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# Designing Fruit Packaging with Kōwhaiwhai Pūtoi Koiora (Auxetic Kōwhaiwhai)

Christopher J. Britton

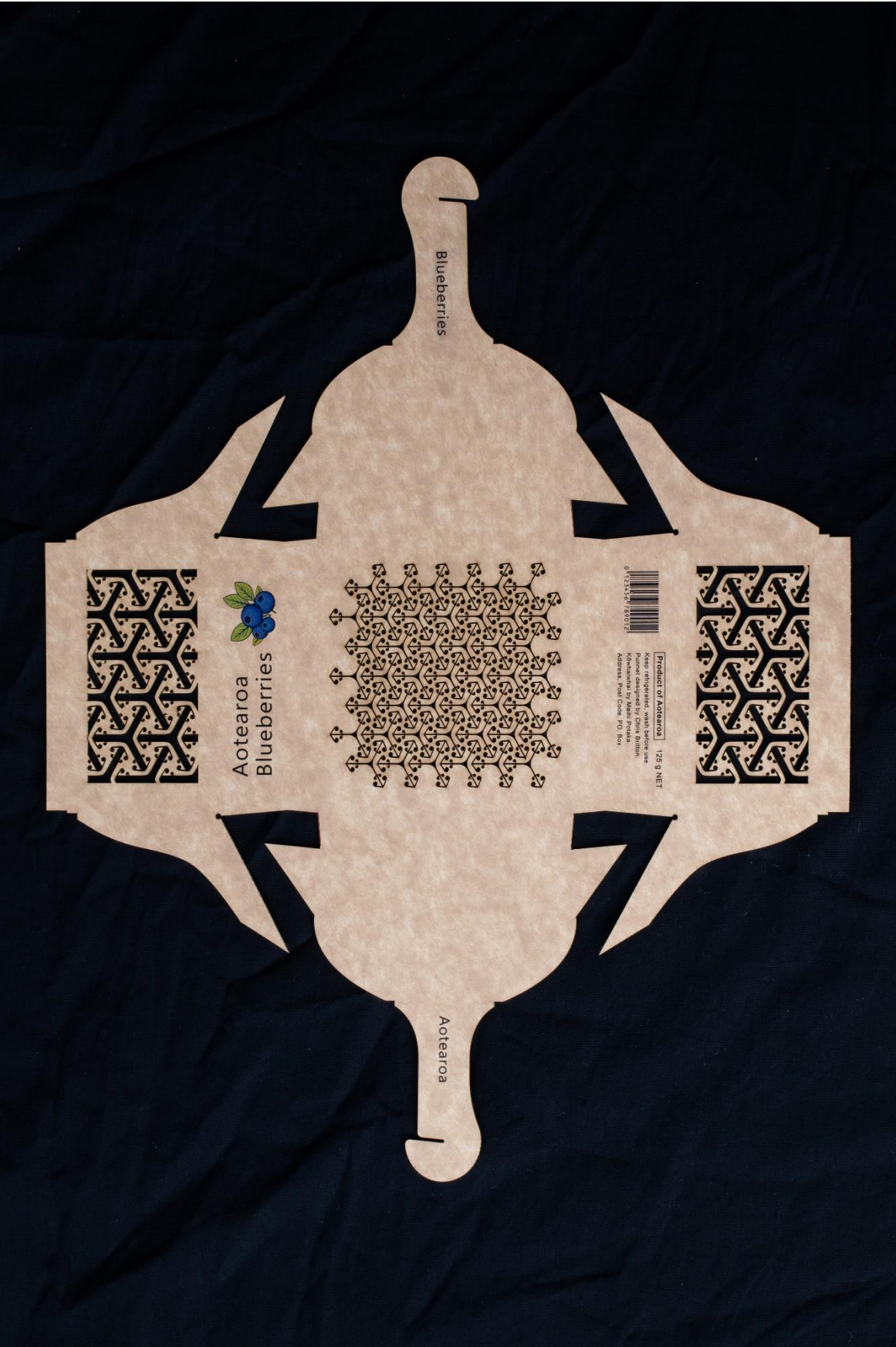
# Designing Fruit Packaging with Kōwhaiwhai Pūtoi Koiora (Auxetic Kōwhaiwhai)

An exegesis presented in partial fulfilment of the requirements for the degree of Master of Design.

Massey University, College of Creative Arts, Wellington, Aotearoa.

Christopher J. Britton, 2023.



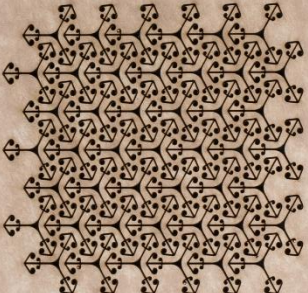


Blueberries

Aotearoa



Aotearoa  
Blueberries



0 123456 729012

Product of Aotearoa 125 g NET  
Keep refrigerated, wash before use  
Pattern designed by Chris Britton  
Kōwhiriwhiri by Māhū Pōhaka  
Aotearoa, 1001 Cook, PO Box



# Abstract

Aotearoa fruit exporters are interested in creating packaging that displays a genuine connection to Aotearoa's cultural values. This industrial design project aims to create blueberry packaging that is driven by the concept of Kaitiakitanga, or guardianship. This is a core cultural value in Aotearoa that speaks of a holistic interest in protection and safekeeping of the environment, ourselves and each other. As a research project, this is located adjacent to a wider body of research coordinated by Massey University's School of Food and Advanced Technology. It is carried out in collaboration with visual artist Maihi Potaka (Ngāti Hauti, Ngāti Manawa, Te Ātihaunui-ā-Pāpārangī), an established Kōwhaiwhai practitioner.

The process involved consultative expertise including cultural, industrial and technical input, and explorative iterative design sampling with shared reflective practice in the cultural expression of kōwhaiwhai. The design research investigates the behaviour and potential of kōwhaiwhai pūtoi kōiora (auxetic kōwhaiwhai) in a context of produce packaging design. Multiple material and form design samples develop into a folded paperboard fruit punnet concept. These design-led explorations facilitate further opportunities for packaging applications as well as reflection on the significance of designing for real-world industry alongside localised cultural learning.



# Acknowledgements

To my supervisors, Dr. Eli Gray-Stuart, Maihi Potaka, and Matthijs Siljee, thank you for sharing your wealth of knowledge, giving guidance, and providing the opportunity to do this master's project. I would also like to thank Prof. John Bronlund for authorising and organising the structure and financial support for this project, and Deb Cumming for the organisation, assistance, and understanding I have received throughout the duration of the project.

Thank you to all of those involved in this project from Scion, Oji Fibre Solutions, Essity, BJ Ball Papers, Zespri, and other businesses, that have given support throughout this project in the form of time, materials, and knowledge. The help I received elevated this project greatly.

I would also like to acknowledge my friends and family for their continued support during this project. Finally, I would like to thank my fellow students and the Massey University Wellington staff for their friendship, critical advice, editing help, practical knowledge, and overall providing a suitable environment for creative learning.



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Unless stated otherwise, all figures by author.

Any images displaying work that contains the mangopare or huaperi auxetic kōwhaiwhai; this kōwhaiwhai is by Maihi Potaka, 2022, who also holds the copyright, and has given permission for its usage in this exegesis and the design work carried out.

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# 1. Introduction

## 1.1, The Beginning, Research Questions

This project began in 2020 when I was offered the opportunity to do a Master's degree at Massey University, Wellington, utilising resources and connections with, and made by, the Massey University School of Food and Advanced Technology in Palmerston North. The aim of this project was to design a consumer facing piece of fruit packaging for produce grown here in Aotearoa.

Initially, the premise for the project was to address an issue raised by the Riddet Institute in A Call to Arms, a document that details how export from Aotearoa needs to lift its agri-food export higher up the value chain, while agriculture is reaching limits in sustainable volume it can produce (10). I was to address this through designing a piece of fruit packaging that made overseas consumers willing to pay more for the product based on its presentation, and the experience it provides.

An opportunity also arose to work with Maihi Potaka (Ngāti Hauiti, Ngāti Manawa, Te Ātihaunui-ā-Pāpārangī), a Māori visual artist based in Palmerston North, who had started a project creating kōwhaiwhai pūtoi koiora (auxetic kōwhaiwhai) and testing the physical properties of them. As the project progressed, and my understanding grew around what working with kōwhaiwhai entailed, a realisation that a deeper understanding about using kōwhaiwhai to package a product was necessary, especially as a Pākehā who was working with an indigenous artefact of cultural importance. The scope was then changed to no longer focus on profit, but to focus on this, with the new research questions being:

- How can an auxetic kōwhaiwhai be applied to packaging in a way that utilises its auxetic properties?
- What is required for this to be done in an appropriate manner?
- What form could this packaging take?

## 1.2, Te ao Māori

To work with kōwhaiwhai, especially as a pākehā who had little previous knowledge of Māori cosmology, I needed to familiarize myself with te ao Māori in order to understand the principles and connections between the art form and the culture. This allows for me to understand mātauranga Māori to a greater degree in relation to my own Pākehā knowledge systems, to ensure I would not resort to superficial assumptions that could lead to situations of misuse of the kōwhaiwhai.

Te ao Māori is the origin of the world, and ourselves, according to Māori. While different iwi and different tohunga have mātauranga that can differ, many of the core themes remain consistent (Reilly et al. 25). In this instance, I will refer to the version that starts with Io-matua-kore, which is a tradition of Ngāpuhi. The first theme I explore is the interconnectedness of everything, stemming from Io, the supreme atua, and Te Kore. The second theme is one of two opposing/complimenting halves, where the traditions of Te Pō (the night), Te Ao Mārama (the realm of being), Ranginui (Sky Father) and Papatūānuku (Earth Mother) will be referred to.

Te ao Māori speaks of the origin of our universe beginning with an all-encompassing unharnessed potential, Te Kore, in which Io existed eternally within (Reilly et al. 13). Everything began with Io-matua-kore, nā nā i hanga i ngā mea katoa (he who created everything in this world), which includes, but is not limited to, the creation of Te Pō, Te Ao Mārama, Rangi and Papa. This even flows on to the creation of ourselves. From this it is seen that everything is deeply and inherently connected, and implies that our actions are influenced by, and influence, a deep web of factors outside of ourselves, because not only do we come from the same thing, but we also are a part of an inherent relationship with everything.

Both Te Ao Mārama and Te Pō, and Ranginui and Papatūānuku, speak of another major theme within te ao Māori. This theme is of two halves, or two opposing/complimenting opposites, that also contain complimenting differences. These two different parts hold each other in balance and is referred to by Hanson as creating an

ambivalent tension between union and separation (215-219). Te Pō is the night, a contrast to Ao Mārama, the realm of being. One example of these two states is when one leaves a place of ignorance and becomes enlightened, they are bringing this knowledge from Te Pō into Ao Mārama (Barlow 4). This contrast can also be seen in Rangi and Papa, where both are seen as opposites, but both hold each other in balance. This is important to understand due to the referencing of this theme in Māori visual arts such as kōwhaiwhai, and is an important part of understanding the visual language of the art form.

Working with kōwhaiwhai during this project meant that it was important to be aligned with and understand the values of Māori culture, and the origins of these values. While any design project can have a broad and far-reaching impact, this one also directly impacts a culture that is not my own. This is due to the important link between art and culture, and the holistic interconnectedness of everything detailed in te ao Māori. Being consistently aware of this impact during the process, and paying attention to, and listening to the knowledge that Maihi would share with me about the appropriate application of the kōwhaiwhai, was an integral part of carrying out this project in an appropriate way. This meant bringing my own knowledge on this from Te Pō into Te Ao Mārama.

A diagram of the relationship of these different traditions, and how they tie into the next chapter, kaitiakitanga, can be seen in fig. 1.

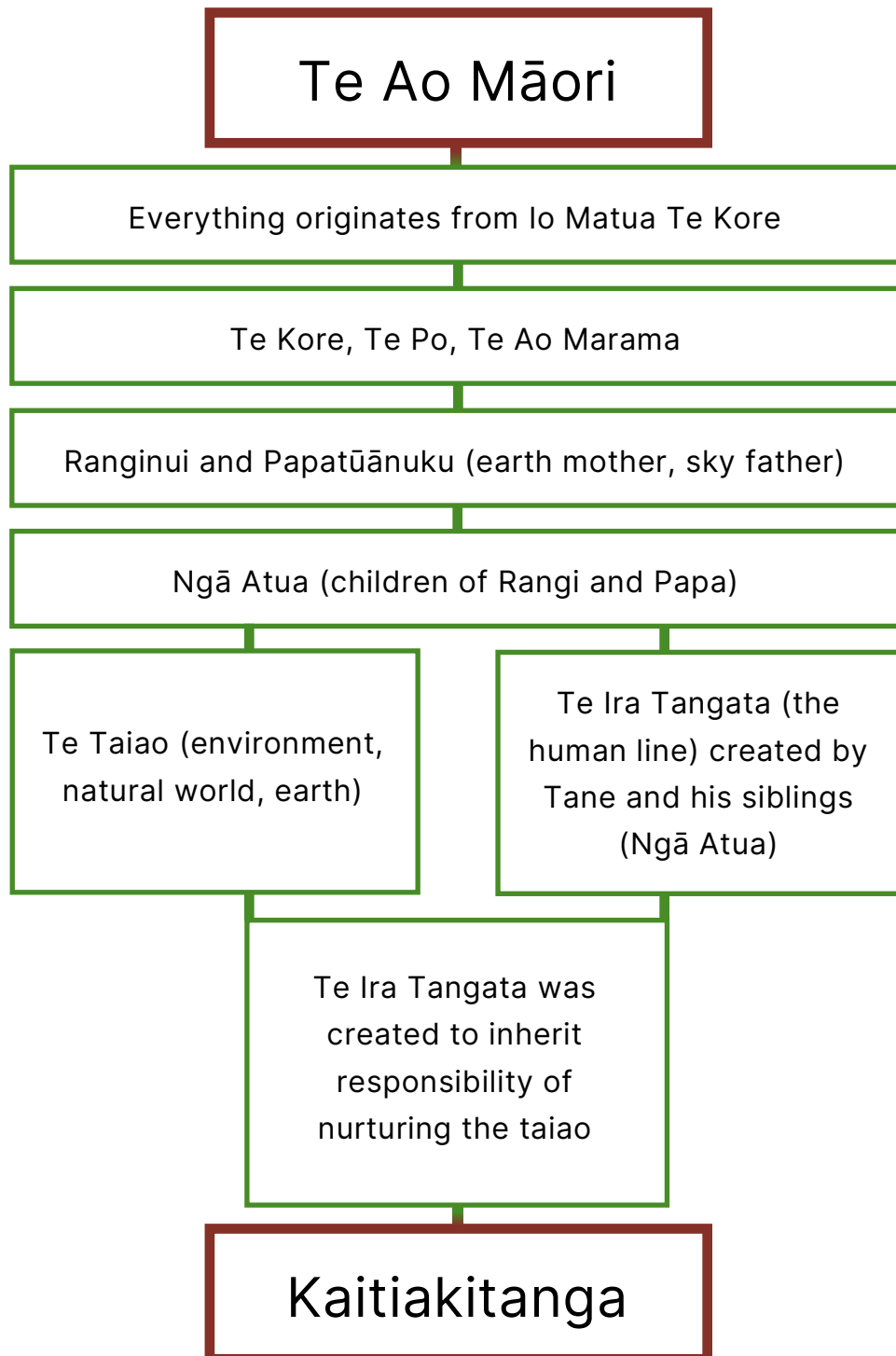


Fig. 1: Diagram showing how te ao Māori links to kaitiakitanga. By Chris Britton and Maihi Potaka, 2023.

### 1.3, Kaitiakitanga, the Driving Concept

Kaitiakitanga, the driving concept behind this project, guided the design outcome to uphold a specific set of values. It also played a part in ensuring that the usage of kōwhaiwhai in the design was culturally appropriate.

Kaitiakitanga speaks of observation, care, and protection (Barlow 34), and is frequently used as a term to refer to environmental protection. It is, however, a concept that has much broader and more holistic implications than that (Reilly et al. 86). While considering environmental impact is critical for any project, it became a staple of this project as it is of such high importance in te ao Māori, as Te Ira Tangata (the human line) were created to inherit the responsibility to be the kaitiaki of the natural world (Potaka). There are also themes within Māori culture of respecting those that came before you, or those older than you (Barlow 40), which the relationship between Te Ira Tangata and Te Taiao is an example of, as Te Taiao came before us.

As the project progressed, I realised that I knew little about using kōwhaiwhai in the way that we intended. Due to this, and the cultural significance of this taonga, it then became important to identify a key aspect of te ao Māori that could be used to create a suitable foundation for the usage of kōwhaiwhai in the design. When “understanding using auxetic kōwhaiwhai in packaging” became the aim of the project, it was decided by Maihi and I that to drive the project in a direction that upheld what mātauranga Māori teaches as being important, kaitiakitanga should be the central concept around which the project was based, and it should have a narrative that refers to this concept from start to end.

Fig. 2 is a continuation of fig. 1, and shows a summary of points relating to kaitiakitanga that were aimed for during this project. One point to note is the circular nature of a lot of what is shown in the diagram. For example, protecting produce from damage leads to less waste, furthering the protection of the environment, and can lead to cost reductions of healthy produce to the consumer (kaitiakitanga of ourselves) due to the producer not having to cover the cost of this.

