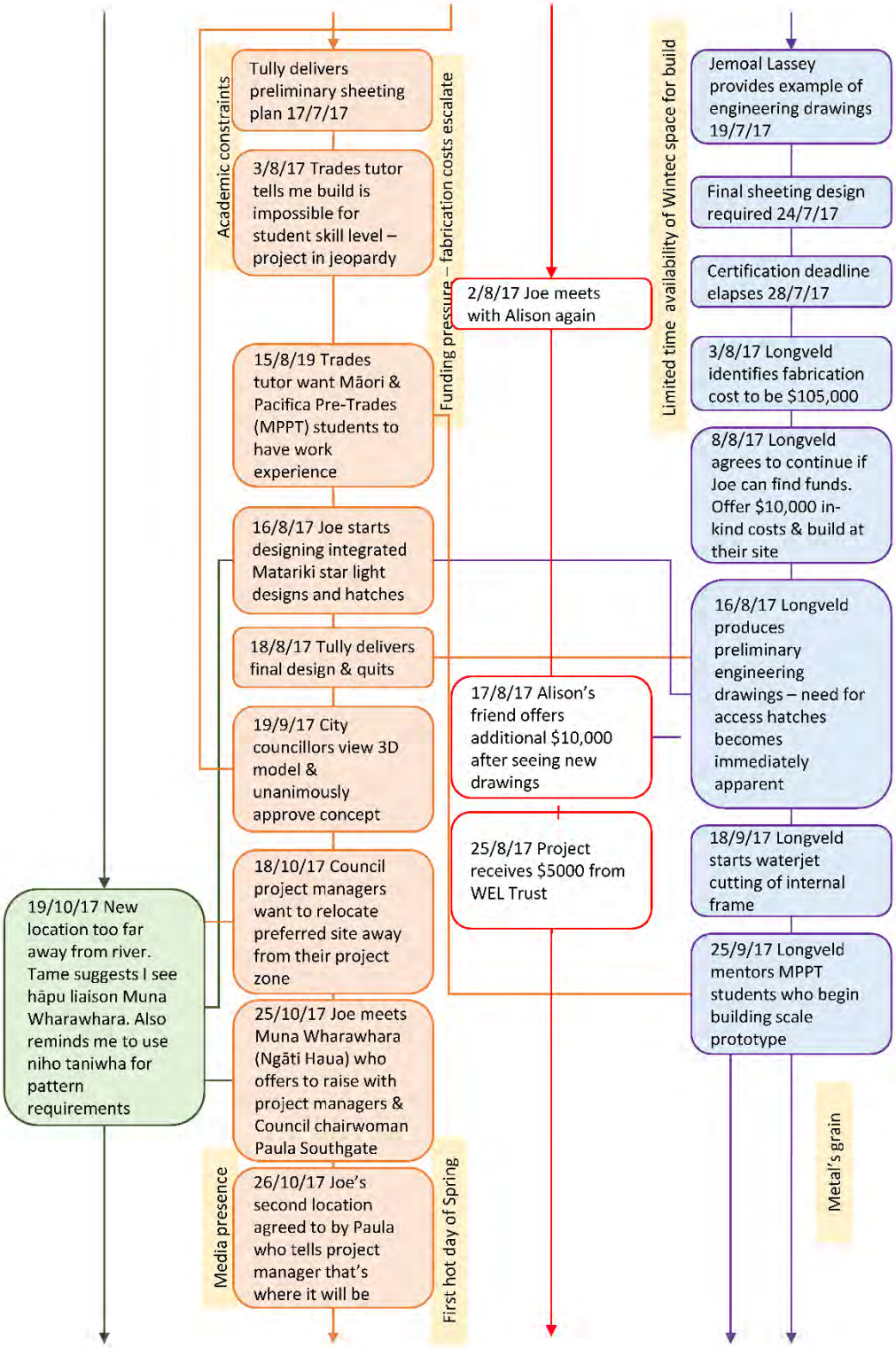


Fig 7 (c) Aesthetic voices

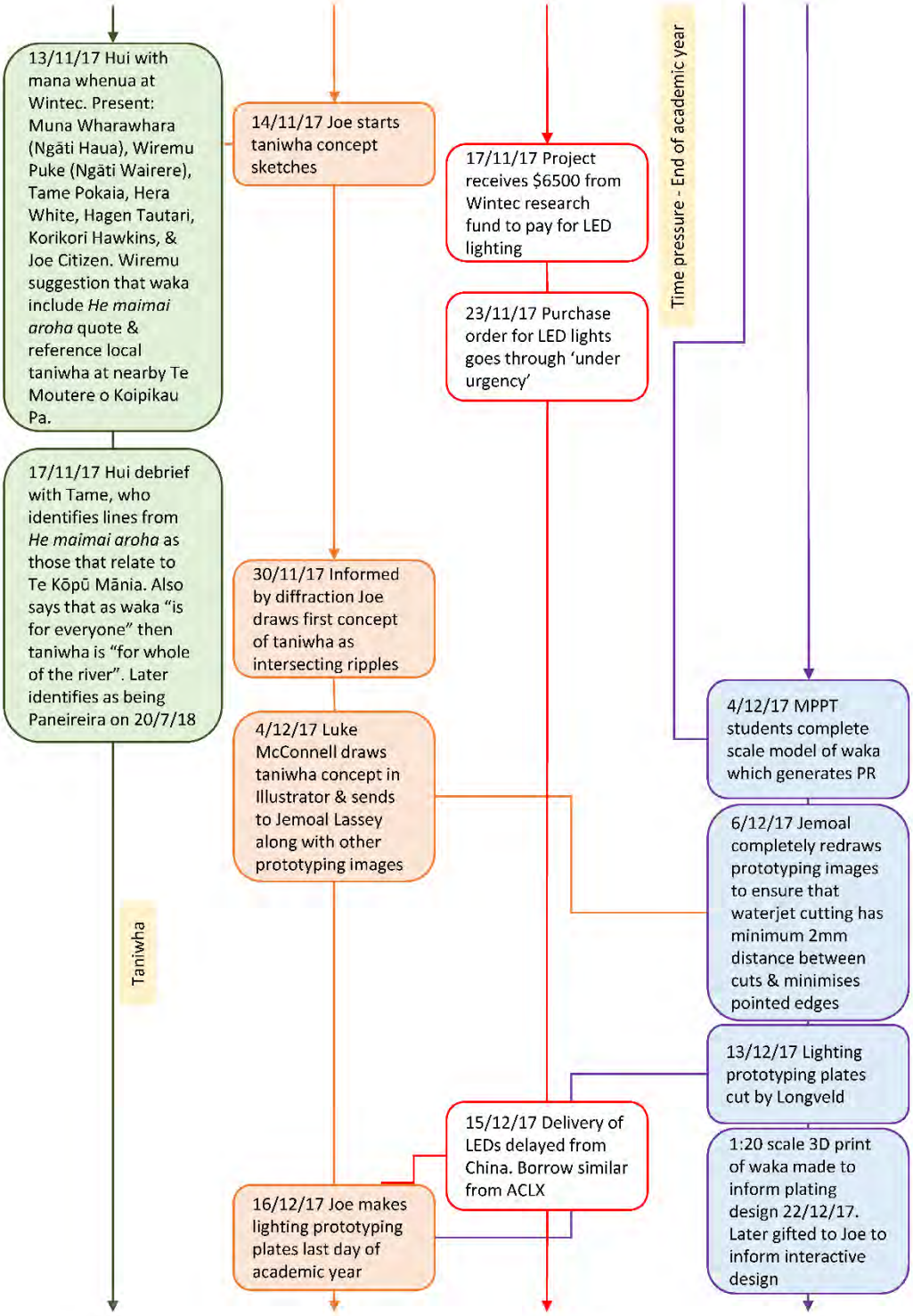


Fig 7 (d) Aesthetic voices

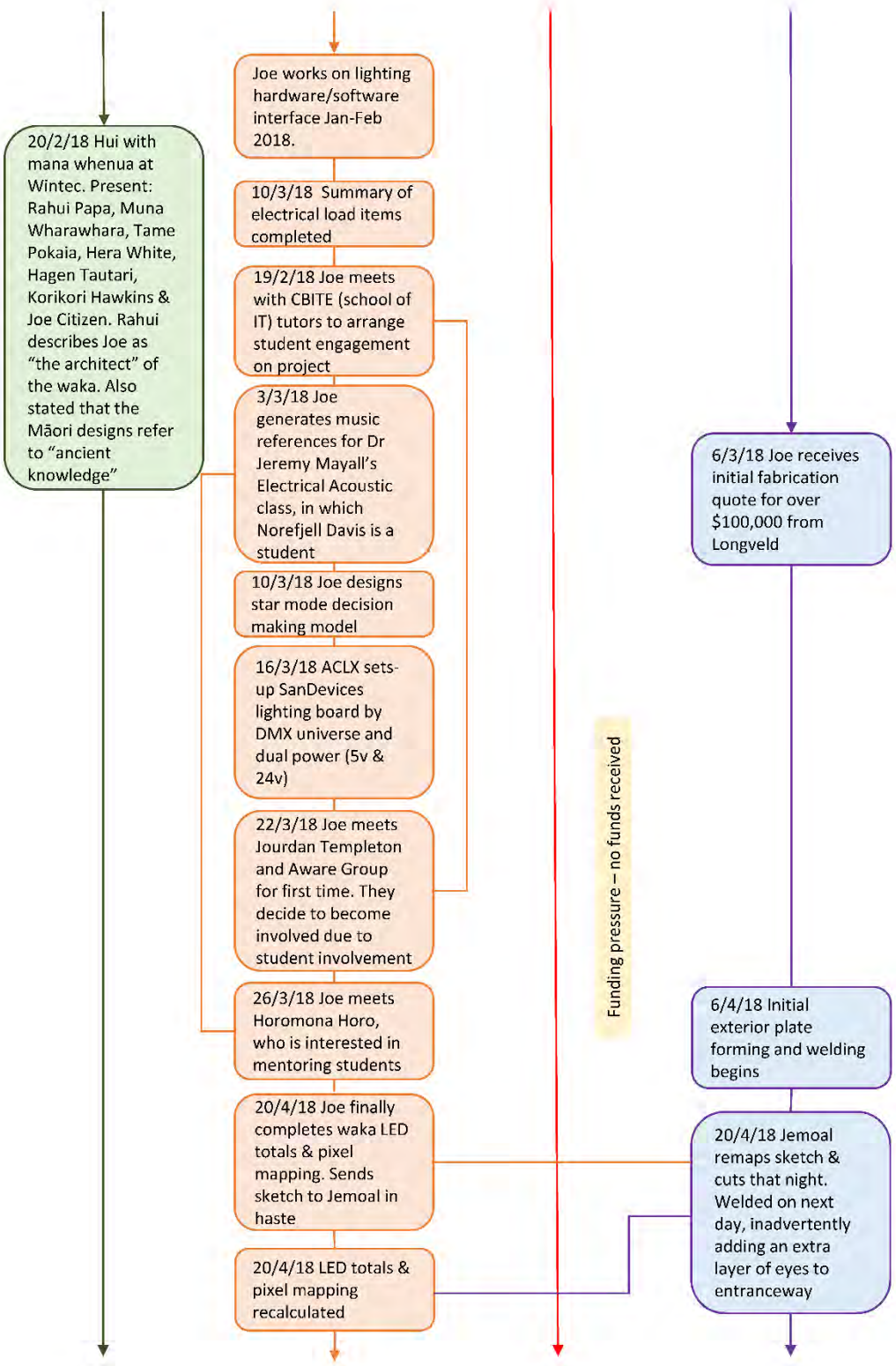


Fig 7 (e) Aesthetic voices

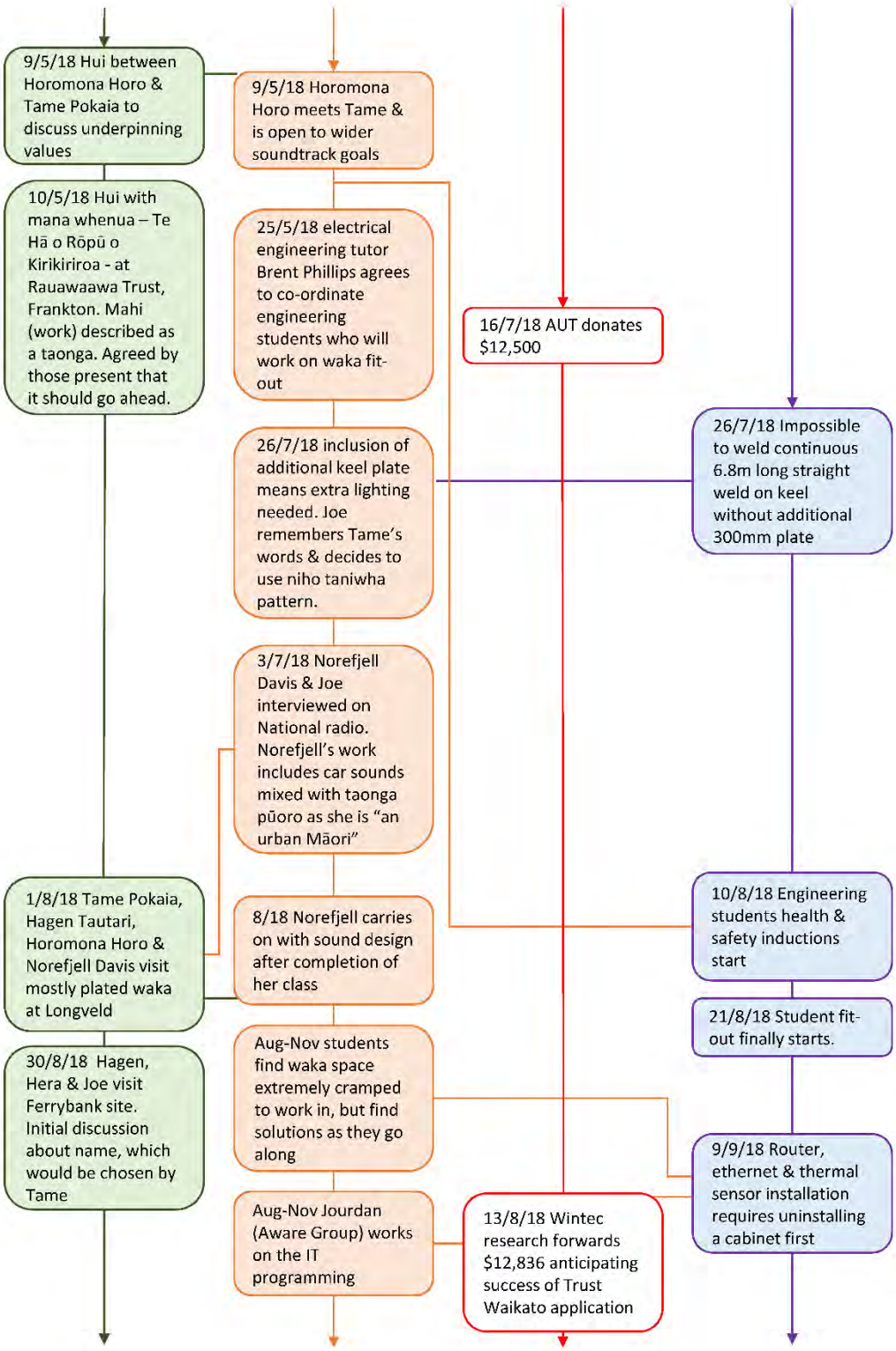


Fig 7 (f) Aesthetic voices

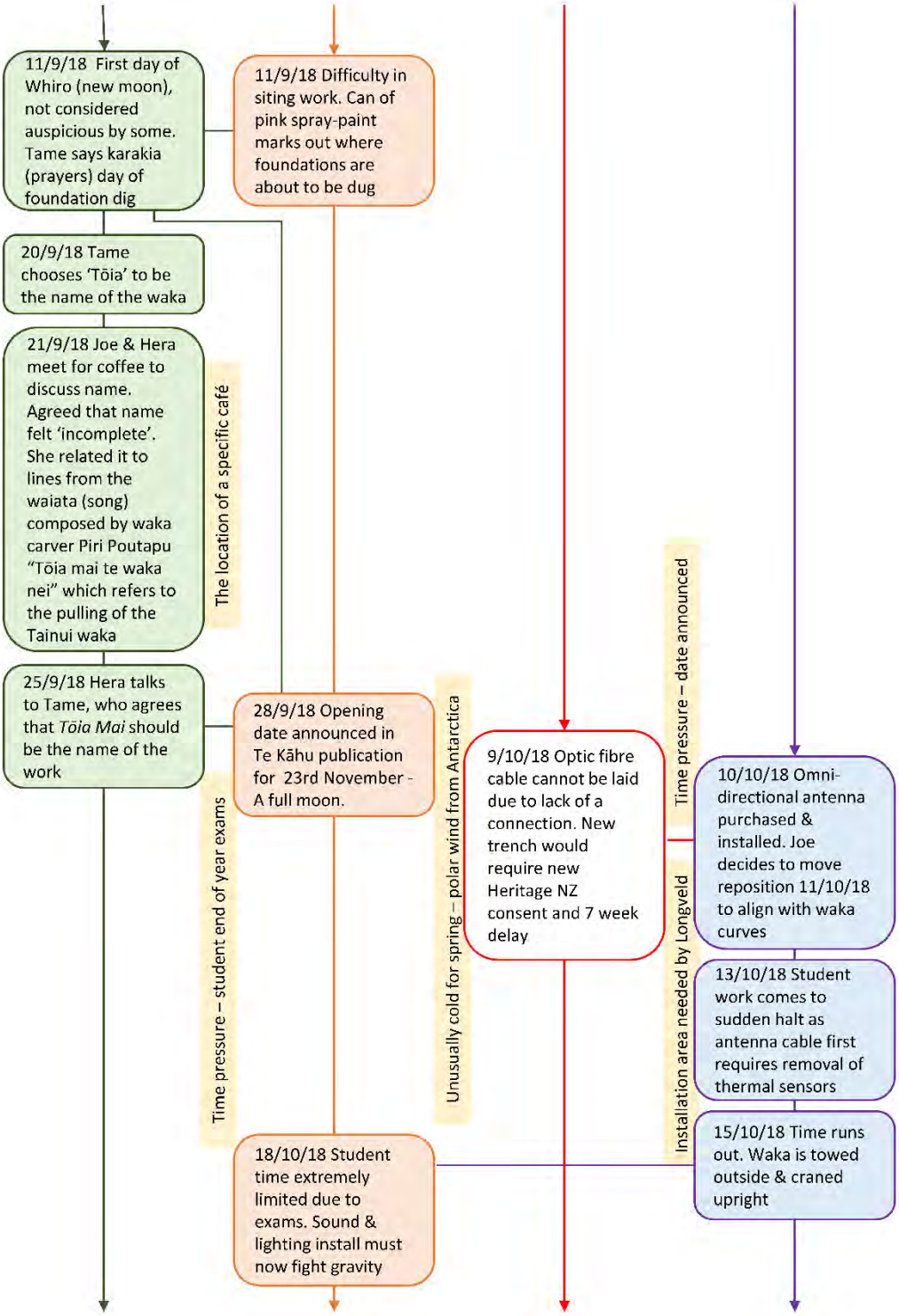


Fig 7 (g) Aesthetic voices

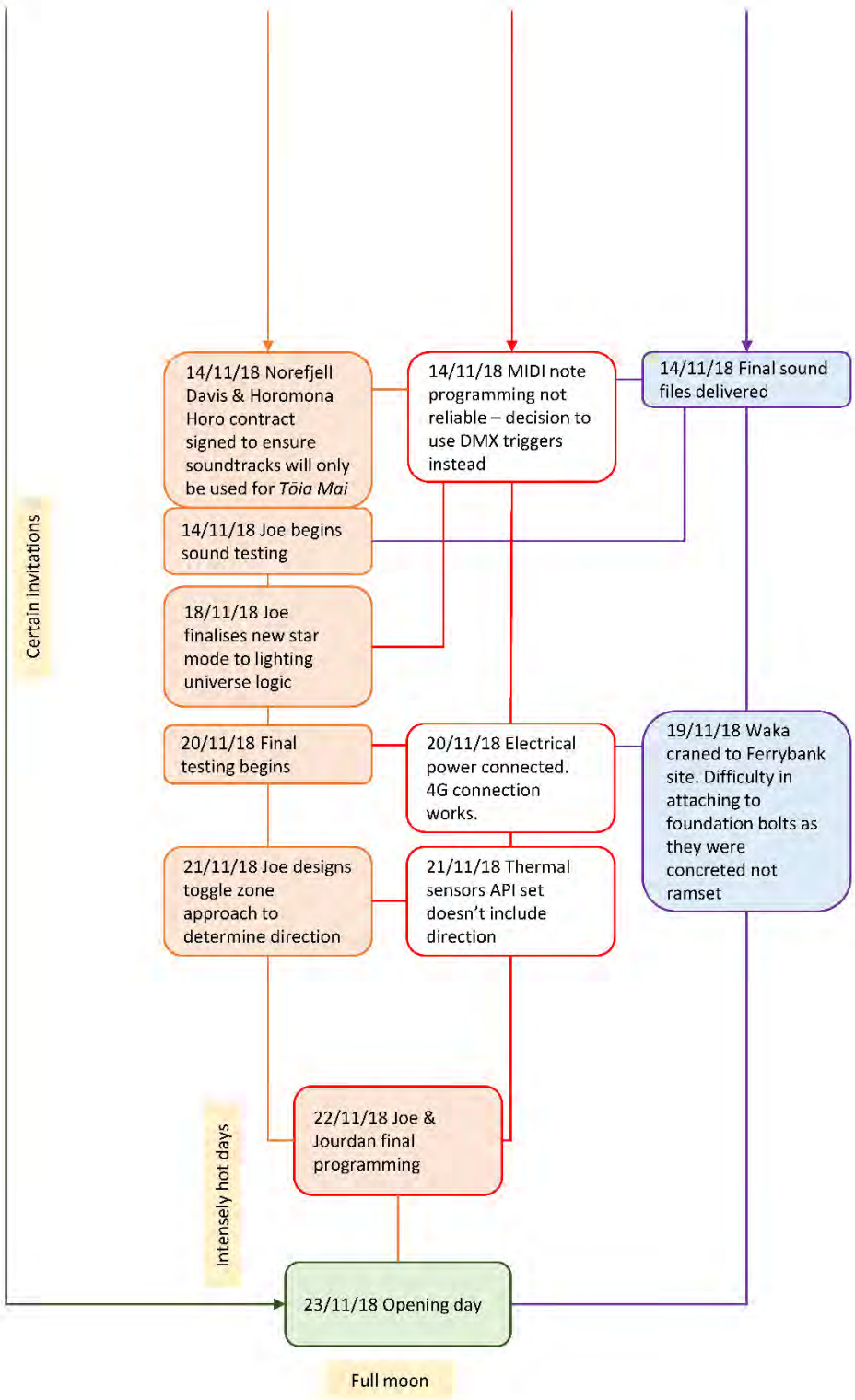


Fig 7 (h) Aesthetic voices

Figure 7 begins to address conception(s) of the universe where everything is interconnected. This waka journey has always had a relationship to Matariki, the star cluster known as Pleiades to the Greeks, Subaru to the Japanese, and Krittika in Hindu belief (Matamua, 2017). To Waikato-Tainui (a Māori pan-tribal confederation traditionally originating in the upper middle of Aotearoa-New Zealand's North Island), Matariki has seven stars, in other places nine or more are recognised. How many there are is not as important as the way they present a means to understand the interconnectivity of the world. Carl Mika (2017) uses the term 'worldedness' to access what he identifies as a common theme amongst indigenous writers. Worldedness "relates to the confluence of all things in the world, such that there is an underlying driving move of all those things to be in conversation with each other." (Mika, 2017, p.38) Compare this to Barad's (2007) description of what she calls 'intra-activity', which signifies "*the mutual constitution of objects and agencies of observation within phenomena*" (Barad, 2007, p.197) [Italics in original]. Notwithstanding the very different metaphysical frameworks from which these approaches arise from, they both acknowledge the interrelationality of things in the world.

It has been hard to ignore the influence of the moon, particularly sunny days, and certain cafés. What causal dynamics ignores is how on the brink of disaster some unforeseen potentiality became momentarily present. In te reo Māori (the Māori language) the expression "mā te wā" encompasses both "see you later" and "time will tell", with the implication that things may not happen if the time is not 'right'. Throughout all these processes there has always been a relationship with that which is beyond comprehension – hitheroto unknown agencies making themselves felt 'in the mix', adding their influence, so that what had previously seemed like a limited range of possibilities suddenly blossomed into quite a different set of circumstances.

Examples of other agencies at play include: How Waikato te awa (the Waikato River) flooded its banks in a once in every 25 years event during Easter 2017, with the waters completely covering the area where *Tōia Mai* was originally conceived as standing; the constant pressures of funding and insufficient time that constantly reshaped schedules and resources; and attempting to align critical pathways within academic constraints. And yet a multitude of other factors were also present – the laughter that erupted when the mayor Andrew King broke the tip of the 3D printed model right before the Council were to vote on whether or not to approve the concept, those unforeseen encounters with just the right person at just the right time, raindrops splattering sketches in my notebook causing me to think of waves, the qualities of different technologies that simultaneously enable and constrain the types of operations they perform, the binary logics of contemporary computing with their requisite need for certainty and the

regulatory function of the clock. (See p.58) These influences and more were no less present than other collaborative partners, although the cultural logicities of participatory technologies were perhaps more hidden than others. All these aspects intra-actively constituted the continuously emerging phenomena of *Tōia Mai*.

Since the technological aspects are not apparent to casual inspection, a greater explanation as provided in the next section.

Intra-active technical details:

Following the realisation that light, sound, heat, water, and matter all exhibit wave behaviour (Barad, 2007, p. 82), *Tōia Mai* uses thermal imaging sensors to detect the presence of heat emitting participants, as described in figure 8 and thereafter.

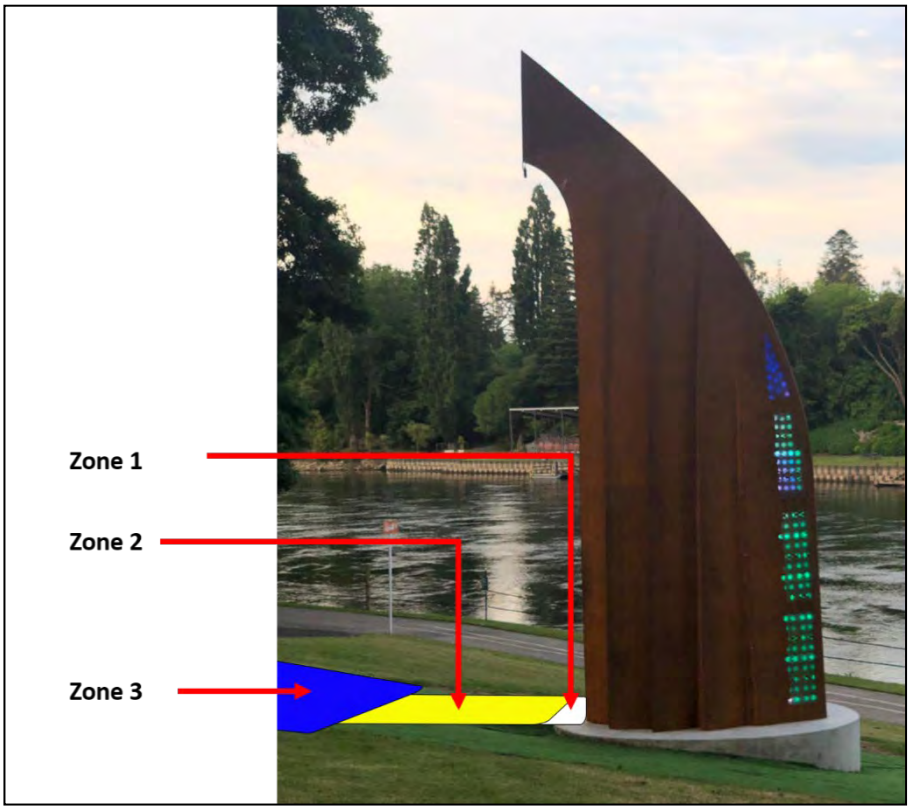


Fig. 8 Heat emitting participants enter one of three zones to initiate encounter specific sequences.

The general logic for sound and lighting changes in relation to the detection of heat emitting participants entering each zone, is as follows:

Zone	Lights (on ch 0)	Sound
No-one present	Taniwha (9), Tāniko etc (11/ 12)	None
3	Entrance (2), Tāniko etc (11/ 12)	None
2	Entrance (2), Tāniko etc (11/ 12), Eyes, (10)	Entrance / Exit sounds (Tracks 57, 58, 59, 60)
1	Entrance (2), Tāniko etc (11/ 12), Star modes (1, 3, 4, 5, 6, 7, 8)	Star mode tracks, currently: Matariki (1 -4) Ururangi (9 - 12) Waitii (17 - 20) Waitaa (25 - 28) Waipuna-aa-rangi (33 - 36) Tupua-aa-rangi (41 - 44) Tupua-aa-nuku (49 - 52)

This can also be explained as a series of rules:

1) The Tāniko and Keel are always on, but change patterns over time (see rule 7, below).
2) When no-one is in any of the zones, the Taniwha (0, 9) is on, star modes are off, and there is no sound.
3) When Zone 3 is activated, the Taniwha is off, star modes are off, the Entrance is on (0, 2), but there is no sound.
4) When Zone 2 is activated, the Taniwha is off, star modes are off, the Entrance is on (0, 2), and Entrance / Exit sounds (Tracks 57, 58, 59, 60) play until:
   a) Track finishes, or
   b) Zone 1 is activated
5) When Zone 1 is activated, the Taniwha is off, the Entrance is on (0, 2), and Star modes operate. Entrance / Exit sounds fade out over 0.5 seconds, and star mode track plays until end.
6) When Zone 1 has been activated and nothing else happens for 5 mins, time out and reset all: Taniwha (0, 9) is on, star modes are off, and there is no sound.
7) In order to progress different patterns of the Tāniko and eyes, each new instance must toggle between two channel values (0, 11) and (0, 12), so that when the star mode changes, the Tāniko channel also changes. (e.g. If Ururangi was last in operation and Tāniko (0, 11) was on, the next star mode change initiates Tāniko (0, 12), and the following star mode change initiates Tāniko (0, 11) etc.)

Figure 9 shows how three thermal imaging zones when mapped in a straight line from the entrance way of *Tōia Mai* are used to detect direction as well as presence.

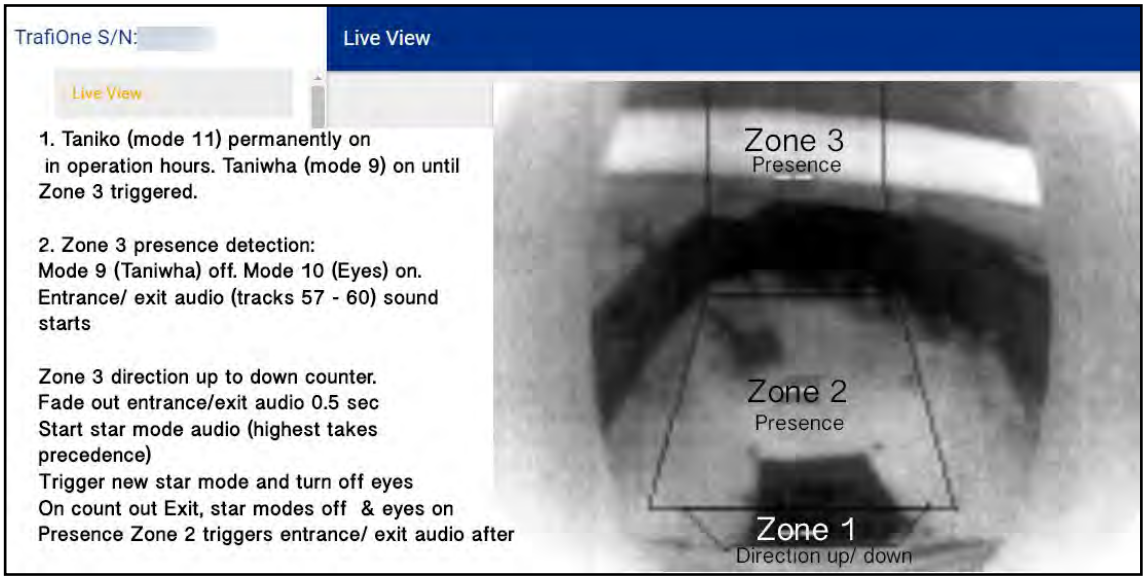


Fig. 9 View from thermal imaging sensor.

Zone activation relates to lighting mode changes in a general sense only i.e. it initiates a star mode for each encounter, but does not determine what their lighting patterns are. There are some lighting modes that are only specific to each encounter.

Star modes are determined using the star mode decision path process, which initiates when each encounter occurs through the detection of heat emitting sources entering one of the zones. This process polls all the available environmental data sources, calculating them as percentiles and modifying these scores in relation to numerous lunar, seasonal, and ‘special event’ additions or subtractions. The data sources come from a combination of Internet of Things (IoT) devices and existing public domain websites. An example of an IoT device that measures with a data can be seen in figure 10.

Fig. 10 Example of IoT device that measures weather data, as attached to a nearby streetlight.

A scalar operation ontologically flattens all incoming data sources so that a modifier decision table can be generated. Regardless of the different scales and units of each measurement, the highest kept value is generated as 100% and the lowest kept value is generated as 0% These percentiles are then modified according through reference to a very generalised understanding of a Waikato-Tainui maramataka (location specific lunar based calendar which is also informed by tohu [signs] and other sources). These maramataka-based modifiers can be updated, so that local experts can contribute their knowledge should they wish to do so in the future.

Individual star modes for each encounter are determined by the highest score arising once all the different modifiers have been accounted for. Star modes in operation can therefore change across the course of a single day, or even encounter by encounter. A section of the original star mode modifier table as designed by Joe Citizen on 10 March 2018, can be found in figure 11.

Matariki Waka Star Mode Modifiers and Decision Paths

Default mode = Taniwha only (no eyes) = Waitii and Waitaa signals to inform Taniwha operation (See Star Mode Operations chart). Taniwha fades away when thermal sensors detect heat presence & star mode decision process is initiated for duration of heat presence only.

***MATARIKI STAR MODES:** Determined after highest averaged total is calculated, including total modifier values*

MODIFIERS: Add to averaged percent	MATARIKI MODE:	WAIPUNA-AA-RANGI MODE:	WAITII MODE:	WAITAA MODE:	URURANGI MODE:	TUPUA-AA-RANGI MODE:	TUPUA-AA-NUKU MODE:
	Values turned into	***Values turned into percentages which are averaged***	***Values turned into percentages which are averaged***	***Values turned into percentages which are averaged***	***Values turned into percentages which are averaged in***	***Values turned into percentages which are averaged***	***Values turned into percentages which are aver***
	Where 100% is highest known value & 0% is lowest known value	*Where 100% is highest known value & 0% is lowest known value*	*Where 100% is highest known value & 0% is lowest known value*	*Where 100% is highest known value & 0% is lowest known value*	*Where 100% is highest known value & 0% is lowest known value*	*Where 100% is highest known value & 0% is lowest known value*	*Where 100% is highest known value & 0% is lowest known*
	Ultra Violet light	Humidity	River turbidity as per polling update as inverse	Tidal coefficient at Port Waikato per tide cycle	Wind speed (in gusts)	Frequency (rate) of bird calls per minute	Seismic vibrations intensity per 15 minutes
	Presence of mobile phones (Meshlium	Rain as volume per hour	River temperature as inverse	High tide height of waves at Port Waikato per tide	Air temperature as inverse (?TBC)	Number fo different types of bird calls per minute	Seismic vibrations frequency per 15 minutes
	Presence of heat sources in immediate	Volume (sound & frequency values) of rain hitting waka	River volume	Temperature of water at Port Waikato	Pressure, where values are inverted (low pressure becomes highes	Volume of tree creak per interval (To be determined)	Earth moisture
	Number of Matariki Waka website hits	Temperature of top of waka structure	Average speed of current at specified place	Solunar activity of fish at Port Waikato	Amount of negative ions in atmosphere	Growth rate of specified tree	Earth temperature
			Presence of life via sonar under Victoria Bridge	Distance Earth to the Moon			Vibration frequency of waka foundations per 250 ms
				Sri: http://www.tidewfishing.com/wp-content/port-waikato/8_catch-running-1_observation			
Pipiri - *starts with appearance of Matariki, until duration of lunar cylce?* May - June	+20						
Hoongoongoi June - July	+ 10	+ 10					
Heretuikookaa July - August		+ 15	+ 15		+ 5		
Mahuru August - September		+ 10	+ 10		+ 10		+ 10
Whiringa-aa-nuku September - October		+ 5				+ 5	+ 20
Whiringa-aa- rangi October - November							
Hakihea November - December					+ 10	+ 10	+ 15
Kohitaatea December - January						+ 20	+ 10
Hui Tanguru January - February						+ 15	+ 5
Poutuuterangi February - March						+ 10	+ 10
Paengawhaawhaa March - April						+ 5	
Haratua April - May: Until start of new year beginning with appearance of Matariki		+ 5			+ 5		
Whiro onwards Nights of the new moon to quarter moon	+5						
Nights of Tamatea Nights with quarter moon							
Te Mgahuru/ Hune *Tenth day after start of lunar cycle*	- 20		- 20	- 20		- 15	- 15
Nights between quarter moon to full	- 5						
Nights of full moon	+ 10			+ 15		+ 10	+ 10
Nights of Korekore Nights between full moon to three quarter moon			- 5	- 10	+ 10	- 15	- 15
Nights of three quarter moon				+ 10			
Nights of Tangaroa Nights betwen three quarter moon and empty moon			+ 15	+ 20			
Nights of Mauri and Mutu Nights with empty moon (dark moon)	- 15		- 20	- 20		- 20	- 20
Christmas eve To 0330 hours 25th Dec	+ 15						
Christmas day To 0330 hours 25th Dec	+ 10						

Fig. 11 Original star mode decision path modifier table, designed by Joe Citizen 10th March 2018

Using this original modifier table, Jourdan Templeton from Aware Group created an application that runs on the Microsoft Azure platform to achieve the same objectives through using a series of active rules. A screen grab of his application can be seen in figure 12.

```
PS C:\Users\jourdant> $j.starModes|%{"$($_.isActive) $($_.starmode) - $($_.score)"; $_.Rules|where isActive -eq $true|ft -autosize}
False Matariki - -5

name              description                                 positiveImpact negativeImpact isActive
----              -----------                                 -------------- -------------- --------
Te Ngahuru / Hune Nights between quarter moon to full moon             -5              0     True


False Waipunaaarangi - 0
False Waitii - -5

name               description                                  positiveImpact negativeImpact isActive
----               -----------                                  -------------- -------------- --------
Nights of Korekore Nights between full moon to three quarter moon             -5              0     True


False Waitaa - -10

name               description                                  positiveImpact negativeImpact isActive
----               -----------                                  -------------- -------------- --------
Nights of Korekore Nights between full moon to three quarter moon            -10              0     True


True Ururangi - 10

name               description                                  positiveImpact negativeImpact isActive
----               -----------                                  -------------- -------------- --------
Nights of Korekore Nights between full moon to three quarter moon             10              0     True


False Tupuaarangi - 5

name               description                                  positiveImpact negativeImpact isActive
----               -----------                                  -------------- -------------- --------
Kahikaatea         December - January                                    20              0     True
Nights of Korekore Nights between full moon to three quarter moon            -15              0     True


False Tupuaanuku - -5

name               description                                  positiveImpact negativeImpact isActive
----               -----------                                  -------------- -------------- --------
Kahikaatea         December - January                                    10              0     True
Nights of Korekore Nights between full moon to three quarter moon            -15              0     True
```

Fig. 12 Screen grab of Jourdan Templeton's programming, showing maramataka-informed star mode decision making process for *Tōia Mai*.

When each star mode is determined, then corresponding sound and lighting modes are triggered depending on which zone participant(s) are occupying. These modes cycle through different scenes so that repeat encounters within extremely short timeframes are not exactly the same.

Zone occupancy therefore informs the specific lighting and soundtrack changes that are relevant to each star mode, by only sending the individual star mode data values to the PC and audio player located inside *Tōia Mai* via 4G. The PC runs Lightjams (a custom lighting software) which receives SaCN (DMX) data to update the different lighting scenes, located using DMX universes. Each universe also receives live sensor values using the DMX 0-255 value range (which Lightjams reconverts back into percentiles), although these values are only used if a specific star mode is in operation.

An example of this application in progress can be seen in figure 13, which also shows the audio integration using a proprietary API set as used by the RSF MultiDAP-IP audio player, which cycles through specifically composed soundtracks for each activated star mode.

```
[01:19:56 INF] [PROGRAM] Startup tasks complete.
[01:19:56 INF] [PROGRAM] Executing module loop tasks...
[01:19:56 INF] [SCENE] Transitioning from '' to 'Default - No Occupancy'
[01:19:56 INF] [MULTIDAP] Fading volume to 0 over 0.5s
[01:19:57 INF] [MULTIDAP] Playing track 0
[01:19:57 INF] [MULTIDAP] Fading volume to 0 over 0.5s
[01:19:57 INF] [SACN] Updating universe 0...
[01:19:57 VRB] [SACN]   [0, 0, 0, 0, 0, 0, 0, 0, 255, 0, 255, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[01:19:57 INF] [SACN] Updating universe 1...
[01:19:57 VRB] [SACN]   [162, 152, 4, 0, 42, 17, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 88, 0]
[01:19:57 INF] [SACN] Updating universe 2...
[01:19:57 VRB] [SACN]   [255, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[01:19:57 INF] [SCENE] Transition complete.
o 3
[01:20:11 INF] [SCENE] Transitioning from 'Default - No Occupancy' to 'Zone 3'
[01:20:11 INF] [MULTIDAP] Fading volume to 0 over 0.5s
[01:20:11 INF] [MULTIDAP] Playing track 0
[01:20:11 INF] [MULTIDAP] Fading volume to 0 over 0.5s
[01:20:12 INF] [SACN] Updating universe 0...
[01:20:12 VRB] [SACN]   [255, 0, 0, 0, 0, 0, 0, 0, 0, 0, 255, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[01:20:12 INF] [SACN] Updating universe 1...
[01:20:12 VRB] [SACN]   [162, 152, 4, 0, 42, 17, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 88, 0]
[01:20:12 INF] [SACN] Updating universe 2...
[01:20:12 VRB] [SACN]   [255, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[01:20:12 INF] [SCENE] Transition complete.
o 2
[01:20:14 INF] [SCENE] Transitioning from 'Zone 3' to 'Zone 2 - Entrance'
[01:20:14 INF] [MULTIDAP] Fading volume to 0 over 0.5s
[01:20:14 INF] [MULTIDAP] Playing track 59
[01:20:14 INF] [MULTIDAP] Fading volume to 100 over 0.5s
[01:20:15 INF] [SACN] Updating universe 0...
[01:20:15 VRB] [SACN]   [255, 0, 0, 0, 0, 0, 0, 0, 0, 255, 255, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[01:20:15 INF] [SACN] Updating universe 1...
[01:20:15 VRB] [SACN]   [162, 152, 4, 0, 42, 17, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 88, 0]
[01:20:15 INF] [SACN] Updating universe 2...
[01:20:15 VRB] [SACN]   [255, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[01:20:15 INF] [SCENE] Transition complete.
o 1
[01:20:17 INF] [SCENE] Transitioning from 'Zone 2 - Entrance' to 'Zone 1 - Star Mode (Ururangi)'
[01:20:17 INF] [MULTIDAP] Fading volume to 0 over 0.5s
[01:20:17 INF] [MULTIDAP] Playing track 11
[01:20:17 INF] [MULTIDAP] Fading volume to 100 over 0.5s
[01:20:18 INF] [SACN] Updating universe 0...
[01:20:18 VRB] [SACN]   [0, 0, 255, 0, 0, 0, 0, 0, 0, 0, 255, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[01:20:18 INF] [SACN] Updating universe 1...
[01:20:18 VRB] [SACN]   [162, 152, 4, 0, 42, 17, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 88, 0]
[01:20:18 INF] [SACN] Updating universe 2...
[01:20:18 VRB] [SACN]   [255, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
[01:20:18 INF] [SCENE] Transition complete.
```

Fig. 13 Screen grab of Jourdan Templeton’s programming in progress, to show Zone occupancy sequencing in relation to the RSF MultiDAP-IP audio player and SaCN (DMX) lighting data.

There are some lighting modes that are permanently on (the Tāniko and Keel), and some that operate only in relation to Zone occupancy or lack of it (the Taniwha and Eyes). The selection between which lighting groups are in operation in relation to star modes and presence detection is performed in Lightjams, as shown in figure 14.

Fig. 14 Initial switching operation of lighting groups.

An example of the way that individual star modes relate to specific lighting groups can be found in figure 15. At present there are four different lighting 'scenes' for each lighting group, but depending on what the live sensor values are, each scene can have enormously different lighting effects. These effects include variations in saturation, hue, and luminosity, the speed and velocity at which these transitions occur, multiples of transitions, different wave functions, direction of light emitters, and other effects.

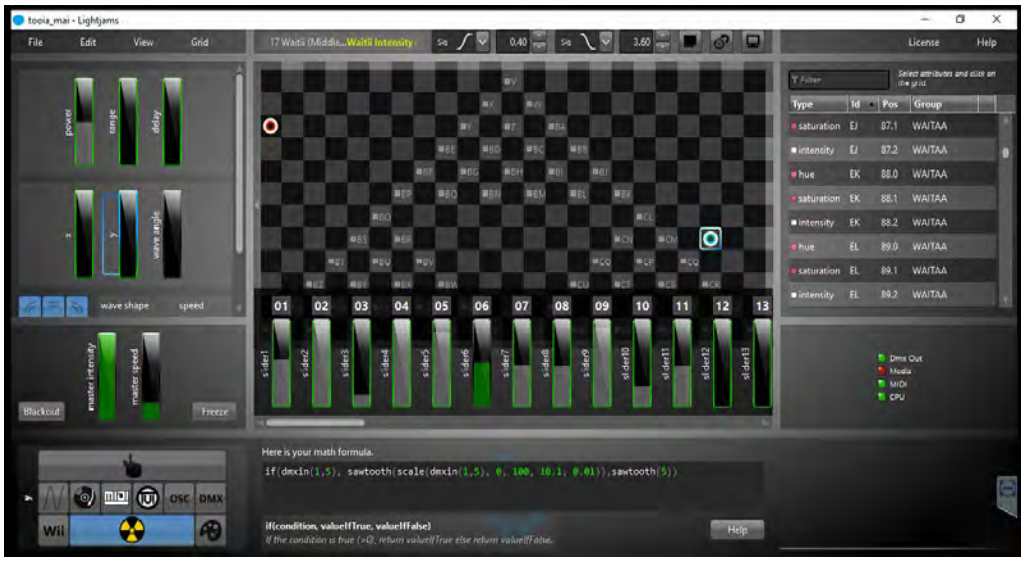


Fig. 15 A lighting scene example showing how live sensor values inform the lighting intensity (brightness) of the LEDs in the Waitii lighting display. All Lightjams programming by Joe Citizen.

Figure 16 is a more developed example of Jourdan Templeton's application, and shows the integration of thermal imaging presence data (zone occupancy) as a means to inform live sound and lighting changes on the fly.

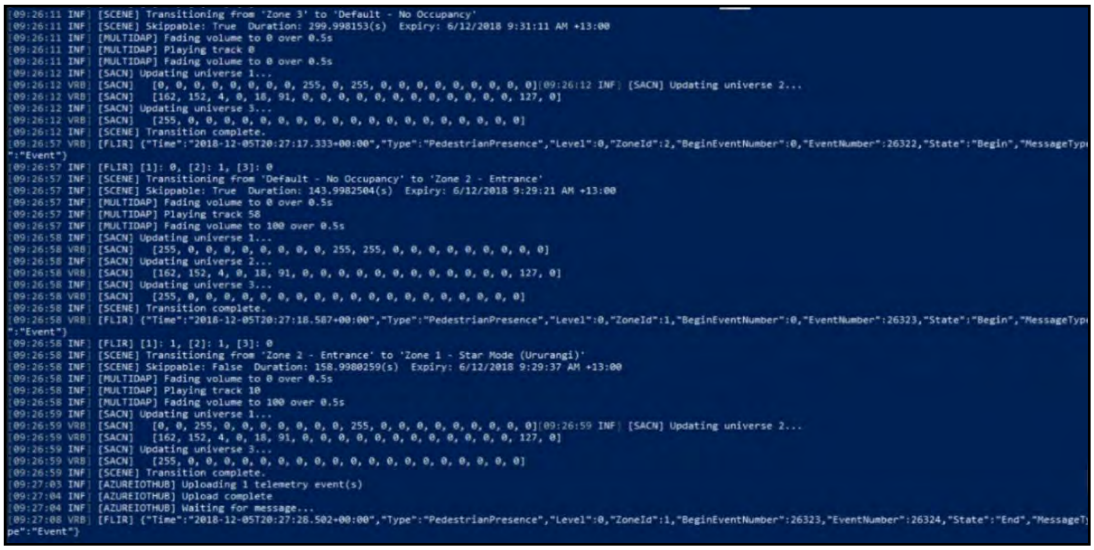


Fig. 16 Microsoft Azure application programming by Jourdan Templeton from Aware Group.

Generic presence data can now be collected for ongoing educational use. It is currently being used by Wintec students, but pending student engagement, will be made publicly accessible in the future. Examples of this presence data can be seen in figures 17, 18 and 19.

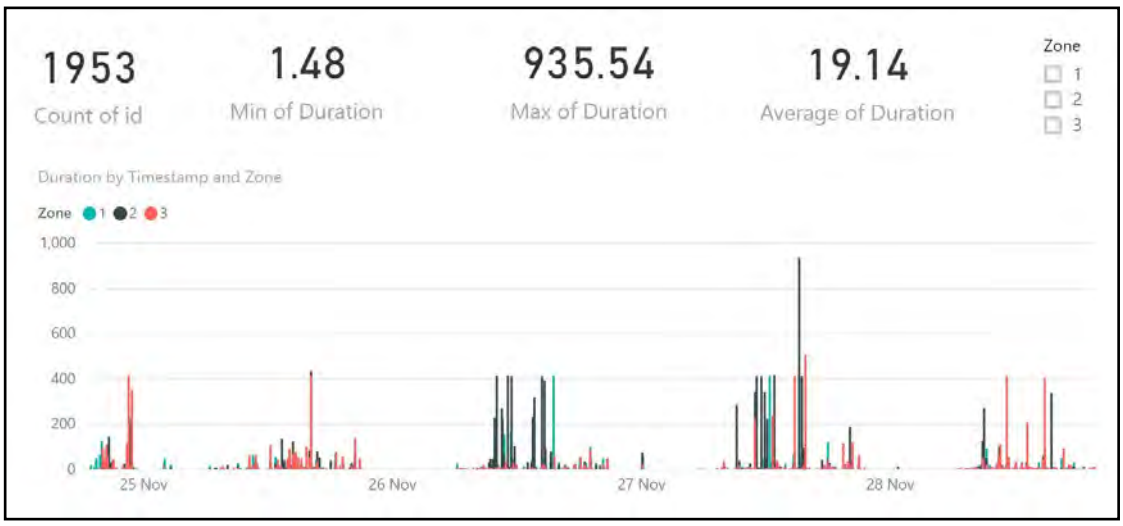
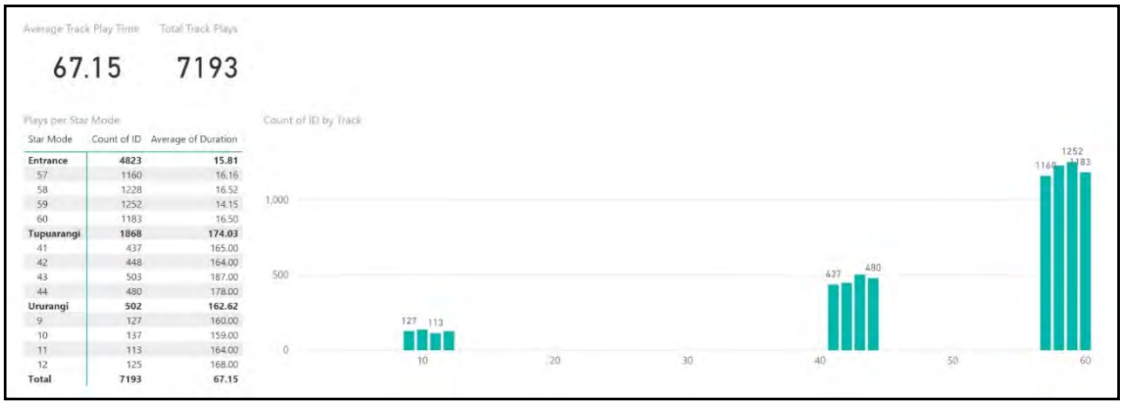


Fig. 17 Example of occupancy data for each Zone, from 25th to 28th November 2018



Star Mode	Count of ID	Average of Duration
Entrance	**4823**	**15.81**
57	1160	16.16
58	1228	16.52
59	1252	14.15
60	1183	16.50
Tupuarangi	**1868**	**174.03**
41	437	165.00
42	448	164.00
43	503	187.00
44	480	178.00
Ururangi	**502**	**162.62**
9	127	160.00
10	137	159.00
11	113	164.00
12	125	168.00
Total	**7193**	**67.15**

Fig. 18 Example of Star Mode soundtrack plays and duration time.

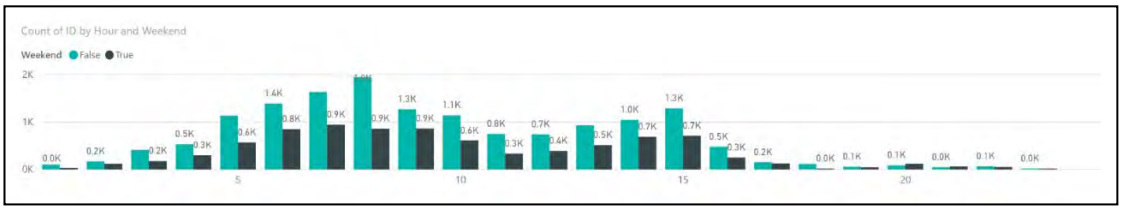


Fig. 19 Number of visitors for each day after opening on 23rd November 2018

All data visualisation images kindly provided by Jourdan Templeton (Aware Group).

What is missing from this technical description is how might these technologies intra-act to co-constitute emerging phenomena? Or to put that another way, how can these technologies combine with what else is going on so that new types of phenomena relationally emerge? An example can be seen in the next section which considers how the sound design came to be in relation to a number of different strands which needed to be woven together.

Weaving the strands together: The sound journey

Tōia Mai has a sound design that incorporates taonga pūoro (tradtional Māori music) and contemporary postproduction techniques. To describe it as sound 'design' is something of a misnomer, for the current 32 tracks emerged from a series of other processes already in action. Whilst attempting to retain some sort of chronological fashion in order to provide a structural overview by which these processual strands can be understood, the flow of events as described must be considered as a confluence of agencies with varying affect depending to the circumstantial affiliations of their meeting.

The integration of sound and light had been a part of the design since its early inception, and existed even before the occurrence of wanting to make a waka sculpture. When I'd first visited the waka *Te Winika* on 18th October 2016, I'd been reminded of Barad's (2007) descriptions of diffraction and intra-activity when drops of rain fell onto some ink sketches in my notepad. The original idea was to use infra-sound (very low frequency sounds) to align with my thinking around vibrational energy. It was after meeting with Tame Pokaia on the 1st February 2017 to discuss, amongst other things, the relationships between the Matariki stars and waka journeys, that I finally made the link between the stars and water. By the 19th February I'd made the decision that taonga pūoro would be part of the waka sculpture's sound design, asking in my notes if "taonga pūoro might actually be the best choice to explore these onto-epistemological questions?" (Citizen, 2017, January – March unpublished notes). After meeting with Tame again on the 21st February, I learnt about Hani and Puna, and that it was Puna who created the first sound as a wave of energy. What had started off as a series of unconnected musings was beginning to coalesce together, although I was far too task focussed at the time to realise it.

From the outset I had thought of taonga pūoro as being composed in an experimental manner, augmented with other sounds such as birdsong, bells, voices, drones and bells. This thinking had been informed by an earlier interactive work called {*presence*} (2015) where I had worked with renowned taonga pūoro practitioner Rob Thorne. By March 2017 the 'star mode' sensor alignment for each Matariki star had been decided, and as part of this kōrero (conversation) I was beginning to gain a greater appreciation of the maramataka (large body of knowledge pertaining to lunar calendar and seasons). Realising that the maramataka and the rising of the Matariki cluster were interrelated, it became obvious that there should be different soundtracks for each participatory encounter. The sound could no longer simply be playback, it had to become fully integrated into the IT architecture.

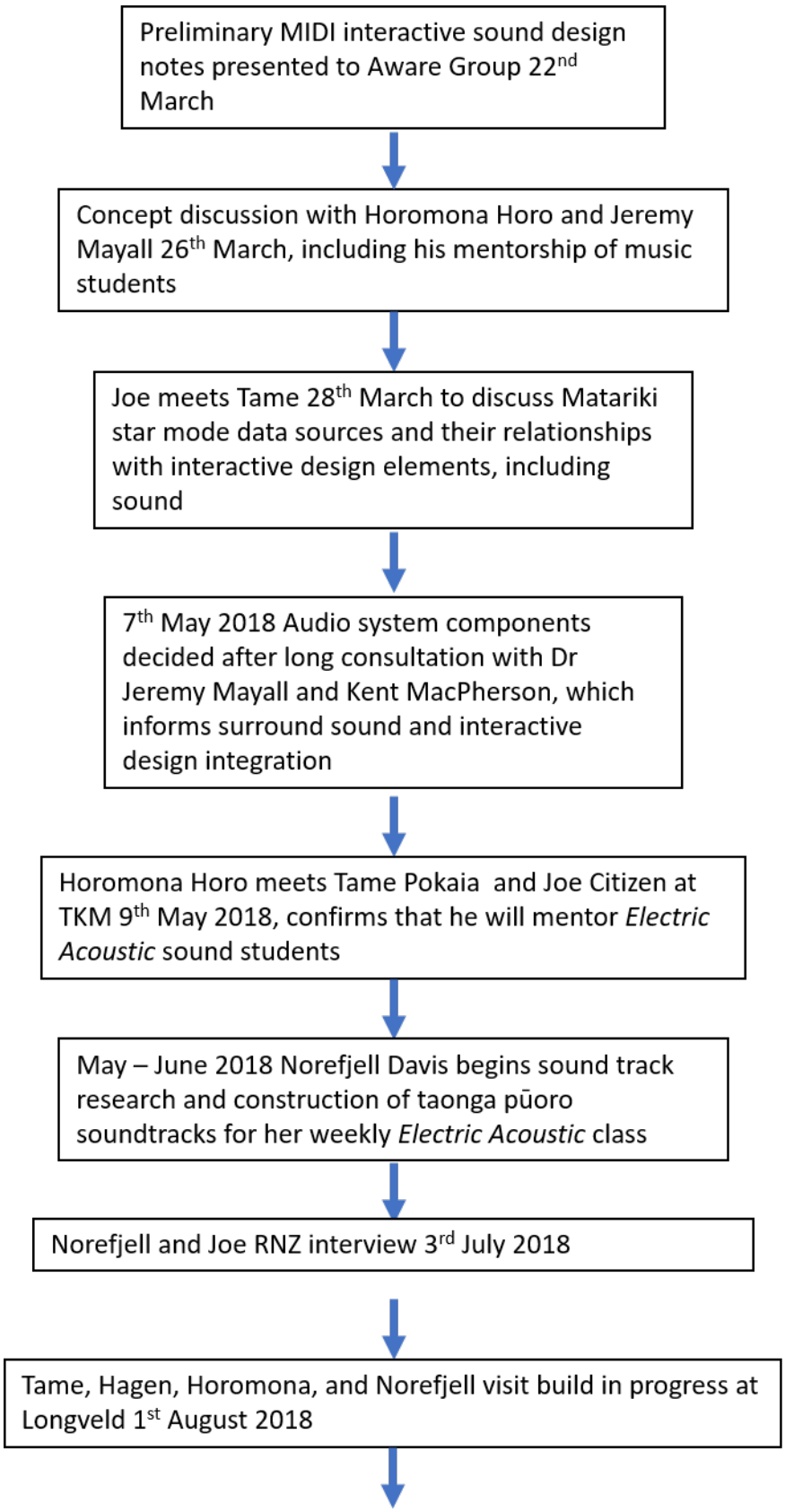
Running in parallel to these developments was the educational aspect to the project. Student involvement required opportunities to engage with 'industry', or at the very least, to incorporate their learning within 'real world' environments. Finding actual taonga pūoro composers and performers to contribute to the project however, was in practice somewhat difficult. My first attempt at asking a local practitioner in the latter part of 2016 was unsuccessful, when it became obvious that he was no longer replying to my emails. Similarly, two music students who had expressed interest in the project throughout 2017, did not actually do any work on it. It was only at a weekly research meeting in the early part of March 2017, that I learnt of the long-running collaboration between my colleague Dr Jeremy Mayall and the world-famous taonga pūoro

practitioner Horomona Horo. After several failed attempts to contact him by email, he finally agreed to meet with Jeremy and myself. What initially attracted him was the opportunity to mentor music students rather than the wider project, voicing his reservations based on long experience with other projects where his work had been used inappropriately or not acknowledged. His full engagement therefore rested on wanting to meet with kaumātua Tame Pokaia, until then he would reserve his decision.

At this point in early March of 2018, a chronological list of events can now be constructed. Figure 20 appears to chart a rather orderly sequence, but is less successful in revealing the interwoven strands of existing relationships, Matariki and the maramataka, the IT architecture, the interrelationship between amplified sound and electrical power, and budgetary and spatial constraints. Also missing is the need for student learning to be right at the heart of the entire undertaking.

The student who would become central to the sound design was Norefjell Davis, who like others in her class was offered the opportunity to learn from Horomona. Unlike her peers however, she chose to continue on from his shared masterclasses and develop a much larger body of work that continued well into the second semester. It was her innovation to include urban sounds such as the low grumbles of traffic with traditional taonga pūoro instrumentation into some of the soundtracks. Whilst she was criticised by some of her classmates for this, who thought it was not somehow ‘proper’, for her this acknowledges her authentic urban reality. Whilst undocumented, it was in our long conversation just prior to our RNZ radio interview on 3rd July 2019, where we discussed at length the cultural differences between Māori and Pākehā ways of knowing the world, that I really realised just how much she knew, that I did not.

This was to be the first of many experiences where my encounters with students were to prove that oftentimes my role was simply to be ‘the energy’, to provide a platform by which their self-directed knowledge blossomed. Acknowledging that I am not the expert in all things within the student-teacher relationship did not easily align with my Western academic background, but is far more taken for granted within Māori understandings of the learning environment. If I had started out on this journey thinking myself as being similar to a director, as it progressed I increasingly realised that I was contributing to it more in the fashion of a weaver, sometimes one of many, not all of whom are human. Sometimes too, I’ve had the feeling that the pattern partly weaves itself, with strands and spaces falling just *so*, and I have merely been present to witness it unfolding.


Preliminary MIDI interactive sound design notes presented to Aware Group 22nd March
Concept discussion with Horomona Horo and Jeremy Mayall 26th March, including his mentorship of music students
Joe meets Tame 28th March to discuss Matariki star mode data sources and their relationships with interactive design elements, including sound
7th May 2018 Audio system components decided after long consultation with Dr Jeremy Mayall and Kent MacPherson, which informs surround sound and interactive design integration
Horomona Horo meets Tame Pokaia and Joe Citizen at TKM 9th May 2018, confirms that he will mentor *Electric Acoustic* sound students
May – June 2018 Norefjell Davis begins sound track research and construction of taonga pūoro soundtracks for her weekly *Electric Acoustic* class
Norefjell and Joe RNZ interview 3rd July 2018
Tame, Hagen, Horomona, and Norefjell visit build in progress at Longveld 1st August 2018

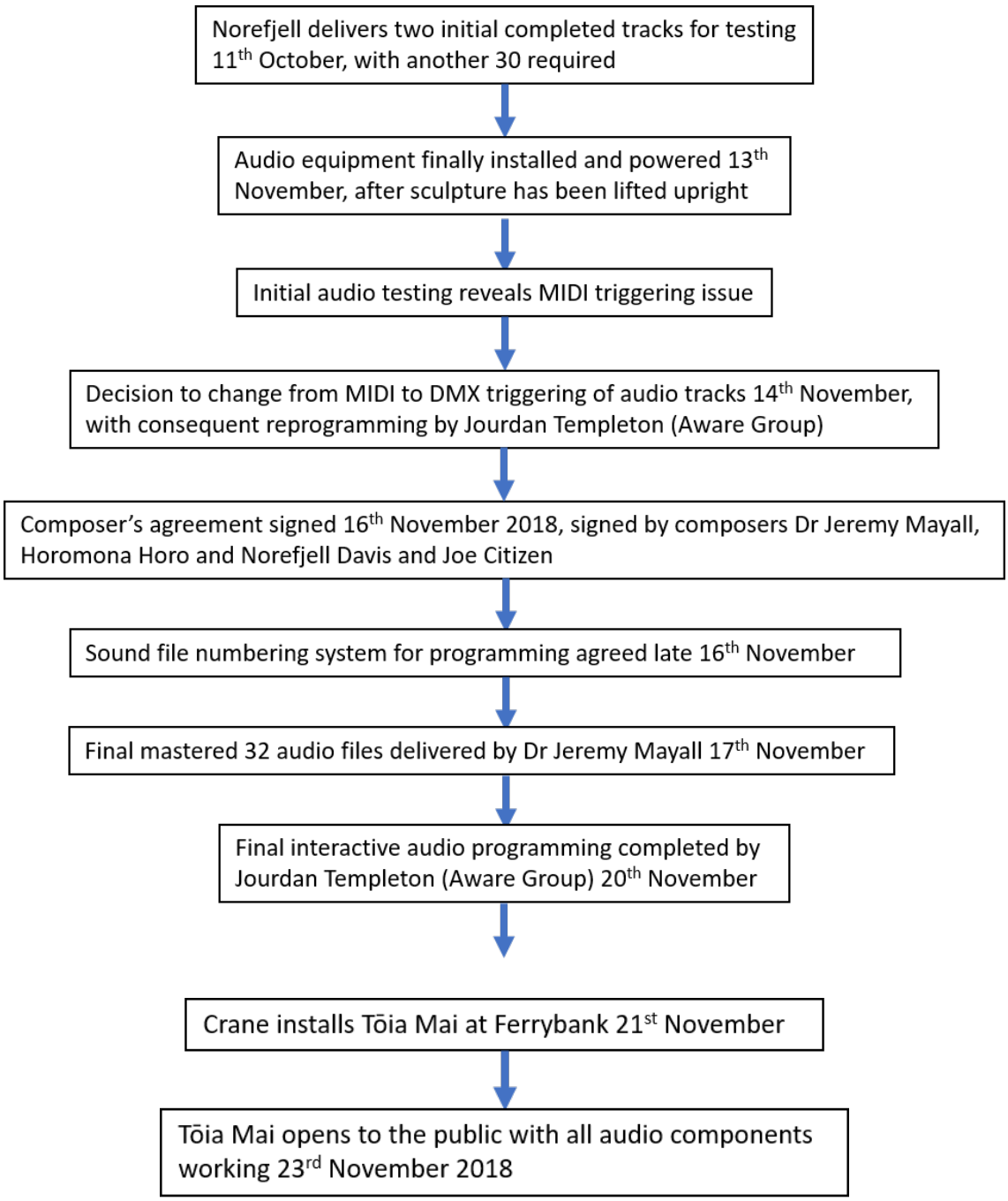


Fig. 20 Chronological flow of events from 22nd March 2018

If the final sound design relationally emerged from the contributory events listed above, it is important to also acknowledge the agency of Māori spirituality, the protocol differences between MIDI and DMX, the proprietary API set of the IT audio player, the structures and limitations of academic semesters, the logical requirements of cloud-based stateless computing applications, and a host of other aspects. At this point, some might ask in the context of the partnership between Maori achievement and myself, which parts are Māori in which parts are not? The following section addresses the problematic of attempting to identify contributions from specific cultural knowledges.

The problematic of attempting to identify specific cultural knowledge at the hyphen:

Attempting to identify the distinct cultural origins of specific contributions within a shared collaborative undertaking that acknowledges nonhuman and intangible agencies, will always be at best, problematic. The term 'Māori' glosses over distinctions between iwi (tribal confederation), hāpū (sub-tribe), and whanau (extended family), whilst 'Pākehā' is a term that fails to acknowledge the multiple cultural positionings of a people that may have once originated from Europe. Furthermore, such labels fail to account for those who identify as belonging to multiple, pluralistic, backgrounds. To those who would make generalised statements that differentiate between 'traditional Maori knowledge' and 'Western technology', is, in the context of contemporary Aotearoa-New Zealand, simply racist. And yet neither can it be said of New Zealanders that 'we' are all 'one', as commonly announced by our state television provider. There *are* some aspects of *Tōia Mai* that are distinctly Māori and *not* Pākehā or Western. This is evident on those occasions when it is referred to as a 'Māori sculpture', or when one observes the behaviour of some people subtly shifting within its field. To an extent this may be less to do with the structure itself, than with its presence providing a loci by which spiritual interfusion with Waikato te awa is reaffirmed.

The journey of becoming for *Tōia Mai* has been informed by a partnership concept between myself, multiple other partners, and Wintec's Māori achievement. The goal has been to attempt to work in a manner where Māori ways of being and doing is the default mode. It has been informed the concept of the intercultural hyphen, which "joins as well as separates" between cultures, and it is important to remember that the hyphen "can only name an always conditional relationship-between." (Jones, 2017, p.187) Attempting to identify the distinct cultural contributions made to *Tōia Mai* is equally conditionally relational, for it has, and continues to, emerge out of the confluences of multiple agencies.

Critical moments in practice 1

Between worlds and worlding: Placing the waka foundation

It was the 11th day of September 2018 at just on 8am that I met Wayne the builder, on the site where the Waka sculpture's foundations were about to be excavated in the presence of an archaeologist employed by the Hamilton City Council. It was the second day of Whiro - the new moon - and not an auspicious day from a Māori perspective for a new undertaking. Everything felt right on the edge, and walking down to meet him on the riverbank I felt 'between things' as if anything could happen, I was at a tipping point, in the fullest curve of the swing, at that place where mist begins to form into something not quite there in a beam of light.

I was also anxious because we were still without somebody to bless the undertaking before we started, a situation that had evolved from the day before when I had received a phone call from my contact at Council confirming that Muna Wharawhara was going to do the blessing. Towards around three o'clock however, I received a call from Muna, who asked "Have you organised someone to do the karakia?" I had not, for I had thought it was to be done when the concrete was poured and, in any case, it was the Council's responsibility. He asked if Wintec's Kaumātua Tame Pokaia might be available, whereupon I went up to Te Kōpū Mānia marae to talk with Hagen Tautari. "It's that before the first sod is turned thing" he said, and I realised then I'd been wrong about the timing and should've had a hand in organising before this. Worse, Tame would not be available as he was meeting the education minister Chris Hipkins in the morning. Thoroughly alarmed, I called Muna and explained the situation. He wondered out loud if somebody from mana whenua might be available - he would ask them. I felt quite uneasy about this, for I had met this man Rawhiri only once before at a hui where the project had been discussed, and this was by anybody's reckoning extremely short notice, and could be taken as being quite rude. Furthermore, my standing as a Pākehā artist and researcher in the web of relations between people (whanaungatanga) was only due to the relationship of my colleagues to him. I was seriously out of my depth.

It was also the first real day of Spring, which is to say it was a crisp sunny morning that very quickly became uncomfortably warm after what had felt like weeks and weeks of a wet and cold winter. I had only met Wayne the builder once before too - when the contract had been awarded to his company in a corporate room comprised almost entirely of windows. Our meeting now felt somewhat awkward, as two men not likely to meet so on a quiet morning beside the river. I had wanted to be here following my concerns that the foundation engineers had not drawn their plans as directed - with the keel of the sculpture pointing to the rising sun in the east - but had instead aligned it

north in relation to the conventional gridlines as found on maps. By way of breaking the ice, he had said that he didn't "get art that doesn't look like anything", preferring instead paintings where "you can see every brush stoke of detail." We tried to find some common ground talking about architecture, but the placement of the Waka sculpture and rotational direction of it was not important to him other than it being more or less within the 20 square meters of the riverbank we were standing on. Wayne for his part was respectful of my wishes, but as our conversation dwindled away to nothing, he handed me the can of water-based pink spray-paint he had been playing with and said "Well, you mark the centre of where you want it to go."

I was somewhat flabbergasted, having been under the impression from my previous dealings with Council and the engineers that the GPS co-ordinates had more or less been prescribed. It was at that moment that the Parks and Reserves manager Zeke Fiske chose to arrive, and under his eye I roughly sketched out on the ground where I thought it should go. I immediately felt a great sense of foreboding, it wasn't right, I could feel it in my gut, and I felt the heat rising in my face. Would they both mind, if they would stand there for a moment, stand in for the sculpture, whilst I went and looked at them from a distance? It struck them both as being slightly humorous to stand in for the waka sculpture, as I went down to the river side to look at them. It definitely wasn't right. I went back up the hill to tell them so. "That's alright" said Wayne, "we'll just cross it out and you can have another go." Suddenly, what had seemed so very clear for months became immensely difficult. Whilst they walked down to look at the access possibilities for the digger, I became intensely aware that the matter of the Waka placement *mattered* more than I had ever previously realised. Where it sat in relation to the curve of the hill, how it would be framed by different places through the curve of the river and the surrounding trees, what its relationship to the passing of the sun would be on its journey through the seasons - everything I had previously thought about for so long was coalescing into a few precious moments before a machine would come along and start digging. I felt like I was walking through treacle, time felt impossibly slow and fast at the same time, and I was unbearably hot. Muna called, he'd not been able to find somebody at short notice, but offered to come down himself at around 1.30pm. It was better to have karakia even if the work had already started. I took a breath, aware that this was not the best situation, but far better to have karakia performed later in the day than not having one at all.

I tried to concentrate on the task at hand, but felt distracted. I kept fiddling with my phone, weirdly trying to download an app that would tell me where true east was. Nothing was going well and the second time I tried to spray-paint the ground, it wasn't quite right either. By this time Sian Keith the archaeologist had arrived, and after

exchanging greetings she asked me what I was doing. I felt disconnected and tried to explain, but her archaeological task was foremost on her mind and with a smile she suggested I "go and be arty." The sun was now quite high in the sky and feeling overly hot I took the moment to take off my jacket and put it on a nearby park bench above us. Just as I was about to walk back down the hill, my colleague Hagen called. He and Tame would be able to make it just after noon. I felt an overwhelming sense of relief - Tame was the right person to make the karakia, had always been the right person.

Calmer now, I walked slowly back down the hill, pulled somewhat by its incline. I became aware of the slight over-compensation of my body to lean back and resist gravity. Realising this, I stopped, turned, and *felt* that this was the right place on the hill. Taking note of a particular crack on the path I walked down to the bottom and did the same walking up - stopping when I felt the need to push my body a little harder walking up the slope. I looked down - it was just past the same crack on the path. This was more like it - I was in the zone. Walking in a parallel fashion across the hill to the place where I'd roughly drawn the other two outlines, I paused where my feet told me to stop. This was the place. I bent down and sprayed an arrow on the ground. Just one other thing wasn't right - the direction of the arrow was too flat against the angle of the river bank, almost at a right angle to what the original plans had been and needed to be pulled back a bit. I walked back down to the river and looked up, yes almost right, but too regular, too rigid, somehow. I walked back up and realised I needed to rotate the angle a little north, more or less directly at a corporate building on the other bank. There, that was it.

