KA MUA, KA MURI

Walking backwards,
Into the future.

An architectural thesis analyzing
the impacts of computation design
on Māori design culture.

KA MUA, KA MURI
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KA MUA, KA MURI

Is a traditional Māori proverb that considers a person walking backwards into the future.

The notion suggests that the past is discernible, but the future is not. It invites oneself to look to the past for clues to the way forward and highlights that the future is unwritten.

The future comes out of the past.

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Figure 01, Mcdonald, J. (1921).
Woman Weaving a Food Basket.

ABSTRACT

Modern generative and procedural digital tools are beginning to provide a new and previously impossible method of engaging with indigenous design from all parts of the globe. Diverse geometric patterns form the basis of many indigenous art forms, and complex digital design workflows can recreate and extend upon these.

This thesis is centred around traditional Māori arts and, in particular, fabric arts as there is an opportunity for a digital tool to be established that can interact with Māori design in a far more engaging way than previous, default Western architectural design methods. This research forms an argument that modern computation tools and complex digital workflows allow for much-needed engagement, as Māori culture is often misused throughout New Zealand and the wider world.

This thesis seeks to establish an innovative digital tool that can engage with Māori concepts of time and space. From researching Māori culture, it is apparent that Māori architecture is understood in a diametrically opposed way to Western architecture. By exploiting digital tools and modern fabrication methods, Māori understanding of time and space can become the design driver to form a new architectural linguistics that engages, instead of supplants, Māori culture.

Traditional Māori fabric construction techniques were selected for exploration, due to the complex relationship between their structural integrity and intricate decorative beauty. Many fabric techniques have been tested and implemented into the final architectural form that has derived a new ornamental, speculative, architectural language.

This architecture is focused on ephemeral architectural structures based upon two typologies. The first is the traditional Māori hākari stage, a temporary structure erected for major multi-tribe feasts and celebrations throughout pre- and post-contact eras. The research into the hākari stage informs an outcome that analyses the modern fashion show typology. While seemingly opposites, the two typologies have fascinating similarities through their notions of time and space, which creates an exciting framework for new architectural outcomes.

IMAGE REDACTED

SCOPE

The research scope attempts to achieve an architectural intervention that combines Māori mātauranga (knowledge) and complex computational workflows to create a new form of Māori architecture that is liberated from the constraints of Western architectural understanding.

Through the analysis of traditional Māori fabrics and woven arts, a digital technique is established to derive a bespoke architectural language. Patterns that emerge from traditional fabric arts have been translated into a complex workflow that can reflect the inextricable link between structure and decoration that Māori fabrics possess.

Thus three primary outcomes have been developed enabled by the scope of the research:

First, the development of a digital technique that works in symbiosis and achieves the thesis aims and objectives.

Second, multi-scalar prototyping experiments are designed to develop the digital technique into a robust tool capable of being utilised successfully at different scales.

The final outcome is creating and visualising the final architectural design, which acts as a readable architectural system imbued with cultural motifs.

These three outcomes form the basis of the quantifiable results for this thesis. However, there are many intangible outcomes when analysing Māori culture, due to the often immeasurably complex cultural notions considered throughout this thesis.

AIMS AND OBJECTIVES

The principal research aims of this thesis are twofold. It was vital for me to distinguish the cultural aim from the design aim due to my rudimentary knowledge of Māori culture. By developing a specific cultural aim, I was able to limit the scope of my cultural research. However, the two aims work in tandem to achieve the desired outcome of the thesis.

CULTURAL AIM

How might modern digital tools and fabrication techniques reflect traditional Māori notions of time and space?

DESIGN AIM

How can traditional Māori fabric construction techniques inform a new ornamental, digitally derived, speculative architecture?

CULTURAL OBJECTIVES

To use digital workflows to liberate Māori architecture from the constraints of Western architectural expectations.

DESIGN OBJECTIVES

To establish a robust, yet flexible, digital technique that can achieve a new architectural linguistic imbued with cultural motifs and bespoke customary fabric construction techniques.

DIGITAL DESIGN AND COMPUTATIONAL THEORY

Computational design (CD) is able to harness the power of a computer in order to create rapid and complex geometric design outcomes to a resolution that is impossible with traditional methods of design. (WSP, n.d). The use of CD has arguably revolutionised areas of architecture in the form of a shift of focus from manual design outcomes, to generative process where contextual and analytical influences can be used to derive architectural forms. This thesis will capitalise on the incredible power of these workflows to derive an architectural outcome based upon traditional Māori weaving techniques.

This thesis will focus primarily on the computational design type of Parametricism throughout the design phase. Parametric design is based upon the utilisation of algorithmic tools that can understand and generate new geometry dictated by chosen parameters. Parameters can vary from specific contextual information such as sun shadows to far more abstract notions such as beauty. The designer is in control of which parameters are determining the resulting geometry as well as the level to which each parameter is affecting the design.

Patrik Schumacher of Zaha Hadid Architects coined the term 'Parametricism' by stating "Parametricism is architecture's answer to a contemporary, computationally empowered civilization and is the only architectural style that can take full advantage of the computational revolution that now drives all domains of society." (Schumacher, 2011) Parametricism is only going to become more prevalent with the exponential growth in power and accessibility of technology in the modern era.

Due to the mathematical nature of fabric construction generative workflows are able to understand descriptions in order to replicate traditional weaving patterns. However, this thesis positions itself to not only replicate but also utilise the power of modern computational workflows to create emergent patterns that could not be conceived without the use modern technology. The result of this positioning is an avoidance of blatant replication of Māori iconography and instead uses mātauranga Māori (traditional Māori knowledge) to inform a new applications of traditional Māori fabric techniques.

The computational theory that is a guiding notion for this thesis was formed in 1993 by Greg Lynn. The theory was coined 'folding' and focusses upon the act of folding as a process not a product.

IMAGE REDACTED

Lynn argues that folding in the context of computational architectural design is the creation of a design outcome that is necessarily motionless, however through the constant development and change of form motion can be suggested. (Lynn, 2004)

Lynn developed the idea of 'folding' in 2004 with a focus on defining the role that animation can have on computational design. Lynn identified the misconception of animations use within architecture and instead defines animations in computational design as "a term that differs from but is often confused with motion. While motion implies movement and action, animation implies evolution of a form and its shaping forces." Through the design phase of this thesis special effects software Houdini created by SideFX is used as a design tool to create form evolution through the use of animation and visualisation.

Throughout the argument three definitions of animations were established that describe the way in which animations can be implemented to inform new architectural outcomes.

1. Topological forms are a representation of the relationship between time and shape.
2. Time is a factor allowed by animation software which permits possibility of keyframing and it allows objects to interact dynamically with one another.
3. Parameters finally provide definitive rules under which the subject will deal with the passing of time and its changing typology. Parameters can be used to introduce a field with certain qualities to influence the form and generate an emergent result. (Lynn, 2004)

This thesis will capitalise on Lynn's definitions with a particular interest on computational designs ability to implement time as a parameter. The use of time will enable an engagement with Māori notions of time and space to inform design decisions.

METHODOLOGY

DANIEL WIDRIG

BARTLETT B-PRO RC6

This thesis implements a multi-scalar design methodology enabled by the use of generative design workflows. The design process is based on Daniel Widrig's work. Widrig is an architect who uses computational design strategies to blur the lines between industries that range across architecture, sculpture, fashion, and furniture design. (Widrig, 2020)

Daniel Widrig's multi-scalar approach to design is most evident in the experimental university programme. (Bartlett B-Pro RC6) Widrig runs the programme alongside Stefan Bassing and Soomeen Hahm at University College in London. The programme focuses upon utilising digital systems that facilitate the rapid design of products and environments. There is a clear emphasis placed upon digital systems that are multi-scalar and allow for 'manoeuvring between disciplines' (Migayrou & Sheil, 2015).

Many projects from the RC6 programme result in an outcome that utilises a five-step design process. First, the students will establish a computational design technique or tool that achieve the project's desired result. The computational design technique is then tested through the rapid production of various furniture items. The small-scale furniture allows minor tweaks to the computational technique to be implemented that strengthen the technique's robustness and flexibility.

The scale is then enlarged to a myriad of architectural elements. Columns, stairs, walls, and small structural details are tested in conjunction with the parameters established for the technique to work successfully. Throughout the prototyping of architectural elements, the complexity is increased through the application of progressively more tweaks to the technique and other geometric operations such as symmetry, translation, or rotation.

Selected, tested architectural elements are composed into a small-scale architectural outcome. By this stage of the project, the technique is very robust and can work in conjunction with multiple elements to create continuity between elements. The project's outcome is a large-scale architectural outcome that utilises many elements created throughout the project.

IMAGE REDACTED

The result of implementing such a design methodology is a robust digital tool that can be applied at a wide range of scales. In my opinion, this is a fascinating possibility enabled through the use of complex generative design tools. Disciplines such as furniture design and architecture were a short while ago seen to be very different but are now converging to create astonishing, innovative design outcomes using learnings from each discipline.

IMAGE REDACTED

Figure 07, Authors Image. (2020).
Methodology Diagram

MĀORI NOTIONS OF TIME AND SPACE

Western notions of space and time have severely impacted and constrained our ability to understand perceptions of the building and architecture of Māori. It is proposed that Māori concepts of space and time have to be considered the main method to understand Māori architecture appropriately. This critical theory creates part of the cultural theoretical backbone of this thesis.

Bill McKay and Antonia Walmsley brought the theory to light in their 2003 paper 'Māori Time: Notions of Space, Time and Building Form in the South Pacific'. In the literature, McKay and Walmsley create an argument where it is clear that the Māori understanding of time and space are fundamentally different from the understanding of time and space of Western civilisations. Therefore it can be argued that Māori architecture may not conform to the Western model of a three-dimensional object in space but can also be understood as existing in time as well as space. (McKay & Walmsley, 2003) The authors state that they are not trying to redefine Māori architecture. Instead, they attempt to shine a light on cultural narrative and ideas that are overlooked in descriptions and analysis constrained by Western architectural discourse. The paper also outlines numerous ways in which Māori architecture can be understood in time instead of space, and these are used to inform design methods throughout this thesis.

First, the conception of time needs to be differentiated from the perception of it. According to Robin Le Poidevin, we as humans perceive time as one event following another event. Each moment in time turns into an instalment in our memories which can be referred back to. (Le Poidevin, 2019) The conception of time, however, can be far more diverse from culture to culture. The Māori word for the past is 'mua', which translates into English to mean 'front', and the Māori word for the future is 'muri' which means 'behind' in English.

Ranginui Walker describes the Māori conception of time thus: 'Māori face the present and the past which are in front of him. In this time-frame he has before him the living, their forebears, the dead, the founding ancestors, the cultural heroes or mythology and the gods. This time-frame is the basis of marae protocol.' (Walker, 1982) It would seem as if Māori are constantly aware of the past so that everything in the physical world provokes remembering rather than focusing on the immediate spatial world. (McKay & Walmsley, 2003)

IMAGE REDACTED

Figure 08, Whites Aviation Ltd. (1948).
Wāhine Sitting with Māori Sculpture

With clearly different conceptions of time in Māori and Western ideologies, a question arises. How can Māori architecture be analysed and documented according to Western conventions? Donna Awatere labelled the forceful adoption of the Western conception of time as a 'colonial tool': 'The present is all important. The dimensions of time have been collapsed into space. This occurred when time began to be measured and quantified. It was no longer tied to the cyclical rhythm of nature and to the ancestors' rhythm of life and death.' (Awatere, 1984, as cited in McKay & Walmsley, 2003)

Not only did the separation and displacement of Māori from their sacred land occur during colonisation, but the introduction and forceful implementation of the Western conception of time served to dislocate and fracture Māori culture from their cyclical conception of time. 'The intimate, mimetic and reciprocal relation between the human (Māori), nature and the living past of ancestors was replaced by a time experienced as space and mediated by a history "frozen" into a mechanically measured dimension.' (Awatere, 1984) Māori people are in constant metaphysical dialogue with history, living intensely in time. In contrast, Pakeha live in a far more linear, purely physical and spatial world in which the past is referenced but easily forgotten. (McKay & Walmsley, 2003)

Western architectural perception is fundamentally visual in nature, with importance being placed on the architectural object being seen sitting in space. This is yet another factor that is inherently different to Māori architectural thinking. In 1983 David Levin wrote about modern Western thought as dominated by a vision-centred, ocular-centric paradigm. (Levin, 1993) Ocular-centric ideas are even more relevant now, with the influence of social media platforms such as Instagram, whose sole focus is on a series of visual depictions of oneself and the environment around one.

A Western focus on architecture results in the supremacy of materiality, space, form, and decoration. Until the invention of film and the more recent shift to technologies such as virtual reality and augmented reality, architecture has always been represented by a fixed point of view on a static medium of paper or print. Reliance on static images to represent architecture results in the mummification of the object in time. Western society prefers its buildings to be permanent, durable, and lasting. (McKay & Walmsley, 2003)

When McKay and Walmsley mention the criticism of architectural mummification, they are not attempting to say that architecture's visual nature is not essential. Instead, they are trying to highlight the fact that a focus on primarily visual analysis of Māori architecture bypasses all of the metaphysical and cultural motifs that are so important to Māori and the understanding of their architectural typologies.

Māori architectural typologies exist in a different paradigm that relies on traditional metaphysical beliefs and connections with time that must be experienced and cannot be captured visually. McKay and Walmsley state that 'no one in New Zealand accepts that one can understand the Meeting House without visiting the building and having it explained by Māori, from the inside out.' (McKay & Walmsley, 2003)

Māori architecture is not intended to be seen merely as an object. Instead, it is to be experienced through a series of approaching steps, paepae, that are sacred to the people of that particular meeting house. One does not walk around and admire the meeting house on one's own; they must ensure that the appropriate protocol is adhered to grasp the abstract nature in which Māori architecture is conceived and understood.

The interior of the house is regarded as the present or living world of the local area. Transitions between these worlds are believed to be the threshold between life and death, between the mythological past and the living present. (Brown, 2009) The ritual and experience of visiting a meeting house are not easily perceived or captured in a single moment. Instead, architecture is a series of steps or gateways through the world where architecture becomes a threshold between the inside and the outside worlds. (McKay & Walmsley, 2003).

Architecture in Māoridom is metaphorically personified in order to create a link to an ancestor. Meeting houses are commonly regarded as representing an ancestor's physical body, representing someone of importance, both mythological or ancestral. Architectural elements metaphorically represent parts of the human anatomy. For example, the ridgepole (tāhuhu) is seen as the spine, the gable is seen to be the head, the rafters (heke) are the ribs, the overhangs (maihi) are the fingers, and the internal supporting post is seen to be the heart of the ancestor.

Figure 09, Whites Aviation Ltd. (1947).
Girl With a Carved Post

Diedre Brown, however, warns that ‘these metaphorical readings and meeting houses are set in the context of regional oral narrative, and they should not be applied to all meeting houses nor seen to embody a universal view of the Māori cosmos.’ (Brown, 2009) Due to the significant differences seen in art, storytelling, and culture between tribes in Māori culture, this is not surprising. Brown goes on to state that ‘attempts to resolve these narratives by eliminating contradictions or attempting to find correspondences across stories, only imposes a Western system of judgement on their validity.’ (Brown, 2009)

The personification of Māori architecture results in morality being accepted as a vital characteristic of a building. Mortality of Māori architecture can be described through the cyclical belief of time for Māori that has been referred to as an essential value of mauri or life force. This is by contrast with the Western view. As Pallasmaa wrote, ‘the architecture of the modern era aspires to evoke an air of ageless youth and of a perpetual present.’ (Pallasmaa, 2000).