We cannot simply apply kōwhaiwhai to a product, without first thinking of where it's from, and considering the values of the culture it came from, where it is going to end up, and the impact it has during this lifecycle. Because of this, kaitiakitanga was decided as the concept that would drive this project. It is a key component in a lot of design requirements that were already present, such as packaging needing to protect the contained produce, and necessary for the appropriate usage of kōwhaiwhai within the project.



Fig. 2. Diagram showing some of the specific kaitiakitanga aims of this project. By Chris Britton and Maihi Potaka, 2023.

## 1.4, Confidentiality

Over the course of this project, there were visits to a variety of industrial and research sites, and meetings with industry experts in the packaging, produce production, fibre research, and paper and card production fields. These visits provided valuable insights into these areas, and the possibilities and limitations within. However, this information often came with an understanding between the parties that the businesses, organisations, and individuals that shared the information would remain undisclosed, and often there were no photos allowed of the machinery and equipment used. This means that throughout this project, some of the references used must remain anonymous to various degrees.

The research contained in this exegesis has been approved as falling under Massey University's low risk ethics guidelines.

## 2. Context Review

### 2.1, Kōwhaiwhai

Kōwhaiwhai are patterns that were traditionally painted on various objects, such as rafters of buildings, waka, and possessions of rangatira (Neich 38) by Māori. Traditionally they often depict a range of concepts from Te Taiao (the natural world) and te ao Māori (Neich 33,34). Kōwhaiwhai can take traditional or contemporary forms. Examples of a traditional kōwhaiwhai, one of which being on rafters, can be seen in fig. 3 and 4. These kōwhaiwhai were passed down through generations of artist, with various kōwhaiwhai found around Aotearoa that differ from iwi to iwi. Note that fig. 3 is a reproduction by Herbert William of a kōwhaiwhai of Te Arawa.



Fig. 3. [Kōwhaiwhai from Te Arawa, reproduced by Herbert W. Williams], Ink drawing, 1890s.



Fig. 4. John Dobrey Pascoe, *Kōwhaiwhai on the rafters of Tamatekapua meeting house at Ohinemutu*, Negative, circa 1940.

Contemporary kōwhaiwhai are inspired by traditional kōwhaiwhai, and are modified or new versions of these forms. During conversations with Maihi he stated that contemporary kōwhaiwhai can speak to a wider range of things, such as the example shown in fig. 5, which has depictions of pop culture hero Batman (Potaka 22) and can contain different types of symmetry not seen in the traditional form, such as radial symmetry, as seen in fig. 6. He also stated that anything that strays from the traditional forms, medians, or contents, are usually considered contemporary.



Fig. 5. Maihi Potaka, *Kaitiaki*, Enamel on MDF, 2020.



Fig. 6. Maihi Potaka, *Mutunga Kore*, Enamel on MDF, 2020.

Knowledge is, and has always been, valued highly in Māori culture (Cunningham 62), with oral tradition being an important vessel for holding and passing on knowledge, consisting of many differing formats of narration and art, such as prose, song, and sayings (McRae 11). During a time when there was no written language, visual arts such as kōwhaiwhai were also a way to retain and transfer knowledge (Hanson 211). This physically recorded form of tradition therefore is an important part of both historical and modern Māori culture overall, due to it being a link to historical Māori knowledge. Just like art from other cultures, Kōwhaiwhai have many purposes, such as being a form of rongoā Māori (Potaka 39).

In terms of visual language, an aspect that links this art form to the Māori systems of belief is the contrast. Kōwhaiwhai is created from contrast, the negative space being just as important and holding just as much information as the positive (Potaka). This links back to points discussed in chapter 1.2, Te Ao Māori, where there are strong themes found throughout Māori culture of opposing/complimenting halves. This presented the opportunity to recreate the auxetic kōwhaiwhai through the method of removing material, through methods such as laser cutting.

Through working with these auxetic kōwhaiwhai, I have been given the opportunity to help grow the body of knowledge around how these designs can be applied to packaging, in a way that follows core values seen within Māori culture, and in turn provide a basis for further research and development that assists in promoting these values.

## 2.2, Auxetic Materials.

When a material is stretched, it will usually deform laterally by getting narrower, as sketched in fig. 7, where sides A and B are being pulled, sides D and C deform to be closer together. This property can be described by Poisson's ratio, which is the ratio of the transverse strain to axial strain. Auxetic materials have a negative Poisson's ratio, meaning that when stretched, they instead expand laterally, as seen in figs. 8 and 9. The structure that creates this property can exist from a molecular scale to a macro scale (Wang and Hu 1600).

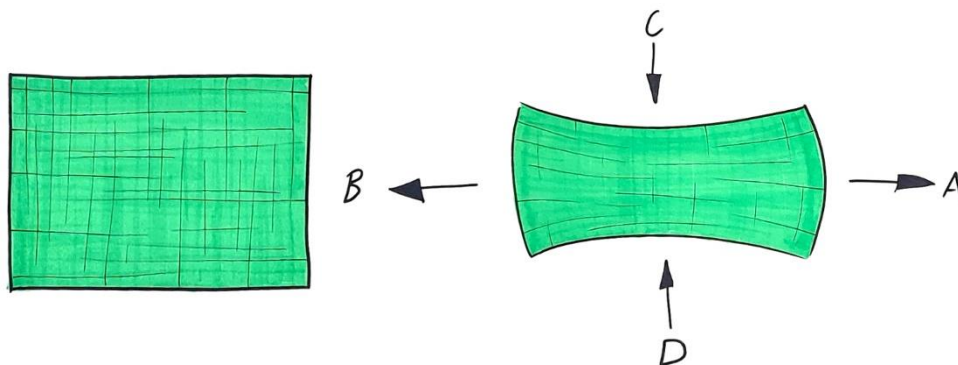


Fig. 7. Sketch demonstrating Poisson's ratio in materials that are not auxetic.

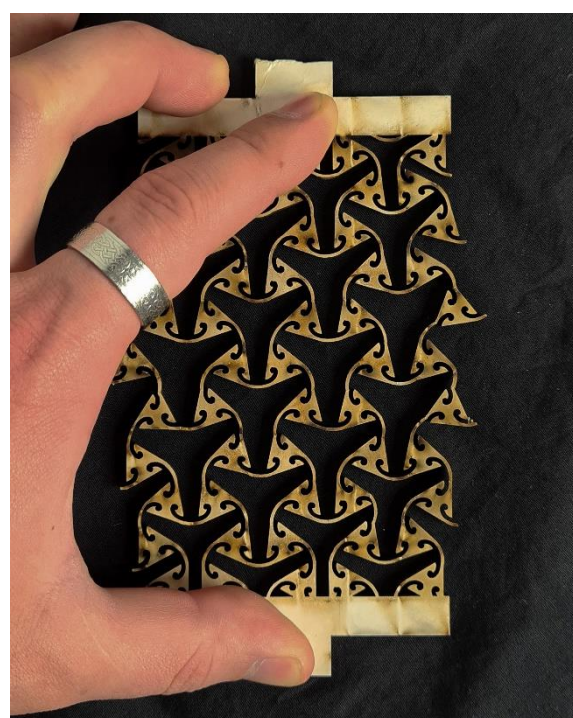
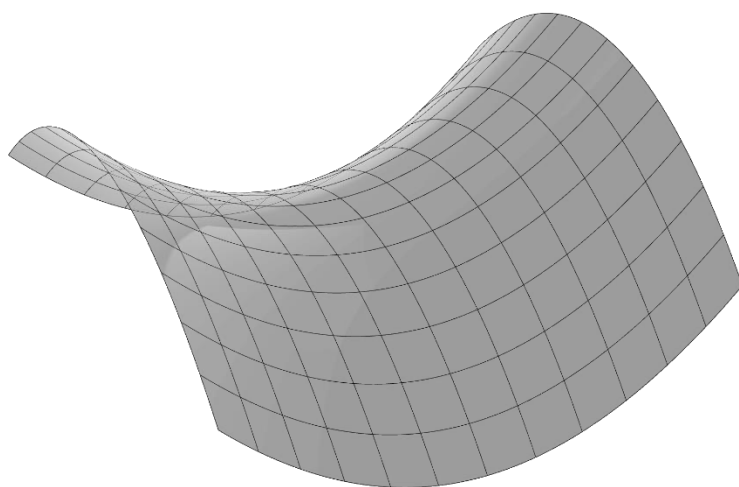
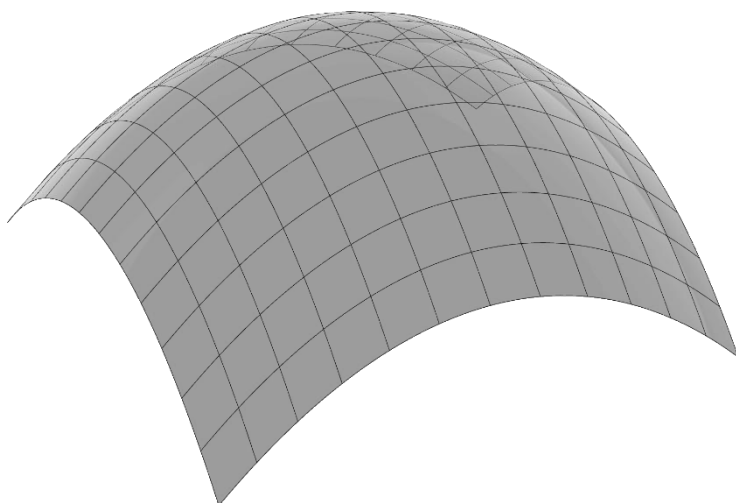
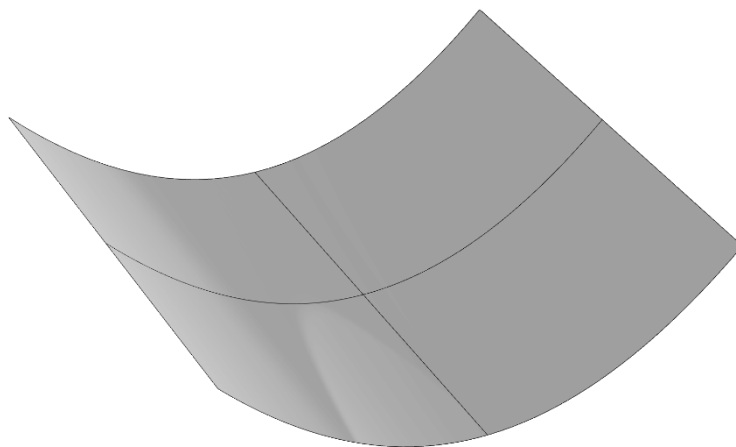


Fig. 8 and 9. Auxetic kōwhaiwhai sampler by Maihi Potaka, 2022, demonstrating auxetic properties when stretched.

Properties of auxetic materials that are of particular interest in this project are its high damping resistance, high energy absorption ability, and for it to display synclastic curvature. (Günel and Ranjbar 456). These curvature types can be seen in fig. 10, with an example of monoclastic curvature. Conventional materials, when bent in one direction, display an anticlastic curvature (Wang and Hu 1606). The ability to display synclastic curvature allows for the potential for more surface area contact, as seen in fig. 11. This has the possibility to reduce bruising of the contained produce items due to increased spreading of load. The damping resistance and energy absorption point to the materials ability to reduce the harshness of knocks and vibration, conditions that can occur during the packing and shipping process.

Page over, Fig. 10. From top to bottom, monoclastic, synclastic and anticlastic curvature.



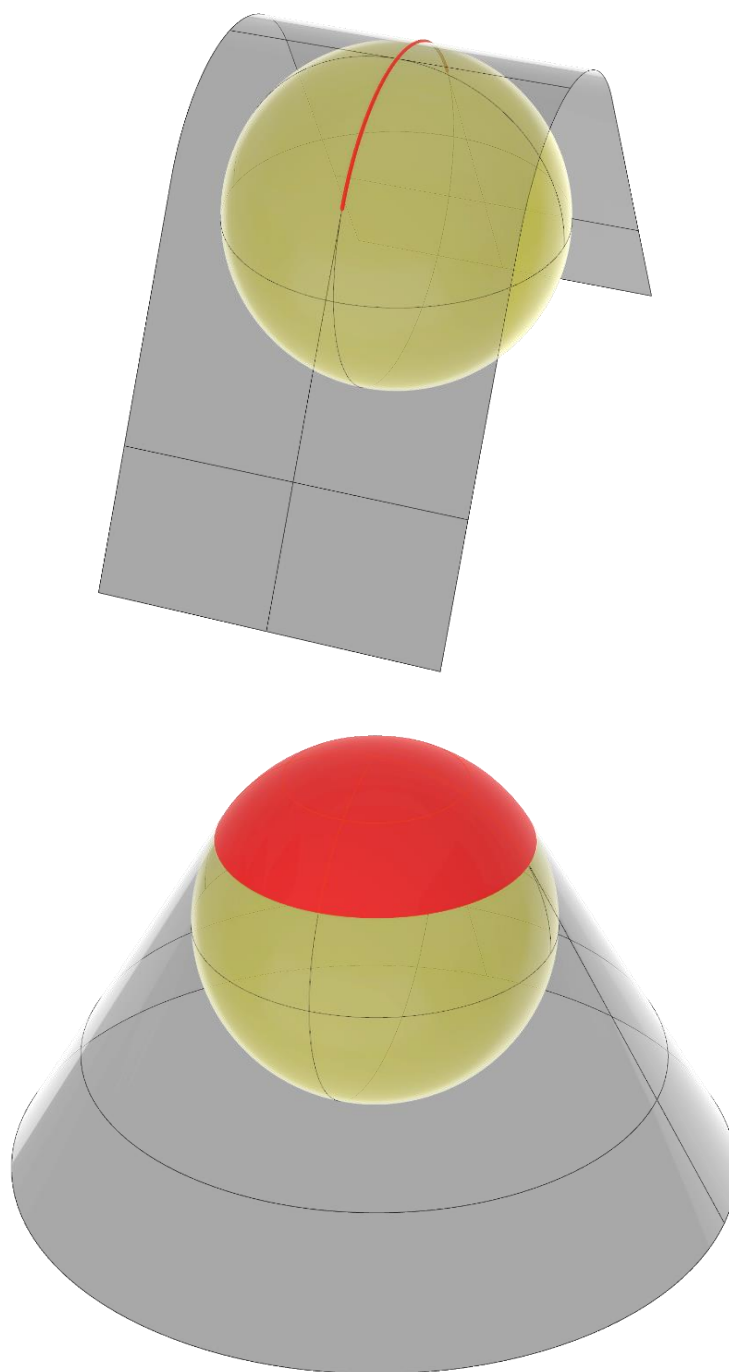


Fig. 11. Showing the difference between the contact area (shown in orange) of a sphere and a material with a monoclastic curve (top) and a sphere and a material with a synclastic curve (bottom).

Coming up with a way to use the auxetic properties of a material as part of a design brief can be challenging, due to their almost counter-intuitive reaction when stressed. This was another of the main challenges for this project and sat near the top of the design criteria hierarchy, meaning that I needed to find as much inspiration from existing products that use auxetic materials as possible.

There are numerous examples of auxetic materials in literature and commercial applications (Bhullar 210). However, most of these are 3D structures and not auxetic in a single plane like the auxetic kōwhaiwhai being used in this project. Auxetic foams, for example, have been tested for use in sports helmets for their damping resistance and energy absorption properties, with research showing that this can be beneficial in reducing peak acceleration imparted on the head over conventional foams in certain circumstances (Foster et al. 6). While this usage of the auxetic materials damping resistance and energy absorption properties in this example is in line with what we are trying to achieve, it has some key differences from the auxetic kōwhaiwhai being used for this project:

- Auxetic foam is a material that has a negative Poisson's ratio no matter which way it is stretched or pulled. The auxetic kōwhaiwhai being used in this project is a sheet material, and the structure is only auxetic in one plane. If not applied to the design correctly, for instance in compression without exterior support, it can be ineffective or distort in ways that do not utilise its auxetic nature.
- The structure that makes the foam auxetic is not discernible with the naked eye. The auxetic kōwhaiwhai I am working with exists on a macro scale, you can tangibly see and feel the structure that makes it auxetic.

These points will present limitations in the methods I can use to apply the auxetic kōwhaiwhai during the design process.

Taking advantage of an auxetic's negative Poisson's ratio for applying mechanical force can be seen in examples such as press fit auxetic fasteners (Alderson and Alderson 571), and the exploration of self-expanding auxetic stents for medical usage

(Xue et al. 14) these are a method of usage that could be translated to a packaging design, for instance push fitting a layer of punnets into a box for shipping, assuring that there is no spare space for punnets to move around in, or creating a suspension system that relies on an auxetic tube narrowing around a container as the container is loaded.

Utilising an auxetic materials ability to display synclastic curvature can also be seen in medicine, with the application of auxetic fabrics that spread load over swelling due to the increased surface area when stretched (Wang and Hu 1608). This could also be applied to fruit packaging, where the force from a piece of fruit on an auxetic material causes out of plane displacement, increasing the surface area of the material in contact with the fruit, potentially reducing bruising.

These cases provide good insight into the sort of mechanisms that can utilise the auxetic materials properties and give me a good base from which to initiate my design thinking, aiming to use its energy absorption and damping resistance to minimise energy transfer to the fruit, and increase contact surface area of the fruit to spread load when it is applied.

## 2.3, The Experience of Food & Packaging

Peoples experience with food varies depending on their individual sense of taste, and associations they might have with a range of sensory feedbacks from the food. However, there are traits that people will often take the same or similar information or experience from. This chapter explores some of these traits and how they impact the persons experience with the food. This includes how these traits can be used in packaging to both draw someone to the product initially, and to change, or amplify positive aspects of their experience of the food during consumption.