By the time Tame arrived, looking crisp in his dark suit that he had worn to his meeting with the education minister, the fencing was up and the first few scrapings of earth had been excavated. Work stopped and I silently asked the other builders who had joined us to take off their hardhats. Tame's first words were to the river: "He piko he taniwha, he piko he taniwha, he piko he taniwha..." At every bend in the river, a chief. I wish my Te Reo Māori was better, but I understood his references to Te Kingī Māori and manaakitanga. He blessed the work and workers, and all of us, and when he said "Tihei mauri ora" I heard Sian beside me echo my own "Tihei mauri ora" in reply. I felt then at the close of his karakia that it was all alright. It had been a struggle, but we had got there in the end.

As I walked Tame back to his car, the digger started up again and the work began in earnest below. Whatever happened now would happen, the past would rise up to meet us as the topsoil was peeled back layer by layer. I tried watching for a while after Tame left, but in the end had to leave as every second minute the digger would be turned off so that Sian could dig to expose hidden objects with her trowel. I feared the digger

would hit a hidden drain or worse, koiwi. Feeling exhausted, I went to a cafe and grounded myself with something to eat. By the time I returned it was all over - no cracked pipes, no bones under the earth, just a broken bottle or two and a handful of nails. Nobody had called to tell me this, one of the builders told me when I asked.

Another account of the day as described above might run as follows: At 8am of 11th September 2018, Joe Citizen met the builder Wayne beside the Waikato River at the Ferrybank Reserve. Wayne requested Joe to "mark the centre of where you want it to go" and handed him a can of pink spray-paint. After several failed attempts, Joe successfully marked out the right place over the course of three and a half hours, over which time the two men were joined by three Council employees - a policy analyst, the parks and reserves team manager, and their joint manager, as well as two builders and a manager from Wayne's building firm, who had by noon unloaded a digger from a trailer and set up a fence. At 12.10pm they were joined by Kaumātua Tame Pokaia, and the work that had just started ceased, as prayers were made in Te Reo. Work recommenced shortly thereafter.

These two approaches both attempt to describe a truthful account of what happened at a certain time, in a certain place. The first is a description of my practice as told from a highly personal perspective, and the second is an attempt to describe it as if from the perspective of an imaginary third person, a convention which has at times been called objective. What I attempt to do in the first however is to open a space for discussion, a place to start considering what else is going on, somewhere by which speculation about first principles or metaphysics might be allowed to arise and inform these events. A performative or agentic analysis is called for, something that might help to make sense of the first description beyond the merely personal. A place to start can be found with my approach, for as a Pākehā attempting to be guided by a kaupapa Māori methodology, I frequently find myself somewhere between worlds, or perhaps I should say, somewhere between worldings, where I'm beginning to identify Western philosophical moves towards recognising co-constitution and material performativities, and a metaphysics informed by the idea that "one thing is never alone, and all things actively construct and compose it." (Mika, in Mika, 2017, p. 4)

Whilst not identifying as Māori, I am nonetheless mindful of that "the very medium of the language, structure and grammar we use is likely to thwart an indigenous metaphysics" (Mika, 2017 p. 3). This situation resonates with my own speculative art practice, which oftentimes finds itself caught between the performativities of the English language with the result that the very co-constituted phenomena I am attempting to describe, are prefiguratively staged and framed in a manner that assumes certain normative distinctions between 'self' and 'object'. Everyday language, such as that

employed by Wayne the builder, is both revealing and problematic: under the surface of a simple sentence lies layers upon layers of moments that have hitherto jostled into a coalition of sorts, whilst simultaneously omitting this confluence through an act of speech that positions these relationships into a homogeneity. The words "you mark the centre of where you want it to go" are so loaded that they freight within them an entire unexamined and unconscious metaphysics, which positions its terms and logics as self-apparent. The word "it" in relation to "you" for example, makes a clear distinction between 'things' and 'people' where people in this relationship occupy a privileged position. Both terms are isolated, where neither impinges upon the other. This is emphasised by the word "mark" which means to make a mark, literally, to use the paint in an act of representation upon the ground. The word "centre" within the sentence implies its importance, an inherent stance towards other parts is at play: the middle of the object that will be placed here has principle status. To "mark the centre" is to perform an act that is not just about ascertaining the determinacy of an originary point, but to call that point zero within an invisible grid from which all else is mapped from. This simultaneously sets up the types of relations as being intrinsically spatio-temporal in terms of measured distances from this point zero, fixed by its own logic.

Uttering this sentence was therefore a performative act, enacting meaning through its unconscious metaphysical underpinnings. It arranges even as it reverberates within the medium of the air. Yet this analysis might seem alien or nonsensical to someone more familiar with empirical or rational modes, for there is no hypothesis, I appear disinterested in causality, and there's precious little evidence that I'm interested in proving anything. As a Pākehā researcher engaged with his PhD studies concerned with what is elsewhere recently described as 'speculative' or 'new materialist' (Dolphijn & van der Tuin, 2012) philosophies, I'm aware of the general tenor of the arguments made "to develop a new philosophy of science and a way to move away from Kant" (Dolphijn & van der Tuin, 2012, p. 72). Within the context of Aotearoa-New Zealand however, there's already an established critique of traditional Western metaphysics close to hand from a number of Māori researchers, academics and practitioners, who have written about the effects of colonialism on an indigenous metaphysics that posits the intrinsic inter-relationality between humans and what might elsewhere be described as non-humans. Whilst a full survey of this critique is beyond the scope of this work, it's worth considering Carl Mika's observation that "The problem is due to the metaphysics of presence, which is the field and parent of that sabotaging linguistics." (Mika, 2017, p. 3) Presence, as traditionally conceived within a Western framework exists in relation to its binary opposite, absence, predicated by ideas of things being discrete and determinate entities. Similarly, within a performative and agentic analysis, ‘things’ can be conceived as being co-constituted as continuously emerging phenomena. (Barad,

2007) This does not mean that I claim any equivalence with Māori frameworks, but seek to identify potential synergies and parallels that may exist through attempting to being guided by a kaupapa Māori methodology.

In some ways, neither my personal nor empirical account reveals the performative agencies at play. That I was there at all in a capacity to make marks on the side of the riverbank to indicate where a 6.8m tall steel plate sculpture would sit, has emerged from a confluence of material-discursive agencies scarcely apparent in the empirical account, and only hinted at in the first. Hidden from view is the $360,000 funding journey that has enabled a sculptural 'object' needing to be 'placed' in the first instance. Also unapparent are the nested and interrelating layers of legal-ethical-cultural frameworks culminating in documents and agreements relating to building consent and the authority to build on that riverbank. Invisible agendas tugging at the interstices of education, industry, and public relations swarm quite undetected. Entire cultural currents run sometimes in sync with each other but often seemingly within parallel universes, perhaps less concealed in the first account, than in the second. Indeterminate materialisms pop in and out of potentiality, inferred through references to spray-cans, diggers and trowels. All of these things coalescing to form the emerging phenomena of the day.

The underlying difficulty to describe or analyse these hidden performativities and agencies, perhaps lies with an acknowledgement that the goings-on of the universe exist without human knowledge, or capacity to know, of them. There is always some aspect of these things we call 'things' that is hidden from our sensing or cognitive facilities. Furthermore, any approach or conception of this 'unknowable knowledge' only exists through a human conception of it. Within traditional post-Kantian Western frameworks, objects in the world can only be apprehended through a subjective (human) understanding of them, and the subjectivity of humans is to be measured against more objective statements of agreed universality. This situation is what Quentin Meillassoux (2008) describes as correlationism:

> Correlationism consists in disqualifying the claim that it is possible to consider the realms of subjectivity and objectivity independently of one another. Not only does it become necessary to insist that we never grasp an object 'in itself', in isolation from its relation to the subject, but it also becomes necessary to maintain that we can never grasp a subject that would not always-already be related to an object.
>
> Meillassoux, 2008, p. 5

From a correlationist perspective, the accounting of that day can never be separated from our human understanding of it. The 'objects' under discussion, whether conceived of as discrete, individual entities, or processes of continually emerging phenomena, are trapped within what Meillassoux describes as the "correlationist circle". (Meillassoux, 2008, p. 5)

Meillassoux, and other 'speculative realists' propose that it may be possible to escape the correlationist circle, and we may (now) have some access to 'true reality'. But to what extent are these claims a "contemptuous arrogance", to assume that "everyone else is deluded, but I know better"? (Shaviro, 2014, p. 10) The four early proponents who first presented their ideas at Goldsmiths College, London in 2007 (Gratton, 2014, p. 4), are Meillassoux, Brassier, Harman and Grant, but they, along with Delanda, Morton, Bryant, and others seem to have little agreement between themselves. (Shaviro, 2014, p. 5)

Before a wholesale engagement with these thinkers however, I find myself somewhat unsettled by what they do appear to have in common - a strangely universalist approach to a history of claims and counter claims that operate within a Western cultural milieu. For example, Meillassoux posits correlationist thinking as emerging from post-Platonic conceptions of the unknowable substance of objects, existing elsewhere, as 'Ideas', perhaps knowable only by a God. For him, Descartes unsettles this narrative by introducing ideas about the primary and secondary qualities of objects, where objects exist in relation to the sensing of them. Finally, Kant's transcendentalism shifts attention away from an understanding of objects in and of themselves, and towards a co-relation where statements that could be agreed to be universal about objects became the pre-requisite for 'objective' knowledge.

As a Pākehā attempting to be guided by a kaupapa Māori methodology, I encounter a metaphysics where the above 'ancestrality' is not at all certain. A completely different framework is at play - one that is far more at ease with objects that are to "be understood as determining events, as exerting forces, as volitional, or as instructing people." (Hoskins & Jones, 2017, p. 52) Within a traditionally Western paradigm, such claims have often been dismissed as primitive, dogmatic, or animist, this last being what Braddock (2017) describes as being dismissed through "scientific racism." At this juncture I no longer claim recourse to a normative Western narrative, but neither can I now claim indigenous understanding. Instead I find myself in a space that, as Alison Jones referencing Michelle Fine describes it, emphasises the relationships with my Māori colleagues - a place of "'working the hyphen', which draws attention to the complex space at the self-other border." (Fine 1994, in Jones, 2017, p. 184) The

hyphen is therefore the ‘between’ of an intercultural space that asks questions like: What is going on? Whose stories and framings are being told? Who benefits?

> Working the hyphen means creating occasions [...] to discuss what is, and is not "happening between" within the negotiated relations of whose story is being told, why, to whom, with what interpretation, and whose story is being shadowed, why, for whom, and with what consequence.
>
> Fine, 1994, p. 72

My understanding of the Māori-Pākehā hyphen space is informed by the practice of our shared Waka journey, which constantly alerts me on multiple levels to question my Pākehā assumptions about how the universe operates. From an entirely methodological perspective, kaupapa Māori is a collective undertaking which seeks to identify what the shared goals, themes and understandings are, who and/or what will be the beneficiaries, and how they will benefit. My part within this shared endeavour is not neutral, or one of a 'distanced observer', neither am I automatically the leader or decision maker. Attempting to be guided by a kaupapa Māori methodology as a Pākehā, means not taking for granted my usual understandings about power relations, roles, how things are done, what things mean, and how they mean it. I'm also intensely aware that Pākehā researchers working with Māori have had a long history of ethnographic bias which has presumed to know what knowledge is, who has access to it, as well as a more general tendency to equate the hyphen space with an 'us'. Many Māori are rightly cautious of Pākehā attempting to engage with them in research, for as Alison Jones puts it quoting from Linda Smith's (1999) seminal work *Decolonizing methodologies*:

> [Pākehā] "research" is probably one of the dirtiest words in the indigenous world's vocabulary." This suspicion towards Pākehā researchers remains strong. Even for kaupapa Māori researchers open to working with Pākehā, engagement requires justification and care.
>
> Jones, 2017, p. 183

Returning then to that Tuesday morning on the banks of the Waikato River at the Ferrybank Reserve, my first account gives an indication of what this undertaking might mean within Te Ao Māori. Perhaps the best place to begin is at the end of Tame's karakia, with the words "Tihei mauri ora!" which literally means "Ah, 'tis life!" (Hēnare, in Spiller & Wolfgramm, 2015, p. 80) The word ‘mauri’ however, is so much more than a simple meditative reference to the experiences of living life, but is:

> variously described as unique power, a life essence, a life force, and a vital principle [...] It is intimately related to other metaphysical powers - *tapu, mana, hau*, and *wairua,* and all of these forces are essences in forms of life in persons, objects, and non-objectified beings.
>
> Hēnare, in Spiller & Wolfgramm, 2015, p. 87

An understanding of mauri, then, may present the possibility of being able to inform contemporary speculative concerns. Yet this is very uncertain ground, and working within the hyphen means that the emphasis must not be on claiming any express or implied correspondence, but must rather highlight our relationship. It is entirely possible that in saying the same thing, our conversation means different things to each of us, as if we were indeed, in parallel universes. Following Hoskins and Jones (2017), it is not possible to:

> collapse post-humanist and indigenous ontological ideas or even compare them in any sustained way. Rather, [...] we try to find ways to allow these traditions to 'work' in our work.
>
> Hoskins & Jones, 2017, p. 57

To illustrate this, it first becomes necessary to unpack some of the processes that occurred before the 11th September, which when combined, enabled the possibility that I stood there at that time with a can of pink spray-paint in my hand. My relationship with Wintec's Māori Achievement began after approaching Kaumātua Tame Pokaia on the 28th July 2016 for his advice, regarding the possibility of making a series of temporary interactive art works on the banks of the Waikato River. Working as I do at the Waikato Institute of Technology (Wintec), I was able to approach him as a colleague. At that time I was variously interested in exploring notions of embodiment, and following Stern (2013), began to think about how interactive art can take situations as objects:

> Not as a function, not a use, not a need, not a behaviour, exploratory or otherwise, not an action-reaction. But a situation, with its own little ocean of complexity. It can take a situation and 'open' the interactions it affords.
>
> Stern, 2013, p. 65

Through the course of our kōrero, Tame suggested I visit the waka *Te Winika* which can be found at the Waikato Museum, in Hamilton. This I did on Thursday 15th October 2016, by which time I had become interested in the ideas of Karen Barad (2007) and Martin Heidegger (1927/1993), specifically their concepts relating to co-constitution. Thus *Te Winika* did not simply present itself to me as an object, but as a vessel co-

constituted with the Waikato River. Gifted to the people of Hamilton in 1973 by Queen Dame Te Atairangikāhu to help foster better understanding between Pākehā and Māori people, its name refers to an orchid tree (Winika Cuninghamii) that grows at Kawhia - the historical landing place of the Waikato-Tainui waka arriving from Hawaiki. This link to Kawhia, and the Pacific voyages of Polynesian people arriving in Aotearoa-New Zealand, quickly led me to consider of how the Matariki star cluster was probably used as a navigational aid.

Further conversations with Tame introduced me to a small part of the multiple layers of cosmology that underpins Matariki as a gateway concept. Considering each of the seven stars of Matariki as recognised by Waikato-Tainui, as portals to different facets of an interconnected environment, ran parallel to my thinking about Barad's ideas of intra-activity and agential realism (2007). By the end of November 2016 I realised I was interested in making a waka sculpture as informed by Matariki, as a means to explore the co-constitution of emerging phenomena. (Barad, 2007)

With the end of the 2016 academic year close to hand, I approached Wintec's Director Māori, Hera White, to propose a partnership with Māori Achievement whereby I would operate in two capacities - the first as a PhD candidate focussed on the metaphysics of materiality, and the second as a Wintec researcher interested in exploring multidisciplinary collaborative practice across the different domains, as a means to embed Wintec's Māori capability framework for students into real-world learning. Our common ground was educational, for as a tertiary educator I was interested in the principle of ako, which at that time I understood as being how learning between teacher and student is reciprocal. What I hadn't fully anticipated was that having started this waka journey together - tentatively titled *He waka eke noa* - what this would mean precisely in terms of working together, as informed by our different cultural understandings.

I spent that summer break of 2016/17 making clay, cardboard and bamboo prototypes, and by the start of 2017 had begun the long journey to convince various parties both within my institution and outside of it, that this was a worthwhile undertaking to invest their time, money and resources to. To return then, briefly, to the moment of the pink spray-can – where my experiential description appears to emphasise the agency of the 'artist' – is to gloss over the far more powerful agencies at play. Yet I have only been a steersman at best and at worst, an unwitting passenger on a journey to who-knows-where. It is often said of Te Awa Waikato that it has dangerous undercurrents that run much faster under the surface than what can be seen from above. It is certainly a dangerous river, with many whirlpools and hidden snags in the darkness.

Navigating the currents that run through the city of Hamilton has entailed, on the surface at least, attempting to channel multiple political agendas towards a common destination. Broadly speaking, these can be described as educational, socio-cultural, industrial, and governmental currents, each with their own streams and gullies, catchments and backwash, flora and fauna. In traversing these currents the waka journey would encounter elements of chance and just the right amount of synchronicity, right from the very start.

The beginning began with Māori Achievement establishing the kaupapa, a process that does not occur through one, or even several hui. Whilst I can appreciate now that the act of listening is performative, or occurs through arohia, which is "dynamic listening and participation" (Nicholson, Spiller, & Hēnare, in Spiller & Wolfgramm, 2015, p. 275), the whakawhanaungatanga barbecue between Wintec trades, engineering, early childhood education (ECE) and media arts students held 2nd March 2017 prompted me to better understand what my Māori Achievement colleagues had hoped to accomplish. It was a sharp lesson in not assuming that different domain cultures, let alone Māori and Pākehā, think the same way. Whilst *whaka* literally means 'to become' and *whanaungatanga* refers to stressing "the primacy of kinship bonds in determining action and the importance of genealogy in establishing rights and status" (Hēnare, in Spiller & Wolfgramm, 2015, p. 91), the different understandings of the event's purpose soon became all too apparent. Despite being held on the front steps of the trades and engineering building at Wintec's Rotokauri campus, only two trades students and three engineering tutors attended it. The ECE students had been told the wrong time and arrived an hour late. Meanwhile, the media arts public relations, journalism and graphic design students could not understand the relevance of being shown around an engineering block, mainly because the person who was introducing it to them did not appreciate the importance of emphasising relationships between people and culture, and instead focussed on objects and machines. A lack of cultural sensitivity was also displayed by the person demonstrating the wonders of the new 3D printing machine, when she bounced a life-sized anatomically correct replica of a human skull in her hand. Such an action demonstrated a lack of knowledge about Māori and Pacifica cultures, for whom the head is often considered tapu, and who constitute almost 50% of trades students and 25% of media arts students. (Wintec dashboard, 2017)

Such misunderstandings as these helped to inform an early (unsuccessful) proposal to the national Matauranga Vision fund, undertaken by myself and Māori Achievement's research leader Jamie Lambert, in March 2017. However it was this process that helped to really hone our common purpose and aspirations, and would go on to become the primary methodology behind the waka journey. It's one thing to say that we

intended "to embed Wintec's Māori capability framework for students into real-world learning", but the very core of our kōrero was around Te Tiriti o Waitangi: How would students be able to better understand Māori culture? What was needed to encourage their comprehension of Te Reo? What was needed to facilitate ako and ensure correct tikanga was observed within the learning environment? What practical steps could be taken to help resource our shared purpose?

Part of the kaupapa process was to also engage with a series of hui with tangata whenua, the first of which happened on the 11th May 2017 and was conducted almost entirely in Te Reo Māori. Present were Tame Pokaia, Hera White, and Korikori Hawkins from Māori Achievement, Wiremu Puke and Whaea Hekeiterangi Broadhurst, both of Ngāti Wairere, Rangitiepa Taipu who was "present on behalf of Ngāti Māhanga, but who does not have the mandate to represent them" (Personal communication, White, 12th May, 2017), and Rāhui Papa, who at that time was the chair of the Waikato-Tainui executive, Te Arataura. Most of the English spoken was by myself, when I was asked to talk, for five minutes only. The turning point came when first Wiremu and then Rāhui, described the undertaking as "innovative." It was only in the following days that I was to learn where we were headed to from here - a valuable lesson for a Pākehā attempting to be guided by a kaupapa Māori methodology - I was out of my depth, and everyone knew it.

Running parallel to these aspirations is the macro-political need for a regional polytechnic such as Wintec to be seen to engage with local industries. The domains of trades and engineering are often perceived by central governments to form the core purpose of polytechnics - to supply 'work-ready' graduates for industry and agriculture. The flow-on dynamics for tertiary education providers has meant a constant need to be current in an era of rapid technological change. But whilst there is a need to be 'agile' to meet these changes, training students to work in a collaborative multidisciplinary manner is particularly difficult for institutions reliant on student numbers and their attendant Education Funded Training (EFTs). Counterproductively, disciplinary 'silos' and fragmentation between subjects is the norm, as minimum class sizes and known timetables of core curriculum topics are easier to schedule and administer.

For example, if the concept of students working together across different domains whilst also engaging with Māori Achievement’s aspirations appears attractive to managers, in practice this is less than easy. Aligning the assessment regimes of different curricula is not straightforward, as each domain typically has different timetabling, and for Wintec trades this means starting courses when a prerequisite minimum number of students are found.

It was therefore extremely fortunate that in early April 2017, the engineering firm Longveld agreed to help mentor trades and engineering students engaged with the making of the waka sculpture. Their additional offer to donate $20,000 of in-kind services for materials and production processes finally incentivised the trades and engineering staff to more fully engage with the project, as it meant that Longveld would have the final technical responsibility. It enabled a number of mechanical engineering students to concurrently work on the prototyping and CAD design, and this in turn created the impetus for media arts and ECE students to engage with various learning opportunities in relation to storytelling and branding aspects.

Another major current to navigate ran concurrently to these events. The original proposal to Hamilton City Council's Public Art Panel in August 2016 had been for a series of temporary artworks, which now needed application to become a single permanent artwork. By the end of 2016 however, a new mayor had been elected and with him came the overnight decision to disestablish the Art Panel along with its recognised process for achieving this aim. With the help of then public art advisor Nick Johnston, the 'Matariki Public Art Project' was presented by 'Wintec' to Hamilton City Council's community and services committee on 4th April 2017. The purpose was to gain the first consent in a three-step process, which would give permission for a permanent artwork to be "located in the Ferrybank Reserve" (HCC report, 2017). The assembled councillors unanimously voted in favour of "Wintec's proposed Matariki public art project" (Letter, Nick Johnston, 5th April, 2017, see appendix A. AA).

Describing these interrelated factors as being different parts of a river, is to be reminded of their power to be comprised of multiplicities, connections, flows, eddies, slipstreams, life-forms, resonances, and echoes. Te Awa Waikato is the longest river of the North Island and beneath its whirling surface are a myriad of sinkholes and cold dark places that release their secrets infrequently, if at all. Time runs differently here, less chronological or linear, where past events might suddenly reveal themselves as if they were never gone, disrupting certainties with their reappearance and destabilising causal conceptions of reality.

If to some this might seem somewhat fanciful, immersed as we are in a day-to-day techno-scientific world where the internet’s innovations increasingly require us to be attuned to data and its logical relations, then consider this: what exactly is digitality? Is it chronological or non-temporal? Is it really separate and distinct to materiality, or if it does relate, what is the nature of this relationship? Are algorithms substanceless and neutral mathematical tools that through science will help to alleviate the world’s ills? Or will digitality only produce more of the same increasingly commodified virtualities, whilst what remains of nature collapses? When attempting to work between cultures, these

questions cannot assume a common understanding. Perhaps more importantly, a reappraisal of digitality starts to confront the very universalisms that Western culture has for so long taken for granted. Here then, are some of the invisible forces that influence those other aspects that some might otherwise consider to be material or cultural differences. What is needed is a better understanding of how the material and the digital interrelate, and to what extent are they informed by cultural assumptions?

When considering these educational, socio-cultural, industrial, technological and governmental currents all running side by side, another entangled invisible force must be acknowledged: the ever-present need for funding. For at that moment with the spray-can, over $160,000 of funds and in-kind costs had already been raised and spent. The painting of those pink lines, spraying, crossing out, re-spraying, evidences a conglomeration of influences; a confluence; a coalescing and settling of processes still in flux; here my role as an individual 'artist' recedes and my body's actions somewhat prescribed by forces still in play. Here 'I' becomes a 'we' that pulls together to launch this waka. Here, *Tōia Mai* becomes reality: *Pull together here.*

Critical moments in practice 2

The Antenna

The original plan to provide *Tōia Mai* with digital access was to install an optic fibre on the same date that a power cable was to be laid. The expense of applying to Heritage New Zealand for permission to undertake earthworks in an historically significant site, paying for the 50m trench to be dug from a pre-existing external electrical box and having an archaeologist in attendance, would be borne by the Hamilton City Council as part of our initial partnership agreement. I had been reliably informed that optic fibre could be thrust down the electrical conduit from the nearby ANZ/ Mercury Energy building, and was confident that this strategy would enable access to both the internet and an Internet of Things (IoT) network.

Having convinced Wintec's Information Technology Services (ITS) that the work done by industry partner Aware Group would allow successive cohorts of students to learn about the IoT hub Microsoft Azure, they had agreed to take responsibility for associated costs by engaging with the telecoms provider Vodafone. With less than a week to go before the trench was to be dug on Wednesday 10th October, it was something of a surprise to learn from Vodafone's subcontractor Ultrafast Fibre (UFF) that not only was there was no fibre they could access from the ANZ/ Mercury building, but that their parent company WEL Networks - who also owned the electrical power network – didn't allow fibre to share the same conduits or boxes as electrical cables, despite being non-conductive. The timing of this discovery was incredibly poor - running simultaneous timelines we'd booked a crane for the same day, aiming to lift the waka upright and situate it outside in order to install and test the interactive systems.

By that Wednesday, the available options for a fibre connection to the waka location were exhausted. The previous public announcement that the interactive sculpture's opening would occur in six weeks' time, was now in serious trouble. The only feasible solution that did not entail a minimum two-month reapplication to Heritage New Zealand for a new trench line to be dug, was to equip the waka with mobile access to the internet using an antenna. Since the sculpture is primarily constructed of 3mm plate steel, mobile microwaves cannot be reliably received by an internally placed fixture. The only available option was to now add an antenna to the outside of the otherwise carefully considered aesthetic form. By 11am, Longveld's project engineer Jemoal Lassey and I made the difficult decision to cancel the crane that had been booked for that afternoon, and rescheduled it for Friday at the same time. There was plenty to do in the interim – the team was well behind schedule with the LED polycarbonate diffusion installation, and still needed to test all their electrical connections too.

An emergency meeting with Jourdan Templeton (Aware Group) was called at 3pm. A quick trawl through the web necessitated a phone consultation with the technicians at Wintec's preferred supplier, PB Tech. Overnight delivery for credit card orders needed to be in by 4pm, and at 4 minutes to 4 the decision was made - a black and stubby omni-directional antenna, modem, pigtail and cable combination that would likely be able to receive mobile signals from one of Hamilton's cell-phone towers. The next day I found myself holding these things in a box, along with the urgent need to decide where to install them.

The modem wasn't exterior rated, so had to go in one of the stainless-steel cabinets. After a quick renegotiation with Paul Nagels the electrician, we 'found space' beside one of the power supply units. 8m of cable had seemed ample the night before, but in our haste we'd forgotten about the interior curvature and framing, so that only an extremely limited range of placement options was now available. The antenna also had to go somewhere where it would be able to receive radio signals, a problem whose solution was blindingly obvious to the engineers in the group - on top of the keel. It was inelegant, but practical, given the short timeframe. After considering the profile lines of the folds of the sculpture and choosing between one side or other of the lifting lug, I made my decision - there, right on the top of the waka.

I went to bed that evening at 5.30pm and woke up a few hours later. It had been a terrible decision to put the antenna on top of the keel, and would forever look ugly. At 3am in the morning I found myself checking the location of Hamilton's cell-phone towers online. Less than a kilometre away from the Ferrybank reserve is a transmission point mounted 43m on the roof of Hamilton's Sky casino. The new orientation for the recently poured concrete foundation meant that the open entrance of the waka would now face in line with it. This was very good luck, and on Thursday morning I made my apologies to everyone and insisted that the antenna location be moved to the top of the inside curve, just below the tip.

That evening I took the modem over to Jourdan so that he could program and align it with the network. After the last few days of intense activity it was something of a relief just to sit there and watch him code. As I watched him however, I realised that what I was witnessing was the creation of abstracted connections, oddly removed from the physical installation work we'd been spending so much time trying to achieve. What then, was the nature of the relationship between the real and the virtual for the waka? We'd previously discussed the actual and the digital aspects of the waka as being linked, which Jourdan had described as a 'digital twin' and I had thought of as being symbiotic. Delanda (2016), in his modification of Deleuzue and Guttari's ideas on assemblages, had introduced me to the idea of a diagram - a concept that enables the

consideration of assemblages to be nested as abstractions within each other as ensembles, which in turn allows them to act as variable parameters for the whole:

> An ensemble in which components have been correctly matched together possess properties that its components do not have. It also has its own tendencies and capacities. The latter are real but not necessarily actual if they are not currently manifested or exercised. The term for something that is real but not actual is virtual.
>
> Delanda, 2016, pp. 5-6

This was a useful concept as it begins to consider the way in which the virtual waka and the actual waka might inform each other. Not expecting an answer, I asked Jourdan if he thought if something could be real but not actual, and that this could be a definition of the virtual. What happened next was a rather extraordinary conversation:

> Jourdan
>
> In the IT space, there is no distinction between a virtual network and a physical one - there's no way a device can determine if its communicating with a physical or virtual device. You could be talking to a device on the other side of the world, and you would never know. That packet travelling through the network could pass through many virtual devices. The whole internet works on the idea that devices and networks could be virtual.
>
> Joe
>
> So the distinction between the virtual and the actual is one made entirely by humans?
>
> Jourdan
>
> Yes. The definition of a virtual device is a representation - equivalent to - a physical device, but doesn't rely on a physical host. It needs to be initially built and hosted by a physical device, but can be migrated across virtual networks and devices.

Devices are the endpoints. Networks are the transport. There are specific devices that run the network, everything else consumes the network. The data is not important, it's the contract that's important.

Joe

It's the set of relations of placeholders within a logical framework?

Jourdan

Yes. This is what the waka project is - there are all these categories with their data sets. It doesn't matter what they are, so long as it conforms to this contract the logic will work. From an IT perspective, the more data is decoupled from each other the easier you can replace their components.

Joe

So, this is essentially a machine - an assemblage of machines, where machines are particular logics operating with each other?

Jourdan

Yes, a system. That's what we'd call that.

Joe

Under this definition, a machine is entirely a mental construct.

Jourdan

Yes, or more accurately a system - it's not real, they're not physical.

Joe

Not physical?

Jourdan

Not physical - not tangible. This is what I mean by not real.

Joe

Just to summarise, virtuality is not tangible?

Jourdan

Yes, pretty much, it doesn't rely on physicality.

Joe

But virtuality is not the same as physicality?

Jourdan

If something performs the same function as a physical thing, isn't that the same?

Jourdan Templeton, personal communication, 11th October 5.56pm

The conversation at this point abruptly finished - he'd finished the programming of the modem and it was time to go home.

Friday morning and with the crane due to arrive at 1pm, we were faced with a new problem - in order to reach its new location, the antenna cable now had to be inserted

into a 10mm hole from around a blind corner past one of the thermal imaging cameras. Having little success in achieving this myself, the mechanical engineering student Vignesh offered to do it so that the topmost cabinet containing the lighting board could be installed, followed by the bottom Atom X4 lighting fixture, before the deadline. Jourdan called - Wintec ITS had decided at the last minute that their SIM card should be used in the modem. Between other jobs he rushed over to install it himself, whilst I made an emergency drive to purchase the additional power cables needed to power the modem. On returning, the antenna cable still hadn't been achieved, and everyone else's process dependent tasks were grinding to a halt as a result. We were massively behind schedule and still needed to install the stainless-steel cabinets containing the main computer, networked audio player, router, thermal imaging router, and connections to the networked lighting board. Completely reliant on the physical infrastructure, the digital architecture was only now starting to meet its preconditions for existence. By 11am Jemoal and I reluctantly had to again cancel the crane, rebooking it for Monday. This suited the needs of the students working on the physical build, but was seriously affecting the other timelines, particularly the available time left in which to do the testing and programming.

By the end of the day it had taken three of us to get that antenna cable in, but only after we had completely dismantled the thermal imaging camera assembly and removed the mounting plate for one of the cabinets. The whole exercise seemed intensely physical, straining our bodies through the small access hatches to install the means by which the virtual might at some point actualise. Despite the conversation with Jourdan, the digital was having a consistent relationship with the tangible, if only through the means by which its signal transport occurs via radio signal or cable. Common factors to both are conductivity, power, signal, heat, and syncopation to the ever-present clock. What then, really, is digitality?

The original conception for the waka as an artwork was not to explore computer mediated 'interactivity' per se, but to explore Barad's idea of intra-activity, which:

> *signifies the mutual constitution of entangled agencies.* That is, in contrast with the usual "interaction", which assumes there are separate individual agencies that precede their interaction, the notion of intra-action recognizes that distinct agencies do not precede their interaction, but rather emerge through, their intra-action. [...] *agencies are only distinct in relation to their mutual entanglement, they don't exist as individual elements.*
>
> Barad, 2007, p. 33 [italics in original].

Whilst Barad seeks to reconcile dualist distinctions of meaning and matter through quantum physics, I wanted to create an artwork that avoided the 'if-this-then-that' programmatic realisations of body-mediated representational interactivity, and create instead a work that aimed to stage “an implicit body as performance" in order to "magnify our bodies’ *emergent relations with* the forces, concepts, and materials that make up and embody, for example, language, society, or space.” (Stern, 2013, p. 77). Barad's critique of Cartesian representational understandings of the subject-object distance and her argument that the universe is comprised of phenomena that exist through the continuous relational emergence of mutually constitutive “entangled agencies”, helped my then nascent understanding of the links between materiality and digitality, not to mention my attempt as a Pākehā to be guided by a kaupapa Māori methodology. (Barad, 2007, p. 33).

Informed through ongoing kōrero with Kaumātua Tame Pokaia, the basic premise of the interactive design is organised around a Waikato-Tainui informed framework that recognises an interconnected universe, as articulated through the gateway concept of the seven stars of Matariki (Pleiades). Each 'star mode' accesses an IoT network and web-scraping service that provides every individual mode with different and constantly changing environmental data sets. For instance, the star Ururangi which relates to wind and the weather in general, is designed to be informed by sensors measuring wind gust direction and velocity, barometric pressure and air temperature. These localised and continually updated environmental datasets are then turned into percentiles based on their latest highest and lowest known values, to 'ontologically flatten' their different scalar measurements. Finally, these sets are transcoded into DMX signals to 'instrumentalise' them in a multi-vector and expressive manner, with dynamic values created for each dataset e.g. the star Ururangi has a different value that equates to eight wind directions, each informed by the current and variable wind gust velocities.

Through this design, the same question of what digitality is, arises once more. More precisely, what is the relationship between the tangible and virtual, and might they, following Barad's understanding of entangled agencies, be mutually co-constituted? Computing requires the presence of clocks, which regulate the binary operations of transistors where the emphasis of their action is informed by the number of operations that they enable per second. As co-constituents of a system, devices, whether 'virtual' or 'tangible' are arranged within logics where they are interchangeable in terms of performing the same action - but performing the same function is not the same as equivalence. To what extent then, has the culture of computing formed and limited the understanding as to what digitality is?

Somewhat more importantly, if co-constitution, performativity, and relational emergence all seem to be entangled with each other, then to what extent are my own practices also tangled with everything else? As I write this research up, I watch the pixels of the screen form into words and the words into sentences, constantly aware of how the grammar of English language forces my ideas into one tense or another. If I am to look at my cultural assumptions in practice then writing seems particularly problematic, for its linguistic prescription seems uncompromisingly stark, influenced as it is by Latin and old German grammatical conventions. Writing has a long history of being associated with representation, a topic that Barad in particular, has difficulty with. Finally, as a Pākehā attempting to work in partnership with my colleagues from Wintec Māori achievement, I must acknowledge how Te Reo Māori, is first and foremost an oral language. The act of writing it seems, is far from being neutral or bereft of cultural presuppositions, and identifying it as an action means that it too has performative agency.

Performative problems

The first two chapters use a structure that can be described as ‘critical moments in practice’, a convention that aims to demonstrate my contribution to new knowledge through my practice-led research. It is supposed to reveal the multiple layers at play through the vehicle of a certain point in time, so that the interrelated fields of performativity, relational emergence, embodiment as incipient activity and intra-activity, as well as my methodological frameworks, can all be discussed.

What becomes immediately apparent to this researcher is that the critical moment structure seems to work against this aim, for it presupposes and therefore co-constitutes certain metaphysical norms. These can be summarised as: An understanding of time as either being fixed like a fly in amber, or as a linear sequence of moments in a cause and effect relationship; informed by documentary representational conventions that stand in for lesser or greater validations of truth; themselves informed by Western academic biases towards binary distinctions between quantitative or qualitative research; these in turn being historically biased towards notions of truth based on a so-called ‘objectivity’ that privileges rationalist or mathematical logics; preconceived formulations of objects as being individually self-contained and separate from humanity; and finally, that ‘things in the world’ are validated through humanist conceptions of them, as understood by a metaphysics of presence (Mika, 2017, p. 3). As such, any research that engages with a performative or culturally different framework has difficulty in articulating itself against these norms. Furthermore, the aforementioned metaphysical grammar resists critique through its very language, reinforcing its discursive power.

There is also a fundamental difficulty about writing about performativity when using the language of representation. In relation to ‘speculative’ and ‘new materialist’ philosophies, performativity has been defined as “matters of practices, doings, and actions.” (Barad, 2007, p. 135). Following Judith Butler (1993), performativity in art has been described as “a non-autonomous and non-subjectivist idea of acting.” (von Hantleman, 2010, p. 19). Historically, performativity arises from Austin (1962) and his linguistic research that explored how some phrases act as constructions “that ‘does’ what it ‘says’, such as ‘I promise you.’” (Jones & Braddock, 2017, p. 185). Representation on the other hand, whether it be using words, images, or sounds, is just that; a *re-presentation*, which takes for granted an inherent separability between a ‘reality’ and presentation through a referent. Even when representation is radicalised as simulacra, where signifiers no longer reference a represented reality and images are defined by the “precession of the model” (Baudrillard, 1994, p. 16), this still assumes a separation from an externalised reality. For simulacra, reality disappears to be replaced

by the logic of the model “which no longer has anything to do with the order of facts and an order of reason”. (Baudrillard, 1994, p. 16)

This taken-for-granted separability between signifiers and signified is the basis for contemporary Western understandings of ‘classic’ communication theory, which as the forerunner of cybernetics originally proposed a mathematical model where the “semantic aspects of communication are irrelevant to the engineering problem” (Shannon, 1948, p. 379). It also underpins Western understandings of semiotics, including the writing of Ferdinand Saussure, Charles Sanders Pierce and Roland Barthes (Chandler, retrieved 8 April 2019 from: http://visual-memory.co.uk/daniel/Documents/S4B/sem01.html), as any first-year media or arts degree student might be able to describe. What is commonly overlooked when discussing these theories, is that they are informed by cultural frameworks that presume universal applicability of their foundational metaphysics:

> The idea that beings exist as individuals with inherent attributes, anterior to their representation, is a metaphysical presupposition that underlies the belief in political, linguistic, and epistemological forms of representationalism. Or to put the point the other way around, representationalism is the belief in the ontological distinction between representations and that which they purport to represent; in particular, that which is represented is held to be independent of all practices of representing. That is, there are assumed to be two distinct and independent kinds of entities – representations and entities to be represented.
>
> Barad, 2007, p. 46

This is the crux of the problem - attempting to research ontological modes using epistemological frameworks is unlikely to generate new knowledge of these modalities. Instead, by using this ‘traditional’ conceptual apparatus and grammar, it is likely that both research and practice will recreate the same tendencies they seek to escape. Within traditions of the Western academy, informed as it is by humanist and epistemological framings that privilege the aforementioned categorisations, rationalisations and humancentric conventions of time and space, language itself must speak with a bifurcated metaphysics in order to validate its truth claims. If performativity is to be seriously considered for research, then the academic convention that seeks to remove the first-person voice in writing is deeply problematic. Traditionally this had been due to a tendency to privilege quantitative notions of objectivity, so research that implicates the researcher within the research becomes automatically suspect as it

positioned as subjective. Originally, my research proposal was informed by several key framings: I acknowledged that myself, my creative arts research, and my creative arts practice are inextricably inter-related and that my research would itself be performative, (Barnacle, 2009); that it be allowed to emerge without the insistent preconceptions of having a research question or problem to be answered (Haseman, 2006); and that it recognise experimentation as improvisation, where such “improvisation is participatory, relational and performative retaining the research subject in its life context.” (Douglas & Gulari, 2015, p.392)

And yet these framings do not adequately account for the notion that language itself may be performative. If elsewhere, indigenous attempts to critique the humanist foundations of academic literacies have been marginalised, then recent posthumanist calls to do so are less easy to ignore:

> We problematize all human/humanist-centric theories because previous critiques of humanism’s violence have functioned as what Sedgwick (1990, p. 85) calls “minoritzing” discourses—discourses that matter to some people (women, the formerly colonized, etc.) and can be easily dismissed or ignored by those with the privilege of not needing, wanting, or choosing to care. We believe posthumanism pushes intersectionality to the point where no one - no matter their field, interest, or position of power - can afford to ignore these critiques.
>
> Snaza et al 2014, in Zapata et al. 2018, p. 480

Considering language for what it *does* rather than what it *says*, requires reassessing its supposed neutrality and account for its capacity to co-constitute meaning. This seems particularly pertinent as I stand in front of my desk using speech to text software to ‘write’ this exegesis document. Implicated conventions include a page structure that alludes to a printed form, as if future readers might only encounter this text on paper rather than pixels on a screen; note the page numbers on the bottom right-hand side as if the linear structure of the book takes precedence over web or digital platforms; more importantly however, is *how* I talk - short staccato bursts of sound punctuated by silent, pregnant pauses – phenomena that are almost entirely absent should I type. Situated within this is the knowledge that academic writing is supposed to be reflective, and yet it seems to me that to some extent the writing reveals itself in a process of discovery, or as Jorge Luis Borges (1966) puts it:

> I don't think a writer should meddle too much with his own work. He should let the work write itself, no?
>
> Borges, cited in Wirtz, 2013, p. 54

Language in this conception loses its human intentionality, and indicates an other, nonhuman agency. Such a statement does not sit easily in 'serious' academic writing, which presupposes the author or authors as being the origin of new knowledge contributions. The notion that knowledge itself might arise and reveal itself to the writer, destabilises the very humanist hermeneutics that gave rise to academic traditions in the first place. Within literary studies however, the notion that a writer might discover something accidently through the act of writing, is less problematic:

> non-intentional invention is an active intellectual position in which the writer is poised intently on what's to come next, what's on the periphery struggling to come into view. Non-intentional invention is a heightened receptive stance akin to feeling your way for a light switch in the dark or casting your hook into the water and the associated vigilance of feeling for what might be a bite on the end of the line.
>
> Wirtz, 2013, p. 54

This position is still a long way distant from the idea that knowledge is not solely the purview of humans. Barad (2007) argues that materiality in its intra-active becoming constantly gains knowledge through its continuous meeting and unfolding processes. The writing that I per-form now is co-constituted through a Bluetooth enabled headset, a HP elite book laptop, certain accent assumptions made by the programmers of the software and AI algorithms, the limits of RAM, a solar panel, inverter, and 12 V battery set up, the amount of available sunlight, human relationships, interruptions, the vagaries of the one… No, that was meant to be 'wind'. There are unforeseen accidents in this process – it's not as if there is not human agency, but rather that nonhuman agency must also be accounted for, so that this practice of writing cannot completely originate from 'me'. Writing is a performative, co-constituted practice, where I as the writer become party to 'things in the world' as they reveal unknown aspects of themselves in a process of continual discovery:

> There is an important sense in which practices of knowing cannot fully be claimed as human practices, not simply because we use nonhuman elements in our practices but because knowing is a matter of part of the world making itself intelligible to another part. Practices of knowing and being are not isolable; they are mutually implicated we don't obtain

> knowledge by standing outside the world; we know because we are *of* the world. We are part of the world in its differential becoming.
>
> Barad, 2007, p. 185 [italics in original].

Barad's call for an "Ethico-onto-epistem-ology" which recognises "the intertwining of ethics, knowing, and being" (Barad, 2007, p. 185) acknowledges how different practices configure matter in its ongoing materialisation. In other words, "material-discursive practices" (Barad, 2007, p. 170) act as boundary making conditions (apparatuses) upon materiality as phenomena, as it continuously unfolds. As a writing practitioner it becomes necessary to consider how academic traditions of writing practice performatively enact discursive conditions upon materiality:

> We come to know through our entanglement with other bodies (human, nonhuman, more-than-human) in the world. This being/knowing is inherently about ethics or relational doing(s), as we are in mutual response-able relationships with other bodies. Therefore, we have to consider the ethics of (rethinking) writing.
>
> Zapata, Kuby & Thiel, 2018, p. 484

This does not sit well within a representational view of language, which might position it simply as a vehicle for culture, separate and distinct from the 'real conditions for existence' which exist exterior to the human mind. What this directly challenges are the scientific rationalist and positivist traditions of objectivity, which co-emerged post Western Enlightenment with the rise of universities as repositories and production centres of knowledge. As argued elsewhere in this research, the notion of objective truth rests on the inherent separability of a human 'knower' and what is positioned as 'the known'. This culturally informed notion that 'interiority' and 'exteriority' are ontologically divided, rests upon Platonic-Christian traditions of 'true reality' residing 'elsewhere', that matter is dumb and inert, and that humans are to have dominion or rulership over the natural world as described in the Bible's Genesis (1: 26). As soon as practices, environments and bodies are conceived of as existing within the same field of relations, then knowledge itself must be seen as a type of practice that co-configures the world. (Barad, 2007, p. 91) Yet if humans and human knowledge are identified as not being separate and distinct from the agentic capacities of nonhumans, then this is deeply problematic for a Western metaphysics which insists that:

> The *ontological* divide between persons and things must remain lest one have no *moral* grounds the privileging man over germ or for condemning pernicious forms of human-on-human instrumentalization (as when

> powerful humans exploit illegal, poor, young, or otherwise weaker humans).
>
> Bennett, 2010, p. 12 [italics in original].

If language and writing can be considered as being co-constituted by the entanglements of human and nonhuman agency, then is meaning itself co-created? Collapsing the Western ontological divide does not just decentre humans from their hitherto position of privilege, but brings to the fore the means by which humans are performatively constituted by the world. Such a perspective exists within the metaphysics of te ao Māori:

> the influence of the world that is hinted at in the forthcoming words has always 'turned back' to the speaker, and the speaker is hence captured by the sublime that resides within the actions *as a whole* from the outset. The unusual aspect of language here is that indigenous notions of time and place dictate that an utterance in total is influential before the words are encountered, or before the self is cognitively aware of them. Moreover, any speaker will be constructed in some way by speech without ever being aware of what is stated.
>
> Mika, 2017, pp. 46-47 [italics in original].

Not only do humans emerge from the world's relations in this approach, but silence is not the absence of presence. Instead it has dynamic agency, a "phenomenon that constitutes things in the world". (Mika, 2012; 2014a; 2015b, 2018, p. 47)

As a Pākehā attempting to be guided by a kaupapa Māori methodology, I am very aware of the cross-cultural differences of what 'reality' is considered to be, and how these differences inform collaboration. Writing about performativity, relational emergence and co-constitution is part of this practice, and it would be unethical to write using traditional Western academic conventions knowing that doing so discursively produces particular arrangements of being. As such, I too conclude that:

> Closing off discourses of possibilities for writing in the name of standardization, normalization, commodification, tradition, or otherwise, is to overlook the dynamics of objects; places; ecological, political, affectual, and linguistic resources; and. . .and. . .and. . . We find much hopefulness in posthumanism and are energized by the ethical orientation at the heart of this work.
>
> Zapata, Kuby & Thiel, 2018, p. 498

Historically however, Westerners have typically assumed notions of superiority in relation to encountering indigenous metaphysics, including those from te ao Māori. Traditional Western enlightenment thinkers usually took for granted Cartesian notions of ontological separability, valuing an intellectual tradition that discredited belief structures which did not conform to their own strictly defined rationalist categories. Anne Salmond (1985) argues that during the colonial era, racist evolutionist ideologies had a vested interest in discrediting any indigenous metaphysics as a means to justify the forcible acquisition of land, so that:

> assumptions of superiority […] serve to objectify the thought-world of others for scrutiny, while closing off one's own. Under such conditions and particularly in colonial and neo-colonial contexts, accounts of 'traditional thought' are likely to be ethnographically insecure and ideologically distorted, and they are also likely to have damaging practical effects for those who thought is being described.
>
> From the first meetings of Māoris and Europeans, Europeans took the virtue of the imperial enterprise for granted. Aotearoa was on the wild edges of the world, to be 'discovered', named, and tamed by scientific exploration, evangelism, and colonisation from the imperial centre.
>
> Salmond, 1985, p. 255

Past attempts by Westerners to consider non-Western conceptions of performativity have been equally problematic. For instance, Austin's narrowly defined linguistic research may well have been deemed less evolved, had it arisen a century before-hand, and elsewhere on the globe:

> Some late nineteenth-century ethnographers took a racist and condescending view of the power of so-called 'primitive' peoples to make things happen through language and performance.
>
> Braddock 2013, in Jones & Braddock, 2017, p. 186

If there are those who would position such circumstances as occurring in the past, then they would do so without engaging with how indigenous understandings of how time and space operate. Such knowledge could very well inform all manner of post-Kantian frameworks including but not limited to quantum physics, materiality, digitality, artificial intelligence, et cetera. Yet there is the danger that 'new' speculative realists and new materialists will inadvertently recreate aspects of the very metaphysical framework they seek to critique. What seems particularly ironic for this current era, is that notions of

performativity and contemporary critiques of Western rationalism are declared as having particular importance to humanity's ongoing survival:

> Such a questioning is urgently needed at a time when we face the prospect of ecological catastrophe and when we are forced to recognise that the fate of humanity is deeply intertwined with the fates of all sorts of other entities. Anthropocentrism also has become increasingly untenable in the light of scientific experiment and discovery.
>
> Shaviro, 2014, p. 1

Elsewhere we are told that "the image of dead or thoroughly instrumentalised matter feeds human hubris and our earth-destroying fantasies of conquest and consumption." (Bennett, 2010, p. ix) If the concept of performativity is overdue a wider and more thorough critique, then why must it be framed using conventions that impart their own structural influence, particularly if associated concepts of co-constitution and relational emergence announce these structural influences?

If digitality, and by extension digital interactive art, is to be considered in relation to performativity, co-constitution, relational emergence, and mātauranga Māori, then not only must its critique reflect the entangled layers of theoretical, historical, cultural, institutional, and discursive concerns that inform these concepts, but also what might lie under the surface of this constantly shifting confluence. Certainly digitality has traditionally been informed by notions of immateriality, somehow disembodied and unrelated to its real conditions of its existence, without having a relationship to heat, electrical power, conductivity, wave energy, or any number of other tangible aspects of 'physicality'. Partly this was informed by the thinking of the afore-mentioned Claude Shannon, whose mathematical model of communication conceived of information "in an immaterial form" (Stern, 2013, p. 31), at around the same time as Norbert Weiner was beginning to think about cybernetics and information theory which blurred "the human-machine boundary" (Gallison, 2011, p. 22). When information is conceived as immaterial, then:

> 'pattern is predominant over presence. From here it is a small step to perceiving information as more mobile, more important, more essential than material forms' (Hayles, 1999: 19). Hayles warns us that if information is seen as separate from, and more important than, materiality, then it can also be misconstrued as more fundamental.
>
> Stern, 2013, p. 32

Across both digital and material frameworks it therefore seems prudent to explore performativity, using chapters that depart from the critical moment model. When concepts from te ao Māori also co-constitute the research, then this is no longer a preference but a necessary requirement. Within the metaphysical models that exist within Māori culture is a huge wealth of wisdom and knowledge about the natural world, which at best has been ignored or side-lined by Western academic institutions, and at worst, actively suppressed. That te ao Māori is protective about its cultural knowledge, is completely fathomable following a long history of misunderstanding, misappropriation, and at times, outright theft. There is also the obvious difficulty of attempting to engage with the metaphysics of one culture, with the cultural toolset of another. With this in mind, my approach is to proceed as cautiously and respectfully as possible. I do not claim correspondence of concepts between cultures, my aim here is to identify potential parallels and synergies that appear to be – on the surface at least – between speculative and new materialist philosophies and concepts from mātauranga Māori.

To consider performativity as being culturally informed has other consequences for practitioners attempting to work between cultures. How, for instance, when we engage in mutual decision-making, that it be assumed that we mean the same thing when talking? When shifting from a representational paradigm to what appears to be a performative one, how do we understand meaning through action? If as Barad suggests, how things are done alters what eventuates, then understanding meaning-making itself exceeds the notion of merely being culturally informed and becomes materially constitutive. If being/knowing is about the ethics of doing in a relational manner (Zapata et al., 2018), then attempting to work at the interfaces between Māori and Pākehā in ways that are Māori-centric are not just ‘politically correct’, but *are themselves constitutive of unfolding phenomena.*

The potentiality of a line

Can a non-Māori be guided by a kaupapa Māori methodology? Or to put that another way, is it possible for someone such as myself to ever really 'get it'? At the start of this journey I had thought – in my liberal humanist manner – that the answer would be 'yes'. Now, after everything, I am far less certain. If there is an answer, then it is more complicated than simply asserting one or the other:

> 'A non-indigenous, non-Māori person can be involved in Kaupapa Māori research, but not on their own, and if they were involved in such research, they would have ways of positioning themselves as a nonindigenous person.' Or the more radical rejoinder might be, 'By definition, no: Kaupapa Māori research is Māori research exclusively.
>
> Smith, 2017, p. 12

Clearly then, to claim that I am *doing* kaupapa Māori in the same way that I might utter that I am implicated within the performative research, is contestable. As such, I position myself as *attempting* to be guided by kaupapa Māori methodology - and it is certainly not up to me to determine the relative 'success' of this approach. Yet even this claim is problematic, as it presupposes common understandings of *what* my colleagues and I attempt to achieve. Within the context of working together on a collaborative project inside the discursive space of a regional polytechnical institute, the name of our shared collective endeavour is called 'He waka eke noa', which is a well-known whakatauki (proverb). Whilst literal translations might describe this as being 'a boat we are all in without exceptions', it is perhaps more accurate to convey what it means through considering the experience of being in a waka together - everyone has a part to play and we must work together if we are not to sink. On paper this looks like an excellent partnership focused on multidisciplinary collaboration, but what is less clear is what this actually looks like in practice, and whether or not my colleagues and I share the same understanding for these words we are using. As a non-Māori person in the company of people for whom Te Reo Māori (the Māori language) is as natural as breathing, it is always I who must adapt, changing my definitions and assumptions in the process.

Kaupapa Māori also refers to a capacity for transformative change. (Durie, 2017, p. 2) Being in partnership with Wintec Māori achievement meant being guided by a kaupapa that aims to embed the Māori capability framework into student learning. As the capability framework already existed prior to my partnership with them, then in order to be part of "explicit commitment to making practical social change" (Smith 1997, 2003, in Hoskins, 2017, p. 101), I had to make significant personal change. This aligned with

my commitments to an interactive participatory art, which had previously been informed by considering arts activism as praxis:

> Arts activism is about the artistry of social consciousness grounded and human interaction. It represents an innovative use of public space to address contested issues of sociopolitical and cultural significance allied with systems of power and control. Arts activism engages community participation as a means of effecting social change and galvanising citizen dissent.
>
> Frostig 2011, p. 50

At the start of 2017 it became immediately obvious that the above approach was not going to seamlessly integrate with the kaupapa of the Māori capability framework. Partnership fundamentally puts collective goals before those of the individual, and my colleagues were less interested in a politics of dissent and more concerned with seeing their goals become a reality through the practice of that reality. If I was to work with them, then I too must come on board with their practice by attempting to work in a way where how things are done are as important as what is done. This meant actively trying to 'change cultural gears', not just at the marae but when working with students or 'being in the world' as my authentic self. Learning how to be at ease in a Māori world takes time and it is important to give this time in a way that rubs up against Pākehā expectations of schedules, priority, and conversational convention. In the day-to-day world of a tertiary education institution working 'under fiscal restraint', it is typical to refer to time, people, funds, rooms, and equipment as allocable resources administered as bookable hourly units. Conversations seek to be 'task focused' and 'move forward' towards 'output solutions' in a manner that justifies in a reportable way the use of these resources. Working in partnership means being available; not expecting that meetings will follow a strict hourly format or predefined structure; listening to and being part of conversations that might not appear to be relevant to the 'subject'; flexibly adapting to suggestions whilst maintaining project cohesion; acting and speaking honestly; and attempting to listen in active relation rather than as a passive perception. In summary, I had to learn how to walk that 'line' between Māori and Pākehā ways of doing things.

Even the terms 'Māori' and Pākehā can be contentious, not the least because they imply a binary relationship occupied by essentialist entities. If after Fine (1994) I attempt to 'work the hyphen' between cultures, then perhaps a working definition of what these terms might mean should be attempted. 'Māori' simply means 'ordinary, everyday, natural' in that:

> the term Māori in history was not always used to refer to Māori people, but rather to something that naturally and organically comes to life.
>
> Royal, 2017, p. 113

This is a long way distant from a popular 'ethnic' definition of what it means to be Māori and has unforeseen ramifications for what being Pākehā means, as it implies a lack of ordinariness.

If within the context of what I have heard described elsewhere as a 'Pākehā tertiary institution', I had at the outset simplistically thought that my Māori colleagues faced huge challenges, then I had done so with an unconscious tendency to consider my own culture in a central, 'mainstream' fashion. Like most of my Pākehā colleagues, schooled and successful within a system that upholds being educated, enlightened, and grounded in liberal humanist values, it is easy to forget that the worst of Aotearoa-New Zealand's colonial legacy has often been informed by exactly the same discourse. Not being alert to one's own cultural assumptions is typically a recipe for disaster, with the unfortunate likelihood that it is usually through disaster or near disaster that such assumptions become apparent.

For example, when I tried to introduce new collaborators to the project without first providing an opportunity for my Māori achievement colleagues and others to meet with them,this nearly shut down the project. I had rather naïvely assumed that the advent of the whakawhanaungatanga barbecue in February 2017 signalled that the waka build was now a priority, and upon discovering that appropriate people could not be found within the existing pool of those involved, had invited some other staff and students to participate. When I cheerfully announced this 'solution' to one of my Māori achievement colleagues, it is fair to say that she was livid: How dare I bring people in that they had not met with, nor provided the new people an opportunity to meet everyone else? I was completely flummoxed – it was not at all what I had anticipated, but very quickly realised that my actions were jeopardising our relationship. I apologised, and from then on always sought to consult with Māori achievement not just about 'things Māori', but about everything to do with our shared undertaking. On reflection I realised that I had assumed a leadership role and had prioritised physical tasks over the kaupapa. I had completely missed the point that a whakawhanaungatanga is all about the "process of establishing relationships, relating well to others" (retrieved from: https://maoridictionary.co.nz/ 17th March 2019), to literally 'become as family'. Had I been more cognisant of this, then I would have immediately known that I should have talked to my Māori achievement colleagues first, and perhaps suggested a meeting afterwards.

To some of my fellow Pākehā colleagues this approach implied a ‘loss of control’, as they too, sought certainty about what was going to happen, and when. Working as they were within a 15-week semester structure, they had assumed that working with Māori achievement would mean that their needs would be met first. They, like myself, had not anticipated that:

> *Kaupapa Māori is about being Māori.* This principle makes Māori normal, no longer the ‘other’; it removes the ‘difference’ or the ‘pathology’ of identifying as Māori.
>
> Stewart, 2017, p. 137 [italics in original]

It is therefore necessary to foster an attitude which, as Pākehā, acknowledges Māori ways of doing and being as the default. This is far easier to say than to do, as there is a tendency within Pākehā culture to assume certain ‘truths’ to be both common sense and universal. What both I and my Pākehā colleagues had difficulty with, is that *working with* entails a willingness to accept that what is considered ‘normal’ is not necessarily so, nor possibly, desirable. In the context of attempting to work within a multidisciplinary collaborative partnership that also sought to produce a tangible outcome, I had to learn how to walk the edges between different cultural expectations centred around time, relationships, and structural power. One must learn to take responsibility without being craven, to give processes their due time, to balance the directives intrinsic to the vertical hierarchies of an education institution with the goals of the kaupapa, and always be flexible to change. In summary, attempting to be guided by a kaupapa Māori methodology as a Pākehā entails recognising that such a relationship can be difficult for all concerned, but it is not impossible:

> Pākehā involvement with Kaupapa Māori [brings] risks… [but] it is not black and white; it is about people, it is about relationships.
>
> Smith 2012, in Jones 2017, p. 191

At the time I did not fully appreciate the huge risk that Māori achievement took by agreeing to work with me, on this very public project. That they continued to do so despite my lack of real understanding, speaks volumes about their commitments, their ability to forgive, and their inclusive manaakitanga. In contrast, my first realisation had been related to my own concerns, rather than towards the collective kaupapa. In my haste to pursue an academic study of relational emergence with specific emphasis on the nonhuman, I had neglected the importance of the very human relationships with Māori achievement. If by realising that my attempt to escape Cartesian binaries had been ironically undermined by my own cultural predispositions towards them, it was not

until much later that I comprehended that this first realisation reveals my individualistic tendencies. Looking back now I understand that like others, this experience did not only help to inform my understanding of Māori culture, but has also informed my sense of identity as being Pākehā:

> In studies specific to the New Zealand context, Pākehā perceptions of self were shown to be transformed through exposure to Māori culture (Brown, 2011; Campbell, 2005; Jellie, 2001; Mitcalfe, 2008), and in many instances, this resulted in a deeper understanding of what it means to be Pākehā. Brown concluded that "knowing something about te Ao Māori, is knowing something about being Pākehā" (p. 19).
>
> Forsyth, 2018, p. 74

Whilst a sustained account of Pākehā cultural identity is beyond the scope of this research, it is nonetheless entangled within a cultural partnership with Māori. By actively working with the direction of Māori achievement – particularly the leadership of Kaumātua Tame Pokaia and Director Māori Hera White - this two-and-half-year journey has come to completion. Many times throughout the whole process and particularly when a difficulty of one type or another was encountered, Tame would say "We will get there." And so we have - that *Tōia Mai* now stands on the banks of the Waikato River in the centre of Hamilton - is a testament to our ability to be 'we', and not 'I'.

What is perhaps most startling about everything that has come to pass in this undertaking, is that it ever came into being at all. At every stage there has been a relationship with the *unknown* that permeates this 'object as emerging phenomena', from its initial inception onwards. If a 'Western' philosophical trajectory can be traced from Plato's ideal forms through to Descartes' subject-object dualisms, Kant's transcendentalist a priori knowledge, and towards various speculative realisms, then these philosophies rest on several inbuilt assumptions: Firstly, that the universe beyond humans can be *knowable by humans.* Secondly, that humans occupy a privileged position within the universe, where human exceptionalism is predicate to what knowledge is. Finally, that knowledge deemed to be universal is not just privileged, but tends to be considered as being what constitutes knowledge.

In the Western milieu, this framework encounters limits when it engages with the quantum discontinuity and aspects of digitality concerned with relational emergence. When 'things' are not considered bounded and discrete, but rather as continuous reconfigurations of matter and/or modifiers, then distinctions between the hidden and the unknown can acknowledge that which is unknowable and beyond human finitude, and that which is presently hidden. A somewhat artificial range can now be considered:

Starting with the known, progressing through stages of comprehension, the incomprehensible, the hidden, and finally, the unknown. Hidden therefore has a relationship with potentiality, which does not need a human knower but rather refers to that which is not yet immanent. This idea developed is in the chapter on *Pull,* which can be summarised as the sway or drift of potentiality that relationally emerges through collectivised complexity. By making this distinction between the unknown and the hidden, it becomes possible to speculate that potentiality may not simply exist in relation to immanence, but in relation to the dynamic agencies of discontinuities. In her explanation of the quantum discontinuity, Barad (2007) discusses a similar relationship between intra-action and indeterminacy:

> if the indeterminate nature of existence by its nature teeters on the cusp of stability and instability, of determinacy and indeterminacy, of possibility and impossibility, then the dynamic relationality between continuity and discontinuity is crucial to the open-ended becoming of the world which resists acausality as much as determinism.
>
> Barad, 2007, p. 182

If, like the quantum discontinuity of electrons between orbitals, potentiality is conceived of as ‘jumps’ or ‘leaps’ between different levels of stability, then potentiality can be considered as being dynamically emergent in a non-linear manner, as discussed in more detail below. Potentiality may therefore have a relationship with the unknown, not because it is possible to escape human finitude, but because of this tendency towards non-linearity.

By acknowledging that the Plato–Descartes–Kant metaphysical trajectory is anything other than universal, claims about the unknown cannot solely refer to the uncertainties of intercultural, read *human,* relationships. That such uncertainties exist within Māori-Pākehā collaborations is undeniable, located at the hyphen space:

> The term ‘intercultural hyphen’ is a metaphor or model for the boundary implied within the concept of ‘ethnicity’, which comes into being *through* contact between different cultural groups (Eriksen, 2002). In this sense, the concept of ethnicity is better envisaged as a relationship, rather than a hard-and-fast category or ‘thing’. This aspect of ethnicity makes the hyphen a useful contemporary model of interculturalism, which is language-based (the hyphen being a punctuation mark), and applicable to interculturalism in Aotearoa New Zealand, where the Māori-Pākehā relationship is central (Hoskins, 2012).

Stewart, 2018, p. 767

If I had originally conceived of the practice-led research that contributed to the making of *Tōia Mai* as a study in relational emergence, then I had not thought at the outset to acknowledge 'both sides' of the metaphysical foundations situated within the partnership relationship. In practice, despite my best intentions, I discovered my own universalist and humancentric presumptions in the process, for it is not so easy to 'step outside of oneself'. This too, became part of our relationship, as over time I became increasingly aware that despite being 'well educated' in one worldview, my colleagues could easily 'switch codes' between paradigms:

> For about the last 200 years, Māori has been obliged to adapt to Pākehā ideas about the world, which gives Māori a formidable advantage in navigating the intercultural hyphen, reflected in the common expression of contemporary Māori experience of 'living in two worlds'.

Stewart, 2018, p. 768

If I had assumed a monopoly over certain types of knowledge, then perhaps this was my unconscious bias at play. The trouble with thinking of oneself as a 'liberal, enlightened, Pākehā', is in discovering the limits of what this actually entails – a certain rigidity of thought that assumes "the teleological fantasy of Western education as a linear increase of knowledge." (Jones, in Stewart, 2018: 770) Yet as soon as one acknowledges that one cannot 'know everything', then the unknown can be admitted on its own terms, and not as a negation or absence. The difficulty for this 'liberal Pākehā' has been discovering one's own epistemological presumptions: The separation of human with nonhuman; that time chronologically consists of a past, present, and future; that causality is similarly linear; that the rights of an individual are important; that 'things' in the world are bounded and discrete; that science can 'unlock' the secrets of the universe; and finally, that there may be 'common ground' between cultures, a meeting place by which we might begin to understand each other. As such, my early engagement with mātauranga was anything other than straightforward, not the least of which because my entire being has been immersed in my own cultural predispositions:

> The ontological orders of Māori knowledge are not obvious; and in seeking to begin to understand *maatauranga*, a Western epistemology cannot be presupposed. The reasonableness of *maatauranga* rests within Māori, and not in the partialities of translation; and gaps and translatability make room for political interest to enter discussions of Māori thought.

Salmond, 1985, p. 260

To be clear, I am not the expert here. I cannot speak for my Māori achievement colleagues or for te ao Māori in general, and do not seek to claim any rights to do so. In the same manner I cannot speak for all Pākehā, for both terms are essentialist at best and do not account for the pluralist and fluid identities so implicated. Māori have also been unduly criticised in the past for a supposed lack of consistency across accounts, as if 'Māori' were one homogenised group. To discuss Māori perspectives in this research in a similar vein would be misleading, and it must be remembered that different speakers or writers refer to their own tribal traditions rather than speak for Māori as a whole. Yet this does not mean that there is not, nor has not been, discussion amongst different experts, at least since the early 19th century:

> For the cosmological accounts it seems that discussion was mainly among learned experts, and for this reason they sought out each other's company and on occasion travelled to the Whare Waananga of related tribes.

Salmond, 1985, p. 248

Intertribal debates between experts enabled a certain relativity to coexist between traditions, whilst maintaining one's own knowledge. This said, there also appears to be some consistency across traditions for those events "on the edge of cosmology, and at the beginning of human history." (Salmond, 1985,p. 248) When situated within speculative enquiry the intercultural hyphen is therefore relational, dependent on different cultural imaginaries and generalisations, where claims about the unknown must be prepared to be challenged:

> The propensity of ethnicity to invoke the unknowable adds to the paradoxical nature of the intercultural hyphen: it touches on the infinite, the philosophical depths, the mystery of existence, the transcendent experience that cannot be measured. What we learn in the intercultural space is not necessarily what we were prepared to know.

Stewart, 2018, p. 770

For example, having put the wheels in motion for a multidisciplinary collaborative partnership with Māori achievement at the end of 2016, I was keen to ensure everything would be 'right' when the 2017 academic year started. I met with Kaumātua Tame Pokaia on the 1st of February to show him my design and was somewhat relieved to hear him say that a waka "is a good shape for a sculpture", having previously spent the last two months working on paper and clay prototypes.

Furthermore I had recently convinced my colleagues at the Centre of Engineering and Industrial Design (CEID), that this was something their students could work on. After showing my sketches of how the different stars 'modes' could be informed by an environmental sensor network, I was baffled to hear him say that he couldn't "comment on what others are saying." Having designed for nine stars after visiting the exhibition at the Waikato Museum, this made more sense when he then said that Waikato-Tainui are "different to Rangi Matamua's people" [Tūhoe]. Matamua had been the curator of the exhibition and the starting point for my literary research. Waikato-Tainui only recognise seven stars, he said, as evidenced by Te-Paki-o-Matariki - the coat of arms of the Kingitanga. This was a timely reminder that my partnership with Wintec Māori achievement would mean deferring to his authority on 'things Māori', rather than being informed by academic sources in the first instance. For while there are a great many Māori scholars, he is an expert of Waikato-Tainui, in whose rohe (lands/ domain) we live in.

By listening to him I've gained insights that I wouldn't have learnt by reading academic texts. Such understanding doesn't come quickly, for when he then said that each Matariki star has "a domain and a function" and are "doorways to information", as they too are part of the "cosmic geography in the sky", my initial reactions were both literal and task orientated: What were the functions of each star? Do they have particular colours or shapes? I was thinking about lighting displays and quite unaware of my own representational predispositions towards Western science, or social constructivist framings of reality (Barad, 2007, p. 48). It wasn't apparent to me at the time, but he chose to share some aspects of his mātauranga, beyond that already embedded into the project's kaupapa. The difference between mātauranga Māori and kaupapa Māori is perhaps best described by Mason Durie:

> Kaupapa Māori is an *approach* to learning, teaching, healing, researching, parenting, and caring. Mātauranga Māori as an always-evolving, underlying *body of knowledge* that can guide practice and understanding.
>
> Durie, 2017, p. 4

When Tame talked of each Matariki star as being a doorway or a portal to different aspects of the universe, it was only later that I comprehended that what he was talking about aligned with my theoretical understanding of what Karen Barad (2007) calls intra-activity. Inherent to both conversations is the idea that the universe is interconnected, and slowly I came to realise, over time, that what I was reading about seemed to resonate with Tame's kōrero. This challenged my presumption that I was working on

something ‘new’ and when I asked him if particular IoT sensors could stand in for each Matariki star, he merely nodded and said that it would be fine. My next assumption that this research would “align Mātauranga Māori with Western science” (MBIE funding application, May 2017) served only to reveal my own ignorance of mātauranga Māori:

> Often, Māori knowledge is seen as ancient, trapped in a time warp, static, and scarcely relevant to modern times. But like other bodies of knowledge such as science, mātauranga Māori is an evolving knowledge base.
>
> Durie, 2017, p. 4

Whilst aligning four different environmental sensor types for each Matariki star might be considered artificial, it has nonetheless proven to be an efficient strategy to help staff and students from IT and engineering to engage with the wider goals of the kaupapa. To put that another way, pitching mātauranga in this manner has helped to embed Wintec’s Māori capability framework into students ‘real-world’ learning about data, IoT networks, solar harvesting, prototyping, materials and manufacturing, and collaborative learning, all through the gateway concept of Matariki.

If, during that conversation with Tame on 1st February 2017, he declined to answer my questions in a manner that I was expecting, then like many of our conversations to follow it was because he chose to reply by recounting a story. And like many of his stories, its hidden depths kept floating to the surface of my consciousness long afterwards. It is thus useful to preface this retelling with an alternative definition of what mātauranga Māori is:

> ‘Mātauranga Māori’ is a modern term for a body of knowledge that was brought to these islands by Polynesian ancestors of present-day Māori.
>
> Royal 2009, in Royal 2017, p.113

A few years ago, Tame had been part of a delegation accompanying the late Māori Queen Te Atairangikāhu, in Tahiti. Amongst other things, they had met with people at Taputapuatea to acknowledge that numerous waka “were at this location” as part of the migration journey from Hawaikii to Aotearoa-New Zealand. The delegation wasn’t claiming that Taputapuatea was the legendary homeland Hawaiki, but that waka had at some point during that journey had “left from there”. Tame’s interpretation of the word ‘Taputapuatea’ was that it refers to a “sacred elevated altar” where priests could view the celestial skies and perform the appropriate ceremonies needed before the long journeys ahead. When the priests “came down to New Zealand they had their knowledges”, but “not everybody had the knowledge”. The stars are not just important

for navigation, but have “a relativity for culture, certain people on the planet, well-being, security, care, and wholeness”. They all “work in sync with each other. Everything has a part in that cosmology” and like seedlings, “they all start small.”

When the waka were about to leave from Hawaikii, before undertaking the long journey across the oceans, the high priest had to ask permission from each domain. Each domain has its “password” and “the children of Tāne (people) needed to seek a path from Tangaroa (atua of the ocean) across his domain”. It's not possible to “make a shortcut”, instead “you have to go through the high priest.” It's like when you “gain access to a domain on your computer” Tame said, it “doesn't give you rights to the next stage.” The stars then, are “children to form part of cosmology to make everything gel. Stars are part of a family, they were put there for a reason - to make cosmology whole.”

As I was thinking about all of this, he started to tell me another story. My summary attempts to use his way of talking, but doesn't do his storytelling skills justice:

> The children of Ranginui and Papatuānuku used to exist in darkness. Once, when Ranginui moved in his embrace with Papatuānuku, one of the children said he saw a glimpse of the outside world of light. All the children had different views, some were for and some were against trying to split their parents apart. Some tried to find a way - pushing up with their hands, but try as hard as they might, they could not. Eventually Tāne had a go and lay down on his back and pushed up with his legs. Where everyone else had failed, this alternative strategy worked. As light hit the living space, all the things in the world started to grow. Distraught at what the children had done, Ranginui’s tears fell back to Papatuānuku in the form of mist and rain. This prompted some of the children to stay with Mum, and some to stay with Dad. Tāwhirimatrea (atua of the winds) decided to stay with Dad.

Personal communication, Tame Pokaia, 1st February 2017 (see also, appendix A)

At this point Tame said “we are part of them, they are not part of us. Humans are the juniors, they are the seniors.” I was starting to realise by this time that his stories have multiple layers. “It's like wheels within wheels” I said. “It's a house within a house” he replied. Towards the end of this conversation he summed up what he'd been talking about: “First there is darkness, then we get separation stories, then light gives us water and growth, with the insects and animals born before humans.” The “demigods” (atua) of each domain, each have their own “rules” and are responsible for particular types of knowledge and resources.