In Western society, the effects of time, such as erosion, decay, or weathering, are considered negatives. All actions possible are implemented to mitigate or hide the effect of ageing. Meeting houses in Māori culture are allowed to decay and age. The process is likened to the ageing of an ancestor. Upon serious structural or aesthetic ageing, the architecture is rebuilt by a new generation and adapted for their new needs and concerns.

McKay and Walmsley cite meeting houses such as Te Tokanganui a Noho, located south of Hamilton, and other Rātana movement buildings for their ‘suprising fluidity’ of form through change and transformation. The architecture is seen as a series of incarnations instead of a static building. (McKay & Walmsley, 2003)

The conception of time in architecture must be seen as a significant protagonist in order to understand Māori architecture as it is appropriately intended. Whilst Western conceptions of architecture and design will be referenced throughout this thesis in the communication and analysis of design results, time must also be thought of as a central concept of design.

By utilising modern technology and procedural, time-based design simulations, time can be integrated into the design process, creating design outcomes that are influenced in time instead of disregarding it.

‘Architecture’s task to provide us with our domicile in space is recognised by most architects, but its second task in mediating our relationship with the frighteningly ephemeral dimension of time is usually disregarded.’

(Pallasmaa, 2000)

MAURI (LIFECYCLE)

In Māori culture, art and, by extension, the artist is considered sacred. Therefore, the weaver and the act of weaving are the incarnation of mauri, mana, tapu (sacred). Māori weavers are also linked through time with ancestors and with future generations through the mauri life cycle. (Patterson, 1992)

During my initial research analysing Māori fabric arts, it was evident that there was an inextricable link between fabrics and mauri, which emphasised the need to explore the notion of mauri throughout this thesis. The concept of mauri also provides an intriguing methodological framework that can act as an abstract narrative throughout the design of this thesis.

Mauri is an extraordinary power possessed by all objects. The concept focuses on the possibility that all things move and live in accordance with their own conditions and limits. Everything has a mauri, ranging from forests and rivers to houses and cars. The concept of mauri is the power that permits these living things to exist within their own realm and sphere. (Patterson, 1992) It is believed that when a human is born, the gods bless them with two parts, the body and the spirit. Mauri is then used to bind these two parts into a whole, and therefore give life. When a human dies, the mauri can no longer bind together the body and the spirit, and therefore life is lost. (Barlow, 1991)

‘The heart provides the breath of life, but the mauri has the power to bind or join. Those who die have been released from this bond and the spirit ascends the pinnacle of death. The mauri enters and leaves at the veil which separates the human world from the spirit realm.’ (Barlow, 1991)

Due to the sacred and powerful nature of the concept, no one can control their own mauri. It is, however, possible to establish mauri from the act of creation, such as weaving or architecture. Erenora Puketapu-Hetet believes that she ‘must give it (flax) another dimension to its life force so that it is still a thing of beauty’ when she is weaving. (Puketapu-Hetet, 1989)

Weaving is far more to Māori than a manual skill: it is the very essence or embodiment of the spiritual values of the Māori people. (Puketapu-Hetet, 1989) In the art form of architecture, mauri is established as the sacred heart of the building. Mauri is seen as a

power obtained through a sacred covenant with the gods to provide protection to the architecture and ensure a prosperous future for its inhabitants.

The concept of Mauri is often not taken seriously in Western scientifically oriented societies, because the ideas do not easily match with Western values and metaphysical beliefs. If a person has been raised to believe that humans are complex biological organisms subject to scientific law and rocks, rivers and mountains are fundamentally different from living things, it may be hard to see mauri as a legitimate concept. However, as John Patterson states, ‘concepts such as mauri are not only metaphysic concepts, they are also used to express a range of important values.’ (Patterson, 1992) If we concentrate only upon metaphysics, we are likely to lose sight of the values underpinning the concept.

This thesis is not trying to dismiss metaphysics, as they are an essential part of the concept. However, for many people set in their way of thinking, concentrating on values is an excellent introduction to the concept. The values of mauri and the values of Māori can be translated into all walks of life. (Patterson, 1992)

Mauri as a concept of values is often described as ‘respect’. However, there are many methods in which mauri can be enacted. (Patterson, 1992) In the case of weaving and textiles, mauri can be produced by the worker showing respect for materials, respecting the object we are creating, respect for the people around us. In a broader context, we must have respect for the whole world around us. Puketapu-Hetet states, that ‘[i]t is important to me as a weaver that I respect the Mauri, life-force, of what I am working with. Once I have taken it from where it belongs, I must give it another dimension to its life force so that it is still a thing of beauty.’ (Puketapu-Hetet, 1989) The materials used in weaving are seen to have a life of their own, unlike in Western cultures where materials are viewed merely as a means to the worker’s end. The materials are sanctioned to be used by Māori people, but they must never be regarded as mere means. The weaving project must result in a successful outcome such as an object of beauty, even if it is a simple object such as a basket.

The standard material used for traditional textiles in Māori culture is the harakeke plant. The centre growth of harakeke is called the rito and is metaphorically likened to a human. ‘Either side of the rito is never cut. Logically, this will ensure the lifecycle of the plant, but

in terms of Māori philosophy it is also acknowledged as a link between the plant and the people.' (Puketapu-Hetet, 1989) Puketapu-Hetet explains that the leaves must be extracted in a certain way to ensure that the mauri is preserved. If the material is sourced disrespectfully, showing a lack of mauri, the plant will perish. Any scraps of harakeke not used in the weaving are referred to as kaikaha. This 'waste' is returned to and deposited at the foot of the plant from which it was originally taken, to help the plants in their future growth and to preserve the life cycle.

Life cycle is an integral part of both mauri and textiles in Māori culture. The woven object's spirit, the history of the weaving's source, the resultant lineage, and the apparent tracings of descent and ownership contribute to the idea of the woven object as an heirloom. The weaving is not primarily an object but a container of time. (MacAulay & Waru-Rewiri. 1996) Puketapu-Hetet states that a woven object will be 'passed down from generation to generation the same way as an heirloom. It is used until it can no longer serve the purpose for which it was created. It is then deemed to have died a natural death and is allowed to go back to where it first began, to begin a new life cycle.' (Puketapu-Hetet, 1989)

This idea of decay and growth central to mauri is due to the intrinsic link between humankind and the ancestors in Māori culture. On the one hand, they keep us safe from other beings in this world and on our part, links must be kept through the implementation of ritual.

'When a woven article is complete, it is time to give thanks to Tāne-mahuta for the material whose life force has been given another dimension so that it lives again in another form to give pleasure and usefulness to human kind. When we take from Tāne-mahuta, we have a responsibility to this life force. This custom helps explain why flax should never be burnt. Material that is not required should be allowed to die naturally, returned to Papatūānuku to begin the cycle again.' (Puketapu-Hetet, 1989)

CHAPTER REVIEW

MĀORI CULTURAL RESEARCH

The initial cultural research for this thesis serves two purposes. Firstly, it defined the cultural scope for the thesis that will derive the design outcomes. However, it also served as a method to fully immerse myself into the ways that Māori view and understand the world with a particular focus on time and space.

The notion that Māori architecture is understood in an entirely different way to western architecture is a concept that I had personally never thought about nor learnt about. Much of architectural discourse and education is so confined to western ideologies that Māori cultural understandings are often overlooked. John Patterson points out that Māori cultural values are often not taken seriously in western scientifically oriented societies because the ideas do not easily match Western values and metaphysical beliefs.

When attempting to answer the question ‘how might modern digital tools and fabrication techniques reflect traditional Māori notions of time and space?’ Bill McKay and Antonia Walmsley’s argument is of critical significance. The discussion highlights ideas such as Māori architecture being seen as a series of incarnations instead of a static building. Notions such as this one can be implemented and achieved through digital tools and simulation commands to arrive at a speculative architectural outcome rich in cultural motifs and understandings.

IMAGE REDACTED

MĀORI RARANGA (WEAVING) PRACTICES

This thesis is merely a glimpse into the Māori world of weaving. To claim to be a complete analysis of Māori weaving would be inappropriate due to the life-long pursuit of knowledge and practice that defines traditional Māori weaving. Weaving for Māori is not just an art form; it is seen as the fusion of creative practice and ritual action (Puketapu-Hetet, 1989).

From the earliest days of settlement, Māori have always relied on fibre and woven arts. The first settlers had to quickly develop new textile techniques to suit the materials and new climate of New Zealand. The need to be sheltered from the elements in a much colder country than their tropical homeland saw the rapid development of fabric and cloak weaving and the introduction of more sophisticated weaving techniques for architectural elements appropriate for the new climate.

Māori created the majority of their textile objects from harakeke, the native flax of New Zealand. The Māori word 'hara' is derived from the flax family of pandanus, and 'keke' means strong or stubborn. Preparation of harakeke always begins with the appropriate selection and cutting of leaf blades from the harakeke plant. (Paama-Pengelly, 2010)

The reliance of Māori on fibre arts as a functional tool crucial to survival is reflected by the significant number of objects created using various fibre construction techniques. Julie Paama-Pengelly created a table that contains all of the objects created using fibre arts and has organised them into four categories: personal adornment, personal items, food collection, and architectural structures. (Paama-Pengelly, 2010) The table illustrates exactly how imperative fabric arts were to early Māori civilisation.

Fabric art was predominantly the women's job in a tribe. It was rare for men to enter the whare pora (house of weaving) as women took significant pride in fabric construction's specialist nature. The women of tribes often protected techniques and knowledge of fibre arts to ensure that the mātauranga (knowledge) was retained for the next generation. (Puketapu-Hetet, 1989)

The New Zealand Māori share many handweaving techniques with indigenous cultures around the world. However, what separates Māori fibre and woven arts from those of other indigenous cultures

IMAGE REDACTED

IMAGE REDACTED

is that textiles were integrated into so many facets of daily life that works acquired a special significance in the form of mana (prestige) in Māoridom. 'Weaving is more than a product of manual skills, weaving is endowed with the very essence of the spiritual values of Māori people'. (Puketapu-Hetet, 1989)

Raranga is the word often used as a blanket term to describe Māori fibre arts. However, raranga can be separated into two basic techniques: raranga refers to plaiting and whatu is used to describe weaving technique. (Paama-Pengelly, 2010) Both techniques involve the interworking of threads to produce taura (patterns) with varying aesthetic complexity and functions.

The ancient Polynesian belief is that the artist is a vehicle through whom the gods create. Art is sacred and interrelated with the concepts of mauri, mana and tapu (Puketapu-Hetet) Woven products of Papa-tū-ā-nuku, the earth mother, assumed symbolic associations with both whenua (land) and wairua (spirit.) Specific rituals and values such as mauri (life-force) are always upheld to create a strong connection between the weaver of the object, the living people, ancestors, gods, and the land. (Paama-Pengelly, 2010)

A Māori weaver transmutes the tough and fibrous leaves of the flax plant into a soft, pliable textile by a series of ritually prescribed actions. After the gathering and preparation of the materials, the weaver will work the muka (fibre) between their fingers moving horizontally from left to right, manipulating and intertwining the strands.

GOTTFRIED SEMPER

'The beginnings of building coincide with those of weaving' (Hvattum, 2004) is a statement from Gottfried Semper, a 19th Century German architect and theorist. Semper wrote extensively on the fusion between architecture and textile art. The origins of architecture developed from the imitation of ritual, rhythm, and dance present in textiles' creation.

Gottfried Semper was profoundly interested in architectural discourse related to theories of the origins of architecture. Semper was influenced heavily by the prevailing neo-classical attitudes of the late 19th Century that were predominately focused on the primitive hut. However, Semper kept arriving at the same conclusion: the obsession with the primitive hut had produced merely 'fruitless speculations which have not seldom led to dangerous errors and false theories.' (Hvattum, 2004)

Although recognising the importance of the wooden hut as a formal origin of the Greek temple, Semper refused to identify the origin of architecture as the original typology of man. Semper concluded that 'it is impossible to trace architecture as the expression and accommodation of social organisms back to its earliest beginnings.' (Hvattum, 2004) Semper thought that attempting to trace architecture's origins to a single typology would be similar to tracing language's origins back to the noises of the animal kingdom.

As Semper wrote, '[t]he most primitive tribes known to us do not give a picture of the original condition of humanity ... their provisional tents can be seen more correctly as an image of their present alienation and homelessness than as the original type of oriental architecture.' (Hvattum, 2004)

The notion that the primitive hut was the original natural architecture of man can be challenged under Semper's logic. Instead, Semper identifies the primitive hut as a developed architecture from the complex product of a long historical process. After discovering this notion, Semper became fixated on seeking the origins of architecture not in the architectural form itself but instead in the components that shaped it. 'The constituent parts of form that are not form itself, but the idea, the force, the task and the means.' (Hvattum, 2004) Semper's focus shifted to identify 'constituent parts', based less upon archaeological facts and more on creative methodologies or principles.

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Figure 14, Semper, G. (1860).
Various knots, seam, and twining

The origins of art became a starting point for Semper to understand the universal human need to create order out of existence. Semper identified through the analysis of mythology that play and ritual were central themes to the world's ordering around oneself. Play and ritual are illustrated in mythology as the overcoming of chaos employing order and representation. 'Man establishes a domain of order in the midst of a mysterious and threatening nature.' (Hvattum, 2004) Semper concluded that art is born out of humanity's need to make sense of the world around it.

Semper believed that the notions of ritual and play had the largest impact upon the notion of ordering as an act of developing the arts and, consequently, architecture. Semper's embodiment of time and movement into rituals such as rhythm, dance, and musical expression was of particular interest. Through these types of rituals, man can enact the creative expression of nature. (Hvattum, 2004) Semper describes ritual as 'the rhythmical sequence of space and time movements.' (Hvattum, 2004)

Creative expression in the form of ritual then transitions into its tangible embodiment in the practical arts, which in Semper's rationale form the foundation of architecture. As he puts it, these (rituals) are the beginnings out of which music and architecture grew.' (Hvattum, 2004)

Semper identified textile art as the most logical translation of ritual into tangible form. He explained textile art as a 'primordial embodiment of the ritual act of joining parts into a whole.' (Hvattum, 2004) Semper believed that there was no more efficient and symbolic method to find order in one environment than the ritual process of turning separate parts into a single whole. Textile joining techniques such as the knot were described as 'perhaps the oldest technical symbol and an expression of the earliest cosmogonic idea, symbolising the primordial chain of being.' (Hvattum, 2004) The knot was capable of mediating both the ritual act of order and the physical manifestation of arts and crafts. Throughout time, the knot was transitioned into more technical and complicated rituals of a prescribed fashion such as the weave, the braid, and the seam, all of which were initial primordial symbols of weaving. (Hvattum, 2004)

Upon identifying textiles to be the original motif of art, Semper began to explore their development and fusion into architecture. A meaningful connection that Semper made was the motif of the wall. Semper argued the primitive wall was closely related to weaving:

'wickerwork was the essence of the wall.' (Hvattum, 2004) The original enclosure was not a solid wall of stone or wood, but instead, the primitive fence created by the ritual of weaving branches and grass together. (Hvattum, 2004) Semper could then conclude that textile art and its entirety, including ritual and rhythm, were not only the foundation of practical arts, but also of architecture, declaring that 'the beginnings of building coincide with those of weaving.' (Hvattum, 2004)

To identify the motifs of enclosure moving from the primitive fence to textile art, Semper proposed the principle of *Bekleidung*. Semper's *Bekleidung* likens clothing or dressing to spatial enclosure. Semper explains that 'the wall is that architectural element that formally represents and makes visible the enclosed space as such, absolutely, as it were without reference to secondary concepts.' (Hvattum, 2004). The wall can establish and define the spatial envelope within which human activity can take place. In other words, the wall establishes a symbolic and ordered boundary for the home of man (Garcia, 2007).