Before we even touch an item of food, our sensory perception of this food, for example its smell, the colour of its exterior, and its texture can impact how we perceive the product. This can affect everything from our appetite and how our body prepares for the food (Webb and Whitney 78), to how we taste and experience the food during consumption (Spence 107). This is important because, for a lot of food, the packaging will often be the first part of the produce that the consumer encounters. Therefore, the packaging needs to suggest to the consumer that the product within has more of these desirable traits.

From a first contact experiential perspective, figs. 12 and 13 display the stark contrast in the emotional atmosphere packaging can create. This demonstrates how two ingested products can aim to be perceived as having different benefits and serving very different purposes based on their visual language and aesthetic.



Fig. 12. Mutant Madness pre-workout, Fruit Punch flavour. Displaying an aggressive and busy visual language, both for colours and text.

The pre-workout is aiming to appeal to a market that want something that will push them through a hard session of physical activity, in an environment where masculinity and aggression is often seen as a positive means to push oneself to work out harder. An example of this is the harsh red and yellow colour scheme, Colours often associated with movement and adrenaline (Eiseman 7).



Fig. 13. Allpress Early Harvest Unfiltered olive oil. This packaging implies that it is a natural, healthy, and luxurious product.

The market for the Allpress olive oil shown in fig. 13, however, is a stark contrast. It tries to link the consumer to the fact that, despite the product being processed, it is still somewhat natural and un-adulterated. This is done through a very muted green and brown colour palette, and main text that looks like it was carefully handwritten, intending to impart on the consumer that it was carefully hand-crafted.

An example of how sensory input prior to and during consumption of food can change the physiological/emotive experience we have is shown by Spence, who talks about how the loudness of potato chip packet when crinkled can lead to the belief that the chips inside are crunchier (78). This is also a strong example of how the packaging that food is presented in can impact our experience of that food.

There are two discernible points at play when talking about potato chips from louder packets being crunchier. The first one is a trait of the food, that being how crunchy the chips are, or how loud the sound is when you bite them. The second is the sensory input, the loudness of the packet, that is tricking or leading the consumer to believe that the product has more of that trait.

I would like to link this back to this project by exploring some of the traits that I think a consumer see as desirable in a piece of fruit such as a blueberry:

- Taste, sweetness, and intensity of flavour. Also, perhaps the lack of sourness?
- Juiciness.
- Being fresh.
- Strong colour.
- Being healthy.
- Having the correct texture for that type of produce.
- Low environmental impact.
- Convenience.

I would argue that a lot of these points are very closely related, and the perception of one often closely relates to the others. For example, a piece of fruit being juicy and sweet might make someone assume that it is comparatively fresher than other choices, and that in turn may have an impact on their subconscious perception around its health benefits.

Some methods used to boost the perception of positive qualities through imagery that I have noticed when looking at existing packaging of fresh produce are:

- A rustic aesthetic.
- Oversaturation of a produce's colour on the images on the packaging.
- Imagery of produce that is cut open.

These points can be clearly seen in the example shown in fig 14.

A rustic aesthetic could be aiming to impart to the consumer that the product inside is processed to a lesser extent. This could firstly instil an assumption that the produce has less of an environmental impact due to the lesser extent of processing. Secondly, it could make people think that it's fresher, as it makes the produce seem like it came straight from a small local farm. One method of achieving this rustic feel is by using a material that is easier for the consumer to link to having natural origins, such as a paperboard, as opposed to a polymer. In fig. 14, the normally white, clay coated side of the card has even been printed to look like an uncoated, unbleached card.

Oversaturated imagery on packaging can also be exploited to subconsciously effect consumers' interpretation of the flavour of the produce inside, or be used to make them think that it contains more of the desired traits that the fruit is known for (Krishna and Elder 124). This ties into the relationships that people hold between colours and associated flavours such as sweetness (Spence 41). Some fruit also have a skin or peel that has a muted or less exciting colour, compared to what is inside, such as kiwifruit. This is often addressed through showing the produce cut open on the packaging. Fig. 14 is a good example of this too.



Fig. 14. Golden Kiwifruit box, displaying oversaturated cut in half kiwifruit on the packaging., and a rustic aesthetic through muted background tones and a handwritten style of text.

In relation to this project, I will be exploring how the fruit is presented in the package and will be aiming to impart a sense that the fruit contained within is precious, using the auxetic kōwhaiwhai and design of the box in a way where it deliberately appears to cradle and ennoble the fruit. I will also be looking at the textures and colours of the material used, as stated in previous chapters, to hopefully impart more of a connection between fruit and Papatūānuku, building on the previously stated connections between presentation, perception, and taste.

## 2.4, Presentation in the Supermarket

When designing packaging for a supermarket environment, factors such as what part of the packaging the customer sees first and the logistics of the space it occupies in the store are important considerations, as necessary information about the product needs to be visible to the consumer. Because this project is based around packaging blueberries, which are sold in punnets, focus will remain on how produce sold in punnets are arranged on shelving in supermarkets.

Visiting a variety of local supermarkets gave insight into the space and display methods used for items sold in punnets. Enclosed shelving and stands that hold the packaging, that are a mix of flat, or tilted towards where the consumer stands, often conceal the sides and rear of the packaging, as shown in fig. 15. This means that the information that is most important to see first, such as the name of the product, and any marketable information (organic, locally grown) should be shown on the top or front side of the packaging, along with imagery that will amplify the consumers desire for the product. This is often repeated on both the top and front due to variation in the product being presented at eye level, or below, with the punnet sometimes being displayed on its side or front as to retain visibility of the top, as seen in fig. 16. Detailed information such as the country of origin or a barcode can then be displayed on a side less immediately visible to the consumer.

For this project, there is little merit in breaking this status quo, therefore my design will focus on presenting itself to the customer to fit this standard method of display currently used.

Page over top, Fig. 15. Showing labelling positioning and concealment of the sides of punnets on display at a supermarket.

Page over bottom, Fig. 16. Showing punnets stacked on their sides to retain visibility of the top.



## 2.5, Design Precedents: Existing Packaging

Examining existing packaging for produce, both sold in and exported by Aotearoa, is a valuable source of insight. From this, we can draw out information around manufacturing processes and limitations, and what branding, aesthetic, and materials companies in Aotearoa are successfully using today, both on paperboard packaging, and on fresh produce items.

### Beekist Tomato Range

Beekist use a variety of paperboard punnets to package their produce, with one size and shape of punnet utilizing a combination of cutouts that vary in shape and size, and printed labelling, to differentiate between products. They use a paperboard material appearing similar to BJ Ball's Formakote Spectra, and use the bleached coated side on the outside of the package with a print-heavy design. A point of interest from this product lines packaging is that they use cutouts at both extremes of practical sizing. They utilise very small cutouts on some cartons, as seen in fig. 17, and that they also have cutouts that are big enough for produce to fall out of, as seen in figs. 18 and 19. The smaller cutouts sit at the limit of what is possible with die cutting, based on expert advice received (source confidential).



Fig. 17. Beekist paperboard carton with ruler in MM to display the size of the smallest cut-out they use.

Page over top, Fig. 18. Beekist Tasty Mix punnet, which has quite large openings on the top.

Page over bottom, Fig. 19. Beekist Tasty Mix punnet, showing that the opening is large enough for the produce to pass through.



In terms of construction, this punnet style uses a simple method of folding two triangular tabs and gluing them on the inside of the sides of the punnet, as shown in fig. 20. The lid of this punnet is also an excellent example of the tight inside angles that can be achieved with die cutting.



Fig. 20. Inside of one of the Beekist punnets, showing the triangular folded tabs, and the lid cut-out with tight angles.

### Mill Creek Orchard Blueberries

This is an example of a 125 gram blueberry punnet that is made out of rPET, and can be seen in fig. 21. This style of punnet is the one I found to be the most common in supermarkets I visited, and provides a good starting point for observational analysis around what the standard is currently.



Fig. 21. Mill Creek Orchard Blueberries.

The colour scheme used on the labelling of this product is one I saw frequently on other blueberry packaging. The reasoning and associations I take away from this choice are as follows:

- The berries are very dark, therefore it is beneficial for the sake of contrast and readability to put the written information in white.
- The printed blue is at a higher saturation than the actual blueberries, this could be to draw attention more, or as mentioned in chapter 2.3, to draw on people's association with a higher saturation of colour being more flavoursome.
- The green is to reference the leaves of the plant, and provide a complimentary colour to the blue. It adds what I perceive as a fresh and natural feeling to the palette chosen.

The package itself is a lidded vacuum formed recycled polyethylene terephthalate, or rPET. The amount of space it takes up in a shipping box is 533.9cm<sup>3</sup> (dimensions are 130x111x37mm). This is relevant as I want to avoid my design taking up an excessive amount of space over the current standard, as it means the shipping process has a higher environmental impact (Ahmad et al. 9), bringing the project further away from its driving principle.

The punnet, when opened (fig. 22), felt utilitarian to me. It did not elicit any identifiable emotive response when interacted with. One point worth mentioning is that this style of rPET punnet can be useful for rinsing the contents prior to consuming, which is a process that consumers may not want to do in a paperboard punnet.



Fig. 22. The open Mill Creek Orchard blueberry punnet.

The only usable space for information about the product is on the top and bottom of the punnet. This is one area where paperboard punnets can excel, as the front and sides can also be used, providing the consumer with information even when the punnet is at eye height.

Overall, this product is very basic. During a meeting with a business that packages their blueberries in a similar punnet, they informed me that the form language of this style of punnet is mostly driven by function, with the graphic design on the label being the part they rely on to communicate an aesthetic. This presents to me an opportunity to come up with something that people are not at all familiar with, and because of that, hopefully creates interest and intrigue.

### Dental products

During my visits to supermarkets, I noticed that dental care brands were consistently using green marketing to try and sell products, with uncoated paperboard packaging being one method used, as seen in fig. 23. While this is not in the same category of product as blueberries, I think it is beneficial to examine the other products utilising the same style of packaging that my design will be sharing the supermarket space with. For this, I will inspect the form language of the packaging, and the aesthetic of the labelling.



Fig. 23. The range of toothbrushes that are targeted towards the eco-conscious found at a local supermarket.

I found that in my local supermarkets, many examples of eco-products and products packaged in card seem to rely on a colour palette that is centred around the colour of the card, and as stated in chapter 2.3, sometimes this colour is even printed on. Further examples of this can be seen on the Grin toothbrushes in fig. 24 and the Colgate bamboo brushes in fig. 25.



Fig. 24. Grin brand toothbrushes with printed on unbleached pulp colour.



Fig. 25. MouthFRESH Bamboo (left) and Colgate Bamboo (right) toothbrushes.

The MouthFRESH toothbrushes shown in fig. 25, and the NZ Hothouse Heirloom Cherry Truss tomatoes in fig. 26 utilise an unprinted, unbleached pulp finish, with high saturation printed colours to retain contrast, unlike where the faux unbleached pulp texture is printed on, and a lower saturation colour is frequently used. To me, the printed on faux unbleached pulp texture feels too fake and fails at producing the emotive response linking it to being natural it is trying to achieve. This may be useful for the design work I do, as linking my design to papatūānuku is an important aim.



Fig. 26. NZ Hothouse Heirloom Cherry Truss tomato packaging, showing a high saturation red being used.

These products display important information around current aesthetic and visual language used with common blueberry punnets, and other fresh produce and products that utilise paperboard in their packaging construction and aesthetic. They also provide some insight into the technical limitations and possibilities of die cut paperboard packaging, which will be useful during my design process and reflection.





## 3. Design Criteria

<u>Aim:</u>	<u>Reason:</u>	<u>Method:</u>
Utilise the auxetic properties of the kōwhaiwhai.	This is the main aim of the project. Exploring this is why the auxetic kōwhaiwhai is being used in the design.	Through research, experimentation, practical exploration, and play, to discover a method of utilisation that fulfils this requirement.
Ensure the kōwhaiwhai is used in a way that is culturally appropriate.	Because I am being entrusted to work with something that is of high importance to a culture that is not mine.	Through understanding the system of beliefs around why this form of art is important to Māori culture. To listen to Maihi and follow his instructions and recommendations.
Create a design that displays a narrative of kaitiakitanga.	It is the concept that the project is based around and integral in using the kōwhaiwhai in a way that is appropriate.	Through designing packaging that addresses key points shown in chapter 1.3 using a variety of methods.
Consider and acknowledge technical aspects around manufacturing, filling, and using the design.	So that there is knowledge gained around the challenges involved in packaging using auxetic kōwhaiwhai from this project.	Through utilising knowledge gained during the research process to inform design choices, through identifying issues when evaluating the final design and process

## 4. Design, Method, Process

### 4.1, Method

The design work for this project was undertaken working in collaboration with Maihi while utilizing methods from Donald A. Schön's *The Reflective Practitioner* and an iterative design process.

Reflective practice was used because it presented the best approach to addressing the design criteria with my design work, and reflecting on how well I am addressing these requirements with each development:

- The kaitiakitanga framework, working with a natural fibre material.
- Working with kōwhaiwhai, integrating it into the design in the correct way.
- Technical viability, what can and cannot be achieved in a manufacturing process.
- Cost, for example not being able to use a thermoforming process.

This method helps me take into consideration these factors and work to come up with solutions to issues I had during this process, but was also integral in identifying issues that cannot be avoided, which will be talked about further in the reflection.

Iterative design was used due to working with a wide array of different experts in different fields in an interdisciplinary and cross-disciplinary process. This allowed me to conceptualise, develop, and present versions of my designs to these experts and those I was working in collaboration with, then gather feedback and develop the design further based on this, repeating this process multiple times.



## 4.2, Material, Site Visits

Due to the project being driven by kaitiakitanga, it was important that the material used in this project was derived from natural fibres, therefore, research into potential materials began early on. This led to multiple site visits, including to two paper mills (one of which is shown in fig. 27) and two separate trips to Scion, Aotearoa's forestry and wood product crown research institute.

Initially I started by watching an array of video resources about how paper and moulded pulp products such as egg cartons are made, to gather an understanding of the basic composition and production of fibre products. This served as a basis for understanding terminology and concepts presented during later research.

While working with a recycled fibre would have furthered the kaitiakitanga narrative guiding this project, the site visit to OJI Fibre solutions in Kinleath on the 28th of June 2022, specifically their commercial fibre recycling facility, and information gathered from experts during this visit, showed why that was not practical. The process used to break down the card and paper being recycled, and the methods used for removing contaminants did not allow for the removal of toxic chemicals such as those created by *Clostridium botulinum* bacterium's secretions. It also does not take into account factors such as the source fibre and binders not coming from an origin that was intended for food contact use, meaning the recycling method used to obtain resources to create this material would need additional processes to thoroughly correct microbiological and chemical contamination (Ecabase and Ottenio 83), adding cost. Cost of the final packaging was already a concern, so using recycled material was ruled out. There were also considerations around using an alternative natural fibre such as coconut husk fibre, however, due to the research around using the auxetic kōwhaiwhai being more important to the project, this fell outside of the scope and would have been too much of an undertaking to add in.

Previous page, Fig. 27. Paper mill I visited for research.

Another possible avenue of exploration was creating a design work made of moulded or thermoformed pulp. Moulded pulp and thermoformed pulp packages are products that are in the shape of the mould that pulp is sucked on to from a suspension bath, and thermoformed products follow this process but are then also clamped between two hot moulds at the end. Figs. 28, 29 and 30 show examples of products made using these methods.



Fig. 28. A moulded pulp packaging item. Note the smoother texture inside where the pulp was pulled onto the mesh mould with a vacuum.

Page over top, Fig. 29. A thermoformed pulp packaging item from Mobling. The side shown here is also the side where the pulp was pulled onto the mesh mould.

Page over bottom, Fig. 30. The other side of the thermoformed pulp packaging item from Mobling.



During one of my trips to Scion on the 27<sup>th</sup> of June 2022, I was taken on a tour of their facility, where I was shown the Kiefel Natureformer, as shown in fig. 31, which is a small-scale thermoforming machine. This was being operated by Dr. Kelly Wade, who was researching using a variety of sources of fibre to create thermoformed trays, pictured in figs. 32 and 33. While this would have provided a fantastic opportunity to create forms that are difficult or impossible to create from a flat paperboard stock, this machine requires multiple custom-made tooling components for each step of the process it uses to create these trays, as seen in figs. 34 to 36. As stated by Dr. Wade during the visit, the costs of creating this custom tooling and the lead times involved are very high, making it unsuitable for my project.



Fig. 31. Kiefel Natureformer, a small-scale thermoforming machine.

Page over, Figs. 32 and 33. Trays made by the Kiefel Natureformer.