On reflection, there are multiple ways by which these two stories have relevance to the journey of making *Tōia Mai.* The construction of a waka is no small task, and requires many aspects to align. It is not just the manufacture of an object but a journey over an ocean of unknowns. It is not for me to call Tame a 'high priest', but without his guidance, advocacy, or actions, the journey would've foundered very early on. More importantly however, is the growing realisation of the enormity of knowledge that is situated under the label 'mātauranga'. Those Polynesian navigators crossed the largest ocean on the planet multiple times using the stars, their knowledge of the weather, and the way wave patterns form around islands. (Personal communication, Tame Pokaia, 2017).

This conversation and those like it, was to have significant consequences for my creative practice-led research, informed at the time by key framings from cybernetics, interactive art, and quantum physics. (Weiner 2011, Salter 2010, Stern 2013, Barad 2007, et al.) Considering humans as being 'junior' appeared to align with my burgeoning theoretical knowledge that critiqued Cartesian-informed Western science, and it's positioning of human subjects being separate and distinct from an external 'objective' reality. I was also starting to wonder if learning more about mātauranga Māori where everything works "in sync with each other", might start to inform my Western metaphysical assumptions about recent 'departures' from Kantian noumenal and phenomenal distinctions. It would take me some time however to be able to reconcile my task orientated aspirations, with these philosophical implications.

In his book *Interactive art and embodiment: The implicit body as performance*, Nathaniel Stern asks, "How do construction and constitution interrelate?" (2013, p. 14) Considering this question at that time, it seemed quite reasonable to incorporate the separation of Ranginui and Papatuānuku into the waka design. If this seems somewhat literal now, my methodology then sought to engage with experimentation as improvisation in a relational and performative manner. (Douglas & Gulari, 2015) Considering each Matariki star as having "a domain and a function" also appeared to align with the use of an IoT environmental sensor network as a means to explore Stern's concept of embodiment as "incipient activity" (Stern, 2013, p. 2). How then, might the design of the waka, stage and frame particular types of activity whilst also referring to Ranginui and Papatuānuku? The answer seemed obvious: Darkness - it would slow people down, cause them to act cautiously, and by having soft and glimmering light refer to the act of separation. A month later the altered design included a cave-like entrance way, which in complete darkness would not reveal that it was less than 800mm deep.

What was not obvious then, is that there is an inherent tension between wanting to explore phenomena as mutually co-constituted and continuously unfolding “entangled agencies” (Barad, 2007, p. 33), and making distinctions between ‘humans’ and ‘nonhumans’. If I had been trying to escape Cartesian informed binaries, then I was actually inadvertently recreating them. The intention to combine each star’s environmental data with people’s movements was meant to reframe nonhuman and human activity as embodied relation, where a body is defined as being:

> a dynamic form, full of potential. It is not ‘a body’ as a thing, but embodiment as incipient activity. Embodiment is a continuously emergent and active relation.
>
> (Stern, 2013, p. 2) [italics in original].

Yet by making these very distinctions between nonhuman and human is to normatively constitute humans, achieved by ‘Othering’ nonhumans and designating them to an external reality. Realising this was to prove a good lesson in reminding myself of my own Pākehā cultural bias, for it's one thing to intellectually think that not “only does Western philosophy picture itself as attached to truth in a privileged way but also sees itself as autonomous from culture” but quite another to realise that I too thought myself free of “cultural embodiment, preferences, and attachments” (Peters, 2017). Similarly, if I had previously thought that my creative arts research would somehow enable “individual and personal transformation” (Anderson & Braud, 2011, p. xvi) through being experientially grounded and informed by its participatory, relational, performative, and co-created goals, then I had not considered the humanist foundation that privileges human individuals as being separate and distinct from both each other, and nonhumans.

Stern’s thinking about interactive art that stages “an implicit body, not in performance, but as performance” (Stern, 2013, p. 13) partly draws on Nicholas Bourriard’s ideas about relational aesthetics (2005). This approach positions artworks as operating beyond “aesthetic consumption” in order to “invite investigations, along with better understandings and perhaps practices, of society, and how we operate with/ in it.” (Stern, 2013, p. 79) Building on relational aesthetics, Stern conceives ‘bodies’ as having relational agency - interactive art amplifies the potentiality of what a body is through “affect, proprioception, and sensibility [whilst remaining] sensitive to the historical languages used for understanding art, materiality, and visuality, while taking account of embodiment and matter’s emergence from and with their relations”. (Stern, 2013, p. 89) As a precursor to emergence, Stern’s relational agency is informed by Brian Massumi (2011), in an almost Heideggerian manner:

> All of matter, sensible concepts, and their bodies, flesh or otherwise, have relational agency in their coming-into-their-own 'out of prior moreness of the world's general always-going-on'.
>
> Massumi, in Stern, 2013, p. 89

For Stern, 'being' is always 'being-with' – so that understanding interactive art is always viewed as intrinsically being a human activity. What he does not ask is what happens when, for instance, data has relational agency with other data, or with other parts of the world's agentic capacities?

An early example of how Stern's theoretical position helped to inform *Tōia Mai*, can be demonstrated through considering the triangular niho taniwha lighting design. The initial idea aimed to explore relational agency through combining live environmental data with human movements. As both the research and the practical project developed, I decided to use thermal imaging sensors for this movement detection in order to relate to heat emitting creatures in general, rather than humans exclusively. The embodied relations that become possible with *Tōia Mai* do not therefore need to have any humans involved at all. Prior to this my thinking had been informed by Weiner's theory of cybernetics (2011), which conceives of humans and machines as being one entity through a closed loop system. As such, I had also considered using screens, spatialised sound, movable walls, and other mechanical actuations in order to create feedback loops within a continuously modifiable environment.

These early explorations into embodiment and relational agency were hampered by lacking self-awareness about my own Cartesian predispositions, not the least of which included having an unconscious tendency to make distinctions between passive objects and knowing (human) subjects. I had somehow thought myself to be 'more educated' than this, completely unaware of my cultural tendency to habitually regard technology as an extension of the body, informed by my rational mind. To put that another way, technology as tool-use considers the mind's extension into the exteriority of the world as enabled through body movements. Writing or drawing for instance, have typically been considered as actions that originate from a rational mind which articulates reason through using pens, brushes, or keyboards as extensions of the hands. A better understanding of embodiment is to consider how materiality in its continual and relational process of becoming informs what a 'body' is. Following Barad's intra-active call that "we are part of the nature we seek to understand" (Barad, 2007, p. 26), it is perhaps more useful to conceive of embodiment as a dynamic 'in-tension' of actants rather than an extension of human will. Relational agency is not the exclusive privilege of humans, but exists at a more fundamental material level. This

requires a renegotiation with what ‘knowledge’ is, as not inherently being about reason or rationality, but through being both materially performative and continuously co-constitutive, within phenomena. Understanding the conditions for knowledge is not predicated by human sense making of the world as interiorised ideation, but through the:

> differential responsiveness and accountability as part of a network of performances. Knowing is not a bounded or closed practice but an ongoing performance of the world.
>
> Barad, 2007, p. 149

This performative understanding of knowledge apprehends meaning by what is excluded as much as what is included, in the ongoing formation of phenomena. The discursivity of materiality in its coming to be forms the determinate co-conditions of ongoing actualisation, as:

> discursive practices are specific material (re)configurings of the world through which the determination of boundaries, properties, and meanings is differentially enacted.
>
> Barad, 2007, p. 148

Applying this knowledge to my initially very basic understanding of the seven stars of Matariki, yielded surprisingly useful results. Whether or not Matariki are the “eyes of God” (Matamua, 2017, p. 20), or a mother and her six daughters (Pokaia, 2018), their attributes are similar: The Matariki star relates to human aspirations for the future and contemplation of those that have passed before; Ururangi relates to the wind and atmospheric phenomena; Waitī refers to freshwater and its kai; Waitā relates to saltwater and its kai; Waipuna-ā-rangi pertains to ‘water that pools in the sky’; Tupua-ā-rangi relates to the kai found in and around trees; finally, Tupua-ā-nuku pertains to kai that can be found under or close to the surface of the ground. In a literal rendering of these domains each could be considered as being separate and distinct, but with a little more contemplation it is easy to see relationships between each of these. Four of the stars relate to kai, with obvious relevance for human survival. Ururangi and Waipuna-ā-rangi seem more ‘elemental’ in the Western sense – they are far less determinate, and affect the other four hugely. To consider how Ururangi in the guise of wind, air temperature, barometric pressure et cetera, might affect the sea, rivers, lakes, rain, trees, birds, and so on, is not difficult to imagine. Similarly, reflecting on how ‘water that pools in the sky’ (Waipuna-ā-rangi), in the form of rain, mist, and steam not only affects that which grows in freshwater, in the trees, or underground, but like wind evokes

psychological, emotional, spiritual responses by humans and nonhumans alike. Making this alignment between quantitative data and mātauranga Māori, is of course, artificial, yet having gained consent from Tame Pokaia, this became a vehicle for people across both the arts and sciences to begin to understand how they might be part of an interconnected environment.

At present *Tōia Mai* has a lighting design where only one of each star 'mode' is activated at a time, with each star being informed by four dedicated environmental data sets as described above. It is envisaged that this will change in the future, as considering one star as a portal to that part of the environment in isolation doesn't align with what Matariki encapsulates. *Tōia Mai* is therefore open-ended and as new students contribute their IT, engineering and story-telling knowledge, will continuously evolve.

Originally partly informed by Delanda's insistence that all assemblages "populate the same ontological plane" (Delanda, 2016, p. 13), the different scaled data values were 'ontologically flattened' with each number turned into a percentile to inform the sound and lighting values. For example, Tupua-ā-nuku displays earthy browns and deep reds to relate to the earth, but different patterns, luminance, saturation, and a host of other modifiers are updated by current seismic activity and nearby vibrations. Similarly, one of four different taonga pūoro soundtracks play for each activated star, and one of four tracks when the transition zone is activated. Embodiment is explored in a live relational manner not just in relation to humans and animals that emit heat, but with the constantly updated environmental data sets interrelating with each other. In an era of climate change the recorded values for new highs and new lows will change over time, or alternatively be modified by localised planting regimes, pest management, water quality interventions, air quality control, and other aspects of the environment in 'real' time. The unknown that exists within this emerging phenomena is an integral aspect of *Tōia Mai* - by constantly drawing on a decision-making process informed by the weather, river, seasons and other emergent tendencies of the environment, the sound and lighting interactions are never predictable, never constrained to being within a set of forecastable possibilities, not so much of an 'if this then that' interaction, but more 'organic', and continuously relationally emerging.

Acknowledging how the unknown is part of the universe, runs counter to the Enlightenment ideal that through knowledge 'we' are able to exert mastery over the physical and tangible. As argued elsewhere in this research, the recent 'speculative' turn is characterised by theorists claiming to escape human finitude through typically mathematical or scientific strategies, each with a fundamental assumption that *the universe is fundamentally knowable by humans alone, and that such knowledge is*

desirable. There seems to be little or no acknowledgement that humancentric worldviews are culturally informed, and that elsewhere other types of metaphysical enquiry exist. If, as both Karen Barad and Tame Pokaia say in different ways, humans are but one part of the universe we seek to understand, then why should there not be aspects of it that are fundamentally unknowable? Furthermore, why should humans have an exclusive claim as to what constitutes knowledge, how it is produced, or where it comes from?

Within the Western tradition, the notion that rationality will reveal the secrets of the universe is informed by a narrow historical trajectory where ancient Greece is positioned as the birthplace of civilisation. Here, Eurocentric claims about written literacy, democracy and criticality, start with the ancient Greek philosophers. Plato's ideal forms therefore underpin the early Christian church's assertion that a true reality lies elsewhere in the form of heaven. Descartes built upon this tradition by asserting that not only it is humans alone who are able to think, but it is necessary to do so in order to determine truth from a world of appearances. The famous subject-object distance is primarily a claim that positions knowledge derived from rationality as being superior to the sensory perception of nature. This is taken to be the basic fundament upon which truth can be derived:

> In dominant Western thought – from Plato onwards and radicalised by Descartes – it is the intellect that can find solid ground. Any ground of credible thought is rationally obtainable; indeed, the Latin *ratio* carries both 'ground' and 'reason' with it (Mugerauer, 2008). In that belief system, 'ground' is directly relatable to the Greek *episteme*, which the term 'epistemology' comes from and which can be broken down to mean 'to stand or something on which to stand, certainty, and knowledge'(Connaway, & Powell, 2010, p. 33). Various Western philosophers have stressed the necessity of the fully attainable ground (that is, a clear theoretical basis) by insisting that one apply a rational framework […] and we see its continuation through to current times.
>
> Mika, 2017, p. 121

As an improvised experiment emerging from a developing understanding of nonhuman embodiment, particularly one informed by kaupapa and mātauranga Māori, it seemed appropriate to consider a Māori metaphysical ground from which to start. For a researcher such as myself this is somewhat fraught by virtue of being Pākehā, so my embodied knowledge can only seek to be co-extensive rather than definitive. Having had so much difficulty in understanding the foundational tenets of what

‘whanaungatanga’ was at the start of 2017, it seemed appropriate to reconsider what ‘whakapapa’ meant, as the two terms are often discussed in relation to each other. The English translation of whakapapa to mean ‘genealogy’ glosses over its subtler meanings - comprising of ‘whaka’ which means ‘to become’ and ‘papa’, which refers to Papatuānuku (Earth Mother), it refers to a performative understanding of active relations, where:

> despite the disclosure of a cognitive foundation, the full and exhaustive ground is never grasped in its totality. Hence, a thing in the world is approachable as an entity but resists being fully comprehended. This revelation of the thing is brought about through the intricate - and itself also inconceivable - arrangement of Papatuānuku and all those other entities that are not immediately discernible in that phenomenon.

Mika & Southey, in Mika, 2017, p. 69

Similarly, translating Papatuānuku as ‘Earth Mother’ is equally problematic, for it simultaneously mythologises and renders static the lively agency embodied in its meaning:

> Since the universe is dynamic and the earth is not simply Papa (rock foundation) but Papa-tua-nuku (rock foundation beyond expanse, the infinite), the universe itself is a process or event within the cosmic process by which Io orders creation.

Marsden, 2003, p. 22

To some of my colleagues the above statements are foundational, self-evident, almost not worth mentioning, and yet it shakes my Western-informed sense of being. Revisiting Tame Pokaia’s version of the well-known Ranginui and Papatuānuku creation story in a dynamic rather than static manner, now means considering it not as a cosmological history lesson, but as an episode within a cosmogony that details the ongoing process of becoming. Its metaphysical ‘ground’ is contemporaneous with the infinite potentialities of a continuously changing now:

> Time is a continuous stream. The temporal is subordinated under the cosmic process and denotes not time but sequences in processes and events which occur in the cosmic process.

Marsden, 2003, p. 22

This runs counter to a traditional Western metaphysics that positions time as occurring in a determinate or chronological manner, but it is also in alignment with Barad’s

agential realism, as informed by quantum physics. Without in any way claiming correspondence, it may nonetheless be useful to identify potential parallels of these two differently originating ontological assertions:

> Thought (whakaaro) in Māori metaphysics is immediately connected to this idea that one is both formed and constructive. Whakaaro (whaka aro) is a double-sided invitation, where the self speculates on how the world has invited him or her to participate in its disclosure, with the self's fragility before the thing being crucial in that thought. Thinking from worldedess is constituted by an act of acknowledgement, in particular towards the fact that something comes about (whaka) into one's regard (aro aro). Whaka is connected with the possibility that time (wa) is non-linear because the self has always already been established by a thing: the full amplitude of any one thing, apparently manifesting for one's regard, always continuously revealed itself to the thinking individual.
>
> Mika, 2017, p. 72

> The existence of the quantum discontinuity means that the past is never left behind, never finished once and for all, and the future is not what will come to be in an unfolding of the present moment; rather the past and the future are enfolded participants in matter's iterative becoming. Becoming is not an unfolding in time, but the inexhaustible and dynamism of the enfolding of mattering.
>
> According to agential realism, causality is neither a matter of strict determinism nor one of free will. Intra-actions always entail particular exclusions, and exclusions foreclose the possibility of determinism, providing the conditions of an open future.
>
> Barad, 2007, p. 234

In both instances, time as a dynamic, unfolding, unfixed relation, is accentuated. Reality is never completely grasped as there is always an aspect of the unknown at play. This point is accentuated by Barad's notion of agential realism, where:

> the dynamic intra-play of indeterminacy and determinacy reconfigures the possibilities and impossibilities of the world's becoming such that indeterminacies, contingencies, and ambiguities coexist with causality.
>
> Barad, 2007, p. 225

It is perhaps useful to note what is meant by the ‘quantum discontinuity’ that Barad often refers to, as it provides a means by which to consider how the unknown relates to time and space – not in a chronological continuous fashion, but in a discontinuous manner. The discontinuity in question relates to the so-called ‘quantum leaps’ that occur within an atom, when electrons move from the stability of one specific energy level to the next:

> Quantum leaps aren’t jumps (large or small) through space and time. An electron that “leaps” from one orbital to another does not travel along some continuous trajectory from here-now to there-then. Indeed, at no time does the electron occupy any spatial point in between the two orbitals. But this is not what makes this event really queer. What makes a quantum leap unlike any other is that there is no determinate answer to the question of where and when they happen. The point is that it is the intra-play of continuity and discontinuity, in determinacy and indeterminacy, possibility and impossibility that constitutes the differential spacetimematterings of the world.
>
> Barad, 2007, p. 182

Potentiality must therefore be considered in relation to these stable orbitals, as well as within all the non-places in between. One relationship between potentiality and materiality is now explicit – for *where and when electrons manifest* is indeterminate and cannot be accounted for through ‘ordinary’ causality.

Considering possible parallels between understanding time and space as being performatively co-constituted with, but not intrinsically determined by humans, could provide further opportunities for metaphysical speculations between mātauranga Māori and quantum physics. Such research however is beyond the scope of this work, but may prove rewarding in the future. Additional possibilities also emerge from taking these potential parallels and applying them to digitality, particularly with regards to embodiment explored in conjunction to stateless computing, a topic that is discussed in the *Pull* chapter and in the conclusion.

There is nonetheless something intrinsically mysterious about the unknown, where a sense of wonder and surprise happens when otherwise unforeseen events or possibilities emerge. Part of practice-led artistic research is about taking risks, leaping the ‘abyss’, uncertain as to where one will land. The funding for *Tōia Mai* did not come all at once, and many times throughout the journey I had to make commitments without knowing if I could either pay for them or provide the requisite resources. At other times,

particularly when all else seemed lost, some otherwise unknown possibility would reveal itself through some chance connection or otherwise seemingly random event.

The unknown also has context within the tertiary education setting for the partnership with Wintec Māori achievement. As the kaupapa relates to embedding the Wintec Māori capability framework into 'real-world learning', one goal relates to fostering ako within the learning environment:

> Ako is a dynamic form of learning where the educator and the student learn from each other in an interactive way. Ako is grounded in the principle of reciprocity and recognises that the student and whānau cannot be separated.
>
> Ministry of Education, n.d.

This definition is, in its own way, a Pākehā rendition of what ako means, arising as it does from New Zealand's Ministry of Education as part of its strategy to better engage with Māori learners. Yet it does not comprehensively cover all that ako relates to, as:

> the backdrop to this human activity are certain Māori concepts such as *whakapapa* (genealogy), *wairua* (spirit) and *manaakitanga* (hospitality). One's connection to another person, witnessed through the display of these terms, can vary the degree to which one can learn or teach: the role of self-esteem in the relationship between learner and teacher and hence to knowledge, the openness of the classroom as a whole to the dissemination of knowledge and thinking, and the point at which one is related to the Other – teacher or learner – are all hugely important in the educational process for Māori.
>
> Mika, 2017, p. 60

As a Pākehā attempting to engage with ako as a lived embodied experience, this was a steep learning curve. It runs counter to how I myself had been taught, and had learnt how to teach within a tertiary context where the 'sage on the stage' maintained 'professional distance' from students. Yet by acknowledging these interconnections to my deeper, more authentic self, I was to discover that not only could I be more relaxed and open to the needs of students, they became more relaxed with me and more likely to engage with what I was talking about. The unknown in this sense refers to this surprising potential that always existed somewhere within my previous 10 years of teaching experience, before it finally emerged. I was also later to learn that ako has within it, an implied relationship to a hidden, mysterious, potential:

> Ako is concerned with these mystical propositions about the concrete phenomenon, including the self. That Ako is mystically oriented yet concrete suggests that another word is needed to describe the nature of an object or idea through Maori philosophy, however. *Mystery* and its various permutations could be workable. In the Maori language, one term that equates with the sense of mystery is *huna*, which simply means 'hidden'. Here, we can think of 'mystery' in its conventional way – engaging with an astonishment at the unknowable.
>
> Mika 2017, p. 64

Ako is thus a process of constant revitalisation in terms of teaching and learning. This became apparent after reflecting on another conversation with Tame on the 21st of February 2017. I was visiting Te Kōpū Mānia o Kirikiroa on other business, and he called me over to chat. I thought he was just being polite when he asked me about how the "Matariki Waka" project was going. I should have paid more attention when he said that whakapapa is "the DNA" of Matariki. It was his story that got me interested, about how "the story of Hani and Puna" relates to Te-Paki-o-Matariki. He started off by saying that when the King [Tāwhiao] initially requested his Tōhunga for a coat of arms, they refused saying that it was not good to share these knowledges with everyone. When he asked again later, they came up with the current heraldry in order to codify some of the concepts as described below. This summary comes from my notes, written just after our meeting:

When the Creator created the male and female elements Hani and Puna, he let them go into a cosmos without sound or light, and without knowledge of each other - all they knew is that they were seeking something. Eventually, after millennia, through all their wanderings they sensed - through that inner sense - or rather, Puna sensed, that behind a planet was the other. She summoned a wave of energy that broke the planet into smithereens, the reverberations of which created the first sound, which, like a gong or bell, rang out creation in those moments of touching each other.

Tame saw this is being like in a movie - a superhero casting her powers in some almighty wave, not in a staunch way, but as a mighty woman throwing her hand forward and the energy emanating from her open palm to blow the planet to pieces. At this point he said "and sound, needs a medium." I remarked that I was reminded of resonances, to which he said, "yes, it's not directly linked, but linked." (Personal communication, Tame Pokaia, 21st February 2017, see appendix A).

This story informed *Tōia Mai* in three distinct ways. In terms of the sound design, I had been wanting to have taonga pūoro (traditional Maori instrumentation) since its earliest

inception, having previously worked with the practitioner Rob Thorne on an experimental interactive dance work called {*presence*} (2016). Tame's retelling of this story confirmed the appropriateness of including it, but at the same time gave me cause to deliberate. Taonga pūoro can make the hairs on the back of one's neck stand up. Who would be the right person? The ideal candidate would be somebody local, preferably with student involvement. What would the relationship be between each Matariki star and the sounds associated with them? How would this process unfold and who would be responsible to ensure that everything was tika? (correct). This was at the beginning of another long journey and it was to take two false starts before the right people were found. Just as it was starting to seem impossible, the famous musician Horomona Horo, my colleague Dr Jeremy Mayall and a music student called Norefjell Davis all became available. Horomona led the team and having first met with Tame, they together proceeded to compose four soundtracks for each of the stars and another four for the intermediary transition zone.

Less obvious, but immensely important in informing my early understanding of how interconnectivity could work between the Matariki stars and the river environment, was sound's relationship with waves. Having fathomed superpositions through observing water ripples, I realised that superpositions and diffraction are as true for sound as they are for water. For some this is obvious, but like many others whose practice has emerged from the visual arts this was not immediately apparent. Reflecting on quantum mechanics provided a further insight - "under certain circumstances matter (generally thought of as being made of particles) is found to produce a diffraction pattern!" (Barad, 2007, p. 82) In other words 'everything' can have wave behaviour - sound, water, light, heat, as well as more 'solid' materials like metal, human bodies, and concrete. This understanding helped to inform the realisation that the difference between the Matariki stars and the river environment, was, mainly of my own making. The story of Hani and Puna became the beginning of starting to understand how being in 'the' environment is inseparable to being part of it.

Much later on I was to discover in that the "opposite but complementary elements" (Flintoff, 2003, p. 12), of Hani and Puna precede Ranginui and Papatuānuku, and according to the great Waikato-Tainui scholar Pei Te Hurinui Jones, are the inception of mauri (life-energy) on Earth:

> It was in this way that the life principle, Mauri-ora, was implanted on this earth, by means of which the male and the female are nurtured, obtain life giving blood, and so take form and flourish. [...] Indeed, all living things were thus nurtured on the earth and have their being. The means

> of sustenance for the tangata (mankind), who came into the world later, were thus provided for by Hani and Puna.
>
> Jones, 2013, p. 68

Mauri, and its potential synergy to vitalism and new materialism is discussed elsewhere in this research, but in the early part of 2017 this possibility had yet to emerge.

Finally, there is also a mysterious, hidden, aspect to this story. Hani and Puna yearn for 'something', without knowing what it might be. They wander "for millennia", so long perhaps, that time itself loses meaning. Knowledge comes to them through some "inner sense", it reveals itself, and all the potentiality that lay latent within them was suddenly made manifest. If one considers this story not as a cosmological account but as cosmogony, then what else might, when the conditions are right, come into being?

To summarise, how things are done are as important as what is done, so that an inseparable aspect of *Tōia Mai* is its kaupapa that brings about transformative change. As a practitioner attempting to work at the intercultural hyphen this requires understanding that Māori ways of being and doing are the default, whilst simultaneously balancing the different cultural expectations that exist both institutionally and as part of the wider world. I am not exempt from Western cultural presuppositions and many times found myself inadvertently recreating the Cartesian framework whilst attempting to escape it. As *Tōia Mai* is fundamentally a collective enterprise, attempting to work between cultures means that it cannot be assumed that all knowledge is knowable. The unknown cannot be regarded simply as absence, but is part of the nature of being where nonhumans have agentic capacity whereby human participants are invited into their disclosure. (Mika, 2017)

Understanding the unknown as a performative actant in the field of relations, has consequences for understanding how potentiality relates to understanding reality as co-constituted unfolding phenomena. Perhaps the Kantian positioning of potentiality as being without substance in the immanence of materiality, can be relinquished. Following Barad (2007), the quantum discontinuity could redefine potentiality in relation to indeterminacy, and this in turn would enable an understanding of how potentiality could relationally emerge in a non-linear manner. This has consequences for contemporary understandings of virtuality, as well as how time and space unfold within phenomena. That these understandings appear to be, if not foreseen, then foreshadowed by a Māori metaphysical framework, requires more research.

These speculations have important consequences for understanding what objectivity is, how time as understood, how materiality and consciousness interrelate, and how

particular trends might emerge out of seemingly disparity elements. In summary, it requires a complete revision of Western presuppositions about how the universe operates.

Pull

On 20th September 2017, Tame called me over to one side and told me that he had decided on the name for the Waka sculpture – *Tōia* – which means ‘pull’ or ‘drag’. At the time I was intellectually pleased, but emotionally somewhat disappointed. *Tōia* aligned with my studies into performativity, for as a verb it describes an action, and yet I was somehow hoping for something grander. Tame had referenced the pull of the river, but it felt as if this did not fully acknowledge the collaboration of the many people who had contributed along the way. The next day I met with Hera for coffee, and we talked about how the name was right but ‘felt incomplete’. She related it to the waiata (song/chant) composed by Piri Poutapu, who built several waka for the 1940 centennial of the signing of the Treaty of Waitangi. The abridged lyrics are:

Tōia Mai

Tōia mai te waka nei	Haul this canoe
Kūmea mai te waka nei	Drag this canoe up here
Ki te takotoranga I takoto aito	its resting place
Tiriti te mana motuhake	The Treaty gives us our autonomy.
Te tangi a te manu e	May the cry of the bird,
Pīpī-wha-rai-roa	the shining cuckoo
Kūi! Kūi! Kūi!	Quee! Quee! Quee!
Whitiwhiti ora!	Signal a change for the better.
Hui e, tāike e.	Draw together, become intertwined!

Tōia Mai: a sculpture for the people by the people, Wintec, 2018

The reference to hauling or dragging the canoe (waka) relates to the waka that represented the seven main iwi (tribes) that had come to Aotearoa (New Zealand) from Hawaikī (legendary island origin). *Tōia Mai* therefore relates to people as a group, working together. Piri Poutapu had also been a student who had worked on the waka *Te Winika* when it had originally been pulled out of mud in 1936, and the lead carver for its 1972 restoration. (Retrieved from: http://waikatomuseum.co.nz/exhibitions-and-

events/view/256). When Hera mentioned this I could only nod, for what she was referring to - including its references to the Treaty of Waitangi - were well beyond what I would ever dream of raising with Tame. A few days later however, she told me that Tame had agreed that the waka sculpture could be called *Tōia Mai.* To say that I was 'blown away' upon hearing this, would be an understatement. What had started as an idea after Tame's suggestion that I visit *Te Winika* at the Waikato Museum, was now truly emerging as its own thing. If I had wanted something slightly grander, I hadn't anticipated this.

As a name, *Tōia Mai* acknowledges the agency of people, but I felt then that it still de-emphasised the other agencies inherent in its creation, as there is a tendency to "understate the degree to which people, animals, artefacts, technologies, and elemental forces share powers and operate in dissonant conjunction with each other." (Bennett, 2010, p. 34). What then, of the material agencies at play? If there is any substance that is so emblematic of dull inert matter, it is metal. Having written a research proposal dense with references to Barad's agential realism and Stern's relational emergence, I was about to discover that it is one thing to think about these ideas intellectually, but quite another to experience them as lived embodied relation. Metal, in Western culture at least, is associated "with passivity or a dead thingness" (Bennett, 2010, p. 55). I remember the day when I first started to think otherwise - Longveld's Waka project lead Jemoal Lassey had taken me round the back of one of the buildings and pointed to a pallet that had a collection of strange 'V' shapes: it had taken me a few moments before realising that these were the parts for a yet to be assembled internal frame or 'skeleton' of the sculpture. "I made sure that we used good pieces" he said. I was nonplussed, as I gazed down at the grey metal. They looked heavy. I tried to pick one up, it *was* heavy. Jemoal grinned "that's 25 mm stainless steel" he said. "25 mm?" He bent down and pushed his finger at a hole where the waterjet process hadn't quite made a clean cut. The small circle snapped out easily. "Yep. Look, you can still see the grain." The grain? Metal has a grain? I was astounded and asked him about it. "Sure. You don't normally see it on stainless after it's been polished" he said. I still have that small round piece of metal, with its tiny entrance hole marring its otherwise perfect roundness. Metal has a grain, because, as I was to discover, metal has a polycrystalline structure:

> The crystal grains of, say, iron, come in a large variety of sizes and shapes, depending on "the space – filling pressures of their neighbours". Though the atoms within each individual grain are "arranged in regular array on a space lattice," there are also "*imperfections* in the array," most notably the presence of loose atoms at the "interfaces" of grains.

> These atoms "belong" to none of the grains, and they render the boundaries of each grain porous and quivering: a grain of iron is *not* "some kind of an enveloped entity," as is "a grain of wheat." This means that the crystalline structure of metal is full of holes or "intercrystalline spaces." These "vacancies" can be "as important as the atom" in determining properties of a particular metal.
>
> Smith, in Bennett, 2010, p. 59

Far from being something homogenised and inert, the irregularities of metal's crystalline structure prompted a re-assessment: metal grain has more of an organic quality than first suspected. The presence of loose atoms and intercrystalline spaces challenges common Western preconceptions of metal's supposedly 'leaden' nature. Considering this idea of atoms 'quivering', Deleuze (1997) introduces the concept of 'A-life', which is:

> As the indefinite article suggests, this is an indeterminate vitality, a "pure a- subjective current." A life is visible only fleetingly, for it is "a pure event freed… from the subjectivity and objectivity of what happens." A life inhabits that uncanny nontime existing between the various moments of biographical and morphological time.
>
> Bennett, 2010, p. 53

A-life starts to bridge the binary between organic and inorganic as it draws attention to the energy of atoms, not life as a living, breathing, sensibility – but as energy, simultaneously constrained and enabled through the phenomena in which it is situated. To think of atoms as vibrantly throbbing overthrew a plethora of historically boredom inducing school classes, with those incomprehensible diagrams of balls and sticks. Why had those moribund images never used the conventions of animation or speed to convey that atoms might be vibrating with a constrained energy? For all my deconstruction of Cartesianism and its influence on visual culture, particularly representation, I had never considered its capacity to instantiate the general background of what I considered to be true about the world, or as Barad succinctly puts it: "How *reality* is understood matters." (Barad, 2007, p. 205) [italics in original]. Perhaps it was because science is supposed to be 'serious', with a long history of attempting to remove emotion or any other 'subjectivity' in its pursuit of 'objective' truth. Years later, to conceive of stainless-steel atoms as being anything other than static and rigid felt somewhat counterintuitive. Even the word 'atom' is informed by Democritus' idea that "the properties of all things derived from the properties of the smallest unit – atoms (the "uncuttable" or "inseparable")." (Barad, 2007, p. 138). Atoms then, are

clearly not what they were originally conceived as being. Far from being the smallest, uncuttable particles of existence, not only are they comprised of multiple subatomic particles, but they can no longer be considered as comprising of:

> simple individual objects occupying specific positions in the vacuum we call space and time: not only is the very idea that they take up determinate positions in space not to be taken for granted, but part of their very nature seems to be wrapped up in the bubbling sea of possibilities that was to be but an inert backdrop for matter's passage.
>
> Barad, 2007, p. 354

A-life was a provocation and not just because of quivering atoms, but because they might occupy a state of nonbeing, which is to say that they can be described as having indeterminacy or potentiality:

> "matter–*movement*" or "matter–*energy*", a "matter in variation that enters assemblages and leaves them." A life is a vitality proper not to any individual but to "pure immanence," or that protean swarm that is not actual though it is real: "A life contains only virtuals". It is made of virtualities".
>
> Deleuze, in Bennett, 2010, p. 54 [italics in original]

But what is virtual, and what might look like in practice? It is popular to call the digital domain 'virtual', so it would not be unusual to consider the 3D CAD model of the waka as being likewise. If digitality is commonly conceived as being somehow without material form, then it should be remembered that it cannot exist without some tangible physicality – it requires electrons to flow through conductive metals, logic gates to operate through resistive gaps, and the multitudinous whole being kept in sync by a regulatory clock. Furthermore, as I was to discover for the installation of a computer and other equipment into the weatherproof stainless-steel cabinets of *Toia Mai,* where there is electricity, there is also heat. Yet what Deleuze is talking about, *is* material, when he says that the:

> virtual is not opposed to the real but to the actual… Indeed, the virtual must be defined as strictly a part of the real object – *as though the object had one part of itself in the virtual into which it is plunged as though into an objective dimension.*
>
> Deleuze 1994, in Delanda, 2016, p. 109

Whilst ‘objective’ is somewhat problematic with regards to a critique of Cartesian thought, the term ‘actual’ here refers to the underlying “spatio-temporal dynamisms” that are “actualizing, differentiating agencies” (Deleuze 1994, in Delanda, 2016, p. 137). Virtuality then, can be summarised as “real but not actual” (Delanda, 2016, p. 5) To consider the matter–energy of A-life as being comprised of virtualities does not divorce it from actualisation, but brings attention to the differentiating agencies which enable or limit potential actualisations. Barad for her part, is careful to distance herself from Deleuze when she says: “The real is not constituted by a collapse of the existing set of possibilities; it is not a singular selection among present alternative possibilities”. For her, Deleuze “trivialises the set of possible relationships between the real and the possible” (Barad, 2007, pp. 436- 437) It should be noted at this point that Barad’s project is a realism which seeks to uphold the notion of objectivity through acknowledging the role of the measuring apparatus:

> The crucial point is that the apparatus enacts an agential cut – a resolution of the ontological indeterminacy – *within* the phenomenon, and *agential separability – the agentially enacted material condition of exteriority-within-phenomena - provides the condition for the possibility of objectivity*.
>
> Barad, 2007, p. 175 [italics in original]

Barad’s criticism of Deleuze is predicated by her own terms of reference - acknowledging the apparatus as enacting an agential cut within phenomena is situated by her scientism that seeks replicability as the precondition of objectivity. Arguably, this is a tendency common to the realist position, but what separates Barad from other realists is her avoidance of reductionism. Agential realism’s causality is not static, and “poses an altogether different way of thinking about temporality, spatiality, and possibility” based on what is delimited or constrained by the mutual co-conditions as they continuously emerge. Whilst she avoids terms like ‘virtuality’, her agential realism is fundamentally about an ongoing possibility space through the “liveliness of intra-activity” (Barad, 2007, p. 177)

Considering the virtual from an agential realist perspective must acknowledge the presence of the measuring apparatus, which in computing, means the clock. Time, once again, becomes a contestable notion, particularly in relation to Einstein’s theory of relativity. Time:

> is relative to motion (not the reverse): “time,” by definition, is what is measured by an observer’s clock, and analogously, “space,” by definition, is what is measured by an observer’s ruler. And what an

> observer measures with a clock (ruler) differs for differently moving observers: time (space) is relative to the motion of an observer.
>
> Galison 2003, in Barad, 2007, p. 437n82

Within computing, one of the preconditions for virtuality is time, for the role of the clock is simply to synchronise operations; if the clock was asynchronous the possibility space for virtuality would also change.

Virtuality then, cannot simply be positioned within a non-tangible digitality, but neither can it be framed entirely by objectivity seeking replicability, when the material self-organisation of "the electricity of our neurons" (Bennett, 2010, p. 10) is considered in relation to consciousness - human or otherwise. Material realism is therefore somewhat problematic, not the least of which because it tends not to account for the human desire for predictability, nor define who or what might be the arbiter of 'objective measurements'.

To return briefly to the notion of A-life in relation to stainless-steel, it does not merely inform why metal can be, as Jemoal describes it, a 'good' or 'bad' piece in relation to its crystalline integrity, but enables an understanding of what Deleuze and Guttari refer to as *material vitality*. This brings attention to the energetic aspect of matter-energy, which is "not quite bodily and not quite spatial, because a body-in-space is only one of its possible modalities". Vitality in this sense refers to "the activity of intensities rather than of things with extension and space, the "pure productivity" of "virtual" matter or "matter energy"." (Bennett, 2010, pp. 55 – 56) What then, might be the difference between potentiality and indeterminacy? For Bennett indeterminacy refers to a situation where there is no causal relation but one of "emergent causality" (Bennett, 2010, p. 59) For Barad, following Bohr, "concepts do not have determinate meanings" so that phenomena like particles or waves are "definable and observable through their interactions with other systems" (Bohr, in Barad, 2007, p. 296) Indeterminacy then, is not 'anything goes', but relational and emergent with other phenomena. Neither author presents a clear definition of potentiality, and the word itself comes from Aristotle who distinguishes between "a thing's power to produce a change" and "its capacity to be in a different and more completed state" (Retrieved 16th of April 2019 from: https://plato.stanford.edu/entries/aristotle-metaphysics/#ActuPote). That Aristotle also positioned things as having 'essences' makes this definition somewhat problematic for the discussion at hand. At this point my definition can be informed by both Deleuzian virtuality, and Barad's Bohranian agential realism: Potentiality refers to the relative intensity of any given possibility within the possibility space, to relationally emerge with existing phenomena, including nonhuman and unknown agencies – in order to

manifest. Deleuze would probably make a claim that the virtual exists within a contingent relation to the actual, but at this stage I would like to differentiate between the potential and the virtual per se, in order to accommodate the unknown and to acknowledge Māori metaphysical frameworks not predicated by Western notions of materiality.

Exploring potentiality within *Tōia Mai* in this sense, reveals just such a relationship with the unforeseen. A typical description of the waka sculpture might read as: 'A permanent public artwork in the shape of a waka, built with a stainless-steel skeleton and clad in 3 mm weathering steel. It's interactive design engages with the seven stars of Matariki through LED lighting and taonga pūoro sound-tracks, as informed by the movements of participants combined with an internet of things environmental sensor network.'

This description however, is somewhat pointless in terms of describing what *Tōia Mai* actually is. The artwork was not simply produced from a list of parts, a definitive blueprint, and a list of instructions ready for assembly. Instead it emerged in an experimental, improvised, experiential, unpredictable, and sometimes downright lucky manner. It is not something one can go to the shop and buy 'off the rack', nor is it in any sense 'done', for its completeness continues to evolve over time. Neither does this describe the institutional, financial, cultural, industrial, socio-political, educational, and environmental influences that have shaped its production. What is needed is some other way of explaining how this assembly of parts, processes, influences and other agencies have stabilised somewhat from their potentialities and other unforeseen factors, in order to describe the 'object' as continually relationally emerging.

An example of these unforeseen factors at play can be demonstrated through two occurrences. The first happened midway through 2016, when I had been on my way to a café and had run into an old friend of a flatmate that I used to live with, some 10 years previously. She was giving out flyers for a gig on the corner, and we rather naturally got chatting about what we were doing. She suggested that I talk with her boyfriend who was working as a policy analyst at the Hamilton City Council, which a few days later I did. He was really interested and suggested that I make an application to the now-defunct Hamilton arts advisory panel. After I had been through that process he took more of an active role, and was immensely helpful in transitioning the then new waka idea, into a permanent artwork. It was he who nurtured the proposal to Council, and he who introduced me to Longveld. Without that unforeseen meeting with his girlfriend on the corner that day, it would have been much harder to have sold the idea to any of my Wintec colleagues, for I would not have met any of the council's deadlines which allow a permanent artwork to be built on a reserve.

The second occurrence was in the early part of 2017, at which time the sculpture existed only as a series of sketches and a cardboard model. The project had no money but had the support of Wintec Māori achievement, and few tutors and their students from engineering and media arts, as well as the goodwill of Longveld who at that stage had offered to mentor students. It needed cash, and fast. Unfortunately, the grants season was not until April – May, with the earliest possibility of receiving funds from successful applications typically being in June. The project looked as if it was going to stall before it had even begun. Somewhat randomly at around this time I'd visited the regional arts organisation Creative Waikato, to look at one of their exhibitions. Quite by accident I ran into their CEO Sarah Nathan, and started talking about the project. With the café being next door, we carried on talking over coffee as I showed her my sketches and the model - which happened to be in my bag that day. She liked the idea and suggested that we might like to have coffee with a friend of hers in the following week. This I duly did, whereupon that person invited me to have coffee with a friend of hers in the week after. At the end of that conversation I was asked by this third person how much I thought it was all going to cost? Somewhat naïvely, I replied "around $30,000". It had been the number I had written on my PhD proposal, it being the highest amount I had thought I could get away with an order to convince my supervisors that the research was achievable. "I think we can do that" she said. Inside two weeks the project went from having no money to $30,000, and all on the basis of having a few coffees with the 'right' people. That the final cost would come in at over 10 times that number was completely unknown then, but it was *the* factor that enabled the project to start, not the least of which because it allowed the purchase of the raw materials from Longveld.

Instead of the word 'factor', I borrow from Bruno Latour (1999) the term actant, which refers to "a source of action that can be either human or nonhuman; it is that which has efficacy, can *do* things, has sufficient coherence to make a difference, produce effects, alter the course of events." (Bennett, 2010, p. viii). Informed by Actor Network Theory (Latour, Law, & Callon, 2005), actants exist within networks that acknowledge how the "social, technical, cultural, and natural" inform phenomena. (Salter, 2010, p. xxviii) As such, actants have *agency* within networks of relations:

> In this network model, the agency of actants (rather than just human actors) is spread out among multiple associations (the network), connected to each other in a skein of relations and transforming each other through such relations.
>
> Latour, in Salter, 2010, p. xxviii

‘Actant’ is a useful term because it places the emphasis on action rather than notions of matter being static, inert, and atomistic. It enframes what it refers to within the context of relations, and is appropriate for research that aims to explore how art making practice can act as a boundary making apparatus in unfolding phenomena. That $30,000 was not just a means to purchase materials, it *did* something – the funds had arrived in time for the beginning of the academic year and so generated a huge amount of public interest, which in turn gained the attention of management and the support of the research office. For many of my teaching colleagues it also indicated that student involvement would be on a ‘real-world project’. Finally, it enabled a change in the conversation with Longveld as I was no longer just asking for sponsorship. When in May I visited them with one of my colleagues from Trades, they offered to become project partners and provide materials and waterjet cutting at cost. As an actant, that $30,000 went a long way - and yet the means of its arrival had been completely unforeseen, it was not something I had planned on, nor did it exist anywhere in official discourse as a means by which to gain funding.

In the above examples it was the idea that was attractive to people, therefore the idea itself, is also an actant. This seems to lie in parallel with Mika’s concept of worldedness, as already discussed in relation to his critique of the performativity of the word ‘whakaaro’ (Mika, 2017: 72). The agentic capacity of the ‘Matariki Interactive Waka Project’ – which was the working title of what was to become *Tōia Mai* – appealed to a wide range of people, for all sorts of different reasons.

One way to begin to understand this relationship between an assembly of parts and the unforeseen, might be found with the term *assemblage*, which Manuel Delanda (2016) develops from Deleuze and Parnet (2002). In this conception, an assemblage is:

> a multiplicity which is made up of many heterogenous terms and which establishes liaisons, relations between them, across ages, sexes and reigns – different natures. Thus, assemblage’s only unity is that of a co-functioning: it is a symbiosis, a ‘sympathy’. It is never filiations which are important, but alliances, alloys; these are not successions, lines of descent, but contagions, epidemics, the wind.
>
> Deleuze & Parnet, in Delanda, 2016, p. 1

This definition appeared to enable an understanding that actants have a wide range of origins and does not seem to require them to have pre-existing relationships based on epistemological categories, but instead emphasises relationships and co-constitution. It should help to inform relational emergence, as this definition seems to imply synergy between actants and the unforeseen, and perhaps an escape from the totality of their

parts to become something else entirely different. Manuel Delanda's *Assemblage Theory* (2016) therefore seemed promising, as it seeks to develop Deleuze's concept beyond its original articulation by ensuring that assemblages include both the human and the nonhuman:

> To properly apply the concept of assemblage to real cases we need to include, in addition to persons, the material and the artefacts that compose communities and organisations: the architecture of the buildings that housed them; the myriads different tools and machines used in offices, factories, and kitchens; the various sources of food, water, and electricity; the many symbols and icons with which they express their identity. The day-to-day practices of neighbours and co-workers take place in well-defined locales populated by heterogeneous *material and expressive* objects, so any concrete community or organisation, when treated as an assemblage, must include these locales explicitly.
>
> Delanda, 2016, p. 20

Considering *Tōia Mai* as assemblage means that along with the sum of its material parts and its idea, it can now acknowledge a much wider range of actants, including: media and PR; public image; popular culture references; various political agendas and policies; the location in terms of site, space, and place; topographical variables in relation to radio transmission and electrical supply; spirituality; the weather; time; and a panoply of other 'things' that arose from the host of potentialities that simmer beneath each of their surfaces before manifesting as continuously emerging phenomena.

Yet Delanda's conception of an assemblage rests on his realist commitments. For him reality existing beyond humans is knowable only through mathematical or scientific rationalist approaches. He claims that "concrete assemblages must be considered to be fully *independent of our minds*" (Delanda, 138, p. 2016), and that "a materialist philosopher can only be a realist about *immanent* entities, that is, entities that may not subsist without some connection to a material or energetic substratum." (Delanda, 2016 p. 139). [Italics in original]. Immanent here means being "irreducible to its parts but does not transcend them, in the sense that if the parts stopped interacting the whole itself ceases to exist, or becomes a mere aggregation of elements." (Delanda, 2016, p. 71) This connection to the material or energetic substratum is the predicator of his materialist realism, which he accesses through understanding assemblages as "characterised by enduring states defined by properties that are always actual existing in the here and now." (Delanda, 2016, p. 108) By this he means the types of properties

that are typically recognised by science, which is to say those properties that align to some form of measurement. This enables him to develop a sophisticated understanding of what he calls an assemblage–stratum, which is a continuum of dichotomies that combine their opposites, so that they:

> can be replaced with a single parametrised term capable of existing into different states. This yields a different version of the concept of assemblage, *a concept with knobs* that can be set to different values to yield either strata or assemblages […] The coding parameter is one of the knobs we must build into the concept, the other being territorialisation, a parameter measuring the degree to which the components of the assemblage have been subjected to a degree of homogenisation, and the extent to which its defining boundaries have been delineated and made impermeable. A further modification to the original concept is that the parts are matched together to form an ensemble are themselves treated as assemblages, equipped with their own parameters, so that at all times we are dealing with assemblages of assemblages.
>
> Delanda, 2016, p. 3 [italics in original]

What this approach enables is a type of differential calculus whereby ‘parameters’ and ‘variables’ are able to map relations between each other. Previously oppositional concepts can be conceived of in terms of having ontological equivalence, so that: “entities operating at different scales can directly interact with one another, individual to individual, a possibility that does not exist in a hierarchical ontology” (Delanda, 2016, p. 19). This is a claim that Delanda makes because he is only interested in an objectivity where performative understandings of science have no place. Whilst he critiques science in terms of what has traditionally been described as the minor or major sciences, he does not vary from an approach which emphasises the use of mathematics in scientific practice. It is interesting to note that whilst his flat ontology is differentiated from a hierarchical one, he does not contemplate alternative ontologies such as those articulated by Barad’s agential realism, or Mika’s worldedness. This is not surprising as much of his language is borrowed from traditional physics, e.g. his terms ‘intensive’ and ‘extensive’ originate from thermodynamics and inform his definitions for quantitative and qualitative changes. Extensive properties are those like “length, area or volume that can be added to each other yielding only a quantitative change”. Conversely, intensive properties are those that “may result in qualitative change. Examples of these properties are speed, temperature, pressure, concentration, voltage.” (Delanda, 2016, p. 76) Qualitative change is one that occurs

through some form of transformation in the property. Using water as an example, a transformational event occurs when a quantitative addition of 1° to 99° means that the water boils at 100° and turns into steam. At this critical point the quantitative property has a qualitative change – thus intensive and extensive properties interrelate on the same continuum.

Delanda's assemblage theory is thus a type of cognitive tool that provides analysis through understanding relationships as mathematical differentials between intensities and thresholds. Applying this theory to *Tōia Mai* should give an indication of its usefulness. In Delanda's conception, time can be considered an extensive property with the quantitative variables of tasks that are needed to complete specific goals. Each goal becomes an intensive property by being a transformational event that enables the next range of extensive properties to be engaged with – new quantitative tasks for the next dependent goal. As I used Microsoft Project to help me plan the scheduling for *Tōia Mai* - a software that maps out tasks as number of days or percentages of completion - assemblage theory should be able to provide some useful insights for specific processes. One such process occurred when a second-year student who was working on the initial CAD design for one of his classes. He needed to complete the design by the end of his semester, so that the number of sheets required for purchase could be calculated. A new group of students would then begin working on the sculpture's fabrication in an area booked for this purpose. Breaking this task into percentages or days towards completion can be seen as extensive properties, and calculating the number of steel sheets needed can be seen as an intensive property. In the event, the student met the learning outcomes for his course but did not complete the CAD design as he'd 'already finished'. This meant that the new students could not work on the project in their scheduled time and the largest engineering space on campus was no longer available. This example does not 'prove' that assemblage theory does not work, but illustrates that it does not adequately account for the complexity of other actants such as the motivations of individuals, existing institutional discourses, available resources within different timelines, and other unforeseen actants. This situation nearly ended the project - that engineering space would not be available again until the following year. What saved the enterprise was another chance encounter at a café, with the second person who had introduced me to the person who had donated $30,000. She had asked how the project was going and on hearing the news had suggested a meeting with the directors of Longveld - who she knew in a different capacity. We subsequently met and after I had explained the situation, they offered that the waka sculpture be made at their premises on the proviso that the labour would be paid for. Suddenly I was looking at a solution which required an additional $90,000. Knowing that I did not have the money in hand, they asked me if I

would complete the funding journey? When I said yes, we shook hands and it went on from there. In the early part of 2019 I asked one of them why they had taken that risk with a completely unknown quantity such as myself? She looked me in the eye and simply replied, “It’s experiences like this that makes us human.” (Personal communication, Pam Roa, 1st March 2019)

The point of this story is that assembly theory does not adequately account for the “agency of actants” (Salter, 2010, p. xxviii) that are ‘already in the mix’, nor does it allow for the unforeseen, such as chance encounters. As an analytical tool that uses a form of number theory to reconcile binary opposites within continuous sets, it has a certain usefulness because these sets can also be accounted for in logical relations with other sets. Yet it privileges these mathematical relations over the actuality of unfolding existence by reducing all events as having the same ontological status. Experience, emotion, spirituality, and all those qualities that elsewhere are described as ‘subjective’ are ignored, as are the random, the complex, notions of worldedness, or ideas about phenomena as co-constitution. This quest for realist truth rests on a certain type of ‘objectivity’, one that ignores that this conception is itself subjective – for this claim to an objective knowledge that is independent from human minds is achieved by a rationalist logic which predefines its own condition, through a *human insistence* that humans alone can logically determine the conditions for objectivity.

There is still however, a great deal of usefulness in considering assemblage as a term that encompasses the collective agencies of actants. If assemblage theory does not adequately account for the unforeseen, it is because it tends towards a machinic conception that overdetermines the relationships between technologies of measurement and their corollary measurements. Similar to a Newtonian machine, assemblage theory seems somewhat reminiscent of a radio, attempting to materially tune between its different control bands and variables.

Perhaps a means by which to acknowledge the unforeseen is through revisiting Tame’s original name for *Tōia Mai*, which was just *Tōia* by itself. This retains an open-ended sense of *Pull* as an ongoing action, with the unforeseen pulling potentiality towards it, like an invisible current attracting similar actants into its field. An example of this sense of an invisible *Pull* at work can be illustrated by the events of Tuesday 13th November 2018. At approximately 1 p.m. an electrical engineering student volunteer wired a 24 V power supply into the 5 V LEDs of the Taniwha. In the blink of an eye we lost around $5,500 of specialist IP 67 rated lights and had a serious problem with less than 10 days before the public opening. It was a calamity. I had no money left, was short on time, losing labour as the engineering students needed to do their exams, and was seriously short on sleep.

The night before had been wonderful, being summer it had finally gotten dark at around 9:30 p.m. and the sound and lighting aspects were finally starting to come together. I had sat there with my laptop wired into a 100 m ethernet cable and had stayed until 2 a.m. completely engrossed in the programming. I'd had the sensation that finally, this confluence between art, engineering, education, methodology, politics, fundraising, and everything else encountered over the last two years, might finally coalesce into something more stable.

The student was understandably devastated. He offered to pay for replacements and to source them himself, but I had taken the advice of our industry partner ACLX and purchased a specific product that had taken three months to arrive from China. There was only one possible solution, we would have to remove the 236 LEDs and replace them with a 24 V LED alternative. This would require remaking and remapping the entire fixture from scratch. At the time I estimated that it would take around three days, but I didn't say this to the student when he had to leave to study for one of his final engineering exams. After he left, I sat down with the electrical engineering tutor Brent Phillips and Jemoal Lassey from Longveld to talk about what we could do, in the available time. It was around 5.30 p.m. on a blazingly hot day, and just before Jemoal was about to leave. "What we need," he said, "is a beer." I was at my wits end, and could only look at him. He smiled, went for a walk, and came back with a couple of beers. Neither Brent nor I wanted one – I was too stressed to think, let alone drink. Jemoal shrugged, had a few mouthfuls of beer and set about making a new backing plate for the Taniwha, as Brent began wiring scrap remnants of the 24 V LEDs together. Inside three hours, Jemoal had drunk three beers and we had made a new Taniwha. I couldn't thank him enough, but he just laughed and said "That was fun! I wish I could do that every day." Both he and Brent had freely given their time, well beyond what anyone could reasonably expect. Later, at the opening of *Tōia Mai*, one of the students put into words this incredible sense of working together on "something that would make a difference" (Personal communication, Arjun Ravi, 23rd November 2018). As a former filmmaker I've witnessed the camaraderie of volunteers, but this was different. What happened that day had been an extension of what had been happening for the last six weeks - a core team of students, working with Brent, myself, and Jemoal, all being pulled along with the sensation that we were working on something greater than ourselves. These unpaid volunteers - the students who were gaining no credit for their studies; my colleague, who was at the busiest time of the academic year and yet turning up to work late into the evenings and in the weekends; and Jemoal, who convinced his colleagues to give so much by way of resources and unaccounted time. They all pulled together and worked above and beyond unlike any crew I have seen in 20 years of creative industry practice.

So what is this thing I'm calling *Pull*? Is it just teamwork? It's so much more than that, for it names the energy that permeates the phenomena of *Tōia Mai* as ongoing creation. It begins to describe that extra 'something' that so many realist approaches lack in their attempts to extend knowledge beyond human finitude. It's an otherwise unacknowledged actant - like the pull of the ocean, or that of the moon, like gravity, or the power of crowds, I'm seeking a way to acknowledge how with increasing complexity this *Pull* seems to attract certain potentialities into its general 'field', so that particular types of outcomes appear to relationally emerge. It's as if each actant has an increased agentic capacity as other actants also come into play. Complexity is also an actant: the initial inertia that prevents particular 'levels' of stability from changing, pulls 'favourable potentialities' towards new 'levels' in order to align with the general direction of the overall situation.

Part of the difficulty of attempting to provide examples of this *Pull*, is the tendency in contemporary 'speculative' philosophy is to either think "of objects as wholly correlated to human practices and thinking of them as having an inherent depths beyond the flux and flow of the world." (Gratton, 2014, p. 120) Borrowing from Spinoza (1677), Jane Bennett (2010) charts the usefulness of the concept of *conatus* which refers to the "trending tendency to persist" (Bennett, 2010, p. 2) in bodies, much like what I describe as levels of stability within a situation. Spinoza's bodies are not singular or discrete entities, but rather they are capable of "continuously effecting and being affected by other bodies" (Bennett, 2010, p. 21) much in the same way that a Deleuze-inspired assemblage might operate. (Gratton, 2014, p. 123) Equally useful is Bennett's return to "moments of methodological naïveté" (Bennett, 2010, p. 17) as a means to escape typical social constructivist responses which position material agency as an extension of human agency. By way of example she revisits the Epicurean philosopher Lucretius and his insistence on the indeterminate nature of bodies, which are:

> not lifeless stuff but matter on the go, entering and leaving assemblages, swerving into each other: "*At times quite undetermined and at undetermined spots they push a little from their path*: yet only just so much as you could recall a change of trend. [For if they did not] … swerve, all things would full downwards through the deep void like drops of rain, nor could collision come to be, nor a blow brought to pass for the primordial: so nature would never have brought anything into existence.
>
> Bennett, 2010, p. 18

Whilst Lucretius's concept of "swerve" relates atomistic bodies, Bennett takes this idea and applies it to assemblages. As such, it resonates with the idea of *Pull* that I'm trying

to describe. What Bennett describes as *thing-power* acknowledges indeterminacy and an inherent unforeseen capacity – what she calls “chanciness”, as well as “an inexplicable vitality or energy, a moment of independence from and resistance to us and other bodies” (Bennett, 2010, p. 18) There is indeed an element of chance here, not in the sense of the likelihood of an occurrence amongst a number of possibilities, but as certain aligned potentialities emerging in relation to the complexity of the continuously unfolding assemblage. Rather than ascribing this agentic capacity to a ‘body’ per se, Bennett acknowledges the agency of assemblages in a way that is less rationalist than Delanda, and extends Deleuze’s original conception:

> each member-actant maintains an energetic pulse slightly “off” from that of the assemblage, an assemblage is never a stolid block but an open-ended collective, a “non-totalizable sum.”
>
> Bennett, 2010, p. 24

I hope to provide another example of this *Pull* in action, by recounting the events that occurred between the last week of September through to the last week of October 2017. Having successfully navigated the first third of the Hamilton City Council’s public art acquisition process on 4th April, which rather vaguely approved “Wintec’s Matariki art project” somewhere within the bounds of the Ferrybank Reserve, the more important decision to sign off the concept occurred on 19th September. On the day, I brought along with me the 1/20th scale 3D printed model of what the completed sculpture would look like. This was duly handed around until the mayor Andrew King exclaimed “I’ve broken it!” He’d inadvertently snapped off the tip, whereupon a journalist sitting in the room promptly tweeted the moment. The counsellors were jovial as the debating session began, calling out to the mayor that it had better not happen with the actual sculpture itself. Before more serious comments could be made, Mme chairwoman Paula Southgate stood up and announced how she had caught up with Wintec chief executive Mark Flowers recently, and how he had said that he saw this project as being a pilot for how Wintec and the City Council could work more closely together in the future, and not just for art projects. A brief pause elapsed, before various counsellors made remarks along the lines of ‘good on you for taking this on board’, to me. At the end of the statutory time allowed for debate, they voted, and the concept was unanimously passed. The next week, the story along with a screen grab from a 3D modelling program was published in one of the free weekend newspapers – the waka sculpture was now well and truly in the public domain.

After only a month, I met with the managers tasked to engage with the project at a practical level on 18th October. The Ferrybank Reserve was in the midst of complex

development plans and they had not anticipated needing to incorporate a sculpture into them. They had some difficulty in understanding the technical requirements of the IT aspects of the sculpture, particularly the thermal imaging sensors and the IoT environmental sensor network. I was asked if the 'real' artwork was being 'hung' on the waka with the lighting, and I tried to explain that the two were integrated. Collectively they raised concerns regarding the feasibility of Council being responsible for the digital components, for which they were not set up for. It would also be 'better' if the sculpture was placed outside of the development zone, so that Council would not have to bear the cost or time required in siting it twice. So whilst the location had already been signed off by Council, I was told that "It's just one small piece in a much greater complex situation that's unfolding" (Maria Barrie, personal communication, 18th October 2017). Furthermore, unfortunately, by their estimation it appeared that Council's readiness was approximately 12 months behind where Wintec might prefer them to be. Perhaps therefore, it would be 'better' if the sculpture was sited somewhere else entirely different?

On 19th October I met with Tame and Hera to discuss these developments. Tame suggested that I talk to Council's Amorangi Maaori (hapū liaison) Muna Wharawhara. They both approved that I write to Paula Southgate that day, to express our preference that the waka sculpture be located with a more immediate relationship to the Waikato River. By the end of Friday the 20th October Paula had replied and suggested that I meet with her and the managers at the Ferrybank the following week, to see if we couldn't work something out between us. That being Labour weekend, I did not return to work until Tuesday 24th. I was about to walk into class at 9 a.m. when Wintec chief executive Mark Flowers walked past me, and asked how the waka project was going? I recounted the conversation that had occurred on the 18th, to which he replied that such things were very unfortunate and had I, incidentally, considered talking to David Hallett - who was one of Wintec's external advisors - with regards to the IT infrastructure? I ran into class, but remembered to email David the following day.

That Wednesday 25th October 2017 was to prove to be busy. In the morning I met with Muna Wharawhara at City Council, who took time to learn about the kaupapa. He informed me that the development project manager I had met with on the 18th had just resigned in order to work to work for the property developer. He therefore thought it best to confirm the location as soon as possible, and to expedite this I should have a conversation with the landscape designers. It would also be good if we (myself and Wintec Māori achievement) formally met with Te Hā o Rōpu o Kirikiriroa (Hamilton inter-hapū Council) soonest.

In the afternoon I met with Paula Southgate, Maria Barrie (Parks and Reserves manager) and Joanna Van Walraven, who, in the absence of Council having either a project manager or an arts advisor, had been drafted in from her role as a strategy and policy advisor to help liaise between myself and the various Council departments. Meeting at the preferred site, which was just below the Waikato Museum, Maria was less than comfortable with the location due to the risk of flooding and the consequent need for a new retaining wall. It soon transpired that a costly new path proposal was about to be before Council, which would run further up the hill from where we were standing. Talking amongst themselves, the three women concluded that it would likely gain a pass vote, should there not be any further complications. It was a beautiful spring day, the first after winter, and having previously scouted out some alternative locations, it was readily agreed that we should carry on walking to look at them before going back to work. Arriving at the area just north of the rowing club, I positioned Joanna at the place where I thought the sculpture might potentially stand. From a distance Paula could now envisage how it might look. Again, Maria was less than happy with this location as she was concerned about the potential cost of retaining, which would have to be signed off once again by Council. She was also worried about the lack of visibility from the road and again suggested an alternative location away from the development zone. Paula looked at her and replied that a few bushes could be given a trim, and perhaps some ‘basic levelling’ could be paid for out of the existing Parks and Reserves budget? It was perhaps not what Maria had been wanting, but it did provide a solution that would not require any further proposal to Council for funds. We shook hands and I walked back to work, elated.

On checking my email when I returned, I discovered that David Hallett would be available to meet that afternoon. He was very interested in the idea and suggested that I talk to Wintec head of IT Bradley Vines. It was this suggestion that eventually led to Jordan Templeton from Aware Group to create the IT infrastructure entirely for free, as “a personal favour” to Brad. (Bradley Vines, personal communication, 20th March 2018)

This rather long description might on the surface appear to be mostly about human politics. Yet under the surface is a roiling mass of other actants all jostling with each other - a chance encounter, a 3D printed model, money pressures, the webs of professional relationships, policy documents, a Twitter account, a newspaper article and image, the river environment itself, a sunny day after winter, and a person standing in for a sculpture. These actants don’t exist alone, their influence comes from their combined synergy, as part of the wider assemblage. In summary, assemblages are:

> living, throbbing confederations that are able to function despite the persistent presence of energies that confound them from within. They

> have uneven topographies, because some of the points at which the various affects and bodies crossed paths are more heavily trafficked than others, and so power is not distributed equally across its surface. Assemblages are not governed by any central head: no one materiality or type of material has sufficient competence to determine consistently the trajectory or impact of the group. The effects generated by an assemblage are, rather, emergent properties, emergent in that their ability to make something happen […] as distinct from the sum of the vital force of each materiality considered alone.
>
> Bennett, 2010, p. 23-23

Pull is an emergent property – as multiple actants meet, the overall complexity moves in the general direction of larger currents. Each actant has with it potentialities that emerge in relation to meeting other actants; these are not fixed properties but likelihoods that arise in the presence of these co-relations. The chance encounter with Wintec Chief Executive Mark Flowers, arose in relation to the assemblage known as 'Wintec'. On that day, at that time, in that place, and sufficiently on his mind to want to stop and talk about it, these are all potentials. On that first really sunny day of the year, the potential to carry on walking from the original site was different to those arising from a rainy day. What were the potentials that lay under the surface of the human and nonhuman actants, present and not present? What was the potential that Paula might articulate an alternative, following Maria's concerns? Potentiality is not the same as probability, rather it is a type of intensity that bursts past the threshold and manifests, in a similar manner to Delanda's intensive values surpassing their extensive boundaries.

Therefore, insights from Delanda's conception of assemblage theory might still be useful, particularly in terms of engaging with the "dispositions, tendencies and capacities that are virtual (real but not actual) when not being currently manifested or exercised" (Delanda, 2016, p. 108). But what is, the virtual, and can it be known? Delanda's most useful work perhaps lies in his exploration of virtual diagrams, which always exist:

> as part of concrete assemblages, diagrams are connected to a space of pure virtuality, a cosmic *plane of consistency* that exists as a limit of deterritorialization.
>
> Delanda, 2016, p. 109

If territorialisation is the degree to which an assemblage's components are homogenous, deterritorialization is the opposite – the degree to which an assemblage's

components are heterogenous. This concept sits in alignment with my claims around complexity – a complex assemblage is one with many heterogenous actants. For Delanda however, a virtual diagram is a “cartographic strategy” (Delanda, 2016, p. 110) which uses the geometries of projective spaces, or the “concept of spatial invariants under transformations” through the stratum-assemblage ‘machine’ (with its attendant parametrised and variable control/state concepts), to produces the means to think of diagrams “as immanent as opposed to transcendent” (Delanda, 2016, p. 115). This enables Delanda to circumnavigate Kantian transcendentalism and Aristotle’s notion of essences. By using an abstracted ‘machinic diagram’ he strips away experience into a mathematical formulation of control and state spaces, in which the reality of the virtual – as non-manifested potentialities – can map extensive and intensive boundaries as differential calculus. Delanda can now develop mathematical arguments to posit a realist metaphysics based on Deleuze’s theories. For example, instead of plotting points for possible material states, points plotted in series could “stand for *possible histories*” (Delanda, 2016, p. 120) [italics in original]. Charting Henri Poincaré’s investigation of trajectories:

> Poincaré noticed that curves tended to converge at *special points* in space, as if they were being attracted to them: it did not matter where the trajectory had its origin, or how it wound its way around the space, its long-term tendency was to end up at a particular point. These special, remarkable, or singular points were eventually named *attractors.* When a state space has several attractors, these singularities are surrounded by an area within which they affect trajectories, an area called a ‘basin of attraction’: if a trajectory begins within a particular basin of attraction then it inevitably ends up at the attractor.
>
> Delanda, 2016, p. 120 [italics in original]

He goes on to say that these basins of attraction have a certain stability, and without claiming a correspondence between these basins of attraction as derived through differential calculus and my concept of *Pull*, there appears to be a certain analogous similarity. Deleuze called these mathematically derived spaces *Ideas* which he defines as “an n-dimensional, continuous, defined multiplicity” (Deleuze, in Delanda, 2016, p. 121) and Delanda describes their pre-requisite conditions as being “*the structure of a possibility space,* associated with an assemblage’s dispositions.” (Delanda, 2016, p. 5) [italics in original].

What Delanda’s possibility spaces enable is the consideration that potentiality and virtuality are linked to the actual, at least through an abstracted mathematisation of

dispositions and what we might otherwise call actants. Virtuality is the real possibility space that exists in relation to the actual – a manoeuvre which is possible only by his insistence that these dispositions all exist on the same ontological plane, which "distinguishes assemblage from other realist philosophies in which there are strong ontological distinctions" (Delanda, 2016, p. 13). This is not something he ever explains, beyond insisting that it is necessary to do so. What it allows however, is a reassessment of the popular conception that the material and digital are somehow distinct. An analysis based on Delanda's conception does not fundamentally differentiate between the two. Materiality as a tangible and physical actuality exists here as one of many possibilities that emerge from the non-manifested potentialities of the virtual. Similarly such possibility spaces are the *sine non qua* of computing, where memory and continuous modifiers enable the 'dispositions, tendencies, and capacities' of the digital assemblage to inform each other in a relational manner. Arguably then, digitality and materiality are in continuum with each other.

This can be seen with *Tōia Mai*, where the disparately scaled data from the IoT network is ontologically rendered flat by performing a percentile operation that takes the lowest known value as zero, and the highest known value as 100%. New highs and lows that exceed the original data sets become the new 0% and 100%. This data is in turn assessed against a large array of live modifiers, which include adjusted values generated from the maramataka, (Māori calendar), lunar phase, and 'special' days such as Christmas, Waitangi Day, and Easter. This produces two datasets, the first being the 'star mode' which is the largest percentile generated of the seven Matariki star categories, and the second is the environmental data as percentile pertaining to each star mode. In the terminology of Delanda, the star mode is the parameter, and the environmental data as percentile is the variable. The star mode in operation activates one of several lighting and sound scenes tagged to that star mode, whilst the relevant environmental variables inform the animated patterning of the lighting e.g. hue, intensity, luminosity, velocity, and other lighting variables. Finally, the movements of heat emitting bodies within the field of the thermal imaging sensors on the waka also inform when particular operations occur, including alterations to the sound and lighting. In this way, the 'dispositions, tendencies, and capacities' of each actant relationally emerges within possibility spaces that are far larger than a programmatic approach, with new possible datasets potentially feeding back into the assemblage. These could include, but are not limited to the frequency of star modes in operation over time, foot count, data derived from length of stay, number of heat emitting sources within pre-definable zones, gesture recognition, and any number of other operations.

Such an analysis is possible by Delanda's insistence on the irreducibility of an assemblage's parts, where "the concept would not be able to replace that of a seamless totality" (Delanda, 2016, p. 12). This irreducibility allows for emergence between its parts in a manner that is neither "*necessary or transcendent*" so that "if the properties are viewed as *produced* by the interactions between components, and their existence and endurance explained by the continuity of those interactions, then the properties are *contingent*" (Delanda, 2016, p. 12) [Italics in original]. Irreducibility then, is also an essential aspect of Delanda's logic.

What is at stake here, in a generalised sense for Western philosophy, is the search to gain knowledge of things in the world that are not predicated or limited by human thinking of them. Delanda's material realism relies on a certain statistical approach, one that relies on a structuralism dependent on measurement, maps, and his insistence on an ontological flatness. Shaviro (2014) summarises his project as seeking to revise Kant's transcendental idealism via Deleuze, so that instead of "transcendental conditions of thought that are imposed by the human mind, we have the realm of the virtual, which is objective and mind independent and thoroughly real without being actual." (Shaviro, 2014, p. 71-72) Delanda is a 'speculative realist' by Shaviro's measure – he seeks a means by which to escape what Quentin Meillassoux (2008) calls 'correlationism', which he defines by way of a question: How can humans "describe a world where humanity is absent; a world crammed with things and events that are not the correlates of any manifestation; a world that is not the correlate of a relation to the world?" (Meillassoux, 2008, p. 26) The 'correlationist circle' is the situation whereby "one cannot think the in-itself without entering into a vicious circle, thereby immediately contradicting oneself" (Meillassoux, 2008, p. 5).

The predicate for this argument is once again Cartesian, which 'bifurcates' between subjects and objects, the knower and the known. Speculative realists are "united by their rejection of correlationism and their commitment to "a speculative wager on the possible returns from a renewed attention to reality itself"" (Bryant at al. 2010, in Shaviro, 2014, p. 10). What this entails is a re-engagement with Immanuel Kant (1781) and his distinction between the noumenal and the phenomenal, where "phenomena are things as they appear to us, not as they are "in-themselves."" (Gratton 2014, p. 19) In other words, our senses lie to us and it is impossible to determine the *correlate* of our thinking - the object - noumenon - which he calls the 'in-itself'. Kant argued that in order to have knowledge of the world *a priori*, or knowledge before experience, certainty was possible through "the shared sensible "form" of experience" (Gratton, 2014, p. 18), which includes concepts like time and space. It is through these a priori forms of knowledge that the faculty of reason is able to determine a great deal about the world,

without ever having experienced it. Mathematics, geometry, physics et cetera are all therefore capable of determining truth about the world, without the senses. (Gratton, 2014, p. 19) These shared sensible forms are what make Kant's metaphysics *transcendental*, as "there are some universal forms of the subjective knowledge of things" (Gratton, 2014, p. 18).

Yet such an argument is based on history of Western philosophy, where 'idealism' is predicated on a supreme being, or beings, and 'realism' attempts to determine knowledge of the thing 'in-itself'. There is a certain arrogance at play – an assumption of a shared universal history stretching across the imaginary of the West, from Aristotle, to Descartes, Hume, Kant, and thereafter. *Toia Mai* is informed through a partnership paradigm and includes Māori metaphysical perspectives, not the least of which because it accesses mātauranga Māori in its composition. So whilst it is possible to perform an analysis à la Delanda and other 'speculative realists', it is necessary to always keep in mind that the original proponents of this movement – if it can be called that – consisting of Quentin Meillassoux, Graham Harman, Ray Brassier and Iain Hamilton Grant (Shaviro, 2014, p. 5), are somewhat "pale, male, and stale" (Lawler, 1996, p. 800) inasmuch as there appears to be no real consideration of indigenous metaphysics.