Semper's achievement was to dismantle the Vitruvian Hut as the indivisible nucleus of architecture. Instead, Semper introduced the origins of architecture not as a single archetype, but instead as a composite structure comprising various architectural elements that had developed through time.

SEMPER AND MĀORI FABRICS

Evidence from early Maori architecture supports Semper's argument surrounding impacts of textiles on early civilisations architecture. Within Maori architecture the architectural elements and features that possess Semperian qualities are the wall, the roof and the plan.

Analysis concerned with Māori architecture must always focus upon buildings of the Tangata Whenua (people of the land.) Using all resources available to them the Maori developed an architecture that used textiles and textile construction in order to survive in the new unique climate of Aotearoa.

The description reveals that the major textile techniques of the weave, and the knot, mentioned in Semper's writing are implemented as joining techniques of structural elements in traditional Māori architecture. These techniques are that of a complete juxtaposition to construction methods employed by European civilisations in that time period. By the 1770s, many major architectural movements such as the Gothic, Renaissance and the Baroque had already run their course. Illustrating the unbelievable architectural development gap between that of European and Māori civilisation.

At a point in Gottfried Semper's *Der Stil* there is a direct reference to the cultures of the "south sea " (Polynesia and New Zealand). Semper explains the global development of *Bekleidung*, beginning by identifying the primitive cultures of the south sea. Semper believes that the south sea is where the woven wall appeared in its original state. Though Semper's writing, the argument is presented that the original enclosure was not the solid wall, but the primitive fence, woven of branches and grass.

The fence was an important architectural element of early Maori fortified Pa sites. Woven fences were relied upon to define enclosure and space of the village as well as provide critical protection from tribal attacks.

Semper refers to the wall in a second way when explaining how original textile walls were "ax's expressed both practically and symbolically in the motifs off the textile arts." Māori Tukutuku weaving accurately express this notion due to the nature in which they were constructed. Tukutuku patterns are wall panels constructed through two weavers interworking fibres between weft elements. The result is a wall panel that forms an integral structural support and protection

Figure 15, Lakeview Images. (1830).
Maori pa at Kaiapoi

IMAGE REDACTED

from the climate however also acts as a decorative interior wall panel imbued with cultural and mythological motifs.

The roof was of paramount importance to the Māori due to the previously mentioned issues relating to the climate of New Zealand. A structurally robust roof that provided essential warmth was developed incredibly quickly out of a necessity to survive. The roof was constructed as thatched structures that were lower in height as a method to retain heat inside the structure. Fabric construction techniques such as thatching, and stitched tututuku (lattice) walls were combined in order to create warm and dry architecture (Brown, 2009).

It is not hard to see the difference between Māori and European architecture however, through Semper's theory some interesting similarities can be argued between the typical early Roman House and the Māori Marae. Semper states, "This building type (Roman house) was in its earliest form characterised by a rectangular plan, and an open, colonnaded atrium." Semper's statement reflects the similarities between the marae and early Roman in house in that they both implement; a rectangular floorplan, and a colonnaded atrium in the form of a porch and monumental columns supporting the roof. The early Roman house just as the Māori marae also had strong notions and symbolic representation of family deriving the formal structures of layout and construction.

It would seem as if Semper's work from the surface contained no relevance to this topic. However, when diving deeper into Der Still and Sempers theories surrounding textile art deriving the conception of architecture it is clear that Māori culture was not only participating but is seen as a driving force of textile art being implemented into architectural structures.

KERIKERI SETTLEMENT, WITH A STAGE ERECTED FOR A FEAST.

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ARCHITECTURAL TYPOLOGY

WHATA KOPIHA KAI / HAKARI STAGE

While their architectural discourse is dominated by the marae or meeting house, there is another architectural typology used by Māori that is not often mentioned called whata kopiha kai, or hākari stage. The term hākari refers to a feast that was common during the pre-European contact era and late as the signing of the Treaty of Waitangi. Hākari stages were often ceremonial and commonly involved multiple tribes. The architectural typologies developed for such events were enormous, stacked structures composed of platforms one above the other. (Best, 1916)

The whata kopiha kai structures are believed to have been created in two very different formal compositions. The first structure was described as being pyramidal and was built by setting up a tree trunk in a vertical position and then placing robust structural supports in place to hold the central 'column' up. (Best, 1916) An illustration from William Yates in his 1835 Account of New Zealand depicts a structure constructed with fifteen platforms under which men could walk, which would result in a proportional height of around 40 m. Yates describes the construction thus: 'A large number of strong poles are erected, and stages are made at a distance from each other of about two-three meters, till they reached the top. Sometimes these piles are from 24-30m high and from 6-10m at the base, gradually rising to a point. The whole is decorated and, when in an elevated situation, presents a very imposing appearance.' (Yates, 1835, as cited by Best, 1916)

William Colenso's 1881 account in 'Transactions of the New Zealand Institute' contains a similar description. According to Colenso, the structure is 'generally in the form of a pyramid, from 80ft - 90ft high, and 20ft - 30ft at the base.' (Colenso, 1881) He describes the process of preparation and construction of the architecture: 'Firstly, the straight tree trunk of a large tree is obtained from the forest and dragged out with no small difficulty to the spot fixed for the feast. There, it was disbarred or dubbed down and set up. Other strong poles were then set up around it. A series of horizontal stages were then made all round the scaffolding at from 7ft to 9ft, and the hole was filled in and built up, presenting when finished one solid mass.' (Colenso, 1881) Colenso also points out that, due to limitations of technology and efficiency, 'the feasts always took a long time, often more than a year' to organise and construct. (Colenso, 1881, as cited by Best, 1916)

Figure 18, Williams, S. (1845).
A stage erected for a New Zealand feast

Another form of whata kopiha kai was horizontal rather than vertically elevated as seen in Dr Sinclair Thomson's depiction of a great feast held in the Bay of Islands in 1894 to celebrate a peace-making agreement between Māori and Pākehā. (Best, 1916) The structure depicted consists of two rows of structural columns inclined inward to meet each other at the top. The structure proportionately shows seven platforms that are roughly 45m long and around 2m apart (Thomson, 1859 , as cited by Best, 1916). The form could be compared to a modern-day, scaffold-like structure.

The sheer scale of the described hākari stages is one striking aspect of the typology. Dr Sinclair Thomson states that 'twelve months before the festival, food was planted and preparations were made' – preparations that included the gathering of materials and construction of the planned hākari stage. Thomson continues to describe the structure to "have an elevation of 50ft or ranges of 6ft, extending from half a mile to two miles long" (Thomson, 1859, as cited by Best, 1916).

Elsdon Best disputes Thomson's account in his 1916 book Māori Storehouses and Kindred Structures. Best maintains that the scale on which Thomson describes the structure to have been built, in particular, the length of half a mile to two miles, 'is of course, absurd and cannot possibly be accepted.' (Best, 1916)

In my opinion, after conducting research investigating the hākari stage typology, I would agree with Elsdon Best that Thomson's account must be exaggerated. However, this thesis will capitalise on the debate of scale to create a speculative architectural typology that will create a framework and design parameters within which to operate.

The Māori conception of time plays a recurring protagonist's role in the hākari stage typology. In Yates's account of the hākari stage it is stated that 'when the ceremony is over the people carry away their potions and the building upon which it is was all piled is left to go to ruin, as Māori never use the same spot or the same wood for a second hākari.' (Yates, 1835) The ephemeral quality of the typology is another indication of a link between architecture and time or mortality.

I believe that the whata kopiha kai or hākari stage typology provides an intriguing speculative framework for this thesis to operate within. Using the various descriptions and illustrations, a design process and design parameters can be established to adhere to throughout the design phase of this thesis.

'The stages varied in shape and size from lines of stacked food, long low structures, and tall, conical or pyramidal multi-level platforms... It appears that the hākari feasting stages were only used once, for a particular event or occasion. After this time they were either left to decay, or cut down for firewood. The site of the stage would not be used for a hākari event again.' (Brown, 2009)

Figure 19, Clarke, C. (1849).
Hakari Stage in Bay of Islands

Author Clarke del. Septem 1849.

The stage erected to contain the food at the feast given by the Native Chiefs Bay of Islands September 1849

MĀORI DESIGN LANGUAGE

Māori design integrity is a contentious topic yet it is imperative to discuss it when interacting with Māori culture. There have been countless examples in modern times, with the globalisation of events and marketing, that Māori traditional arts have been misused and appropriated by artists and businesses with New Zealand and worldwide. (Gardner, 2008).

Iconography and tokenism are issues that Māori people have always struggled with. It is essential that this thesis avoids such issues and respectfully references Māori design language.

Johnson Witehira published an important paper that deals with issues of tokenism and iconographic treatment of Māori culture. Witehira sought to establish guidelines that will help a designer maintain the integrity and intent of Māori ideas and design sensibilities whilst avoiding the use of literal Māori iconography in a variety of design contexts. (Witehira, 2013)

There are some severe disjunctions between the Western idea of 'design' and Māori art forms. There are no words or notions in the Māori language that resemble 'art' or 'design'. Although both Julie Paama-Pengelly and Johnson Witehira use Western concepts to analyse and derive a Māori design language, it must be remembered that a foreign set of conventions are being used to make sense of non-Western visual culture. (Paama-Pengelly, 2010)

According to Professor Robert Jahnke, contemporary Māori design's lack of whakapapa (genealogical connection) to mātauranga Māori (traditional Māori knowledge,) due to the polarisation of Western design ideas, has seen it somewhat disregarded within Māoridom. (Witehira, 2013) The inexorable symbiosis between Western design and commerce acts as a further divide between modern Māori design and traditional Māori art forms. (Witehira, 2013)

In order to reconcile the divide between Māori design and customary Māori art forms, Witehira employs the whakataukī (proverb) *kia whakatōmuri te hare ki mua*, which can be translated as 'to walk into the future our eyes must be fixed on the past'. (Witehira, 2013) The retrospective lens that informs the design guidelines aims to underline the importance of looking at customary Māori arts as an exemplar for the development of contemporary Māori design.

Witehira completed a rigorous comparative analysis of Māori

Figure 20, Unidentified Photographer. (1940).
Pine Taiapa and Maori wood carvings

carving that demonstrated a number of consistent design principles employed within customary Māori arts between the late 18th to mid-19th centuries (Witehira, 2013). Just like European design principles, Māori principles of design are used to help organise visual information. However, Witehira's comparative analysis itself demonstrated that Māori design principles could slightly differ from tribe to tribe, and these intertribal differences raised issues with Witehira's paper as, for the most part, it dealt in generalisations about Māori design characteristics.

I believe that for this thesis, a generalisation of Māori culture is an appropriate starting point so that the scope of experimentation and research is as broad as can be.

The notion that these identified design principles express critical cultural values is of principal significance, as most of the principles are relatively common design concepts that could describe the design aesthetic of many indigenous populations. However, it is the expression of important cultural values that make these principles inherently Māori. This distinction is the very essence of what Johnson Witehira aims to learn when he asks: 'how can the visual language and tikanga of customary Māori carving be used to inform contemporary Māori design practice?' (Witehira, 2013)

The seven principles of Māori design consist of: tātai rahinga (arrangement by scale,) tātai mokowā (spatial interconnectedness,) tātai hangarite (arrange symmetrically,) tātai manawa (heart pulse,) tātai hikuwaru (disrupted symmetry,) tātai whakapapa (tiki arrangement) and mana wahine (female elements). (Witehira, 2013) For this thesis, only four of the principles are references as tātai hikuwaru, tātai whakapapa, and mana wahine are principles that do not correlate to Māori fabrics and are not areas of interest for this thesis.

PRINCIPLE OF TĀTAI RAHINGA (arrangement by scale.)

The principle of tātai rahinga is very prevalent throughout traditional Māori art. Artists used scale to express hierarchy throughout the work in order to highlight significant elements of the composition. Deliberate use of the exaggerated can facilitate faster and more accurate readings of content within the composition by ensuring that essential elements are emphasized. (Witehira, 2013)

PRINCIPLE OF TĀTAI MOKOWĀ (spatial interconnectedness)

The principle of tātai mokowā is where an artist implements overlapping to 'express unity between the different design elements and levels of relief'. (Witehira, 2013) This principle is commonly referred to in carving discourse; however, the principle can translate into fabrics easily. The principle alludes to connecting discrete elements through overlapping to reflect the material and spiritual realms' inseparability. The connection between elements also enables a sense of continuity between elements that is vital in fabric creation.

PRINCIPLE OF TĀTAI HANGARITE (arrange symmetrically)

Māori art forms placed significant emphasis on the use of symmetrical arrangements. Bi-lateral symmetry was very evident not only in fabrics, but also in waka, pātaka and whare whakairo. Symmetrical arrangements ensure a balanced composition.

PRINCIPLE OF TĀTAI MANAWA (HEART PULSE)

Tātai manawa is the design principle where the artist will establish an implied pathway that guides the viewer through the entire composition. This principle is very prevalent when talking about carving but is very relevant – if not more so – when translating to fabrics. When describing tātai manawa through a fabrics lens, the viewer can be guided through the composition with the elements forming a clear pathway.

A second critical reference when establishing a Māori design language framework is Julie Paama-Pengelly's book Māori Art and Design. Throughout the book, numerous art forms are analysed, such as weaving, carving, and architecture. The result is a set of key design conventions that correlate with all of the customary Māori art disciplines.

All of Paama-Pengelly's art terms are derived from Western conventions which, as stated earlier, do not constitute the only method to understand Māori art. However, the terms do allow for a general understanding of the formal structures and composition of Māori art in modern, Western-dominated society. It is worth noting that many if not all of these design conventions were being used in Māori culture during the pre-contact era. So while these are Western concepts and understanding, Māori people were forging their own style using conventions we now associate with Western notions. (Paama-Pengelly, 2010)

The conventions identified by Julie Paama-Pengelly will prove helpful tools to increase complexity with the digital weaving techniques selected in the design process. Conventions such as translational and bi-lateral symmetry, slide rotation and slide reflection can be implemented in digital modelling software to create more complex geometries. (Paama-Pengelly, 2010) The list also highlights curvilinear patterns as a dominant style used in Māori art. This convention can be translated into flowing strands interworked to create a whole.