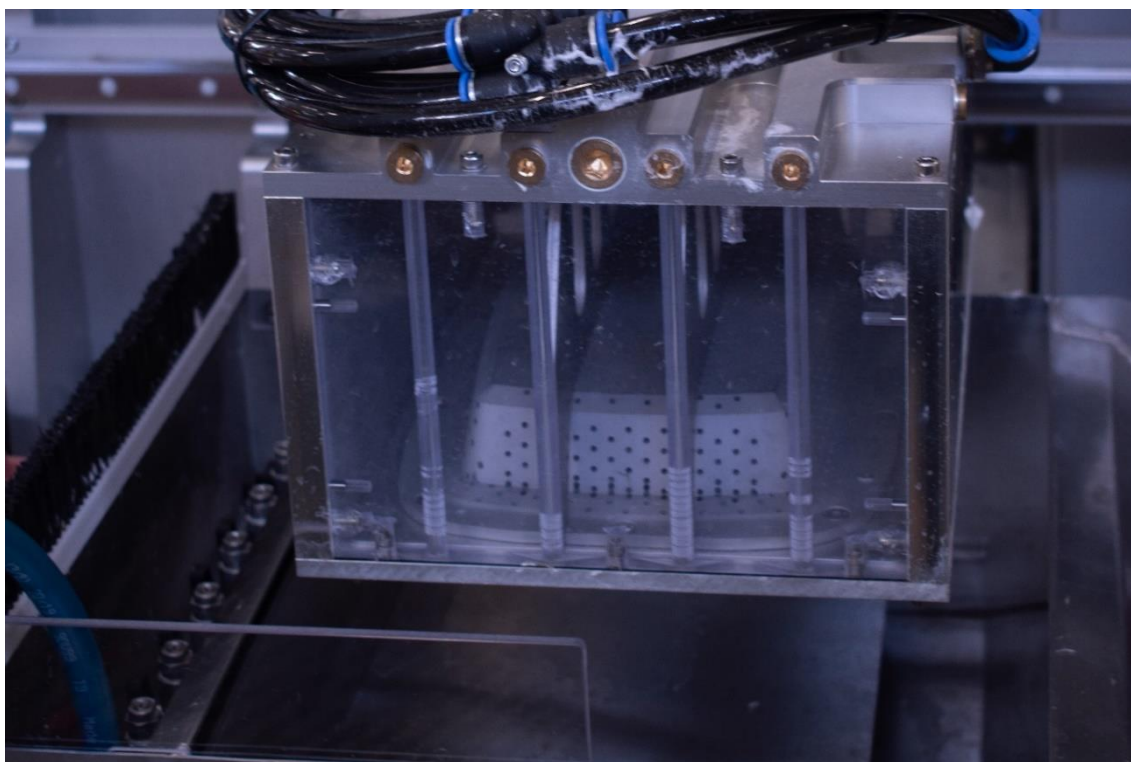
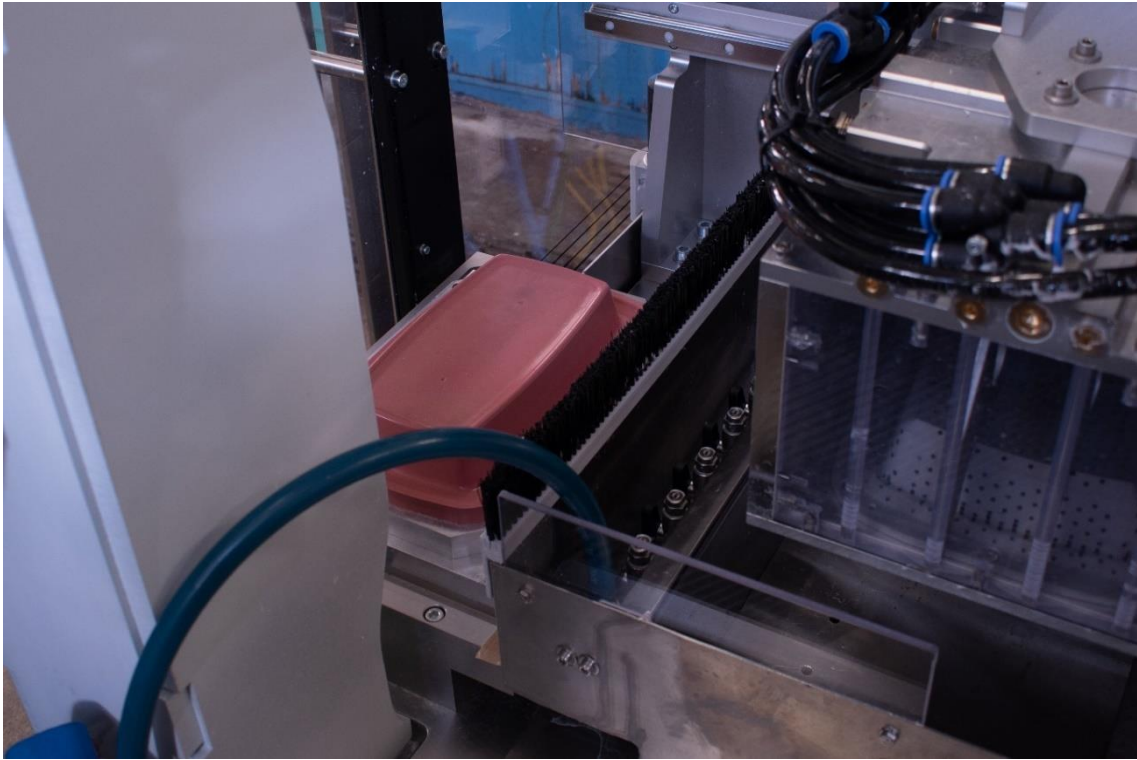


Fig. 34. Showing the component that collects the fibre using suction onto a mesh (inside, not pictured).

Page over top, Fig. 35. The silicone mould (pink component) that helps to press the fibre into an initial shape and remove excess fluid from the pulp.

Page over bottom, Fig. 36. The two machined dies that heat and press the pulp into the final product.



At that stage it was decided that it would be best to use an existing sheet material product. Finding a suitable material to use throughout the project, and sticking with it, then became of high importance. This helped with the design process in two ways:

- The parameters used when cutting the kōwhaiwhai can remain consistent, giving consistent results when stressed.
- I could gain an understanding how the material is going to react to being manipulated during exploration and concept crafting. This makes producing physical concepts more seamless, due to being able to apply the correct techniques to manipulate the material based on experience.

The paperboard chosen as a result of this had to be something that was readily available and established in the commercial market. Two accessible products that fit this description were Formakote Natura, and Formakote Spectra, from B J Ball Papers. These are multi-layered, coated kraftback paperboards, that are similar FDA approved products, with one main point of difference. Both stocks have a clay finish on one side, which is usually used for printing (as shown in chapter 2.8), however the other side of the stock is finished with two different types of pulp. The Natura product uses a bleached pulp, and the Spectra product uses an unbleached pulp. This can be seen in figs. 37 and 38.

Page over top, Fig. 37. Two squares of BJ Ball Formakote Natura, the top square showing the clay coated side, the bottom square showing the bleached pulp side.

Page over bottom, Fig. 38. Two Squares of BJ Ball Formakote Spectra, the top square showing the clay coated side, the bottom square showing the unbleached pulp side.



From a design standpoint, the unbleached pulp side of the Formakote Spectra presents an opportunity to further the connection to the kaitiakitanga concepts guiding this project through visual means, due to the natural looking texture. There is already packaging that makes use of this, with the unbleached pulp side of a paperboard presenting on the outside of the NZ Hothouse Truss Tomato range, and the clay coated side being used inside, as seen in fig. 39.



Fig. 39. NZ Hothouse Heirloom Cherry Truss product, showing the clay coated side of the paperboard being used inside the box.

The sum of the aforementioned points guided me to the conclusion that it would be best to stick to using an existing flat card or paper product and exploring a range of methods of manipulating this material. The goal is to use this material to design packaging that generates interest, drawing the consumer to the product, and impacts their perceptions of the product within, based on their experience with the packaging. If done successfully, the resulting heightened interest in fresh healthy produce within would align with the kaitiakitanga of our bodies and our people.

### 4.2.1, Creating Paperboard Packaging

Paperboard packaging is not a new thing. However, designing paperboard packaging for produce that utilises a single plane auxetic materials properties, at the time of this project being carried out, is something I cannot find evidence of. This means that to begin exploring how one might produce this packaging, we must understand the process and limitations of current technologies used to manufacture paperboard packaging.

The type of paperboard packaging that is the closest to what this project aims to achieve is a printed, punched, folded, and glued paperboard box, sometimes referred to as a folding carton. The previously shown images of the NZ Hothouse and Beekist packages are examples of this, and it is an extremely common type of packaging, which is used for everything from cereal to modern eco-friendly toothbrush boxes. This technology is incredibly widespread, and there are records that indicate it has been in use since 1817 (Hook and Heimlich).

The creation of the modern format of this type of packaging usually consists of a process that takes place in two locations after the paperboard sheet has been produced. The first location is where the paperboard is printed and cut and sometimes glued, to produce a flat printed and profiled blank or a side seam glued folded flat carton. The second location is where these flat containers are erected into their final form, filled with goods, and closed (Kirwan 262). This means that for my project, I have to keep in mind that the process of folding and gluing the printed and cut blank will most likely have to take place in the facility that is packaging the produce, as shipping empty containers is an incredibly inefficient thing to do.

The biggest technological limitation in relation to this project is cut-out size. While I had trouble finding specific information around this (likely due to different machines and processes having different limitations), existing products, and conversations had in confidence with industry professionals, indicate that this could be a serious issue when it comes to cutting the auxetic kōwhaiwhai

out. This could possibly be overcome with more modern, albeit less efficient technology, such as laser cutting, which is what I have been using to create prototypes, however this is an extremely slow process.

Manufacturing complexity, and therefore cost of the packaging must be a consideration during this project. However, there has been a strong, consistent theme that has surfaced throughout the project. There is market space for high-end, high-cost packaging that increases consumer interest and perceived value of the product within. This was something that has been brought up in multiple meetings with representatives of companies that export produce, and is seen frequently in Aotearoa's export industry, for example New Zealand Cherry Corps with their box of cherries that sell for more than \$2 per cherry in the box in China (Edwards). While this project is not intended for any commercial usage, it helps to situate the research to be done in a place of viability.

The next consideration is the process of folding and gluing the printed paperboard blank so that it is ready for filling. This process usually takes place at the start of the packing line, at the location of packing, and is done by a machine (Kirwan 300, 301). The impact of this step on my design work is incredibly difficult to quantify, as complex mechatronic processes are often closely guarded trade secrets. I am sure, however, that there would be a method of working around this, either through a high tech fully automated process or a hybrid automated and manual process.

#### 4.2.2, The Packaging Line, Site Visit

Produce packaging processes vary depending on the scale of the operation, and what type of produce is being packed. This projects design work being based on packaging for blueberries, and on 13 October 2022 I was fortunate enough to visit a site where, among other things, commercial blueberry sorting and packaging takes place. From this I was able to learn a lot about the process of packaging this fruit on a commercial scale, and details around packaging viability based on scale.

Part of this visit was being taken through the process that their particular sorting and packaging machine uses to take the harvested berries from their loose state, to their sorted and packaged state. The first few steps of this process involve the berries being electronically sorted through a machine that detects their size and colour. This machine pushes the berries onto different paths of the packaging line based on the grade it has determined them to be. From there, one grade of berry is put onto a section of the packing line that weighs it, drops it into the consumer punnets, and closes them. This is the final product format, which is then loaded by hand into boxes for shipping.

The point of interest in relation to this project is the part of the line that divides the fruit into weighed quantities and dispenses it into the punnets. This is due to the fact that the design of the punnet is essential for the mechanisms to operate on certain parts and features of the punnet. The punnet being used was a fairly standard type, and can be seen in fig. 40.

Page over, Fig. 40. Blueberry punnet used in visited packing line.



The pictured punnet is first put into a dispensers magazine, pictured in fig. 41, in stacks, by hand.



Fig. 41. magazine and dispenser mechanism for empty punnets, with a part of the conveyor that carries the punnets visible at bottom right.

The empty punnet uses a lip around its edge to sit on top of and underneath 4 rails, allowing it to slide and be held in place. It is pushed along the rails and positioned by a tab attached to a conveyor underneath it. Part of this is shown in fig. 42.

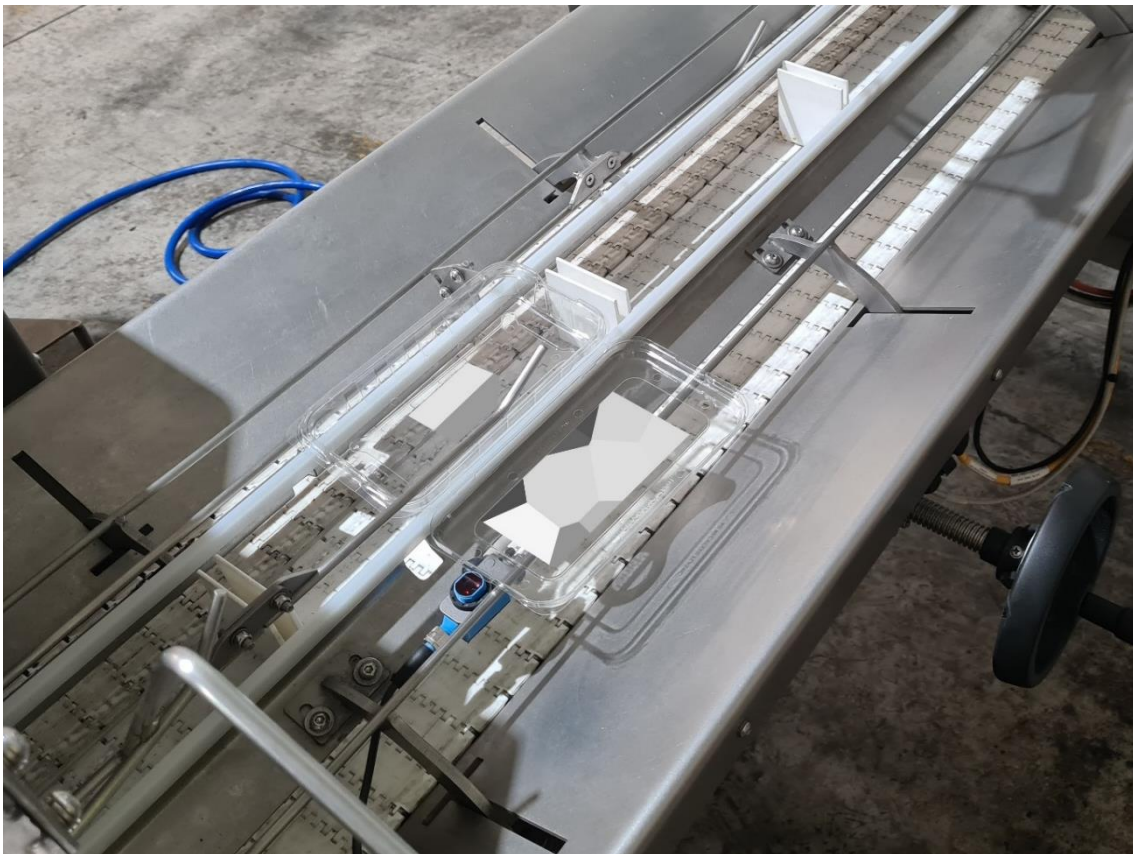


Fig. 42. The empty punnet sitting mostly in its guiding rails.

This is then moved by the conveyor under the weighing gates, as seen in figs. 43, 44 and 45. When all the gates have the correct amount of blueberries in them, they open, releasing the fruit into the line of empty punnets underneath.



Fig. 43 The empty punnet, as if it is about to go under the weighing gates.

Page over top, Fig. 44. The inside of the weighing gates, above each gate fills with fruit until it is at the correct weight for a single punnet, then the gate opens.

Page over bottom, Fig. 45. The full line of weighing gates. Each gate would have 1 punnet underneath it.