Generally speaking, 'Western' philosophers have tended towards positioning aspects of indigenous metaphysics somewhere between "what Heidegger generally castigates as 'ontotheology'" (Mika, 2017, p. 70), and a form of naïve idealism more commonly situated as animism. This last claim being vigorously refuted by Marsden (2003) who says that Western anthropologists failed to understand distinctions between mauri (life force) and hau (the breath of life); that because these concepts were spiritual in nature and inherent to all things that it was assumed that Māori "regarded all material objects as being indwelt by spirits"; and that although Māori often believed that particular places, trees, or objects had guardian spirits that used such places as a home, it "did not mean that the spirit was the spirit of the tree, and animated it." (Marsden, 2003, p. 44) For too long indigenous metaphysics has been ignored under the rubric of a 'savage philosophy', as defined by a "lingering racism and evolutionism that motivate distinctions between the animate and the inanimate, the real and the ideal, between signs and things, and ultimately between who matters and who does not." (Bracken, 2007, in Braddock, 2017, p. 7)

When considering 'speculative realist' philosophies it is therefore necessary to remember that such perspectives are culturally informed, something that is frequently elided within their discourse. The cause célèbre of speculative realism is arguably Quentin Meillassoux, who also engages with Kant by positing that knowledge of the

‘thing in-itself’ is possible through mathematical absolutes, which themselves are contingent on the necessity of the contingency of the correlation itself. (Meillassoux, 2008, p. 65) To put that another way, for him the task is “to find a way for thought to turn back on and erase itself” (Shaviro, 2014, p. 113), in order to find the only absolute truth which does not itself rely on human conception of it:

> Such a purified, noncorrelational thought is purely rational, logical, and theoretical: a “veritable intellectual intuition of the absolute” (Meillassoux 2008, 82). Meillassoux boasts that there is no empirical basis whatsoever for “the ‘absolutizing’ capacity of thought” (2012, 1); it quite literally rests on nothing. It has no relation to the body or any sort of experience.
>
> Shaviro, 2014, p. 113

In summary, what Meillassoux attempts to do is to “radically separate sensory experience from the physical actualities that generate that experience.” (Shaviro, 2014, p. 114)

This absolute truth that evades human conception is what Meillassoux calls the ‘great outdoors’, which is “the eternal in–itself, whose being is indifferent to whether or not it is thought.” (Meillassoux, 2008, p. 63) The only means by which to approach it is through a purely rational ‘factiality’ – a word which elsewhere he calls the virtual. (Gratton, 2014, p. 59) This requires a brief description of Meillassoux’s logic, for in order to understand the conditions of his virtuality it is necessary to understand what he calls *hyper-chaos*. Firstly, he says that the “Kantian correlation of thought and being is itself contingent (or “factial”) rather than necessary. It happens to be the case for us, but it need not be.” (Shaviro, 2014, p. 69) In other words, Kant’s phenomenal/noumenal operation is true for us as humans, but this need not be true for all universes - it’s just that

> our universe provides us with a number of possible conditions, but that the universe itself can change at any time: it is not […] a set of possibilities, but a hyper chaos where anything is always possible.
>
> Gratton, 2014, p. 59

By thinking that thought is able to relinquish “the principle of reason” it becomes possible to “grasp the fact that there is absolutely *no* ultimate Reason, whether thinkable or unthinkable.” (Meillassoux, 2008, p. 63) Virtuality (factiality) therefore reveals an:

> ontological truth hidden beneath the radical scepticism of modern philosophy: to be is not to be a correlate, but to be a fact: to be is to be factual – and *this* is not a fact.
>
> (Gratton, 2014, p. 59) [italics in original].

To put that another way, *being* is not dependent on the correlation (act of thinking about the thing in-itself), but being a thing in-itself is a fact. As humans, we can make factual claims about things in themselves, but these are not facts since we can never know these things in themselves. Things-in-themselves "could be anything whatsoever" (Meillassoux, 2007, in Gratton, 2014, p. 59). The point here is that possibility is not the same as probability - virtuality and hyper-chaos are not bound to possibility in the same way as Delanda's 'possibility spaces' chart or plot a finite number of possibilities, but that the possibilities here, are endless. The correlation between our thinking and the thing in-itself, and by extension, the universal 'laws' of physics, mathematics, et cetera, is for Meillassoux simply one possibility amongst many possible universes. In quantum mechanics this has a potential alignment with the 'many world theory' of Everett (Barad, 2007, p. 287), and in Marsden's Māori metaphysics, with the concept of epochal time, where:

> the universe is not a 'closed' system [and] the existence of other worlds cannot be discounted. For the Māori Tohunga, there are worlds within worlds.
>
> Marsden, 2003, p. 113

Meillassoux's hyper-chaos is thus perhaps a less radical proposition than what it might first appear, even if his logic seems somewhat convoluted at times. By claiming that contingency is necessary he is able to say that it is also "eternal", and furthermore that "contingency *alone* is necessary" (Meillassoux, 2008, p. 65) [my italics]. This leads him to conclude that this absolute allows for a yet more fundamental absolute, one that is:

> absolutely impossible, *even* for all powerful chaos, and this something, which chaos will never be able to produce, *is a necessary entity*. Everything is possible, anything can happen – except something that is necessary, because it is the contingency of the entity that is necessary, not the entity.
>
> Meillassoux, 2008, p. 65 [italics in original].

This emphasis on contingency is the prima facie of his argument, which he differentiates from facticity. Facticity refers to the "structural invariants that supposedly govern the world – invariants which may differ from one variant of correlationism to

another", whereas contingency "expresses the fact that physical laws remain indifferent as to whether an event occurs or not – they allow an entity to emerge, to subsist, or to perish." What this means is "contingency consists in knowing that worldly things could be otherwise, facticity just consists in not knowing why the correlational structure has to be thus." (Meillassoux, 2008, p. 39) Facticity therefore refers to the invariant laws that govern *a* world, which for our world are those invariants that we refer to as physics, mathematics, et cetera, whereas contingency "is an instance of knowledge". (Meillassoux, 2008, p. 54)

In a sense, this is a structuralist manoeuvre – contingency posits that multiple universes are possible, facticity maintains the invariant 'laws' that pertain to each universe, and correlation occurs between thinking and objects in a manner that conforms to the laws relevant to each possible universe. As Shaviro points out, Meillassoux is only interested in positivism and formal mathematics as a means to an end – they simply provide him with the means to establish his arguments. (Shaviro, 2014, p. 122) Meillassoux's Cartesian underpinnings also become apparent, not only are things correlated by thought they "do not correlate on their own and do not make decisions […] they do not engage in any sort of internally generated activity at all" (Shaviro, 2014, p. 112). Matter, for Meillassoux, is dumb and inert – existing only to be thought about, and so, correlated. Thinking is solely the reserve of humans, who "as opposed to other forms of organic life […] think the contingency of the laws of nature" (Gratton, 2014, p. 74). Meillassoux is thus a true proponent of human exceptionalism, something that differentiates him from the 'new materialists' such as Bennett, van der Tuin, and Barad, who are "less concerned with the particular paradoxes of correlationism" whilst also seeking "to elaborate new ways of grasping the world, outside of anthropocentric paradigms and grounded in a firm commitment to realism" (Shaviro, 2014, p. 11).

Despite their differences, Delanda and Meillassoux both affirm the relationship virtuality has with the real. Whilst *reality* is still very much in contention, their ideas have some synergy with Stern's original concept of embodiment as "incipient activity"(Stern, 2013, p. 2). What underpins Stern's concept is the that bodies are staged as performance, so that they become potentialised across the multiplicities of the network. Following Stern, what *Tōia Mai* provides is an example of a "shift from sign and technology to situation and performance" (Stern 2013, p. 49). What is at stake here is the difference between *Tōia Mai* enabling either the *mediation* or *relational emergence* of phenomena. The notion of media itself is the 'in between' of representation, as informed by Cartesian and Kantian notions of the in-itself and our correlate of it. Meillassoux makes his engagement with Kant explicit, whereas Delanda simply takes for granted his

cartographic strategy. For Stern, virtuality is “the potential for change – a movement that is not yet, but still present as a force. Virtuality is the ‘immanence of a thing to its still indeterminate variation’, an ‘unfolding toward the registering of an event’ (Massumi, 2002, in Stern, 2013, p. 14). He is less precise however with regards to what he means by potentiality, and more importantly, the extent to which virtuality is linked to the real. Following Nancy (2000), his understanding of *being* is always *being-with*, (Stern, 2013, p. 99), but his emphasis tends towards *inter*-action, not *intra*-action. The question is, to what extent do implicit bodies relationally emerge towards realities where the intentionality of those bodies become subsumed within the emergent phenomena? When does the human, stop being distinctly human? And when, is nature, human? Such approaches already exist within Māori metaphysics, with the concept of Matariki providing an example of an interconnected and performatively enacted universe.

Toia Mai begins to explore these questions. The concept of *Pull* relates to infinite possibilities of complexity collectivising in a relationally emergent manner, albeit within the stability of this universe. Probability within finite possibilities also exists within aspects of its digital architecture, particularly within its logical operations. By considering the material and the digital in continuum with each other, some clarification of how potentiality operates might be ascertained. Having explored materiality as relationally emergent phenomena, what remains now is to consider the same with regards to digitality. A useful starting point is to consider the differences between traditional and stateless computing, as the IoT network that *Tōia Mai* uses sends data to a cloud platform that runs a stateless application. This is informed by a discussion that I had with my collaborator Jourdan Templeton, who designed and wrote the digital architecture in accordance to my design concept. He is the chief technology officer for Aware Group, an AI and data services company in Hamilton that specialises in artificial intelligence, IoT, and data analytics. In relation to cloud computing, stateless computing is where:

> a job … doesn’t retain the previous history ... The way the program is built … is in a completely different way. In traditional computing you have this big computer … dedicated to that one thing. It has a certain amount of memory, certain amount of storage, certain amount of CPU. And generally that CPU and memory is persisting across multiple jobs that run in that program. When we run in a stateless model instead, there’d be memory assisted between each running of the job, and also the location of where it's running. So, if I was to run a job one day it could be done on a computer with one set of memory and then the next day that same job runs [it] could be running [on] a completely different

> computer and a different part of the country. And so you can't guarantee that that memory will still be there.
>
> Interview with Jourdan Templeton, 8th February 2019, see appendix B-EE

Toia Mai uses both data scraping (technique of retrieving data from existing websites), and data from an IoT network sent via 4G to a hub running on Microsoft's Azure platform. An application polls each of these data inputs at specified intervals and performs all the calculations, before sending outputs as DMX and API to the physical sculpture via 4G. This application assembles its script and runs wherever in the world it is fastest for it to do so, whenever it receives specific API data from the thermal imaging sensors. This API data isn't just a trigger, but forms part of the input within its run state as it polls the current state data held by the sculpture's PC. i.e. the stateless operations are performed on the fly by input memory states that it doesn't hold. Some advantages of stateless computing are that tasks can be processed:

> in any order on as many computers as possible instead of just on one, in order. From a cost and energy perspective, you're only paying for that specific time slice that your code is running for, as opposed to paying for a whole computer's worth of power for a week to do one tiny job for a second.
>
> Interview with Jourdan Templeton, 8th February 2019, see appendix B - EE

Whilst these operations can run anywhere on the internet that meets the requisite conditions, these servers still actually exist – although to the network there is no differentiation between physical tangible devices and virtual devices: "To a code running on a stateless environment it still thinks it's a traditional computer." Virtuality in this conception then, refers to "providing an interface that is the equivalent to a physical interface" (Templeton, 8th February 2019, see appendix B). For example, the data received by the Lightjams software that runs on a traditional computer inside *Tōia Mai,* cannot tell if that data comes from a physical input, or a virtual one:

> We initially created a virtual MIDI port to Lightjams. Lightjams for all intents and purposes believed that the signals it was getting were coming from a physical MIDI device, but instead they were coming from a virtual device that were written in software by what I wrote. So we defined the same interface as a physical device would provide. And because of that Lightjams didn't know any better. So it's all about that interface that we were able to make.
>
> Interview with Jourdan Templeton, 8th February 2019, see appendix B - JJ

In practice we didn't use a MIDI emulator but instead used DMX and API sets. This idea of virtuality as equivalent to physical interface bears some examination – interface in this instance refers to protocols of communication, where the receiving device is unable to determine the difference between virtual and physical inputs. This is because in traditional computing, digitality has always had a relationship to the physical through its binary operations – the on/off pulses of electrons through the resistors and transistors of processors. Similarly, stateless computing still has to run somewhere - it can't exist *ex nihilo,* from nowhere, out of nothing. What is different about stateless computing is that the program only exists when it runs, it doesn't hold any data in memory:

> Basically everything related to that job is distributed to the computers around, and only for that period of time does it technically exist. As soon as that code has finished executing, it's deleted and no longer exists.

Interview with Jourdan Templeton, 8th February 2019, see appendix B - FF

Within a traditional concept of computing, data exists within memory in temporary or non-volatile states. Temporary or volatile memory is that memory which exists only for the duration of the power cycle, non-volatile memory is more permanent and can be held by the processor or external devices such as USB sticks et cetera. Whilst memory is updatable, it is finite within the mathematical operations made possible by the regulation of the processor's clock. Potentiality exists within the structure of possibility spaces, as co-constituted by a homogenised standardisation of time. A clock that ran irregularly would be unpredictable, and because computers are designed to be predictable, unpredictable clocks are not desirable. The logical operations of computing are not inherent to digitality per se, for if the clock was random or in the case of quantum computing not predictable all the time, then the relational emergence of phenomena can be informed by the unknown, and the unforeseen:

> … two thirds of the time we'd know what's going on because the qubit can be all off or all on or both on and off. So there is an aspect which we've done unintentionally, yes. We may actually figure a way out to understand how to use a qubit. And that would make it a more efficient clock. Or, possibly because it can't be controlled and it makes a terrible clock.

Interview with Jourdan Templeton, 8th February 2019, see appendix B - XX

Contemporary computing is rather less interested in emergence, than it is with *control*. Much like Heidegger's tool-being and the associated concept of readiness-to-hand,

computing's purpose exists within the orbit of humans. Operations are conceived as being rational, which is to say, they are designed to be tools as extension of the mind. Considering digitality as materiality, however, requires a renegotiation of what digitality as co-constituted phenomena might be. For instance, designing a situation where chance encounters generate external data input that is able to exceed the original parameters of a program:

> Now some of the things you store in memory can also be operations or additional code. Now what can happen is what's called a buffer overflow which is where another program overflows its assigned memory into the space of another program. Now if you have a buffer overflow program into another program and you overwrite that space that the other program is using with some new code, that program will execute that code. So there is the potential for an external input to override the instructions that a program would expect to run. And it would modify its original design.

Interview with Jourdan Templeton, 8th February 2019, see appendix B - QQ

In such a situation, relational emergence with the unforeseen is possible. It might not be intelligible to humans, but it exceeds the original conception that digitality is entirely rational. The in-itself of the digital may be no more knowable, but this doesn't preclude digitality as being, nor the potential for it to exceed probability.

If then, we are to have a direct material engagement with digitality, *being-with* must also acknowledge *with-being.* The concepts of ako and whakapapa enable an understanding, not of 'reciprocity' or 'genealogy', but of a performative understanding of reality that always acknowledges the unknown and unforeseen. As Barad puts it, "we are part of that nature that we seek to understand" (Barad, 2007, p. 26). This does not sit well with a realist desire that positions the *knowability* of nature, which aligns with the Cartesian and Kantian constructs of human exceptionalism, as well as an inherent discrete individualism. Delanda's irreducibility of parts in his conception of virtual diagrams as part of assemblages, follows this realist position. I contend then, that 'Western' realism is not just posited on human exceptionalism that takes for granted Kantian a priori postulates of time and space leading to logically derived absolutes, but that such logics are founded on the notion that 'things' are distinct entities in the first place. Where this becomes problematic for Western speculation is precisely at the threshold of digital materiality – not just the notion that the digital and the material are in continuum with each other, but at the interstices of the virtual in relation to the real. For if 'things' are mutually co-constituted emerging phenomena, then what is their

capacity, or disposition, towards the trends of a collectivised complexity? Potentiality cannot just be seen as the possibilities within a possibility space, or even an unfolding towards the registering of an event, as both these conceptions rest on the predicate of the 'real' as an independent, fixed tangibility. The notion of immanence assumes a static conception of time fixing a moment of existence, and in this conception operates in a chronological mediating fashion to temporalise spatiality so that phenomena are instantiated as events. Relationally emergent phenomena is however, continuous and complex, with its own tendencies and dispositions and is always in relation to the unknown and the unforeseen. The performativity of phenomena cannot be conceived of as being individual or discrete, for it is not bounded within some finite set of possibilities. Potentiality must be conceived as constantly changing, always 'in relation' rather than 'of' or 'in' a state of being or not being, rather it exists within both or neither.

The Māori concept of mauri has been ignored by many Western philosophers, as if indigenous spirituality has to conform to culturally informed notions of being ethereal and substanceless, or be summarily dismissed as savage superstition. It seems particularly strange that Māori spirituality has been ignored, given that Kantian sensible concepts privilege other forms of substanceless events such as Ideas, time, and space. To what extent then, does mauri relate to potentiality, particularly within a performative and worlded understanding of the universe? The presumption that the universe is knowable is culturally informed, and to consider otherwise is at the very least open to having an uncertainty towards the claim that humans alone can escape their finitude. Such uncertainties are encapsulated within a Māori metaphysical framework which acknowledges the hidden and unknown to humans as having active participatory roles within unfolding phenomena. What then, might this mean in relation to *Tōia Mai*, and to what extent might it disclose itself to us?

So whilst Delanda and Meillassoux are united in their pursuit of realism, neither they, nor to a lesser extent Bennett and Stern, identify how their mathematical and logical methods are predicated on Kantian shared sensible concepts relating to time and space. Delanda for his part simply ignores the way by which his reference to Deleuze is informed by Kant, whereas Meillassoux actively evades the Kantian correlation between thought and being through positioning virtuality (facticity) as a non-necessity of virtuality. In either instance, they display a lack of cultural self-awareness, or possibly a form of arrogance, through their insistence that humans alone can logically determine the conditions of objectivity. The privileging of these mathematical and logical relations over experience fails to account for phenomena which are complex, nonreplicable, or arising out of the unknown. In a performative understanding, such logicities can be co-constitutive of emerging phenomena. This is not to position them as some form of

magical thinking, for as Barad (2007) argues, “concepts do not have determinate meanings” whereas a performative understanding of objectivity is possible as replicability, when the apparatus is acknowledged as an actant. Consequently, mathematical and logical realisms must be identified as forms of Western cultural practices that are co-constitutive, but are not separate from, phenomena.

These understandings have far-reaching implications for understanding potentiality, digitality and aesthetics. In complex situations, particular trends in potentiality relationally emerge as an actant that I call *Pull.* This understanding of potentiality does not rely on Kantian sensible forms, but is informed by Baradian notions of indeterminacy and following Mika, worlded understandings of revelation. When virtuality is informed by this understanding of potentiality, then digitality and materiality are extensions of each other rather than positioned as either being present or absent of material form. Finally, understanding objectivity and potentiality as being culturally informed makes a re-evaluation of aesthetics possible, whereby the making of meaning is not solely the prerogative of humans. What is known as ‘Art’ must now be considered in relation to nonhuman agencies, and in te ao Māori, this has particular relevance to understanding taonga and how they relate to mauri.

Confluence: Where rivers meet

A confluence is not the same as a convergence, in the same sense that it is used by Jenkins (2006), who argued how different types of media and practices might combine into more singular and encompassing types of media formats. In a confluence, currents retain their characteristics to an extent whilst also combining to become something else. *Tōia Mai* is a confluence: co-constituted by the meeting place of multiple currents, continuously being fed by that which came before, and continuously emerging anew.

To a casual visitor *Tōia Mai* appears completed, whatever happened during its creation has been rendered invisible so that one simply encounters an object standing on the riverbank. Perhaps if interested, people might seek to learn more: how it was made, the processes involved, some perusal of relevant 'history' about the place, people and other similar 'facts' associated with the work. So much lies hidden beneath the surface, undiscernible, with its emergence and continuing evolutionary processes evading any totalising account. Perhaps now that its physical tangibility provides a humancentric tactile experience familiar to so-called mainstream 'Western' cultural values, its current manifestation is finally validated. But it is not as simple as this and never has been, for under this veneer resides a continuously intra-active assemblage that *Pulls* towards particular currents, tendencies, capacities, towards illusions of stability.

Digging deeper, it appears there may be some affinity between its initial processes of production and those typically ascribed to filmmaking. There is a certain conglomeration of technical proficiency and an aesthetic sensibility that is sometimes described as 'the technical aesthetic', a term some filmmakers employ to describe how technology and art, work together in the production of their medium. As a former filmmaker who still teaches moving image technology practices to tertiary students, this might seem a logical conclusion. Similarly, socio-constructivist accounts might emphasise the agency of human participants, or scientific rationalists could highlight its measurable milestones and material requirements. As a departure point, it seems reasonable to suppose that a film production model might provide access to the idea that an object is a semi-stable manifested assemblage of continuously emerging phenomena. For instance it could be said that like a film, *Tōia Mai* started off with a cardboard model which acted in a similar in function to that of a synopsis, whereby interested parties quickly gained an impression of the initial concept. The finalised 3D CAD drawing operated like a completed script, providing a 'blueprint' from which preproduction could start. Acting as the designer, producer, production manager and director, under my 'vision', multidisciplinary teams were coordinated to produce a finished work.

Such a description would be misleading, for it rests upon ideas of art as media, of materiality as mediating between subject and knower, of an aesthetics predicated on knowing the right codes, conventions and reified historicities, which provide privileged access to what is 'really' going on. This approach reiterates the notion of a singular, inspired artist, in a similar fashion to a film auteur, and concretises the ephemeral aspects of the process into a representational mode or an abstracted intellectualism. In doing so, this description completely elides the foundational kaupapa, assimilates the nonhuman as dumb and/or inert Other, colonises emergence into a narratological structure and minimalizes, regulates, and renunciates the role of chance, as causality.

By understanding *Tōia Mai* in terms of relational emergence, the performativity of matter and how matter comes to matter across the tangible-digital spectrum, by acknowledging ideas, beliefs and spirituality as having independent and co-constitutive agency within continuously evolving phenomena, is to have, at the very least, a scepticism towards 'media' as 'that which comes between' as a foundational concept. Barad's call, for an "*ethico-onto-epistem-ology* - an appreciation of the intertwining of ethics, knowing, and being" (Barad, 2007, p. 185) is perhaps a place to start, inasmuch that it seeks to re-join ontology with epistemology. Yet Barad's understanding of media culture is limited to her critique of Cartesian-informed representationalism, which makes her susceptible to critique from those who might posit after Baudrillard (1981), that with the advent of simulacra and the virtual image, it is no longer possible to determine between the real and the unreal. For whilst Barad identifies that performative approaches do not "come from standing at a distance and representing but rather from *a direct material engagement with the world*" (Barad, 2007, p. 49), this does not fully engage with all that representation accesses in terms of simulation, spectacle, conceptualism, minimalism, et cetera. Further critique is beyond the scope of this research, but may prove useful in the future.

Similarly, like the supposed neutrality of scientists performing science, there is a tendency amongst technologists and technology theorists to regard technology as somehow being neutral. It is typically conceived of as being an extension of the will, without its own agency, often something that is held in the hand or with an inherent reference to labour, particularly with regards to making certain tasks easier or quicker. Materials are usually positioned as dumb and inert matter, with innate properties that can be manipulated into shape if only one has the right tools and abilities. Again, 'man' as individual, exerts 'control' over the environment. If *Tōia Mai* provides a case study by which to explore how co-constitution, performativity, and material agency might inform notions of technology, it is not surprising that identifying technological processes

as culturally specific practices might receive short shrift on the factory floor, or indeed with technologists per se.

Apart from the typical ‘Western’ belief that ‘Western’ culture is not a culture – a topic that is beyond the scope of this paper to fully explicate, the creation of *Tōia Mai* encountered difficulties within those domain cultures where technology is part of industrialised processes. For example, as an artist walking into a trades domain, the most frequent attitude encountered was one that either directly or indirectly articulated that art and artists are something of a joke, or conversely, positioned as being able to provide some form of ‘magic’ solution. The trades domain usually operates in a fashion where particular tasks exist as dependencies within critical pathways to other tasks. In order to keep costs to a minimum, ‘industrial processes’ require prototypes to be completed at the outset, so that production can begin in a linear manner thereafter. The idea that an art practice interested in exploring experimentation as improvisation, particularly one with several conceptual changes occurring within a short time frame, was not thought particularly practical by my trades colleagues. Perhaps this was because they are used to building houses or cars, which reduce costs through assembly line approaches, where project managers coordinate teams in order to produce a predefined output. Within the creative industries however, e.g. filmmaking, there is a different culture which tries to accommodate a greater degree of fluidity throughout the production process. To some extent it is true that films will not fall on somebody or otherwise physically damage them should they fail, this being the most common explanation as to why experimentation during production should be avoided. The dominant attitude towards technological experimentation, both in relation to physicality and fiscal implications, is therefore one of risk mitigation.

And yet I was constantly being reminded by my trades colleagues, that they needed to adapt to a world where ‘disruptive’ technologies were challenging their long-established practices. In their eyes, my role was to come up with ‘something innovative’, without having to change anything themselves. I was told that trades required shapes to be formed out of variations of “rectangles, circles, and triangles” (personal communication, Raymond Hall, 14th April 2017), as if the complex curves that can be cut out of sheet materials using waterjet, laser, and CNC processes didn’t exist. That graphic designers with no trades training could export design files to these industrial cutting machines was, at best, deemed offensive. Whilst designers are not typically familiar that folds or cuts also occupy material space, opportunities for these types of conversations were extremely limited. There was also an expectation that making a waka sculpture would not require trade staff or students to engage with the production management, despite their superior technical and practise-based understanding. Their general expectation

was that they would be given instructions, turn up at appointed times, do their work, and leave before 4 p.m. Communication between practitioners or the project manager was not seen as a priority, nor was turning up to appointments on time, nor reading supplementary material that might inform them about other parts of the project. Along the way decisions were made without consulting me, as if I was incapable of understanding, or it was not considered expedient to include me in the decision-making process. To those working in this culture it was self-evident that I lacked techne or skill in the requisite technologies, and so would have to negotiate with those who did. Simultaneously, my trades colleagues were continuously under pressure to maintain their technological currency in an efficient manner. There was an inherent tension between needing to change and a culture of 'business as usual', with assumptions about 'what works' is 'tried and true', whereby learning new approaches becomes deferred in order to save time. In summary, the technology–heavy domain of my trades colleagues was one where long-established cultural practices ensured an inflexible approach, a situation that finally eventuated in not working with them.

Perhaps there was always going to be a difficulty where certain domain cultures are also heavily immersed in wider cultural presuppositions. The kaupapa of the project sought to embed Wintec's Māori achievement capability framework into real-world learning through multidisciplinary and collaborative practice, but I would be surprised if some of my mainly Pākehā trades colleagues knew how to spell 'kaupapa', let alone knew what it entailed. Knowledge of Māori culture by them was particularly low, despite over 25% of their students identifying as Māori. (Wintec dashboard, 2018). For instance, at the initial whakawhanaungatanga (literally: 'to become like family') barbecue held at the trades campus in early 2017, one of the Pākehā technicians gleefully demonstrated their new 3D printing machine by throwing up and down into the air like a ball, the exact replica of a recently scanned human skull. Even a cursory knowledge of Māori culture would have informed this person, that the head is tāpu (sacred), and that this action in public would, as one of my colleagues described it, make many Māori feel 'extremely queasy'. Unlike the other domains involved at the start – media arts, early childhood education, IT, and engineering – my trades colleagues were particularly resistant to wanting to engage with *how* things were done, focusing instead on *what* the result would be - arguably an important distinction when attempting to be guided by a kaupapa Māori methodology. In summary, my trades colleagues demonstrated very little understanding about what practice is, concentrating instead on rather fixed ideas of what being 'practical' is.

To return once more to a comparison with filmmaking - like film, *Tōia Mai* has involved the collaboration of many people from across multiple domains, required calculated

risks and improvisation during its process, and has tended to go over budget. And yet its production process is not all that *Tōia Mai* is, for it does not seek to be encountered by passive viewers but rather by participants, who are at the very least, visitors. This is not just because of its interactive features, but because as architecture it cannot be viewed in its entirety in a proscenium arch fashion. Not that its participants need be specifically human, as the only requirement to initiate different sound and lighting changes is that they emit enough heat to register on the thermal imaging sensors. *Tōia Mai* also does not attempt to present a narrative in the same way that a film genre might operate, but it is still capable of storytelling through implicating its participants into the field of its relations. Nor will it always have the same sequence every time it is visited, for there is no 'ideal position' with which to engage with the work. Instead participants bring with them their own expectations and partially complete the 'loop' between actants through their actions.

Embedded within cultures of technology are assumptions about logic, as if, like objectivity, logic is capable of rendering forth a better or more desirable truth. Yet there are many types of logic, just as there are many types of truth. Typical claims are located in relation to efficiency, a term grounded in interrelated notions of paid labour hours, ideas about process, energy expenditure in relation to identified benefit, the size and proportions of one's body in relation to a tool, et cetera. Rarely are these conditions considered as being actants which might exert some agency within the field of relations. Both logic and efficiency are situated within what might otherwise be described as the realm of ideas and beliefs, and yet are not typically considered within 'Western' culture as being types of cultural practice.

A good example of how logic and efficiency are co-constitutive parts of a type of cultural practice, can be found during a time when *Toia Mai* inexplicably stopped working. During New Zealand's fourth hottest summer on record, the PC inside shut down, and could not be remotely restarted. Access was therefore required through its bottom hatch, which has approximately 30 security screws. On three separate occasions, three separate council employees approached the problem of removing the hatch, by what each of them described as being in the most logical manner. The first began at the top, and in a clockwise fashion removed each screw in a linear process. This resulted in the weight of the circular hatch, which is curved through two planes, resting on a single screw that it did not want to come undone. When he put it back on, he did the same thing in reverse, which resulted in the circular hatch shifting in a circular fashion so that each screw was slightly off-centre from its original thread. The second employee was happy to be helpful and asked a lot of questions about the sculpture in general, but was less focused on the mundane task at hand. Taking a

cursory glance at the hatch, he cheerfully removed the top screws first and worked towards the bottom on both sides. This technique resulted in the maximum gravitational weight of the hatch resting on its bottom edge so that it became a fulcrum, which began to pull out the bottom screw. Watching over his shoulder, I quickly suggested that he should replace the screws at the top to prevent this from happening. The third employee was in a hurry to complete the task before he finished work for the day at 4 p.m. and as he considered the hatch to be like the wheel of a car, the screws were removed in an alternating zigzag fashion. His haste resulted in breaking the tool used for removing the screws, scratching the hatch's surface, and shifting the weight onto a screw on the left whereupon it stuck fast.

Is there one, most efficient way, to remove the hatch? I rang up Jemoal from Longveld, who suggested that all the screws should be loosened off first, before removing in a fashion that allows the topmost screw to be the last screw removed. We discussed the possibility that the sculpture might've moved due to the current temperature, and that having suffered the previous three attempts, the threads of each screw had begun to realign themselves, wear out, or become cross-threaded. This example is not a refutation of logic, it simply illustrates how each of these very capable people held that their approach was the most logical way to remove the hatch. Jemoal's suggestion could be turned into a protocol that council employees are asked to follow in future, or alternatively, it might be considered that there is no 'right' way but simply the current situation as it presents itself at the time. By considering how events and ideas are actants, then the repeated removal of the screws wearing their threads, overzealous tightening, the temperature on the day, humidity, how close it is to knock-off time, and the size of a person's hands in relation to the smallness of the screws, can all be accounted for. Therefore there is no idealised form or perfect way that can be attained in practice. There are always variations, circumstances beyond control, aspects of phenomena that evade uniformity in some way or another. Another example is the unknown tremor that affected the waterjet machine that cut out the Tāniko pattern. This resulted in an irregular and unforeseen shape visible at around eye height. Combined with different understandings as to what 'logic' is, or should be, there are a multitude of influences continuously at play; a veritable confluence of actants, all in tension with each other. Technology is far from neutral, for there is no subject–object distance, rather there are forms of practice with agentic actants, which may or may not meet replicable expectations depending on what else is going on.

If locating *Tōia Mai* as an artwork is somewhat problematised by a metaphysical representational apparatus grounded in Cartesian or Kantian preconceptions, then an art philosophy approach that considers it in relation to the so-called 'speculative turn' is

equally difficult. If, in general terms, the aim of Speculative Realism is to be able to access the world in a non-correlational manner, then humans as actants are either in absentia or ontologically flattened along with everything else. A 'speculative realist art' seems therefore, somewhat redundant:

> Given contemporary art's cultural privileging as the site of negotiation between the conceptual and the sensory, it is understandable that it should have played host to the convergence of SR and aesthetics. Yet such an alliance is puzzling when one considers what SR might bring to this negotiation, in so far as its primary selling point (according to the popularly diffused credo) is its dismissal of the mediating role of human experience. Indeed, if this 'movement' is concerned with wresting attention away from the primacy of intuition and interpretation, it could be (and has been) construed as an anti-aesthetic tendency.
>
> Beech, 2013, p. 1

It is both Speculative Realism's re-engagement with Kant's transcendentalism as a universalism *and* Cartesian-informed notions of materiality as media, that makes situating *Tōia Mai* as art practice, difficult. If 'new materialism' is less concerned with correlation, then it at least begins to provide an access point to art as a form of continuously emerging phenomena. It recognises both human and the nonhuman as actants, whilst also acknowledging the unknown and mysterious as co-constituents:

> the human tendency to understate the degree to which people, animals, artefacts, technologies, and elemental forces share powers and operate in dissonant conjunction with each other. No one really knows what human agency is, or what humans are doing when they are said to perform as agents. In the face of every analysis, human agency remains something of a mystery. If we do not know just how it is that human agency operates, how can we be so sure that the processes through which nonhumans make their mark are qualitatively different?
>
> Bennett, 2010, p. 34

So what is meant by this term 'agency'? In post-Kantian frameworks that emphasise human exceptionalism, agency is usually positioned as a quality belonging to humans in relation to matter, which by contrast, is dumb and inert. Any posthumanist conception will require a reassessment of what agency *is*. It seems somewhat absurd to attempt to relate it to notions of 'free will' or consciousness, and yet despite the

ubiquity of the term there seems to be few attempts to provide a definition. One definition in relation to emergence, comes from neuroscience:

> Agency requires a degree of autonomous action coupled with a goal-seeking mechanism that steers the behaviour of a system in pursuit of particular goals. Agency here thus denotes any goal seeking system, from organic, life-like organisms to secret agents, robots, and software systems.
>
> Cariani 1991, in Salter, 2015, p. 140

Cariani's interest is not an art, but in cybernetics – which explains the intentionality of purpose that underpins his definition of agency. And yet, must agency always be in relation to intentionality? It seems that the mysterious and the unknown must here be subsumed in relation to whatsoever the 'goal' is. Perhaps the difficulty is, as Bennett identifies, with linking agency to notions of causality where the Kantian subject position of humans is one that exerts their will over the universe. If the agency of materials are conceived as being "lively and self organising, rather than passive or mechanical" (Bennett, 2010, p. 10), then the emphasis shifts from conceptualising actants as being singular and isolable, towards understanding them as partial, modular, and open-ended. In summary, more akin to notions of assemblages:

> Alongside and inside singular human agents there exists a heterogeneous series of actants with partial, overlapping, and conflicting degrees of power and effectivity.
>
> Here causality is more emergent than efficient, more fractal than linear. Instead of an effect obedient to a determinant, one finds circuits in which effect and cause alternate position and redound on each other.
>
> Bennett, 2010, p. 33

Rather than vacate humans from phenomena, Bennett's vibrant new materialism employs an understanding of agency that acknowledges indeterminacy, where 'actants' are not discrete and self-contained and where there is no need for a human 'knower'. As such, an interactive art informed by Bennett's notion of agency acknowledges humans, but does not require them.

Similarly, Barad's agential realism seeks an objectivity based on replicability, but makes no claims on non-replicability with regards to unfolding phenomena. As such, an agential realist art might be possible. Either approach begins to acknowledge the collapse of the humanities/science binary that has dominated previous disciplinary discourse. As a Pākehā attempting to be guided by a kaupapa Māori methodology, it is

not unusual to encounter a worldview where the boundary between human and nonhuman is less than distinct, or that:

> Within a Māori ontological frame, all beings and objects are experienced as having mana, a form of presence and authority, and a 'vigour, impetus, and potentiality' called mauri (Durie, 2001, p. x). Te mauri o te whenua, 'the life force of the land', or te mauri o te tā moko o Hongi Hika, 'the life force of Hongi Hika's moko' on [a] paper deed, are perfectly mundane ideas to Māori. Terms such as mauri and mana name the interconnectivity of the human and non-human worlds.
>
> Hoskins & Jones, 2017, p. 52

If this investigation began as an exploration of relational emergence through experimentation as improvisation within art practice, where then, is the art? The typical Western privileging of the artist appears to have become another relational actant, within the shifting ebb and flow of what can only be described as a confluence – a convergence of influences, pulled along at different levels and velocities. Less of an artist than a producer, a designer, and more than anything, a wrangler, of forces not at all within my control. What also becomes apparent when working within te ao Māori, is that understanding these relations – whakapapa – in all its many layered conceptions, is not just an appreciation of cosmology, but an essential requirement for humans within an interconnected universe:

> Creation accounts are the foundations upon which Māori of the Pacific have built a cosmological, religious philosophy and metaphysics. They are the bases for a Māori philosophy of vitalism, the idea that in all things in creation, with a material or nonmaterial, there is a life that is independent of the thing itself, and there is an original source of life itself.
>
> Hēnare, 2015, p. 81

To understand the relational emergence of *Tōia Mai* is to also have an appreciation of its whakapapa: Not simply in terms of its material conditions for existence; the mātauranga Māori that informs it; the interweaving of people, places, and philosophies; the agentic capacities of politics, policy, and *Pull*; the spiritual dimensions it accesses; the roles of chance, luck, and happenstance; but *all* of these layers, relations, and influences. So whilst not claiming correspondence, there are synergies and parallels between 'contemporary' materialist vitalisms, and Māori conceptions, where "vitalism is expressed in a number of terms in Māori and constitutes an assembly of life forces:

namely *tapu, mana, mauri,* and *wairua*" (Hēnare, 2015, p. 84) [italics in original]. As an art practitioner schooled in Kantian and Cartesian thinking, there's an obvious difficulty in trying to understand Te Reo Māori kupu (words), and not simply because transliteration is imperfect, but because the metaphysical framework is completely different. In attempting to understand this relational and agentic worldview, it quickly became apparent that notions of reciprocity are not 'nice to have' ethics, but as *an essential part of being part of an interconnected universe.* Engaging with *mauri* as "a life force" (interview with Tame Pokaia, 12th December 2018, see appendix B - T), was not to find some academic definition, but to unexpectedly come face-to-face with a shared reality staring back. Sitting in *Te Kōpū Mānia o Kirikiriroa* with Tame talking about the stone imbued with mauri that he buried under the wharenui, caused me to remember the sensation of encountering the mauri stone of the previous whare, *Te Kākano* (The Seed), some 27 years earlier when I had been a nursing student at Wintec. It's very hard to explain that experience on a page, part of the difficulty comes from attempting to concretise into written form what can only be described as existing within the spiritual domain. Yet here I was trying to ask Tame for some clearly defined demarcations between mauri, wairua and hā (life-breath). What will I say when someone asks me about the mātauranga Māori that is so intimately entwined with *Tōia Mai*? I have been privileged to have shared with me such knowledge, and consequently have a responsibility that comes with that knowledge. For as Jones (2017), puts it "such gifts form a debt that the recipients cannot avoid" (Jones, 2017, p. 189). Similarly, concepts like kaitiakitanga (stewardship) acknowledge the reciprocal relations between spiritual and physical well-being:

> humans are stewards endowed with a mandate to use the agency of their *mana* (spiritual power, authority, and sovereignty) to create *mauri-ora* (conscious well-being) for humans and ecosystems – and this commitment extends to organisations.
>
> Spiller, Pio, Erakovic, & Hēnare, 2011, p. 223

As the above authors note, much of Western thought has been predicated by Descartes' 'I think therefore I am' which has "precipitated a philosophy that asserts primacy of the individual." (Spiller, Pio, Erakovic, & Hēnare, 2011, p. 223) Understanding reciprocity within the relational worldview means that as an artist, I have *a* role within the collective, but it is not *the* role.

To place these different vitalisms side-by-side, is not, as stated above, to claim any correspondence between them. Bennett (2010), for her part avoids any connotation of a spiritual aspect:

> What I am calling impersonal affect or material vibrancy is not a spiritual supplement or "life force" added to the matter said to house it. Mine is not a vitalism in the traditional sense; I equate affect with materiality, rather than posit a separate force that can enter and animate a physical body.
>
> Bennett, 2010, p. xiii

Similarly, researchers such as Hoskins & Jones, "do not attempt to ask whether mauri or hau are 'the same' as thing-power." (Hoskins & Jones, 2017, p. 57). If then, by Tame's conception, nonhumans also have wairua and hā, (interview with Tame Pokaia, 12th December 2018), what becomes problematic in terms of potential parallels with 'new' materialism, is the realisation that the distinctions between human and nonhuman, life and 'life force', matter and ideas, are from my own Western metaphysical framings. For if "life itself cannot be reduced to matter or form, and in Māori thought, life itself is independent of form" (Hēnare, 2015, p. 84), then both Bennett and Hēnare have the capacity to resonate with each other. And as Tame reminds me, "mauri could be just a physical making but not connected necessarily to a wairua [spiritual connection]" (interview with Tame Pokaia, 12th December 2018, see appendix B - U). So what Bennett calls 'life force' sits within a particularly narrow definition, and elsewhere she describes vitality to mean:

> the capacity of things – edibles, commodities, storms, metals – not only to impede or block the will and designs of humans but also to act as quality agents or forces with trajectories, propensities, or tendencies of their own.
>
> Bennett, 2010, p. viii

Somewhere between "trajectories, propensities, or tendencies" and "life force" there appears to be an *apparent synchronicity* between these different metaphysical worldviews, with the potential to recognise each other like long lost cousins. For as an artist attempting to work within a partnership model, I too have attempted to:

> find ways to allow these traditions to 'work' in our work. Indigenous and new materialist ontologies come face-to-face, recognising the other, engaging maybe in an exchange of hau, breath.
>
> Hoskins & Jones, 2017, p. 57

Unlike much of what has been described as 'interactive art', *Tōia Mai* is not a strictly programmatic experience – there is no 'right way' or 'if this, then that' approach required. Rather, much of the interaction between actants is hidden from humans, who

in many ways partially complete the loop between nature and themselves in a fashion where they may not be completely aware of what is going on. This emphasises a sense of ‘magical’ encounter that is simultaneously familiar and unfamiliar, as if entering a space “marked out for it, either materially or ideally, hedged off from the everyday surroundings” (Huizinga, 2014, p. 19). In part, this was enabled through a conscious consideration of the architectural space of a marae, using Wintec’s *Te Kōpū Mānia o Kirikiriroa* as an exemplar. It was also informed by a walk-in interactive installation that I had co-designed in consultation with Tame Pokaia, called *He whare kōrero, he māramatanga* (2015). As an urban marae, *Te Kōpū Mānia o Kirikiriroa* replaces the significant tūpuna (ancestor) figure who typically forms the body of the whare (house) with a transparent ridgeline to refer to Ranginui, ancestor to all people. *He whare kōrero, he māramatanga* also did not refer to a significant tūpuna figure either, but was designed so that participants gained the sense of encountering te ao Māori through designs painted on the maihi (barge boards), by the artist Zena Elliott. Like these two examples, *Tōia Mai* stages and frames expectations for visitors by having designs such as the niho taniwha and Tāniko patterns and by using taonga pūoro for its sound. Also like a marae, *Tōia Mai*, has an extremely small marae atea - this being the area immediately in front of marae that enables visitors to transition from their everyday selves to become in tune with the spiritual domain that they are now entering. *Tōia Mai* achieves this by the use of transitory zones and a narrow entrance way. The furthest zone from the entrance causes the Taniwha lighting to fade away and to trigger the exterior eye-patterned lights. The middle zone triggers the transition atmospheric sounds, whilst the nearest zone causes the eye-patterned lights to fade out and for the sound to transition into an appropriate star mode soundtrack. The process of encountering *Tōia Mai* is one whereby lights flash on, and as someone passes the threshold of the entrance way, they are temporarily plunged into darkness before a niho taniwha lighting hatch activates. This light and then dark sequencing evokes a marae atea space, prompting visitors to slow down as they enter the interior of the sculpture.

One starting place to situate *Tōia Mai* as artwork, can be found in relation to the way in which it uses weather and terrestrial data as part of its ongoing manifestation. A comparable artwork of this nature is Rachel Shearer’s *Wiriwiri* (2017), which transforms the rays of the sun into a continuously changing sonic composition. The title refers to the quivering hand movement commonly used in Māori performance. It acknowledges:

> Tānerore - the shimmering heated air rises from the ground on a hot summer day, personified as ‘te haka a Tānerore’ (the dance of Tānerore). Wiriwiri is to tremble, shiver, quake. This gesture resonates

> in an idea of vibration at the core of the material world that is performed in this work is a field of trembling sound.
>
> Randerson, 2018, p. 99

Like *Tōia Mai,* this work uses a nonhuman actant to produce continuous variations. *Tōia Mai* achieves this in the lighting design, and to a limited extent through the determination of which star mode is in operation. *Wiriwiri* on the other hand uses the sun to inform its audio. The system:

> consists of a photovoltaic system powering digital audio playback, reproduced through two suspended speakers. The photovoltaic system, via electronic processing, oscillates the volume levels in response to variable intensities received from the sun. More heat, more light, more noise.
>
> Randerson & Shearer, 2017, p. 77

Like *Wiriwiri*, *Tōia Mai* is situated at the interfusion between the spiritual and material. It too has a relationship with continual movement, although with less of an explicit reference to vibration and more of a dynamic engagement with environmental data values, thermal sensing, and emergent lighting patterns. The sound for *Tōia Mai* is less emergent, activating or deactivating one of four soundtracks for each of the seven star-modes. Each star-mode is determined by an artificial intelligence engine that polls approximately 100 environmental and seasonally adjusted modifiers, as activated by the presence of heat emitting creatures, or sometimes by the bounce back from the earth on an extremely hot day. Once determined, movements and environmental data for each star inform the lighting changes for the LEDs in relation to their colours, velocity of animated changes, luminosity, and intensity. Similar to *Wiriwiri*, the organising principle is located around waveforms, which exist in sound, light, water, and heat.

According to Tame, mauri exists “in all things”. Similarly, the artist Rachel Shearer evokes mauri as inherent to *Wiriwiri* through vibration, where it is:

> a life force that imbues the material world binding our listening to metaphysical realms. The conceptual loop of vibration as matter as sound as vibration, and the presence of mauri permeating all elements of this process, as presented here is a sonic imagining of the sound of Tāneore’s shimmer.
>
> Randerson & Shearer, 2017, p. 77

There will be those that might say that as a Pākehā artist, I have no right to speak of the mauri of *Tōia Mai*, for I am not qualified, as I am not an indigenous person. So I'll do no such thing, rather I'll refer them to others who talk of *Tōia Mai* as having mauri, of being a taonga. (For example, see: https://www.facebook.com/tainuiwakatourism/videos/2267760933236154/ as posted by Tainui Waka Tourism Inc., Retrieved 10th March 2019). This makes my own position as 'the' artist somewhat precarious, for when I hear Tame Pokaia or Hera White refer to *Tōia Mai* as a Māori artwork, my own artistic agency slips beneath the surface, back into potentiality. And yet, was this not part of the kaupapa? To acknowledge Māori ways of being and doing is not to simultaneously attempt to assert my own distinct individuation, but to work as an active participant within our partnership.

As an exploration of relational emergence through the making of an artwork, what becomes apparent unfolds itself from an otherwise hidden co-constitutive ground. 'Ground' here, is not that which is typically understood from a typically Western tradition, as something to stand on, or as a foundational base of rational laws of cause and effect. Instead, as a Pākehā attempting to be guided by a kaupapa Māori methodology, I perhaps catch a glimpse of a ground that Mika describes as "something that we can reflect on but remains ungrounded (unknowable) to the extent that we do not have complete access to it through thought." (Mika, 2017, p. 127) For enfolded within the relationality of *Tōia Mai* emerges those aspects which have been, and will always be, unknown to me. This possibility sits in stark contradistinction to the underlying assumptions of the speculative realists and their re-engagement with Kantian transcendentalism - that the universe is intrinsically knowable. Within an intercultural hyphen conception I return then, to the notion of a wrangler, or perhaps, a steersman attempting to steer a boat made from the very currents from which it is constituted. There is nothing to stand on, so I must learn to be part of the boat.

To consider *Tōia Mai* as taonga is to acknowledge its inseparable mauri, which I as Pākehā am scarcely aware of. When I visit *Tōia Mai* now and watch how people engage with it, see some pray, or others leave offerings around its base, then this is not that which was made in an engineering workshop nor as a refinement of my imagination, but something else entirely. I am a stranger here, at best a visitor. This is not re-presentation or an act of an inscribed signification, instead there is an "ancient knowledge" (Rāhui Papa, personal communication, 13th November 2017) in force, which I have finally 'woken up to', like a dreamer dreaming a dream, discovering that it is the dream that is dreaming me. This is no ethereal conception of spirituality somehow distinct and separate from materiality, rather *Tōia Mai* as taonga brings attention to the way by which its objecthood is intrinsically relational:

> ‘the very partibility and motility of taonga… their “thinginess” within a general state of flux, is precisely what makes them indispensable to the work of relating.’
>
> Hēnare, in Barnett, 2017, p. 29

Once again, te ao Māori provides a framework which parallels ‘recent’ speculative enquiry, which otherwise exists at the intersections of Western philosophy, science and technology studies, and quantum physics, struggling to navigate around the constraints of its own subject/object predispositions. This is perhaps because there is traditionally no “ontological apartheid between persons and things” (Hēnare, in Barnett, 2017, p. 30), within a Māori worldview. It is therefore not surprising that *Tōia Mai* as taonga deemphasises my agency as human subject (Barnett, 2017, p. 30), for although I may be thinking and feeling in relation to what I might otherwise describe as ‘it’, from one Māori perspective, it is the taonga that discloses its “wairua, mauri, and mana that call me to feel and think them.” (Barnett, 2017, p. 30) Such a claim, however, becomes problematic across several fronts: Some Māori will say that a Pākehā will ‘never understand’ and should not attempt to; Western academia tends to privilege evidence-based research underpinned by the same subjective/objective distinctions under discussion; and there is the yet unresolved question of what differentiates taonga from art. Considering Western art’s tendency to consider the thing in-itself as informed by rationalist explanation, subjective representation and capable of affect only through some mediating substrate, then this does not account well for understanding taonga as “subjectless objects that call for conscious engagement, [which] perform and are performed.” (Barnett, 2017, p. 30) Perhaps Pākehā will never understand, due to a long enculturated liberal humanism which claims as virtue both individual agency and rationalist supremacy over materiality. Relationality is perhaps, as Barad claims, “onto-epistemological” (2007, p. 185), inasmuch *being is informed by how we think.* Culture is neither as interchangeable nor as essentialised as Western modernity’s universalist statements might proclaim, underpinned as they are by trajectories of an enlightened subject. In her discussion of Terri Te Tau’s *Unwarranted and Unregistered: Te Āhua o te Hau ki Te Papapaioea* (2015) Barnett argues that “*taonga* [have] the ability to fold ‘outsiders’ encountering it now (in an art-object) into its kōrero. Taonga are *always* weaving their connections.” (Barnett, 2017, p. 28) [italics in original]. Here *Tōia Mai* is both art and taonga, for by its very relationality is it determined *who* understands and who doesn’t.

Such a conclusion does not determine an either/or outcome. Considering *Tōia Mai* as an artwork within a field of relations that acknowledges unknowability as being co-constitutive of its unfolding phenomena, is to also acknowledge its own complex *Pull*,

the role of chance, synergy, and potentiality. What is required are distinctions between relationality and interactivity, particularly important when considering what is otherwise described as ‘interactive art’. Relational emergence is not the same as interactivity, which often posits an ‘if this then that’ logicity that co-constitutes the types of interactions possible in relation to the constraints or qualities of the technology logic utilised. As previously discussed, the logicity of digitality is predicated by a clock, which regulates potentiality as probability. Emergence occurs when potentiality exceeds probability, not by any logical combination of the known, but by its constant relation to the unknown. The universe is also not a mathematically closed system, as Meillassoux argues with Cantor’s theorem:

> take any set, counters elements, then compare this number to the number of possible groupings of these elements (by two, by three – but there are also groupings ‘by one’, or ‘by all’, which is identical with the whole set). You will always obtain the same result: the set be of possible groupings (or parts) of a set A is always bigger than A – *even if A is infinite.* It is possible to construct an unlimited succession of infinite sets, each of which is of a quantity superior to that of the set whose parts it collects together. This succession is known as the series of alephs, or the series of transfinite cardinals. But this series itself *cannot be totalized,* in other words, it cannot be collected together into some ‘ultimate’ quantity.
>
> Meillassoux, 2008, p. 104 [italics in original]

Meillassoux’s argument for the contingency of necessity rests on the way that probability is always exceeded by possibility, for which he argues via Cantor’s theorem that there is “at the very least a fundamental uncertainty regarding the totalizability of the possible” (Meillassoux, 2008, p. 105). The difficulty of conceiving of emergent phenomena within a Western conception is due to the co-constitutive logicity of a mathematics that renders numbers as static and fixed, a tendency that rests on the capacity of numbers to apparently chart time and space. This is what traditional Western understandings of what ‘inter-action’ rest upon - the charting of possibilities within a probability space, the absurdity of which can be demonstrated through Zeno’s paradox:

> Zeno’s infamous arrow flies through the air, but never gets to its target. For his arrow to reach the bull’s eye, it must first get halfway there; it must also get halfway to that halfway mark; and halfway to that, and so on. In fact, the arrow must move along an infinite number of markers –

> thus making it impossible to reach its goal. Of course movement does not work this way. To map out all the possibilities through which the arrow must travel in order to hit the mark is to see the arrow as only going between many static points, rather than as in motion. If this is the case, it only *is* when it *isn't doing.*
>
> Stern, 2013, p. 56 [italics in original]

Understanding emergence as a capacity in interactive art can be informed by Stern (2013), who argues for an understanding of interactive art predicated on the primacy of movement rather than on the fixity of possible positions calculated within a probability space. For him, "movement *is*, and positionality is always an *emergent quality* of that movement." (Stern, 2013, p. 60) [italics in original]. This conception of movement and positionality aligns with Barad's (2003) ideas of phenomena as emergent materialisation, as Stern argues in relation to performativity (2013, p. 61). Relationality to unknown possibilities outside of known probabilities results in a re-engagement with both emergence and potentiality. Stern, drawing on Massumi (2002), returns to the notion of a body as being always in motion and with a constant relationship to potentiality:

> This approach to the body also includes the folding in of what the body *might become.* Here is an incorporeal dimension to the body – a virtual and not-yet body that embodiment moves towards, in its moving.
>
> Stern, 2013, p. 56 [italics in original]

Potentiality here informs both emergence and possibility, not as mutually exclusive conditions but as a dynamic field where "the body is full of and producing potential: always potentialized and, through movement, potentializing" (Stern, 2013, p. 60). The best interactive art for Stern then, is one that stages 'the body' in its ongoing potentiality to be, including its "active relation to other forces, matter, and matter-in-process" (Stern, 2013, p. 57), in a way that implicates these active relations to other forces and matter-in-process in a continual process of becoming. Yet there is a strange elision at play here, for whilst he follows Massumi and argues for a metaphysic predicated on events rather than objects, Stern's implication of the nonhuman appears to be one-sidedly humancentric. For him, interactive art is an intrinsically human practice, albeit one that "has the power to frame and highlight events as they occur – to make them perceptible and felt" as achieved through a "technological rig" in order to create "event-spaces" (Stern, 2013, p. 74), as "situations" which enable the "potentialization of a context" (Massumi 2002, in Stern 2013, p. 74). Whilst it could be argued that this is precisely what occurs with *Tōia Mai* for human participants, the

technological rig also enables potentialised interactivity within the context of the artwork for nonhuman actants as well e.g. heat emitting creatures, the wind, temperature, humidity, et cetera. Considering art as being an activity beyond the realm of the human is beyond the scope of this research, but this situation does open up some interesting questions: Does the implication of the nonhuman through technological rigs require a human interpretant? Barad would argue otherwise, as would a number of practitioners in the field of artificial intelligence. Similarly, the trajectory of this question opens up possibilities within a paradigm that acknowledges unknowability as a precondition of reality.

To summarise, a performative understanding of unfolding phenomena is to assert that there is no representational media that 'gets in between', but only acknowledges the shifting mixtures of actants. Such an understanding is uncommon within those domains that position technology as being an extension of human agency, with a tendency to be goal-orientated rather than process-orientated. Representational paradigms such as those used in mathematical and scientific practices, tend to ontologically flatten numbers in a manner that doesn't accurately convey continuously changing movement, but rather as static points in space. Similarly, practice is always subject to unknown variations. So whilst speculative realists attempt to rid themselves of the human through recourse to mathematical and scientific logicities, they do not acknowledge the human origin of such practices beyond a culturally informed notion of exceptionalism. Logic is not a-subjective as Deleuze et al. claim, but is a form of human aesthetics. In contrast, new materialist and agential realist approaches that decentre human privilege within the field of relations, open up possibilities for nonhuman aesthetics.

Since Māori metaphysical frameworks emphasise the inter-relationality of all entities, there is a tendency to articulate the need for reciprocity whereby humans are typically charged towards having stewardship over the environment in the form of kaitiakitanga. This said, whilst seeking cultural equivalency between concepts is not particularly useful in itself, it is possibly more useful to seek synchronicities and parallels between different world views. By acknowledging mauri as "vigour, life-force and potentiality" (Durie, 2001) as an inseparable part of phenomena is to acknowledge how things in the world have agency beyond human conception, including the spiritual agency of nonhuman entities. Such acknowledgements might also admit aesthetics as existing beyond humans, where aesthetics does not require a human knower as it does in the Cartesian or Kantian traditions, but could exist entirely within the realm of the nonhuman. Within the intercultural hyphen space it thus becomes entirely plausible to travel towards a posthumanist understanding of aesthetics, informed by Māori-indigenous perspectives.

Contributions to the field

The journey of *Tōia Mai* is unusual because it navigates the confluence of two very different metaphysical currents. This practice-led research speculates on the potential parallels and synergies between a rather generalised account of metaphysics arising from te ao Māori, and different aspects of the posthumanities – which can be summarised as refusing "to take the distinction between "human" and "nonhuman" for granted." (Barad, 2007, p. 32) Following Fine (1994), this research is situated at the 'hyphen' space of Māori–Pākehā relations, which in an effort to avoid the inherent paradoxes and essentialisms of such terms, should be considered as being relational. To attempt to find equivalence between Māori and Pākeha cultural concepts has to be recognised as impossible, as "'us' cannot stand *in place of* the hyphen; it can only name an always conditional relationship-between." (Jones, 2017, p. 187) As this research is particularly informed by recent developments in speculative realism and new materialism, which broadly attempt to "develop a new philosophy of science and a way to move away from Kant" (Dolphijn & van der Tuin, 2012, p. 72), then these developments must acknowledge their own universalist cultural tendencies. Through seeking potential synchronicities and parallels between Western new materialism and indigenous-Māori knowledge, it becomes possible to acknowledge that *different* metaphysical frameworks predicated upon inter-relationality and relational emergence can *conditionally exist relationally*. This does not detract from either tradition, but has the potential to inform both.

Perhaps in the most generalised manner it can be said that within traditionally Western post-Kantian frameworks, objects in the world are typically apprehended through subjective (human) understandings of them, which are in turn measured against objective statements that have an agreed-upon universality. Within Māori metaphysics, where it must be stressed that different writers or speakers refer to their own tribal traditions rather than speak for Maori as a whole, it is not unusual to encounter a worldview where the boundary between human and nonhuman is less than distinct, where spirituality and materiality are always threaded through each other, and where the world has agency in its interwoven relations with people.

The notion of objectivity assumes that reality beyond human finitude is knowable through mathematical or scientific rationalist approaches, a belief perhaps grounded in the desire for replicability. Knowledge becomes validated through its logical relations, so that truth is that which is repeatedly able to be derived from these relations, where any "ground of credible thought is rationally obtainable" (Mika, 2017, p. 121). These logical relations stand in parallel to the way in which matter is typically located as being atomistic and without agency, the latter being a disruptive ontological position within

the schema. In contradistinction are a wealth of Māori cosmogonical accounts that detail an ongoing process of becoming, so that "the full and exhaustive ground is never grasped in its totality" (Mika & Southey, in Mika, 2017, p. 69). Cosmogony should not be confused with cosmology, with the former referring to metaphysics and the latter to explanations of origin. *Tōia Mai* refers to an interwoven web of continuous phenomena that can never be completely understood, rather than an object that can be rationally described. A central concept here is that of whakapapa, which literally refers to *whaka* meaning 'to become' and *papa*, which refers to Papa-tu-ā-nuku. (Mika, 2017, p. 69) If whakapapa is commonly translated to mean 'genealogy', then this glosses over the multitudinous layers of understanding of what Papa-tu-ā-nuku is. Rather than simply referring to 'earth mother', Papa-tu-ā-nuku refers to a dynamic universe with a foundation that is "beyond expanse, the infinite" (Marsden, 2003, p. 22). Whakapapa therefore refers to becoming a lively agency, of the infinite.

The whakapapa of *Toia Mai* has many layers, not all of which will ever be fully encompassed. When *Tōia Mai* is called a Māori artwork or a taonga, then it becomes evident that my role as the artist is only one of many roles. Within Western art, artists have traditionally assumed a certain agentic capacity or claimed a relationship with originality, but in this conception the artist's role is decentred. Yet to what extent was my agency affected by the multitude of other agencies at play? The seed of this journey was planted by Tame Pokaia who suggested that I visit waka *Te Winika* at the Waikato Museum, and it was through our many conversations that *Tōia Mai* began to emerge, with some aspects being conscious decisions on my part, and others not. The Tāniko, niho taniwha, and taniwha did not arise from my original thought, but through suggestions made by mana whenua as the practice progressed. The weathering steel can only bend so far before it breaks and *can* bend across two planes simultaneously, but only under pressure. The discursive agencies of working within the tertiary education institution have their own influences. These agencies and many more, known and unknown, have shaped a reality beyond any mere replicable capacity. This reality arises from a completely different metaphysical framework than one that is predicated by realism, one that is far more at ease with objects that are to "be understood as determining events, as exerting forces, as volitional, or as instructing people." (Hoskins & Jones, 2017, p. 52) From a Western perspective this contradicts cultural beliefs that privilege individual agency, ontological separability, and rationalist explanations for causality. Māori metaphysics in general also has different understandings of how time operates, grounded in a deep abiding spirituality, and assumes a fundamental interrelatedness between all things that for those not embedded in the culture can find extremely difficult to comprehend. *Tōia Mai* operates as an access point to this metaphysical framework through the gateway concept of

Matariki, the seven stars of which – as recognised by Waikato-Tainui – act as portals to different facets of the interconnected environment. No single aspect exists in isolation, so that distinctions between the human or nonhuman is far more blurred than how they might typically be understood by Western cultural conceptions.

Pākehā cannot take for granted that they understand what it means to be Māori, and should they attempt to engage with the underlying body of knowledge known as mātauranga Māori, cannot assume Western epistemological truths. (Salmond, 1985, p. 260) Pākehā therefore need to foster an attitude that acknowledges Māori ways of being and doing as the default. This is not easy for Pākehā as it means confronting one's own Western cultural biases that sees itself attached to truth whilst remaining free of cultural predispositions and preferences (Peters, 2017). Considering oneself as an educated, enlightened, liberal humanist is no guarantee of being able to work with Māori, as such assumptions are predicated by beliefs which position knowledge as being fundamentally both knowable and accessible, a principle that is seldom seen as being either practical or possible. (Jones, 2017, p. 189)

Navigating the intercultural hyphen space requires learning how to traverse a line between different expectations centred around time, relationships, and structural power. For *Tōia Mai*, this means engaging with a partnership model which puts the collective goals before those of the individual. Partnership in this sense is not some one-to-one equivalence, but attempts to work in a way where being Māori is ordinary and every day. This means actively trying to 'change cultural gears', whilst attempting to be one's self. *Attempting* to be guided by a kaupapa Māori methodology as a Pākehā is to make an "explicit commitment to making practical social change" (Smith 1997, 2003, and Hoskins, 2017, p. 101), which is possible only after making *significant personal change*. This learning journey does not occur overnight, nor will it ever be completed, for the intercultural hyphen is situated at the meeting places between the multiplicities of different cultures.

As the kaupapa for *Tōia Mai* was/is to embed Māori achievement goals into real-world student learning, I had to learn that how things are done are as important as what is done. Learning to engage with arohia is critical in understanding that listening is not some passive sensory perception, but "dynamic listening and participation" (Nicholdon, Spiller, & Hēnare, in Spiller & Wolfgramm, 2015, p. 275). All too often I was to learn that in my intellectual attempts to escape Cartesian binaries, I had ironically been recreating them through differentiating between sense and intellect, inside and outside, human and nonhuman. By actively listening to the stories that Tame Pokaia chose to tell me, I gradually became aware of a much wider body of knowledge that I had initially missed in my literal and task orientated thinking. It was when the dense theoretical

texts I had been reading started to resonate with what he was talking about, that I realised my understanding was not necessarily 'new'. When he talked about "cosmic geography" (Pokaia, personal communication, 1st February, 2017) in relation to the star cluster Matariki, and went on to talk about how they are not just important for navigation but they have "a relativity for culture, certain people on the planet, well-being, security, care, and wholeness", it was not until much later that it finally dawned on me that he was talking about mātauranga Māori.

Pākehā expectations of what knowledge is, what form it takes, how it is practised, and its relationship to the universe, make it difficult to be open to forms of knowledge that don't meet these expectations. If my initial academic, 'intellectual' approach was informed by key framings from cybernetics, interactive art, and quantum physics, then it was something of a surprise to discover that it was not a lack of access to mātauranga Māori that was hindering my understanding, but my own metaphysical assumptions as to what form this knowledge should take. Working at the intercultural hyphen is not just a learning process, but a means to understanding about the importance of process and processes. Not getting it 'right' is inevitable, although getting it 'wrong' should certainly be avoided. For example it was one thing to say that I was interested in researching 'the interconnected and interrelated nature of the universe', but quite another to really engage with the way in which whanaungatanga operates within te ao Māori. If I had not followed the lead of Tame Pokaia and Hera White, then it would have been unlikely to have met who they know, and certainly not in the right context. In our hui with tangata whenua my standing had nothing to do with what I said, but rather stood or fell by what others said on my behalf. Understanding the fundamental difference between 'consultation' and kōrero is critical, with the first typically being task-orientated and the second being open-ended and relational. One's engagement in such processes is more than simply gaining access to 'things in the world' using the same metaphysical lexicon, for being part of the web of relations means just that - one cannot stand 'outside' because there is no outside. One's standing is consequently constantly in flux, as the web of relations also constantly shifts. Knowledge and process are interrelated in a way that does not separate between 'things' and action, as much as they do within te ao Pākehā. Kaupapa is therefore intimately interrelated with mātauranga Māori, as goals are achieved through practice that itself embodies these goals.

Practice, in this sense, is a lifelong undertaking. Emphasis sits not just with how action evolves, but how it evolves collectively, with much consideration given to who benefits and how. Despite my shaky start in terms of understanding how actions should occur at the outset of our partnership, the goals of the kaupapa were clear because they already existed within our shared educational setting. At the heart of our shared

endeavour sits Te Tiriti o Waitangi, with its principles and practices taken to be foundational concepts as articulated through the action of our actions. It is our students who benefit by learning about our Māori achievement values, as well as the wider public, for that is where our students come from and will return to. Working at the intercultural hyphen as a Pākehā attempting to be guided by a kaupapa Māori methodology is to realise that the methodology and goals are not just interrelated, but that there is a co-constitutive aspect to them. That a tangible object can now be said to stand in one sense on the Western bank of the Waikato River, and in another sense a digital object now exists within a myriad of data spaces, are not simply end points in themselves, but have emerged in relation to all those who have contributed and continue to contribute to this undertaking. *Tōia Mai* is a continuously emerging and co-constituted phenomena, where the interrelationship between the tangible and the intangible now indicate the passing of a threshold state to reveal a different level of being. When one visits *Tōia Mai* now and sees it as part of the wider landscape, observes how different people and creatures behave around it at different times of night and day, then this is not the journey of its making but something else entirely different. There is an ongoing relationship with its originary principles but there is also something that has emerged in relation to these principles, partly something hoped-for, partly something unforeseen.

If an advantage of practice-led research is that it enables the capacity to review one's initial theoretical framings, then the learning from *Tōia Mai* has much to offer. Notwithstanding the inherent difficulty of attempting to work within an intercultural hyphen space, there nonetheless appears to be potential synergies and parallels between Māori metaphysical frames and recent developments from speculative realist and new materialist approaches. Yet such a re-appraisement is also deeply problematised, as attempting to research ontological modes using theories informed by reactions to supposedly universalist epistemological frameworks is likely to replicate variations of those reactions. If this is to be avoided, then any such synergies and parallels identified must not be considered as permanent or static conceptions, but be considered as temporary vessels by which these ontological modes can be evaluated on their own terms. It is likely that both contemporary Western metaphysical speculations and Māori mātauranga can learn from each other, but this is not to claim any equivalence between each of these frameworks. Furthermore, such speculations are by their very nature *generalised* inasmuch that entire cultural trajectories cannot be encapsulated in any single work.

The notion of objectivity can be traced within the Western cultural milieu as emerging from Plato, specifically his conception that the substance of objects is fundamentally

unknowable by humans and exist exterior to them as ‘Ideas’ (Meillassoux, 2008, p. 25). His notion that ‘true reality lies elsewhere’ informed European Christian conceptions of heaven, and a God as a divine architect, where “God first created an intelligible world akin to the Platonic forms and thereafter the sensible world.” (Moran, 2014, p. 307) These foundations were used by Descartes to assert that humans alone have the capacity to think, in order to determine truth from a world of sensory appearances. This human exceptionalism assumes that the universe is fundamentally knowable, that such knowledge is attainable through rational logic, and that said derived knowledge is desirable. Furthermore, Descartes’ famous dictum “I think therefore I am” (1644) reveals another presupposition of his logic, namely “a philosophy that asserts primacy of the individual.” (Spiller, Erakovic, & Hēnare, 2011, p. 223) Immanuel Kant’s transcendental idealism shifts attention away from an understanding of objects in and of themselves, which Kant considered to be unknowable, and towards subjective representations “that can be universalised, and are thus capable of being experienced by everyone, and hence ‘scientific’.” (Meillassoux, 2008, p. 4) Kant too, argued that in order to have knowledge of the world without our sensory perceptions deceiving us, these ‘common’ or shared experiences must be obtained through reason. He called these experiences “the shared sensible “form” of experience” (Gratton, 2014, p. 18), and they provided the requisite means by which objective knowledge could be deduced *beyond* the human condition. In this way sensible forms like time and space - which he argued were self-evidently pre-existing - could logically produce all manner of scientific knowledge such as mathematics, geometry, physics, et cetera. (Gratton, 2014, p. 18)

The ‘speculative realist’ par excellence, Quentin Meillassoux, identifies the Kantian logic described above as correlationism, which “consists in disqualifying the claim that it is possible to consider the realms of subjectivity and objectivity independently of one another” (Meillassoux, 2008, p. 5). In other words, what Meillassoux describes as ‘the correlationist circle’ refers to the way in which objects, whether they be conceived of as discrete or individual entities, or processes of continually emerging phenomena, can never be separated from our human understanding of them. In contrast Meillassoux argues that knowledge of the ‘thing in-itself’ is possible through mathematical absolutes, which are themselves contingent on the necessity of the contingency of the correlation itself. (Meillassoux, 2008, p. 65) Such absolute truth, according to him, does not rely on a human conception of it. The Kantian correlation between thought and being is itself ‘factial’ (virtual) rather than necessary – or rather it is necessary in our universe, but it is not necessary and all universes. Our universe “can change at any time: it is not […] a set of possibilities, but a hyper- chaos where anything is always possible.” (Gratton, 2014, p. 59) By making this distinction between virtuality and probability, anything might be possible - the only absolute is not the Kantian correlation

(which exists in our universe), but the contingency of that relation (the necessity that relations like this exist). Facticity refers to the invariant laws that govern *a* world, where contingency "is an instance of knowledge" (Meillassoux, 2008, p. 54).

Despite the relative fanfare accompanying Meillassoux's speculative realism, he navigates past Kantian transcendentalism by returning to Descartes. Matter for him is dumb and inert, existing only to be thought about by humans who alone are capable of such correlations in order to determine truth. His manner of escaping the correlationist circle that rests on the Cartesian bifurcation between subjects and objects, is not to argue that such bifurcations do not exist, but that they exist differently for different universes as predicated by the difference between probability and possibility. His logic relies on maintaining that: "*all those aspects of the object that can be formulated in mathematical terms can be meaningfully conceived as properties of the object and itself.*" (Meillassoux, 2008, p. 3) [italics in original]. He argues this through reference to Cantor's theorem, which brings into question "a fundamental uncertainty regarding the totalizability of the possible" (Meillassoux, 2008, p. 105). Meillassoux is a 'realist' inasmuch that he claims access to an 'objective' truth that exceeds human conception of it, made possible by being "purely rational, logical, and theoretical" (Shaviro, 2014, p. 113). He does this through a "veritable intellectual intuition of the absolute" (Meillassoux, in Shaviro, 2014, p. 113), a manoeuvre which has more in common with the logic of Kant's 'sensible forms' than he acknowledges. (Shaviro, 2014, p. 69)

Meillassoux is therefore less of an original thinker than at first supposed, for he continues a typical Western metaphysical trajectory that assumes a shared universal history which starts with Plato, and travels through Descartes and Kant. Although the original speculative realisms of Harman, Brassier and Grant differ with each other and with Meillassoux, they share "a common commitment [...] to metaphysical speculation and to a robust ontological realism" (Shaviro, 2014, p. 5). Elsewhere Shaviro refers to this realism referring to variations of mathematical and physicalist science with the exception of Harman, who extends the Kantian rift between thought and being to include all entities, not just human ones. Such a shared ontological realism also shares similar Western cultural assumptions regarding the fundamental knowability of knowledge, the separation of humans from things in the world, human exceptionalism, the privileging of certain types of logic and mathematical reasoning as a means to ascertain absolutes or 'objective' truth, and an emphasis on individualism. Speculative realism is thus an extension of an existing cultural belief system that does not countenance enquiry beyond its own universalist assumptions.

Practice-led creative research at the hyphen on the other hand, cannot take the above cultural trajectory for granted. *Tōia Mai* was originally conceived of as an interactive

artwork that attempted to be more than the typical ‘if-this-then-that’ relationship between actions and activations. Reappraising situations as objects with their “own little ocean of complexity” (Stern, 2013, p. 65) seemed like a reasonable strategy, until one asks, “how do construction and constitution interrelate?” (Stern, 2013, p. 14) It is here that the concealed cultural metaphysics of objects is revealed, not so much by asking what is a thing in itself, but with the more general question - what are these things called objects? During the manufacturing process where metal is cut out using a waterjet process, it initially seemed evident to consider things as being distinct and self-contained, as the materiality of metal seemed to be unrelated to the interactive componentry that would be fitted later. In this conception the metal sculpture would serve as a proscenium arch to which the digital infrastructure would connect and attach to, so that particular digital interactive experiences would be staged and framed for visiting people.