Both of these references present a robust, research-based framework with which to reference conventions of Māori art forms to inspire the final design outcomes. The main objective of implementing these various conventions is to avoid cultural appropriation and the literal use of Māori iconography seen today around New Zealand and overseas. However, it is imperative to acknowledge that these conventions identified by both Johnson Witehira and Julie Paama-Pengelly must act in parallel to the representation and communication of Māori cultural values, if this thesis is to be fully immersed in Māoridom.

KEY DESIGN CONVENTIONS		
	Definition	Application to Māori Art
Symmetry	Two halves as mirror images of each other.	Apparent symmetry in Māori art is broken by asymmetrical elements.
Bilateral Symmetry	Corresponding in size, form, and arrangement of parts on both sides of an axis of symmetry.	Common in whakairo, tā moko and kōwhaiwhai.
Translation Symmetry	An object that looks the same after a shift along a longitudinal or latitudinal axis.	Applied to the translation of kōwhaiwhai designs.
Slide Reflection	A unit of design is reflected after a shift along a longitudinal or latitudinal axis.	Transformation of kōwhaiwhai units.
Slide Rotation	A unit of design is rotated after a shift along a longitudinal or latitudinal axis.	A transformation process of kōwhaiwhai units.
Perspective	Appearance of objects allowing for the effect of distance from the observer.	Spatial device used in whakairo after European contact.
Aspective	Strict frontal or profile presentation or a combination of the two.	Convention used in whakairo to create a conceptual view of anatomy.
Simultaneity	Where profile and frontal aspects feature together on the same figure, i.e. occurring simultaneously.	Device used in whakairo to show multiple viewpoints.
Cyclical patterns	All main structures of pattern are moving in a circular (clockwise) direction. ('Anti-cyclical' refers to the situation where substructure patterns oppose the cyclic rhythm of the main pattern structure).	Describes natural kōwhaiwhai and tā moko design units.
Curvilinear patterns	Curved or having curved parts as opposed to straight lines. (Rectilinear or 'geometric' shapes consist of or are bounded by straight lines).	Used to describe the dominant style of carving or composition in carving.
Figurative Representational	Form that references the real or man-made world. Non-figurative is essentially the opposite of figurative. However non-figurative patterns in Māori art can reference ideas or concepts that allude to form in the real world.	Figurative and non-figurative forms have their expression in the arts of the Māori.

KEY DESIGN CONVENTIONS		
	Definition	Application to Māori Art
Representation	Signs that are used as a substitute for something else. That is, the sign can resemble in a mimetic sense or allude to in the symbolic sense.	Māori art is representational both in the mimetic and symbolic sense.
Realistic, Naturalistic	Lifelike representation of people and the World.	Rare in Māori art but part of figurative painting traditions.
Symbolism, Iconography	To represent something abstract with something concrete.	Māori art uses predominantly symbolic language.
Mnemonic	A visual aid which allows the viewer to read the image.	Carving has a mnemonic function in recalling ancestral devices.
Perpendicular	Upright or at right angles.	Used in the geometric weaving and plaiting arts.
Split Representation	Split at the mid-line between two sides, or bilaterally. Represented by overlapping parts.	Presentation of split views of two face halves.

Figure 21, Paama-Pengelly. (2010).
Table of Key Māori Design Conventions

CHAPTER REVIEW
MĀORI ARCHITECTURE AND DESIGN

The hākari stage typology provides a compelling architectural reference that is not a marae. It was vital for me to focus upon an area of Māori architectural history positioned outside of the commonly discussed and meticulously defined meetinghouse typology. I believe that when pursuing a speculative architectural design outcome, the marae typology provides a constrictive framework that is hard to manipulate.

The descriptions and illustrations from Yates, Best, Colenso and Thomson all provide valuable insight into the quantitative details of the hākāri stage. However, the debate regarding the described scale and form of the hākari stage provides enough speculation for my own interpretation of the typology to be articulated throughout the design phase.

As a Pākehā with a lack of experience engaging with Māori design research of Māori design language needed to be undertaken when trying to answer the cultural research question, how might modern digital tools and fabrication techniques reflect traditional Māori notions of time and space?

Too often, we see surface-level Māori iconography and cultural motifs incorporated into designs as an easy way to signify that something is ‘Māori’. Both Johnson Witehira and Julie Paama-Pengelly provide a strict set of design conventions that have been identified through the analysis of traditional Māori art and design. The two sets of design conventions will play a critical role throughout the design phase to ensure that my design outcomes can avoid issues of cultural appropriation and the blatant use of iconography.

DEVELOPMENT OF THE FASHION SHOW TYPOLOGY

The fashion show originated in the same period as the rise of Haute Couture movement in mid-19th century Europe. Haute couture produced multiple designs that could be altered or remade by dressmakers (ateliers) for individual clients. The Haute Couture movement raised the role of the tailor to fashion designer, in effect transforming a tradesperson into a creative artist. Previously designers were seen as dressmakers who would create fashion from the wishes of their clients.

Charles Frederick Worth, a London-born Parisian designer, often hailed as the founder of Haute Couture, pioneered showing his collections on models to display the garments in motion and a real-life context. Worth would send his wife, Marie Vernet, to walk around in the dresses in front of potential clients. Marie Vernet has thus been deemed the first model in history. (Quick, 1997) At the beginning of a season, Worth would invite clients to his Parisian studio to view his creations in the form of a fashion show known as a 'salon show.' Models would parade in designs in an informal atmosphere in front of clients seated on the studio's periphery. (Skov et al. 2009)

The salon shows provided a revolutionary shift between the relationship of the designer and the client. The relationship was no longer one of the designer going to the client; now, the client would go to the designer. The client could choose a model from a portfolio to present the clothing.

During the fashion show's origins, the catwalk consisted of an elementary architectural intervention of models parading in front of the customer. There were no frills where designers would change the spatial qualities of the room. The shows were simplistic and bland, without the accompaniment of scenography or music. The focus of the show was entirely on the clothing. (Margaria, 2018)

The fashion show system that we see today is thought to have been established in the first decade of the 20th century by a British designer, Lucile, Lady Duff Gordon, who organised presentations of her brand (also Lucile) in Europe and America. However, the fashion show was quickly taken up in America in a very different manner to the European shows.

In the early 20th century, American department stores abandoned the intimate atmosphere of European fashion shows and

IMAGE REDACTED

Figure 22, Crane. R. (1953).
A Christian Dior catwalk show at the Krupp family's Villa Hügel

transformed it into a large-scale entertainment event. (Evans, 2001)

They pioneered the seasonal shows that we see today, where attendees would be treated to afternoon tea, piano, and an announcer who would describe each dress's details. The Haute Couture shows had reached new heights of selection, with designers showcasing up to 150 garments during a show that lasted upwards of two hours.

The fashion scene at this time was female-dominated. Women who were clients of fashion houses or buyers for department stores would attend private fittings in addition to the seasonal show. This resulted in the fashion show becoming engrained in the shopping experience of an upper-class woman of her day. (Skov et al. 2009)

During this time, the fashion show typology saw a rise in basic choreography, furniture, music, and lights. The inclusion of these elements in the fashion show led to the collections being understood as a series of meanings or stories. Lucile's sister Elinor Glyn would write stories for each collection that would be given to the audience. The fashion show thus became the communication tool for fashion houses to the consumer.

The designer's choice of venue and the spatial qualities that it possessed began to have an influence on the success of the show. Some architectural requirements began to emerge that would define what a fashion show was. A show required ample space that was could be somewhat altered. The room had to allow for a walk that was readily visible to the audience. If the scenography was adapted from collection to collection, architectural spatial treatment began to determine what was appropriate for the fashion show, thus creating a new architectural typology.

Another revolutionary point in time for the fashion show typology came in 1913, when Paul Poiret was the costume designer for Paris Theatre's production of *Le Minaret*. The costumes were so imaginative that they transformed a theatrical play into a fashion show. The costumes became the main protagonists within the dreamlike spectacle. Through an architect's eyes, this innovation in the typology asserted the affirmation of the scenographic space as a container for the story of the collection. (Margaria, 2018)

Le Minaret was an example of the designer's collection or the costume becoming the story, using atmospheres and places that inspired them throughout the design process. The implementation of scenography was able to provoke the audience's imagination so that

they wanted to be part of the narrated story – the birth of the fashion show as a vehicle for creating desire in the viewer by presenting them with an idealised image or vision of themselves.

Poiret's *Le Minaret* spectacle was so successful that it became a real fashion show at the Wanamaker department store in New York. Poiret had sent photos to *Le Minaret*'s organisers, and the show was based upon the scenography of a Parisian garden. It was clear that from this point in time, the fashion show was going to be inextricably linked to architectural scenography.

Previously, fashion shows were held in highly rigid spatial conditions. Poiret subverted the catwalk's rigidity and introduced the idea of the show representing the concepts of the collection, taking a step closer towards the combination of fashion, visual arts, architecture, and music that is so evident in contemporary culture. (Skov et al. 2009)

The twenties and thirties saw the strengthening of the fashion show set as an architectural typology. Fashion houses and department stores were opting to include a room dedicated to fashion shows inside their stores. The fundamental spatial characteristics of the space were broadly similar between all houses or stores. The room was always longer than it was wide, which saw a raised walkway or footbridge located in the room's centre that acted as the runway. The audience was always situated around the footbridge and arranged for optimised viewing.

In 1937 the Parisian department store *Le Bon Marché* built a fashion show space in their store that was 50 metres long and 12 metres wide, designed by architects Boileau and Carrière. The space was realised so that the store could hold fashion shows whenever they needed to without the rigmarole of finding a new space for every show. (Margaria, 2018)

The launch of what would become New York Fashion Week came in 1943, under the name of 'Press Week.' Fashion publicist Eleanor Lambert set up shows at the Pierre Hotel and the Plaza. Until then, US fashion had been dominated by European designers. With the American press unable to travel to Europe during the Second World War, an opportunity arose to promote homegrown talent, including minimalist pioneer Norman Norell. This was the dawn of the localised fashion weeks which we see today. Milan Fashion Week was launched in 1958, Paris in 1973 and London in 1983.

IMAGE REDACTED

After the atrocities and hardships of the Second World Wars, Paris shows followed the Americans in abandoning the salon show's intimate nature and opened the shows to buyers instead of holding closed-door, client-only shows. (Skov et al. 2009) This saw a shift in the relationship between brand and client. Due to the scale and economic reliance on department stores to buy their designs, brands had little or no choice but to diminish the relationship of exclusive clients and focus on more considerable consumer opportunities through department stores' mass consumption.

Until this point, the press was not highly favoured by the fashion industry, which tended to regard reporters as spies for rival brands. Cameras were not allowed in any shows; instead, designers would hire registered illustrators who would draw garments' silhouettes. These illustrators, however, were under contract to release the illustrations only after the commercial launch of the collection.

The 12th of February 1947 saw Christian Dior reinvent the fashion show by inviting the press and allowing cameras to attend his collection dubbed 'New Look.' The collection was an instant hit with the editor-in-chief of Harper's Baazar, Carmel Snow, who hailed Dior's show as a revolution and his clothing as providing a much-needed 'new look' in a world recovering from war. (Skov et al. 2009) The majority of other brands and designers followed in Dior's steps and allowed cameras into their shows. The involvement of cameras and press into the fashion show is the evolution towards the prodigious marketing events that we see every modern designer present.

Architecturally, the period after the war saw little to no innovation in the fashion show typology. The time was one of great adaption, mainly from Europe, increasing the event's scale to match those in America. The fashion houses were primarily focused on adapting the collection to be consumed instead of innovating new communication methods.

By the 1960s, the fashion show audience was primarily press and buyers. Careful and large numbers of garments gave way to a fast-paced show with a centralised design concept. These changes were influenced by the rise of prêt-à-porter (ready-to-wear) fashion as distinct from Haute Couture. Ready-to-wear fashion collections expelled the bespoke culture of Haute Couture with the need for alterations or ateliers replaced with mass production and immediate sales to stores.

The innovation of technology also played a part in these changes, with the chance to now air shows on television. The shows

had to become smaller and faster to keep a captive audience and eliminate the costs of a two-to-three-hour television broadcast. In 1991, a fashion show was chosen as the first transatlantic satellite transmission from Paris to America. (Skov et al. 2009)

Since the press and media's ever-growing presence at fashion shows, consumers have somewhat become marginalised as fashion show audiences. The rows of seating are filled with social élite – royals and celebrities, buyers and media – with little to no room for the general public or fashion enthusiasts. Rather than the formalised relations between client and designer based on biannual sales established by such pioneering designers such as Charles Worth, fashion labels have now shifted to informalised relationships between company networks based on ever-developing collections.

Apart from the most highly prestigious brands, such as Louis Vuitton and Gucci, brands have increased the number of garments in each collection. The fashion show only displays a small range of the most anticipated designs. Business insiders are already familiar with the collection through studio visits and communication with creative directors and designers in the design phase and the lead-up to the show or release. The fashion industry now views the fashion show typology less about sales to end-customers and more about social perception, anticipation, and ritual.

The fashion press still only report on fashion shows in their biannual editions, being fall/winter in September and Summer/spring in February. With the rise of technology and social media, fashion shows have never had so much attention and reach with which to communicate to consumers. In 1986, 1875 journalists and 150 photographers attended the Paris fashion shows, nearly a four-fold increase in the figures recorded for 1976. (Quick, 1997)

With social media platforms such as YouTube for streaming and Instagram for images, there is mind-blowing potential for audience numbers. An example of this would be the Off-White S/S 2020 fashion show, which received 4.5 million views on YouTube, not to mention the inclusion of models such as Gigi Hadid, who has over 50 million followers on Instagram.

A highly accomplished and highly regarded fashion show designer, Alexandre de Betak, believes that since the early 1990s, the way that a fashion show is developed has wholly changed. With the rise of social media and globalisation, the idea of location has been completely destabilised.

Brands now often have a mandate in order to look the same anywhere in the world. Whether the show is in Paris, London, or New York, the streaming and broadcasting opportunities do not matter to most of the audience as the location is only on a screen in front of them. (Betak & Singer, 2017) This has resulted in a de-stabilisation of the effect that fashion weeks and shows have, with some brands presenting shows where they want, when they want.