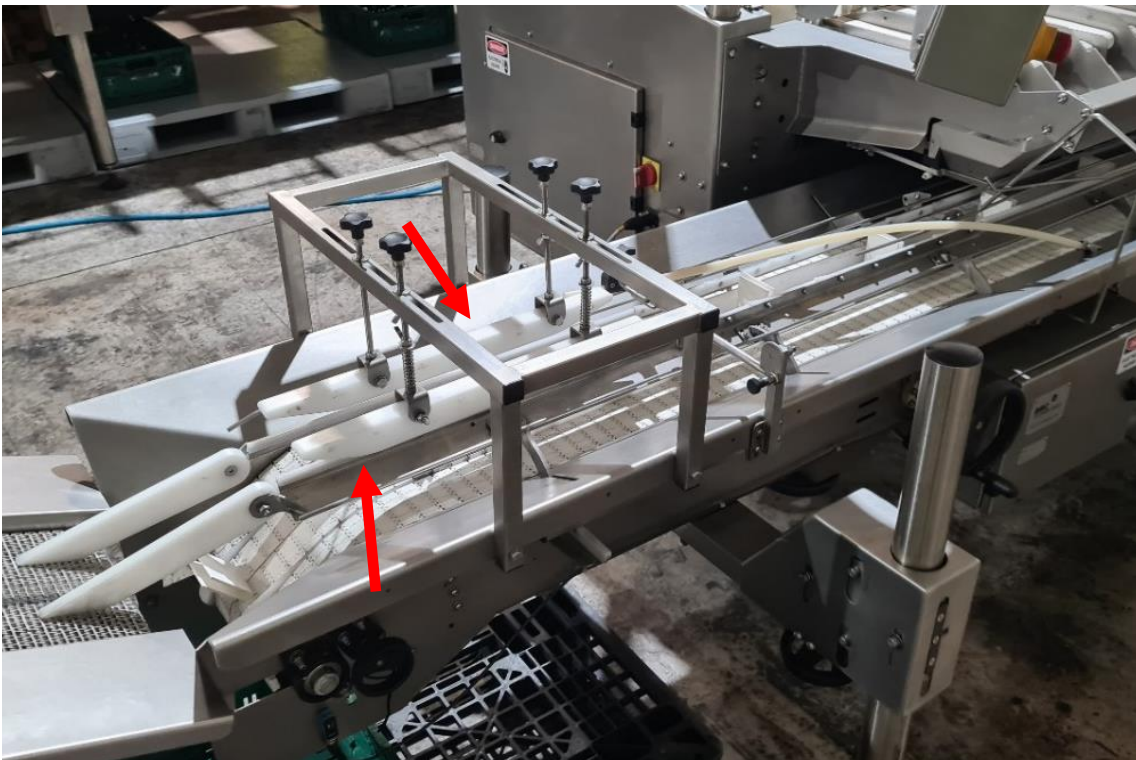
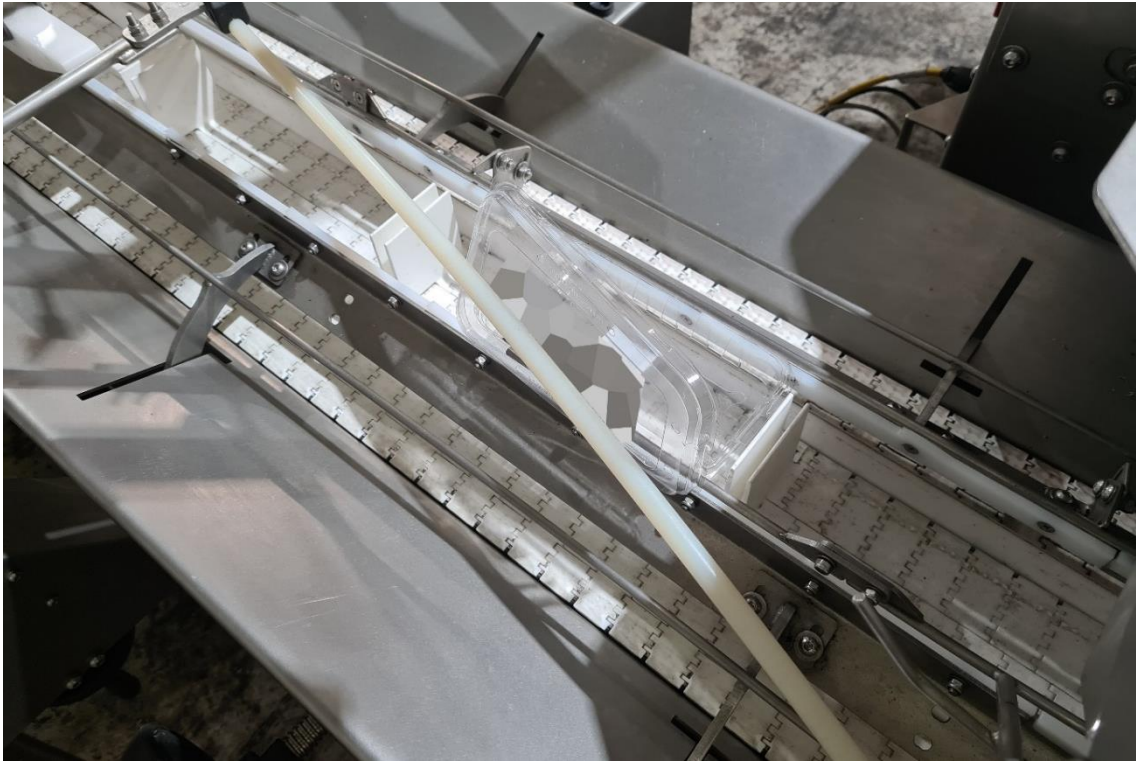
Once this process is complete, the filled punnet is pushed along the track and through a device consisting of a nylon rail that flips the lid over, as pictured in figs. 46 and 47, and two nylon blocks that force the lid down evenly, as pictured in fig. 48. This completes the process of filling the punnets, and it is then moved off to the area where it is put in its shipping boxes.



Fig. 46 The punnet, which would be full of berries, at the start of the process of having its lid flipped over by a nylon rail.

Page over top, Fig. 47. The intermediate stage of the nylon rail flipping the lid over.

Page over bottom, Fig. 48. The two nylon blocks at the end of the rail that finish the process of closing the lid.



Once this process is complete, the blueberries are chilled, and then distributed to wherever they are going, either a retailer here in Aotearoa, or overseas.

Scale influences the methods used in these steps. Experts from the business visited were confident that it was very much viable to hand package the highest qualities of berry, after they have been sorted by the machine. This is a key point that influences the design work, as it allows me to create packaging that does not go through parts of the process that carries out tasks that require the packaging to have a certain shape or features to work, the two major ones being the mechanism that dispenses the packets onto the conveyor that carries it under the weighing gates, and the mechanism that closes the lid of the container.

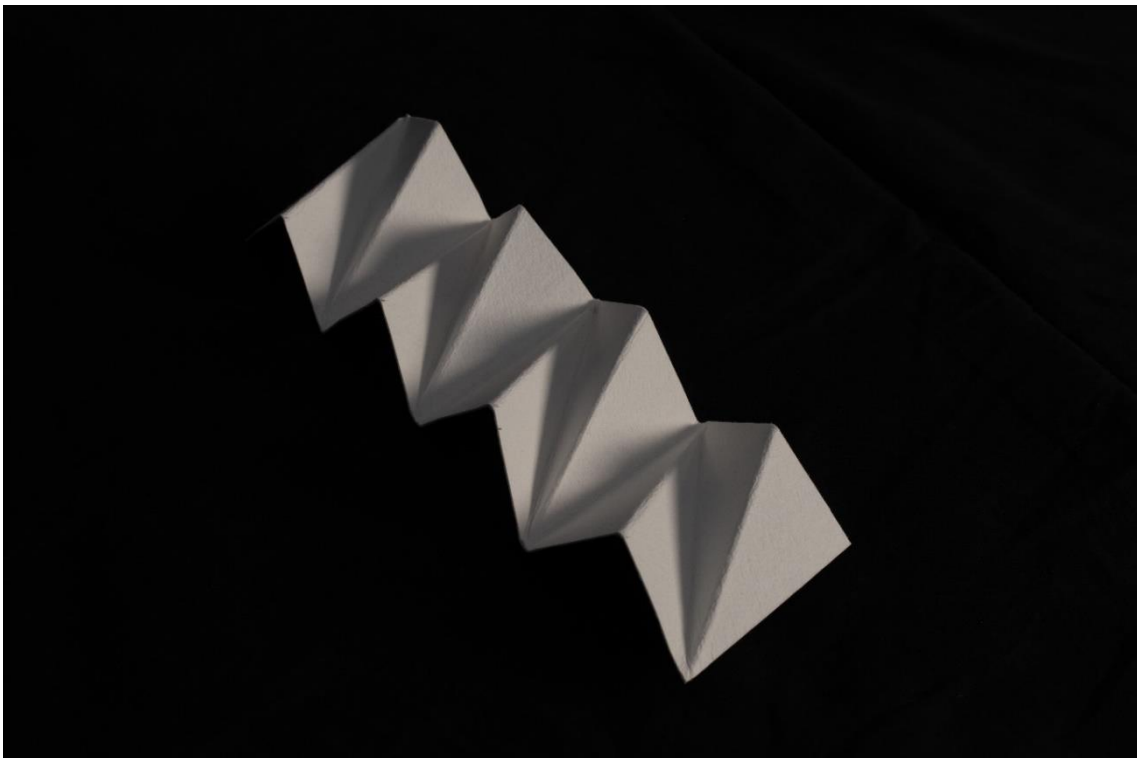
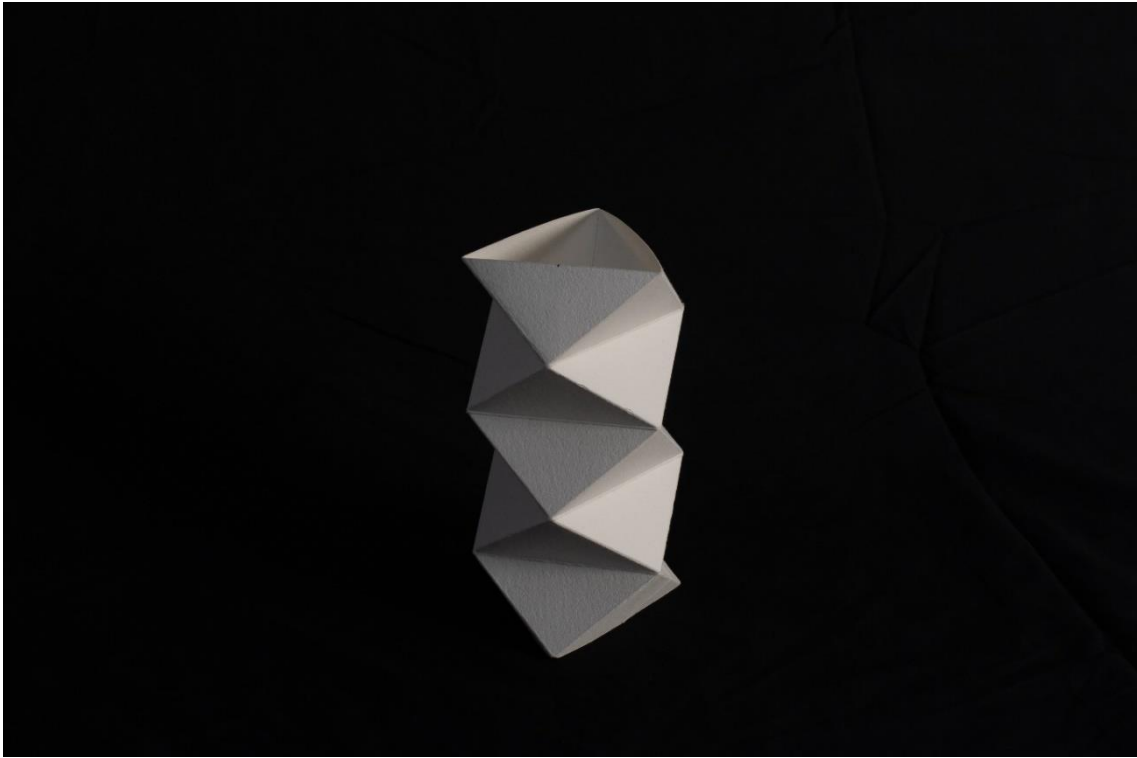
I do, however, need to be aware of the way that the punnet I design fits into a larger box for shipping, and the way that the punnet stacks on top of itself when full.

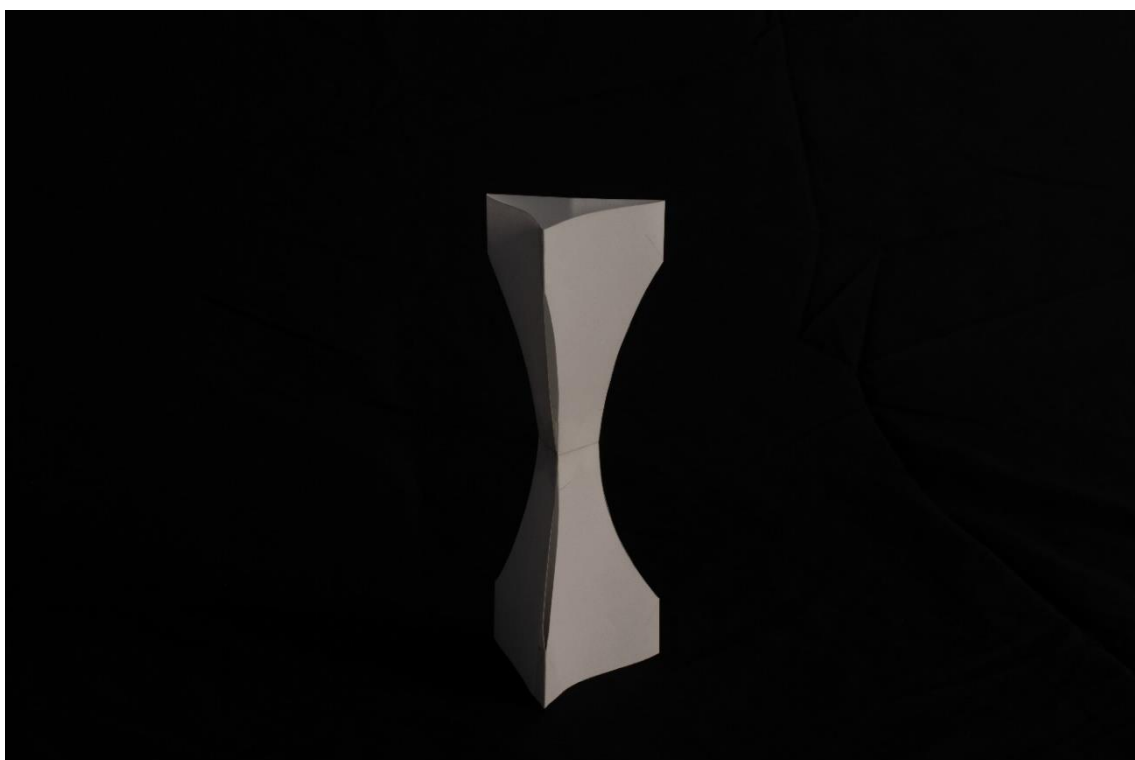
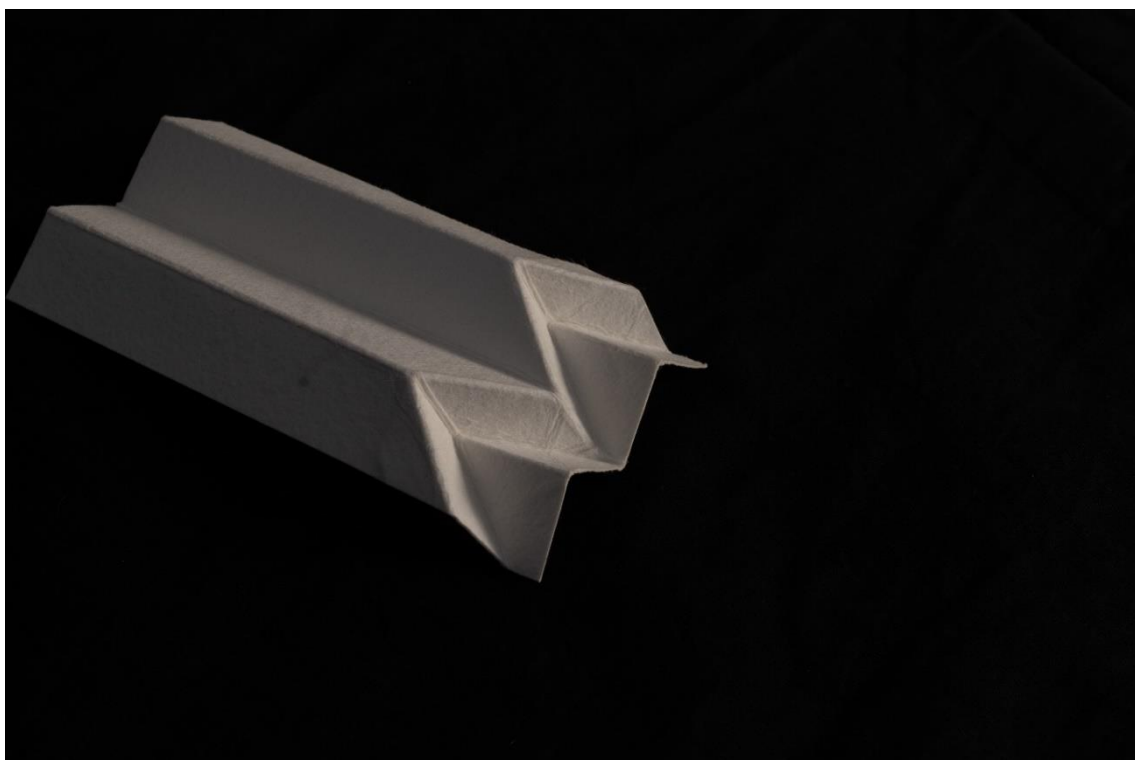


## 4.3, Design Work

The design process was started adjacent to starting the research process, and involved a lot of play. This method was used to get a handle on how natural fibre and paper materials can be manipulated. I tried to be as varied as I could with the ways I manipulated the materials used, the following fig. 49 shows some of these experiments. Most of the items seen in the following chapter were laser cut, as this was the best way to create iterations affordably and accurately.

Following 3 pages, Fig. 49. Early experiments in paper manipulation methods and form.