Continuing to follow Stern’s conception of interactive art, is to attempt to stage “an implicit body, not in performance, but as performance” (Stern, 2013, p. 13). Whilst this is immensely useful as it considers how bodies can have relational agency with one another, he draws upon Brian Massumi’s interpretation of Deleuze to help define what he means by ‘bodies’. Massumi for his part refers to the Kantian sense of matter and their correlate sensible concepts (Stern, 2013, p. 89), and this in turn enables Stern to introduce the idea that ‘being’ is always ‘being-with’. Bodies here, stand in relation to one another and with what else is going on in the world. This approach is problematic for *Tōia Mai* however, because Kantian sensible forms presume how time and space operate. Consequently, they validate or invalidate what is considered to be ‘real’ by privileging logical and replicable relations over non-replicable experiences. That humans alone are considered to be capable of determining these shared universal experiences is absurd within Māori metaphysical frameworks, where for example, within Waikato-Tainui, the Waikato River is considered a tūpuna:

> It remains common in Māori and other indigenous thinking for ‘objects’ – whether Hongi Hika’s tā moko on paper, a dead body, a forest, or a piece of greenstone – to be understood as determining events, as exerting forces, as volitional, or as instructing people.
>
> Hoskins & Jones, 2017, p. 52

Acknowledging the agency of entities other than, or beyond, human, is to challenge a culturally informed notion of human exceptionalism. When this happens, then the corresponding referents within the subject-object operation lose their predicate symbolic equivalence to determining objective reality. This does not mean that realism

should be abandoned, but that objectivity must be reconceived in terms of being relationally conditional for humans, because it "is about being accountable to specific materialisations of which we are a part." (Barad, 2007, p. 91)

So whilst *Tōia Mai* does stage and frame particular types of engagements for humans through its architectural form, it also stages engagements with and *between* the wind, birds, the rain, sun, and a host of others. When it is cold and wet the weathering steel turns black and particular types of arrangements are more or less likely to occur. When it is warm and dry the steel turns orange and brown and a different set of arrangements are more or less likely to occur. These general environmental conditions interrelate with a host of seasonal, lunar, and other environmental modifiers to produce unpredictable sound and lighting outcomes, and these in turn affect that which is within the immediate field of relations. Yet when Stern discusses embodiment through interactive art as being an "incipient activity" and as "a continuously emergent and active relation" (Stern, 2013, p. 2), he does so with the implicit understanding that this is a particular type of relationship between humans and the world as determined by supposedly universalist human ways of knowing and doing. Stern's humancentric position becomes clear when he discusses amplifying the potentiality of what a body is, as achieved through "affect, proprioception, and sensibility" (Stern, 2013, p. 89). His interactive art is thus implicitly informed by human intentionality and a Kantian transcendental idealism, as evidenced by his claim that "embodiment and matter's emergence from and with their relations" is "sensitive to the historical languages used for understanding art, materiality, and visuality" (Stern, 2013, p. 89). Consequently his 'being-with' should always be understood as 'being-with-human' or 'being-with-*for*-human', as for him there is no 'being-with-world'.

Tōia Mai reconfigures Stern's original conception of continuously emergent and active relations, by blurring distinctions between human and nonhuman agencies within an interconnected universe. It is not just human activity or intentionality that creates meaning, but following Barad's agential realism, the universe creates meaning in relation to itself (Barad, 2007, p. 148). When different modes are initiated through whatever qualities are most prevalent at any given time and are then informed by the thermal imaging sensors by whatsoever meets a requisite heat threshold, then not only is a continuous feedback loop possible between these agencies, but unexpected phenomena can also relationally emerge. That this emergent capability occurs between the continuously changing agencies of different data sources, and in combination with the world's continuously changing capacities, reveals two key findings: Firstly, that things in the world are not atomistically discrete, and secondly, that interactive aesthetics are not predicated by human involvement. Since *Tōia Mai* was originally

grounded within artistic practice, this further brings into question what art is, or may be, at least within a Western conception of it.

Another problematic of the reference-referent relationship is the tendency to consider matter as tangible, and referents as somehow intangible. There is a similarity between Kantian sensible forms and Plato's Ideas, inasmuch both seem to be informed by the notion that that intellectual or ideal forms, lack materiality per se. A common thread shared by Meillassoux, Stern, Delanda and Bennett are their mutual references to conceptions of virtuality, where virtuality lacks a material tangibility. Meillassoux's conception of virtuality is described as facticity, the non-tangible Kantian correlation between thought and being, elsewhere described as the invariant laws of a particular universe. Stern draws upon Massumi, who draws upon Deleuze, where virtuality is "the 'immanence of a thing to its still indeterminate variation,' an 'unfolding toward the registering of an event'" (Massumi 2002, in Stern, 2013, p. 74). Delanda's ideas of virtuality draw upon the Deleuzian ideas, where the:

> virtual is not opposed to the real but to the actual… Indeed, the virtual must be defined as strictly a part of the real object – *as though the object had one part of itself in the virtual into which it is plunged as though into an objective dimension.*
>
> Deleuze 1994, in Delanda, 2016, p. 109

Bennett also draws on Deleuze to help explain the virtual:

> "matter–*movement*" or "matter–*energy*", a "matter in variation that enters assemblages and leaves them." A life is a vitality proper not to any individual but to "pure immanence," or that protean swarm that is not actual though it is real: "A life contains only virtuals". It is made of virtualities".
>
> Deleuze, in Bennett, 2010, p. 54

This idea of the virtual as being 'real' but not actual, relies on an understanding that actualisation relates to immanence, which is to say, has *material form.* That which does not have material form but exists with varying potentials to do so is virtual. This is a continuation of Kantian sensible forms and their reliance upon human exceptionalism to determine 'universal' truths, through rationality and mathematically logical relations. Presence, as traditionally conceived within a Western framework exists in relation to its binary opposite, absence, is predicated both by ideas of things being discrete and determinate entities, and that matter is *dumb and inert.* As Mika (2017) reminds us, this metaphysical supposition is not universal but cultural. His articulation of a metaphysic

grounded in ‘worldedness’ is constituted of spiritual and mysterious entities as well as the material, as discussed below. Karen Barad (2007) criticises the Deleuzian underpinnings of the virtual with her agential realist account: “Possibilities aren’t narrowed in their realisation; new possibilities open up as others that might have been possible are now excluded: possibilities are reconfigured and reconfiguring.” (Barad, 2007, p. 177)

The concept of virtuality in the context of *Tōia Mai* is not straightforward, for whilst virtuality has a long Western history of being immaterial, the digital infrastructure always has a relationship with tangible materiality through conductivity, radio, electrical power, and heat. These relationships are contingent upon the ‘goings-on’ of the world as continuously emerging and co-constituted phenomena, without the need for a human knower. Agential realism is founded on the performativity of matter, where different practices operate as agential cuts within phenomena. In a Māori metaphysics “the self has always already been established by a thing” (Mika, 2017, p. 72), so that as a taonga *Tōia Mai* does not stand outside of phenomena but discloses its “wairua, mauri, and mana that call me to feel and think” (Barnett, 2017, p. 30). If Barad’s criticism of Deleuze is predicated by her own terms of reference - acknowledging how scientific practices enact agential cuts within phenomena are situated by a scientism that seeks replicability as the precondition of objectivity, then objectivity for her does not require human instigators of practice. In both Mika’s worlded framework and Barad’s agential realist understanding, phenomena are conceived of as being inseparable from its constituents, and humans are decentred from a position of exceptionalist privilege along with their corollary capacity to define distinctions of reality through culturally informed logics. Yet this is where Barad’s agential realism and a Māori metaphysical framework begin to part company, for her focus on replicability does not account for all that is experience or phenomena.

If the concept of virtuality is to be useful at the hyphen space of *Tōia Mai*, then it needs to be underpinned by more than a shared criticism of Kantian sensible forms. Part of what makes virtuality useful is that it has a relationship to ideas about potentiality, particularly in terms of what *might* be, which is to say what might relationally emerge from what is otherwise unknown. This could inform how the digital and ‘physical' aspects of *Tōia Mai* operate in relation to each other, as well as more conventional understandings of how virtuality operates in digitality. For example, the continuously changing environmental data values activate light and sound patterns when particular thresholds are crossed. Whilst these operate through a series of logical relations, the environment, participant behaviour and quirks in the technological apparatus co-constitute many unpredictable and accidental aspects. These in turn have the capacity

to operate in unpredictable feedback loops, so that every encounter – that need not be activated by humans – is definitively different.

My initial approach attempted to combine Delanda's concept of virtual diagrams with Barad's agential realism to help provide an alternative way to understand potentiality. It also needed to acknowledge the unknown in order to account for unforeseen data values. Consequently, the following definition was considered: Potentiality is the relative intensity of any given possibility within the possibility space to relationally emerge with existing phenomena, including nonhuman and unknown agencies, in order to manifest. It quickly became apparent that this definition is deeply problematic for *Tōia Mai*, and not just because it lacks reference to a Māori metaphysical framework. Although the environmental data from the sensor network is turned into percentiles to place them into the same field of relations, this is not the same as Delanda's virtual diagrams that use a "cartographic strategy" (Delanda, 2016, p. 110). His aim is to ontologically flatten data in order to reconcile previously oppositional concepts to derive 'objective truths' using a type of differential calculus. Delanda's material realism requires a Kantian subject–object relation that positions matter as being manifestly present but inert, with a corresponding immateriality for their referents. This strategy enables his physics derived mathematics to claim access to objectivity through what Mika (2017, p. 3) calls the "metaphysics of presence". Delanda makes his commitments clear when he says:

> a materialist philosopher can only be a realist about *immanent* entities, that is, entities may not subsist without some connection to a material or energetic substratum.
>
> Delanda, 2016, p. 139 [italics in original]

His concept of potentiality is therefore irreconcilable with any performative approach that acknowledges either material agency or the agency of the unknown. For him, potentiality is situated in relation to an un-manifested nonbeing that somehow hovers beneath the surface of being. His Kantian commitments are confirmed when he acknowledges how the type of assemblages called virtual diagrams require a bifurcated understanding of reality:

> The distinction between the concept and its cases also has an ontological aspect. The concept itself is a product of our minds and would not exist without them, but concrete assemblages must be considered to be fully *independent of our minds.* The statement must be qualified, because in the case of social assemblages like communities,

> organisations, and cities, assemblages would cease to exist if our minds disappeared.
>
> Delanda, 2016, p. 138-139

Similar Kantian framings exist within the arguments of Stern and Bennett, where virtuality and A-Life are predicated by concepts of nonbeing that equate with an absence of materiality. When considering concepts from mātauranga Māori such as mauri and worldedness however, these framings seem somewhat irreconcilable. What is needed are different ways of thinking about potentiality that admits relational emergence without having a Kantian dependency. This becomes possible when potentiality is informed not in relation to material substance or lack of it, but by performative frameworks.

A departure point can be found through Stern's original question concerning interactive art: "How do construction and constitution interrelate?" (Stern, 2013, p. 14) For *Tōia Mai* this refers to multiple interrelationships between myself attempting to be guided by a kaupapa Māori methodology, along with my colleagues from Māori achievement, the mātauranga Māori and technological capacities that were accessed, the place itself, the authority of mana whenua, and numerous institutional and material agencies all entangled with each other and the multiple hyphen spaces in between. As a starting place within this field of relations, acknowledging the partnership between myself and Māori achievement is immensely significant. A key finding relates to process rather than to an external goal, for understanding kaupapa means realising that *how things are done are as important as what is done*. Stern's question now becomes less atomistically informed and more inclusive of acknowledging co-constitution in terms of practice. His question can now be reframed: How do construction and co-constitution co-create transformative change? Co-constitution here is about partnership in terms of working collectively, not just with regards to understanding that the goals of the collective come before the goals of the individual, but that *knowledge and methodology inform each other – the journey is part of the destination.* This means understanding action in a way that is not entirely reflective, but through *doing and being.* Understanding action therefore, can only really be, through action.

Knowledge that is centred on doing and being has not traditionally sat well within Western epistemological frameworks founded on Kantian noumena-phenomena distinctions, which typically privilege the taxonomic over the ontological, through representation. It is only comparatively recently within a Western metaphysical framework that a comparable concept grounded in performativity have been seriously countenanced. There are also fundamental difficulties for understanding performativity

when approached using a cultural paradigm that privileges writing, a practice that takes for granted the separability between signifiers and signified through representation. Reassessing language for what it *does* rather than what it *says* means acknowledging its capacity to co-constitute meaning through the action of writing itself. In the context of writing this research this means acknowledging how writing is an act of discovery, as doing writing is to acknowledge the *agency* of words and their co-constitutive capacity to enact meaning.

The term 'agency' at this point needs some explanation, for in most post-Kantian frameworks it equates to human notions of free will and intentionality, which matter is considered in this conception not to have. Identifying how the agency of materials can be considered as "lively and self organising, rather than passive or mechanical" (Bennett, 2010, p. 10) enables an understanding that is not humancentric. When matter is identified as being performative and informed by discursive-material practices, then former atomistic notions must be discarded to acknowledge "*the mutual constitution of entangled agencies*" (Barad, 2007, p. 33) [italics in original]. A definition of agency cannot therefore be limited to the causative or linear, nor solely be the prerogative of humans. At the same time it must acknowledge how human practices – including language and language making – also have their own agentic capacities in relation to what else is going on.

This new materialist informed understanding of the performativity of language appears to run in parallel with Mika's worlded understanding of how knowledge reveals itself to the knower. Rather than being grounded in a human exceptionalism that determines what knowledge is:

> the influence of the world that is hinted at in the forthcoming words has always 'turned back' to the speaker, and the speaker is hence captured by the sublime that resides within the actions *as a whole* from the outset. The unusual aspect of language here is that indigenous notions of time and place dictate that an utterance in total is influential before the words are encountered, or before the self is cognitively aware of them. Moreover, any speaker will be constructed in some way by speech without ever being aware of what is stated.
>
> Mika, 2017, p. 46-47 [italics in original]

A worlded understanding is one where human privilege is decentred within the field of relations, unsettling typical Western assertions that knowledge of the universe is fundamentally *knowable* by humans. Rather than placing emphasis on how human agency reveals the secrets of the universe, the universe's agency reveals aspects of

itself to humans. Potentiality here does not refer to mapping possibilities within a possibility space, nor to notions of immanence predicated by a metaphysics of presence and its lack thereof (Mika, 2017), but to performative agencies operating within human knowledge, at the hidden edges of this knowledge, and that which is *unknowable.* As the performativity of phenomena cannot be conceived of as being individual or discrete, potentiality should be conceived of as constantly changing, always 'in relation' rather than 'of' or 'in' a state of being or nonbeing. By making these distinctions between what is *hidden* to humans and what is *unknown* to them, enables acknowledging human finitude, not as a lack but as a situation that admits the performative agencies of the *unknown* into the field of relations. The unknown is therefore acknowledged as an *actant*, which is:

> a source of action that can be either human or nonhuman; it is that which has efficacy, can *do* things, has sufficient coherence to make a difference, produce effects, alter the course of events.
>
> Bennett, 2010, p. viii

A non-Kantian informed understanding of the relationship between potentiality and the unknown can now be considered at the hyphen, with a concept that I call *Pull*. Co-informed by Tame Pokaia's naming of *Tōia Mai,* the word '*tōia*' by itself means to 'pull' or 'drag'. Also informed by Bennett's reconfiguration of the Epicurean philosophy of Lucretius, where a conception of potentiality is able to drift or 'swerve' with an inherent unforeseen capacity. Bennett calls this a type of "chanciness", as well as "an inexplicable vitality or energy, a moment of independence from and resistance to us and other bodies" (Bennett, 2010, p. 18). Whilst Bennett is interested in material agency, the final aspect of *Pull* is that it is informed by the concept of indeterminacy, which refers to that which is not determinate, situations that are not causal, relationally emergent in a non-linear fashion, analogous to the quantum discontinuity:

> if the indeterminate nature of existence by its nature teeters on the cusp of stability and instability, of determinacy and indeterminacy, of possibility and impossibility, then the dynamic relationality between continuity and discontinuity is crucial to the open-ended becoming of the world which resists acausality as much as determinism.
>
> Barad, 2007, p. 182

Pull can now be defined as potentiality where continuously fluctuating indeterminacies emerge within the contingent relation. Considering these indeterminacies as being performatively worlded does not presume the primacy of a material foundational reality,

but can acknowledge, for instance, spiritual and nonhuman realities. Barad however is interested in ensuring that her reader does not think that an objective realism is impossible, but is based on ensuring the conditions for replicability. For her indeterminacy is relational: “concepts do not have determinate meanings” by which she means, phenomena is “definable and observable through their interactions with other systems” (Bohr, in Barad, 2007, p. 296). Observable here relates to a resolution of the ontological indeterminacy through the agency of apparatuses, which “are the practices of mattering through which intelligibility and materiality are constituted (along with an excluded realm of what doesn’t matter).” (Barad, 2007, p. 170) The critical point is that ‘resolving the ontological indeterminacy’ does not require humans – her agential *realism* acknowledges humans as producing such practices, but is not dependent upon them:

> There is an important sense in which practices of knowing cannot fully be claimed as human practices, not simply because we use nonhuman elements in our practices but because knowing is matter of part of the world making itself intelligible to another part.
>
> Barad, 2007, p. 185

There is a parallel here between Barad’s agential realism and Mika’s articulation of worldedness, inasmuch that neither intrinsically require a human knower in order to produce knowledge. Situated at the hyphen, *Pull* describes how within situations like *Tōia Mai* that have extremely complex fields of relations, aligned non-Kantian potentialities can relationally emerge with/from the performativity of actants unknown. In other words, when multiple actants become entangled, their overall complexity enacts a relational shift between potentiality and the unknown in the general ‘direction’ of what else is already going on. Each actant has potentialities that emerge in relation to meeting other actants; these are not fixed properties but exist in flux within the continuously changing co-relations. *Pull* has the capacity to overcome the persistent inertia of existing stable complexities, so that through relational emergence new ‘levels’ of stabilised complexity can align in a non-linear fashion. This too is analogous to the quantum ‘leap’ that electrons make between energy orbitals, whereby *Pull* relates to shifts between relatively stable ‘levels’ of potentiality, that through the contingent relation also have continuously variable instabilities. *Pull* accounts for those times when all else seemed on the brink of disaster, unknown and unforeseen potentialities would somehow emerge so that the endeavour shifted towards different potential outcomes.

Pull opens up a new speculative field at the intercultural hyphen, but does not seek to make definitions or to claim correspondence between concepts, instead seeking to

identify spaces for further research. Informed by the unfolding phenomena known as *Tōia Mai*, there are four main relationships that can inform this burgeoning understanding of *Pull*, the first being with mātauranga Māori which is "an always-evolving, underlying *body of knowledge* that can guide practice and understanding." (Durie, 2017, p. 4) For *Tōia Mai* this relates the gateway concept of Matariki, where each star is a doorway or portal to different aspects of the interconnected universe, and which have "a relativity for culture, certain people on the planet, well-being, security, care, and wholeness" so that everything "work[s] in sync with each other." (Pokaia, personal communication, 1st February 2017) Within a Waikato-Tainui cosmogony, humans are only the latest phase which unfolds from the Creator, the male and female entities known as Hani and Puna, the originary Ranginui and Papatuānuku, the different atua that are responsible for different types of knowledge and resources, then plants, insects, and animals, until finally, humans. It is not possible to know what happens next, because "Humans are the juniors, they are the seniors". Much is unknown, and human endeavour must be guided by tōhunga who can seek permission from of the atua who are responsible for each domain. There is also hidden and known knowledge, but just because some knowledge is known, it "doesn't give you rights to the next stage." (Pokaia, personal communication, 1st February 2017) Without mātauranga Māori, *Tōia Mai* would not have relationally emerged nor continue to emerge as the phenomena it is. There is an "ancient knowledge" (Rāhui Papa, personal communication, 13th November 2017) in force here, and whilst I cannot speak for it, I speculate that it resonates with a worlded understanding of the world so that serendipitous potentialities relationally emerge.

The second relationship is coextensive with mātauranga Māori, for a worlded understanding of how the universe operates is to acknowledge that "the universe itself is a process or event within the cosmic process by which Io orders creation" (Marsden, 2003, p. 22). In Mika's seminal work (2017), a Māori conception of worldedness is articulated through several key framings, including the foundational concept of whakapapa. By translating *whaka* as being 'to become' and *papa* as referring to Papatuānuku, *whakapapa* is revealed as being actively constituted but never "grasped in its totality" for it is through Papatuānuku "and all those other entities that are not immediately discernible in that phenomenon" that "a thing in the world is approachable *as* an entity but resists being fully comprehended." (Mika & Southey, in Mika, 2017, p. 69) There is always something inherently mysterious about things in the world, so that thinking (*whakaaro*) is co-constituted by the revelation of the world to the self:

> Thinking from worldedness is constituted by an act of acknowledgement, in particular towards the fact that something comes

> about (whaka) into one's regard (aro aro). Whaka is connected with the possibility that time (wa) is non-linear because the self has already been established by a thing: the full amplitude of any one thing, apparently manifesting for one's regard, always continuously revealed itself to the thinking individual.
>
> Mika, 2017, p. 72

Within a worlded understanding, certainty does not exist, for much of the universe is unknowable and yet the unknown also co-constitutes the self. It is necessary to be 'in tune' with the world rather than stand at a distance from it, so that "one "*cast[s] attention to*" (Takirirangi Smith, 2000, p.58) a thing but not from a position of authority." (Mika, 2017, p. 72) Of critical importance in this framework are non-linear understandings of time that do not position it as occurring in a determinate, or chronological manner. Cosmological accounts must be approached as cosmogonical knowledge, so that their metaphysical 'ground' is contemporaneous with the infinite potentialities of a continuously changing now. Again, I cannot speak from an indigenous position, but I speculate that worldedness has a relationship with *Pull*, a certain drift or swerve that comes from being 'in tune' with the universe.

The third relationship to *Pull* comes from Barad's notion of agential realism (2007), including her understanding of the quantum discontinuity. Agential realism emphasises the agency of actants co-constitutively enacting continuously evolving phenomena. It acknowledges the performative nature of matter in its becoming through the contingent relations of inclusions and exclusions. Barad's discussion of the quantum discontinuity brings to attention the non-linearity of these emerging relations in both time and space. As such, Newtonian conceptions of causality cannot be considered as either universal or, materially accurate. When electrons 'leap' from one energy orbital to another, they do not traverse the intervening space at any point and neither is there any way of predicting where they might emerge: "The point is that it is the intra-play of continuity and discontinuity, determinacy and indeterminacy, possibility and impossibility that constitutes the differential spacetimematterings of the world." (Barad, 2007, p. 182) Time and space are enfolded into each other, so that through iterative exclusions "causality is neither a matter of strict determinism nor one of free will [...] providing the conditions of an open future" (Barad, 2007, p. 234). *Pull* here is informed not just by the unknown aspects of the contingent relation, but in understanding the agentic performativities of the quantum discontinuity which exists in the macro universe as well as the micro. Intra-actions do not exist in isolation – every 'thing' is constantly relational with every 'thing' else. Acknowledging the agency of indeterminacy is to acknowledge

Bennett's 'chanciness' and the understanding that causality is emergent rather than efficient, "more fractal than linear" (Bennett, 2010, p. 33).

Pull can also be informed by its relationship with the intercultural hyphen itself: "What we learn in the intercultural space is not necessarily what we were prepared to know." (Stewart, 2018, p. 770) Through this practice-led research I have discovered my own cultural and epistemological presumptions, which are not easily evident nor laid aside. As a Pākehā attempting to be guided by a kaupapa Māori methodology within an educational context, there is much I do not know and will never know. And yet *it is not my knowledge that is important, but acting collectively to achieve the goals of the kaupapa.* This means laying aside my desire to have control over events and phenomena, to be comfortable with uncertainty and not knowing. This also entails acknowledging the dynamically changing potentialities that exist within those relationships between Māori achievement, myself, and others, that relationally emerge with the multiple unknowns of unfolding events. This relationship between *Pull* and the intercultural hyphen acknowledges *how something is done is as important as what is done* – even if at times this might challenge my own sense of what is going on.

The concept of virtuality can now be re-approached in relation to a non-Kantian concept of potentiality and *Pull,* in order to help inform how tangibility and digitality interrelate within the phenomenon of *Tōia Mai.* Virtuality must be understood in a performative manner, rather than having an inherent relationship to notions of materiality or lack thereof. Because potentiality can be understood as continuously fluctuating indeterminacies that relationally emerge within contingent relations, it still has a relationship with possibilities that are not predicated as being within finite sets. Virtuality can now be understood as a type of apparatus in the sense that Barad means the term, a practice that performs agential cuts to resolve ontic indeterminacies that relationally emerge with practices of digitality, itself contingent upon regulatory clocks and/or procedural logics. That virtuality may be indistinguishable within contemporary digital practices, is part of "the practices of mattering through which intelligibility and materiality are constituted" (Barad, 2007, p. 170) for those practices of digitality. As such, virtuality and tangibility can exist within the same field of relations, which for *Tōia Mai* means having relationships with *Pull* and its emergent relationships with mātauranga Māori, worldedness, agential realism and the quantum discontinuity, as well as the intercultural hyphen. Virtuality can therefore be informed by, and relationally emerges with, cosmogonical processes of becoming that acknowledge non-linear conceptions of time and space.

Considering virtuality as a type of apparatus that enacts agential cuts means that it is not dependent on human practices or knowing, nor does it imply a requirement that

digitality be contingent on contemporary regulatory practices or logics. The contingency of the clock and logical systems in contemporary computing is a human requirement for predictability, and consequently, control. It is quite conceivable to consider a non-predictable form of digitality, for example, a form of quantum stateless computing where multiple stateless entities await inputs from quantum events, which run, disassemble, and generate other stateless entities in a non-linear manner. *Pull* can still inform this conception of virtuality, as a swerve towards potentialities relationally emerging with the unknown.

As *Pull* is informed by potentiality that accesses indeterminacy as much as an "inexplicable vitality or energy" (Bennett, 2010, p. 18), it must be remembered that this definition does not solely come from te ao Māori, but is rather the result of practising at the intercultural hyphen. It is speculative, for being in this space between cultural metaphysics "touches on the infinite, the philosophical depths, the mystery of existence, the transcendent experience that cannot be measured." (Stewart, 2018, p. 770) The concept of potentiality is most commonly referenced in Māoritanga in relation to the concept of mauri, which has been described as "a 'vigour, impetus, and potentiality' [...] (Durie, 2001, p. x) [...] Terms such as mauri and mana name the interconnectivity of the human and non-human worlds." (Hoskins & Jones, 2017, p. 52)

Whether potentiality is approached from Māori or Pākeha metaphysics, there appears to be a commonality with regards to a concept that describes a fundamental interconnectedness within all phenomena. How this interconnectedness is articulated is quite different, with a tendency in Western metaphysics to either maintain a teleological explanation or expunge it completely in favour of a material realism. As much as can be determined by this Pākehā researcher, mauri is almost always referred to in Māori culture within the context of a deep abiding spirituality that is imbued into lived existence. In both written and oral accounts, mauri is commonly translated as referring to 'life-energy', but not in a singular, isolable manner that makes distinctions between living and non-living entities, but rather as a:

> unique power, a life essence, a life force, and a vital principle [...] It is intimately related to other metaphysical powers - *tapu, mana, hau*, and *wairua,* and all of these forces are essences in forms of life in persons, objects, and non-objectified beings.
>
> Hēnare, in Spiller & Wolfgramm, 2015, p. 87

That mauri is related to but distinct from hau/ hā (the breath of life), wairua (spirit), and mana (prestige, authority), does not mean that hā or wairua are essences that are the exclusive privilege of humans, for nonhumans can also have wairua and hā (interview

with Tame Pokaia, 12th December 2018). Spirituality and materiality in this metaphysical framework are non-separable, a position that has ramifications for contemporary critique of Kant and Descartes. Whilst such critiques are beyond the scope of this research, considering *Tōia Mai* as a taonga that discloses its "wairua, mauri, and mana that call me to feel and think" (Barnett, 2017, p. 30) sits within a worlded framework "where the self speculates on how the world has invited him or her to participate in its disclosure, with the self's fragility before the thing being crucial in that thought." (Mika, 2017, p. 72)

To make comparisons between mauri and a discussion of material vitality, is however, clearly unsustainable when contemporary Western metaphysics insists on privileging objectivities that dismiss Māori spiritual realities. That such objectivities are demonstrably flawed does not deter Western frameworks from claiming authority based on the primacy of replicability, even whilst attempting to uncouple from the consequences of humancentrism. When Bennett (2010) attempts to bridge the Western binary of the organic and inorganic, she does so by drawing attention to the energy of atoms that are simultaneously constrained and enabled through the phenomena in which they are situated, so that she can further her arguments of 'thing-power' and the agency of a material vitalism. Drawing on Deleuze's notion of A-life (1997), which is "an indeterminate vitality, a "pure a- subjective current" that is visible only fleetingly, for it is "a pure event freed… from the subjectivity and objectivity of what happens" (Bennett, 2010, p. 53), the notion of vitality here refers to "the activity of intensities rather than of things with extension and space, the "pure productivity" of "virtual" matter or "matter energy"." (Bennett, 2010, pp. 55 – 56) Yet in order to claim this conception of the virtual, Kant's division between materiality and immateriality must once again be invoked. Bennett's 'life-force' or material vitality adds to this existing trajectory simply by acknowledging the agency of actants:

> [T]he capacity of things – edibles, commodities, storms, metals – not only to impede or block the will and designs of humans but also to act as quality agents or forces with trajectories, propensities, or tendencies of their own.
>
> Bennett, 2010, p. viii

Like Delanda (2016), actants in her conception operate within open-ended situations called assemblages, a useful concept which enables understanding phenomena such as *Tōia Mai* as more than its sum of its material parts, but rather includes its idea, associated media and PR; public image; popular culture references; various political agendas and policies; the location in terms of site, space, and place; topographical

variables in relation to radio transmission and electrical supply; spirituality; the weather; time, et cetera – or so an assemblage might be supposed from its original definition:

> a multiplicity which is made up of many heterogenous terms and which establishes liaisons, relations between them, across ages, sexes and reigns – different natures. Thus, assemblage's only unity is that of a co-functioning: it is a symbiosis, a 'sympathy'. It is never filiations which are important, but alliances, alloys; these are not successions, lines of descent, but contagions, epidemics, the wind.
>
> Deleuze & Parnet, in Delanda, 2016, p. 1

And yet what is never given credence by Bennett, Delanda, and their mutual references to Deleuzean concepts, is anything that might remotely refer to spirituality. If for Delanda spirituality simply does not fit with his differential calculus, Bennett is more direct when she says:

> What I am calling impersonal affect or material vibrancy is not a spiritual supplement or "life force" added to the matter said to house it. Mine is not a vitalism in the traditional sense; I equate affect with materiality, rather than posit a separate force that can enter and animate a physical body.
>
> Bennett, 2010, p. xiii

Bennett's definition of 'life-force' seems to be too closely informed by traditional Western understandings of what this term might entail, particularly as it aligns so closely to historical anthropological definitions of animism. It is hard to ignore how indigenous metaphysical frameworks have been historically marginalised by racist Western preconceptions, particularly when such frameworks provide comprehensive knowledge that might otherwise inform the very questions that contemporary Western speculative philosophies seek to engage with. Despite what is elsewhere described as a shift towards posthumanist perspectives, it seems odd that claims by many indigenous groups insisting that 'life-force' exists across the non-material are otherwise discounted. If ideas, practices, discourse, and all manner of other performativities that acknowledge the non-tangible can be admitted as actants, then what is this reluctance in contemporary Western thought to acknowledge the potentiality and agency of indigenous spirituality? Is it because that despite disenchantment with metaphysical traditions that bifurcate nature and culture as predicated by Kantian sensible concepts, Western culture cannot relinquish its sense of superiority based on insisting that 'objective' knowledge is not just 'a-subjective', but that it's conception alone

apprehends a pure, untrammelled, truth? Perhaps like addicts attempting to evade their hangovers, the godlike powers afforded by the scientific rationalism of the Western enlightenment cannot break its desire for an omnipotence that promises to reveal the secrets of the universe. Having relinquished an all-powerful God to a Newtonian clock-like universe, this too is being discarded, but it is not so easy to let go over the desire for mastery. Yet this "teleological fantasy of Western education" that knowledge is "a linear increase" (Jones, in Stewart, 2018, p. 770) not only assumes that all knowledge is intrinsically *knowable*, but requires the very Kantian sensible concepts it is avowedly attempting to depart from. For without a linear conception of time, determinism cannot be claimed to be universal; without Kantian Ideas there is no virtuality predicated on immateriality; and without the correlation of shared sensible concepts with their abstracted representations, numerical logical relations cannot assert equivalence beyond their own quantifiable calculus.

Part of the difficulty for Western culture to engage with a posthumanist understandings of emergent phenomena, undoubtedly rests on positioning numbers as static and fixed abstractions that can apparently chart time and space. Recent 'speculative realist' attempts to rid themselves of human influences in a bid to exceed human finitude and gain access to things-in-themselves, are a recent example. They are "united by their rejection of correlationism and their commitment to "a speculative wager on the possible returns from a renewed attention to reality itself"" (Bryant at al. 2010, in Shaviro, 2014, p. 10), where reality is *positioned as being accessible through mathematical or positivist approaches.* Yet like the supposed neutrality of scientists performing science, (Latour, Law, & Callon, 2005), mathematicians typically do not position it as a cultural practice that performatively co-constitutes phenomena. By contrast not only does practice always have variations, but as Zeno's paradox ably demonstrates, mapping motion as a series of possibilities can only be conceived as "going between many static points" (Stern, 2013, p. 56). Mathematical logic here represents motion, but it cannot claim correspondence to what movement actually *is.* (Stern, 2013, p. 60) Meillassoux similarly argues with his reference to Cantor's theorem that there is "at the very least a fundamental uncertainty regarding the totalizability of the possible" (Meillassoux, 2008, p. 105). What neither Meillassoux or Stern consider however, is how time and space are rendered ontologically flat by numbers as extensions of Kantian sensible concepts. Linear cultural conceptions of time fix the events of the past into causal relations, and the supposed universality of three-dimensional space privileges a spatiality which is quantifiable. The notion of indeterminacy in relation to the quantum discontinuity plays havoc with the idea that numbers are stable and contiguous entities, and for Māori, conceptions of time are

anything but linear, with the agency of tūpuna (ancestors) in the present moment being but one example.

To further contemplate a metaphysics where time is nonlinear, where there is no "ontological apartheid between persons and things" (Hēnare, in Barnett, 2017, p. 30), and where materiality is not reduced to determinate relations, is not impossible – but simply, not predicated by Western Kantian sensibilities:

> Creation accounts are the foundations upon which Māori of the Pacific have built a cosmological, religious philosophy and metaphysics. They are the bases for a Māori philosophy of vitalism, the idea that in all things in creation, with a material or nonmaterial, there is a life that is independent of the thing itself, and there is an original source of life itself.
>
> Hēnare, 2015, p. 81

Mauri is an inseparable aspect of *Tōia Mai*, despite my Pākehā self being scarcely aware of it. To acknowledge the unknown within the interrelationship between myself and its phenomena, is to acknowledge a potential parallel with a worlded framework where I am positioned within the field of relations rather than positioning such a relational field to myself. Enfolded within the relationality of *Tōia Mai* emerges those aspects that have been, and always will be, unknown to me. I catch a glimpse of a ground that is "something that we can reflect on but remains ungrounded (unknowable) to the extent that we do not have complete access to it through thought." (Mika, 2017, p. 127). Acknowledging the mauri of *Tōia Mai* is to acknowledge it as a taonga, which are "subjectless objects that call for conscious engagement, [which] perform and are performed." (Barnett, 2017, p. 30) Spirituality and materiality as phenomena are here entangled, so that the objecthood of *Tōia Mai* is intrinsically relational. Like other taonga, "their "thinginess" within a general state of flux, is precisely what makes them indispensable to the work of relating." (Hēnare, in Barnett, 2017, p. 29)

Understanding *Tōia Mai* as a taonga, emancipates it from an art aesthetic that typically positions the thing-in-itself as informed by rationalist explanations and subjective representations that are capable of affect only through mediation. My own role as artist becomes deemphasised, replaced by the activation of the collective goals of the partnership kaupapa. By being woven into its connections outsiders are enfolded into a relationality which enable different understandings (Barnett, 2017, p. 28), and in acknowledging these interconnections it becomes apparent that notions of reciprocity are unavoidable. When humans realise that "we are part of the nature we seek to understand" (Barad, 2007, p. 26), then we are "endowed with a mandate to use the

agency of [our] *mana* (spiritual power, authority, and sovereignty) to create *mauri-ora* (conscious well-being) for humans and ecosystems" (Spiller, Erakovic, & Hēnare, 2011, p. 223). An aesthetics that acknowledges the interrelationship between humans and the environment must accordingly shift from humancentric practices towards kaitiakitanga (stewardship). Similarly, when there are no ontological separations between humans and objects, then the aesthetics of relational emergence has a constant relationship and acknowledgement with the unknown. Whether this is informed by an agential realist approach where "Knowing is not a bounded or closed practice but an ongoing performance of the world" (Barad, 2007, p. 149), or a worlded approach where taonga "call me to feel and think them" (Barnett, 2017, p. 30), an aesthetics of relational emergence is not the same as interactivity, which is underpinned by enculturated notions of time, the supposed neutrality of technology, and notions of causality predicated by mathematical logical relations.

By acknowledging unknowability as a precondition of human reality, an aesthetics of relational emergence can implicate multiple understandings of the nonhuman within continuously unfolding fields of relations. Whether potentiality is acknowledged as indeterminacy or as mauri, then such aesthetics are always open-ended and can be known by nonhumans. Engagement of the nonhuman through technological rigs or other situations, uncouples the need for a human interpretant as a prerequisite for aesthetics, yet without necessarily requiring their departure. This move towards posthumanist understanding of aesthetics at the hyphen has profound consequences for both art and science, inasmuch that neither can simply be identified as solely a human activity. Whilst performative reassessments of science have begun to critique the co-constitutive capacity of representational technologies in terms of replicable data, such critiques within art domains have scarcely begun.

Conclusions and reflections

This practice-led creative research situated at the Māori-Pākehā hyphen in Aotearoa-New Zealand, has sought to explore potential parallels and synergies between the Western posthumanist approaches of speculative realism and new materialism, and Māori ontological approaches. A relational methodology was used to acknowledge that it "is the relation, or connection, not the thing itself, that is ontologically privileged in indigenous and Māori thought." (Hoskins & Jones, 2017, p. 53) As a Pākehā attempting to be guided by a kaupapa Māori methodology, this researcher recognises that he is relationally implicated within the phenomena that is called *Tōia Mai*. Being implicated is to consequently acknowledge the co-constitutive performativity of multiple entangled agencies that are also operatively engaged. Attempting to understand the fluidity of this relationality at the hyphen requires not engaging in essentialisms, but to recognise that Māori ways of being and doing as the norm. It is to attempt to be "*Māori-centric* rather than *Māori-only*." (Stewart, 2017, p. 139) To be Māori-centric need not imply humancentric in the Western sense, but to engage with a worldview where the Cartesian bifurcation between nature and culture does not exist:

> Philosophically, Māori do not see themselves as separate from nature, humanity, and the natural world, being direct descendants of Earth Mother. Thus, the resources of the earth do not belong to humankind; rather, humans belong to the earth.
>
> Hēnare, 2015, p. 82

There appears to be a partial parallel between this metaphysical framework and the idea of the "agency of actants" (Latour, in Salter, 2010, p. xxviii) which informs Barad's (2007) and Bennett's (2010) new materialism. Partial, because both Barad and Bennett locate their arguments in relation to materiality without acknowledging spirituality beyond references to the relational agency of human practice. Indigenous spirituality has clearly been excluded by traditional and contemporary Western philosophy, with concepts such as mauri typically being enframed by Kantian informed notions of being ethereal and substanceless.

Such conversations are well overdue - not the least of which because indigenous-Māori knowledge at the hyphen has much that could help to inform Western posthumanist understandings. Trying to "move away from Kant" (Dolphijn & van der Tuin, 2012, p. 72) appears to have been problematic for speculative realist and new materialist philosophers, grounded in the same Western philosophical trajectory they attempt to distance themselves from. Yet the universal applicability of Kantian sensible concepts that informs contemporary understandings of time, space and matter simply cannot be

taken for granted. Neither can it be assumed that humans are exceptional in being able to produce knowledge of the world, whether this occurs through rationalist logicities or otherwise. Here then appears to be a fundamental difference between speculative realists and new materialists, inasmuch speculative realists are “united by their rejection of correlationism” (Bryant at al. 2010, in Shaviro, 2014, p. 10), typically through recourse to mathematical or positivist approaches that attempt to exceed human finitude and gain access to things-in-themselves. For instance, whilst Meillassoux (2008) claims to evade Kant through positioning the supposed correlation between thought and being as being true in this world but not necessarily in others, he nonetheless relies on Kantian sensible concepts to inform his claim towards objective knowledge. This is clearly demonstrated when he says that there are some subjective representations “that can be universalised, and are thus capable of being experienced by everyone, and hence ‘scientific’.” (Meillassoux, 2008, p. 4) Similarly, Delanda (2016) attempts to avoid reductionism through his assemblage theory and its nested concept of virtual diagrams, which are a form of “cartographic strategy” (Delanda, 2016, p. 110) in order to derive objective truth through a type of differential calculus.

Barad (2007) takes issue with the universal applicability of these metaphysical assumptions in her explanation of quantum mechanics. She argues that representations are not “independent of all practices of representing” (Barad, 2007, p. 46) and instead contends that the supposed omnipotence that calculus offers is disrupted by the quantum (Barad, 2007, p. 233). Calculus is not the deterministic affair that Newton envisaged, for the universe does not operate like a gigantic clock that predicates causality. Instead, time and space are performatively enacted within unfolding phenomena:

> Space, time, and matter are intra-actively produced in the ongoing differential articulation of the world. Time is not a succession of evenly spaced intervals available as a reference for all bodies and space is not a collection of pre-existing points set out as a container for matter to inhabit.
>
> Barad, 2007, p. 234

If Barad’s agential realism is founded on the idea the universe creates meaning in relation to itself (Barad, 2007, p. 148) then this too has a partial parallel with Mika’s articulation of worldedness, whereby “one thing is never alone, and all things actively construct and compose it.” (Mika 2016, in Mika 2017, p. 4) Yet despite her insistence that “practices of knowing cannot fully be claimed as human practices” (Barad, 2007, p.

185), Barad steadfastly refuses to engage with any notion of spirituality, grounded as she is in material realism.

A similar trajectory can be found between Bennett's (2010) exploration of vitalism and mauri, where Bennett makes pains to distance herself from what she sees as "a separate force that can enter and animate a physical body." (Bennett, 2010, p. viii) This is a particularly narrow view of how spirituality and materiality might relate to one another as Marsden (2003) vigorously disputes, and one that seems to align with a Western history of "lingering racism and evolutionism that motivate distinctions between the animate and the inanimate" (Bracken, 2007, in Braddock, 2017, p. 7). Comprehending mauri as 'life-force' in a Māori context, is to understand that "vitalism is expressed in a number of terms in Māori and constitutes an assembly of life forces: "*tapu, mana, mauri,* and *wairua*" (Hēnare, 2015, p. 84) [italics in original]. Elsewhere, this interconnected nonbinary framework appears to have some resonance with Bennett's definition of an assemblage that "is never a stolid block but an open-ended collective, a "non-totalizable sum." (Bennett, 2010, p. 24) Furthermore, it also seems to have some synergy with Bennett's *thing-power* which is "an inexplicable vitality or energy, a moment of independence from and resistance to us and other bodies" (Bennett, 2010, p. 18). But whilst Bennett provides an understanding of agency that acknowledges indeterminacy, with actants that are not discrete and self-contained and where there is no need for a human 'knower', like Barad she is steadfast in maintaining a materialist sensibility which explores "the vitality of matter and the lively powers *of* material formations" (Bennett, 2010, p. vii).

Part of the difficulty for this creative researcher who has attempted to engage with Māori metaphysics at the hyphen, has undoubtedly arisen from a philosophical background informed by Kantian divisions between material substance and its opposite, the insubstantiality of shared sensible concepts. It underpins Delanda and Meillassoux's claims to realist objective truth, and where they are otherwise very different, unites the arguments of Bennett, Stern and Delanda in relation to virtuality. Stern draws on Massumi (2002) by saying that virtuality "'is the immanence of a thing to its still indeterminate variation'" (Stern, 2013, p. 14) and Bennett's definition of A-Life is informed by being "a vitality proper not to any individual but to "pure immanence, or that protean swarm that is not actual though it is real: "A life contains only virtuals". It is made of virtualities". (Deleuze, in Bennett, 2010, p. 54). Virtuality for Delanda is somehow "real but not actual" (Delanda, 2016, p. 5), so that his virtual diagrams are "connected to a space of pure virtuality, a cosmic *plane of consistency* that exists as a limit of deterritorialization" (Delanda, 2006, p. 109), where deterritoralization is the degree to which an assemblage's components are heterogenous.

Attempting to practice at the intercultural hyphen space, the distinction between the substantiation of immanence and its oppositional insubstantial absence is problematic. The notion of potentiality in particular appears to have very different understandings and requires a sustained and comprehensive reassessment. If, as Mason Durie (2001) puts it, “all beings and objects are experienced as having mana, a form of presence and authority, and a ‘vigour, impetus, and potentiality’ called mauri” and “mauri and mana name the interconnectivity of the human and non-human worlds” (Hoskins & Jones, 2017, p. 52), then this is quite different to Delanda’s conception of virtuality as being non-manifested potentialities. Neither does it align particularly well with Bennett’s vital materialism, which is “an incorporeality or a differential of intensities” (Bennett, 2010, p. 58). Nor is Stern’s conception of interactive art particularly well suited, ideally defined as amplifying the potentiality of what a body is through “affect, proprioception, and sensibility […] while taking account of embodiment and matter’s emergence from and with their relations” (Stern, 2013, p. 89). For Stern, potentiality seems always to be defined in relation human concerns and actions. Finally, in digitality potentiality is usually synonymous with probability. In summary, potentiality is typically conceived in Western frameworks as somehow being nonmaterial in relation to a more ‘real’ tangible materiality.

Mika (2017) agrees to the extent that he argues that Western knowledge of the world is predicated by a ‘metaphysics of presence’, where a thing is “divided from other things in the world; and it has permanent, identifiable characteristics that make it possible to be represented as here-and-now.” (Mika, 2017, p.21) He provides the critical insight that presence is always positioned to its lack thereof – absence. In contradistinction he provides an explanation of indigenous-Māori metaphysics based on what he calls worldedness, where “one thing is never alone, and all things actively construct and compose it”. (Mika 2016, in Mika 2017, p. 4) This description enables access into the difference between rendering Māori cosmology into a Westernised conception of time as being linear, and understanding how cosmogony details the ongoing processes of becoming. “The temporal is subordinated under the cosmic process and denotes not time but sequences in processes and events which occur in the cosmic process.” (Marsden, 2003, p. 23) Far from the universe being intrinsically knowable, within a Waikato-Tainui cosmogony humans are only the latest phase in the way Io orders creation, where just because some knowledge is known, it “doesn’t give you rights to the next stage” and “Humans are the juniors, they are the seniors” (Pokaia, personal communication, 1st February 2017, see Appendix B-V to B-CC). Here, potentiality is not positioned in relation to the absence of materiality, nor does it sit within a Newtonian conception of causality, because:

> Indigenous holistic thought does indeed suggest that apparently different stages of time are, in fact, co-instantaneous. Events do occur separately, but they are contained within a certain potential, and that potentiality is of utmost consequence for indigenous philosophy. That potential is non-linear (Mika, 2015d; 2016c; Mika & Stewart, 2015). Something had *always already* occurred, and its occurrence always already constituted other things. (Mika & Tiakiwai, 2016)
>
> Mika, 2017, p. 45 [italics in original]

There is then, a synergy between these accounts and new materialist descriptions that emphasise performativity and acknowledge nonhuman actants as having agency. Yet there is a reluctance from Barad, Bennett, or Stern to depart from the material–human relation, despite Barad's insistence that time and space are iteratively enfolded into one another, Bennett's arguments about the agency of assemblages, and Stern locating embodiment through the implicit body in performance. Perhaps this reluctance is due to the need for their arguments to be articulated using "sabotaging linguistics" (Mika, 2017, p. 3) that co-constitutes and implicates them back into a field of materiality. Barad for instance, identifies that "representationalism marks a failure to take account of the practices through which representations are produced" (Barad, 2007, p. 53) and calls instead for a performative understanding of the universe through "*a direct material engagement with the world.*" (Barad, 2007, p. 49 [italics in original] Despite her meticulous critique of science and technology practices as being co-constitutive within phenomena, she situates language within representation, asserting "Language has been granted too much power" and that everything "is turned into a matter of language or some other form of cultural representation." (Barad, 2007, p. 132) That language itself might be performative is not so much addressed as misapprehended, with a reference to Nietzsche's warning not to believe "that the subject-and-predicate structure of language reflects a prior ontological reality of substance and attribute." (Barad, 2007, p. 133) Her understanding of language is therefore always predicated by this Western preconception, whereas Mika's articulation of worldedness within language is certainly not grounded in representation:

> The unusual aspect of language here is that indigenous notions of time and place dictate that an utterance in total is influential before the words are encountered, or before the self is cognitively aware of them. Moreover, any speaker will be constructed in some way by speech without ever being aware of what is stated.
>
> Mika, 2017, p. 46-47 [italics in original]

To return to the spiritual; Western metaphysics often places it outside of, or at a distance from, the material. It is situated within the realm of insubstantiality, like a Kantian Idea it lacks tangible form. A performative understanding of language begins to collapse this dualism, for it does not describe spirituality but through the action of speaking it "is to *do* it" (Austin 1976, p. 6) [italics in original]. Within a worlded understanding language is acknowledged as having agency, for it "resides within other non-human entities including apparently inanimate objects, the dead and those to come; it is a phenomenon that infuses throughout the world and its undisclosed facets." (Mika, 2017, p. 75)

How these dynamics play out in practice within the intercultural hyphen space is not without its difficulties. Who or what is attributed as having agency, and when, cannot be presumed. As a non-Māori person who does not have an embedded knowledge of Te Reo Māori, I have often been unaware as to what is unfolding, until possibly, much later on. When attending hui where Te Reo Māori is the default mode, then what did I agree to or become enfolded within? When Tame Pokaia performed the karakia on that day when the foundations were first dug, my understanding of what he was saying was limited and yet the *experience* of it completely changed the tenor of the day. It was only later I learnt that karakia engaged with wairua and could tune in to mauri "to look after things" (Pokaia, personal communication, 12th December 2018, see appendix B-T). How too, can I describe the sensation felt at the end of the waiata that was sung on that first Matariki beside *Tōia Mai*? I'd been standing at the back with the Japanese student rustling around in his plastic bag to find his umbrella. As the last repetition of "Pai marie" followed the flow of that green river north, everyone was crying in the rain. I was a stranger at the back, part of something that escaped my fullest comprehension. 'Ko au te awa, ko te awa ko au' (I am the river, and the river is me) perhaps begins to describe it, but I am a Pākehā, and it is important to remember that "the hyphen is un-negotiable" (Jones, 2017, p. 186).

Theory is not practice, and practice does not automatically provide access to being. It does occasionally however confront one with what they thought they knew. Karen Barad calls for an "*ethico-onto-epistem-ology* - an appreciation of the intertwining of ethics, knowing, and being" (Barad, 2007, p. 185). It causes me to wonder why she chose epistemology to stand-in for 'knowing', when knowing can also be 'being'. This journey started off trying to make an interactive artwork as a means to explore the co-constitution of emerging phenomena. Attempting to be guided by a kaupapa Māori methodology emerged from a series of existing relationships, it did not suddenly arise from a book or taxonomies of knowledge. Trying to identify potential synergies and parallels between Māori metaphysical knowledge and posthumanist theory in practice,

means being prepared to not know, to acknowledge human finitude and all that this entails. This does not sit easy within academic traditions that assume “the teleological fantasy of Western education as a linear increase of knowledge.” (Jones, in Stewart, 2018: 770) The unknown is part of the universe as much as human knowledge or “matter of part of the world making itself intelligible to another part” (Barad, 2007, p. 185) [italics in original]. By putting to one side a desire to have control over events and phenomena and to be comfortable with uncertainty and not knowing, is to acknowledge the agency of the unknown. To collectivise it into a singular is a convenience, it is a way of accepting worldedness without completely understanding it. To put it another way, when sufficiently complex co-constituted phenomena occurs, they produce their own drift or *Pull* towards certain types of potentiality. *Pull* does not arise entirely from Māori metaphysics nor entirely from Western thought, it has emerged from this creative practice at the hyphen. ‘Things’ emerge, make themselves felt, opportunities that were not even possibilities coalesce through what might otherwise be described as chance alignments of encounter. In this space exists the in-between of the in-between. To attempt to find equivalence between Māori and Pākeha cultural concepts has to be recognised as impossible, as “‘us’ cannot stand *in place of* the hyphen; it can only name an always conditional relationship-between.” (Jones, 2017, p. 187) What does become apparent is the *appearance of parallelism*, those strange echoes of each other bouncing back in unfamiliar ways, talking to each other and sometimes through each other, diffracting perhaps, to become the start of some other kōrero.

Research such as this is necessarily broad, and it is impossible to encompass within it everything that might be relevant. Notable in his absence is the speculative realist Graham Harman whose object orientated ontology could almost have had a chapter to itself. The decision to exclude him was not taken lightly, with the main reason being that his argument is an extension of Kant inasmuch that for him objects are fundamentally withdrawn from each other:

> This consists in extending the gap between phenomena and noumena to the experiences of all entities. We can no longer specially privilege human beings (or rational beings in general), because every object encounters all other objects phenomenally only, as “sensual objects,” without being able to reach those entities as they in themselves, noumenally, as “real objects.” No object can ever entirely *know* (grasp or comprehend) any other object; indeed, an object cannot even really “know” itself.
>
> Shaviro, 2014, p. 70 [italics in original]

This view adds little to an overall discussion that originally attempted to find potential parallels and synergies between the metaphysics of te ao Māori and te ao Pākehā. Much of the critical framing of this research has already covered some of this post-Kantian ground and although some comparison is inevitable when researching difference between cultural frameworks, his claim that “For the most part, objects withdraw into a shadowy subterranean realm that supports our conscious activity whilst seldom erupting into view” (Harman, 2011, p. 37) is starkly oppositional to discussions about indigenous worldedness. When frameworks are placed in opposition to each other the result is a binary which clearly privileges Western modes of knowing, and situates indigenous knowledge and ways of being as Other.

Similarly, the metaphysical graphical structuralist arguments of Dipert (1997), Bird (2007), Oderberg (2011), Shackel (2011), et al., which argue that “at some fundamental level the world is a mathematical graph of nodes and edges” (Shackel, 2011, p. 10), have been excluded because it was felt that their structuralist assumptions maintained a universalism that in a general manner has already been addressed. This is not to say that these approaches might not have relevance for future research, not the least of which because the hyphen both acknowledges and has a relationship with difference. The hyphen is a pluralist domain, and whilst this stands in contradistinction to epistemological claims to a single ultimate reality, practice in practice appears to continuously evade singularities. Perhaps, these truths too, might be “coemergent wisdoms” (Ahenakew et al., 2014, in Mika, 2017, p. 49).

Also obvious in their absence are discussions about panpsychism and nonhuman consciousness. Despite David Skribina’s claim that “Panpsychism is not a spiritual or theological theory” (Skribina, 2017, p. 10), in his otherwise comprehensive survey of the topic, there is much that could be explored in relation to what he acknowledges as being excluded in his own work:

> It is a statement about theories of mind, not a theory of mind in itself. It claims only that all things, however defined, possess some mind-like quality; it says nothing, *per se*, about the nature of that mind, or of the specific relationship between matter and mind.
>
> Skribina, 2017, p. 319

So whilst this research has in a small way considered notions of worldedness, there is undoubtedly much to consider here. For when indigenous knowledge is approached as being cosmogonical rather than historically positioned as cosmological, then there is much that Pākehā can learn from Māori - if only Pākehā can let go of their desire to

understand everything. Finally, it seems appropriate to end with the start of the unfolding now:

Nā te kune te pupuke	From the conception the well up of emotion
Nā te pupuke te hihiri	From the well up of emotion the energized thought
Nā te hihiri te mahara	From the energized thought to remembrance
Nā te mahara te hinengaro	From the remembrance the consciousness
Nā te hinengaro te manako	From the consciousness the desire
Ka hua te wānanga	Knowledge became conscious (fruitful)

(Translation adapted from the Māori text of the cosmological chant of Te Kohuwai as cited in Hēnare, 2003; Salmond, 1991; Taylor, 1855/2007; cf. Marsden, 2003; Shirres, 1997)

In Nicholson, Spiller, & Hēnare, 2015, p. 273

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Glossary

My thanks to Tame Pokaia for helping to provide further explanations.

Actant	“A source of action that can be either human or nonhuman; it is that which has efficacy, can *do* things, has sufficient coherence to make a difference, produce effects, alter the course of events.” (Bennett, viii: 2010)
Ako	Simultaneous teaching and learning relationship
Atua	‘God’; Spirit personification with authority over specific domains
Ariki	Chief
Arikinui	Chiefly status
Aro	Attention
Aro aro	The front of something. Also used by Mika (2017) to refer to ‘come into one’s regard’ (see below)
Arohia	"dynamic listening and participation" (Nicholson, Spiller, & Hēnare, in Spiller & Wolfgramm, 2015: 275)
Ao	World/ universe
Correlationism	Belief that things in the world can only be apprehended through our thinking of them
Ethico-onto-epistem-ology	Study that recognises “the intertwining of ethics, knowing, and being” (Barad, 2007: 185)
Ex nihilo	Latin: ‘From nowhere, out of nothing’
Hapū	Subtribe
Hau	Breath of life/ breeze/ wind
Hawaikii	Legendary island, departure point for Polynesian migrations
He waka eke noa	Proverb that means ‘a canoe able to navigate its domain’
Hyphen	Intercultural space that draws “attention to the complex space at the self-other border" (After Fine, 1994)
Hui	Important group discussion; meeting
Io	Supreme being; the creator
IoT	Internet of Things
Iwi	Tribe, tribal confederation
Kai	Sustenance; food

Karakia	Blessing; chanted or otherwise; prayer
Kaumātua	Elder
Kaupapa	Plan; theme; goal; 'field'
Kaupapa Māori	"An *approach* to learning, teaching, healing, researching, parenting, and caring" (Durie, 2017: 4)
Kia ora	Expression/ greeting; 'Be well'
Kingitanga	Pan-Māori King movement
Kirikiriroa	'Long stretch of sandy gravel; Māori name for city of Hamilton
Kōrero	Talk; conversation
Koiwi	Bones. Literally, 'of/ belonging to iwi'
Kupu	Word(s)
Mai	Here; this place here
Mana	Presence; authority; status
Mana whenua	People with local authority over the whenua (land)
Manaakitanga	To restore mana; hospitality
Māori	'Ordinary'. Indigenous people of Aotearoa-New Zealand
Marae	Meeting house; typically tribal house in the form of a tūpuna, although not always for contemporary urban or educational forms
Marae atea	The area immediately in front of marae where visitors are welcomed
Matariki	Star cluster known elsewhere as Pleiades. Gateway concept to interconnected universe. In Waikato-Tainui tradition represents a mother and her six daughters; elsewhere refers to 'eyes of God'
Mātauranga	"Always-evolving, underlying *body of knowledge* that can guide practice and understanding" (Durie, 2017, 4)
Mauri	Life-force/ life energy, resides in all things
Moko	Descendent/ descent. (Compare with 'ta moko' = facial tattoo depicting lines of descent)
Ngāti Haua	Hapū of Waikato
Ngāti Māhanga	Hapū of Waikato
Ngāti Wairere	Hapū of Waikato. Mana whenua of Ferrybank reserve where *Tōia Mai* is located
Ngāhere	Bush/ native forest
Niho	Teeth
Noa	'Ordinary'; unrestricted

Pākehā	Originally meaning Europeans, nonindigenous people
Papatuānuku	‘Earth mother’; “rock foundation beyond expanse, the infinite” (Marsden, 2003: 22)
Performative	The action of action
Piko	Fern shoot; curve or bend
Pōtatau	First Māori king
Ranginui	‘Sky father’
Rangatira	Chief of tribe
Rangatiratanga	Chiefly authority
Reo	Language; typically ‘Te Reo Māori’ = the Māori language
Rohe	Lands; area
Rōpu	Group
Tāne	Atua descended from Ranginui and Papatuānuku. Atua of Ngāhere
Tangaroa	Atua descended from Ranginui and Papatuānuku. Atua of the oceans
Tangata	People
Tangata whenua	People of the land. Indigenous people
Tāniko	Embroidered hem patterns of kahu (cloaks)
Taniwha	Spiritual entity
Taonga	Commonly translated as ‘treasure’; “subjectless objects that call for conscious engagement, [which] perform and are performed.” (Barnett, 2017: 30)
Taonga Pūoro	Māori instrumentation/ music with atonal sounds
Tapu	‘Sacred’; restricted
Tāwhiao	Second Māori King
Tāwhirimatea	Atua descended from Ranginui and Papatuānuku; Atua of the winds
Te Awa	The River
Te Hā o Rōpu o Kirikiriroa	Literally ‘the living breath of the groups of Kirikiriroa’; Hamilton inter-hapū Council
Tihei mauri ora!	Expression meaning ‘Ah, tis life!’; Sneeze of life
Tiriti o Waitangi	Oral version/ living version of The Treaty of Waitangi. Aotearoa-New Zealand’s founding document between Māori and Pākehā
Tōhunga	Priest, highly educated person
Tōia	To pull, or drag; haul

Tōia Mai	To pull together
Tūhoe	Iwi originating from Urewera mountain range of North Island
Tūpuna	Ancestor; elsewhere spelt Tīpuna
Wā	‘Timeless’ time; Nonlinear time
Wai	Water
Waiata	Song, or chant
Wairua	Spirit
Wairuatanga	Spirituality
Waikato-Tainui	Tribal confederation of the Tainui people in the Waikato region and surrounds
Waka	‘Canoe’; boat; vehicle; vessel
Wānanga	Learning space
Whakaaro	To think; or thoughts/ “Thinking from worldedess is constituted by an act of acknowledgement, in particular towards the fact that something comes about (whaka) into one’s regard (aro aro).” (Mika 2017, p. 72)
Whakapapa	Whaka = ‘to become’, Papa = ‘Papatuānuku’; Sedimented layers; Common interpretation - genealogy
Whakatauki	Proverb
Whakawhanaungatanga	“Process of establishing relationships, relating well to others” (retrieved from: https://maoridictionary.co.nz/ 17th March 2019)
Whanau	Family. Extended kin group
Whare	House; building; sometimes, room
Whare kai	House on marae where food is consumed
Whare nui	Large house; main meeting house of marae; no food is to be eaten here
Whenua	Placenta. Land
Whiro	New moon. Trickster/ mischief/ innovator
Wintec	Waikato Institute of Technology. Tertiary level regional polytechnic of the Waikato region
Worldedness	“Idea that one is both formed and constructive” by the world. (Mika, 2017, p.72)

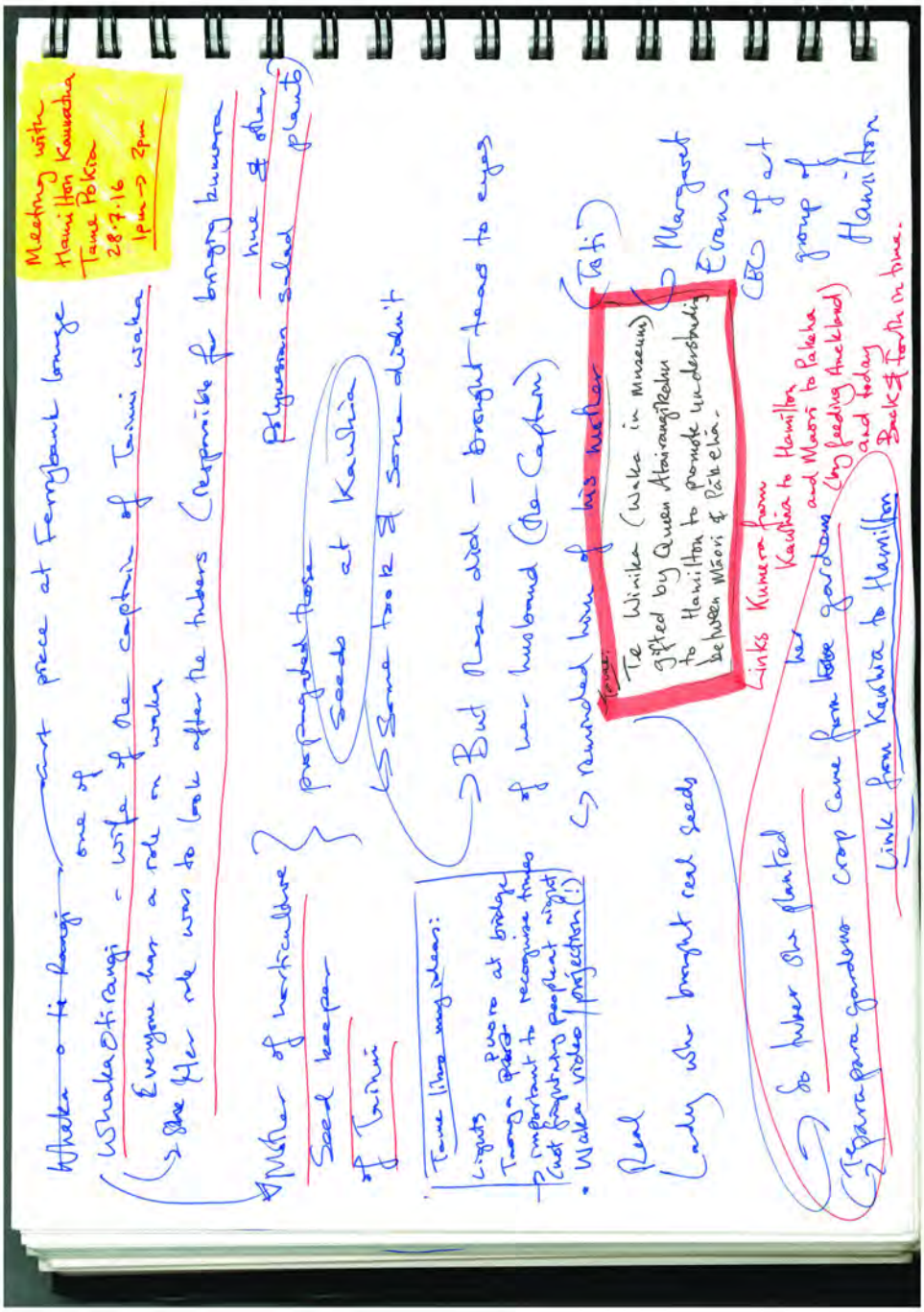
Tōia Mai opening at Ferrybank Reserve, Hamilton,
Aotearoa - New Zealand
November 23rd 2018

Appendix A

Guide to Appendix A

The following pages are scans of my notebooks from between 2016 and 2018. They illustrate how my ideas evolved over time and document various conversations and concerns. They are grouped both chronologically and thematically, so that readers can gain a sense of actants co-acting and emerging in relation to specific strands.

28/7/16 - 7/11/18	Kōrero, concept, and construction	A-C to A-M
1/2/17	Notes of conversation with Tame Pokaia	A-N to A-P
2/2/17	Reflection of conversation with Tame Pokaia	A-P
Mar 2017- Jun 2018	Conceptualising relationships	A-Q
Nov 2017	Hera White notes from hui with mana whenua	A-R
Dec 2017	Anticipated timeline end of 2017	A-R
Sept 2018	Project schedule example 2018	A-S
2016 - 2018	Matariki, relational emergence, Sound, IT & Power	A-T to A-Y
11/10/18	Notes of conversation with Jourdan Templeton	A-Z
2016 - 2018	Entangled agencies - letters	A-BB
Jun 2018	Example of promotional summary	A-CC to A-DD
19/10/17 – late 2018	General prototyping process for lighting	A-EE to A-II
May 2017 – July 2017	Tāniko lighting design process	A-JJ to A-OO
2017 - 2018	Exploring ethico-onto-epistemologies in lighting	A-PP
10/5/18	Reflections of hui with Te Hā o Rōpū o Kirikiriroa	A-QQ



Notes from conversation with Tame Pokaia 28th July 2016

Waikato taniwha rau! } Waikato of a hundred chiefs!
He Piko, he taniwha! } At every bend a chief!
He Piko, he taniwha! } At every bend a chief!

Original name of Waikato river:
Te Awanui o Taikehu
(The vast river of Taikehu)
Taikehu was a Tohunga who came to Kotaroa on the Tainui waka.

Tuna
Kanae (mullet)
Koura (crayfish)
Kaakahi (mussels)
inanga (whitebait)

Soil: Alluvial
taro, kumara, hue (gourd)

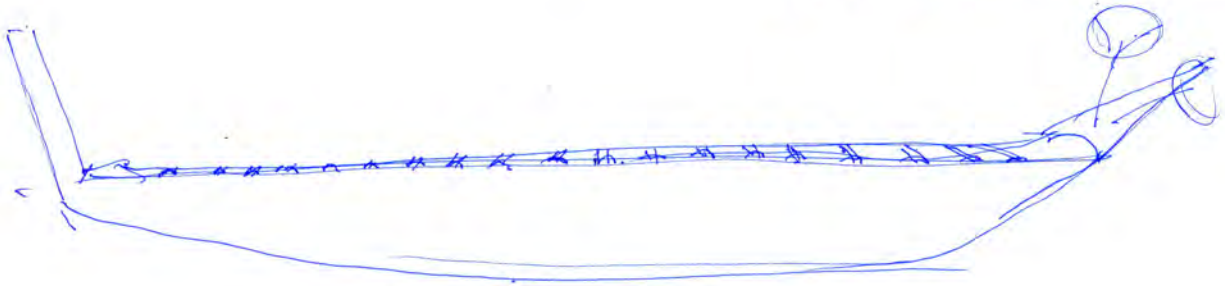
Collective undertaking

Te Winika

Refers to an orchid tree

Carved from single Tootara tree trunk

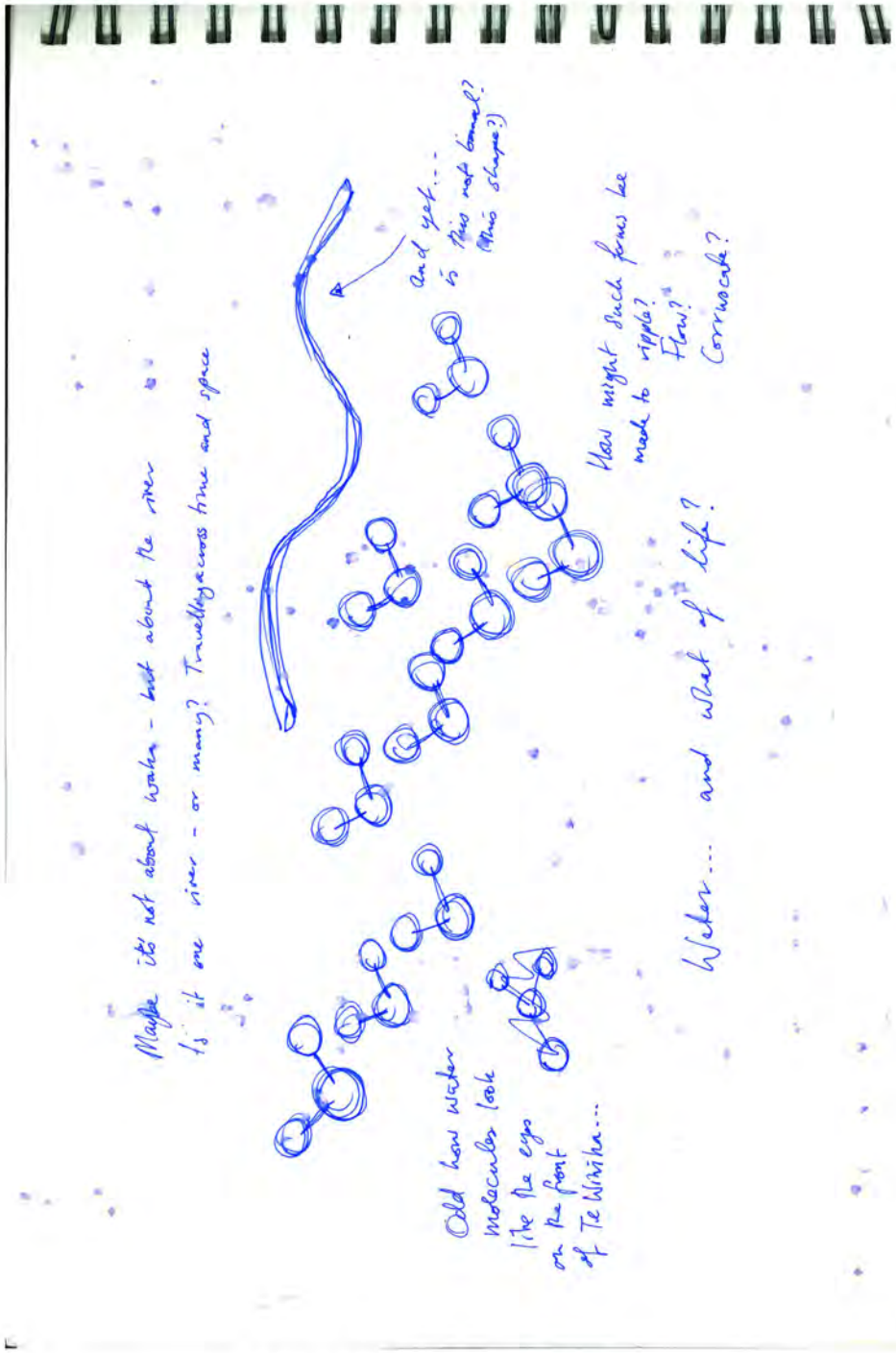
Gifted to the people of Hamilton by Queen dame Mairangikaahu ~~1938~~ 1973 to help understanding between Pakeha & Maori



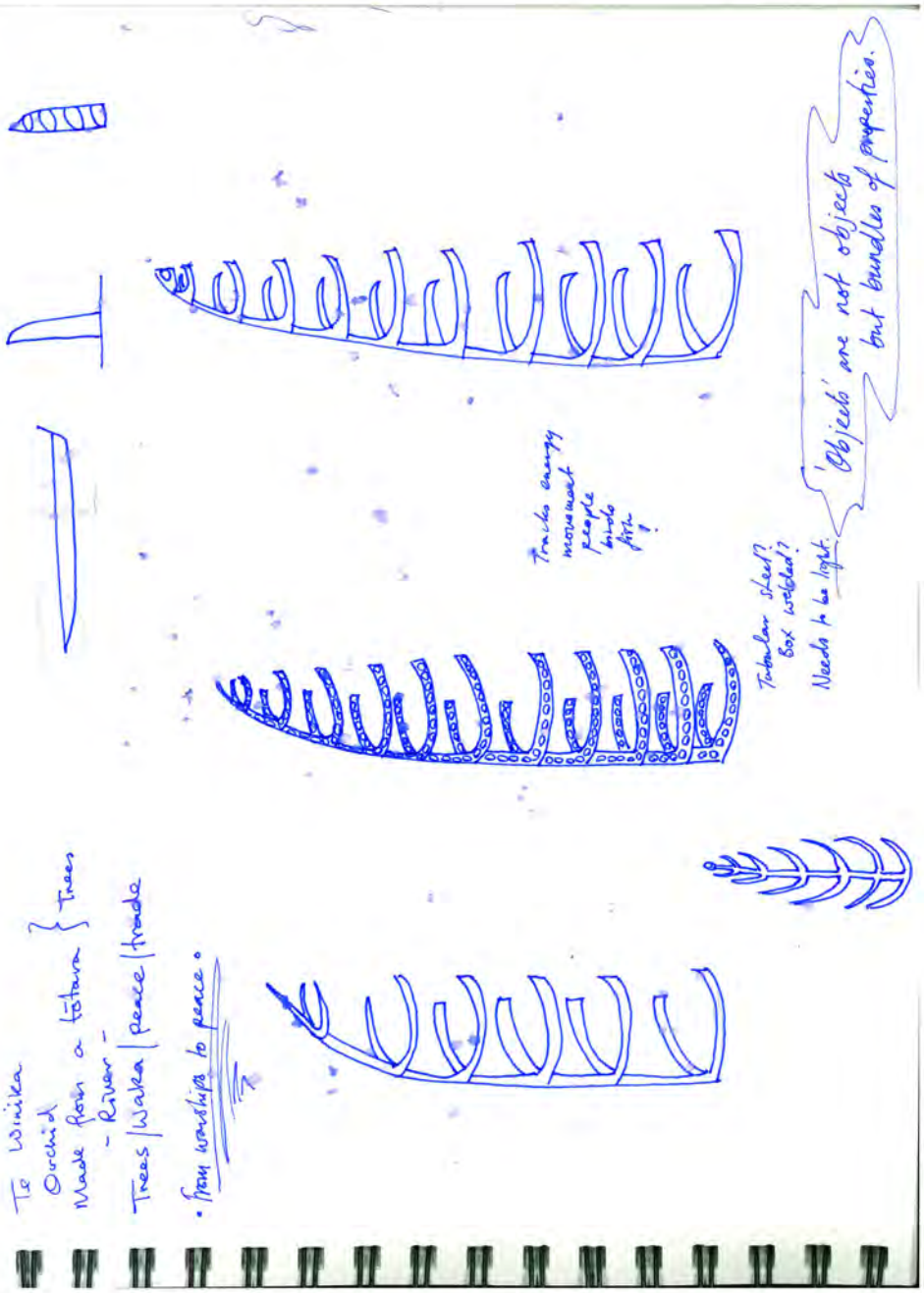
18th Oct 2016 - Visit to Waikato Museum

20 seats

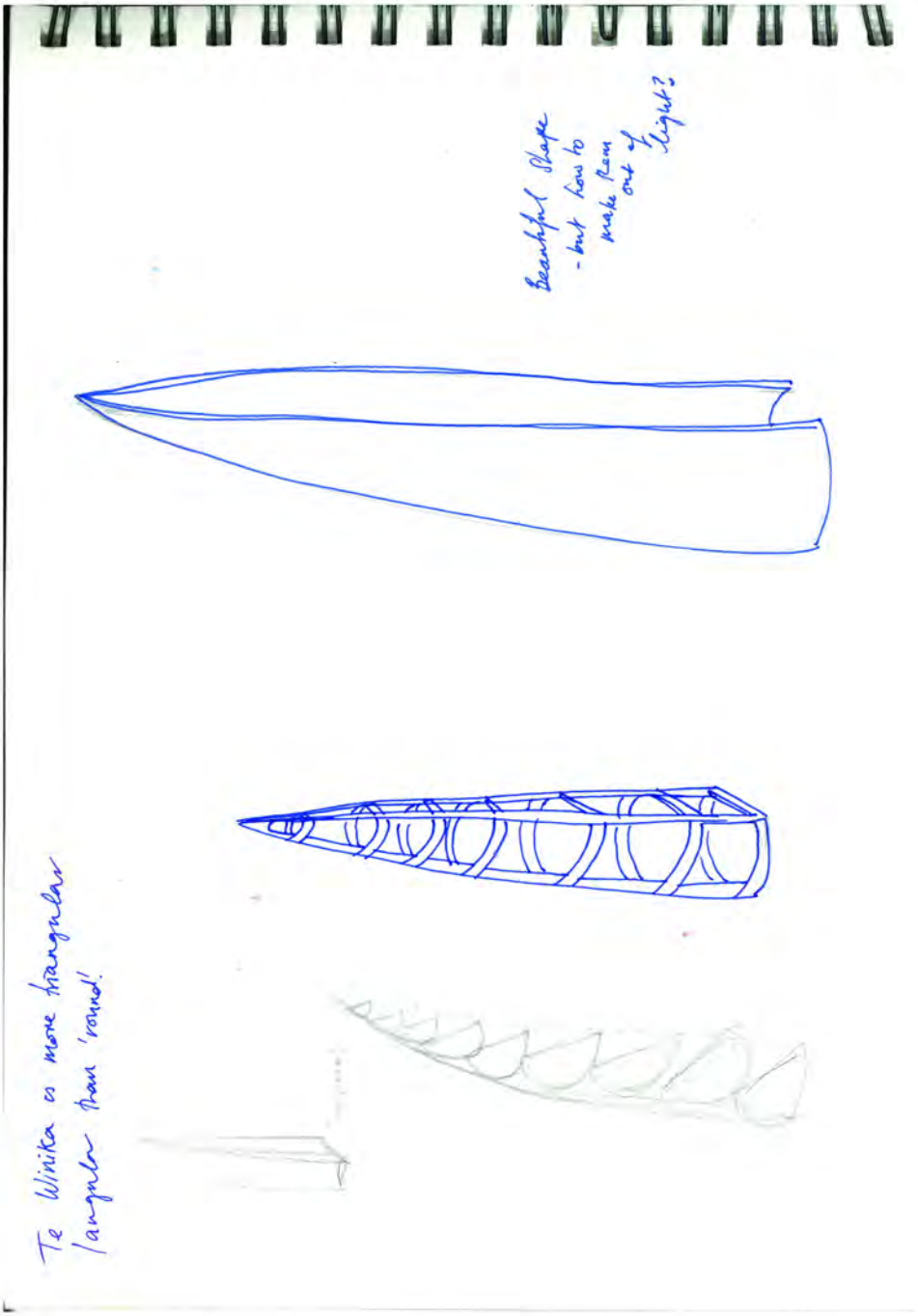
Visit to Te *Winika* at Waikato Museum, 18th Oct 2016



Ponderings, 18th October 2016



Ponderings, 18th October 2016



Ideas, late October 2016

Bundles of properties	Animals	(Including) humans	'Elements'	Vibrations
	Movement/speed direction	Movement/speed direction	Movement/speed direction	Movement/speed direction
	Temperature	Temperature	Temperature	X
	Use O_2, Produce CO_2	Use O_2, produce CO_2	Trees produce O_2 Use CO_2 Cars produce CO	X Cars produce vibrations
	Humidity	Humidity	Humidity	X
	Make sound	Make sound	Can make sound	Can make sound
	Carbon N	Carbon N	Carbon N	X

Common of projector, project sensorial, sound, etc
Could project textures, sound, light, or interactivity
(e.g. Nature projects have being and perspectives)

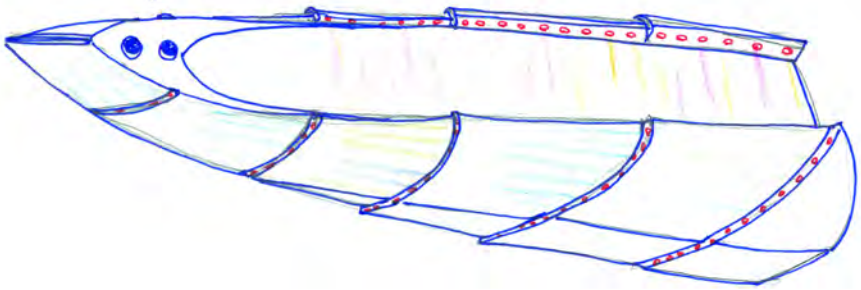
→ Has both behind and sensors for sensing & lighting

→ Underlighting emphasizes shape and minimizes spill (maximizes effects, minimizes light 'over exposure)

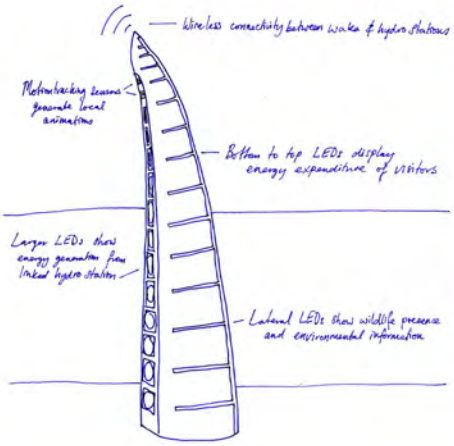
→ But is it still too rebelwind? Feels more horn-like or even dolek - laterals - even compromises mechanic structure less graceful, less whale-like.