In the postmodern, social media-dominated landscapes where brands survive or die on the strength and conviction of the hyper-realities that they create, runway shows have been transformed from industry-exclusive events into prodigious global marketing events. Brands will only continue to innovate and push the envelope of what is perceived to be possible to remain relevant and create spectacles that invoke a desire to purchase their garments. What were once small-scale meetings with clients to discuss alterations to dresses are now large-scale cultural experiments, involving fashion, architecture, technology, music, art, and theatre that explore historical references and symbolism, and endlessly innovate global culture. Each show aims to build a self-contained world around each collection, accomplished by carefully designing and organising every detail to create a spectacle to reverberate through all technological platforms flashing across screens and creating desire in anyone who watches. (End Clothing & Benstead, 2019)

FASHION SPACES VÉSMÁ KONTERE MCQUILLAN

In the last 50 years, the fashion show typology has seen an incredible surge of relevance and popularity. Fashion and architecture have long been seen as discordant disciplines. Pestellini Laparelli, the former lead AMO architect for Prada, stated in an interview: ‘in the architectural world, the fashion shows are disregarded.’ (McQuillan, 2020) However, this common thought among architects has now changed due to the meteoric rise in fashion shows’ global popularity. The invention and seamless integration of technology such as high-power phones and social media fashion shows have transitioned from an architectural experience by a few to a multi-disciplinary, transcendental environment for abstract expressions both of fashion and of architecture. The typology’s meteoric rise has resulted in an influx of academic research into fashion spaces as a purely architectural expression. Due to the incredible speed at which social media has evolved fashion and architecture in their own right, much of the research has already become somewhat outdated. However, in 2020 Vésma Kontere McQuillan released an updated fashion space architectural publication that analyses research dating from before the rise of social media and uses aspects of each to present a modern analysis of fashion spaces that takes into account modern influences.

German scholar Alicia Kühl has been a pioneer in fashion spaces. Kühl’s work was focused on developing three factors of fashion spaces: ‘place’ (ort), ‘location’ (raum) and ‘metaraum’, which is translated as ‘imaginary space.’ (Kühl, 2014, as cited by, McQuillan, 2020) Kühl summarises her research by stating: ‘by the place of a fashion show I am referring to the geographical place where it is held, but one that, based on the “coloration” it is given in the fashion business also has social, political and economic connotations... The term location is used while referring to a concrete point within a place at or in which the fashion show is staged. The imaginary space is the space the designer creates in his/her imagination.’ (Kühl, 2014, as cited by, McQuillan, 2020). The work was ground-breaking. It finally began to analyse the intersection of architecture and fashion and how the two could complement each other to create incredible works both of fashion and of architecture.

Kühl’s research limitation is that much of it is extremely hard to access as it is written in German. There are methods to translate

the work; however, much of the finer detail and meaning can be lost through translation when talking about complex academic research. Another issue with Kühl’s research is that it was produced in 2014, when revolutionary technology such as smartphones, ultra-fast mobile internet and social media were still in their infancy. With all of these inventions being influential in fashion shows, Kühl’s research became obsolete very fast. Vésma McQuillan utilises Kühl’s research as a basis for her book Fashion Spaces. However, McQuillan has seamlessly integrated the recent technological influences to derive a new, more contemporary theory.

Vésma McQuillan has taken into account three significant technological developments that have redefined the modern fashion space. The first technological development was the creation of Web 2.0, which saw the boom of the social media platforms that have provided new opportunities for accessing, sharing, and producing content. Secondly, the seamless integration of high-powered smartphones into daily life has made it possible to access and digest content anywhere, at any time. Lastly, the development of infrastructure to support and allow for the previous two technological advancements has been critical in redefining fashion spaces. Infrastructure such as high-speed fibre internet and cloud computing has been pivotal in enabling the integration of heavy data use content such as high-definition images and videos to become an integral part of our daily information flow. As a result of these significant technological impacts on fashion spaces, the theory is now defined through four key concepts: location, place, site, and metaspace. (McQuillan, 2020)

LOCATION

Location is defined as a precise position globally, often derived from GPS (Global Positioning System) or grid references on a map. Mobile devices and social media have helped to change how we perceive and interact with location through the ability to geo-tag posts on platforms such as Instagram and Facebook. The power of geo-tagging transforms the location from a purely physical location to a hybrid of physical and digital location to search libraries of information to find data on locations such as the user’s engagement with the location. Thus, the term location when talking about ‘fashion spaces’ is defined as the coordinates of a real-world, geographic position.

(McQuillan, 2020)

PLACE

The term 'place' is a direct juxtaposition to the concrete notion of location. 'Place' is defined as 'the abstract idea that exists around a location.' (McQuillan, 2021) According to Elizabeth Parsons, Pauline Maclaran and Andreas Chatzidakis, there are four important concepts that characterise a place's identity:

1. The physical setting and its physical contents.
2. The social, political, and economic connotations that create the context of the physical setting.
3. The activities and events produced inside the place and the individual and collective meanings created through the intentions and experiences related to the place.

(Parsons et.al, 2018, as cited by, McQuillan, 2020)

For Fashion Spaces, the identity of a chosen location is crucial when conveying a solid message or narrative to the audience. For example, a high-class, luxury brand such as Chanel will always choose to locate their fashion spaces in areas that will showcase their brand's luxury narrative. This was a central focus when Karl Lagerfeld chose the Grand Palais in Paris to show their Haute Couture collections since 2001. Fashion Spaces defines place as an abstracted idea that provides context and identity for creating a site.

SITE

In John Potvin's 2009 essay 'Inserting Fashion into Space', the nature of fashion sites is defined as 'sites that can be marked out of places and spaces which define and are transformed through, by and because of the subjects and objects of fashion.' (Potvin, 2009, as cited by, McQuillan, 2020) Understanding the concept of a site and the notion of an abstract site is imperative to ascertain its potential as a fashion site. Tom Porter states that 'a site appraisal is often the first tangible information produced at the onset of the design process. It not only represents a moment of analysis of the context for a building proposal but also provides a significant stimulus for initial thoughts on the development of an architectural form.' (Porter, 2004, as cited by, McQuillan, 2020)

A fashion show's site is often determined by three main factors. The first is that the venue is offered to the brand/designer. The offering

IMAGE REDACTED

will most likely come from the organisers of Fashion Week but could also be offered through partnerships or investors. This option is typically chosen by smaller, less established brands as the venues will typically have a base set/space already designed and set up for the show. Whilst being great for finances, the space's standardisation can often negatively impact the narrative or aesthetic of the show as the space usually is very minimal to fit in with all brands that are showing there.

The second factor is to choose your own site instead and reuse it each year. Large and well-established fashion houses often employ this strategy as a way to show stability. An example of a brand utilising this strategy is Prada. Prada has held their menswear and women's wear shows in the Prada Fondazione in Milan since 2000. This strategy has been highly successful through their collaboration with OMA/AMO who uses complex and intelligent architectural design to transform the same space for every show into completely unrecognisable spaces from show to show.

The last factor is choosing a potential site according to the designers' vision for that particular season, which will strengthen and reinforce the designers' narrative to the audience. A recent example of a brand using this strategy has been Vetements, a post-Soviet inspired clothing brand that was established in 2014. Vetements continuously choose sites such as a Chinese restaurant, a church that have no connection to commercial fashion in order to connect with countercultures and evolve their potential collection narrative through the development of site. (McQuillan, 2020)

A very accurate summary of the notion of 'site' when talking about fashion spaces can be found in the architectural journal OASE: 'In architecture the site is "merely" the context for the object to be designed... the transformation of the site is the subject of design itself.' (OASE, 2019, as cited by, McQuillan, 2020) Thus, the site is both the context for the object to be designed and the object's design to augment to become a fashion space.

METASPACE

The last of the four significant 'fashion space' concepts is what has been referred to by Vésma McQuillan as the metaspaces. The concept was first thought of by Alica Kühl, who defines it in opposition to her

concepts of place and location by stating: 'the Metaspaces cannot be localised, as it is abstract. It is a not-yet-realised, imagined space, the initial place, or an idea of a place.

The "metaspaces" becomes a place in the process of spatialisation during the performance of a fashion show, but disappears after 15 minutes when the show is over.' (Kühl, 2014, as cited by, McQuillan, 2020). According to Kühl, the metaspaces only exists in a reduced form in the audience's memory after the completion of a show. Whilst this analysis of the metaspaces was highly relevant in 2014 when the paper was published, the rise of social media platforms has fundamentally altered the 'metaspaces' and has made Kühl's conclusion seem rather dated.

Vésma McQuillan has redefined the idea of the metaspaces to take into account the impact that social media has had. In the age of Instagram, both the significance and longevity of the metaspaces have exponentially increased. Fashion is now mediated and communicated almost entirely through private, semi-private, and commercial social media platforms. As a result, a fashion house inhabits a permanent metaspaces, where its presence online can reach millions of people and sell the narrative of its brand and increase its products' desirability. (McQuillan, 2020) The modern fashion metaspaces can be thought of as 'A visual representation, read like a text and decoded in cinema-like images. Imbricated with fantasy and desire, as well as suffused with memories and nostalgia of other places, fashion space is always heavily romanticised and imbued with fiction, fetishism and ideals.' (Quinn, 2003, as cited by, McQuillan, 2020)

For a long time, fashion space has been under-appreciated by architects and architectural discourse. However, in modern times we have seen a transition from temporary metaspaces that were experienced only by a certain select few, into an experimental architectural typology in which architecture and fashion are fused to create abstract alternate worlds that transport millions of people around the globe into the world of that particular brand.

IMAGE REDACTED

Figure 25, Peccoz, M. (2012).
Prada Men AW-12-13

IMAGE REDACTED

Figure 25, Osio, A. (2011).
Prada Men SS-11-12

TIME AND FASHION SPACES

Fashion is a highly dynamic and time-based industry. To stay relevant, a brand is forced to adapt to rapid political, social, and economic changes. For this reason, it can often be challenging for architecture to keep up with the dynamic nature of fashion. Architecture is a prolonged art form due to the vast amounts of time required to design and build an architectural intervention. In the early 2000s, brands such as Calvin Klein opted for a strategy in which all of their fashion spaces would deliver the same or similar message. However, the outcome of this strategy was the emergence of temporary or permanent obsolescence, as the trend or message conveyed in all of their fashion spaces would become 'out of style'. (McQuillan, 2020)

Time is the critical aspect that differentiates the contemporary fashion space from any other spatial and architectural typologies. In some instances, the fashion spaces are experienced for a minimal period, often only for the length of a fashion show, a photoshoot duration, or a retail space's lifecycle. In other instances, fashion spaces can remain relevant for a long time in the form of an expression of the zeitgeist (spirit of the times). (McQuillan, 2020) However, this relevance is often retrospective. In modern times, fashion spaces are becoming the central factor in determining a fashion brand's relevance with the ever-increasing globalisation of the fashion marketplace.

Adapting a brand's message to an individual media platform is now a vital aspect of creating fashion spaces. Unlike the singular message strategy employed by brands such as Calvin Klein in the early 2000s, a brand does not need its messaging, storytelling, and aesthetic to be amalgamated into one. Brands can now experiment with different strategies and aesthetics to communicate with as large an audience as possible. (McQuillan, 2020) For example, a brand's Instagram does not need to communicate the same aesthetic as their fashion shows or retail spaces. Vésma McQuillan has linked the increased autonomy and sustainability of multiple different forms of fashion spaces to contemporary fashion space's ongoing and flexible engagement with the brand's public imagination across diverse physical and virtual platforms.

CHAPTER REVIEW

The detailed research into the fashion show typologies history and architectural theories provided an insight into the remarkable architectural development that has occurred since the mid-19th century. However, the research also articulates how a deep interaction with time and space is present in both fashion shows and traditional Māori hākari stages. Therefore, elements of Vésma McQuillan's Fashion Space theory can be used to further the understanding of the hākari stage typology.

Location is one element of McQuillan's theory that share similarities with the hākari stage. In both typologies, location is of paramount importance. As McQuillan outlined, fashion brands will often choose a location for a fashion show and never show there again. In a description by William Yates, 'Māori never use the same spot or the same wood for a second hākari stage.' (Yates, 1835)

The second part of McQuillan's theory that provides an intriguing overlap with the hākari stage is the idea of 'metaspace'. As introduced by Alica Kühl the metaspace only exists in a reduced form in the audience's memory after the completion of a show. When reflecting on Māori cultures past focussed conception of time, the metaspace becomes of more significance when reflecting on the understanding of the hākari stage.

Whilst the two typologies may seem diametrically opposite, an interesting understanding of time and space can be applied to both of the typologies in an unexpected yet convincing manner.

IMAGE REDACTED

DESIGN PRECEDENT

IRIS VAN HERPEN

Iris van Herpen is a visionary Haute Couture designer who has created an interdisciplinary brand that has emerged from the connection between technological innovation, craftsmanship, biomimicry, and studies of the human body. The Iris van Herpen Maison, founded in 2007, shows collections biannually at Paris Haute Couture week. The brand is distinguished from fast fashion, instead opting for slow fashion with an approach towards collaborations with artists, scientists, and architects such as Daniel Widrig (van Herpen, n.d.).

Iris van Herpen has identified Haute Couture fashion as a 'transformative language' (van Herpen, n.d.). The symbiotic relationships found in naturally occurring phenomena, the forces that structure architectural patterns and the human body's form, are all clear influences on van Herpen's creative process.

Every collection has had a particular influence from natural elements, which perpetuates a deep sense of organic presence. The elements water, air, and earth are all very much referenced throughout the collections. In particular, water's unbounded fluidity is a facet present in many of van Herpen's collections. The Maison has turned time and time again to biomimic design techniques to visualise and materialise the hidden forces that shape our world.

The female body plays a lead role in all designs from van Herpen. Through incredible digital and physical craftsmanship, van Herpen can design garments that mimic and accentuate the human body's dynamic nature. A multiplicity of lines, notches, gaps, holes, and fissures purposefully curated throughout the garment can emphasise the female body's regions. Throughout fashion studies, garments are often claimed to be 'dead' without the inhabitation of the human body. Van Herpen's treatment of the body differs from most other fashion designers' due to the symbiotic relationship between the innovative techniques used throughout the garment and the wearer's body. In van Herpen's 2011 debut collection Capriole, a white, 3D-printed 'garment' was created in collaboration with computational architect Isaïe Bloch. The garment recreated a speculative and enhanced human skeleton with a particular focus on the vertebral system. The wearer's curved body shape is reflected in the silhouette whilst achieving a perfect balance using bi-lateral symmetry.

IMAGE REDACTED

Figure 27, Unidentified Photographer. (2018).
Capriole Ensemble

IMAGE REDACTED

Figure 28, Unidentified Photographer. (2018).
Capriole Ensemble on runway

Iris van Herpen's collaborations extend from manufacturers, artists, and sculptors; however, the collaborations with architects such as Daniel Widrig and Isaïe Bloch are of particular interest for this thesis. Iris van Herpen has stated that she is 'captivated by architecture and how we embody space and inhabit sculpture.' (Van Herpen, n.d.)

IMAGE REDACTED

DESIGN PRECEDENT NAGAMI DESIGN

Nagami Design is a design studio at the forefront of investigating product, furniture, and architectural design in a technological era. The studio creates in constant collaboration with architects: Manuel Jiménez (madMdesign,) Ross Lovegrove (Ross Lovegrove Studio,) Patrik Schumacher (Zaha Hadid Architects,) Daniel Widrig (Daniel Widrig Studio) and Héctor Serrano (Héctor Serrano Studio.) The result is a vast range of bespoke aesthetics, digital techniques, and products that each in their own right push digital design boundaries and large-scale 3-D printing fabrication. (Nagami Design, n.d.)

The 'Rise' chair has been selected for this thesis as the Nagami Design case study. The chair was designed in collaboration with Patrik Schumacher and Zaha Hadid Architects (ZHA) as part of ZHA's ongoing research into the domains of 3D printing and materials experimentation.