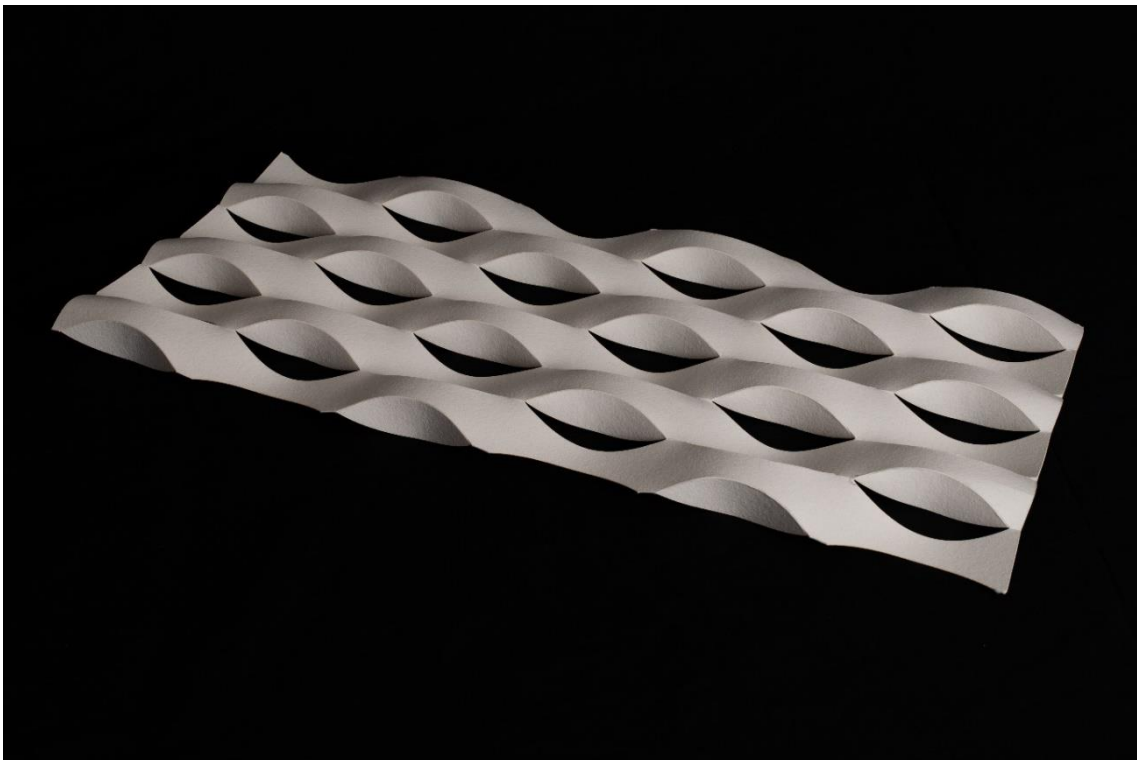
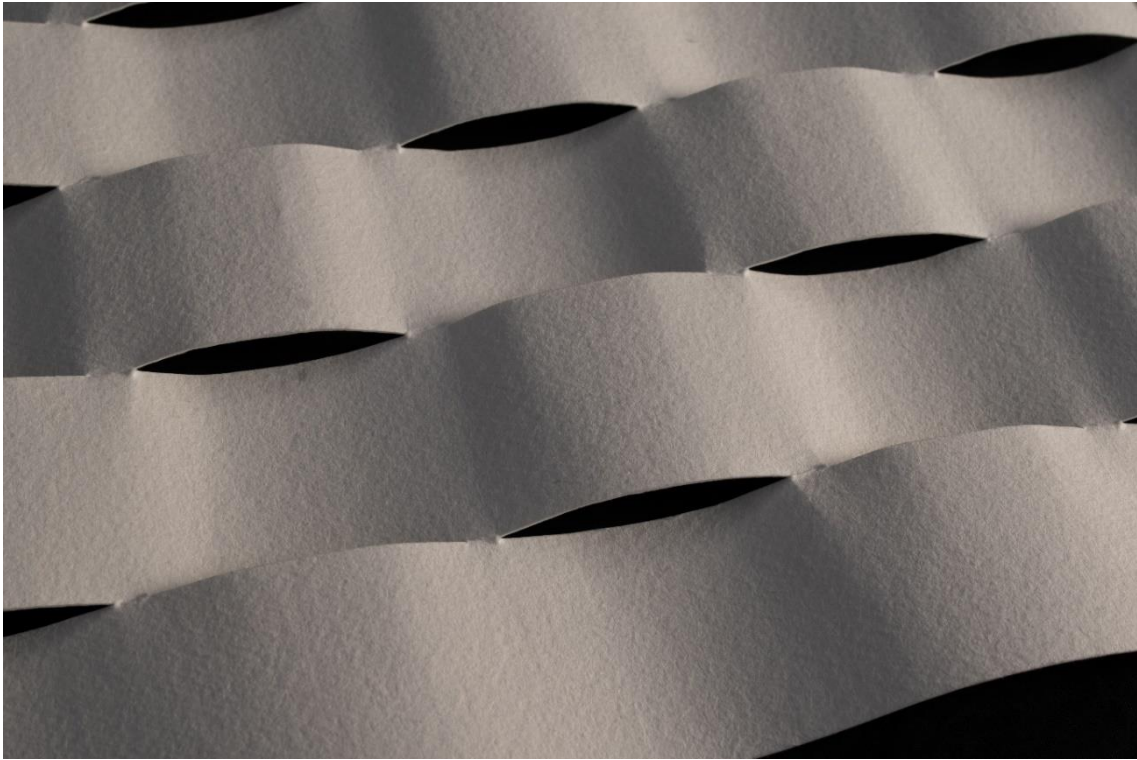


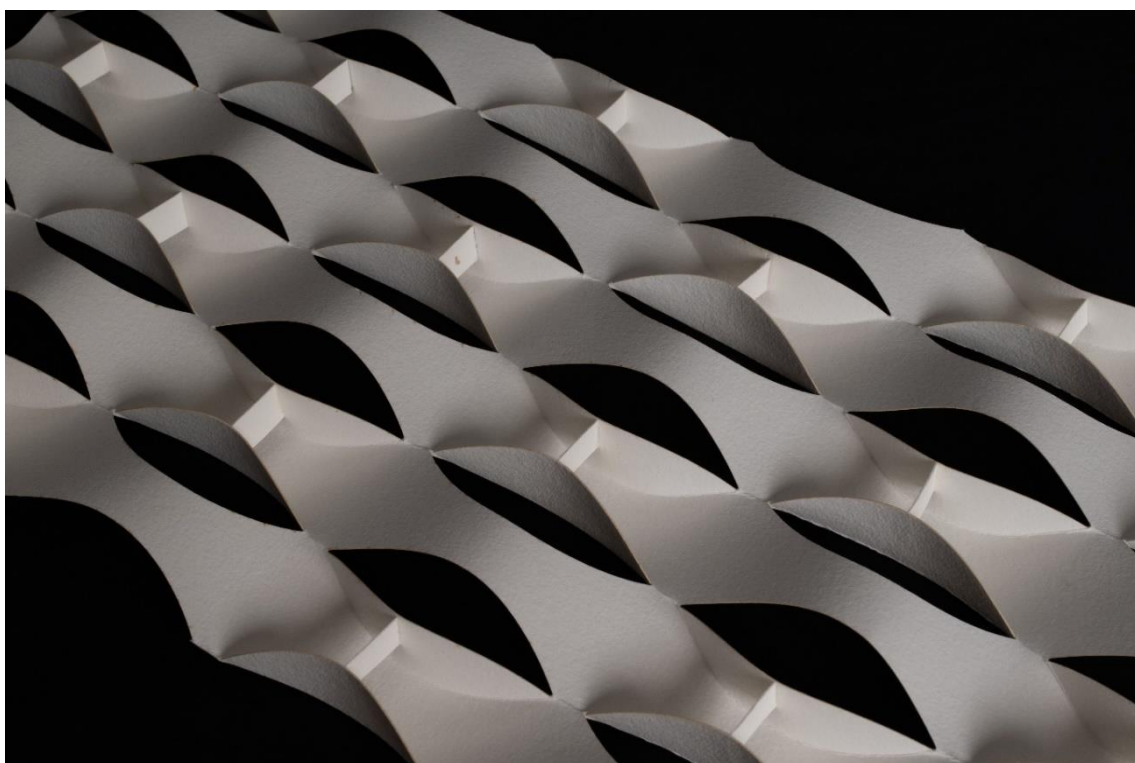
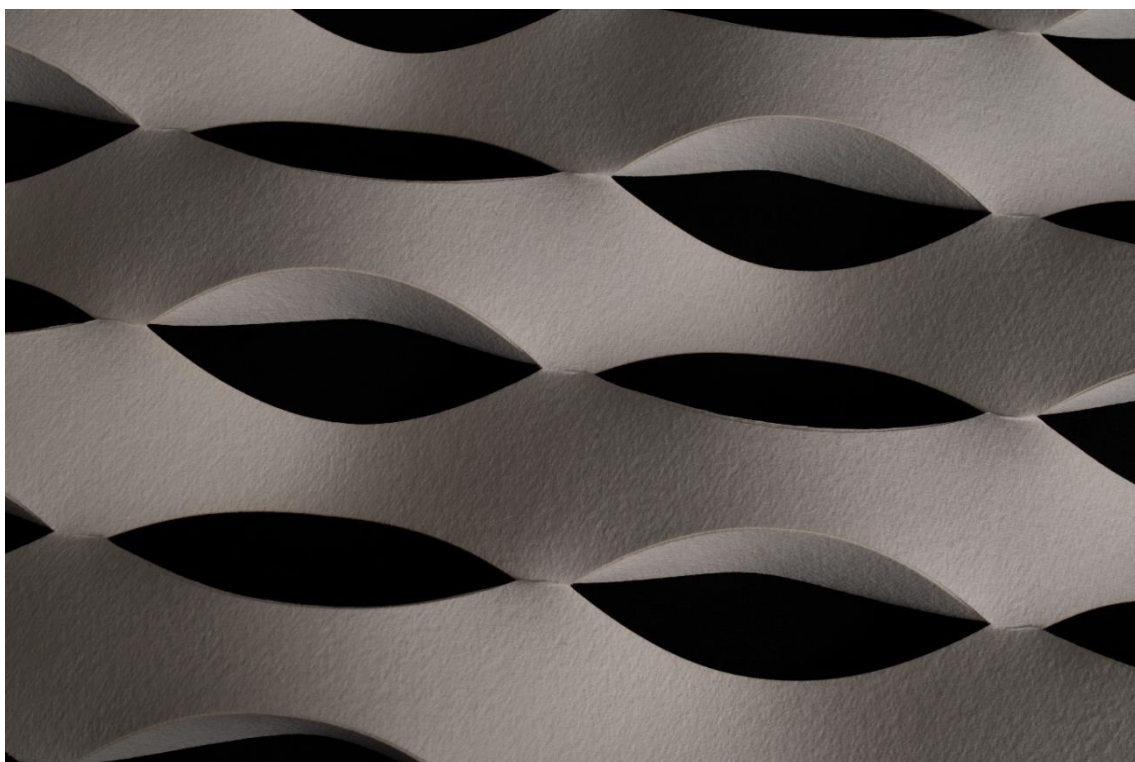
A pocket pack tray is an item of packaging that has a cup for each piece of fruit, so they remain nicely presented and do not rub together in shipping. This inspired early design explorations that can be seen in the following figs. 50 and 51, with the aim being that it would be constructed from a flat piece of material that has been cut or folded to provide support to the fruit it holds, without causing points of highly concentrated pressure. This was done to further explore and reimagine how fruit is currently packaged.



Fig. 50. The initial concept for the pocket pack.

Following two pages, Fig. 51, Details and developments on the pocket pack concept





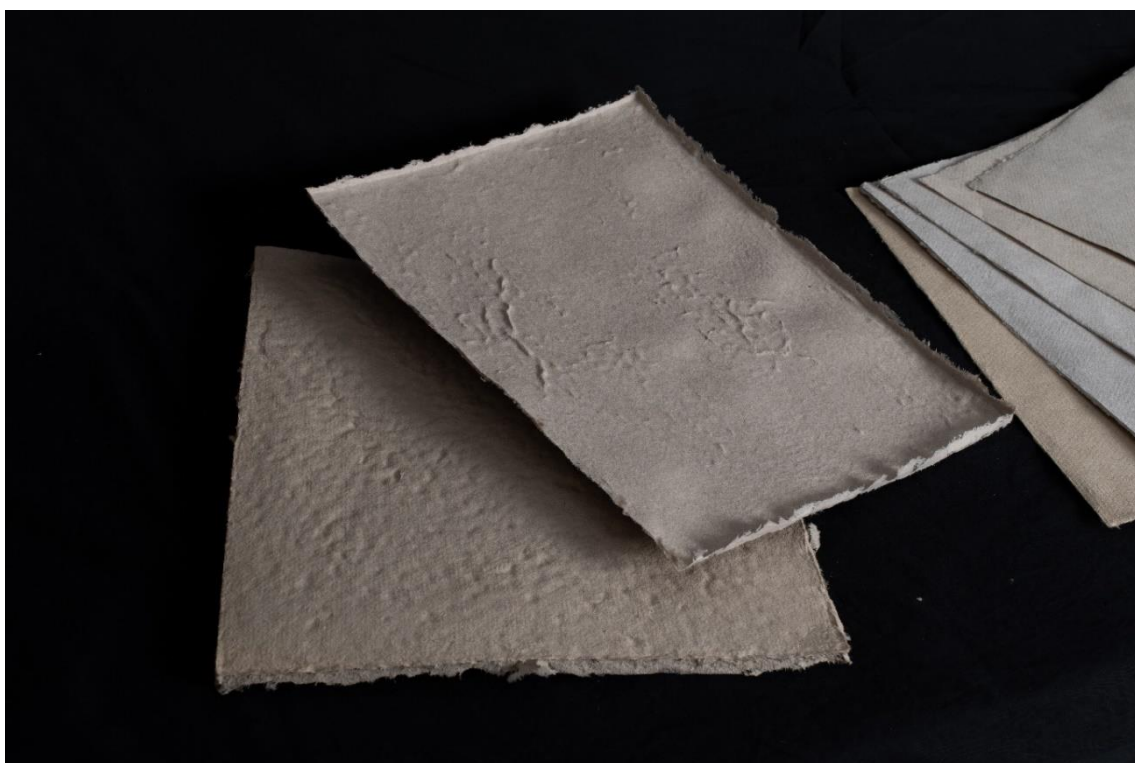
Making paper was also a process I experimented with at the start. This was done to further my understanding of the structure of modern paper and comprehension of how paper fibres are impacted and changed when you manipulate the paper, for example scoring paper with a blade vs indenting it with a blunt object.

This was done using a mould and deckle, shown in fig. 52. I did this in a variety of concentrations of pulp and using a few different methods, yielding differing results in quality and thickness, as shown in fig. 53, with the thicker examples lifting off the mesh of the deckle, forming ridges and undulations.



Fig. 52. Mould and deckles used in paper making, made by me using screen door mesh and pine.

Page over, Fig. 53. Showing textures of self-made paper.



One of the issues of making paper using this method, by hand, is that it does not have a grain, or orientation of fibres, that is as noticeable as paper made using an industrial process. Making paper at an industrial scale is done by spraying the pulp over a continuously spinning mesh belt. This aligns a lot of the fibres to a similar orientation, giving the paper a grain, a process I was when visiting the Essity paper mill in Kawerau. This means that the paper I made was not behaving in the same way as the paper or card I would be using to create prototypes.

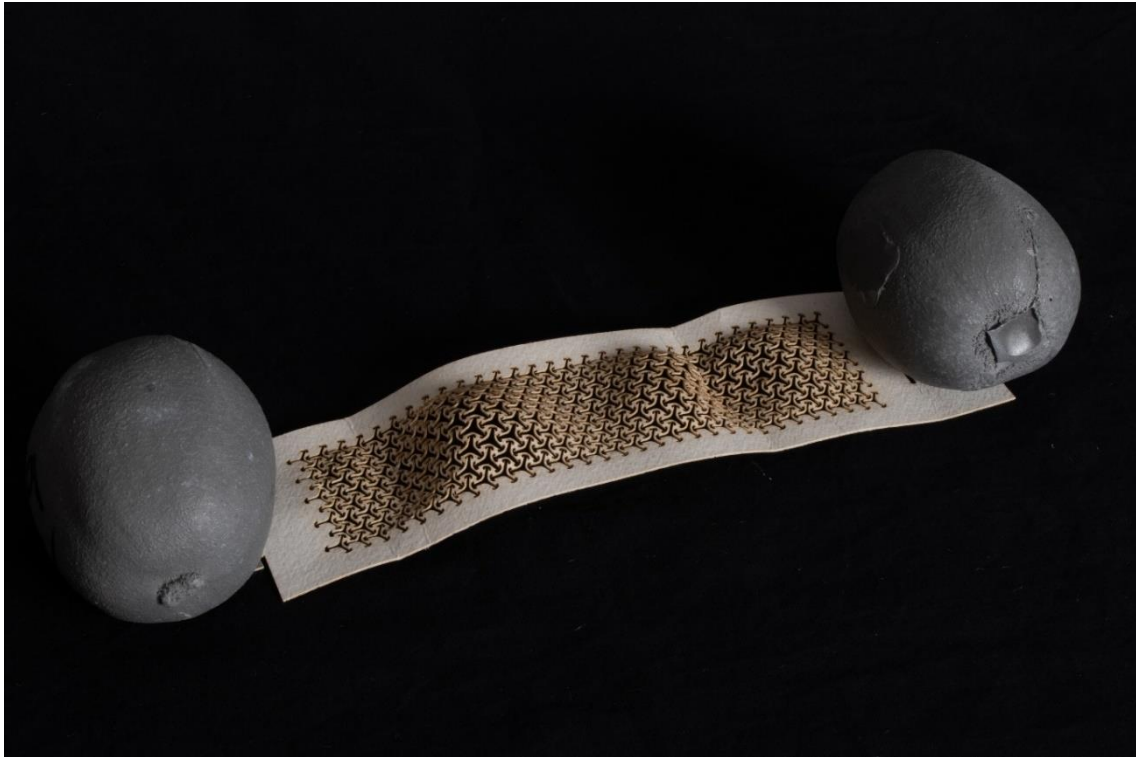
At this point, Maihi had created some of the early versions of the auxetic kōwhaiwhai. This meant that I could start exploring how they could be used, initially by finding out how they could deform around an object and hold it in place, as seen in fig. 54. This progressed to testing the properties of the kōwhaiwhai with different parameters, such as:

- Experimenting with different materials.
- The spacing between the elements of the kōwhaiwhai.
- The scale of the kōwhaiwhai.
- How the edges of the kōwhaiwhai are cut, how the repetition is ended.