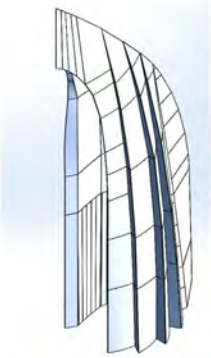
→ Which is a shame, as underlighting effects could play up kicker aspect.

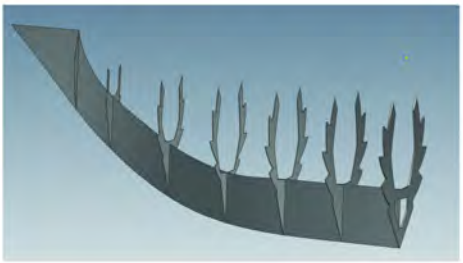
→ Think I will return to the vertical-only version - cluster style one: it allows for some behind aspects - just not in the way I anticipated.



Bundles of properties, November 2016

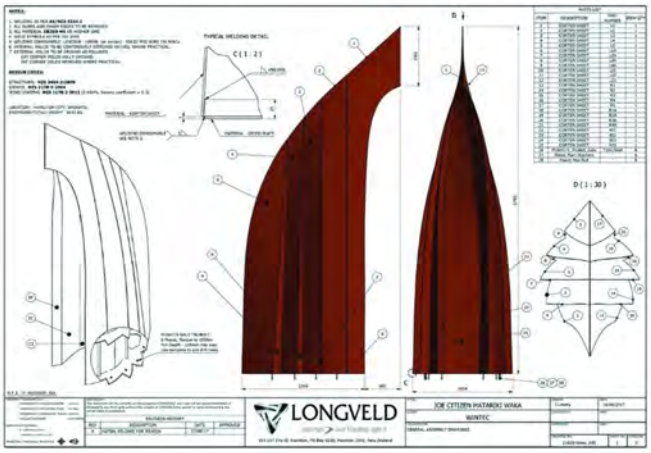


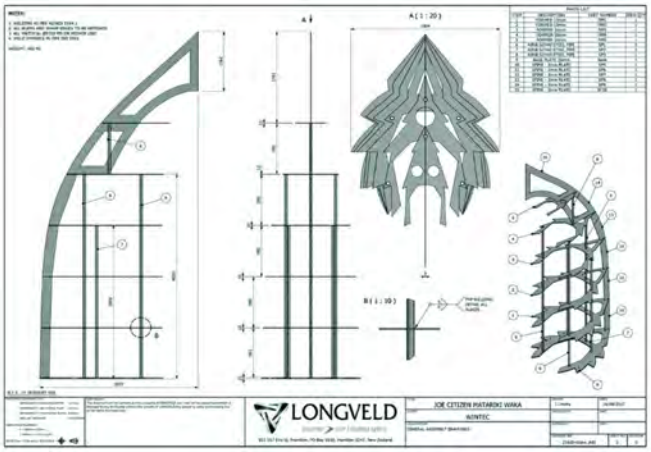


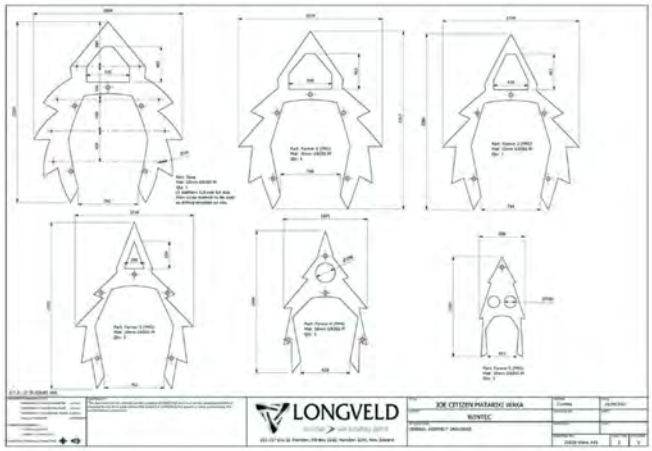


Journey of a Waka

1. Early drawing Oct 2016
2. Clay models Dec 2016 - Jan 2017
3. Cardboard models Feb 2017
4. 3D model by Luk McConnell Mar 2017
5. 3D print May 2017
6. CAD design Tully Billett July 2017
7. New design Jemoal Lassey Aug 2017



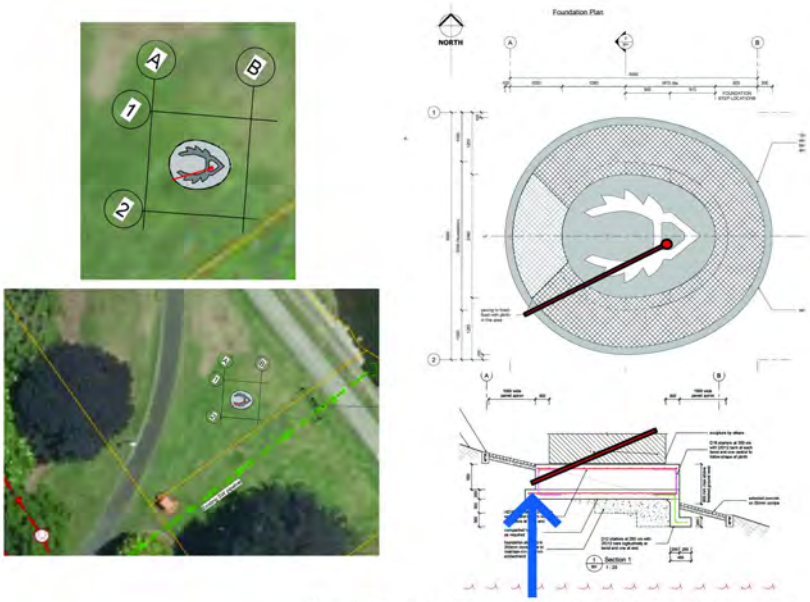




Longveld plans, September 2017

Student exhibition work
documenting the build process
at Longveld with student trainees
All images by Ying Wang
Images used with permission

Digging the foundation 11th Sept 2018



Electrical connection instruction 13th Sept 2018

Lifting day, 12th Oct 2018

Testing at Longveld, 17th Nov 2018

TŌIA MAI

Waikato taniwharau, he piko, he taniwha, he piko, he taniwha.

E ngā mana, e ngā reo, e ngā hau e whā, nau mai, haere mai.

I ngā rā o mua he wāhi taunga waka tēnei. Ka whakatūria te waka toi hou nei kia whakamahara ake i te awa o Waikato, ngā iwi o Kirikiriroa, me te kāhui whetū rongonui o Matariki.

Ka takohatia atu tēnei taonga e te Kuratini o Waikato me te ringatoi, ki te tini me te mano. Nō reira, tēnā koutou, tēnā koutou, tēnā tātou katoa.

Artist's impression of Tōia Mai prior to construction.

This modern waka sculpture, named Tōia Mai was gifted by Waikato Institute of Technology (Wintec) and the artist Joe Citizen to the people of Hamilton Kirikiriroa on Friday 23 November 2018.

It commemorates the rich history of the Waikato people who occupied the vast network of pā and garden settlements located along the Waikato River and the early settlers. It is also a tribute to the diversity of people and modern life today.

The waka sculpture celebrates Matariki (the star cluster Pleiades). Matariki and her six daughters are represented in the waka design through an Internet of Things network using environmental sensors and other data, and activated by movement.

Matariki holds special significance to Tainui as it heralds the start of a new year. It is a time to reflect on the past and plan for the future.

Other design features which include the niho taniwha and tāniko patterns were taken from and inspired by the kaitaka of the second Māori King, King Tāwhiao.

Tōia mai means to pull and work together. This project was completed through the collaborative efforts of Wintec staff and students, Hamilton City Council Te Kaunihera o Kirikiriroa, project partner Longveld, mana whenua and the participation of community groups and individuals.

Pai marire.

Tōia Mai was gifted by Wintec and the artist Joe Citizen to the people of Kirikiriroa on Friday 23 November 2018

Second year Wintec electrical engineering student work on Tōia Mai at Longveld.

KEY PROJECT PARTNERS:

Wintec

Hamilton City Council

LONGVELD

PRINCIPLE SPONSORS:

PERRY

AWARE

Trust Waikato

EL ENERGY TRUST

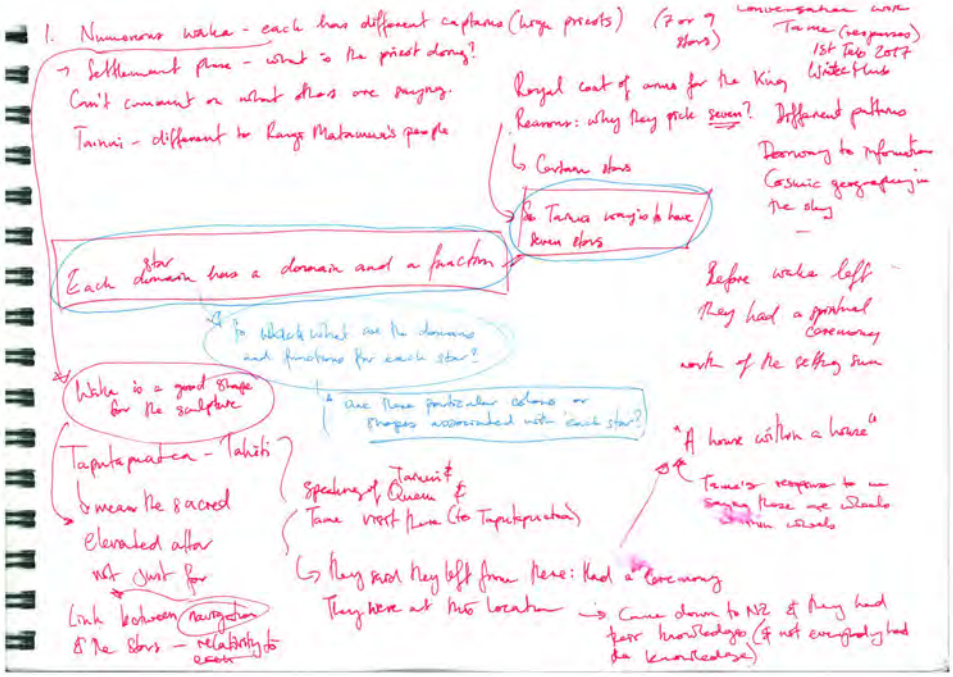
AUT

SPONSORS:

ACLX

McCREATIVE

Tōia mai signage, designed by Luke McConnell



1. Numerous waka - each has different captains (large priests) (7 or 7 stars)
Conversation with Tame (Pokaia) 1st Feb 2017 Waitetuna
→ Settlement phase - what is the priest doing?
Can't comment on what stars are singing.
Tainui - different to Rangi Matamua's people
Royal coat of arms for the King
Reasons: why they pick seven? Different patterns
↳ Constant stars
Harmony to information
Cosmic geography in the sky
Tania wanted to have seven stars
Each star domain has a domain and a function
Before waka left they had a spiritual ceremony
work of the setting sun
To sketch what are the domains and functions for each star?
Are there particular colours or shapes associated with each star?
Waka is a good shape for the sculpture
"A house within a house"
Tapuitapuatea - Tahiti
Tame's response to our singing those are stands from stars
Speaking of Tainui & Queen Tame visit from (to Tapuitapuatea)
↳ means the sacred
elevated altar
not just for
They said they left from here: had a ceremony
Link between navigation & the stars - relationship to each
They were at this location → Came down to NZ & they had their knowledge (& not everybody had the knowledge)

Conversation with Tame Pokaia 1st Feb 2017 - part 1

Stars have a relativity for:

Navigation
Culture
Certain people on the planet
Well being/Safety
Security/Care/Wholeness

They all work in sync with each other
Everything has a part in that cosmology
Seedling starts small - amongst many

Long journeys
Children from Tane needs a path (sought permission from) Tangaroa across his domain
Thanks afterwards

Disbanded at what the children had done
When light hit the living space (darkness) the everything started to grow (Tane said he was right)
Have decided to stay with Mum of some with Dad
Two hitmaker stayed up with Dad

We are part of Nature - they are not part of us
So humans are juniors - they are seeing

Meeting of the children of Rangi & Papa
One said he saw the outside
Worried when Rangi moved
Different views - arguments
For or against (Pirate are hateful)
Some favoured Tane
Some against
Tane - majority agreed to split them
Different strategy - worked

Lagoons
First: Darkness
2. Separation stones -
3. Water, Growth - light - insects & animals born before humans - Birds created later
4 'Demigods' of these domains - in control of a domain Resources & feeding of each domain.

All same day

1st ~~Thursday~~ Feb
Tane
Wednesday
-Tangaroa

Learning from Hawaiki - priest had to ask permission from each domain
Each domain has a 'pass word' (regulation) To access those rules - only the higher priest can do that.
Can't make a shortcut - must go through the higher priest

the program - logging in to that domain - doesn't give you rights to the next stage

The stars are children to form part of cosmology to make everything gel.
Stars are part of a family. Stars were put there for a reason - to make cosmology whole

Conversation with Tame Pokaia 1st Feb 2017 - part 2

Stars of Matariki - they are here on one level of the cosmos - they are a family.

Whakapapa

Only one star who is in charge - Ururangi - Tane thought that Papatuanuku looked too bare
So he made her a cloak of trees
When he looked at Dad, he looked too bare
Went to his brother Ururangi - who was in charge
of the stars - cloak of stars - can I borrow some
of your stars to pass on to Dad.

Tane cried from up
Dad because of his sadness - Rain
Mum " her sadness - Mist

First born? Turn to check terms

Senior
First born

Might be second
of the first Ururangi

Key ideas

different waters have different domains
e.g. Wai ora, wai kino (means good water)

When you watch water it comes from above

Drop → droplets → rain

Cycle (cycle of life)

Water as a source of life

Waiti
Waitā

Metaphorical terms
Fresh water gets lost when it mixes with the sea

people in the village will have better clarity

to do prayers or ceremonies

The point of waters into the highest points - [Wai tapu] or Waiorangi

in the sky

link to hinduism?

Can also relate to crossings

Different categories of water - different quality of waters have different aspects

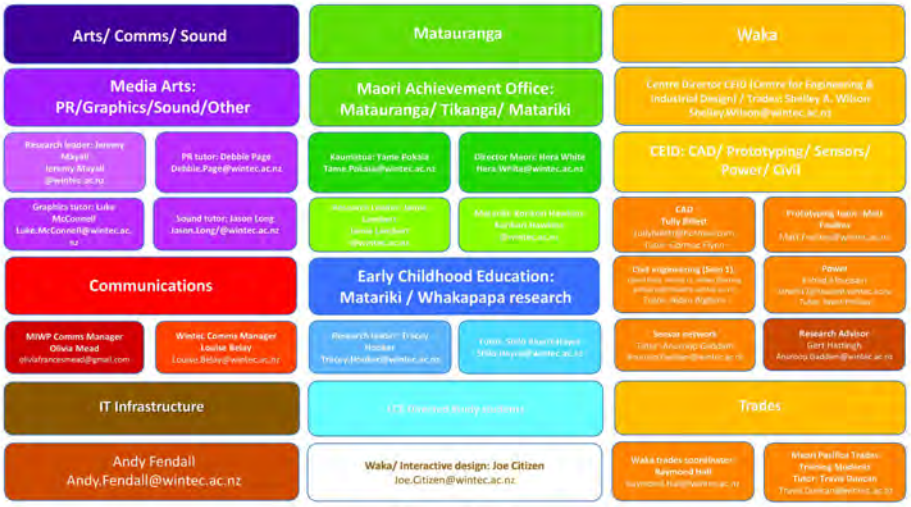
- Pumaho ka with
  - Earthquakes
  - Vibrations
  - Natural
- Tohuwhenua
  - Vibrations

Reflections - meeting with Tame Pokaia 2.2.17 (Home, in bed)

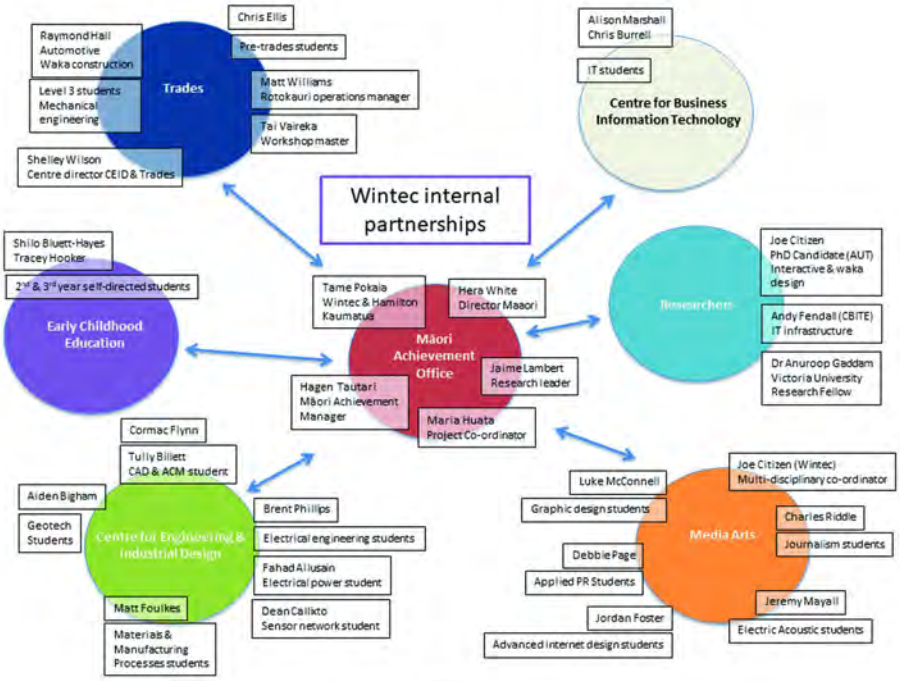
- Wheels within wheels, within wheels!
- A good decision to think of the 'Matariki journey' and my studies into the interrelationships between human and non-human agencies and interactive art as being separate (although these relationships do exist - just that its necessary for identifying different 'research projects.')
- A good decision to defer to 'things Māori' to him and Tama White. The subtleties and nuances involved mean that I am the learner - not and not therefore in a position to simply take a interpretive 'artist's' stance.
- Starting to think more about 'ordering of the world' and object-oriented-ontologies which decentred the human from a place of privileged.
- Hadn't appreciated before how the whakapapa of creation story between Rangi and Papatuanuku relates to 'being - knowing - feeling'
- Relationship between stars and water!!! Different types of waters have different qualities.

  Stars as 'icons' - " doorways to information."
- Links between waters - across times and places
- Domains of knowledges that inter-relate: Cosmology and being... lots to ponder on here.

Conversation with Tame Pokaia 1st Feb 2017 - part 3



Mar 2017



Jun 2018

Conceptualising relationships

Meeting at
Te Koopu Neania
2pm Monday 13th Nov
2017

also, Wiremu reference
to Te Mauteere O Koipakau
Pa & Sea Nga Tupuna O
Hokianga & Tamaiwhenua at this
Island

Joe Citizen

From: Hera White
Sent: Tuesday, 14 November 2017 10:56 AM
To: Tame Pokaia; Korikori S. Hawkins; Hagen Tautari; Jamie Lambert; Joe Citizen
Cc: RAHUI PAPA
Subject: mana whenua meeting

Kia ora koutou
Here are my notes if I've left anything out let me know. As Rāhui was'nt present have taken the liberty of sending these notes.

- Commenced 2 pm 13 Nov
- Attending; Muna Wharawhara on behalf of council and Ngāti Hauā, Wiremu Puke on behalf of Ngāti Wairere, Tame, Hera, Hagen, Korikori and Joe Citizen (Wintec staff).
- Karakia – Tame
- Apologies Rāhui. Māhanga rep to be contacted - Hera
- Introduction of Hagen as new Māori Achievement manager and purpose of meeting; to update members of mana whenua of the waka project since meeting of 11 May and recapping the kaupapa of the project
- Joe presented us with summary of project and changes made from feedback of last meeting
- Discussion points raised by Wiremu; suggest Wintec be familiar with the public art policy, ongoing maintenance and security and how this is factored, what financial support and importance of council processes including getting final consent for the site of the art work – Joe gave feedback on these areas
- Muna will guide Joe on the consenting of the site as this could adversely affect our timeframe and also council meeting dates
- Collaboration and in particular involvement of students in several schools a positive
- Wiremu suggested Tāwhiao quote from 'he maimai aroha' on base – Joe to investigate
- Direction towards east – this was agreed on practical and cultural reasons
- Q's about story telling and research on local history, waka culture etc – media arts students have started on the research as well as medium of story telling – web site etc.
- Karakia whakamutunga - Hagen

Hera White
Director - Maori
Wintec
Private Bag 3036, Waikato Mail Centre, Hamilton 3240
Phone: +64-(0)7-834 8800 ext 7810
Mobile: +64 0274307015
Email: Hera.White@wintec.ac.nz
Web: http://www.wintec.ac.nz/

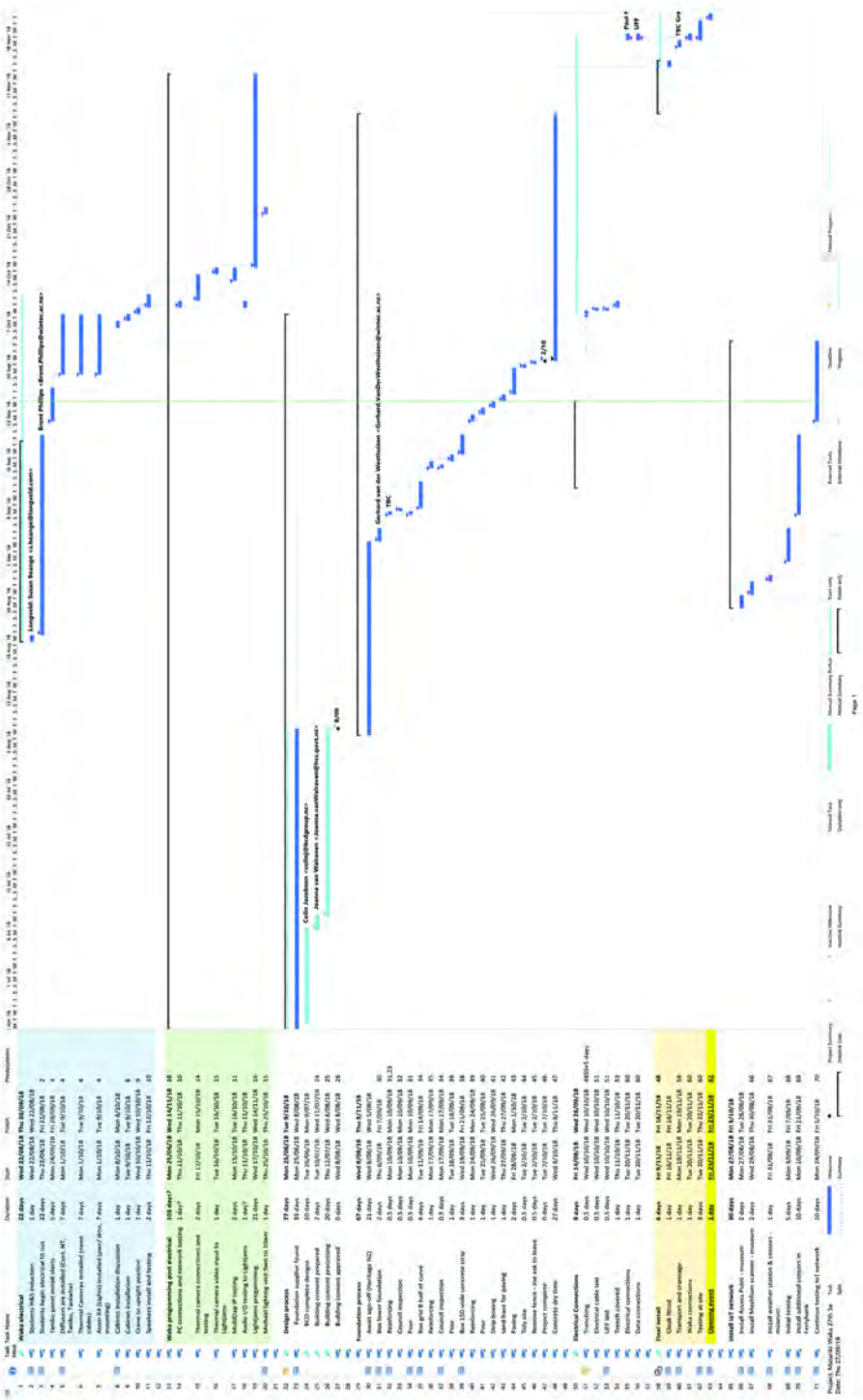
Wintec
WAIKATO INSTITUTE OF TECHNOLOGY

Email from Wintec Director-Māori re: Hui with mana whenua Nov 2017

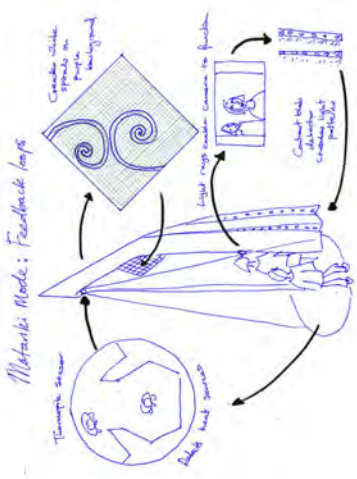
Matariki waka project – summary of timeline proposal

Key milestones	CEID	Trades	Media Arts	ECE	Maaori Achievement
Beginning of semester 1 2017	Intro/ whakawhanaungatanga BBQ – March 1st	Intro/ whakawhanaungatanga BBQ – March 1st	Intro/ whakawhanaungatanga BBQ – March 1st	Intro/ whakawhanaungatanga BBQ – March 1st	Whakawhanaungatanga plan delivered to all one week in advance
	Meet artist/ walkabout/ begin sensor/ power scoping		Graphics/PR meet each other and MAU	Begin research	Meet graphics/ PR/ ECE
			Graphics/ PR meet ECE researchers	Meet graphics/ PR	Location for Matariki celebrations 2017 decided
By end of term 1 semester 1	Prototype CAD delivered to MPP; Power sources identified; probably environmental sensor types identified in relation to proposed Arduino/ Raspberry Pi network		PR event plan draft completed Meet ECE	Meet journalism	
By end of term 2 semester 1	Final CAD delivered; final aluminium prototype completed; electrical design plan completed; environmental sensor prototypes completed		Concept, banner, logo images delivered to PR; PR event plan is live; journalism stories are live	Matariki presentations to other centres started	
Matariki 2017	**MATARIKI EVENT 2017**				
Mid year break	Build design starts	Build design starts	Spark 2017 planning starts		Spark 2017 planning starts
Beginning of semester 2 2017	LED fixture design starts (?) Power distribution design for waka and mesh network starts; microcontroller network communication scoping starts; environmental enclosure design starts	Begin waka build	Brand campaign meets with MAU; Spark story(s) delivered		Meet with Brand Campaign
Spark 2017	**Research opportunities (PBRF) – Spark exhibition**				
By end of term 3 2017	Lighting fixture prototypes delivered; power distribution plan delivered; networked environmental prototypes delivered		Graphics meet ECE to discuss Matariki stars representation	ECE meet graphics to discuss Matariki stars representation	
By end of semester 2 2017	Lighting fixtures built; power distribution / storage solution delivered; integrated	Waka build completed	Brand campaign delivered; journalism waka build stories delivered; animated gif designs		

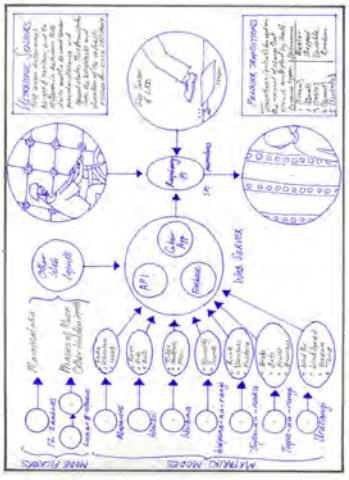
Timeline, December 2017



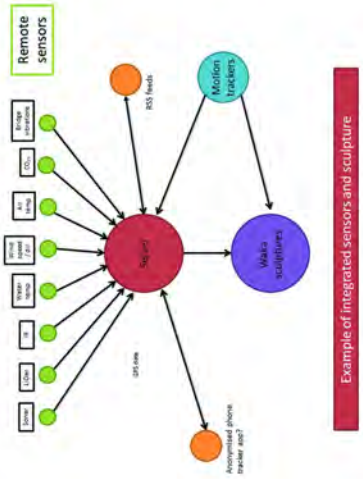
Project schedule - Sept 2018



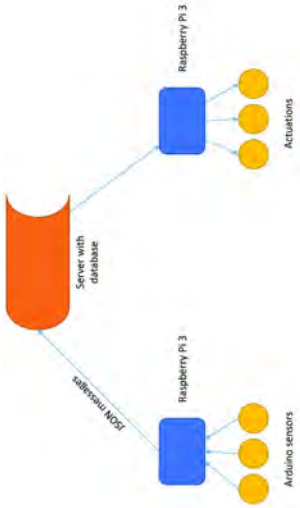
24th May 2017 - IT Overview



24th May 2017 - IT Overview



Oct 2016 - IT Overview



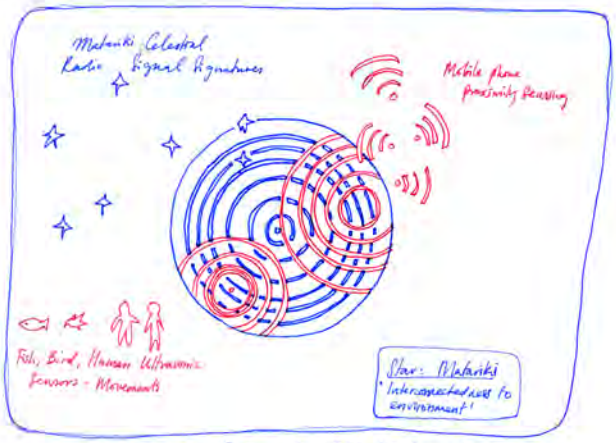
Nov 2016 - IT Overview

Early IT architecture ideas, with acknowledgements to Andy Fendall

Proposed sensors and measurements to be used in relation to each of the Matariki stars and their domains

Star	Domain	Emphasis	Sensors/ measurements to use
Matariki	"Eyes of God" Interconnectedness with the environment	I'd like to use wave energy – as waves permeate all things in the physical realms	• Radio signature of Matariki star • Thermopile and ultrasonic sensors (heat and ultrasound) for motion tracking on the waka sculpture itself • Radio signatures of mobile phones • Traffic vibrations from nearby bridge(s)
Waitii	Fresh water	Emphasis on kai	• Tracking the movements of fish, eels, koura etc. • Also, the river: Currents, speed, volume, temperature, turbidity (clearness)
Waitaa	Salt water	Emphasis on kai	• Tracking the movements of fish, edible seaweed, shellfish etc. • Also, the ocean: Tides, lunar cycle, salinity, possibly the currents at Port Waikato, Whaingaroa, and Kawhia?
Waipuna-aa-rangi	Water that pools in the sky	Emphasis on rain and mist, also steam	• Acoustic rain gauge – measures the sound of water droplets hitting surfaces (doesn't emphasise rain over mist) • Humidity
Tupu-aa-nuku	That which grows in the ground	Emphasis on kai	• Vibrations of root growth • pH, moisture, temperature etc. • Vibrations of the earth?
Tupu-aa-rangi	That which grows in the sky	Emphasis on kai	• Tracking the movements and sounds of birds • Measuring the growth of fruits, berries and nuts • Growth and movement of tree branches?
Ururangi	Connected to the wind	Emphasis on weather	• Wind speed and direction • Temperature • Pressure etc.

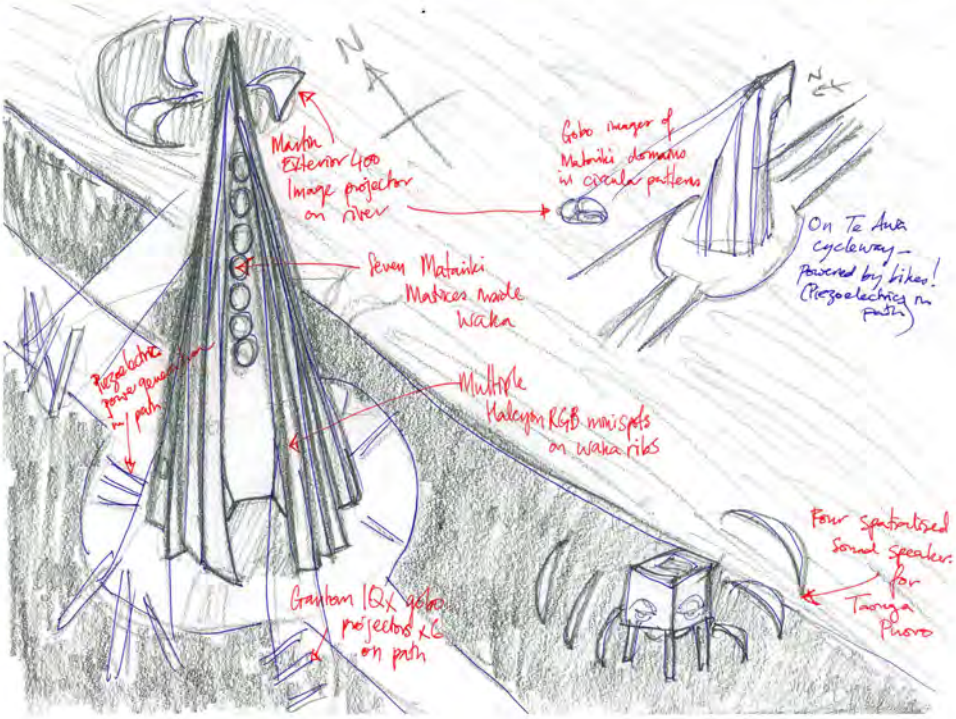
Original sensor proposal Mar 2017



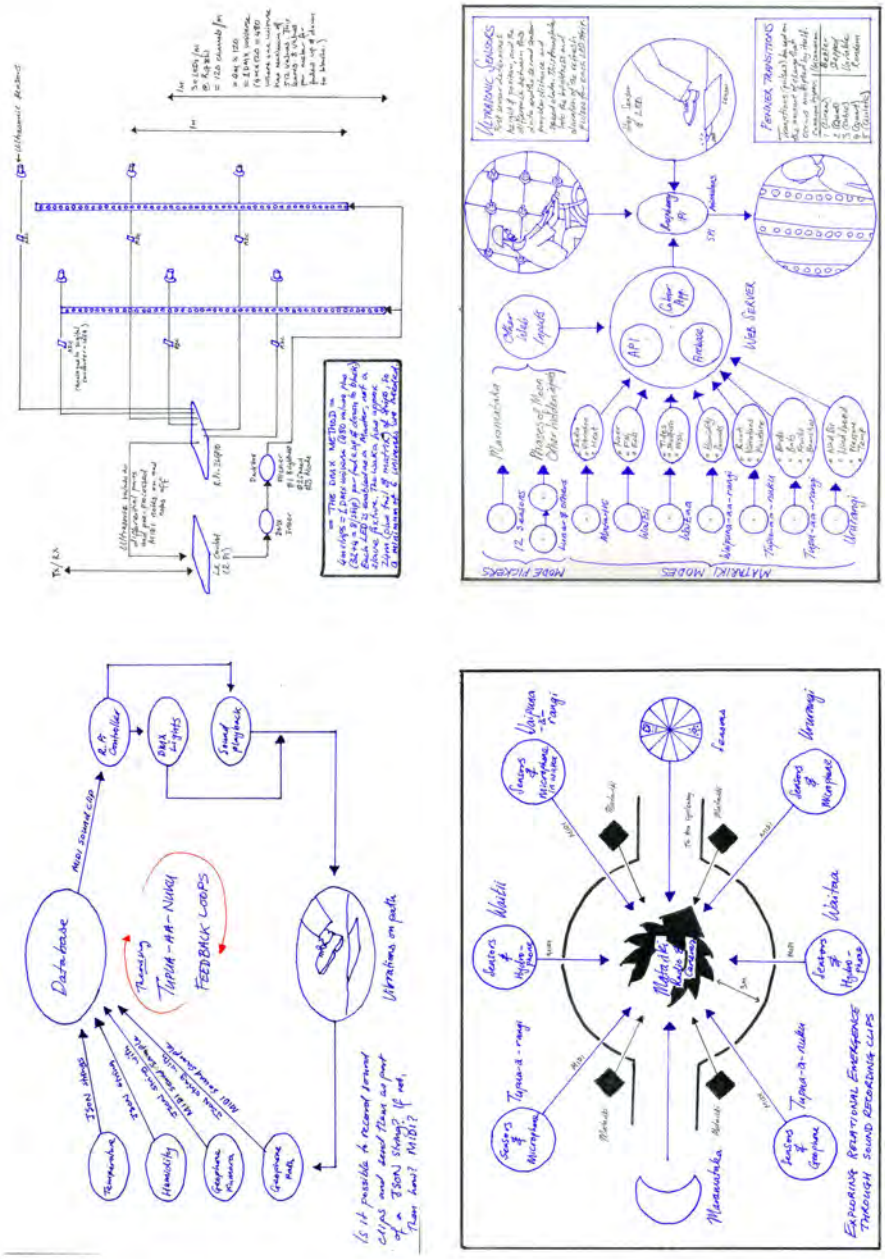
Example of Circular LED 'Matariki Star Map' which shows how participant motion tracking and other environmental sensor data can be represented.

Conceptualising relational emergence, Mar 2017

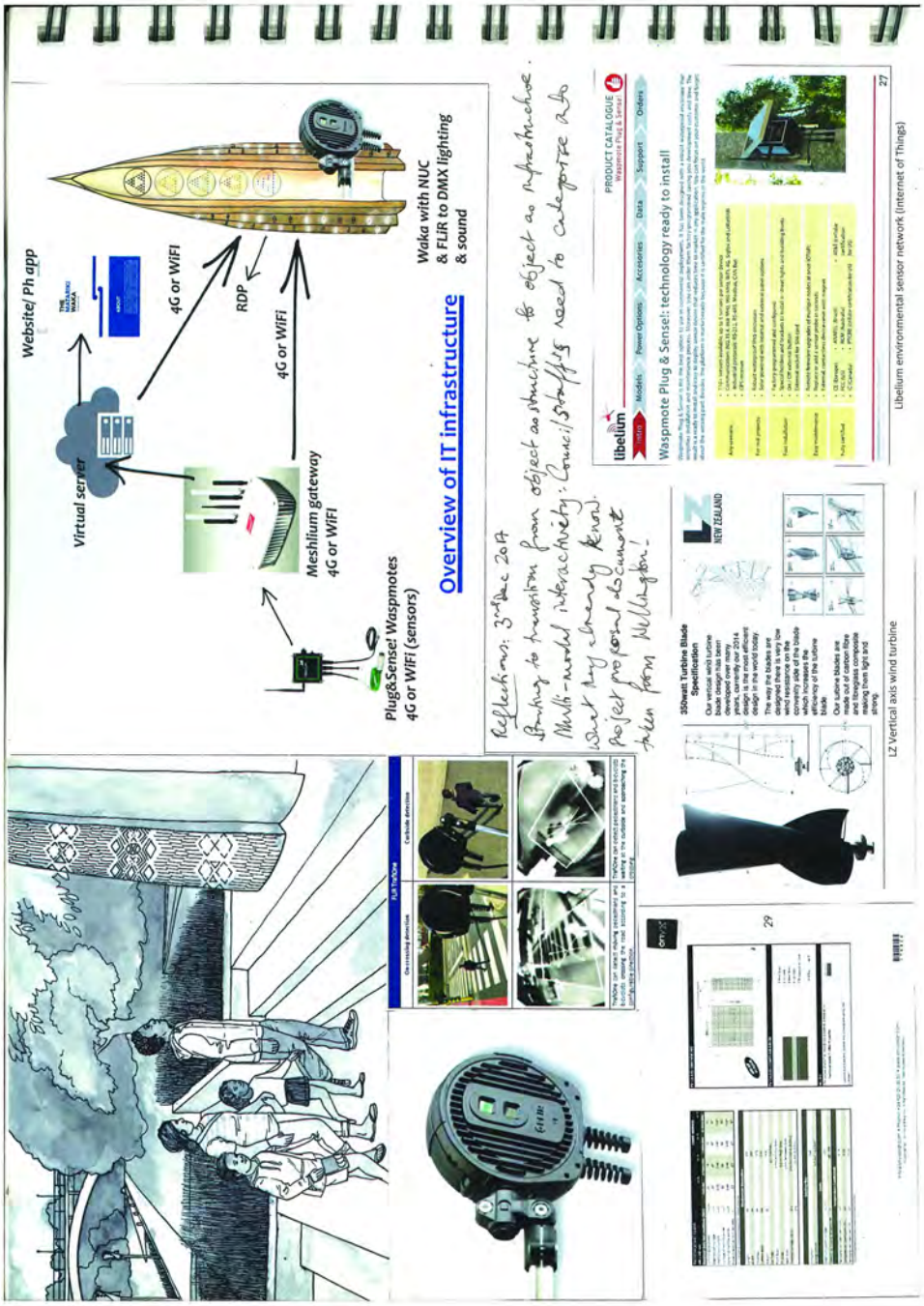
Speaker 1	Speaker 2	Bass & Speaker 5.1	Speaker 3	Speaker 4
[aspirations reflections connections]	Star Mode: Matariki (Daytime) - Sound Clips			[Triggered by presence of lots of people and/or the nights of Matariki]
Tinkling bells	Ringing bell	Singing bowl or Deep gong sound resounding	Ringing bell (2)	Intermittent tapping
Sound of a top being spun	Sounds of harakeke being woven	Sounds of chisel carving	Sound of a kite flying	Sounds of kindele-bonos being played
Footsteps quietly through leaves	Trees creaking	Pyrkeko hooting ~~Ruru hooting~~	Tui burst ~~Kiwi hooting~~	Piwakawaka ~~Bats flying~~ Chattering
Celestial tone 1	Celestial tone 2	Ulan deep drone tone	Celestial tone 3	Celestial tone 4
Group of children running.	Burst of childish laughter	Sounds of a group of girls skipping	A different burst of laughter	A Child's voice: "Coming, ready or not!"
A deep exhalation of breath (slow) Sigh	Slow deep breathing	Slow deep heartbeat	Slow-paced claps	Slow Counting Tahi, Rua, Toru, Wha, etc
Ropes being cast off into water & piled up	Waka moving through water	Paddles in water in unison	Wood creaking	Fish jumping out of water



Exploring relational emergence through sound - Mar/ Apr 2017



May 2017 - Conceptualising sound, light and IT architecture

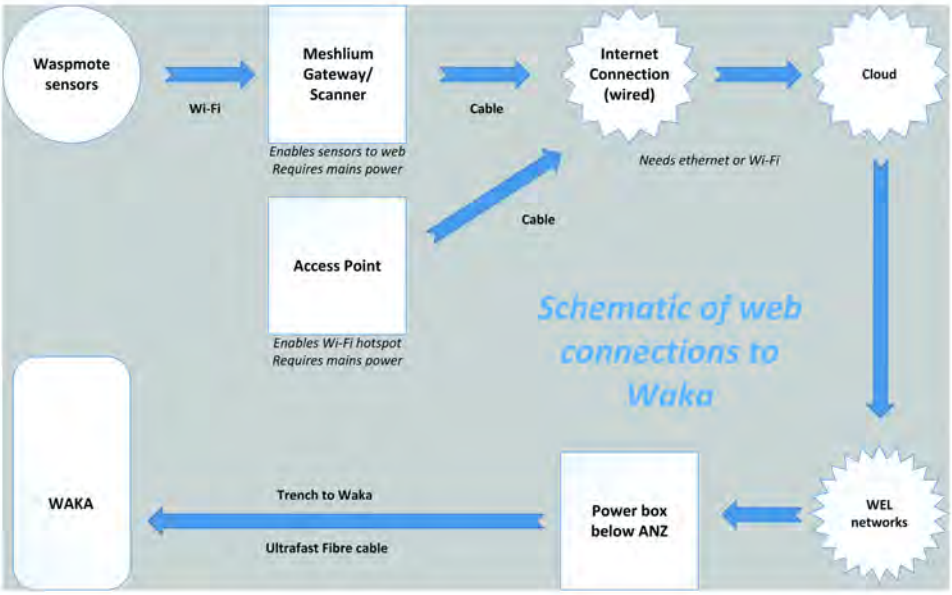


Pondering IT architecture & power relationships, 30th Dec 2017
Illustration by Juliann Smith, used with permission

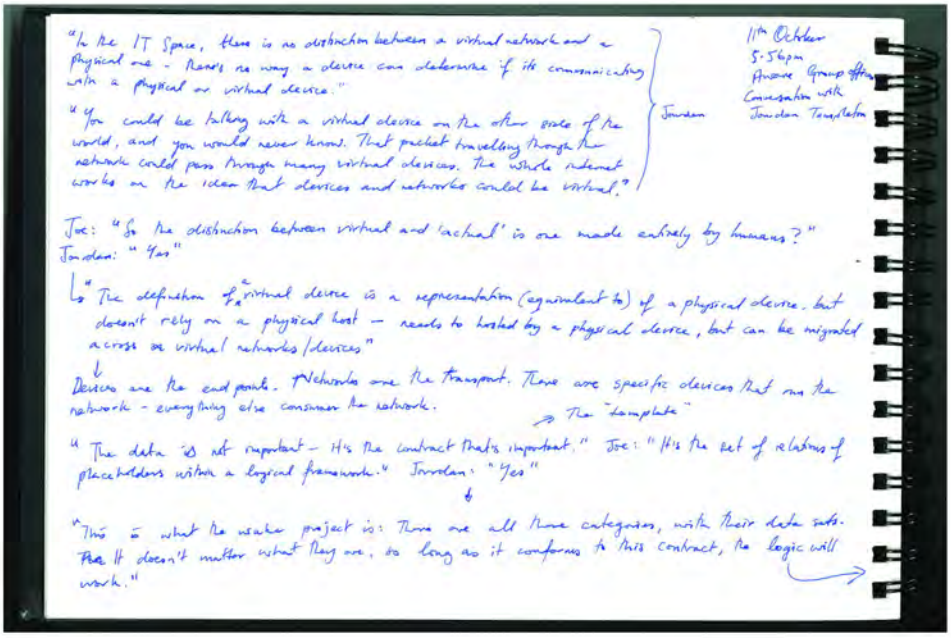
Summary of electrical load items for Waka

Item	Quantity	Power (W)	Phase A	Phase B	Phase C	Link	Image
Rising Dragon D6 RGB LED strings (1.08w per pixel x 50 pixels per string/ 5m)	28 strings Approx. 1512w	1512	1512			http://www.risingdragonlighting.com/prosinfo1.php?id=27&left=2&op=1&cid=43	
GLP Atom x4 RGBW* *Conversation with manufacturer regarding mains power source	1 fixture Approx 30w	30		30		http://zeermanlightproducts.com/products/glp/x4-atom-free-connect/	
FLIR TrafiOne 195 thermal imaging sensor Plus Ethernet interface	3 9w + interface	77		77		http://www.flir.com.au/traffic/display/?id=74.jpg	
PB Pro Business 53303 Small Form Factor PC with Gigabyte GeForce GTX1050 Graphics Card	1	300		300		https://www.gbtech.co.nz/product/WK5PB53403/PB-Pro-Business-53403-Small-Form-Factor-Intel-Kaby http://www.gigabyte.co.nz/Graphics-Card/GV-N105-OC-2GI #rf	
Wetsounds HT-AS-10 Subwoofer	1 500w max	500		500		https://wetsounds.com/pages/products/steath-AS-10_spec.html	
Wetsounds XS65 speaker or similar	8 X 120w	960			960	https://wetsounds.com/pages/products/XS-65_spec.html	
Raspberry Pi 3	3 max	37.5		37.5		https://pihrop.nz/RPI3-COMBO-1/	
Libelium Meshlium scanner And/or Access point (TBC)	1	15		15		http://www.libelium.com/products/meshlium/	
		3.4	1.5	1.0	1.0	kW Total	
		4.1	1.8	1.2	1.2	kW Total with 20% contingency	

Electrical loads calculations 15th Feb 2018, by Brent Phillips



Original connection plan Oct 2018, abandoned Wednesday 10th October
Antenna installed untested Friday 12th October



"In the IT Space, there is no distinction between a virtual network and a physical one - there's no way a device can determine if its communicating with a physical or virtual device."

"You could be talking with a virtual device on the other side of the world, and you would never know. That packet travelling through the network could pass through many virtual devices. The whole internet works on the idea that devices and networks could be virtual."

Jourdan

11th October
5-5.30pm
Amazon Group offices
Conversation with
Jourdan Templeton

Joe: "So the distinction between virtual and 'actual' is one made entirely by humans?"
Jourdan: "Yes"

↳ "The definition of a virtual device is a representation (equivalent to) of a physical device, but doesn't rely on a physical host — needs to hosted by a physical device, but can be migrated across or virtual networks/devices"

↓

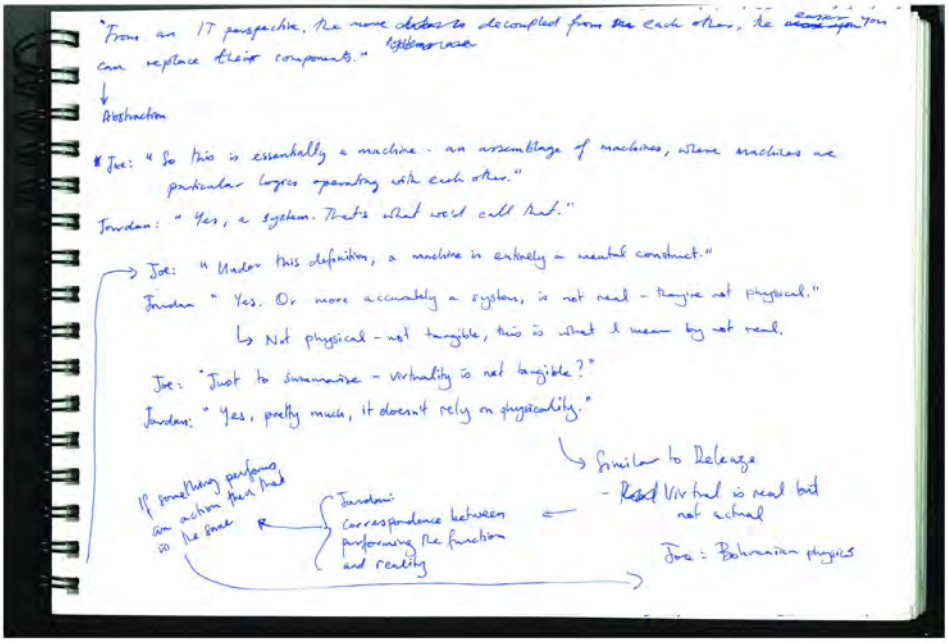
Devices are the end points. Networks are the transport. There are specific devices that run the network - everything else consumes the network.

→ The "template"

"The data is not important - it's the contract that's important." Joe: "It's the set of relations of placeholders within a logical framework." Jourdan: "Yes"

↓

"This is what the wealer project is: There are all these categories, with their data sets. ~~The~~ It doesn't matter what they are, as long as it conforms to this contract, the logic will work."



"From an IT perspective, the more ~~devices~~ decoupled from ~~the~~ each other, the ~~easier~~ easier you can replace their components."

↓

Abstraction

Joe: "So this is essentially a machine - an assemblage of machines, where machines are particular logics operating with each other."

Jourdan: "Yes, a system. That's what we'd call that."

→ Joe: "Under this definition, a machine is entirely a mental construct."

Jourdan "Yes. Or more accurately a system, is not real - they're not physical."

↳ Not physical - not tangible, this is what I mean by not real.

Joe: "Just to summarise - virtuality is not tangible?"

Jourdan: "Yes, pretty much, it doesn't rely on physicality."

↳ Similar to Deleuze - ~~Real~~ Virtual is real but not actual

Joe: Bohmanian physics

Jourdan: correspondence between performing the function and reality

If something performs an action that that is the same

Notes of conversation with Jourdan Templeton, 11th Oct 2018

Tōia Mai Interactive Logic

Zones 1 to 3, with Zone 1 being closest to entrance:

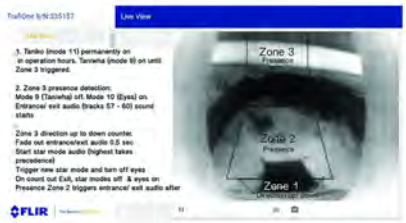
Zone	Lights (on ch 0)	Sound
No-one present	Taniwha (9), Taniko etc (11/ 12)	None
3	Entrance (2), Taniko etc (11/ 12)	None
2	Entrance (2), Taniko etc (11/ 12), Eyes, (10)	Entrance / Exit sounds (Tracks 57, 58, 59, 60)
1	Entrance (2), Taniko etc (11/ 12), Star modes (1, 3, 4, 5, 6, 7, 8)	Star mode tracks, currently: Matariki (1 -4) Ururangi (9 - 12) Waitii (17 - 20) Waitaa (25 - 28) Waipuna-aa-rangi (33 - 36) Tupua-aa-rangi (41 - 44) Tupua-aa-nuku (49 - 52)

Zone logic - Oct 2018

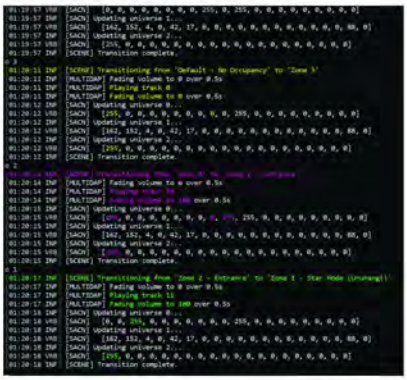
Star modes and their sensors

Star	Sensors
Matariki	UV light (waspmote), Number of mob phones in area (meshlium), Number of heat sources in field of view (flir thermal camera)
Ururangi	Wind speed (waspmote), Air temperature (waspmote), Air pressure (waspmote), Wind direction (waspmote) [8 values: N, NE, E, SE, S, SW, W, NW]
Waitii	River temperature (WRC), River volume (WRC), Turbidity (lawa.org.nz), River speed (lawa.org.nz)
Waitaa	Lunar phase (8 values), Ocean temperature (Port Waikato), Tidal co-efficient (PW), High tide height (PW), Solunar activity (PW)
Waipuna-aa-rangi	Rainfall (waspmote), Air temperature (waspmote), Humidity (waspmote),
Tupua-aa-rangi*	Particulate levels in the air (WRC), Hamilton power load (Transpower) * Want other values but can't find anything suitable at present
Tupua-aa-nuku*	Seismic activity Waikato region (Geonet), Lunar phase (8 values)
Trigger for eyes [1] and 2	(Flir thermal cameras)

Sensor logic - Oct 2018



Zone logic testing - Nov 2018



Data listening (Custom app) - Oct 2018

Maramataka modifiers

Data listening (Lightjams) - Oct 2018

Zone detection - Nov 2018

Star mode plays - Nov 2018

Exploring relational emergence: all data is modifiable
Design & Lightjams programming by Joe Citizen
App & IT architecture by Jourdan Templeton (Aware Group)

5 April 2017

To Whom It May Concern,

MATARIKI PUBLIC ART PROJECT

I am writing on behalf of the Hamilton City Council about Wintec's proposed Matariki public art project.

At the 4 April 2017 Community and Services Committee meeting, the Committee resolved to approve the Matariki public art project for Ferrybank Reserve at Stage One of the Council's Public Art Development Process. The project has unanimous support from all of the councillors present at the meeting.

Approval at Stage One means that the project has approval for installation in Ferrybank Reserve, and the exact location within Ferrybank will be determined when the concept is finalised.

The project has strong strategic alignment with many of the Council's current strategies and plans, including the Hamilton Plan, the River Plan, the Arts Agenda and the Public Art Plan and Development Guide.

We are very excited to see this project develop further, and we thank the Wintec staff involved for creating a fantastic public art project for the city.

Regards

Nick Johnston
Strategic Advisor – Arts & Community

Council Building
Garden Place, Hamilton
Phone 07 838 5854
Email nick.johnston@hcc.govt.nz
Website www.hamilton.govt.nz

Hamilton City Council

Private Bag 3010 | Tel. 07 838 6699
Hamilton 3240 | Fax 07 838 6599
New Zealand | www. info@hcc.govt.nz
hamilton.govt.nz

17 June 2016

To Whom It May Concern,

FERRYBANK INTERACTIVE PUBLIC ART PROJECT

I am writing on behalf of Hamilton City Council about the proposed interactive public art project by Joe Citizen.

Hamilton City Council adopted an arts sector action plan called the Arts Agenda in December 2015. The Arts Agenda identifies 34 actions to develop the creative sector in Hamilton.

The proposed public art project in Ferrybank responds to many of the Council's objectives set out in the Arts Agenda, including:

- Support the development of high-quality public art and urban design
- Encourage the use of spaces that are not usually seen as arts spaces or venues
- Support projects and initiatives that encourage participation

The project is also aligned with the Council's vision for public art in the city, in particular:

- Our artworks challenge, surprise, entertain and inspire.
- Our artworks engage diverse communities and stimulate interaction
- Our artworks are at the core of urban transformation and revitalisation.

Ferrybank is a site of strategic importance to Hamilton City Council. The Council's objective is to develop the site into Hamilton's premier river destination.

The Council will be working with Joe over the next three years as he develops his proposal and undertakes the series of experimental works. The project will also be assessed by the Council's independent public art advisory panel.

The project will not be formally assessed until the project proposal is completed, but staff are comfortable with the proposed activity and do not foresee any major issues at this stage that would prevent the project from taking place in Ferrybank.

Regards

Nick Johnston
Strategic Advisor

Council Building
Garden Place, Hamilton
Phone 07 838 5854
Email nick.johnston@hcc.govt.nz
Website www.hamilton.co.nz

Hamilton City Council

HERITAGE NEW ZEALAND
POUHERE TAONGA

8 August 2018

File ref: 2018/751
11013-21.

Joanna van Walraven
Hamilton City Council
Private Bag 3010
HAMILTON 3240

Tena koe Joanna

APPLICATION FOR ARCHAEOLOGICAL AUTHORITY UNDER HERITAGE NEW ZEALAND POUHERE TAONGA ACT 2014: Authority no. 2018/751, S14/258 and S14/259, Maori Horticulture and Military Settlement, Ferrybank, Hamilton

Thank you for your application for an archaeological authority which has been granted and is attached.

In considering this application, Heritage New Zealand Pouhere Taonga notes that you wish to install a Matariki Sculpture at Ferrybank, Hamilton. Subsurface features associated with two recorded archaeological sites may be affected by this proposal (S14/258 and S14/259). The wider archaeological landscape includes pre-European Maori horticultural sites and evidence of European-era settlement dating from 1864. The area is of significance to THAWK (Ngati Wairere, Ngati Mahanga, Ngati Hauaa, Ngati Tamainupoo and Ngati Koroki Kahukura), Waikato Tainui and Nga Mana Toopu o Kirikiriroa (NAMTOK) and we note the consultation you have undertaken.

Please inform THAWK, Waikato Tainui and NAMTOK, the approved archaeologist and the Heritage New Zealand Pouhere Taonga Archaeologist of start and finish dates for the work.

An appeal period from receipt of decision by all parties applies. Therefore this authority may not be exercised during the appeal period of 15 working days or until any appeal that has been lodged is resolved.

If you have any queries please direct your response in the first instance to:

Dr Rachel Darmody
Archaeologist
Heritage New Zealand Pouhere Taonga, Tauranga Office
PO Box 13339, Tauranga 3141

Phone (07) 577 4535 Email

The Matariki Waka

Public Art/Sculpture Agreement

Between

Hamilton City Council

And

Waikato Institute of Technology

And

Joe Citizen

8 June 2019

HCC Contract Number:

Wintec Contract Number C1-233744/18

Entangled agencies

He waka eke noa:

The Matariki Waka

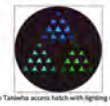
Concept image by 3rd year Illustration student Juliann Smith

He waka eke noa: ***The Matariki Waka***

Summary of project

Illustration student's impression of the waka with sensors

King Tauwhio tanko lighting design for corten steel cladding



Niho Taniwha access hatch with lighting design

Matariki lighting pattern design for corten steel cladding

He waka eke noa refers to a research partnership that seeks to create a public artwork with the working title 'The Matariki Waka'. It is being built with a stainless-steel skeleton and clad in 3mm corten plate, and will utilise an interactive design that engages with the seven stars of Matariki through LED lighting and ambient soundtracks. These will be informed by the movements of participants combined with an Internet of Things environmental sensor network, and will primarily operate at dawn and dusk.

This work will be situated at Hamilton's Ferrybank Park, having gained unanimous consent from the Hamilton City Council at both its concept and siting stages. It is a collaborative, consultative, multidisciplinary partnership with Wintec's Maori Achievement office, with guidance being provided by local kaumatua Tamie Pokaia. Students from across Trades, Engineering, Early Childhood Education, and Media Arts, have worked on the project to date, and next year will see this happen again on a greater scale. This project is being made with the support and partnership of Wintec researchers, ITS, and PhD candidate and artist Joe Citizen.

The aims of the project are multiple, and include: Celebrating the importance and interconnected nature of the Waikato river – in all its physical, spiritual, historical, and mental capacities – through the movements, vibrations and temperatures of human and non-human participants (such as animals, the weather, the seasons, phases of the moon, plant growth, the river itself etc.); helping students gain industry-ready skills through a unique collaborative project that values their contributions so that they become co-creators in the work; and providing new opportunities for long-term relationships between Wintec and Hamilton City Council, industry, mana whenua, and the people of Hamilton.

Current industry partnerships include Longveld, ACLX, and MechEng. Over $100,000 of funding has been secured so far, with donations, grants, and in-kind received from Perry's, Trust Waikato, WEL Trust, Longveld, and Wintec. Sustainable energy options have been researched by Electrical Engineering students, and next year will see their implementation, using solar and wind solutions.

The primary audience/ participants of this endeavour are rangatahi and young families, both in the finished work and in its process of becoming a reality.

1

He waka eke noa: ***The Matariki Waka***

Student engagement 2017

Semester 1:

Manufacturing Production and Processes (CEID)

Civil Engineering (CEID)

CAD Design (CEID) with Longveld

Applied Computational Modelling (CEID)

Matariki self-directed research (ECE)

MATARIKI

MATARIKI

2nd year Graphic design (Media Arts)

Painting and Sculpture (Media Arts)

PR (Media Arts)

He waka eke noa: ***The Matariki Waka***

Student engagement 2017

Semester 2:

(Sem 1 & 2) Power and Distribution (CEID)

(Sem 1 & 2) Electrical engineering - IoT (CEID)

Illustration (Media Arts)

Web design (Media Arts)

Pre-Trades students at Longveld

Promotional document June 2018 - Part 1

Additional images by: Juliann Smith, Tully Billett, Paul Nelson, PJ Williams, Longveld & Awhina Kerr

Student engagement 2018

Confirmed for semester 1:

- Electrical engineering and trades students to work together on the solar and wind energy aspects, following the proposed schedule below. Initial conversations with Dynamic Energy are in progress.

- Engagement by Early Childhood Education (ECE) self-directed research students.

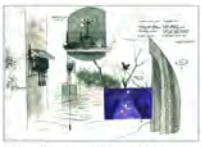
Interest received from, but unconfirmed for semester 1 and 2:

- Additional opportunities for Pre-Trades student mentorship with Longveld
- Electrical engineering IoT students
- CBITE students to develop a phone app that will stream music created by Media Arts sound students, access a website as designed by a Media Arts graphic design student, and add an Augmented Reality (AR) layer to the waka experience.
- Graphic design class (Media Arts)
- PR class (Media Arts)
- Journalism class (Media Arts)
- Media Arts new degree programme 2018 has a 3-week multi-disciplinary project focussed on Matariki, planning in progress
- Civil engineering class (CEID - pending confirmation from Hamilton City Council)
- Horticulture class (ongoing riparian planting collaboration with Hamilton City Council, pending funding)

Matariki interactive aspects (1)

Concept illustrations as painted by 3rd year painting and sculpture (Media Arts) student Juliann Smith

Concept for motion tracking



Concept for environmental data using Libelium sensors

Matariki interactive aspects (2)

Star	Domain	Emphasis	Sensors/ measurements to use
Matariki	'Eyes of God' Interconnectedness with the environment	Wave energy – as waves permeate all things in the physical realms	• Radio signature of Matariki star • Thermal imaging cameras (heat) for motion tracking on the waka sculpture itself • Mobile phones app
Waitii	Fresh water	Emphasis on kai	• Tracking the movements of fish, eels, koura etc. • Also, the river: Currents, speed, volume, temperature, turbidity (clearness)
Waitaa	Salt water	Emphasis on kai	• Tracking the movements of fish, edible seaweed, shellfish etc. • Also, the ocean: Tides, lunar cycle, salinity, possibly the currents at Port Waikato, Whaingaroa, and Kawhia.
Waipuna-aa-rangi	Water that pools in the sky	Emphasis on rain and mist, also steam	• Rain gauges – both volume and acoustic • Humidity
Tupu-aa-nuku	That which grows in the ground	Emphasis on kai	• Vibrations of root growth • pH, moisture, temperature etc. • Vibrations of the earth using geophone
Tupu-aa-rangi	That which grows in the sky	Emphasis on kai	• Tracking the movements and sounds of birds • Measuring the growth of fruits, berries and nuts • Growth and movement of tree branches
Ururangi	Connected to the wind	Emphasis on weather	• Wind speed and direction • Temperature • Pressure etc.

Work in progress

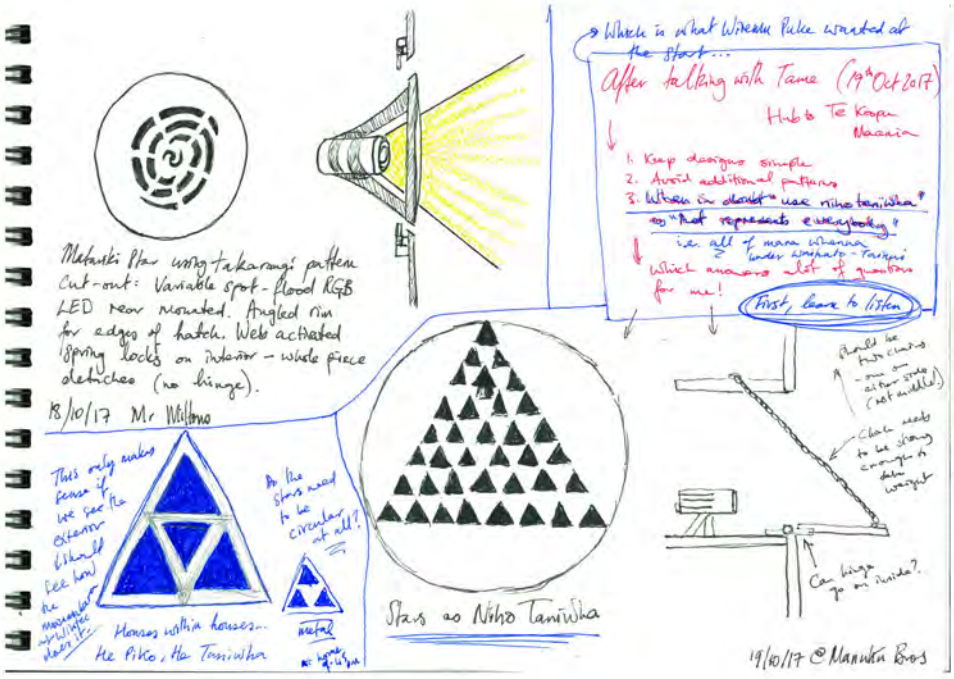
Proposed site

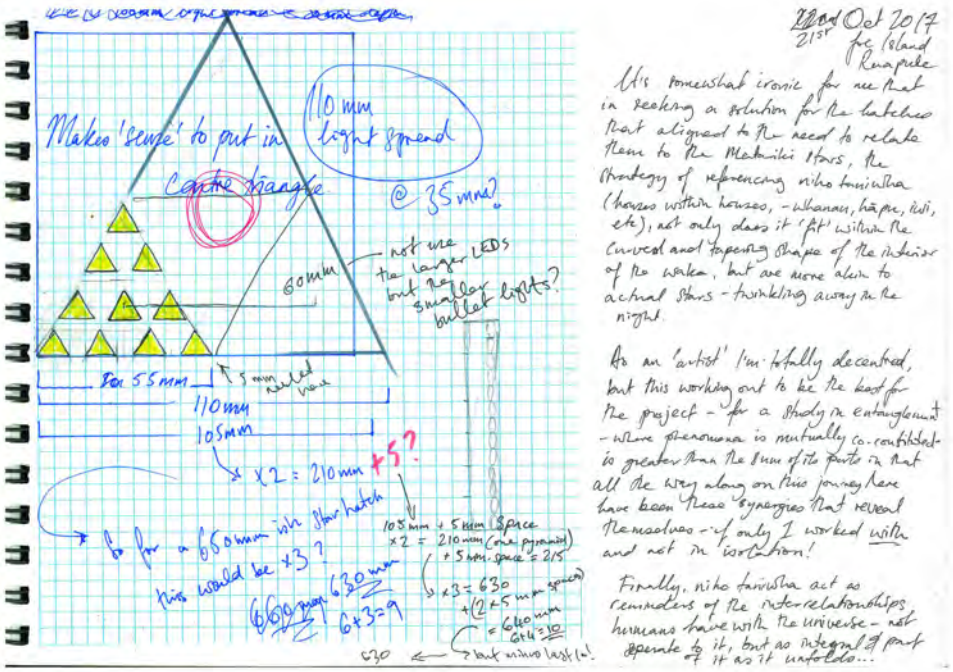
Following meeting with Hamilton City Council's Park and Garden's unit who informed us that our preferred site below the museum is prone to flooding and that proposed work to the area will not occur for a few years, we've engaged in a process of considering alternatives. We have recently received confirmation from Hamilton City Council that the proposed site 'C' as indicated above, would be the best alternative site.