Through rigorous testing using innovative 3D software workflows, a form was derived based on natural growth processes evident in marine biology. Structural optimisation was also tested for the design to possess the necessary structural integrity to be constructed whilst pushing the boundaries of thickness and weight fluctuations.

The chair's material aesthetic was derived from an interest in how furniture relates to its context. (Zaha Hadid Architects, n.d.) The gradient moving from the blue base to the translucent top can inform a hierarchy throughout the design that signified a robust base with delicate top details.

Construction of the chair was conducted using a custom-built pellet-extruder fed raw plastic particles rather than standard filament plastic. The plastic is a natural polylactic-acid plastic made from cornstarch. The chair is entirely biodegradable and non-toxic. (Hitti, 2018)

IMAGE REDACTED

Figure 30, Unidentified Photographer. (2018).
Rise Chair

DESIGN PRECEDENT

OMA*AMO FOR AND WITH PRADA

The collaboration between OMA*AMO and Prada has bridged one of the most physical disciplines of art (architecture) with one of the most ephemeral (fashion) to produce incredible innovation in the worlds of architecture, fashion and global culture. The collaboration has also been central to the idea of 'fashion finding architecture' to communicate and enhance a brand. The relationship was formed in 1999 when Miuccia Prada enlisted 'starchitect' Rem Koolhaas and his international architectural practice OMA to set up a process of architectural experimentation to enhance Prada's brand.

Koolhaas established AMO in response to the Prada commission in 1999. AMO works in parallel with OMA's clients to implement architectural thinking and intelligence to new typologies that go beyond 'traditional architecture.' In the case of Prada: AMO has researched subjects such as brand identity, store technology, fashion shows, and content-production such as look books and films to help generate OMA's architectural designs for Prada. Markus Schaefer (Director of OMA) states that "Prada provided an opportunity to continue OMA's search for the new typologies with methods that go beyond traditional architecture." AMO offers Koolhaas the freedom to not be bound by the perception of 'traditional architectural methods' and instead enables OMA's work to be based on far more intellectually driven ideas (McQuillan, 2020).

OMA has over 20 years, transcended many typologies, and has constantly challenged what is thought to be 'traditional' architecture through collaboration with Prada. By using intellectual architectural thinking to derive contextual design outcomes. OMA*AMO has been able to constantly redefine culture and place Prada right in the centre of the 'new'. Ultimately OMA has achieved the aim set out by Miccuia Prada, to set up a process of architectural experimentation and, in doing so, has changed the dialogue between fashion and architecture forever.

IMAGE REDACTED

CONSTRUCTION PRECEDENT FIBERBOTS

In 2018, the Mediated Matter Group, part of the MIT Media Lab, completed research that resulted in a step towards autonomous, collaborative robotic fabrication. Fiberbots is a swarm-based robotic system for digital fabrication of fibre-based composites. The system comprises a group of robots that operate synchronously to build specific parts of an overall structure. Each robot is identical and operates as a filament winding system that implements fibreglass thread and a UV-curing resin to fabricate a continuous self-supporting composite tube. (Oxman, et al., 2018)

The research was a result of analysis into some of nature's builders that operate in a swarming fashion. Organisms such as ants, bees, and termites are dependent on communication strategies to coordinate their construction tasks. Colonies of these organisms can build robust, adaptable structures through precise communication and synergy. Material properties of spiders were also investigated to understand their ability to leverage hierarchal structures to control and optimise multiple material properties. Fiberbots can combine both of these investigations by using multi-robotic coordination systems with fibre-reinforced composite materials to reproduce robotically building techniques found in nature.

Fibre-reinforced composite (FRC) materials such as fibreglass and carbon fibre are commonly used in the aerospace and automotive industries due to their lightweight and high-performance capabilities. On the other hand, architecture has had a slow uptake in the material due to unclear regulations and cost; however, significant work is now being done with FRCs, including lightweight façade design. Fiberbots create fibre-reinforced composite materials through the use of filament winding, which is a process in which resin-saturated fibrous threads are wound around the outside of a mould (Oxman et al., 2018). The mould is designed to collapse upon completion and can be reused. The resulting form of filament winding is a tubular structure that can bend and branch as the design requires.

Fiberbots takes design parameters in the form of location and orientation as user input data to create viable robot trajectories for structural fabrication. The system employs each robotic unit to 'crawl' and orient itself as it constructs the design. Each robot creates a

IMAGE REDACTED

IMAGE REDACTED

IMAGE REDACTED

singular tube constructed sequentially, segment by segment, enabling the production of structural composite tubes 'tens of times longer than the robot'. (Oxman et al., 2018) There are very specific parameters which control the segments, 'each composite segment can be up to 90mm in length, between 115 and 97mm in inner diameter and up to 40mm in thickness.' (Oxman et al., 2018).

The Fiberbots technology is an integral design precedent for this thesis. It is able to provide the design with parameters of materiality, sizing, and structure. More importantly, it provides an opportunity for a speculative, time-based architectural outcome to move from just digital speculation to a physical architectural intervention. Implementing such innovative construction techniques also clearly illustrates my desire not just to imitate traditional Māori weaving and textile design but instead utilise knowledge from the past and integrate it with the future.

GENERATIVE DESIGN EXPERIMENTS

The initial design experiments act as an introduction for me to generative computational design methods. Having never utilised computational design software prior to this thesis, it is imperative to understand the possibilities and limitations of purely generative design outcomes.

All of the experiments identify different methods of creating fibre or strand-based geometries that result from algorithmic computational design strategies. A mixture of scales ranging from a singular fashion garment to a largescale architectural wall installation illustrates the unique multi-scalar nature of the methods developed.

Understanding and learning the ability to perform time-based simulations was a crucial focal point of the design phase. For computational time-based simulations to work logically and functionally, a high level of control of the technique must be demonstrated to ensure that each simulation element is working the way that is intended.

Figure 35. Authors Image. (2020).
Generative Fashion

GENERATIVE FASHION FABRIC SKIN

The initial generative design experiment focuses on fashion design. Due to Covid-19's impact on this thesis and the cancellation of New Zealand Fashion Week, I was interested in creating a generatively designed fashion garment that could replace the fashion that would have been a central focus of the thesis. Garment creation is also a very integral element of the development of Māori fabric arts when settlers first arrived in New Zealand out of a necessity to survive.

The design experiment implements a point finding algorithm that results in a dense fibrous geometry. The distances between points are calculated only to create geometry to points in a specified proximity. By increasing or decreasing the number of connection points, varying levels of density are created.

The guiding lines are derived through a contour computation command that identifies the steepest ascents and descents on the human avatar's body. This design decision was influenced by Iris van Herpens' use of the body to accentuate geometries created throughout her fashion collections.

Through a growth simulation of the derived contoured body lines, fibres can be made with the connection points to articulate how the computation tool can understand and construct the final garment.

Figure 36, Authors Image. (2020).
Fabric Skin Diagram

FABRIC DENSITY 1
GRID SIZE: 30cm x 60cm
POINT DISTRIBUTION: 100 x 100
CONNECTION POINTS: 10,000

FABRIC DENSITY 2
GRID SIZE: 30cm x 60cm
POINT DISTRIBUTION: 200 x 200
CONNECTION POINTS: 40,000

FABRIC DENSITY 3
GRID SIZE: 30cm x 60cm
POINT DISTRIBUTION: 300 x 300
CONNECTION POINTS: 90,000

FABRIC DENSITY 4
GRID SIZE: 30cm x 60cm
POINT DISTRIBUTION: 400x400
CONNECTION POINTS: 160,000

FABRIC DENSITY 5
GRID SIZE: 30cm x 60cm
POINT DISTRIBUTION: 800x800
CONNECTION POINTS: 640,000

Figure 38, Authors Image. (2020).
Avatar Contour Diagram

Figure 39, Authors Image. (2020).
Ascent and Descent Lines Diagram

Figure 40, Authors Image. (2020).
Front View Fashion Garment

Figure 41, Authors Image. (2020).
Front View Detail Fashion Garment

Figure 42, Authors Image. (2020).
Back View Fashion Garment

Figure 43, Authors Image. (2020).
Back View Detail Fashion Garment

Figure 44, Authors Image. (2020).
Side View Fashion Garment

Figure 45, Authors Image. (2020).
Front View Detail Fashion Garment (2)

GENERATIVE FASHION
YOUTUBE LINK

Either click on the circular icon to the
left or copy the youtube link below

<https://www.youtube.com/watch?v=ktQ2mlw-GM8>

Figure 46, Authors Image. (2020).
Fashion Animation Still Image

GENERATIVE FABRIC VOXELIZED WALL

The second design investigation is a voxelised generative wall. The design experiment focuses upon time's decaying effect on architecture. Through the abstract notion of time, a morphing and ever-changing wall is designed that deconstructs and constructs itself using a time-based simulation.

The technique involves the organised distribution of pre-derived components to create a fabric-like structure. The distribution of elements is organised by voxels, three-dimensional cubes, to establish an even distribution. The components can fit inside the voxel and connect at defined points to create a singular structure.

Three types of fabric component are developed with a focus on varying levels of porosity. The components are constructed from connecting points of a cube together. The variance of density is dependent on the number of connections in the cube.

The time simulation is achieved through a computational selection algorithm deleting components to demonstrate a subtractive representation. The selection can elegantly move through the wall and develop small alcoves and new spatial qualities to be established throughout time.

1. BASE WALL
2. VOXELIZED WALL
3. COMPONENT WALL

Figure 48, Authors Image. (2020).
Voxelized Fabric Wall Component Diagram

FABRIC CONNECTION DIAGRAM
VOXEL SIZE: 0.7 x 0.7
NUMBER OF COMPONENTS: 21

Figure 49, Authors Image. (2020).
Voxelized Fabric Wall Assembly Diagram

Figure 50. Authors Image. (2020).
Voxelized Fabric Wall Component Type 1 Diagram

VOXEL COMPONENT 02
 VOXEL SIZE: 0.7 x 0.7
 NUMBER OF CONNECTIONS: 5
 POSSIBLE POINT CONNECTIONS: 8
 POROSITY: 62%

Figure 51, Authors Image. (2020).
 Voxelized Fabric Wall Component Type 2 Diagram

VOXEL COMPONENT 03
 VOXEL SIZE: 0.7 x 0.7
 NUMBER OF CONNECTIONS: 4
 POSSIBLE POINT CONNECTIONS: 8
 POROSITY: 50%

Figure 52. Authors Image. (2020).
 Voxelized Fabric Wall Component Type 3 Diagram

Figure 53, Authors Image. (2020).
Voxelized Fabric Wall Render 01

FABRIC_TIME_DIAGRAM
FABRIC_WALL.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

GEOMETRY PARAMETERS
LENGTH: 45m

WALL PARAMETERS
POINT SEPERATION: 0.07
NUMBER OF POINTS: 144,194

COMPONENT PARAMETERS
COMPONENT SIZE: 0.7 x 0.7
MINIMUM NUMBER: 72,111
MAXIMUM NUMBER: 99,189

Figure 54, Authors Image. (2020).
Voxelized Fabric Wall Time Diagram

Figure 55, Authors Image. (2020).
Voxelized Fabric Wall Render 02

Figure 56, Authors Image. (2020).
Voxelized Fabric Wall Render 03

Figure 57, Authors Image. (2020).
Voxelized Fabric Wall Render 04

Figure 58, Authors Image. (2020).
Voxelized Fabric Wall Render 05

GENERATIVE WALL ANIMATION
YOUTUBE LINK

Either click on the circular icon to the
left or copy the youtube link below

<https://www.youtube.com/watch?v=5peo9dZ8grE>

Figure 59, Authors Image. (2020).
Voxelized Fabric Wall Animation Still Image

POINT ADVECTION SWARM ALGORITHM

The swarm design experiment focuses on a technique utilised to design an outcome similar to the Fiberbot precedent. Throughout the investigation, the strands emerge through the use of computational point advection algorithms.

Point advection is a transport mechanism that moves a point through a volume. Computational algorithms can perform time-based simulations that determine a vectors' influence on the direction and the resultant path travelled.

Parameters that influence the magnitude and direction of the vectors are used to change the articulated partway. A vector with a lower magnitude will result in a more unaffected and linear pathway instead of a large magnitude that will result in an almost hairlike path.

The experiment varies in complexity when the number of strands being affected by the advection increases. As the number of strands increase, more interactions between the elements begin to occur, creating more complex patterns.

Figure 60. Authors Image. (2020).
Point Advection Diagram

SWARM_EXPERIMENT_01
SWARM_ALGORITHM.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

GEOMETRY PARAMETERS
POINTS: 2 x 2
STRANDS: 4
HEIGHT REACHED: 7.85m

NOISE PARAMETERS
FREQUENCY: 0.8
OFFSET: 0.7
AMPLITUDE: 0.478
ROUGHNESS: 0.04
FORCE MULTIPLIER: 0.021

Figure 61, Authors Image. (2020).
Swarm 1 Time Diagram

SWARM_EXPERIMENT_02
SWARM_ALGORITHM.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

GEOMETRY PARAMETERS
POINTS: 2 x 2
STRANDS: 4
HEIGHT REACHED: 11.3m

NOISE PARAMETERS
FREQUENCY: 1.5
OFFSET: 3
AMPLITUDE: 0.4
ROUGHNESS: 0
FORCE MULTIPLIER: 0.03

Figure 62, Authors Image. (2020).
Swarm 2 Time Diagram

SWARM_EXPERIMENT_03
SWARM_ALGORITHM.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

GEOMETRY PARAMETERS
POINTS: 5 x 7
STRANDS: 35
HEIGHT REACHED: 7.85m

NOISE PARAMETERS
FREQUENCY: 1
OFFSET: 3.5
AMPLITUDE: 0.2
ROUGHNESS: 0
FORCE MULTIPLIER: 0.028

Figure 63, Authors Image. (2020).
Swarm 3 Time Diagram

SWARM_EXPERIMENT_04
SWARM_ALGORITHM.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

GEOMETRY PARAMETERS
POINTS: 2 x 2
STRANDS: 4
HEIGHT REACHED: 13.9m

NOISE PARAMETERS
FREQUENCY: 0.8
OFFSET: 0.7
AMPLITUDE: 0.478
ROUGHNESS: 0.04
FORCE MULTIPLIER: 0.088

Figure 64, Authors Image. (2020).
Swarm 4 Time Diagram

Figure 65. Authors Image. (2020).
Swarm 5 Time Diagram

Figure 66, Authors Image. (2020).
Swarm 3 Experiential Render

Figure 67, Authors Image. (2020).
Swarm 5 Experiential Render

GENERATIVE EXPERIMENTATION CONCLUSION

Due to the limitless outcomes that computational design presents in a design process, general experimentation was undertaken to identify the possibilities and limitations of generative design techniques. Whilst the results were successful, and all of the learnings from each experiment extended my knowledge and control of the software, it became abundantly clear that computational design relies on interoperability.

Interoperability is defined as ‘the ability of computer systems or software to exchange and make use of information.’ In the case of architectural computational design, interoperability is achieved when geometry can be created and transferred between design software to exploit the strengths of each software package.

These design experiments were created through the use of SideFX Houdini, a procedural design software developed for special effects. Each design outcome was created entirely from computational algorithms, which results in successful time-based simulations, but often a lack of human control and designed precision enabled through manual computer modelling.