Due to still not knowing what fruit I was going to be working with at this stage, this process was not to test and measure results in a regimented way, but instead start to understand its properties. This was done through using a test rig that I developed two versions of, and multiple inserts. Fig. 55 is of this process.

Pages one and two over, Fig 54. Experimenting wrapping the auxetic kōwhaiwhai around a kiwifruit.





Following three pages, Fig. 55. Development of the test rig and inserts.

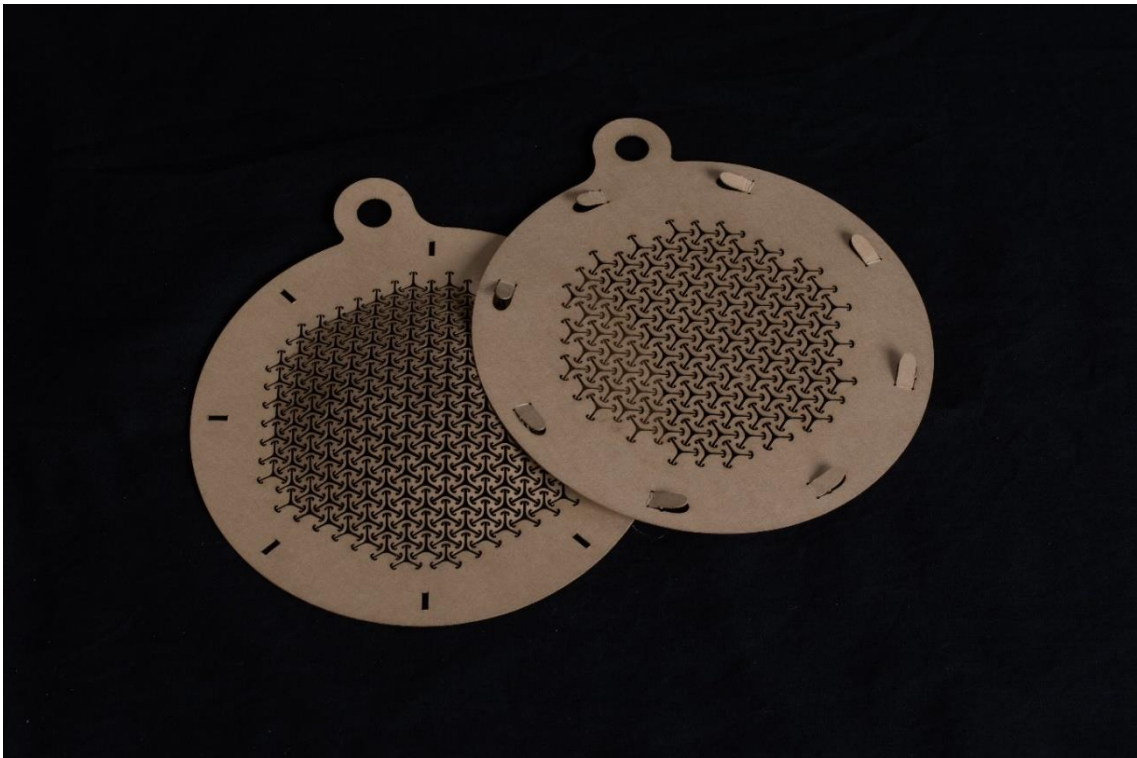
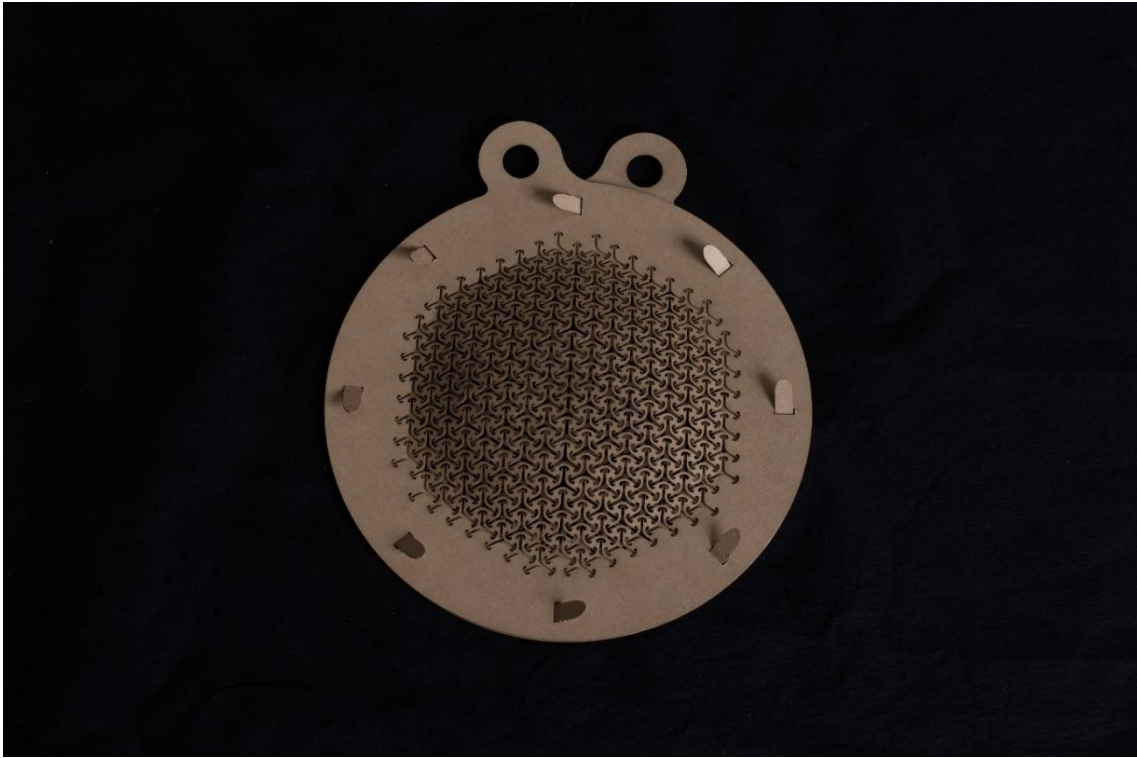


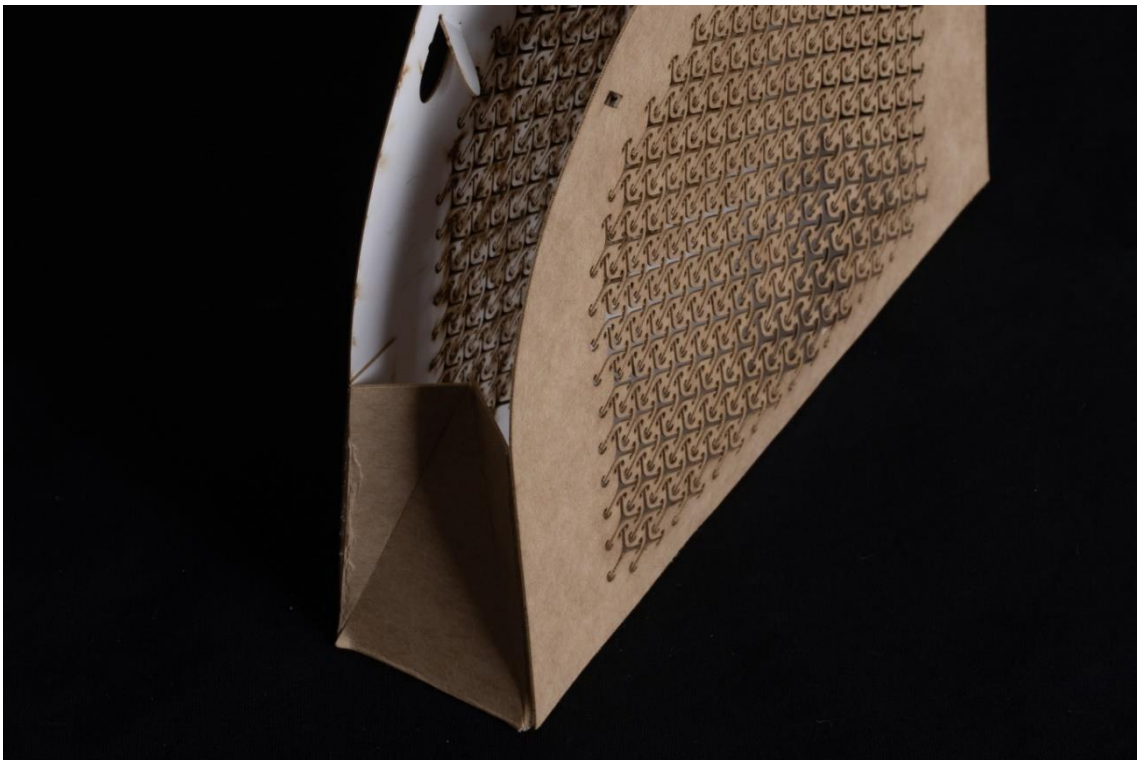
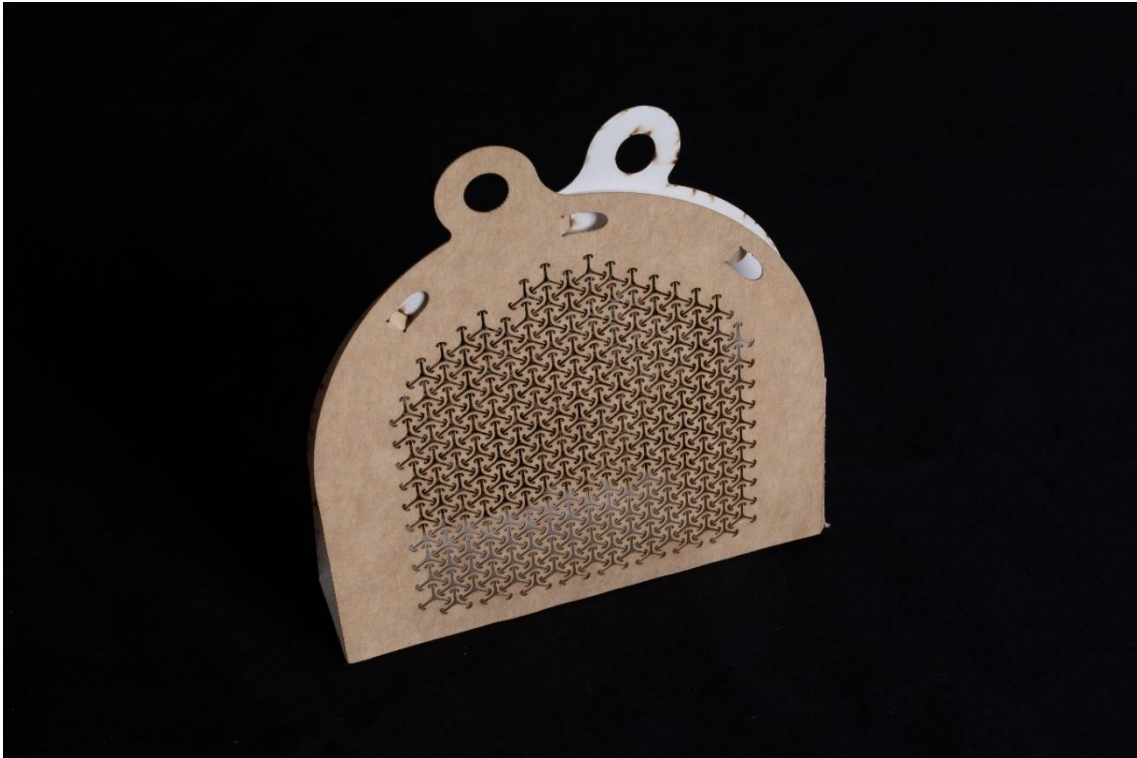


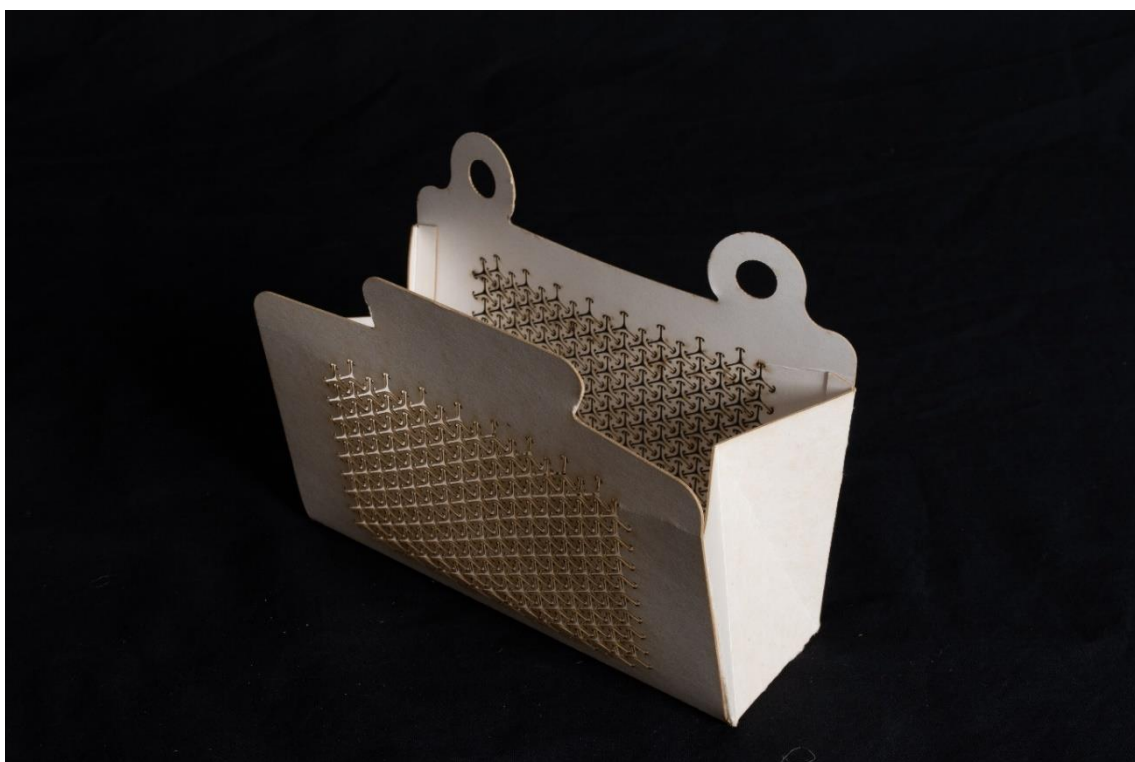


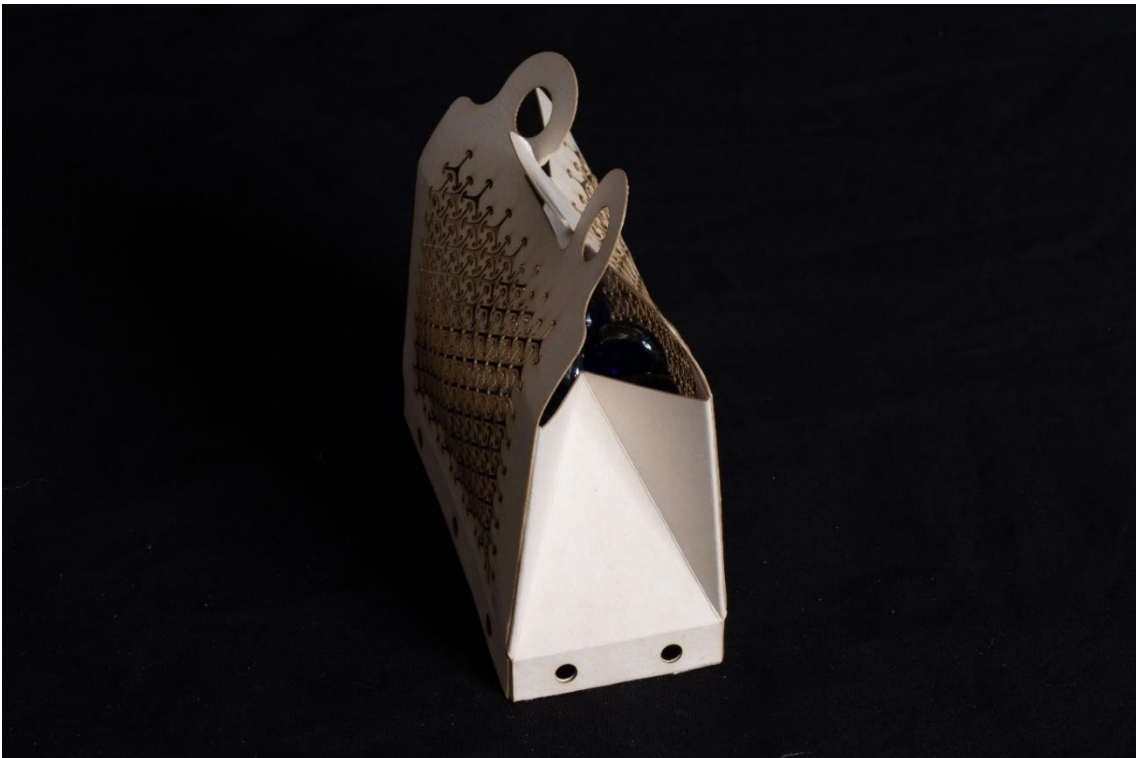
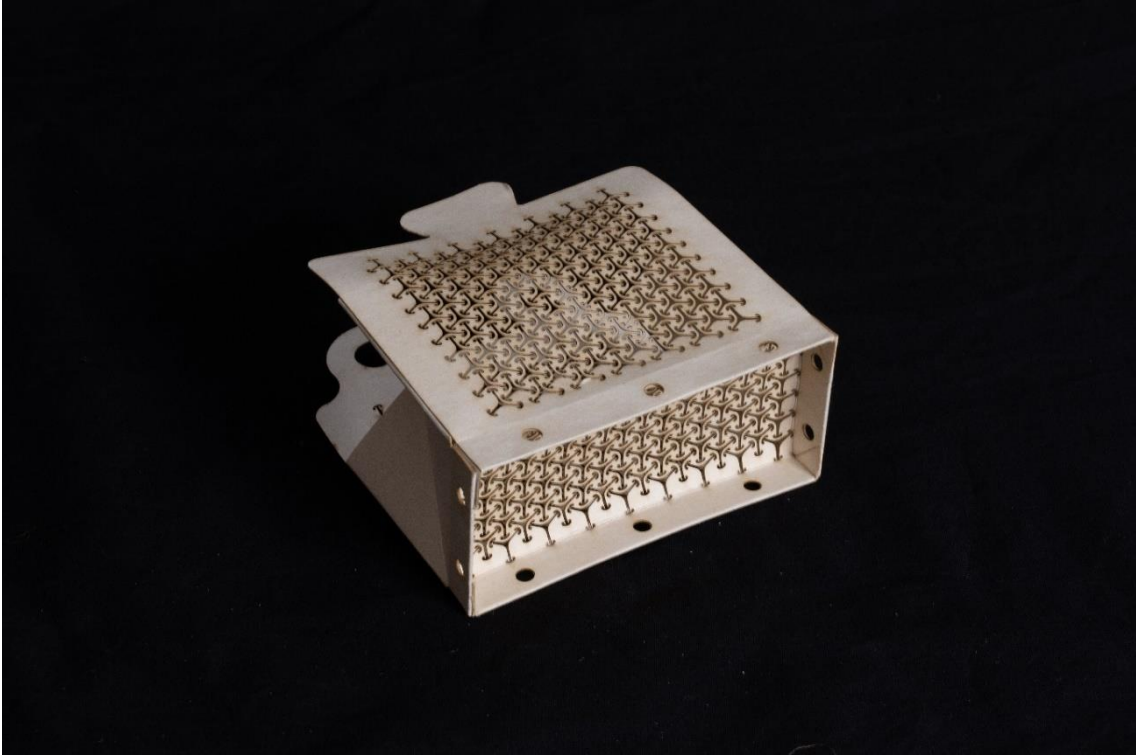
During most of this conceptualisation, there was an ambiguity around what kind of produce I would be designing the packaging for. At this stage of the project, I decided to do it for blueberries, because I had met with a variety of companies that were involved in growing and packaging them, which had provided me with the opportunity to get information about the processes and technicalities around packaging them. From here, I came up with 3 punnet concepts that utilized the auxetic properties of the kōwhaiwhai, a basket concept, a box concept, and a bowl concept. These are shown in the following figs. 56, 57 and 58, with development for each one. The development of these happened simultaneously, with innovation from each one informing aspects of the others.