Phase 1 completed

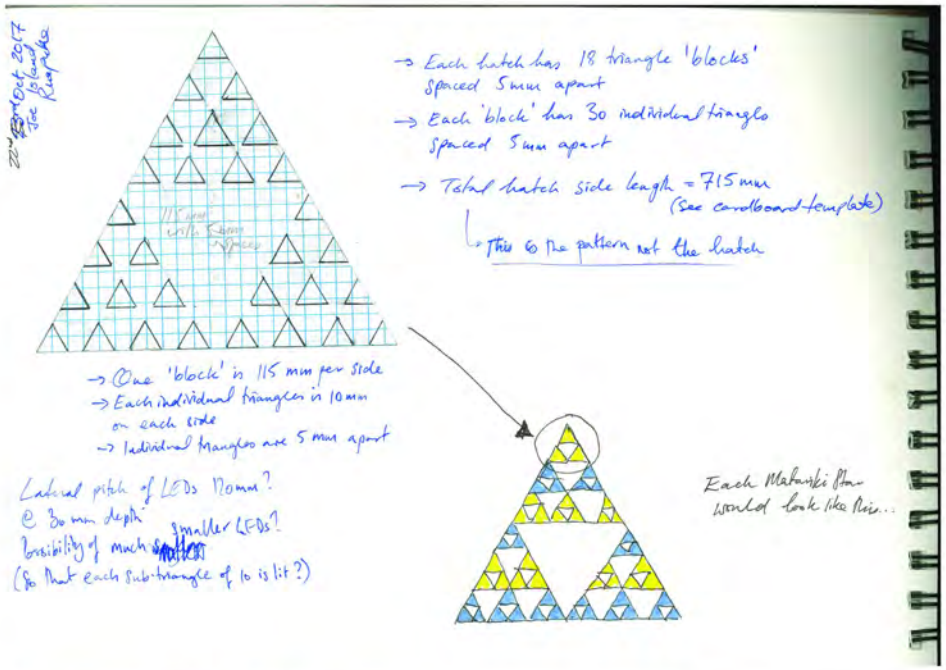
Keel and ribs of waka sculpture (phase 1) completed

Promotional document June 2018 - Part 2





Prototypes - 1



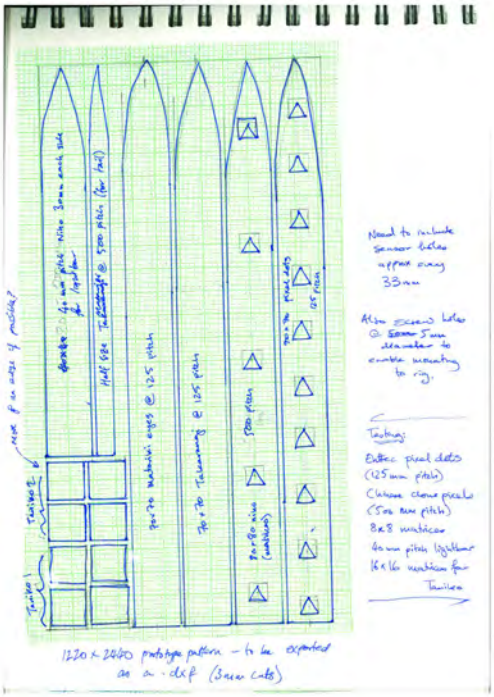
Round LEDs wiring pattern January

Round LEDs from ACLX, without polycarbonate diffusion

Adding polcarbonate diffusion to round LEDs

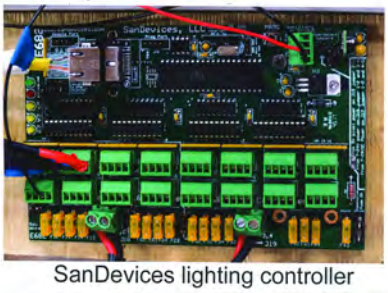
Blue moon eclipse in February

Prototypes - 2

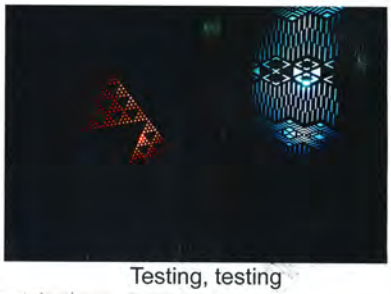



Making lightboxes March 2018

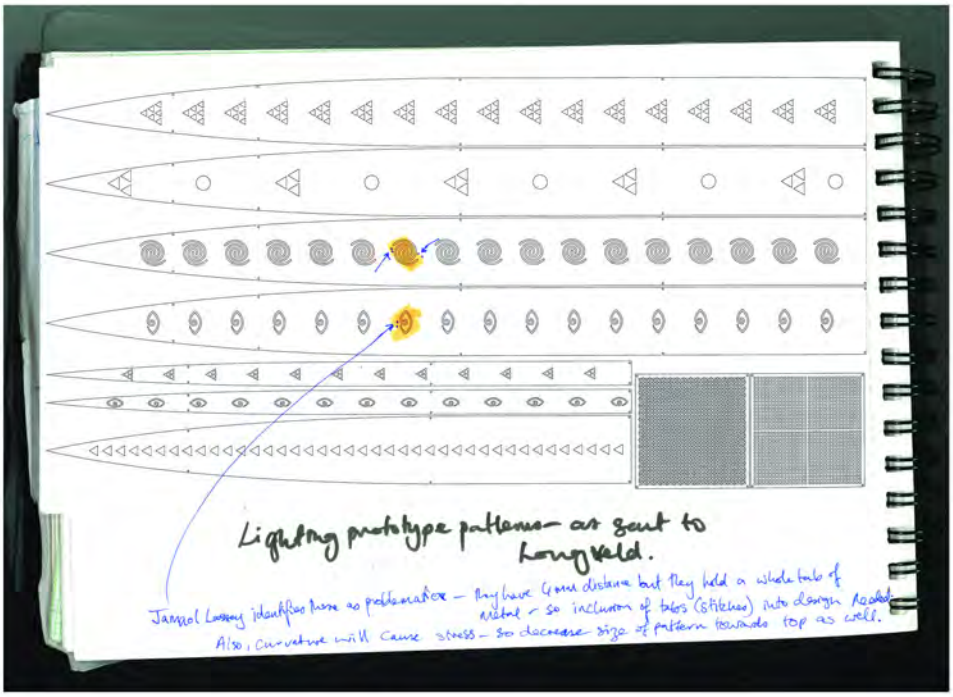

Prototyping D6 LEDs

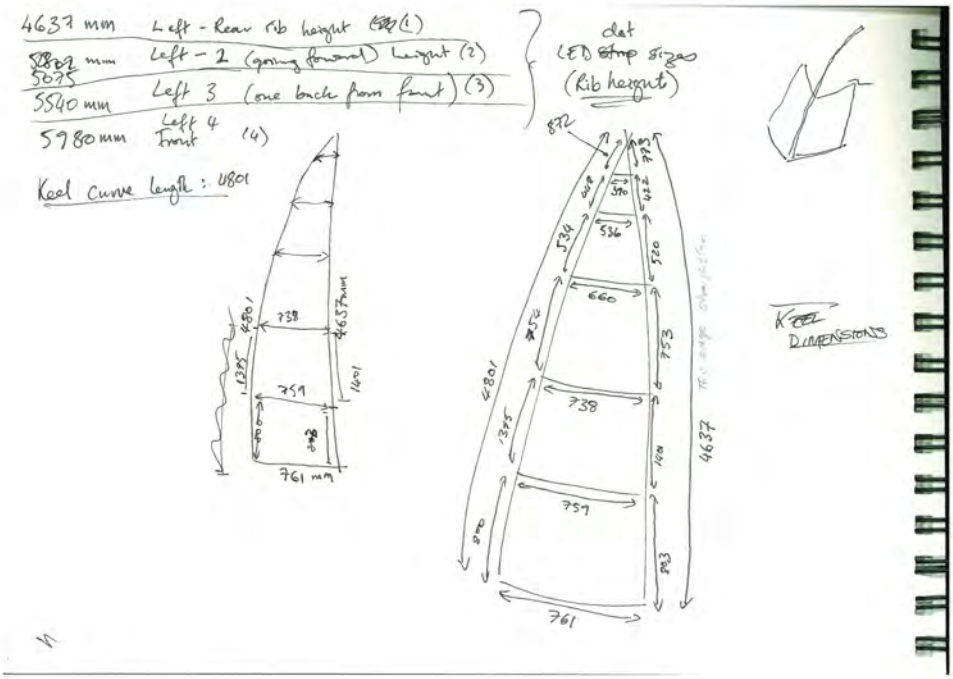


SanDevices lighting controller

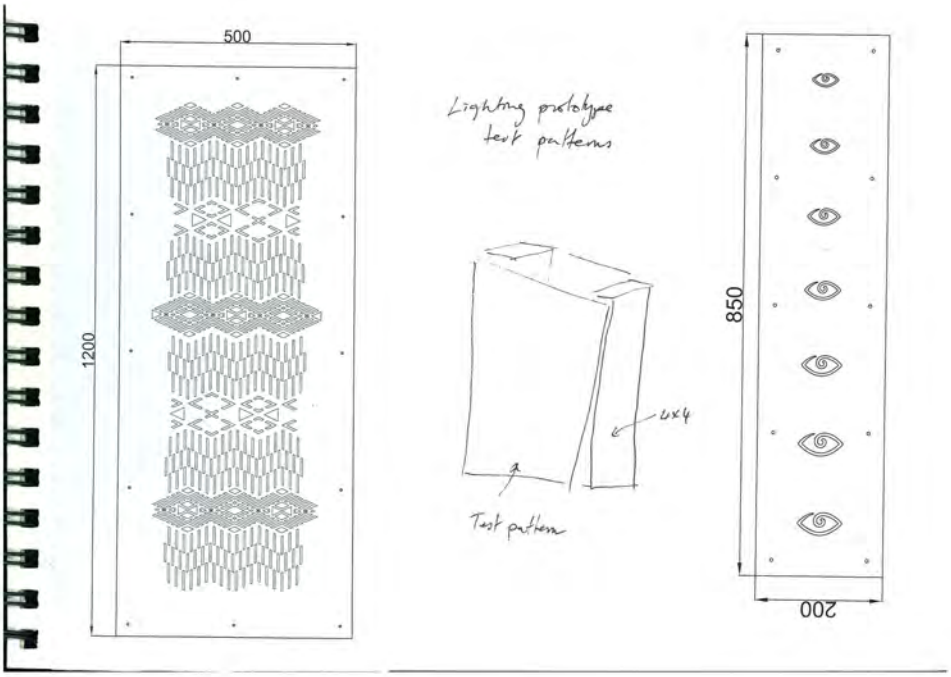

Testing, testing

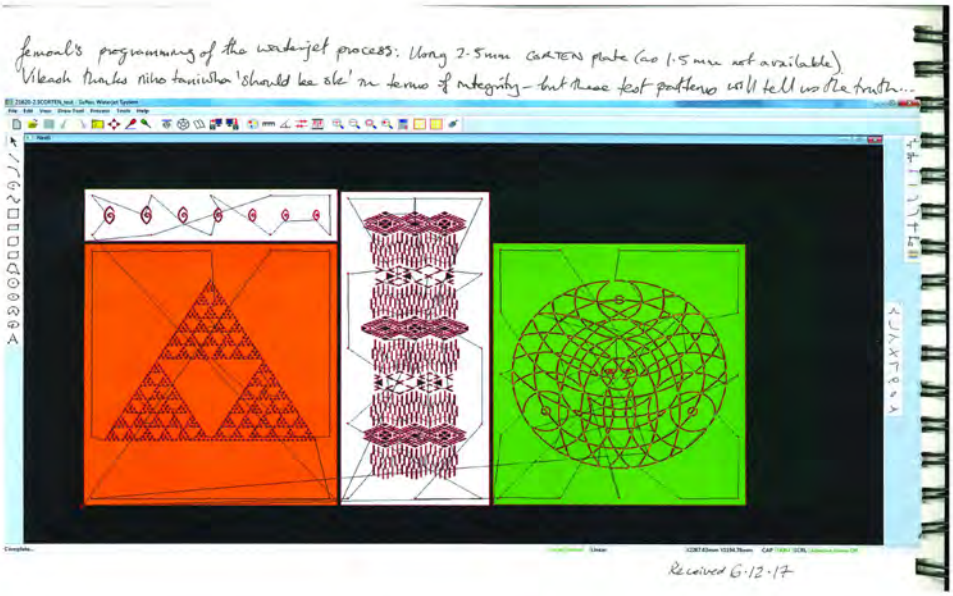
Prototyping - 3



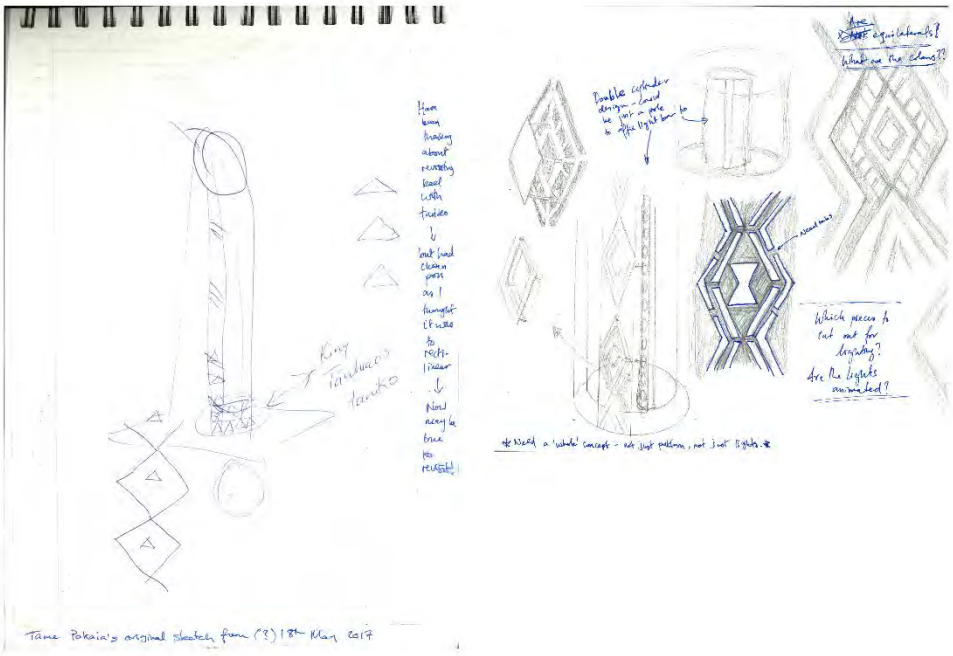


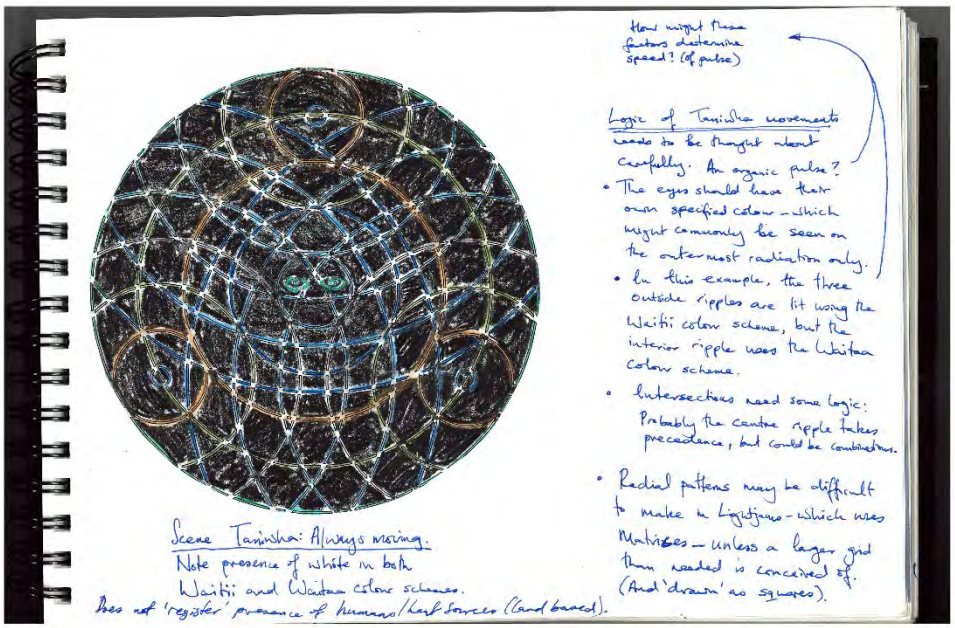
Prototyping - 4



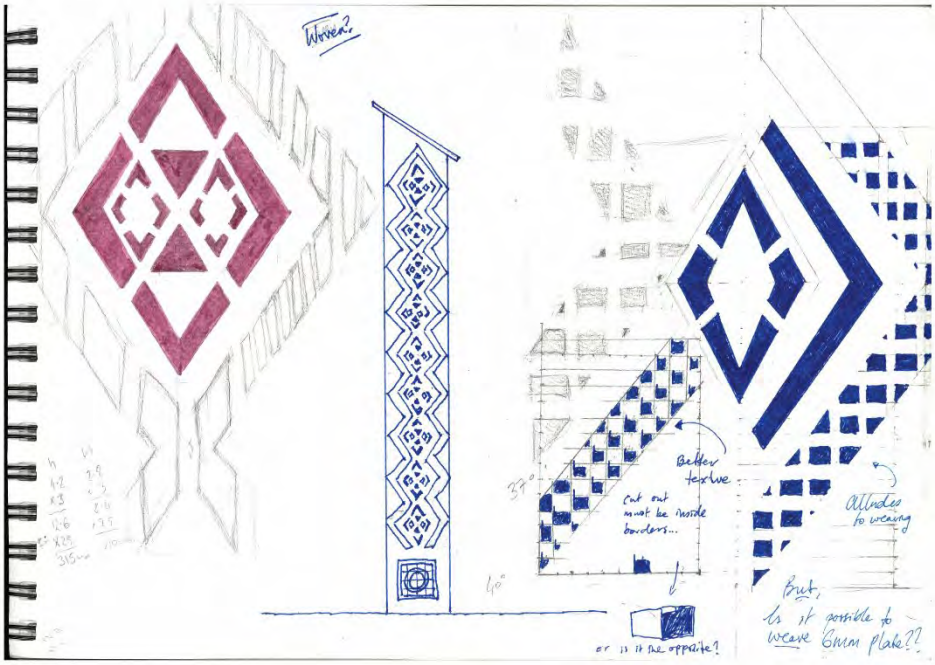


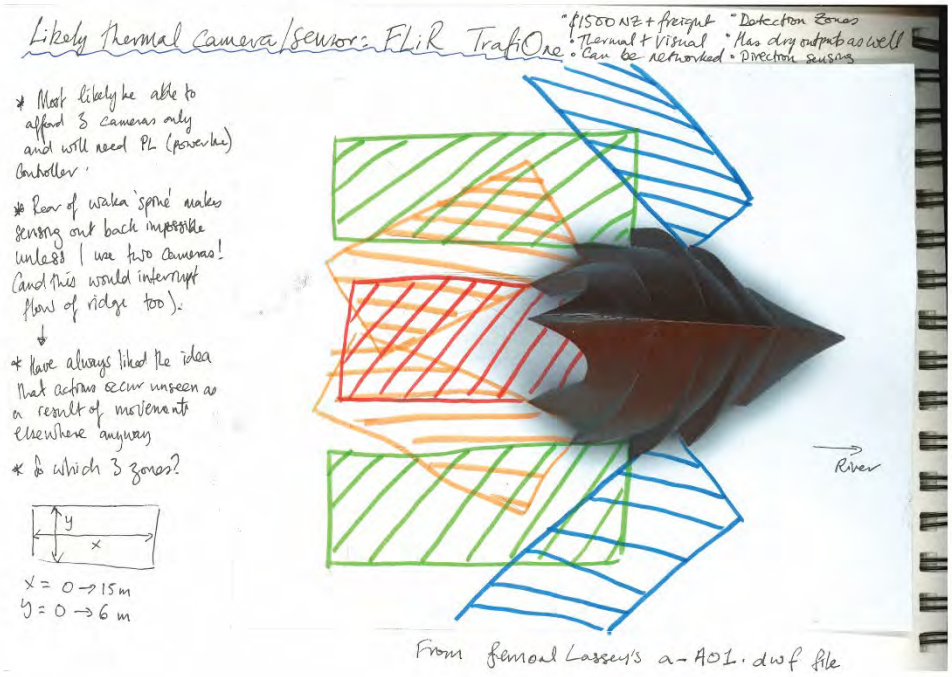
Prototypes - 6


Tame Pokaia's original sketch from (?) 18th May 2017
Double cylinder design – could be fun or pole to offer light bar to
Which pieces to cut out for longevity?
Are the lights animated?
* Need a 'whole' concept – not just patterns, not just lights. *

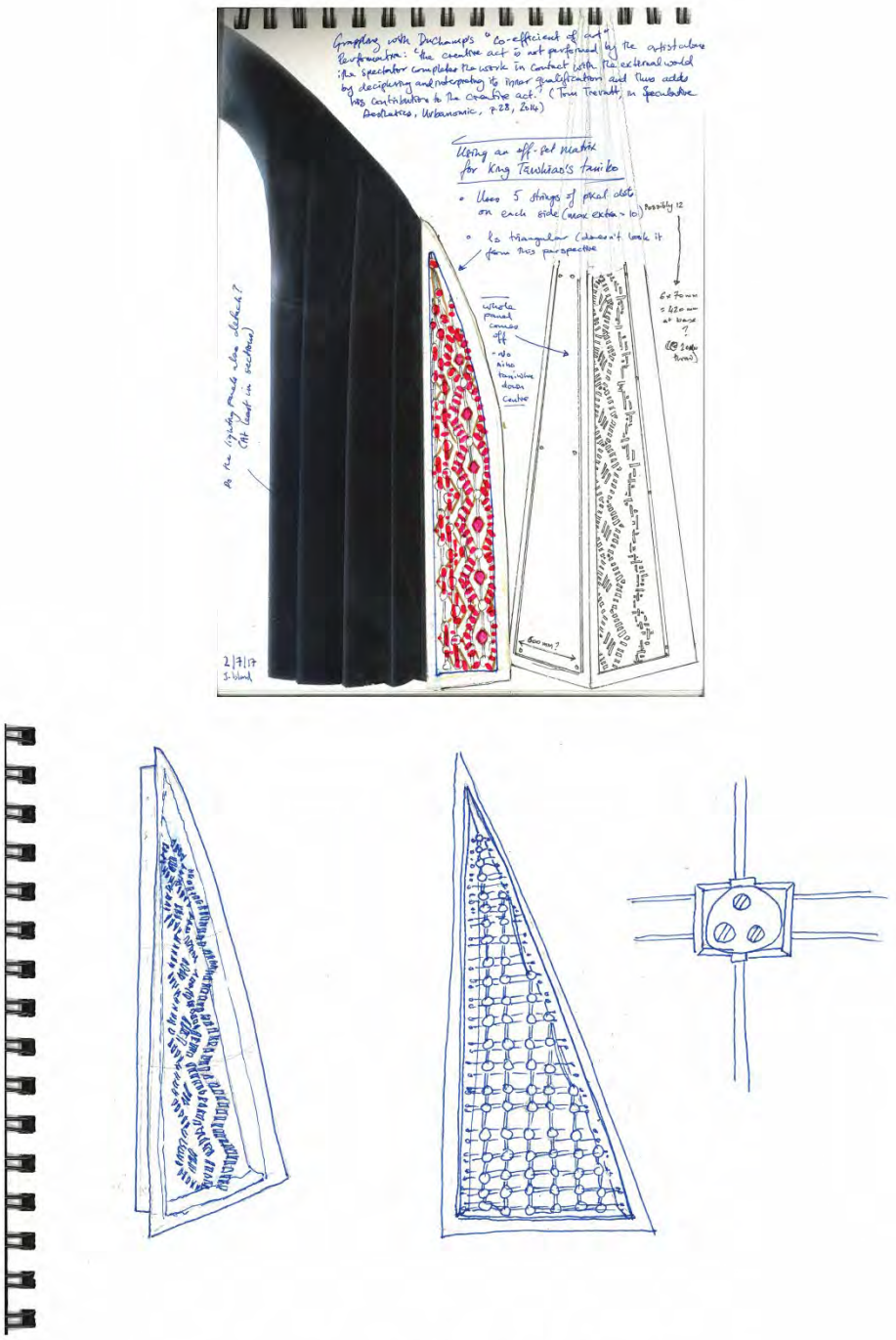

How might these factors determine speed? (of pulse)
Logic of Tanirha movements needs to be thought about carefully. An organic pulse?
• The eyes should have their own specified colour – which might commonly be seen on the outermost radiation only.
• In this example, the three outside ripples are lit using the Waitiri colour scheme, but the interior ripple uses the Waitaha colour scheme.
• Intersections need some logic: Probably the centre ripple takes precedence, but could be combinations.
• Radial patterns may be difficult to make in Lightjams – which uses Matrixes – unless a larger grid than needed is conceived of. (And 'drawn' as squares).
Scene Tanirha: Always moving.
Note presence of white in both Waitiri and Waitaha colour schemes.
Does not 'register' presence of humans/leaf sources (land based).

Concepts - 1


Woven?
Better texture
cut out must be inside borders...
Allrodes to weaving
But, is it possible to weave 8mm plate??
or is it the opposite?


Likely thermal camera/sensor: FLiR TrafiOne
$1500 NZ + freight
Thermal + Visual
Can be networked
Detection zones
Has dry outputs as well
Direction sensing
* Most likely be able to afford 3 cameras only and will need PL (power line) controller.
* Rear of waka 'spine' makes sensing out back impossible unless I use two cameras! (and this would interrupt flow of ridge too).
* Have always liked the idea that actions occur unseen as a result of movements elsewhere anyway
* & which 3 zones?
y
x
x = 0 → 15m
y = 0 → 6 m
River
From Bernard Lassen's a-A01.dwf file

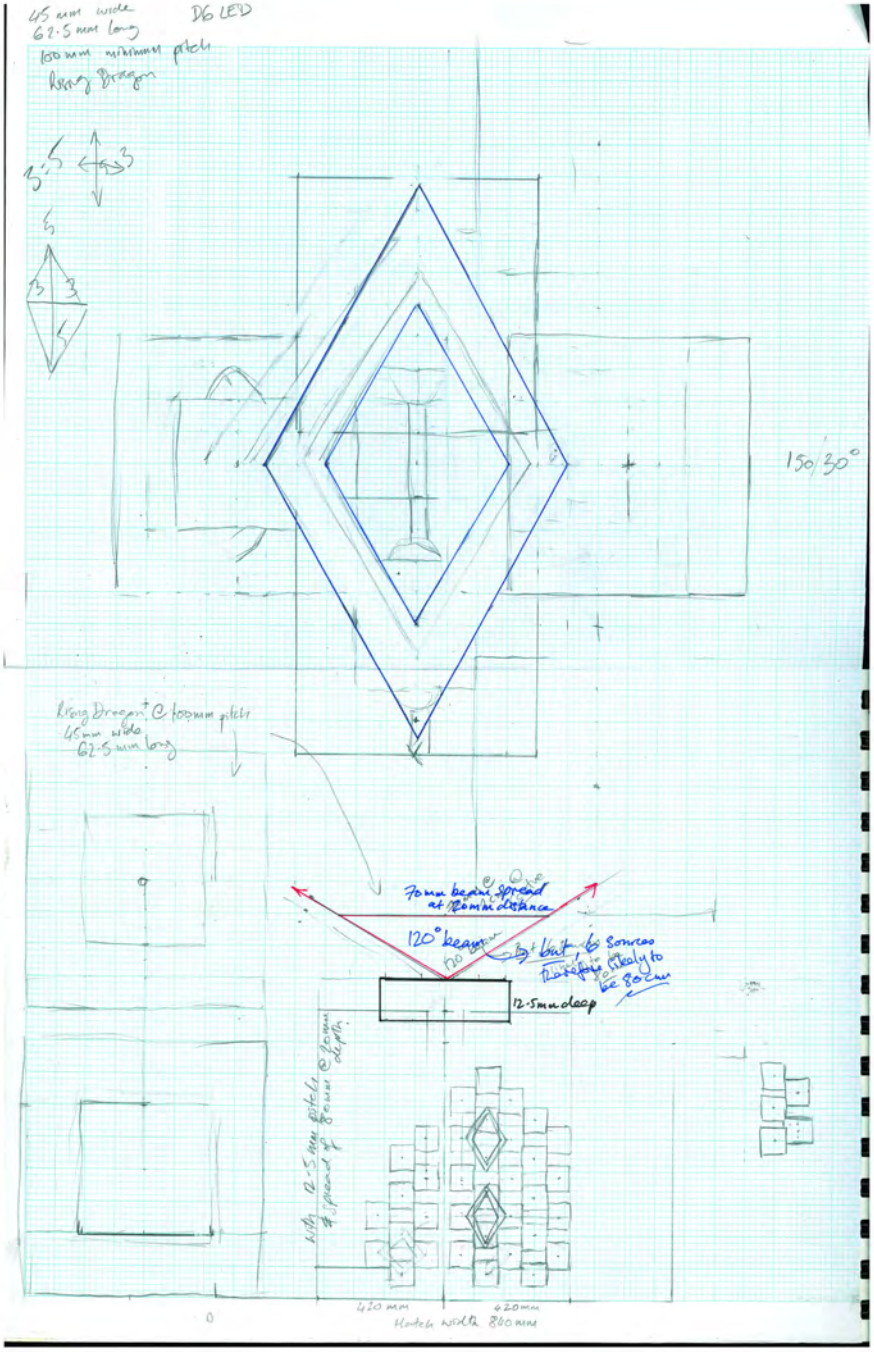
Concepts -2



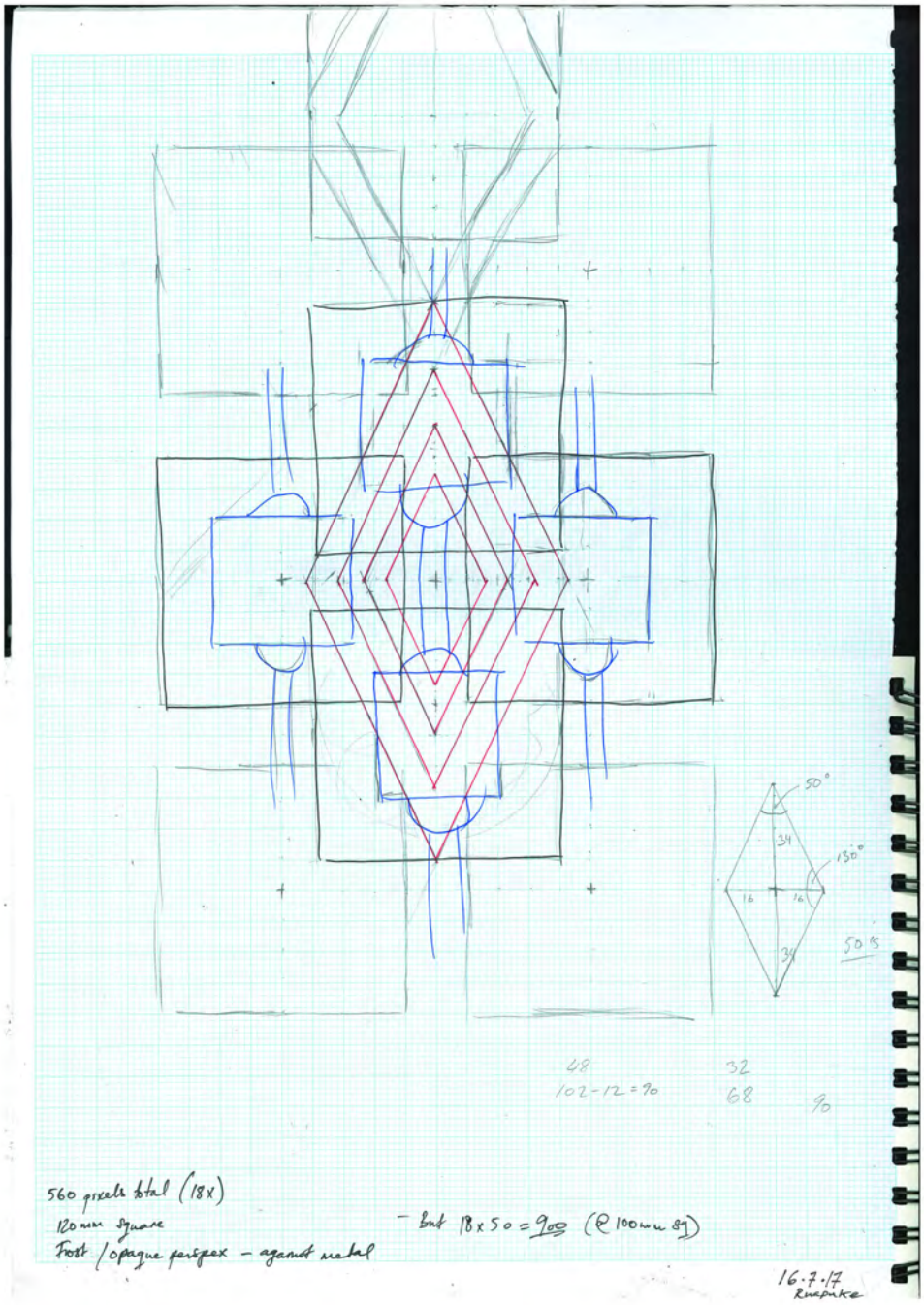
Concepts - 3 King Tāwhiao taniko pattern

Note: The taniko pattern used here is referred to as one that adorned the kahu (cloak) as worn by King Tāwhiao. This does not imply that this pattern originated from him:

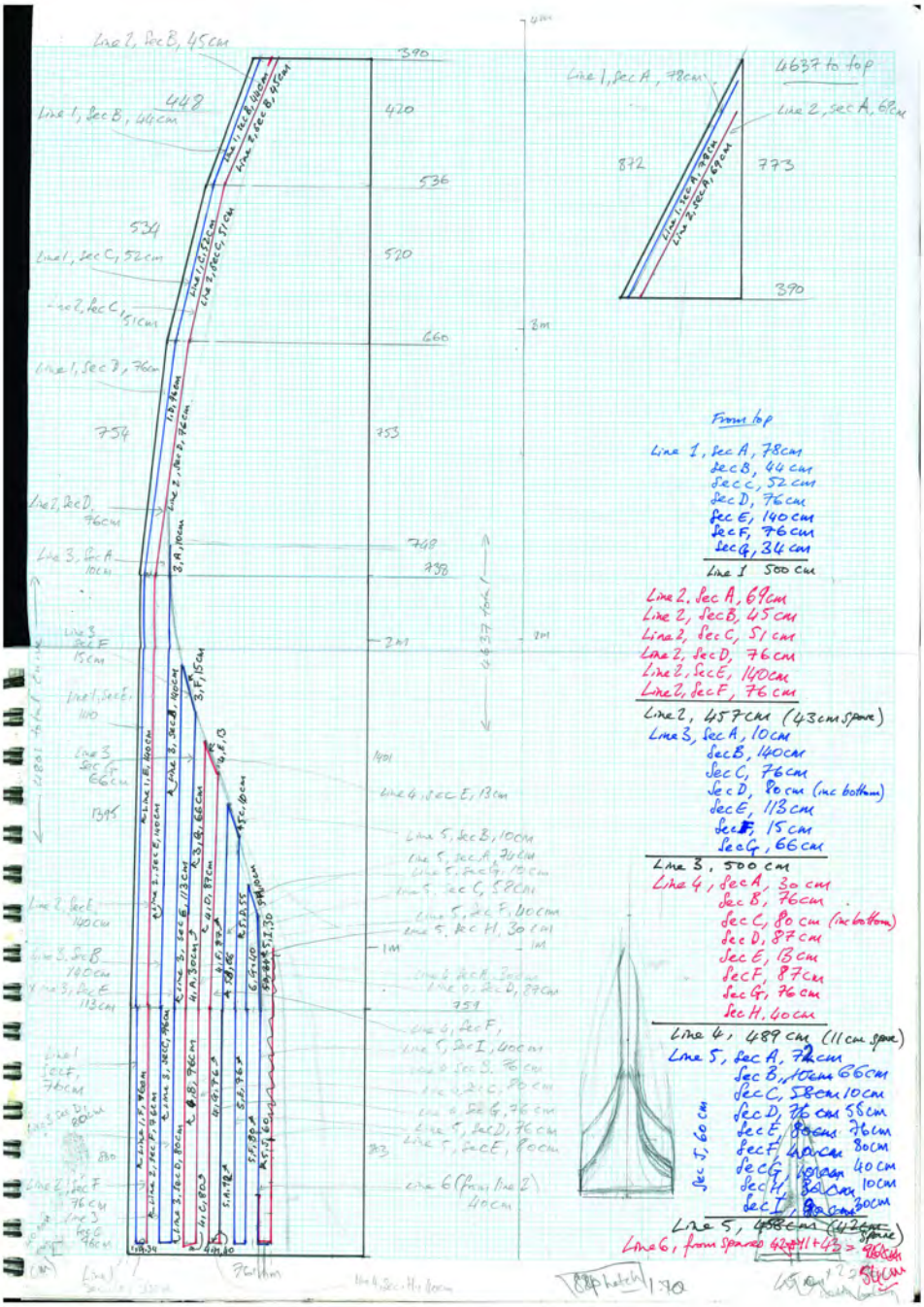
> Tāwhiao has several different kahu, each one has different meaning and style and is not weaved by the same person. The ownership of each kahui ariki kahu is also another research on its own. These taonga can be weaved for the King or "Tuku taonga" to the King, where the descendants may ask for it back, however in most cases this does not happen.
>
> Email communication, Tame Pokaia, 11th November 2019



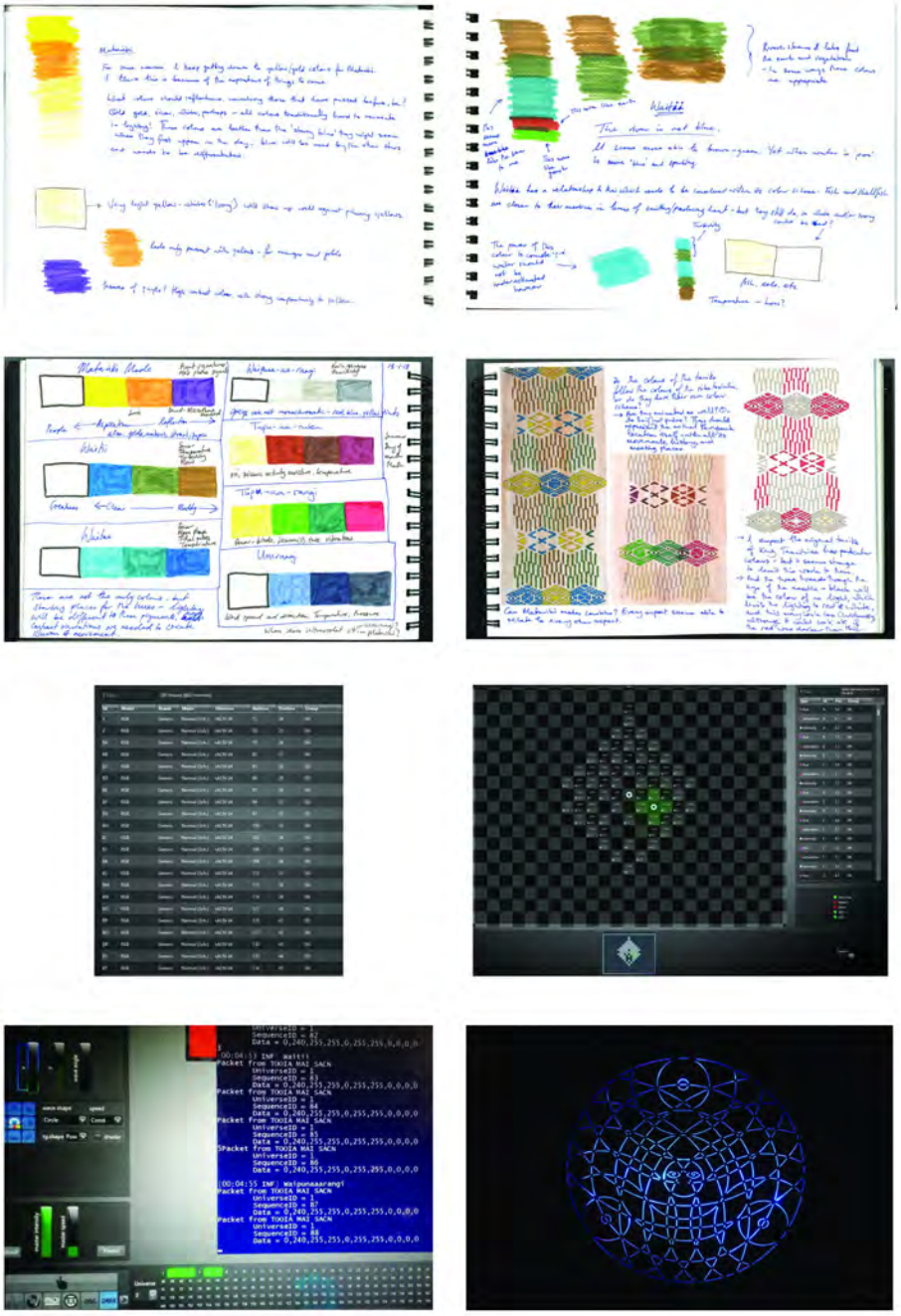
King Tāwhiao taniko concepts 4



King Tāwhiao taniko concepts 5



King Tāwhiao taniko concepts 6



Exploring ethico-onto-epistemologies (Barad, 2007)
Colour schemes, Lightjams programming, and a moment unfolding

Reflections on Mana Whenua hui – Te Hā o Rōpū o Kirikiriroa (THoRK) at Rauawaawa Trust 50 Colombo St 1pm

Thursday 10th May 2018 be cor. River Rd.

Apparently it went smoothly ("soft" as Tame put it) but I feel completely out of my depth. And when the chair asked if I was coming to ask for permission with the words "Are you saying that if I say you have to put a picture of my face inside this thing, I'll give my permission?" I thought he was joking at first, then wondered if he was angry. I was immensely relieved when Hera and Tame reminded those present that this wasn't the first time we had met with mana whenua.

I really felt today as part of the group with Hera, Tame and Hagen. It was strange to look at Jo and Sian (archeologist) and think that they weren't quite in tune with it all – and this is whilst I was feeling immensely nervous about the whole thing! I am in deep waters. Tame and Hera think the vote will go with us, but time will tell. It was touch and go there for a while, for this opponent we have already started – this is not the start of the endeavour. It was good when Sonny described the work as a taonga. (And that's a word that has immense ramifications). There were questions around how would the work relate to narratives? Hagen's thought afterwards was that the expectation was around spoken oral story and karakia as part of the sound. My reply had been about Hirovanna's mentorship of our students to make the soundtracks with reference to taonga puoro. I'm glad then of Maria's kōrero at that point and Tame's reference to a whakatauki of

King Taushiao – the one around the friends who would come from the four corners of the earth to bring new technologies (the carpenters, the shoemakers, and the blacksmiths). To say that this was the same, was humbling for me. These are deep, deep waters.

I've spent the rest of the afternoon trying to gather my thoughts – almost in shock. I feel so very tired. And to hear that the process with Heritage NZ is going to take 7 weeks from lodgement from Jo means that June 28th is not going to be a reality. This is a long road and it's going to be longer.

But this is a collective endeavour, and it's open ended. That's its beauty – it can adapt and grow for a long time after the structure is finally in the ground.

I feel I am somewhere in between cultures now. Perhaps no longer Pākehā, and not "Māori enough" as that Kuia said to me today. If I was "more Māori" I'd feel confident enough to share my opinion. Well, once again I am within and without. But this is perhaps the most so in my life. I am but a child here, which is strange, because today I feel extremely old as well.

Reflections on meeting with Te Hā o Rōpū o Kirikiriroa (THoRK) 10th May 2018

Appendix B

Interviews

Transcription of interview between myself (Joe Citizen), and

Waikato-Tainui Kaumātua Tame Pokaia.

The interview took place at Te Kōpū Mānia o Kirikiriroa marae (Hamilton) on 12th December 2018. My questions and comments are in italics.

Part One

00:00:51 *Tame, I would like you to could I just get you to start off with your full name if that would be alright?*

00:00:55 My name is Tame Pokaia and I'm form Waikato-Tainui.

00:01:04 *Tame, I've got two questions today. They're only two but they're both complicated. The first question is in relation to some of the reading I have been doing. Writers like Ranginui Walker, Pei Te Hurinui Jones – people like Māori Marsden talk about this progress between te kore, te pō and te ao mārama but maybe it's because to a Western mind, when they talk about it seems to be in a linear sense of time. Could you talk a little bit please about what each of these realms are, how they relate to each other and perhaps how they relate to time?*

00:02:03 I think they are relating to creation time periods. Everything must have a starting point. And so that's what they are relating to when they are going back into time. Time is born from somewhere. Somebody made that time, time didn't just appear. It was created time and to make the stages of time, someone was in charge. Someone was in charge of the stages of epoch of time to make it come from point A to point B where we stand. So, we are going through one of those stages of time and that's walking on the face of earth. But when we walk from the face of earth, we're way down in the chain of the creation of those time periods. So, when you go in reverse, to teach that to students and academic world and you see the now time. They don't see how it was made before if we take times back. And were only on earth for 'X' amount of years, so generally at this time if you look after yourself, you will be here for 100 years. If you don't look after yourself or the environment doesn't

accommodate that, then you can be here anywhere between 30 – 50 years which is quite short. So, when you go back in time, because the environment is different, they tended to live a little bit longer. So, going back before that to the creation of man, every country and every culture on earth would have a view or narrative on how they came into being. So, I can't comment on other nations around the world on how they see that picture, but some of them have a starting point at a certain epoch of time. Māori go further back to when there was nothing and that came forward. So, they have a deeper meaning of the creation times. If you come into a western view of those time periods, you'll see is something very short. If you look at the bible for example, it was created in seven days, but it doesn't go into detail how that seven days worked. The Māori view goes quite detailed. How that was and even in that detail from those creation periods and that time period, a lot of that knowledge wasn't available for anybody. What that means is, for example, a student learning - at the base of their learning. But if a tutor was to say, the tutor has certain requirements to teach at that level. Now there are tutors out there that are higher than that tutor, we have a different level of learning who can teach a bit further because they have progressed their learning to another level. There are other tutors who are higher than those tutors and they could be a masters or a doctorate tutor. And the western way of learning, that's the level you attain. Like Doctor Ranginui Walker, so you will teach from there, down. Doctor Ranginui Walker won't go into the higher realm because he wasn't trained in and may not have been trained in that Māori world of cosmology. So, in the Māori world not anyone will get into that school of learning that's passed on. I just want to make the point, I'm not talking for other regions that might have their own criteria. But I definitely know the entry into the Tainui house of learning to get those higher learnings. So those higher learnings go back into that time period and are passed down to do a certain job for humans in the Tainui space. So that's how the epochs of time, we've got te kore, the nights – the forming of the nights, the forming of the day, the marriage of those elements before certain things can take place. Because those elements have to be formed to make what we have before we come down into time into humans. Humans are way down the chain, but there are a lot of things happening in the cosmos before that. It the kore when, what we know as the kore, the nothingness when nothing was there. That's a brief summary of the

kore, te pō and the binding of those elements. How those bindings are locked in, they're locked in with genealogy. So, they have a genealogy which makes the learner or the expert faster recall how it all happened. Now, if you had a book, you'll see the experts when they stand up, they don't carry a book. So you've got to carry that knowledge in between your ears and one of the best ways to do that is in the genealogy and we can – the listener or the other expert can pick it up straight away when you make your links coming down, there might be a slight variation of how these two met. So the tribe might have a slightly different name but basically the foundation of that knowledge coming down can be picked up through the genealogy right down to the captain, coming down to us today and the formation of the tribes. So the expert will pick up in the genealogy, that's where that knowledge is now. Even myself, I have limited knowledge of that genealogy, I can only go back so far, but then I've thought "that's okay, I'll just work on this epoch to feed this learner."

00:08:15 *When I've talked to creative people, sometimes they talk about te kore, te pō and te ao mārama in a less epochal sense and more in a part of the creative process sense. Could you comment on that?*

00:08:35 As part of the creative sense – yes. To a point, they're right. They're talking about it in a language they can understand in a creative sense and they will demonstrate that maybe in art, or in sounds and music. They'll demonstrate that – a high priest would do the same, but he won't do it in the music that we know today. He will do it in a lament or something like that which is deeper. When you hear his words and he'll do a chant, it's totally in a different realm. Very hard for the normal person to pick up, that tone, that volume and just come out with it in laments. And to explain that further, sometimes the female carries that expertise better than the male. So, the male will carry a way of expressing that will be in oratory. It's knowledge of genealogy, it's knowledge of te kore, te pō and te ao mārama. Some men can carry it, I've seen some of the younger generation try and carry that and a sound form that's in a waiata, it just doesn't have the same feeling, I believe, as a female elder. So, when I see a female come, if you've been on a marae like I have, and when those elders come on bringing someone that's passed on – straight away they can go straight into your connectors and you can see when they sing that lament, tears are

rolling down their eyes. So, when a male comes on you will not see the tears rolling down, because his carrying all those learnings not the same as a female, female are designed, well not designed we're not talking about a car, a female has a special role in the epochs of time to carry certain things. A little bit different, what they carry the male's duty. So the female knows how to cut straight through you and touch those laments, those chords of your emotions, your feeling, your wairua – she can connect to that part and you'll see it when she walks on the many powhiri. Today, a lot of that I feel a little bit lost, we do it in tertiary context, they'll come out and do a karanga, but the spirit is a little bit different with today's generation compared to when I was raised with the nannies would come out, they were in their 80's and you could tell straight away their connections were a lot higher than what you see today. It's not to belittle our females who try to do the best they can, but my level of knowledge is totally different to the men I saw as a young man. So, when I saw the orators, their knowledge and their wisdom was just a level above – and would be a level above a lot of the doctors in universities because they're a doctor those guys can stand up and when they talked you would be hard to respond. Even someone like Ranginui or Marsden – they can respond in a Christian way but in the Māori way they would not probably make it to that and I'm talking about the experts like Henare Tuwhangai, Dr Tui Adams, Hone Haunui and all those experts in that Māori world.

00:12:08 You will see those experts because when I go to university and they come onto the marae you can see the calibre. Their calibre, the level just goes down straight away, these guys their level's just up here. And they're just sort of, how do I say it, they're just in warm up mode, they don't let out too much they do enough just to put their cloak over those guys, you know as such a cloak of oratory, a cloak of I'm in command, I'm in charge. But they do it in a humble way, they know how to put that over you whereas if this tries to do it they know counters exactly over the whole area so that's experts in that field who know te kore, te pō. Some men like you'll see come out of some of the institutions they put on a show to try and capture the people's eyes, now for a novice it's very it's very captivating and you'll think wow this guy's an expert, to someone's that's learned, no that's not, that's not an expert because he's doing it for show, they do it for show in their dress, the way they thing, but it's just missing that main point and I've seen it on maraes

when you're under pressure, big audience and you can just sort of. So it's the delivery of your words and a response can nullify a lot of things or showmanship just by certain proverbial sayings to nullify that really fast. And so that's the expert in that area that carry those treasures, I guess, of the ancient world.

00:14:00 *It seems to me when you're talking that you're talking about states of being.*

Yeah, that's right so you're going between two worlds so you gotta remember once you go into that realm the good experts will never waste, how would you say, it's like you never waste that knowledge. It's not just casualised out into the world, it's not casualised for any just a topic just for the sake of talking about it it's not casualised. So once you go into that realm you're dealing with another world which is a higher level and there's a lot of things attached to it, there's respect, there's honour, your credits are on the line as well. What I mean by your credits if you play with something that you don't have knowledge on then you're at a danger of putting yourself at risk in an unseen way. It's just like kids, when you teach your children about this light if that child hasn't been taught that there's some danger behind that makes that light go the child will only ever, if it was on the table the child will just see the beauty of it but can't see the dangers and will try and touch it and try and taste it. And if it touches the wrong thing that's sending that power to that light that child is at risk of going because he hasn't been trained, it's beautiful but there's a danger behind there. So that's the same as the transfer of knowledge from te ao, from that ancient world, it's a beautiful learning but there are dangers if it's not used right, in a right way if that makes sense. I'm trying to make it in a way that's easy. It's like a stove, it's got that beautiful element, it shines, it glows, it's there to heat that thing. Now when a child comes it doesn't know that it just sees that light in it's hand and if you didn't train it or hit that hand away or teach that child it'll try and touch it.

00:16:00 A child will crawl around, not knowing the learnings, it'll try and put every and anything in its mouth because it's trying to learn *is this good*? so that might be ok, it's safe but if it touches something that's not and the mother's not teaching it or watching that child grow it could be in danger so that's the simplest way I can break it down for a child that will not know the world yet and that child is learning this world. If the mother has

brought dangerous substances or something into that domain, the child won't know because mum's placed it there. Child may tell I wanna taste it so you can see the child will always experiment with taste, with touch, you know it hasn't learned balance that if I lean on this or pull on something it will fall on me. it hasn't learned all of those basics. Now te ao marama and that ancient world, now also safety on who you transfer that knowledge to and how somebody could pick it up and totally get it wrong and how they pass it back on. They've got it totally mixed up. That's why those genealogies are so important on te kore, te pō, te ao marama, the marriage of those different time periods to create the next phase the marriage of those time periods creates the next. If you casualise it and give it to the wrong person, they're not making the joins, if they're out there speaking they'll get picked out really fast. So the experts and that were well say for example if they do prayer, and Māori always have, you do it right there's no consequences, you do it wrong or something's gonna happen to you or your family. So that's why it's not for anyone when you do it you know what you're doing it for.

00:18:06 *I have a lot of questions and only one mouth. The way that you're speaking there, and correct me if I'm wrong, it strikes it seems to me that the speaker is almost like, you're talking of a world that is beyond this world. Or perha.. is it connected to this world? It's intimately connected to this world. The status of humans seems to be less central in the way that you're speaking, is that a fair comment?*

00:18:55 Humans are part of that epoch time, they are part of it but they are not, they are not the… they have a part of it which is important and what humans need to understand is they need to respect having that part in that epoch, they need to respect and not. Not, sometimes some humans disrespect, oh I can walk, I can talk, I can control that animal, i can take that animal out, I can take that bird out, I can just shoot it, so I have a lot of power. So humans got to learn to work with what they have to look after that environment around them, if that makes sense? That includes those plants, those birds, cause they all are there subliminally and they don't know. Humans have lost the ability because of the way they've been taught, that bird also has a right, that fish has a right, that whale has a right, that eel in the river has a right, that creature down in the swamp has a right and humans just say no it doesn't, I can walk, I'm gonna build a machine, I can flatten that and put my house, I don't need

that. So that is being watched and observed and if you do that to earth then you gotta run as a human race living on the earth there's gonna be a great risk and you gonna see that. But what's happening in the world today that this country is challenging that country, blocking off those borders, they forget about the right of what's in that space. Because they feel well I control this oil reserve, I control this middle reserve so my rights are more important than yours but they forget the right of a human on the planet and that's the point of difference where cultural views is the right of that environment is paramount than you trying to make a big mansion because you've decided to control that reserve. So the two super-powers in the world are at odds because they're trying to control that. So that's the planet earth and that's why I really like New Zealand, if we could stay away from that and protect what we have in our beautiful, what I call the garden of Eden. But that is changing fast.

00:21:30 *So previously we've had talks about mauri and I think well I wonder when you talk about the rights of that, the animals and the rights of the earth could you, what is the link, if you like, between mauri and what you're talking about and also the links between that and te kore, te pō, te ao marama.*

00:21:56 So in the Māori world and when we go back in te kore, te pō, and then the formation and the Māori world when you go to the formation of earth. The Māori view on humans they those other parts of earth came before the human, now I can't talk about the other religions and their view on that but the human and so. But the Māori, the trees started to get formed, the earth was getting formed, the tides were put in place, the winds were put in place, the sun was put in place, it's role to create to growth and etc. they were there before humans and when that beauty was in place then it was realised ok there's no one to enjoy that beauty let's put some humans in place and see what they can do and look after that and that's where the coming of Tāne to try and find how do I do that? How do I create someone out of what we have been given? So this is where in the creation stories, different tribes will have different views on how it was formed and one view was with Tāne trying to find ok, first of all you gotta create someone to that is suitable to make that all happen, someone must be appointed. In the western world you'd say well the CEO or the managers appoint or delegate to put on a show and to bring all of the parts together to make that show effective or that when

the community comes it's got beautiful sounds, it's got beautiful imagery, it's got beautiful everything. Now to make a human, now that's not a show but it's to move into the next stage of a epoch to the human. And that's where those beautiful creation stories start to come into place. There was a person there delegated to do that and different tribes will have it was this person delegated or it was this person delegated. Now that is not a person like walking, it is an unseen, how would I say, element or thing created delegated that role so if we look at that plant out there so if we're delegated ok you have a leader over the plants we'll delegate your leader to have that role or we could look at the second and say we'll delegate that to your leader to make that happen. Or Tawhiri, we'll delegate that to your department, you make that happen. So when Tāne was asked so Tāne can you pull things together but you need to work with different elements to make it happen. So Tāne is one of those senior, senior elements or deities above humans who pulled it together to make it happen for humans, he pulled the environment, well I can try and make a human but I can shape the earth to make something, whatever it is. But when he shaped something to look like it could get up it wouldn't work because he needed other elements to make that, whatever it was, work. So Tāne realised and ok my model is not actually gonna work, it's almost like building a robot, the robot's not gonna work because it needs other parts and you've seen it down with your lighting. So Tāne worked out all the different elements he needed to have that person move, it would not move unless he had help from his brother who controlled the breeze and the air. It would not move if he didn't have the elements of the soil to come together and bring that bone and the soil, the right combinations to make it work, to make the body sort of form but the body couldn't work unless it had something else, it's like a plant, to make it grow. Plant will not grow unless it has the right amount of pressure, water, etc. Then the plant will grow. If you put a seed in and you don't nurture that seed it will not grow, it's got to have the right timing, the right pressures, the right amount of moisture on it and it'll grow. Tāne worked out that he needed all of these different elements including the lights and the amount of minerals that went into that earth before it could happen and then when he finally got it, he thought that it was perfect, it was still missing something, didn't quite. And then he leant down to its nose and did the hongi and gave the final breath, transferred the breath, his breath not like a human breath, it's

the breath that he had from nature. Transferred it down and then he came back and he saw what was happening and if that would work and then that what they had created started to move and he realised I think I've got it. And then when that being that they made from earth started to come awake he realised I think I've got it. And that was the first, in the Māori history or legend of the epoch, how she came to be. And stood up and didn't know where, you know what am I here for? What is my role? That was the first of the creation.

00:27:35 Now right to the point of the selection of where that being was to be made had to be in a certain site, so it had to be in a certain land at a certain temperature, place, certain type of rock, colour had to be right, everything had to be perfect for that being. You cannot just walk out there and make it there because that soil type is not the right type, you can't make it here because the pressures around here is the wrong pressures. So Tāne was delegated, he found the right place and they're in those myths and legends, where he had to go, he went to a certain site, I think this is the site I have to make that person. He did it, once he got his brothers, all those delegated who had authority in different areas. Well I need your help with this part, I need your help with that part. It's almost like the electronics or the spiritual electronics to make it happen, I need your part to make the domes to sort of hold the soils, minerals together. I need your part to make it, get the blood, the veins, something to hold the veins. I need your part. When they had formed that, because he had delegated authority from above to carry that out it was easy for him to pull all of the parts together. He had the spiritual budget, if I can appoint it in this way, that we know he had the spiritual budget allocated to do that. Whereas today we can't do that unless the whole ???? helps, someone else helps, this ???? helps. That won't happen unless you got the budget on all of that. So Tāne had unseen authority but in the world today you say basically that project will never happen you need a budget, you need funding for this, this, this and this. That's today's language but Tāne had ay. Does that make sense?

00:29:37 *To run in parallel conversations then, there's a lot of potentiality involved, a lot of chance, to find the right conditions…*

He had to find the right everything but he had the authority to, ok brother I've just been delegated could you give me a bit of your **haaa** breath, yeah ok and they knew yes he was delegated so we have to help him

out there. But they could have withdrawn and said no I'm not helping you I think it's a silly project but they can't because it's an authority above, It's like the CE saying well media arts can you guys make a thing here for Wintec we're gonna gift it. If you approved it then you can go ahead. There's a lot of slant. There's a lot of slip in there definitely. And those sections are saying I own that too. I've helped you, that's my part. Don't forget so when you see that thing come out, so when we go down to te waka they're only gonna see te waka, Tōia Mai, but this company can say I helped that because I did this. Now I won't know that I'll only know what I did to help, Joe Citizen will know what he did to help. That guy, what's his name, he spoke he knows what he did to help out, if we all pulled us all together and stood there you would really realise who helped that waka. If we stood in a line right to the smallest. So there could be someone in the back I helped that too because I was right at the start, I welded that first joint and then I was left behind. The show was only the last ten guys and that's thing but I was there, and so he can you know what I mean he was part of it.

00:31:33 *But of all those possibilities, you're drawing the thread of potentiality through it.*

That thread of potentiality through it. That thread of potentiality came through all of them and that happened so to make Hine-Ahu-One. Hine the woman, ahu means to come out of, one is dirt. The girl that came out of the dirt, all of these other potentialities had to be joined, had to come, they weren't to argue to make her happen. Because this one above, the epoch can do a lot to cancel out a lot of things in your space if he needs to. Not a budget space but a power space, he can take out that space. Or change it and that's hard to get across to people.

Yes because when you talk about it sounds so concrete its somebody said to me oh you should write about this I'm going how do I even start? Because as soon as you write about it you're fixing something to a page and it's not really like that it's we're talking about states of being and also yeah the potentiality in those states it's all possibilities

It's all possibilities, so a lot of the physical part came and then the final signal from it was in that prayer that came from that world to say thank you very much for helping all your elements are in there, your elements

of the steel are in there, those are your domains, the lighting those that came from those elements. So using a modern element those elements have a link to somewhere to make that bowl, that steel had a link somewhere to make that steel

When you put it like that just to come back to this idea of time and we in the past have talked about te wa and you've talked about genealogy but genealogy is often thought of as being linear but in a way so when people talk about te kore, te pō, te ao marama it seems as though there's a lineal a linear direction to it. But the way that we're talking about it now it seems that there's a direction in the other direction or there's more than one direction to it. Is that correct? Can you say that you're traversing between those states rather than…

00:33:57 Those states all come down but there's still that main thread coming through. That main thread comes through and when we do something down here you can disregard that thread and as a human just go and build your house, nah I don't need to connect to that because I'm just gonna I've got a good job and I'm just gonna build my house and that's the domain you'll live in today, you know and go and buy whatever, take you shopping and you'll live in a good physical world. You will not have that unseen connection. Whereas I can go home and do the same thing here but now and again I'll tune in and just say thank you for that day that you gave us, thank you for that storm. Because I can't go out there and say stop. But what I'm saying is please protect my family when that storm passes over. When that flood passes over. When that lightening comes down. So I tune in and just give those things just to know I'm on earth and there's others that control those domains and give us warning, just remember you walk here but you don't control me. I can control you. So that's hard thing to get apart and they'll say no that's just nature but simplified like that, that's just nature, meant to happen.

But the way you were talking before strikes me that the relationship between humans and nature seems to be more inter-related than some Western modes of thought.

Yes, totally different in the way we're connected. Highly connected whereas western no, no I was born here and in this year my grandad thing and they'll start like that. So that's their view, everyone has their

different view of thing and that's what makes different cultures of around the world.

00:35:52 *But it's arguably that the Western mode of thinking has brought us to the brink of environmental collapse, so these are very relevant conversations.*

So that way of thinking has brought this domain because they said no I don't have to believe that way of thinking and the reason why I don't have to I can just because I've made this big weapon and it can just terminate that way of thinking. You can do that and that way of thinking but the environment is watching what's happening

So before when you talked about Tāne and you talked about is it Haaa? the breath of life. What is the relationship between that and mauri and wairua?

Ok. Like the mauri sitting under Tāwhaki [referring to whakairo in wharenui] was brought from a special place and that's a physical, that's the stone so how can I explain it today? So if I can break it down today, on Anzac day all the soldiers and all the family will go somewhere to remember their loved ones and they'll generally do that at a cenotaph or a memorial stone or thing. So they'll head down to memorial park opposite Tōia Mai and that plaque that those builders have made is their mauri they'll go to remember. They'll always go to a point so that's in the western view of the mauri. When you look at a Māori those Māori that family went to the war overseas will go to there but the Māori mauri is different to that, it is not connected to that statue it is connected to a stone or something straight form earth so you see the difference? Straight back to earth again. So when we put the mauri to help look after the spirit of this one you have to get that rock or that stone and it's come to come from one so you don't just drive out on the, again, remember when Tāne made that first being he had to pick the right site to make it because of the elements required. So when I went to do this one I didn't just pick any, or drive down the side of the road there's a stone there right that'll be the mauri put it there. I could have went down the quarry, that'll be the mauri I'm taking that. It had to be a special site so there's actually quite a detailed story on that which a lot of Wintec people don't even know where that stone came from that held that mauri which is connected to that that side of the unseen that was placed in here that

when they did the night pō, the day pō, so at night when I picked that stone from a special site and one day if you wanted to go there I'll take you to that site where it came from and you'll see why I took it form that site. And when I brought that back…

[Tame's phone rings, interview is paused].

Part Two

00:00:00 *Yeah no, we're just picking up on the relationship between mauri, wairua and hā. And you were talking about the mauri of the stone at the moment beneath Tāwhaki. And so I was really interested in the relationship between mauri, wairua and ha. And how do they relate to each other? How are they distinct and relate to each other perhaps too? Because…*

Ok, so you know those domains, like say the trees the sea the wind, they are controlled, they have different entities that control them in the Māori world so there's a genealogy for that one, that one, and every plant. So this one controls say that plant there and this one controls the wind. So that's their mauri, they have charge of their mauri or that spirit. This one doesn't control that mauri, this one doesn't control that one, they have their own spirit as such in their spaces or in what they control. So media arts control their own mauri, Māori control their own mauri, ECE, Health control their own way of doing it. So they have a special way of doing things, special topics how they do things, how they teach that's the way they do it and that's cloaked with their mauri whatever.

Just to interrupt, mauri is something that non-humans also have?

Yes, yes, definitely. They definitely have a mauri. So that bird that was flapping around here, I saw him out here, he definitely has a mauri, he has a mauri connected to his boss.

And stones?

Stones are harder to explain but they have a mauri as well and I'll tell you where they have their mauri. If you look at the elements of mother earth she's not made up of just dirt. So if we just got the dirt and tried to make something it just would not happen. So mother earth has got many elements. Now some people, Tāne knew which elements of mother earth which I take to make, not gonna say the taste or the glue or to make that person, he knew which elements from mother to form

that element. Now humans only see two types of elements; gold and diamonds. They don't care about nay other elements. To Māori, gold and diamonds are the least of the elements. Does that make sense? They are important elements but I don't need those ones to form this goal but they are important elements. Does that makes sense, they are important but to this view no, only these two are my main important because I know I can buy a house with that [other] one.

So mauri is something that everything has, and things are not necessarily physical? Or must mauri always be connected to a physicality?

For us as humans to understand mauri yes, yes we've got to have that, we connect it to something for a human Ok. So to look after this marae well I'm gonna put, I can do a prayer as one but watching, I'm only going by what we learnt too. Our elders before will put something in here, a mauri in here and that'll be like. And when I go back into time when our ancestors arrived here and you'll see the difference. When they arrived they didn't just jump for joy, yay I'm alive I got across that sea I am so happy, and jump for joy. That's one way that you can celebrate that you just come out of a dangerous ocean crossing and your feet on the ground and you gonna be so happy you can jump for joy and forget about wairua, mauri, you're just happy about my body is walking and I can run and search my legs, run over there, run there and be one happy person. When the captain got here, this is the difference, he did not do that. He established, he collected the stones and he probably had some from his thing, a special ones from the homeland they left, he collected them and he built up like they do like Anzac will call a monument of some sort but they did a stone so that when someone walks past it they would not know there was a mauri placed there. You'd just walk past it and you'll think it's a stone left in the bush or left in a place, or it's been knocked over by animals. Whereas if you walk past this one you'll know something happened there, let's go and read the plaque. And then, this is a memory of World War One soldiers, and so you'd understand that mauri or that place of prayer or gathering. If you walked in the bush and you saw one you would not know because they way it is placed like naturally but it may have a shape of something placed on each other. When they got off they put that tua it's called a tuahu, the collection of, they'll say I'm not sure the amount of stones they put, they put it there,

he got the crew around it, they got the high priest and they gave prayer to thank those levels above for getting across the ocean. So they think that's their monument as such so when they come across and moved on that mauri plot is there. There'd be a stone there. Now people would come today or the years after, get those stones, this is a bunch of rocks and just biff them, it's nothing.

00:06:36 So in the formation of this building, I didn't bring a heap of them but I went to get one from a special that was placed in there the night before the pō, so just like how you were doing the thing, the waka, so we knew because I was in constant talk with the entities building and then we said, they notified me. Tama at the pō, the ground has spread the pō is happening on Thursday night of Thursday day. So as soon as I got that message I came I said I'll be down to place the mauri on the Wednesday night when there's no one around, when it's dark. And so I came with my granddaughter, we parked there, I walked across. And I came across, the site was prepared for me, that stone went in there. I stood back and did those words that they did when the canoe landed, those same words were there to say can you look after our whare, our place of learning for us here at Wintec, those people. So it was a modern building but still embedded with old mauri ways. So a bit of the old world went in here under that concrete pou plus the new to look after us. So all I did was just carry on the different epochs from the elders, that's all I did.

00:08:05 *I feel like we've come a little bit of a spiral conversation here. The, the, jumps slightly sideways again when we were talking about orators and the way in which they could, I don't know how to put it, create a place of being in a way then what you're talking about, tell me if I'm wrong, the word that comes to mind is a channel. It's, if you take the notion that, in a way that seems to me that humans have a portion of the world that they are able to work with but there's many other portions of the world which they are not. What you seem to be talking about is creating an alignment or more of an alignment*

That's right so, Māori are, not all especially the younger ones today because of the ways they've been raised etc, intergenerational things, can walk in two worlds. They can go in here when they need to and come back in this world and just go and you wouldn't know the difference. They can go in both. But sometimes today other people they

can walk in this and we can tell straight away how they you know by the way what comes out of their mouth and etc. so that's why you have that Māori saying the corners of the house can be seen, the corners of someone's heart can't be seen until they open. When they open and look in and the orator is listening he can see the shape of the house from being formed straight away by the content coming out. Those others that he's speaking with sitting back, cause you gotta remember the orators job is to respond in a nice way and or to make those connections to their genealogies etc. Oh ok he just needs to say one word. Ko Tongariro.. Straight away Tuwharetoa, just one word. I know your mountain, I know your awa, I know your ancestors, I know your history, I know your lake, that joins to Waikato. So he's making those links as humans now when someone comes across another part now that's different because there's language he could say Ni-hao, so straight away I have to think so what is your river? what is your mountain? what is your tribe? Yeah so we're trying to, so we'll just link our knowing as best we can to that tribe. Now say if he comes from a different language, French, then we'll make that link to that country.

00:11:02 And those countries feel good if you can make that link to them. Now sometimes when those countries come they don't know how to make links cause their creation stories were not, they just see themselves as a person and so they get lost in their oratory. It's not a priority because they were raised on building a building, things so you can see the disconnect, the walking only in the physical world, the spiritual wairua world is not plugged in because of their knowing, their teaching. And the knowledge, so in their Māori epochs and creation stories you'll see when they pass on those knowledges, and they'll pass onto certain people on earth, not everyone is gonna have access to what I call those prayers, to those knowing, to those creation stories. Not everyone will have access to them. It's just the same if we come to the pass to your computer, not everyone's gonna have access to your password. Only you will have access. Learning about those epochs also has protocols and customs who has access to it so for me, my knowing, like that boy who rung me he's ok I can share with him, but I would not share with this one, this one or this one. Because they haven't met the requirements of knowing and transferal like you know your students. You will pass your students when they've met what you are teaching. If they do not meet that you will not just give the tohu of the diploma or whatever you need to pass because

they must your requirements of what you have set to get that degree then they can go and say well I should be on this because I've trained for three years under Joe Citizen so I feel that I'm good at my subject matter and I feel that my CV, if I could get a job here I'll be happy to work and get that because Joe has passed me, I've met the criteria of wairua, sound, recording, animation. Whatever he's taught me. Have you? Yes. And where did you do that? if I'm on the panel. You did that at Wintec. You graduated? Yes. Do you know this skill or that skill? Yes, I do. Right we'll give you the job.

00:13:46 *But also people are receptive in different ways with predispositions towards things. I just wanted to, you use the term spiritual in relation to mauri and then in relation to wairua you also used the term spiritual. And then you talked about hā and the breath of life, I'm just trying to understand, make the connection, but understand the differences with the connections.*

Well we've got to go, how can I visualise the unseen? If I can try and visualise the unseen and the best way to do that about the hā and the unseen power is so simple if we got a little child or adult to stand right here and just stand like this, we can see that person, we can make comment. If we want to switch that person off from the hā the wairua and I just say to that person if we did a little experiment I have, I say right I am was delegated authority over the breeze, the air, Joe doesn't have that authority but Joe has the authority for making you walk, whereas I don't. So I could say walk over there and you will start to walk but as soon as Joe says stop you will stop because he's the authority. Now I could say keep walking and because Joe has authority you will not walk and I don't have authority, Joe does. But what I do have authority in my domain in your hā. So I'm gonna say to you to that person stop breathing and if that person says ok I'll listen because Joe can't do that he only controls me walking. Now if I said to you stop breathing you watch the reaction and that person will go ***uuuhhhaaaahhhuu*** and stopped. You will see what happens with that invisible side. Does that make sense?

Yes and no.

00:16:00 You will see that if I stood here like this and I said right stop breathing, in a medical term I'd go like this for my first ten seconds I'd look normal.

After thirty might change, might go. I'm trying to search for that unseen hā or air otherwise my body's going to start to complain. It needs it. Now Tāne asked his brother for that part. To make that woman move. Now that's that unseen, that's there, the wind is there so like if you see that plant, it's out there but you can't see it. Does that make sense? You'll see it when if you went out and see it's not around today but it's there. Because that's why we are standing, it is there. When he's around and on a busy day you'll say that plant going like this, so his temperature's moved up a bit but he's there. So we don't need the full amount but we need enough to keep us walking and talking. So that's that hā, that's that mauri that's one of them. So you'll see it if we tell the kids to sit here and then I tell the kids hold your breath for five, for who can hold it the longest? And if they all sat like this you gotta see the reactions to them after a while.