A flow-on effect from purely algorithmic design inside the scope of this thesis is the lack of relation to traditional Māori weaving techniques. Many construction techniques of Māori fabric arts are precisely articulated in defined instructions. When attempting a purely algorithmic design outcome, the lack of human control results in the inability to arrive at an outcome informed by specified instructions.

Therefore, interoperability is essential in the design phase to allow for greater control when deriving the base fabric patterns. Rhino3D, a manual design software, can derive the base weaving patterns due to the software’s ability to manipulate curves. Houdini will then be introduced to enable simulation commands and manipulation with geometry to result in final design elements.

Figure 68, Authors Image. (2020).
Voxelized Fabric Wall Render 06

MĀORI WEAVING TECHNIQUES

JANE CONNOR

Fabrics of any kind have an extremely interesting analytical and aesthetic value that not many other art forms have. Unlike many artefacts, which, when completed, reflect only the final result, fabrics display the process which the designer was following whilst creating the object. (Connor, 1983) Although the structure can sometimes be determined by the raw material or the desired form or function of the final object, more often than not, the structure exists independently from these factors. Therefore, the structure can form the basis for a comparison and analysis of many different weaving types.

The majority of publications on Māori fabrics were written more than 50 years ago. Even though Māori weaving has not changed in this timeframe, many of the publications offered conflicting assessments due to the inability to analyse Māori fabrics as a broad class of material culture in which variability is displayed. Instead, many descriptions were used for any one type of weaving and often very ambiguous language was used to describe each.

In 1983, Jane Connor published a groundbreaking paper in the 'Journal of the Polynesian Society', which took into account various publications that focused on Māori fabrics and combined them into a succinct and definitive paper. The paper intended to set out a range of structures present in traditional Māori weaving and to clarify the terminology employed to describe each weaving type.

An essential aspect of fabrics is that its manufacture entirely relies on prescribed actions. Unlike many other art forms, weaving has instructions in order to create the desired result. Therefore, the terminology in which weaving is described throughout this thesis must be defined to ensure continuity throughout.

Element:

'An element is a component or a part of the structure of a weave. Each element is manipulated and interworked with at least one other element in order to make a structure.' (Connor, 1983) In some cases, individual elements such as fine fibres can be twisted or plaited to establish a more significant element before being interworked. As seen in Jane Connor's classification, a weave is constructed with at least two elements.

IMAGE REDACTED

Figure 69, McDonald, I. (1921).
Chadwick, wearing a korowai, weaving a small flax basket

Two of the most common classifications of elements are the weft and warp. The weft and warp are often synonymous with the technique of weaving where a loom is used; however, weft and warp elements can be used as the definition of elements in all weaving techniques. On a loom, the warp elements are the longitudinal elements that are always vertical during the construction of the fabric. The weft elements are the traverse elements that cross over with the warp at a right angle. Weft elements are always horizontal during construction.

A SET OF ELEMENTS

A set is a group of elements in a weave that are ‘functionally undifferentiated and trending in the same direction.’ (Emery, 1966) The structure of a weave is always constructed of at least one set of elements. For example, a braid has one set of elements (4 strands) interworked together to create a complete structure.

ACTIVE AND PASSIVE ELEMENTS

Passive elements are elements that are not manipulated or interworked into the structure of the weave. Instead, passive elements are held in place by the opposing set of interworked elements, named active elements.

Jane Connor establishes a hierarchical form of classification to enable a holistic view of particular weaving types’ similarities and differences. The hierarchy is established at each level by specific variabilities judged to be significant in defining each class or subclass of the technique.

The most basic classification concerns the number of elements included in the construction of the weave. The second distinction is made between the structural classes, which can be recognised as techniques such as braiding, plaiting, or cordage. The final classification is that of known variability of that particular structural class. For example, fabric that is created under the classification of cordage can be either plied or braided.

This specific classification system defined by Jane Connor is also highly flexible in terms of adding weaving types. The broad range of the specification level means new weaving types can easily be added to the hierarchy without affecting the rest of the hierarchy. The classification at its most basic level is based on the number of elements or sets of interworked elements to create the desired fabric.

Jane Connor identified four main categories into which Māori

Figure 70, Connor, J. (1983).
Table of Classification

fabrics can be separated: one set of elements (cordage, plaiting and windmill knotting); two or more sets of elements (twining and weaving); single element (looping or netting), and lastly, two single elements (coiled work). For the purposes of this thesis, I will use a simplified categorization – one set of elements and two or more sets of elements – as they are techniques that have similar characteristics to common architectural elements such as columns.

ONE SET OF ELEMENTS

Cordage, plaiting and windmill knots are all techniques found within Māori weaving and traditional arts constructed using one set of elements.

CORDAGE

Plied cordage is a simple technique that is constructed through the twisting or spiraling of two elements. Plied cordage is most commonly seen in the construction of rope or cord fabrics. Variations in plied cordage can be identified as the number of strands that are interworked into the cord. This variation is classified as two-ply, three-ply and so on. The direction of the twist also provides another variation to the technique. Strands twisted in a clockwise direction are classified as an S-twist, whilst strands twisted in an anti-clockwise direction are labelled Z-twist.

Braided cordage is a structure that is constructed through the interworking of three or more elements. The elements are worked across each other with established instruction to ensure a tidy and tight structure. Variations of braided cordage are created by the number of elements used to create the structure. The more elements that are used, the more complex the structure will become. Variation will also arise from the established instruction that is implemented to create the structure. The choice of instruction will result in a variation in surface appearance and variance in cross-section.

When describing a cordage weave, it is often useful to measure the number of twists per unit length and the angle of the twist to measure how tight the weave is.

PLAITING:

A plait weave is constructed through the interlacing of one set of elements. The two main categories of plaiting are plain, and twill, classified by the number of elements crossed in the interlacing.

IMAGE REDACTED

Plain plaiting follows each element's instruction, passing over one and under one of the elements travelling in the opposite direction. The result of this construction technique is an even, checkered pattern. Variation within this technique is achieved by increasing the number of elements which will result in finer plaiting. A second variation is to change the position or orientation of the elements. Decorative plaiting will often change the elements' orientation to create a different visual language and create a more complex-looking pattern.

Twill plaiting construction occurs when each direction's elements pass over and under more than one element at a time. Even twill plaiting occurs when each element from both directions passes over and under the same number of elements. For example, a 2/2 twill pattern occurs when each element passes over and under two elements at a time. On the other hand, uneven twill construction occurs when the number of elements passed over does not equal the number passed under. For example, a 3/2 twill will result from the elements passing over three and under two.

TWO OR MORE SETS OF ELEMENTS

Jane Connor has grouped weaving structures composed of two or more sets of elements according to the relationship between elements at the point of crossing.

TWINING

Twining involves two or more interworked elements. One element is always passive, and the other is active. If the structure requires extra rigidity, one more passive element can be added. The technique is constructed through the active element being twisted or spiraled around the passive element to enclose the passive element with either a complete turn or half turn. Twining is often described as weft twining or warp twining. The name is determined by which set of elements is active. All evidence of Māori twining is weft twining, probably due to the resources and tools that were available. According to Jane Connor, variability in twining construction is influenced by four critical factors:

- The number of elements in each twining row
- The nature of the warp-weft interaction
- The weft rows' spacing
- The grouping of the warp elements

There are four different twining techniques used in Māori fabrics that can be distinguished by these factors: single-pair, two-pair, three-strand, and tāniko.

IMAGE REDACTED

SINGLE-PAIR TWINING

Single-pair twining refers to two active elements wrapping around the passive element. The result is a tight weave similar to the previously mentioned cordage technique. Many variations can be created with a fabric constructed with single-pair twining, making it a very decorative and versatile technique.

Variations can be determined by the twist's direction and classified as S-twist for clockwise and Z-twist for anti-clockwise. Another variation can be distinguished by the nature of the twist. The weaver can either implement a half-turn or a whole turn, resulting in two very different surface structures. The half-turn will emerge alternately on the face and the reverse of the fabric, whereas the whole turn will result in the same element shown on the face or the reverse.

The spacing of the weft element can impact the rigidity of the structure. Compact twining occurs when the weft rows are closely spaced and result in a tight, strong structure. Spaced twining, on the other hand, creates a looser, flimsier structure.

TWO-PAIR TWINING

Two-pair twining, or as Sir Peter Buck wrote, 'two-pair interlocking weft', (Buck, 1911) is constructed using four elements for each row. The elements are paired and are visible on both the front and reverse of the fabric. Two-pair twining can be varied by the weft rows' spacing that will result in a looser or more compact weave.

THREE-STRAND TWINING

Three-strand twining, otherwise known in Māori culture as tāniko, is a traditional weaving technique used to provide the rigidity necessary in some basketry structures and to allow for ornamental colouring of fabrics for objects such as a Kaitaka (tāniko-bordered Māori cloak.) The tāniko technique enables weft elements of several colours to be used decoratively through complex interworking of two colours as a single twine. Passive elements run both directions in order to provide more rigidity and to straighten each row.

IMAGE REDACTED

DESIGN TOOL FLOWING WEAVES

The established design tool for this thesis utilises a flowing computational command to create geometry that is directed along a pre-defined path. The tool allows for significantly more control than the previous design experiments due to manually designed components forming the two geometry inputs for the tool.

Two specific geometry inputs are required to ensure the successful use of the tool, a flowline and a base geometry. The flowline establishes a guiding direction and path for a selected geometry to follow. The flowline can move in any direction allowing for incredible flexibility when experimenting with form.

The geometry that follows the flowline in the instance of this thesis is a pre-drawn weave pattern. The manually drawn weaving patterns are derived using Jane Connor's research of traditional Māori weaving techniques. The choice of manually modelling the geometry reflects the necessity for control to articulate and comply with weaving instructions. Whilst it is possible to derive weaving patterns computationally, manual modelling presents the opportunity to manipulate techniques more efficiently.

The primary parameter that influences the design tool is time. The designed weaving patterns grow and morph along the flowline, establishing a relationship with time. Each strand is represented, and the complex structural workings are effectively articulated.

Utilising this flowing tool will allow for a high level of control and adaptability moving forward throughout the design phase. The design method will be tested at multiple scales to analyse the robustness and flexibility that can be achieved when using this tool as a design method.

Figure 74, Authors Image. (2020).
Design Tool Diagram

WEAVE DESIGN TEST FURNITURE SCALE

As seen throughout Daniel Widrigs' work, a furniture scale design investigation is used as an initial test to develop a digital tool. Furniture provides a design situation with sufficient parameters in regard to dimensions and ergonomics whilst allowing abstract design ideas to manifest.

When developing a tool, it is vital to ensure that the user is in control of the input parameters to understand how the tool will react to specific design situations. The small scale allows for a significantly more manageable geometry than focussing immediately on large complex architectural elements.

This section of the design phase will focus on three types of furniture that increase in complexity. Firstly, the bench has been identified as the archetypal fashion show seat. The bench is the simplest of furniture pieces created with the design tool as the weave geometry is only following a single flowline. Secondly, a table is designed to focus on structural integrity and connections to the tabletop and the ground. Lastly, a complex chair is designed to test the tool's ability to interweave multiple different flowlines and weave patterns to establish continuity and intricate details.

Figure 75, Authors Image. (2020).
Chair Render 01

Figure 76, Authors Image. (2020).
Bench Flowline Diagram

Figure 77, Authors Image. (2020).
Bench Isometric

Figure 78, Authors Image. (2020).
Bench Render 01

Figure 79, Authors Image. (2020).
Bench Render 02

Figure 80, Authors Image. (2020).
Bench Render 03

Figure 81, Authors Image. (2020).
Bench Render 04

→ Flow direction
 — Flowed weave pattern

Figure 82, Authors Image. (2020).
 Table Flowline Diagram

Figure 83, Authors Image. (2020).
 Table Exploded Isometric

Figure 84, Authors Image. (2020).
Table Render 01

Figure 85, Authors Image. (2020).
Table Render 02

Figure 86, Authors Image. (2020).
Table Render 03

TABLE ANIMATION
YOUTUBE LINK

Either click on the circular icon to the left or copy the youtube link below

<https://www.youtube.com/watch?v=H7TC-IUobGA>

Figure 87, Authors Image. (2020).
Table Animation Still Image

→ Flow direction
 — Flowed weave pattern

Figure 88, Authors Image. (2020).
 Chair Flowline Diagram

Figure 89, Authors Image. (2020).
 Chair Exploded Isometric

Figure 90, Authors Image. (2020).
Chair Render 02

Figure 91, Authors Image. (2020).
Chair Render 03

Figure 92, Authors Image. (2020).
Chair Render 04

Figure 93, Authors Image. (2020).
Chair Render 05

Figure 94, Authors Image. (2020).
Chair Render 06

Figure 95, Authors Image. (2020).
Chair Render 07

CHAIR ANIMATION
YOUTUBE LINK

Either click on the circular icon to the
left or copy the youtube link below

<https://www.youtube.com/watch?v=ky57GxSzmDI>

Figure 96, Authors Image. (2020).
Chair Animation Still Image

FURNITURE SCALE REFLECTION

The furniture scale experiments provided an important initial test for the established digital tool.

The bench was the simplest of the three outcomes however provided critical control and understanding of how the selected weaving pattern follows an isolated flowline.

The table allowed for speculation of underfloor structural elements that can support and connect to the floor above. The development of designed connections to the intricate tabletop details can now be tested and utilised throughout the design to increase the sophistication of the final design outcome. The table also introduced the hierarchy of primary and secondary flowlines articulated by varying scales in the final table geometry. Hierarchy will be a critical design component to establish a concise design language when dealing with ornamental structures.

Finally, the design of the complex chair utilised the knowledge attained through the previous design outcomes to result in a highly intricate piece of furniture. The chair introduced detailed and precise connections between the two separate flowlines to achieve a seamless continuity throughout.

Each outcome has given me insight into techniques and methods to begin to move on full scale to architectural elements.

ARCHITECTURAL ELEMENTS

The next phase in the design methodology is the development of crucial architectural design elements. Due to the vertical nature of the hākari stage, columns and stairs were selected due to their essential inclusion in the final architectural designs.

The development of central columns will explore levels of complexity through the interweaving of multiple patterns. Through precise weaving, complex structures can interact with one another to create new patterns and fabric linguistics.

The development of woven staircases focuses on the formal composition of stair elements ranging from straight stairs to spiral stairs. Throughout development, ornamentation has to work in tandem with function to ensure that the stairs, whilst containing the decorative linguistic of this thesis, can function as a working staircase.

Each investigation is explained through time simulations to articulate the inner workings of the elements patterned structure and test the tools' ability to perform intelligent time-based simulations.