I guess I'm interested in understanding how, maybe this question then is more concrete. Everything has mauri but do only humans have wairua? Or do non-humans also have wairua? And do non-humans also have hā?

00:18:14 Yes they all, in my view they all are part of that world, they are all part of that world. They have a part to play in life. They have a part to play on the planet and they have a part to play on earth. Because Earth is a little bit different to say Mars, Pluto and those planets so those elements there are made so that another stage can evolve out of that which is us, humans. And there could be humans in another, on another planet, we just don't know. They could come here with their different technology but what we know as humans because this is why because some say well the other people that come down and then take off they've got their different technology could be out there and advanced than what we are.

But what I mean by that is when you talk of mauri you talk about it in two senses, first is an innate thing that everything has and the second is something, I don't know if transference is the right word but there is a sense of continuity there's a sense of, you were talking about when the captains arrived they would bring a stone with them and they would put it with other stones…

And place it in a heap.

So that's a, transference is the closest word that I can think of.

So what they do is when they bring their stone they're giving acknowledgement they're going to that unseen, so they're going in that spirit world. They're going back into that spirit world again. So they've given thanks for the physical, like my safety, I've gotten across, my boat didn't sink and then when they got here they went back in the spirit world, thank you for getting us safe. And they placed that mauri to remember that.

So what's the difference between mauri and wairua in terms of spirit?

00:20:13 The mauri, the mauri is like it's a type of, I guess, it's like a type of life force, it is part of a life force, the mauri is a life force. So there's a force there designed to protect this area only. So if you go over there they probably may not have a mauri because they did not think that's important to us so here's got a mauri, over there they may not have in their building but the land has a mauri, the land. So yeah so Ngāti Wairere would have put a mauri on their land to protect their land and say this is our land, our mauri is here. So the mauri of this place is with Ngāti Wairere. So they've got a mauri here that protects it and they say well no our mauri is here if I met someone from Ngai Tahu their mauri or their force is in South island.

So mauri is something that is … there innately?

Yes, it's almost like, how can I explain it… Regional policy. City Council's one is for Hamilton only. Wellington's mauri is for Wellington, Auckland's mauri is for Auckland but they call their mauri legislation, regulation, that's the western mauri. We call ours, see when you look at a stone, that's not legislation. That's just an ancient way of knowing, that does not count they'll get that and just biff it that means nothing.

But what we're talking about here is metaphysics, we're talking about what I call the thingyness of things. So that's what I'm trying to tease out of you I guess is to understand better an understanding of the thingyness of things in a way that I'm trying to put to one side my desire to want to define. So I'm…

It's a way of saying every part has value and importance to us, every little thing has an importance and you can make that good with your wairua side now that's gonna be hard because no one knows they don't know the special karakia for that wairua side to tune in to look after that

mauri or look after things around so that's a specialist area to get in there to please look after us here safely. Or to navigate safely or to be safe when I go in the bush so I don't get lost so that's that wairua side we can say right here look after these kids. Now the kids today like from my grandchildren, they only know the world of playing and they will go into that ngāhere where there's no houses and that and they will go in and we'll teach them and they'll get scared because they're not used to that's a living tree, that's a living bird, he's there to do a job. They just see there's no toys, there's no, they're mind's in a different world they don't know that world yet. So we don't impart that knowledge on them until they've raised on their knowing and then sometimes when I was a young boy and my dad tried to teach me my mind was always over here, my mauri was here to play with my friends. It wasn't ready to be tuned in here if that makes sense. Because even dad was trying to teach me, he said this boy's not ready. I'm not gonna transfer. Because my mind, I just wanna play with my friends. My world was this this, my mauri wairua was this big, his was this big and mine was only just baby level.

00:24:15 *And maybe that's what I'm grasping with is the difference between mauri and wairua? Because when you talk with people everyone seems to go oh they're different and I'm going yes but what is the difference?*

What is the difference. The mauri helps, it helps, mauri helps how can I explain? Mauri helps help us understand a little bit about that spirit world because you could see that stone heap there, oh yep someone did something here. When I, so if you went before everything was flattened if I saw that there in the bush I'd say something happened there's a. I don't know the narratives for this here but there was definitely something here. Today ninety nine percent will walk down here and they'll see that oh that's for the soldiers and they'll pick it up straight away. But when I walk into a different space I would not be able to pick up straight away that mauri but I'll know it's something that mauri was protecting something but I don't know what it is until I hear the narratives. If I go to another country they'll have something and my first inquiry oh what's your story for this and they might, they will share maybe part of it, it means this, this, oh thank you very much for the sharing. But to them that's special, their mauri or their story about whatever but their mauri could be just a physical making but not connected necessarily to a

wairua, you see it could be to them that's their mauri but they don't have a link to a spirit side. It's just a temple or something.

Right so wairua could, I appreciate that humans can have a spiritual side, could rocks have a spiritual side? We talked about the mauri of a stone, do you can could it also have a wairua of a stone?

Yes it does. Cause everything is made not just well I'm gonna make the soil and the trees, I'm not making a stone. I'm not gonna make a bird, I'm only gonna make the soil to make the grass grow. Rocks don't have a thing, but you gotta remember everything is relevant, there's heat involved. Why do they need heat because if you have too much, you go close to Tamanui then nothing's gonna live, the grass will go, we'll go, the… so heat and everything is all relevant. That's science coming into it too, the science of living. You take a baby and if you don't get that baby warm at a certain temperature when they baby's born it's gonna go. That baby needs a certain heat to live, certain pressures to live. Earth is like that so with a rock or we look at a rock, the rock has a special place, was the rock there? the rock come up first in that heat, did the rock come out to make it all happen? Did the rock have to be moved out to make room for the soil? Because wasn't like just this beautiful green, it was some you know earth was earth but it needed parts to make it grow. That rock needed parts to grow. So was earth just a rock or was it just a heated ball? And needed elements to make it work for the creation.

00:28:11 *So there was a designer?*

Yes. Definitely a designer saying right ok I've got these. Maybe I could go to a stage two of my design and make it different because I've got a hundred of those and I've not made anything different. I've got about a hundred floating around in the cosmos I wanna make something a bit different but I need to change the temperature. I need to change the elements.

So the designer is Io?

Yeah he's the architect and he has the authority to delegate down.

So again I come back to time. What is time? That's the big question, what is time? Coming back to the questions I started off with.

Ok well time if you were to teach a child what is time, how would you answer that and a child was born and he's learning and the child said to

you dad what is time? How would you answer that to that little child? So the child can walk to school and say I know what time is cause my dad's taught me time. Now if you taught that child about Io, Ranginui, it'll never get it. How would you simplify time so that child can pick up time? So if I was teaching time to that little child I would say time means this. There's a time when you gonna wake up, time when you gonna have to have your breakfast, there's a time when you gonna get ready, mum's gonna get you ready to go to school and there's a time you are gonna come home and then you can play for a while and there's time you'll go to bed and we'll read a story. That's the time I'm gonna teach that child. Then tomorrow we're gonna go through that routine again.

00:30: 10 I wouldn't, I could get advanced and teach that child early about things but probably wouldn't, not at that age. But other times because as the child grows the child's gonna ask me, "dad who's your dad?" so that that the child is gonna ask about a time period and so I'll say, "well my dad he lived in Auckland and we moved to Hamilton." "Oh why did you fullas move?" as the inquiry started, "Oh well we moved because mum had a better job so we shifted to get a better pay, son." "Oh I heard Auckland was a good place, wish I could have been born there." I said, "No we had to shift because of this and this." "And where did mum come from?" "Well mum came from Ireland." "Where did dad come from?" "Well he came from Brazil." "So they came from two different places dad?" "Yeah yes our grandparents too and they married."

00:31:13 So that inquiry will start asking about time or some may not even want to know that. They might not want to know time, the only time they're interested in is when they get up and what they gonna do today. today's time until the end of the day. All our children now the time that they wanna know is what they're gonna do on that phone. yeah what are they gonna do on their phone, that is their time period.

But there's a link then between time and potentiality.

There's a link then between time and potentiality but is potentiality going this way and potentiality going that way if we can work in our space, allocated space, so I can't, mightn't be able to control everything in that space in this part of the world but will do our best to make our potentiality in this period and our location as best as we can for those little kids that will come into our time space.

It's less of a question, it's more of a ponder. When I look at digitality there's no time but there's a lot of potentiality.

There's a lot of potential yup, there is, cause digital can also capture and get that message of time a lot easier for the minds of today. We would use that technology.

Time simply becomes a practice but it's not limited to those practices. So te kore is often described as a realm of infinite potential? Is that correct?

00:33:17 Yeah it is the birth of potential and someone must give effect to that potential. Something must make that potential happen. So it's sitting there like, it's sitting there. We, if we go to sleep in the darkness and we're resting and if there was ten of us sleeping in here in this wharenui, we can get up and do the same thing each day. There could be someone in there, in that group who'll say "I have an idea, I have a potential, I have a thought that I'd like to try something" and you won't know until that person goes out and does something different to what the others may be doing so you have a potential yeah. So te kore for some reason had that potential and said right I'm gonna do this and this is what my plan is and he started off those epoch journey coming from the world te kore was used to and allowed to dwell in, to come out of that world into form, whatever.

There seems to be a link between te kore and where do ideas come from?

Yes, definitely, it's the same thing. Like today someone doing a high-tech thing will think you know everyone will just go to work and do the normal but someone else is out there thinking right now I'm gonna change it, I'm gonna make it better. I think I can do it by doing this, this, this and this by these key players now I'm gonna make that better that I don't need to hold that, I don't need to charge it, we're gonna have something. I'll just put it there and it's gone charged and do the same job. I don't have to type it, it'll be typed for me and it'll be sent straight to my printer in five minutes.

What is the link between te kore and te pō, if te kore is a potential or potentiality and how does and maybe te marama is the becoming of it, is that a good way of putting it?

00:35:45 Yes. So the kore is the nothingness, so to get in to show someone to demonstrate the nothingness is is really simple. You stand there and you know when I talk about breathing and you see the reaction if we say well I control breath and I did that demonstration with a group of students, I had five of us sitting here on the seat, we got the students that sat there. This one only had power over walking, this one had power on the arms, this one had power on speech, and this one had power on breath. So each one of us were controlling that person so "right, move your arm" and if this one asked to move he would not move the arm because he didn't have authority, only this one did. This one could make it walk, "walk there, come back there", but then he couldn't control the arms until this gave permission and then the person. Then you can see the controlling of that person. Now in te kore when we look at te kore the best way to try and explain it so you can see it is to close your eyes. Nothing's gonna happen, no person can not move because he's happy in that domain. That's all, that's my domain. So when you're in that world of te kore and not seen there's no problems, you can't see a problem out there because you're just in that nothingness. There's no problem, there's no pain, there's no fear, nothing's coming at you. There's no people talking to you because there's totally nothing, you are in control of that space but if you wanted to come out of that and grow that you can. Like te kore had things to grow to come out of that nothingness into the pō and then if he gets "ok I want to see something different to the pō, maybe I should bring a light into play". So te kore had the power to go from that dark, the unseen, so we all go in te kore at night when we sleep. We go back into the darkness, we cannot sleep with the sun twenty four seven on us. You must go back into that rest period. So in te kore was like that then he made the night, then he made that light, the night and light married, he created the next time period, those two married and created the next stage. Those two elements joined then created the next stage and that's gotta come down the chain getting ready to make earth. Down the chain to make humans you must have those elements coming together but te kore was the architect. Uh sorry Io was the architect which made te kore and the light and the dark join to make something. You two join and see what you can make. And then the formation came.

00:38:59 It's starting to build a cosmos. And you'll probably see it if you're playing with lights, lights going on, lights going off. Alright nothing else is

happening, what can we do with that? But then pressure's gonna start to build with the light, pressures to form things, light's gonna come in play, pressure's gonna start to come in play, heat's gonna start coming. Something's gonna happen. And when that's Māori's when you see them building you see their whakapapa and when I go through the whakapapa and I go "why did that one marry that one?" or have a link with that? why did that one join with that one?" And you can sort of see it's starting to unfold before it gets to earth, all these parts must be in place first before earth, earth is way down the chain down here. So it doesn't just say te kore, earth. It just seems like a fantasy, earth with birds on it, Māori world doesn't go like that. Every section, it's like I said when that demo, you control that path, you control, come together. And that's how Māoris when they go in that taha wairua if they go on the sea they're giving, they're asking, they're doing the karakia for the ngaru for the sea, "please when we come across you and we wanna respect you and we don't come to harm if we come to get fish we gonna acknowledge you, cast the first one back, we'll take enough just for our family. We ask that you just give enough for us." And they'll go and do it like that in our ??? And we'll go in the bush, we'll go in there and chop that tree down for a canoe, we're gonna ask "can we take one of your trees?" now to another culture that's "why did you do that? why did you ask to take a tree? you actually did a prayer and took that? and you did another when you launched, why are you doing one there, one there, and another one over there for the mauri when you get across the sea? it's just, why don't you just one prayer that will cover every section?" So sometime's it's best to withdraw your knowledge, "ok well you do your way, I'll do my way."

00:41:22 *But what you're talking about there is continuously evolving phenomena?*

It's continual, "why did you do one there? why did you do one there? why did you do one over here? why do you wake up and look at that thing and say it's a beautiful day?"

It's an artificial way to put humans and non-humans together but what you're talking about, the word I use for that is co-constituted, it's yeah. It's lots of parts around the mix.

There's a lot of parts moving past the body when you go in health, there's not just one part and so sometimes when you ask of mauri, "why did they talk of here only? when they forget, you forgot that piece down here, that toenail". That is that stone of your body you never acknowledged it, he has a role to do. You take that away, then take his other mate away, the foot, and then you take, de-power someone, I used de-power students and say ok and we'd talk about the Māori and then I used to de-power them like, take one, take your arm away, one arm, and then they'd walk their way around and then they could do not as much as two, they can still like but they were limited to certain things they could do. They like right, right give your arm back. By you, I've de-powered you and take one foot away, now that's gonna be a bit of a struggle with one because we gotta try and get there with the aid of something. Now the other one, how you can test a student too is if you stand there right, "I'm gonna teach you about this thing called trust" and they go "right ok, how do you do that?" "Ok you gotta really trust me, I'm gonna look after you, close your eyes. Now close your eyes." Right and you take them where there's staircases and say "take one step, now you gotta trust me, one step" So they will go like this and go down and they are scared because they are going on your trust but first you get them trust by going on the flat, "Ok come forward, right put your hand out," so they'll walk straight, "don't stop, don't turn" and the student is going like this and you watch this, no the student's going like this and you do this sometime, go like this I'll go "Stop, don't turn. Stop. Reach out, push and that they'll push that door. They'll push it, right, yep, take two steps forward. Now push the door" they'll go and you can see they're still still nervous. Cause they don't know if you're a good guy gonna make them fall in the puddle and that "ok let that door go," ok and they still trusted you, so they've built up a trust in that safe zone and you gonna take them go up a corridor "turn right, go down the corridor, turn left. Five steps, one, two, three, four, five, stop. Turn right, one step, five steps forward, one, two, three, four, five." Now once they've built that trust they get confident. Now some people are still scared because even though you've done it in a safe zone in here they've still got a bit of, you know they're still a bit thing. Now if we took them out on a stairway and you've got to get them down that's where you see how they trust your words are good. "Now we're gonna go on a stairway, they are short

steps, take a short step and go down slow. They'll take one and once they get down they built up that trust.

So we're talking about not just in terms of trust but also in terms of if you think about continuously evolving phenomena, you're talking about levels.

And you talking about the appreciation of what you have, like earth. And some people forget this path far away is no relevance to up here until you de-power that like I did there. Once you de-power that and see it's important then you find you cannot do a lot of things.

So within these continual processes there are levels of stability?

Yes. Which makes you complete, some people are only complete because of their knowing of just this amount of knowing so they're only, think you know this is all I need. Anyway, that's a bit that I can share, there's more to it I think that's enough for now.

Yeah that's enough for now. Thank you so much for your time.

I'll save some for another day.

I've got question in relation to quantum physics so that's alright that can wait.

But hopefully that made a bit of sense on some of the…

Yeah thank you.

Our world, the different elements, the different mauri to look after that that that and other people, tribes have theirs. I don't know why that mauri's put there until I ask "oh well I don't my zone, why is that there? Is someone buried there, a site there?" and so that's what that boy's learning. He's learning about all of the special sites that we're getting mapped. We're looking to get on the heritage thing.

But you're not just talking about things, like this chair is a thing. you're talking about states of being. Yeah.

States of being. And this chair here, he came from a special place on the earth but been reformed. So you'll look at that and think oh that's rubbish. It's just only a chair but it has a genealogy if you went back and saw the beauty, where this piece this mineral came from you'll see it looking something like that. You'll see this as a fine steel ??? Taharoa,

[place on West coast] but you just see a chair now but it's whakapapa, it's genealogy goes back there.

But in all from the potentialities, it's in a stable form but it may yet change to another form.

It's in a stable form now but it may change.

Which further down the chain there's no sense of, at the start of things it's very hard to appreciate what's the end, what the later stages may be but at the later stages it's possible to look back and go "oh there's a chain that got us here".

Yeah, yeah so even when I go around I look at it, I look at that door, "yes you're one of the mineral family, you're one of the steel mineral family, you're one of the plastic part of earth."

That's what I call practice.

You can see it all around when you move around. But some people don't see that. Kids they don't see that. They just see a building but I see beyond the building. I look at its whakapapa, it's genealogy then I can look at that, "now that mineral's not from here, that mineral's from another country. We don't have that." Remember on this block I was talking about, one of those first settlers came they heard there were minerals and they went on the back of our block to dig for a green stone that they heard was there, they wanted to find it. They went searching for different minerals into the valley in their culture. But you see a Māori will see a pounamu and a Westerner will see this diamond and you say "which one would you take, please can I have that diamond, I don't want that pounamu, that pounamu has no" in their view no value, than this diamond because I could sell that and buy five hundred of those. But wairua that's a different kōrero.

Thank you.

Thank you very much.

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This interview was recorded specifically for this research.

Transcription of interview between myself (Joe Citizen), and

Aware Group Chief Technology Officer, Jourdan Templeton.

The interview took place by phone on 8th February 2019, beginning at 4.30 PM.

My questions and comments are in italics.

00:02:25 *I'm just going to jump straight into it. Thank you so much for your time today, I really appreciate it.*

00:02:30 Sure.

00:02:32 *Could I get you just to state your name for the interview and any affiliations that you might have?*

00:02:39 Sure. My name is Jourdan Templeton. I'm the CTO at Aware Group, an AI and data services company in Hamilton. We specialise in IoT, data analytics, and also in AI.

00:02:56 *Thank you. So, just to kick off, in the past we've discussed stateless computing. Could you briefly summarise what it is please, and how it is different to conventional computing?*

00:03:12 Sure. So, stateless is the idea that – actually I'll start with standard computing – In the old days we would configure our computer with a dedicated purpose and generally when you do that there's certain software that's a prerequisite to run your program. This is seen as kind of wasteful because that server does one thing and one thing alone and sometimes that one thing may only be required once a day, once a week, once a month, once a year, even. So, the idea with stateless computing is where you basically define what the jobs are and they can be distributed across multiple computers and not actually require one dedicated CPU that can be used for that one thing. It's a more effective use of resources.

00:04:08 *There seems to be a difference between running a script and the memory state? Could you comment on that?*

00:04:17 Can you say that again, sorry?

00:04:18 *You've talked before about how stateless computing doesn't actually hold on to that memory, so to speak.*

00:04:26 Yeah, so the idea with stateless computing is that, or at least from a cloud computing perspective, a job, it doesn't retain the previous history of the job. The way the program is built, the application is in a completely different way. In traditional computing you have this big computer, like I said, dedicated to that one thing. It has a certain amount of memory, certain amount of storage, certain amount of CPU. And generally that CPU and memory is persisting across multiple jobs, that run in that program. When we run in a stateless model, instead, there'd be memory assisted between each running of the job, and also the location of where it's running. So, if I was to run a job one day it could be done on a computer with one set of memory, and then the next day that same job runs, it could be running on a completely different computer and in a different part of the country. And so you can't guarantee that that memory will still be there.

00:05:32 *That kind of leads to my next question which is what would you say the advantages and disadvantages of stateless computing are?*

00:05:43 Stateless is great because it's more scalable, which means that say you're processing a queue of items, you can actually process them in any order on as many computers as possible, instead of just on one in order. From a cost and energy perspective, you're only paying for that specific time slice that your code is running for, as opposed to paying for a whole computer's worth of power for a week to do one tiny job for a second. So a more effective use of resources.

00:06:23 *So, in terms of resources, can you run a stateless network which could regulate itself? In terms of those resources that it uses or is that the nature of stateless, of cloud computing.*

00:06:40 Well, cloud computing still has limits because its ultimately running on the cloud provider that you're paying for. It's just at a higher level. So multiple customers are running their software all on the same computer and that cloud vendor kind of restricts that across the load to make the most effective use of that.

00:07:05 *So, that cloud vendor still has a server if you like, an older way of retaining that data, is that correct?*

00:07:17 Yes. Most office jobs is actually still a traditional computer but it's running all these modern types of tasks.

00:07:33 *So, could a network exist entirely in stateless computing or must it have that reference point, if you like, to a server somewhere?*

00:07:44 To the computer itself it doesn't know. To piece of code running on a stateless environment it still thinks it's a traditional computer. It's just a change in the way the developers have written the program, that's the only difference.

00:07:59 *Sure, but I guess what I'm asking is a functional question. Does it need that ultimate reference point to a server in terms of it running or can it only run in a stateless mode?*

00:08:21 No, it can run in both modes. You'll just get better performance running stateless code on a stateless server. You could potentially encounter a bunch of issues if you try and run stateful code on a stateless server.

00:08:33 *I guess what I'm asking really is can code exist entirely in the moment of its creation, so to speak, between different distributed parts across the network rather than having to rely upon, at some point in that network, somewhere for it to sit in memory as it were?*

00:09:05 That is a tough one. So, technically the program exists in the moment that it's being executed on that stateless server. Basically everything related to that job is distributed to the computers around and only for that period of time does it technically exist. As soon as that code has finished executing, it's deleted and no longer exists.

00:09:31 *But, where did the instructions for the compile exist?*

00:09:39 Well, it depends. If the code is pre-compiled then you don't need to worry about that. The instructions are distributed as a stateless job. If the stateless job is a script, it's interpreted at the time that it's run.

00:09:52 *I guess the question is when you talk about a pre-compile. Can that pre-compile, if it exists as a script and it runs at the time that that script runs. Could you have a network where only it is scripts that run, so to speak, without that need for a pre-compile anywhere as, I don't know, I'm going to call it solid, that's a not very good word, memory?*

00:10:24 Not really understanding, sorry.

00:10:28 *Just seeking clarification, then. What you're saying is that, when you talk about a pre-compile, where does that pre-compile sit?*

00:10:38 If I was a developer writing a program, I'd write that on my own computer. When I actually compile that program into a binary, that's the point where those instructions are generated into that binary piece of code. When it gets executed, the server that hosts the stateless job takes the binary that I've already compiled and it just executes the code as-is.

00:11:01 *So, what I'm asking is when it executes that code, you're talking about compiling in terms of the origin, if you like, of that code. But whilst it's in that stateless running, could it exist entirely from one device to another, virtual or otherwise, without needing a further compiling? Could it simply pass on that information to another node, if you like, in the network, so that it's always running in a continuously running and breaking down and continuously running a breaking down state? It's never actually holding it.*

00:11:42 I'm not sure. Finding that one a bit tough to understand, sorry.

00:12:00 *Ok, well we'll leave it for now. I might come back to it.*

00:12:05 Okay.

00:12:05 *Well, by way of clarification, if scripts run on the momentary activation of that activation, where is the script data normally kept?*

00:12:21 Ok, so there is the concept of shared storage and this is not necessarily in memory, this is like hard disk storage and this storage exists in the data centre where the servers are, generally. But with the advent of cloud computing, storage can be on the other side of the world and attached to virtually any computer in the world. So, traditionally storage had to be physically electronically connected. That's no longer the case. Storage can be virtual.

00:12:59 *But those virtual connections must all have a physical tangible place to reside in?*

00:13:05 In the end there is a physical point. But that just means that that physical storage could technically be on the opposite side of the world.

00:13:15 *Sure. So coming back to my original question: Can it exist purely virtually, always continuously running, without having to reside in some physical hardware state?*

00:13:36 Yes. It would have to originated on a physical design map. But technically after that, if it exists in memory, then it's no longer on a volatile piece of hardware. So, when we talk about memory on computers we've got volatile and non-volatile. Volatile memory is like the RAM when you're on a computer and the RAM gets cleared, whereas non-volatile memory is like a hard drive or a CD or floppy disk or USB stick. Those things persist even after the PC is turned off. So technically if your instructions or your code were sitting in volatile memory, the instructions would still exist but they would not be persisted in any way.

00:14:26 *So, in a way you're saying, again a point of clarification, in terms of physical computing, what is a physical computer? It could be as small as a tiny device, yes?*

00:14:41 Yes. A computer is technically any … takes code or makes computations. [Speech becomes inaudible.]

00:14:49 *Sorry, I missed that could you say that again, please?*

00:14:55 A computer could be anything that runs instructions, computations. Anything with a processor in it. Technically you can even build analogue computers as well, not just digital ones.

00:15:11 *Could you explain, sorry?*

00:15:16 So, a processor is a series of transistors or gates, and basically it's a combination of on/off binary switches that determine how to do all of the operations that a processor does. So a processor is just doing a whole bunch of mathematical operations in a specific order and it uses the memory to determine which instructions to execute.

00:15:51 *Right, so what is memory?*

00:15:54 Memory. Well, two kinds of memory non-volatile memory, or RAM - random access memory - is temporary storage for a CPU. So, any time the CPU needs to put some temporary storage somewhere because it can't store everything in a CPU at any one time. The CPU itself has

memory, and so anything it needs to put away for temporary storage it puts into the RAM, and then we have non-volatile storage which is things like hard drives and CD-ROMs, and USB sticks and all that.

00:16:33 *So an analogue computer could be made, I don't know, out of water gates. It could be entirely organic.*

00:16:40 Yup, exactly. And there are plenty of examples of people having built those.

00:16:48 *Wow, that's pretty amazing. Well, I guess just coming back to this idea of virtuality then, if it's technically possible, once having been compiled the data exists between devices within the network, constantly running and disassembling. In a way what we're talking about there is virtuality in a pure form. Would you agree with that as a statement?*

00:17:29 Can you define virtuality?

00:17:30 *Well actually that's my next question. I was wondering about your definition of what virtuality might mean?*

00:17:38 In a computing context, virtual is really just, abstracting away or decoupling something from something else. So for example, in virtual computing, a virtual machine operates like a physical computer, performs the same operations, but it may not have physical hardware or it may be sharing the same physical hardware as another virtual computer. The difference is that the virtual computer doesn't know that it's virtual. For all intents and purposes, it believes it's a physical computer.

00:18:16 *What do you mean by decoupling?*

00:18:19 In computer engineering, decoupling is the idea that a computer has inputs and outputs. So inputs would be things like a keyboard, mouse, a microphone, network, plenty of the input peripherals. Outputs are things like a display, sound, file storage, a bunch of things like that. When you decouple the inputs and the outputs, the computer expects to have a file as an input, as an example. Now whether that file comes from a floppy disk or a CD-ROM or a USB drive, it doesn't care because it's been designed to receive a file.

00:19:15 *Yep.*

00:19:17 And so when we decouple inputs and outputs, it allows us to basically put a virtual replacement in there instead. So for a virtual computer we actually decouple the computer operating system itself from the physical hardware. We put a virtual layer in there instead. The computer is still getting the inputs that it'd expects, so it doesn't know any different.

00:19:46 *You're telling me about the functionality but could you be more precise as to the definition of what you think virtuality is?*

00:20:01 Oh, I was describing decoupling. So, in my mind virtuality is providing an interface that is the equivalent to a physical interface. That's as clean as I can get it.

00:20:27 *It's an interface that stands in for a physical interface.*

00:20:31 That's right. Take that MIDI example for the waka. We initially created a virtual MIDI port to Lightjams. Lightjams for all intents and purposes believed that the signals it was getting were coming from a physical MIDI device, but instead they were coming from a virtual device that were written in software by what I wrote. So we defined the same interface as a physical device would provide. And because of that Lightjams didn't know any better. So it's all about that interface that we were able to make.

00:21:10 *You've previously talked about a contract as being kind of a set of logical relations. That's what you're referring to here?*

00:21:23 Yeah. In a way. Yeah that's true. So for example, MIDI is the protocol and MIDI instructions in a specific way. That structure of how the MIDI packets are built, we could consider that the contract, and a contract defines kind of what the structure of a piece of data is. So in MIDI, you have a control bit, you have a value, and a few other things. That would be the contract for a MIDI byte essentially. And contracts exist all over computing.

00:22:03 *It's a set of logical rules. That's what you're saying?*

00:22:08 It's more of a definition of expected data. Contracts specifically are used in the context of communications. So because two devices are expected to communicate, the contract defines what the data looks like that should be sent, and how to understand what has been sent.

00:22:32 *So the next question is what is the relationship between your definition of virtuality and the contract?*

00:22:51 When you provide a virtual interface to a computer, that interface needs to provide the contract to the consuming system in exactly the same way that the physical system would do it.

00:23:04 *Yep.*

00:23:05 So, that interface is basically a collection of those contracts, or an implementation of those contracts.

00:23:13 *So what I guess I'm getting at is that in the past you've made the distinctions between the virtual as not being tangible, inasmuch as not being physical, and the real, you know, which you describe as being tangible and physical.*

00:23:27 But just to carry it on there. While the virtual, in reality is not tangible, to the computer that is virtual, it is tangible, or it is equivalent to something that is tangible, it doesn't know a difference.

00:23:47 *Yes, yes and you've said as much previously but does it not have a tangible relation in terms of energy consumption, generating heat, reliance on a clock and that type of thing?*

00:24:03 It does rely on all those things but to the virtual machine itself it doesn't have any insight into what that, in fact, is. The only way you could measure that would be the host that is providing all the interfaces. The host would have to provide all that data.

00:24:24 *Right. I guess what I'm driving at here, what I'm trying to get to, is the relationship in stateless computing and virtuality, and I guess the potential for that virtuality to exist. I guess what I want to know is, where does that data reside when a script doesn't run?*

00:24:49 You mean the instructions?

00:24:56 *Yeah.*

00:25:02 It would reside on physical storage somewhere.

00:25:05 *So there appears to always be a link between the virtual and the physical. Is that correct?*

00:25:19 Yes. At the most basic level that is true. But we also even have this idea of virtual storage too. All the files could exist virtually and that can be read by a computer which is also virtual. The physical storage where that resides could be in Seattle and the computer which executes those instructions could be in New Zealand, and the computers - the virtual computers - executing that virtual file would believe that the file was literally physically attached to it. However, it's actually been abstracted through two different virtual layers and a network that spans the whole world.

00:26:10 *Do you ever have a conflict of inputs like that, on virtual devices?*

00:26:15 It does complicate things somewhat and conflicts can happen but that's no different to physical hardware. You can always have issues with hardware as well not being able to find files or whatever.

00:26:31 *In relation to the virtual becoming, for want of a better word, actual, you know like when a virtual machine makes something happen in the actual world.*

00:26:46 Yeah.

00:26:47 *Is it always a one to one correspondence? Or do you think there is a room for slippage or difference?*

00:26:57 How do you mean?

00:27:00 *To what extent is the system completely logical?*

00:27:08 It's pretty logical. I mean computers execute code as written. If bugs happen, it's due to programmers missing specific conditions more than anything else.

00:27:20 *I guess this comes back to really the part that I'm driving at and we've kind of talked a little bit about it in the past. Could you explain to me the difference in your mind between artificial intelligence and machine learning?*

00:27:36 Sure thing. Data science is this idea of pattern recognition where you could train a machine learning algorithm or a model to look at… Say we’re looking at image recognition. You could give it 100 photos of a bus and tell us that that's a bus and the machine will learn the pattern between those hundred images to understand what a bus is. AI is this idea that you can automate decisions or actions based on inputs, so it's

slightly different, still uses machine learning or pattern recognition to decide which action to take. But AI is the manifestation that it's almost acting on its own, if that makes sense. In reality, it's technically not acting on its own because it's still obeying instructions that were originally written, but in some way it still is, kind of making a decision on its own.

00:28:48 *Can it modify its original instructions if you wrote them into its code?*

00:29:00 Yep. In machine learning we have this idea of reinforcement learning. So for example, I think I could say that a good example is the game Super Mario. Using reinforcement learning you basically tell the computer the variable you're trying to optimise for. In a game that's generally like a high score. And so the computer will take all the inputs that it's given, so all the buttons, it will push them in different combinations to understand what actions have an impact on that score. And when it figures out what things positively impact a score it will continue to do those things. So in a way it's technically rewriting its actions or it's making smarter decisions based off the previous action that it took. That's reinforcement learning.

00:29:56 *It's very task orientated, if you don't mind me saying. So, it's got a single goal.*

00:30:01 Yeah. You know you pick a specific goal or a specific variable that you want to optimise for and it will continue to perform actions as it learns what has the best impact on that.

00:30:14 *Could you write into the code where it chooses what might be the best optimum itself? The best goal to pursue?*

00:30:27 Yep. So at the moment in the data science world we're seeing tools like auto ML - auto machine learning - coming out. And basically what these do is they almost brute force every possible model and every possible combination of input features to figure out which is the best model to use in a given scenario. So if you combine that with reinforcement learning, technically you could build a data science algorithm or a model that could choose the best way, it would know which feature was the best to optimise for, and it would also know how to run a model to get the best outcome on that feature.

00:31:07 *What's the definition of best under that model?*

00:31:09 That would still be defined by a person. So we'd need to choose a specific action for us to know what the best thing would be. But in games it could be the highest score, in retail it could be the highest number of conversions to sales.

00:31:43 *But it's a measurable quality each time?*

00:31:47 That's right. The computer needs to have enough representative data to understand how to increase the outcome happening.

00:32:02 *Do you foresee an artificial intelligence which is able to rewrite that original value set?*

00:32:08 You're talking about like, general intelligence? Could a computer learn something new? Something it hasn't seen before?

00:32:16 *Yeah.*

00:32:19 I think that in the near future we'll be seeing machine learning models which can learn about new things, but only within the same parameters as they've been choosen. For example, a computer vision I think that we'll be able to get a computer to learn how to recognise a new object on its own. However, I don't think in the near future, we'll have general artificial intelligence where it's more like a cognitive being as opposed to a computer that can do one thing like image recognition.

00:32:58 *i.e. It can recognise these things called objects and we can say that is also an object, but we won't be able to say oh actually this whole new category might also be this whole new thing, might also be, it doesn't conform to my notion of objecthood, but I could therefore recognise it as objects. You don't see that as happening?*

00:33:29 Not in the near future.

00:33:29 *I guess the question that I have with relation to this is, really, first of all, comes back to a very early question which is what is virtuality? And your explanation is of an interface of interfaces is that correct?*

00:33:54 Yes. And remember it is all about the interface with inputs and outputs. So even if you take something like virtual reality. Virtual reality replaces the outputs and inputs that you have in real life. So it tricks your body into believing that what you're seeing is real but it's a virtual interface. The input to your senses like the screen and sound and even like other aspects now, they are now virtualising. Those are all the virtualised

inputs. And then you've got all those outputs and then you've got the virtual - sorry those are virtualised to you as a person - and the outputs are actions that you perform with the controller or whatever and that modifies the virtual world that you're in. In that regard, that's exactly the same as a virtual computer where you're just abstracting away the interfaces that its seeing.

00:35:00 *In that example it requires humans for them to complete the loop so to speak.*

00:35:04 Yeah. And so in a computer's world, it's the software that's the operating system. I guess that's maybe where the bit of the confusion might be in my description is that when we talk about virtual computers it's not so much about the hardware, it's more about the software that's running. So, when you turn your computer on and you run your operating system. That's kind of like a host set of code that runs your programs. That's really the thing that we're virtualising. That's the part that interfaces with the hardware, we’re not so much virtualising the entire physical computer. We're more virtualising, we're more being able to compartmentalise multiple operating systems and run them all on one physical computer. To each of those compartments, they all believe they're running from the server's computer but they don't know that they're not.

00:36:00 *So when we're talking about a form of artificial intelligence, what we're really starting to talk about is how do we create the means by which that kind of hardware can be rewritten. Is that correct?*

00:36:22 Well, an artificial intelligence is just software, in the end. And in fact, you can represent an entire neural network with a list of numbers. We call them weights. The multi-layered neural network is just a list of mathematical operations and numbers. It’s not actually, yeah… that's how we represent it, that’s how we store it.

00:36:47 *These are logical relations with each other?*

00:36:51 Technically there are neurons that are stronger than others, just like in a brain, but it's still mathematical operations that evaluate the whole program.

00:36:58 *Seems very different to a brain to me because what you're talking about is just mathematical abstractions, which seems quite different to a brain.*

00:37:07 Is a brain not just a set of calculated electrical signals and chemicals?

00:37:19 *Well I think a brain has that capacity but obviously there's something that resides in the brain which we might call a mind. I guess this is what I'm trying to make this distinction between virtuality and tangibility. It is…*

00:37:31 I think I agree with that. I don't think that we're going to reach a point, at least in the near future, where computers are completely free-thinking agents unto themselves. I still think they're going to be bound by the rules that were written into them when they were programmed, as opposed to a human who has agency and the ability to act for themselves.

00:38:02 *Yes, it comes down to notions of agency. And, however mathematical abstractions, in relation to humans at least, and also in terms of, the means by which we can alter things in the world, also have a form of agency.*

00:38:19 Yes.

00:38:19 *Yeah they have agentic capacity. And I guess what I'm starting to wonder about, is the means by which this agentic capacity co-constitutes phenomena, where you might get inputs if you like, which relate to things that they weren't originally designed for, that you have a chance encounter… Do you follow what I'm saying here?*

00:38:56 Are you saying that a computer could modify itself in a way that we won't expect?

00:39:01 *Yes that's what I'm asking.*

00:39:04 And it would change the way that we would interact with it?

00:39:06 *Yes.*

00:39:13 I don't know if we can get to that stage in the way we look at traditional computing. It might be possible with quantum, because there are things in that we just don't understand yet.

00:39:24 *It comes down to this idea of chance in a way, or, you and I have previously talked about that randomity per se in computing doesn't exist, and yet…*

00:39:36 Pure randomness doesn't exist, no.

00:39:39 *In computing. Or in total?*

00:39:48 In computing. I'm undecided in general.

00:39:59 *Are you familiar with the term - potentiality?*

00:40:05 Like, in physics?

00:40:10 *Hmmn. As intensity of a possibility.*

00:40:18 Okay.

00:40:19 *So I guess what I'm wondering is, at what point can an input in terms of the way in which that data might then influence the type of code that it writes? Exceed the original parameters based around chance encounter with things that… um… yeah…*

00:40:54 Okay. Well actually how about this. So, one of the main issues in computing, at least, it doesn't really happen so much these days, but was very common when computers first came out. People needed to be very careful about how they manage memory, because, when you write a program you consume a certain amount of memory doing the operation. You reserve a certain amount for your application and you store things in there as required. Now some of the things you store in memory can also be operations, or additional code. Now what can happen is what's called a buffer overflow, which is where another program overflows its assigned memory into the space of another program. Now if you replace, if you purposely buffer overflow a program into another program and you overwrite that space, that the other program is using with some new code, that program will execute that code. So there is the potential for an external input to override the instructions that a program would expect to run. And that would modify its original design, if that makes sense.

00:42:12 *That makes a lot of sense, that's very interesting.*

00:42:14 Now in the past that was more of an accidental thing. These days, hackers use that to get access to memory space that they shouldn't get access to. For example, every piece of code runs in a privileged or non-privileged state. If you can overflow from an unprivileged state into a program that is privileged, suddenly you can inject your own instructions into that program, and basically that's what considered hacking, that's

where you're getting access to a part of the computer that was not intended. They do that by overflowing into an area of memory, overriding instructions to be used by a program that is privileged. Does that make sense?

00:42:57 *Yep.*

00:42:59 So you could technically use that same technique to have a program override the instructions of another program and modify it. That's actually kind of what viruses do, in a way.

00:43:14 *So this could be a means by which to create a virtual machine which is able to learn, so to speak?*

00:43:32 If you had two different programs that were both trying… Say you had two different reinforcement learning algorithms that were both trying to optimise for different things and what they were doing was modifying a single application, you could actually have that single application turn out as a completely different program because of the changes made by the two external programs.

00:44:00 *Or more than two. Yep.*

00:44:10 Or more than two. Yeah. That would be the only way that the program would operate in a way that didn't match the intended instructions written by the original programmer.

00:44:23 *And those applications, for want of a better word, they themselves could also be open to this form of modification?*

00:44:39 Yep. I think that would create a very volatile environment. It'd be impossible to understand what you click on is going to do what you expect. [Laughs].

00:44:52 *Ah, what you're talking about there is predictability. But that's not the same thing.*

00:44:58 Once the computer takes over on modifying those instructions, there's no way we can know that it's going to operate in the way we expect.

00:45:08 *There's a difficulty surely between, what, a desire for computers to do tasks, and a desire for an understanding of consciousness, of a type. Machine consciousness.*

00:45:23 That's right. If you were trying to apply the same logic to a person, you'd have the same problem where you can't actually figure out whether that person is going to do what you expect because they have their own agency and their own inputs.

00:45:40 *But people are not rational beings.*

00:45:44 That's what I mean. I guess if we were looking at machine consciousness like a program, we would be able to say what it would do in any particular moment, but if you suddenly allow machines to start modifying external code, then that program will not behave in a rational way.

00:46:10 *That's worth trying then isn't it?*

00:46:11 The instructions will execute exactly as written. We would not be able to understand what the results of that would be.

00:46:22 *Yes. Particularly if those results inform the instructions of something else, that you make loops, that you make cascades.*

00:46:37 Yup. It will get progressively harder and harder to understand.

00:46:38 *Well, theoretically then this need not exist purely within the digital as you say, this could also exist with an organic model.*

00:47:01 How do you mean?

00:47:01 *Well you said to me that computing need not occur in terms of its memory state, digitally. You can get the analogue version of computers.*

00:47:16 Yes that's right. If you build a computer that could do addition using water gates, and you suddenly had a crack in one of the gates and it was never filling up then that would behave in a way that we wouldn't expect. Or if you had, had someone else completely externally come in and add an extra bucket to your computer, we have no idea what impact it’s going to have on the overall computation.

00:47:47 *That's an interesting point, Jourdan, because, is a computer essentially in your mind, a computational device?*

00:47:57 Yes.

00:48:00 *I would suggest that computers are more than computational devices. They are a type of mutually constituted phenomena.*

00:48:14 Is that not its actual name, though? A computer literally computes things. It takes an input and produces an output.

00:48:23 *Well, to me that's your contract. That's simply the logical form that you created.*

00:48:28 A contract is a literal definition of what the input or output should be. It's not the actual input or output itself.

00:48:39 *It's your system.*

00:48:42 The definition of what the input or output should be.

00:48:46 *Yes. But a computational device under your definition is a set of logical rules which even though it may be working in abstractions, seek outputs or inputs which conform to those logical rules.*

00:49:06 Sure. So if I've got, for example, two computers that are speaking MIDI between each other. When we first start communicating, we establish that we're going to be using the MIDI protocol and that means I will send my data using many contracts, and you will interpret data coming from me, using MIDI contracts.

00:49:26 *Yep. But if we had a means by which we could, say, the packet data of MIDI data - the actual packet structure itself, could suddenly take on an extra aspect, an extra packet, and furthermore that there was the capacity for this extra packet to inform another means by which the system might update its understanding of what extra packets were. Yeah, that's interesting. The means to exceed the logic of its original parameters, is kind of what I'm interested in here.*

00:50:19 The only way that could occur is from an external influence.

00:50:37 *But surely when you have networks in relation to other networks... Define external.*

00:50:41 We're talking about the program itself, and it relies on inputs/outputs and temporary storage. If an external program, which can exist on the same computer or the same network, modifies that memory, then your program will operate differently than expected. That's actually a physical problem as well. For example, did you ever use the FireWire or any devices for FireWire?

00:51:19 *Yes.*

00:51:20 Pretty common in all audio-visual stuff. Firewire is a protocol. Actually, some of the pins on that cable actually do allow the device to talk directly to device memory.

00:51:33 *Wow.*

00:51:34 Which is a bad thing because it means you can plug a physical device in that could literally modify the memory of a program running on that computer. So you could actually initiate a buffer overflow with a physical device and take over a computer.

00:51:51 *Just by plugging in a device.*

00:51:54 Yes, and that's one of the reasons why FireWire no longer exists, was because of that vulnerability.

00:52:02 *I did know that because I had a friend of mine that used to run his own operating system on other people's computers by running off a drive.*

00:52:11 Yeah, you can. Well, I mean, the operating system can be run from internal storage or external. FireWire was one of the first protocols that supported booting externally, but FireWire has direct access to the RAM, not just storage, and the RAM is where all the instructions are kept. So that was not really planned for, I guess, when that protocol was built.

00:52:41 *There's a certain tension here though, isn't there, between the desire for interconnectivity and a desire for security.*

00:52:48 That's right. Security is increasingly more important, the more stuff that is put into the digital world. DNA is a big - not issue - but a big, lot of controversy around DNA at the moment, becoming a digital thing.

00:53:06 *Go ahead.*

00:53:11 For example, I could go and get my entire genome sequenced and arguably, my genome is the most personal data that represents me as a physical being, that there is. It would have biometrics, like I scanned some thumbprints and all that for a long time. But ultimately, the genome is the most personal kind of data you can get. And with all these companies now that do genome sequencing for ancestry purposes, these companies have retained copies of your genome. So, what happens if a malicious actor gets access to your genome and what can they do with it? And with the research that's happening right now

around virtual... Is it possible that somebody could get your genome and build a virtual version of you, or even a physical version of you?

00:54:20 *Well, that would be your biological you. That wouldn't be good.*

00:54:23 That's right. Yes.

00:54:24 *Comes back to what I was talking about before. The term I tend to use is relational emergence. Where phenomena emerges in relation to each other. And I guess what I'm interested in is the link between, you know, I was really interested to hear what you were saying about virtuality and your definition of virtuality, because an interface of interfaces and… It doesn't ah… I guess what I want to know is, just to define that even further, is that pure data? Or what is that? To come back to your original definition of virtuality.*

00:55:23 Yep.

00:55:30 *You describe it as an interface of interfaces.*

00:55:35 I said it was an interface that represents the same inputs and outputs that a physical device would have.

00:55:45 *That's the crux of it there. When you say representation, you're actually just talking about a number. Is that right? Or numbers? What do you mean by representation per se?*

00:56:08 Say, we go back to the waka example again, with the virtual MIDI device. If we represented say, a keyboard, a physical MIDI keyboard. It has inputs to the keyboard which are the keys, and it has outputs which are the MIDI signals which can be changed as something else. So, to represent that physical keyboard exactly in virtual space, we would have to create a device that could produce the same kind of MIDI output that the physical MIDI keyboard was producing. That would be the virtual representation of that physical thing.

00:57:01 *Is that not just data? When you say... Yeah. What is that...? I understand what you mean, again, operationally?*

00:57:11 The wires are exactly the same. And in that regard that's just data. The code that represents the virtual keyboard is technically data because, well it's technically... Yeah, I guess you could say that its data sitting on some type of storage. And when that virtual device is used to get loaded

into memory and executed. You could even say that that code can be run in a single session as well.

00:57:52 *So what is data?*

00:57:58 Data is a collection of ones and zeros that represent specific data structures, and specific arrangements of data represent different things, and we use combinations of these structures to provide the inputs and outputs to computers.

00:58:19 *So when you say ones and zeros we're talking about ons and offs, running through resistors and transistors. A flow of electrons.*

00:58:29 Exactly. So you might have a music file on your USB, at some point the binary in that music file ends up on a processor of some sort that turns it into an analogue signal. It's still data.

00:58:45 *When you're talking about signal, you're talking about waves? You're talking about particles?*

00:58:56 That’s right. Sure.

00:58:56 *You're talking about the flow of electrons through conductors as regulated by a clock.*

00:59:06 That's exactly right.

00:59:10 *So the whole thing in terms of the data structure relies upon this thing we call a clock.*

00:59:21 Yes. The clock is the most central part of any computer. It's not possible to have a computer without a clock. Then you have no sense of ordering.

00:59:30 *And the clock is essentially... What?*

00:59:36 A clock is essentially a standard unit of time that we can use as an anchor point.

00:59:48 *It's a ruler.*

00:59:55 Yeah. Sure.

00:59:55 *And this comes back to a conversation we had before, but essentially as a ruler, it requires a homogeneity or a regularity between points.*

01:00:15 Not necessarily, your clock could be random. But if you want any consistency in the way that your computer would run, you would want it to be a consistent unit of measure.

01:00:24 *Right. So quantum clock, would be an unpredictable clock but the system would still run, albeit unpredictably.*

01:00:39 Yes. I mean like two thirds of the time we'd know what's going on because the qubit can be on off or on on or both on and off. So there is an aspect which we don't fully understand just yet. We may actually figure a way out to understand how to use a qubit. And that would make it a more efficient clock. Or, possibly because it can't be controlled and it makes a terrible clock.

01:01:16 *[Laughs.] But we might discover something else along the way.*

01:01:24 That's true. Everything in computing is pretty much tied to this idea of a clock. You know, when they talk about CPUs and they say like this many megahertz or gigahertz.

01:01:35 *Yeah.*

01:01:35 That's actually the clock speed of the CPU. That's how many Hz that your CPU performs operation at.

01:01:42 *It's a frequency. It's not a speed, it's a frequency.*

01:01:50 Correct. In this case, the higher the gigahertz the faster the processor works. So technically those are speeds.

01:02:02 *Only in terms of oscillations in relation…*

01:02:08 In terms of the processing of instructions, specifically, on the CPU, higher frequencies relate in higher output, throughput.

01:02:24 *But relativity says that space and time are the same thing.*

01:02:33 [Interference]

01:02:44 Yes but the clock speed isn't necessarily…

01:02:54 [Cut off]

01:02:57 *Hello. Hello. Lost you there for a moment.*

01:03:04 Hi, can you hear me?

01:03:06 *Yup. You were saying about relativity. About the clock speed.*

01:03:14 Yes, so when we talk about the clock speed of a CPU, that's how fast a CPU can complete an operation in a given second. So we say it's 3.4 GHz then that is still a time reference. It's the number of operations completed in that second.

01:03:31 *If we were off the surface of Earth, or closer to the core, that would occur at different speeds.*

01:03:49 That's true. And NASA has had a lot of issues over the years where computers didn't behave as expected in space.

01:04:07 *You're able to explain further?*

01:04:12 Yep. So remember I talked about buffer overflows?

01:04:15 *Yep.*

01:04:17 That was a very common occurrence in space because the components are electrical in nature and there's a lot of solar radiation and things like that. Solar radiation could pass through a computer and slip some bits on a CPU or in the memory. If that happens, then it also introduces a sense of random in that computing program as well, because the instructions have now changed. That's another example of an external influence that can modify the way a program would run. So solar radiation in space actually affected the way that early computers ran in space. And now since then they've figured out how to shield and reduce redundant systems that can fix that, but it was a problem when they first started going to space.

01:05:11 *Perhaps they were being hacked by the analogue solar computing systems… but that's my humour.*

01:05:18 Yes, but that would be accurate. The sun was an external factor that caused the program to change in a way that wasn't expected.

01:05:33 *The difficulty here is really that there is a desire of humans to continue to have computers that are predictable. I'll come back to that.*

01:05:45 Yes. I don't think I would want an unpredictable computer.

01:05:49 *Why's that?*

01:05:45 Because I use it for doing precise tasks. I don't want it to perform imprecisely.

01:05:58 *Ah, you use it as a tool.*

01:06:01 Exactly.

01:06:03 *That's an interesting thing because that's really the fundamental difference between a tool as an extension of the mind through physicality, and the idea that tools might have their own being.*

01:06:23 Yes. In this case, I'm expecting the computer to be acted upon by me. As an extension of me, as opposed to acting for me or on behalf of me, making its own decisions.

01:06:38 *So in a way artificial intelligence completely separate to humans is already doomed, because humans don't really want that.*

01:06:52 No, I don't think they do. There is a degree of automation that we can get and that is currently what we're seeing as being cool AI. And that's still acceptable. It's still acting as a tool on our instructions, but it's not going out and doing things completely out of the blue.

01:07:23 *Yes, when we see a shift from deep blue to out of the blue then we'll have AI.*

01:07:31 [Laughs.]

01:07:35 *Hey Jourdan, it's been lovely. Thank you so much for your time. I could go on a lot like this, but I need to sort of have a chance to think and wrap up.*

01:07:47 Have I been making sense?

01:07:48 *Yeah, heaps of sense. What I'm struck by is the immense sense of rationality. You know, the immense – what I call the logicity – of the thinking. And fundamentally, that's something I associate with a very human trait. A certain type of thinking. You know, from a cultural practice, it's a Western thought. Because you know, what we're talking about here is, I'm fundamentally interested in the nature of being, and particularly the idea that phenomena is mutually co-constituted and continuously emerging in a performative sense. So, I'm kind of interested in understanding, first of all, how potentiality might inform virtuality, and you define very precisely what virtuality is, whereas of course, you know there are wider definitions of virtuality in relation to the material. Where people talk about the manifestation of a certain range of*

possibilities, whereas for you you're quite clear about the limitations of virtuality, so to speak. Does that make sense?

01:09:28 Yes, I think so.

01:09:29 *I would really like to continue this conversation at another time, eh? But let's call the interview finished here. And would like to catch up with you… do you still have a little bit more time?*

01:09:50 Yep.

01:09:51 *Yeah, I'll just turn off this device that I've been recording with. Hang on.*

Interview ends.

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This interview was recorded specifically for this research.

APPENDIX C

Additional documentation

Guide to Appendix C

Tangible milestones

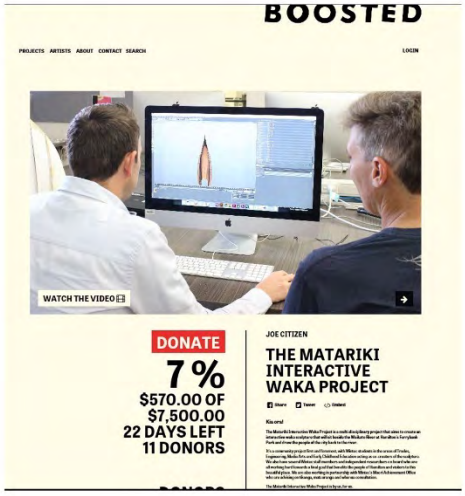
2016	
Oct	Initial waka concept sketches
Nov-Dec	Clay and paper prototypes

2017	
Jan	Full-scale bamboo prototypes Interactive design starts
Feb	Cardboard scale prototype completed
Mar	3D model (Maya) Matariki design sign-off
Apr	Initial IT design completed
May	Initial CAD design completed First 3D print produced
June	Initial lighting prototype designs for waterjet process
July	Longveld first design drawings (internal frame)
Aug	Longveld second design drawings (external skin)
Sept	Hamilton City Council concept sign-off
Oct	Waterjet cutting of sub-frame
Nov	Sub-frame completed Initial LED purchases
Dec	Initial lighting prototyping plates produced (2.5mm)

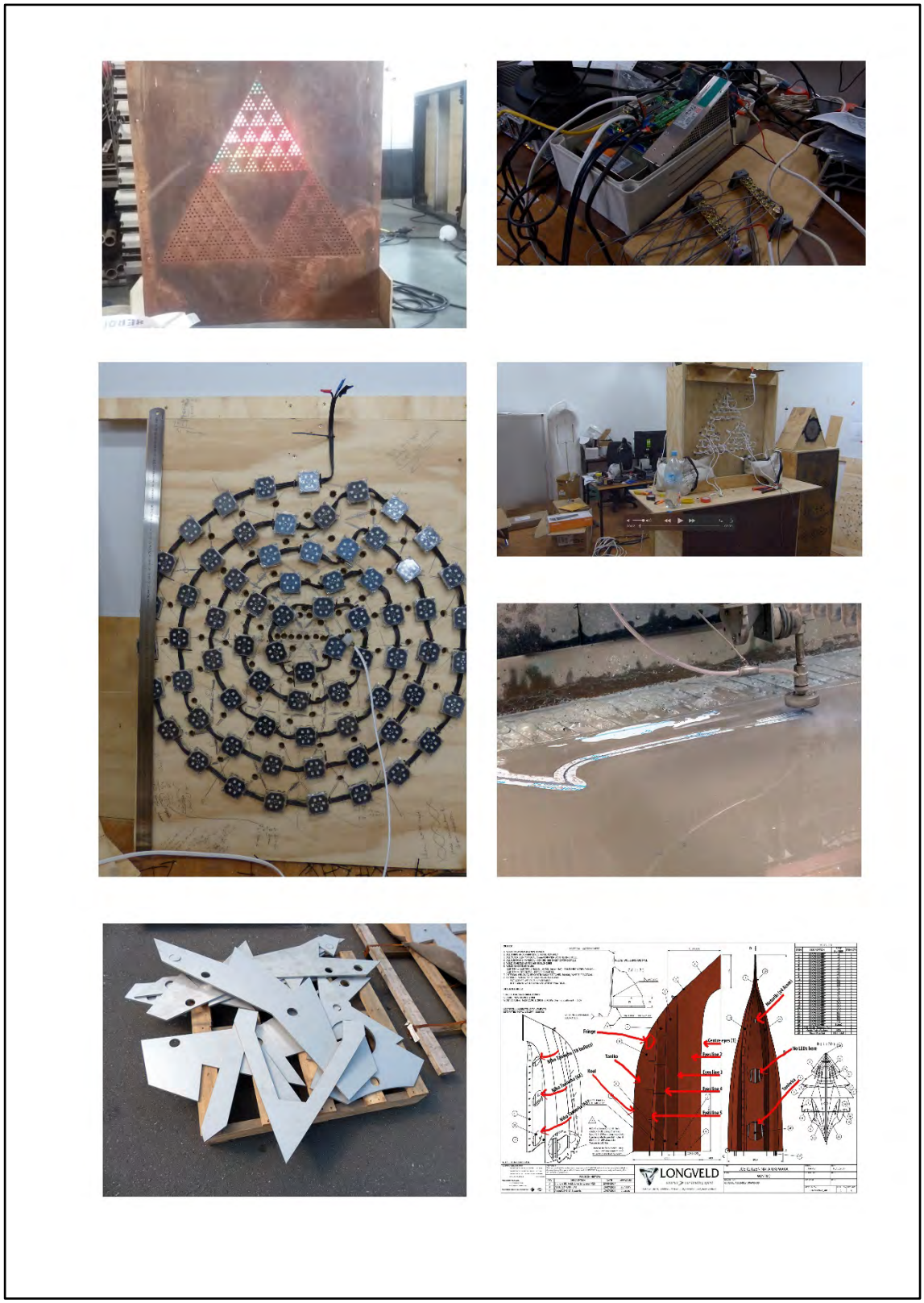
2018	
Jan	First scale lighting prototypes built and tested
Feb	MIDI to light prototyping
Mar	Initial lighting plan completed Sound design starts
Apr	External plate welding starts Aware Group joins project
May	Initial programming starts
June	Foundation design starts
July	Taniwha lighting prototyping
Aug	Student electrical and mechanical install starts Thermal imaging camera and IT components installed
Sept	Foundations dug and constructed
Oct	Tōia Mai lifted upright Final testing starts
Nov	Crane and installation Opening day 23rd Nov

Wintec students of note	
Juliann Smith	Illustrator
Norefjell Davis	Composer, Performer, Arranger
Geng Xu	Electrical install
Qi Chen	Electrical install
Tim Fan	Electrical install
Arjun Ravi	Mechanical install
Vignesh Venkatesan	Mechanical install
Tully Billett	CAD modelling
Wiehan Vosloo	IoT install
Stefan von Maltitz	IoT install
Ashton Church	Experimental sound app

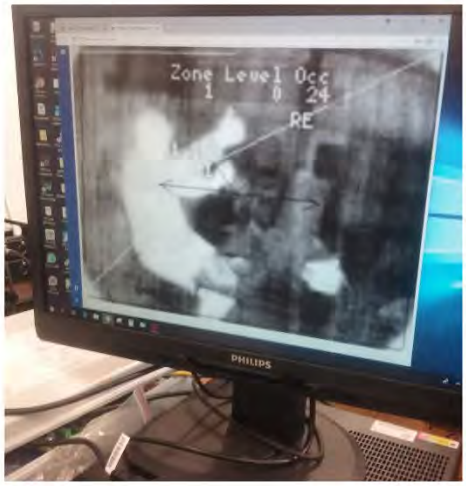
The above students all contributed above and beyond their normal studies and were critical contributors to the journey of Tōia Mai, so that it became a reality. Ngā mihi nui.

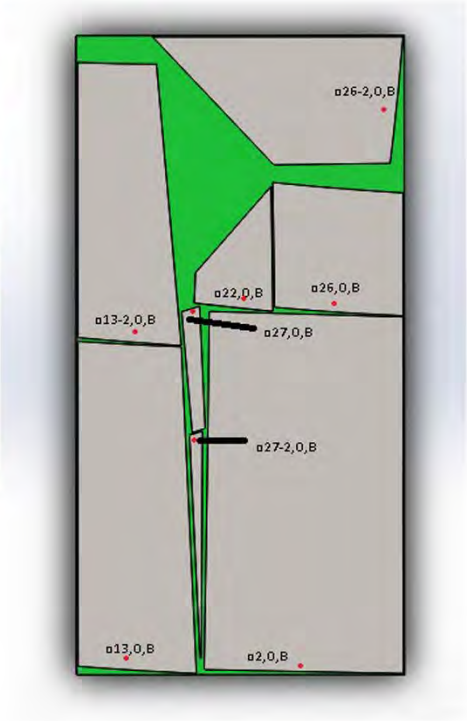


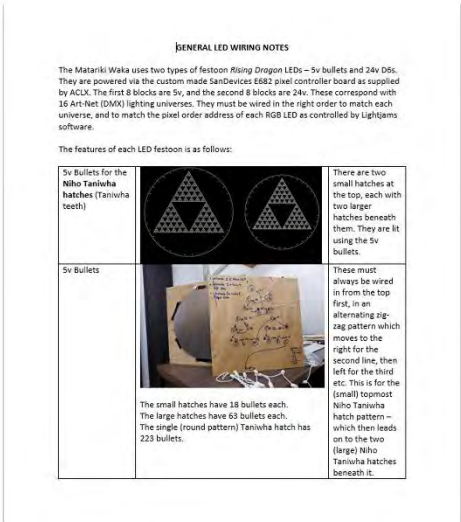
Early days, from left to right – the unsuccessful Boosted capaign that was run by the excellent Olivia Mead; the first 3D printed waka model, with its broken tip; an original lighting prototyping plate; making the local newspaper front page.



From left to right: The original lighting prototype at ACLX; the ‘don’t try this at home’ prototype; the original taniwha prototype; view of Joe Citizen’s lighting prototyping space in progress; waterjet operation at Longveld; the original frame cut out of 25mm steel; an identification drawing for students.





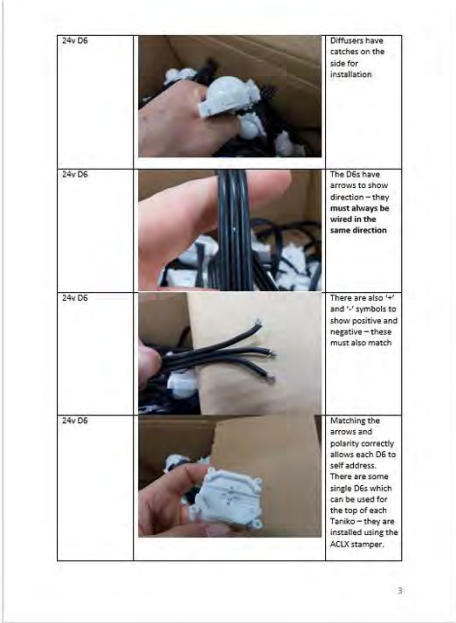


GENERAL LED WIRING NOTES

The Matariki Waka uses two types of festoon *Rising Dragon* LEDs – 5v bullets and 24v D6s. They are powered via the custom made SanDevices E682 pixel controller board as supplied by ACLX. The first 8 blocks are 5v, and the second 8 blocks are 24v. These correspond with 16 Art-Net (DMX) lighting universes. They must be wired in the right order to match each universe, and to match the pixel order address of each RGB LED as controlled by Lightjams software.

The features of each LED festoon is as follows:

5v Bullets for the **Niho Taniwha hatches** (Taniwha teeth)		There are two small hatches at the top, each with two larger hatches beneath them. They are lit using the 5v bullets.
5v Bullets	The small hatches have 18 bullets each. The large hatches have 63 bullets each. The single (round pattern) Taniwha hatch has 223 bullets.	These must always be wired in from the top first, in an alternating zig-zag pattern which moves to the right for the second line, then left for the third etc. This is for the (small) topmost Niho Taniwha hatch pattern – which then leads on to the two (large) Niho Taniwha hatches beneath it.

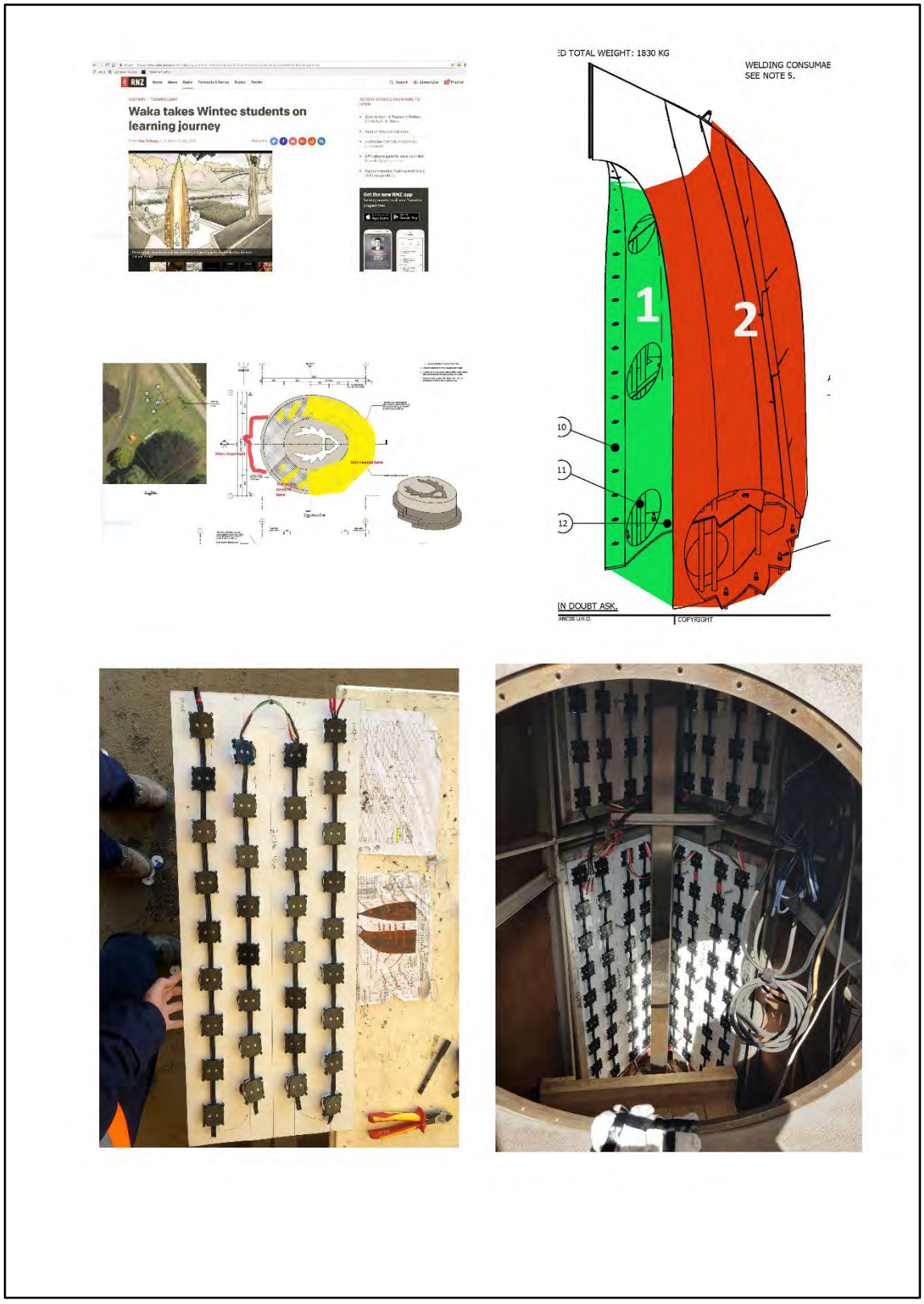


24v D6		Diffusers have catches on the side for installation
24v D6		The D6s have arrows to show direction – they **must always be wired in the same direction**
24v D6		There are also '+' and '-' symbols to show positive and negative – these must also match
24v D6		Matching the arrows and polarity correctly allows each D6 to self address. There are some single D6s which can be used for the top of each Taniko – they are installed using the ACLX stamper.

3

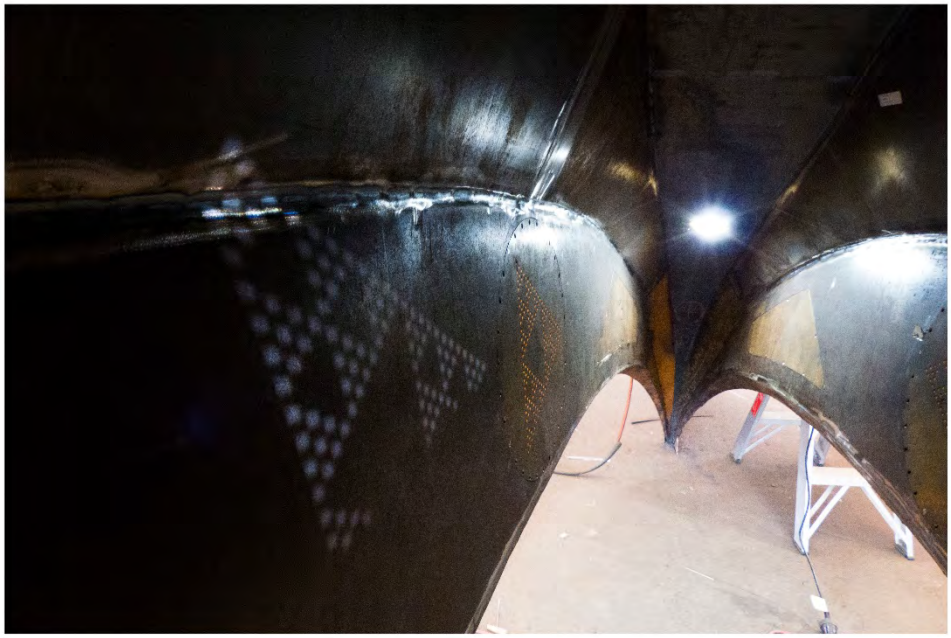
From left to right: Hey look it works! Mucking around with the thermal imaging sensor; an example of Tully Billett's original sheet calculations; some pages to help students wire up the LEDs.

Top right image courtesy of Tully Billett.

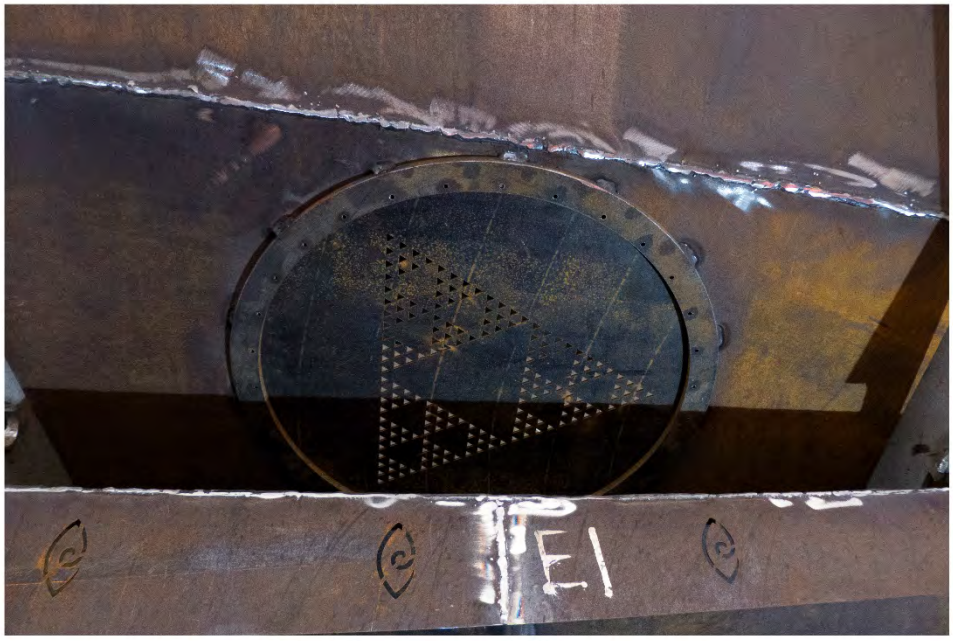


From left to right: Screen grab of the Radio New Zealand interview with Norefjell Davis; diagram sent to the canvas manufacturing company to inform making the cloak used for the reveal on opening day; details of the foundation design with additional

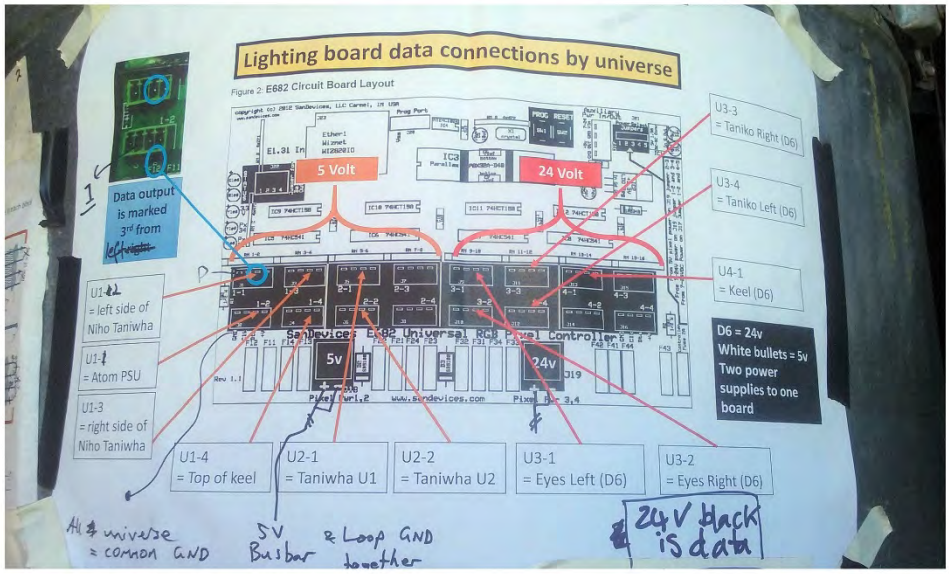
instructions for the builder;work in progress; inside the bottom hatch during the electrical fit-out.

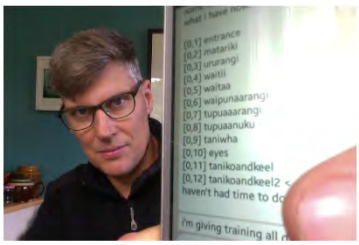


Tōia Mai comes to life. Work in progress at Longveld, May 2018



Tōia Mai comes to life #2 Work in progress at Longveld, May 2018





From top to bottom: The reality of wiring the lighting board; Joe Citizen receives Jourdan Templeton's successful DMX mapping documentation; Just another impossible thing before breakfast - Jemoal Lassey at Longveld.