Figure 98, Authors Image. (2020).
Stair Render 01

→ Flow direction
 — Flowed weave pattern

Figure 99, Authors Image. (2020).
 Column Flowline Diagram

→ Flow direction
 — Flowed weave pattern

Figure 100, Authors Image. (2020).
 Step Flowline Diagram

Figure 101, Authors Image. (2020).
Column 01 Front View

Figure 102, Authors Image. (2020).
Column 01 Time Diagram

Figure 103, Authors Image. (2020).
Column 02 Front View

Figure 104, Authors Image. (2020).
Column 02 Time Diagram

Figure 105, Authors Image. (2020).
Column 03 Front View

Figure 106, Authors Image. (2020).
Column 03 Time Diagram

Figure 107, Authors Image. (2020).
Column 04 Front View

Figure 108, Authors Image. (2020).
Column 04 Time Diagram

Figure 109, Authors Image. (2020).
Column 05 Front View

Figure 110, Authors Image. (2020).
Column 05 Time Diagram

Figure 111, Authors Image. (2020).
Column 06 Front View

COLUMN_EXPERIMENT_06
COLUMN.HIPLC

ANIMATION PROPERTIES
SECONDS: 5
FRAMES: 120
FRAMES PER SECOND: 24

WEAVE PARAMETERS
NUMBER OF STRANDS: 8
NUMBER OF WEAVES: 2

GEOMETRY PARAMETERS
HEIGHT: 6m
WIDTH: 1.1m

Figure 112, Authors Image. (2020).
Column 06 Time Diagram

Figure 113, Authors Image. (2020).
Column 07 Front View

Figure 114, Authors Image. (2020).
Column 07 Time Diagram

Figure 115, Authors Image. (2020).
Column 08 Front View

Figure 116, Authors Image. (2020).
Column 08 Time Diagram

Figure 117, Authors Image. (2020).
Column 09 Front View

Figure 118, Authors Image. (2020).
Column 09 Time Diagram

Figure 119, Authors Image. (2020).
Column 10 Front View

Figure 120, Authors Image. (2020).
Column 10 Time Diagram

Figure 121, Authors Image. (2020).
Column 11 Front View

Figure 122, Authors Image. (2020).
Column 11 Time Diagram

Figure 124, Authors Image. (2020).
Column 10 Render

Figure 123, Authors Image. (2020).
Column 11 Render

Figure 125, Authors Image. (2020).
Spiral Staircase Flowline Diagram

Figure 126, Authors Image. (2020).
Spiral Staircase Isometric

SPIRAL_STAIR_CASE_1
SPIRAL_01.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

STAIR PARAMETERS
SPIRAL: 75%
NUMBER OF FLOORS: 1
ELEVATION: 3m
WIDTH: 1.2m
RISER: 0.2m
RUN: 0.3m
NUMBER OF STEPS: 15

Figure 127, Authors Image. (2020).
Spiral Staircase Time Diagram

Figure 128, Authors Image. (2020).
Spiral Staircase 02 Flowline Diagram

Figure 129, Authors Image. (2020).
Spiral Staircase 02 Isometric

SPIRAL_STAIR_CASE_2
SPIRAL_02.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

STAIR PARAMETERS
SPIRAL: 50%
NUMBER OF FLOORS: 1
ELEVATION: 3m
WIDTH: 1.5m
RISER: 0.2m
RUN: 0.3m
NUMBER OF STEPS: 15

Figure 130, Authors Image. (2020).
Spiral Staircase 02 Time Diagram

→ Flow direction

Figure 131, Authors Image. (2020).
Curved Staircase Flowline Diagram

Figure 132, Authors Image. (2020).
Curved Staircase Isometric

CURVE_STAIR_CASE_1
CURVE_01.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

STAIR PARAMETERS
SPIRAL: 25%
NUMBER OF FLOORS: 1
ELEVATION: 2.4m
WIDTH: 1.3m
RISER: 0.2m
RUN: 0.3m
NUMBER OF STEPS: 12

Figure 133, Authors Image. (2020).
Curved Staircase Time Diagram

Figure 134, Authors Image. (2020).
Straight Staircase Flowline Diagram

Figure 135, Authors Image. (2020).
Straight Staircase Isometric

STRAIGHT_STAIR_CASE_1
STRAIGHT_01.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

STAIR PARAMETERS
NUMBER OF FLOORS: 1
ELEVATION: 3m
WIDTH: 1.5m
RISER: 0.2m
RUN: 0.3m
NUMBER OF STEPS: 15

Figure 136, Authors Image. (2020).
Straight Staircase Time Diagram

Figure 137, Authors Image. (2020).
Straight Staircase 2 Flowline Diagram

Figure 138, Authors Image. (2020).
Straight Staircase 2 Isometric

STRAIGHT_STAIR_CASE_2
STRAIGHT_02.HIPLC

ANIMATION PROPERTIES
SECONDS: 10
FRAMES: 240
FRAMES PER SECOND: 24

STAIR PARAMETERS
NUMBER OF FLOORS: 1
ELEVATION: 3m
WIDTH: 1.5m
RISER: 0.2m
RUN: 0.3m
NUMBER OF STEPS: 15

Figure 139, Authors Image. (2020).
Straight Staircase 2 Time Diagram

Figure 140, Authors Image. (2020).
Stair Render 02

Figure 141, Authors Image. (2020).
Stair Render 03

ARCHITECTURAL ELEMENTS REFLECTION

The experimentation of architectural elements has proved to be a vital step in the design phase. The stair and column both provided different requirements, which the tool had to adapt and process.

While flowing along a simple vertical curve, the column allowed for experimentation in complexity when implementing weaving structures as architectural components. There was a constant dialogue between structural integrity and ornamentation.

The columns complexity increased through the use of multiple weaving patterns interacting with each other. Whilst the complexity created for a more structural weave due to the number of elements, the pattern began to be hard to distinguish. Commonly ornamentation results from complex geometry. However, for this thesis, the legibility of the weaving pattern is essential to ensure that the design language of Māori fabric arts is retained.

The stair element was able to test the tools' ability to handle curves on an architectural scale. The step flowlines were developed to provide a degree of curvature that did not result in deformation of the weave. Specific learnings from the furniture experimentation were able to be implemented when constructing the flowlines.

Figure 142, Authors Image. (2020).
Stair Render 04

SMALL SCALE DESIGN

The small-scale architectural experiment provides an opportunity to test the design tool on a small architectural pavilion before moving to the full-scale design outcome. Incremental changes in scale are vital for this design methodology to be successful as the design tool needs to be tested to ensure that the necessary control can be achieved. Continuity between elements is of paramount importance because continuity is an essential characteristic in the construction of fabrics, and control of the tool is imperative to achieving continuity.

The design is located in the centre of Albert Park, a short 5-minute walk from New Zealand Fashion Week Headquarters. The formal composition has been derived from the pyramidal cone shape identified throughout the research of the hākari stage. The design will act as a temporal pavilion that can be utilised by a brand showing at New Zealand Fashion Week.

The circular nature of the cone provides a free-flowing circulation up through the design. The spiral staircases created in the previous design phase have been implemented into the pavilion design to emphasise the circular nature of the design and guide the inhabitant up to the top level.

Figure 143, Authors Image. (2020).
Pavilion Render 01

Figure 144, Authors Image. (2020).
Pavilion Pedestrian Site Analysis

Figure 145, Authors Image. (2020).
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Figure 149, Authors Image. (2020).
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LARGE SCALE DESIGN

The large-scale architectural design finds its guiding compositional reference in the described horizontal form of the hākari stage. The design is located in Aotea Square, which connects to the main headquarters of New Zealand Fashion Week, the Auckland Town Hall. The design is envisioned to house multiple fashion week events ranging from fashion shows to small fashion exhibits and designer showings.

The formal composition is derived from site analysis identifying major pedestrian access points throughout the site. The resulting cross form provides major entrances to both the Town Hall and Queen Street, and the Auckland Civic Center. At each entry are large atrium spaces that offer a monumental entranceway for the inhabitant and provide an immediate chance to enable the ornamental architectural linguistic to be viewed.

The materiality used throughout the design is functionally graded plastic. The use of a gradient between black and translucent enables a level of hierarchy throughout the design. The gradient is implemented at specific connecting points between elements such as the central columns and the stairs.

The design features a functional arrangement of the architectural columns and stairs created in earlier stages of the design phase. A considerable focus was placed on the continuity between all of the design elements to merge different weaves and elements together delicately.

Fluctuating heights of the design are a direct reference to the illustrated hākari stage from William Yates. The changing heights allow for variance in the connection between floors. As the inhabitant moves up through the design, the spaces get more discrete.

The structural system has been influenced by original discrete elements merging to create a single component. The notion is highly evident in complex weaving techniques where elements are interwoven to create a larger structure. The structural flow lines reflect the linear scaffold type arrangement of the hākari stage; however, they merge and morph to form a singular structural component at the top.

Figure 166, Authors Image. (2020).
Final Design Render 01

Figure 167, Authors Image. (2020).
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Figure 168, Authors Image. (2020).
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Figure 171. Authors Image. (2020).
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Figure 181, Authors Image. (2020).
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Figure 184, Authors Image. (2020).
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ARCHITECTURAL ANIMATION
YOUTUBE LINK

Either click on the circular icon to the
left or copy the youtube link below
<https://www.youtube.com/watch?v=2V1qRJ3pASw>

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Final Design Render 02

Figure 187, Authors Image. (2020).
Final Design Render 03

Figure 188, Authors Image. (2020).
Final Design Render 04

Figure 189, Authors Image. (2020).
Final Design Render 05

Figure 190, Authors Image. (2020).
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Figure 191, Authors Image. (2020).
Final Design Render 06

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Final Design Render 07

Figure 193, Authors Image. (2020).
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Figure 194, Authors Image. (2020).
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DESIGN REFLECTION

Time has been an integral component throughout the entire design phase. The implementation of time has enabled the architecture to articulate itself, much like a woven object. The strands' ability to interweave and interlock to form new geometry conveys to the inhabitant how the pattern was constructed, providing clues of the designers' decisions.

Historic Māori fabrics construction methods have been adapted and manipulated to be reconceived as architectural elements. New patterns, motifs and linguistics have been designed whilst still complying with traditional methods of construction.

The outcome of both the small scale and large-scale designs demonstrate the formal characteristics identified by the cited descriptions of historic hākari stages. Through the combination of selected hākari stage components and decorative fabric construction techniques, a new speculative hākari stage has designed for contemporary times.

I believe that each design outcome of this thesis convincingly demonstrates the guiding premise of 'ka mua, ka muri'. Mātauranga Māori has been analysed and articulated to inform design decisions at every stage of the design process. The resulting outcome is architectural designs that aim to apply learnings from the past and apply them to modern-day architecture

Figure 195, Authors Image. (2020).
Final Design Render 10

CONCLUSION

As this thesis had dual objectives, the conclusion has been split into two sections. The first section concentrates on the research findings, analysing Māori cultural values and the implementation of research-led design outcomes. An argument is then presented that reflects on how these two outcomes worked in tandem to form the final positioning of this thesis.

CULTURAL REFLECTION

I believe that this work reflects the remarkable opportunity that modern digital tools present designers to engage with Māori culture throughout all aspects of design.

With the knowledge obtained through researching Māori notions of time and space, time was integrated into the design process as a determinative parameter. Traditional design tools for architecture do not allow for an engagement with time, due to their inability to perform computational simulation commands. By utilising design software packages from different disciplines, such as special effects, architects can now reach design outcomes that can elevate time to the status of a determinative parameter that generates designed forms.

Whilst this thesis focussed upon Māori notions of time and space, it can be argued that many other cultural motifs can inform architectural outcomes through the use of digital tools and workflows. An important aspect to note is that many of these digital tools and workflows are only in their infancy. With the remarkable speed at which technology is now evolving, yet more opportunities to engage with Māori culture will present themselves.

DESIGN AIM

The research utilised the important Māori phrase ‘ka mua, ka muri’, which translates to ‘walking backwards into the future’ as a guiding premise for the implementation of Māori weaving techniques throughout the design phase. Mātauranga Māori of fabric and weaving techniques was used to inform new design outcomes, enabled through modern digital tools. This guiding premise resulted in traditional weaving knowledge informing contemporary linguistics and applications to be used in design outcomes.

Throughout the design phase, there was a focus on the critical symbioses of structural integrity and ornamentation vital in traditional Māori fabric arts. This binding relationship is a discussion in all aspects of design and, in particular, architecture, out of the necessity of structural integrity juxtaposed with the interest in ornamentation. The conversation is no different in Māori architecture, with the decoration of structural elements articulated with carvings.

The geometry created throughout this thesis by using digital tools can combine Māori fabrics’ ornamental aesthetic with the structural nature of architectural elements to inform a new type of design language.

The newfound application and linguistics of Māori fabrics identified throughout this thesis provide an exciting insight into the possible ways that are emerging to utilise traditional knowledge and apply it in modern focused design outcomes to learn from the past whilst looking to the future.

OVERALL CONCLUSION

I believe that the two objectives of this thesis work in tandem to present an intriguing insight into the future of traditional indigenous knowledge, in this case, mātauranga Māori and its application in modern society.

In recent years in New Zealand, it has been well reported that Te Reo (the Māori language) and other aspects of mātauranga Māori, are facing the threat of extinction. Many factors of modern life are responsible for this, but most important of all is the dominant influence that western ideologies and lifestyle have on society in New Zealand. However, through computational tools, there is an opportunity for mātauranga Māori to inform new design outcomes.

How digital tools can be applied to form emergent patterns allows for a new Māori linguistic instead of implementing blatant iconography to reflect a design object being ‘Māori.’ Cultural motifs can be critical parameters, influencing the design process and outcome, instead of being mere, surface-level iconography.

The outcome of this thesis provides a framework not only for traditional fabric techniques to be applied to design, but also opens the door for other customary Māori art forms, such as carving techniques, to inform new computational design outcomes.

PERSONAL REFLECTION

Whilst this thesis had the intention of an immersive engagement with Māori culture and groups. Unfortunately, Covid-19 rendered this almost impossible due to the cancellation of Miromoda (The Indigenous New Zealand Fashion Board) and New Zealand Fashion Weeks 2020 events. It could be argued that a greater level of engagement with Miromoda would have enabled a more focussed cultural scope for this thesis and proved to enrich the research and design process. As a Pākehā designer new to Māori culture and design, I believe that this thesis demonstrates a sufficient engagement with Māori culture. However, when progressing the research agenda and moving into real-world design environments, the importance of an immersive and collaborative environment when focussing on Māori culture is of paramount importance.

Whilst insight from my supervisor at specific points of the thesis was valuable, the lack of critical engagement with Māoridom resulted in the most significant personal struggle whilst completing this research. Being a Pākehā who has had little education or interaction with Māori culture at an academic level, I found myself often with a lack of confidence to make bold design decisions out of fear of misusing or misunderstanding sacred Māori motifs. Whilst architectural knowledge from previous years of university study and a willingness and determination to understand Māori culture has taken this research to where it has ended up, I firmly believe that a critical immersion with Māori culture would have avoided all of these issues.

A flow-on effect from a culturally immersive design experience would be a focussed research scope and design outcome formed around a particular iwi or group. It became known through the research presented by Jonhson Witehira and Julie Paama-Pengelly that inside of 'Māori culture', each iwi can often have different values and understanding of the world around them. Explicitly focusing on fabric and weaving techniques, specific iwi have specialised techniques and construction methods for particular uses. An interesting next step of this research would be to analyse and implement specific iwi fabric and weaving techniques as well as cultural values and understandings that may have been underutilised or missed altogether through the generalist lens of this thesis.

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