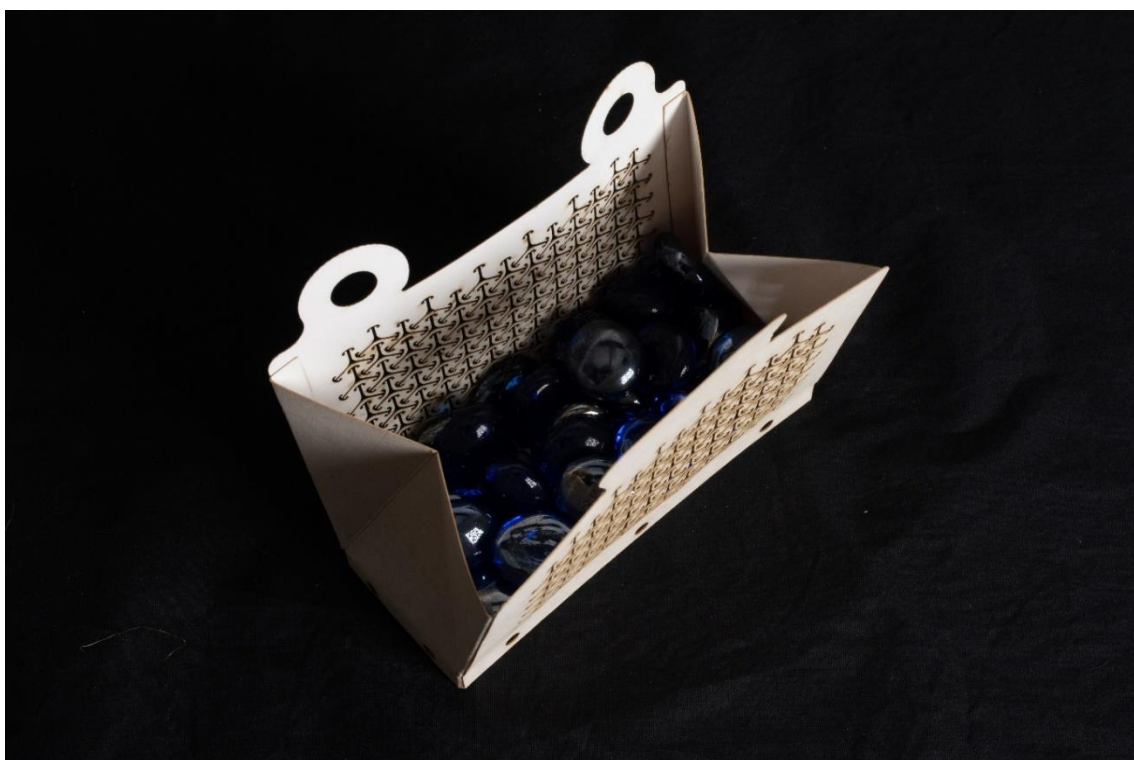
Following 5 pages, Fig. 56. Chronological development of the basket punnet concept









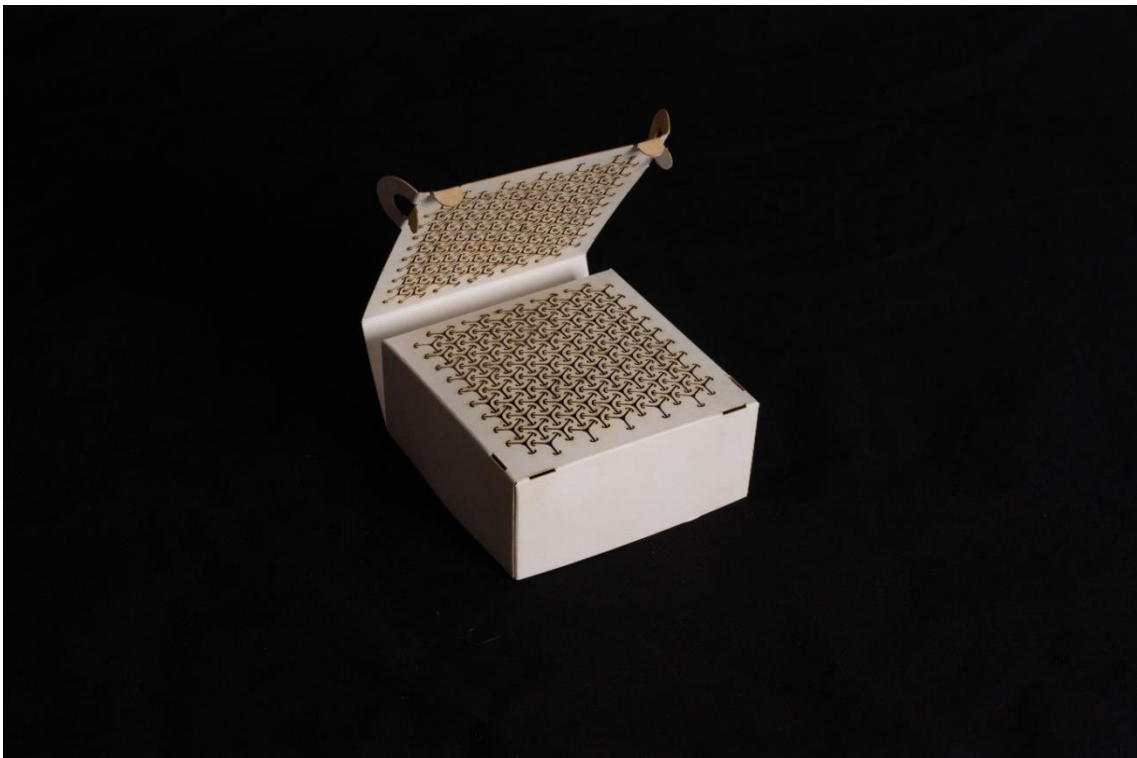
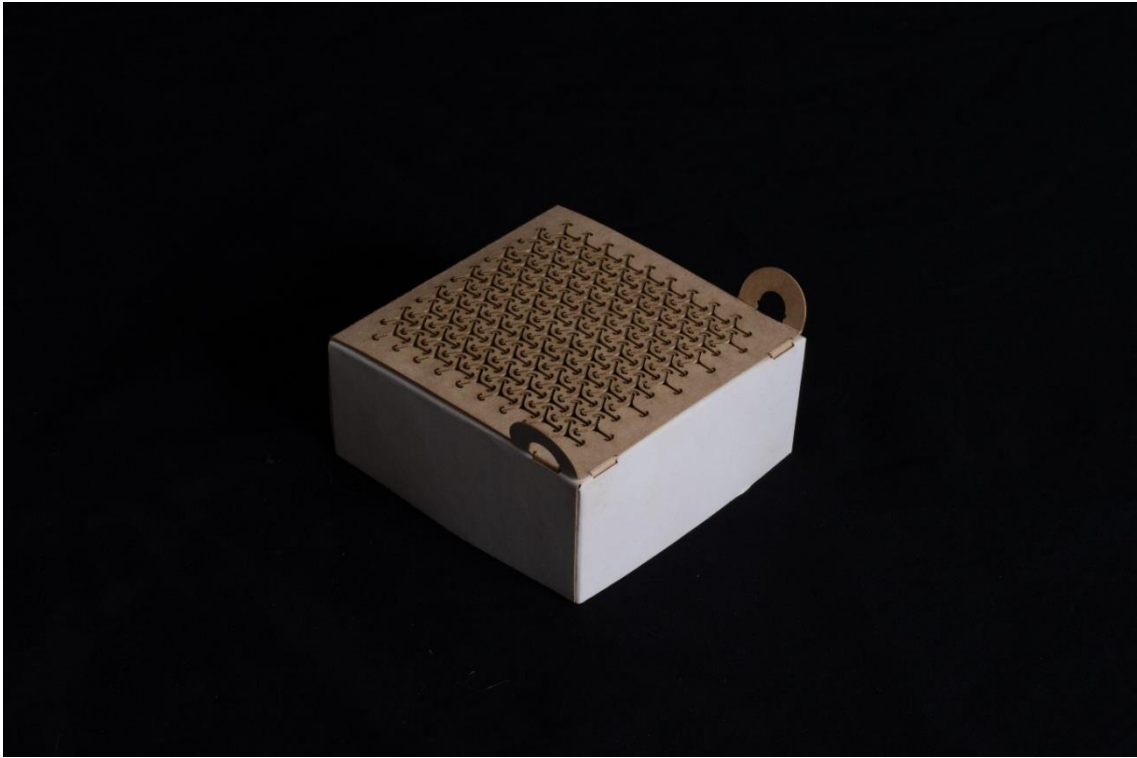


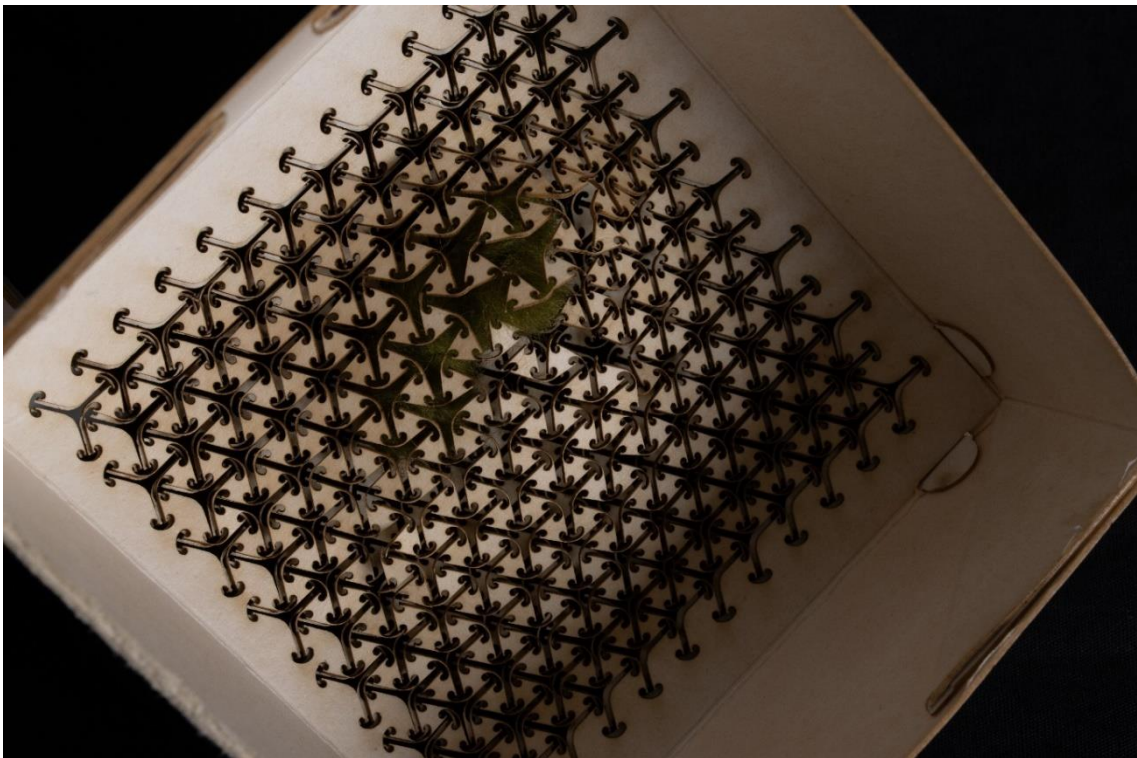
From there, this concept was not developed further. It is important to note that this concept was specifically not referred to as a kete, as a kete is an item that often represents a story that is not told through this object. The interpretation was left open to it being referred to as similar to a kete, but that would be left up to the person interacting with the design.

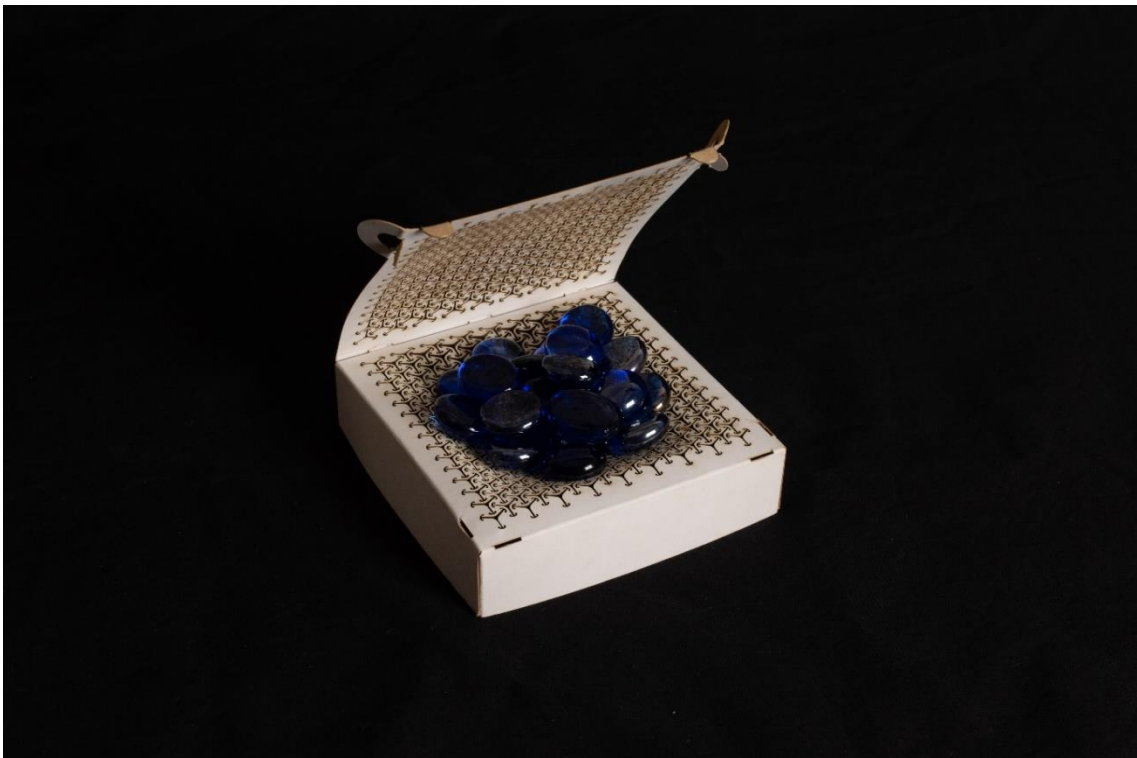
The next concept and development shown is the box concept, shown in fig. 57. This concept was taken further than the last one, and was a strong contender going forward. This also includes a sample of a partially constructed blank that had a fault in its design, and a paper test of the final offset lid development.

Following 7 pages, Fig. 57. Development of the box concept, including tests and a sample of the blank.

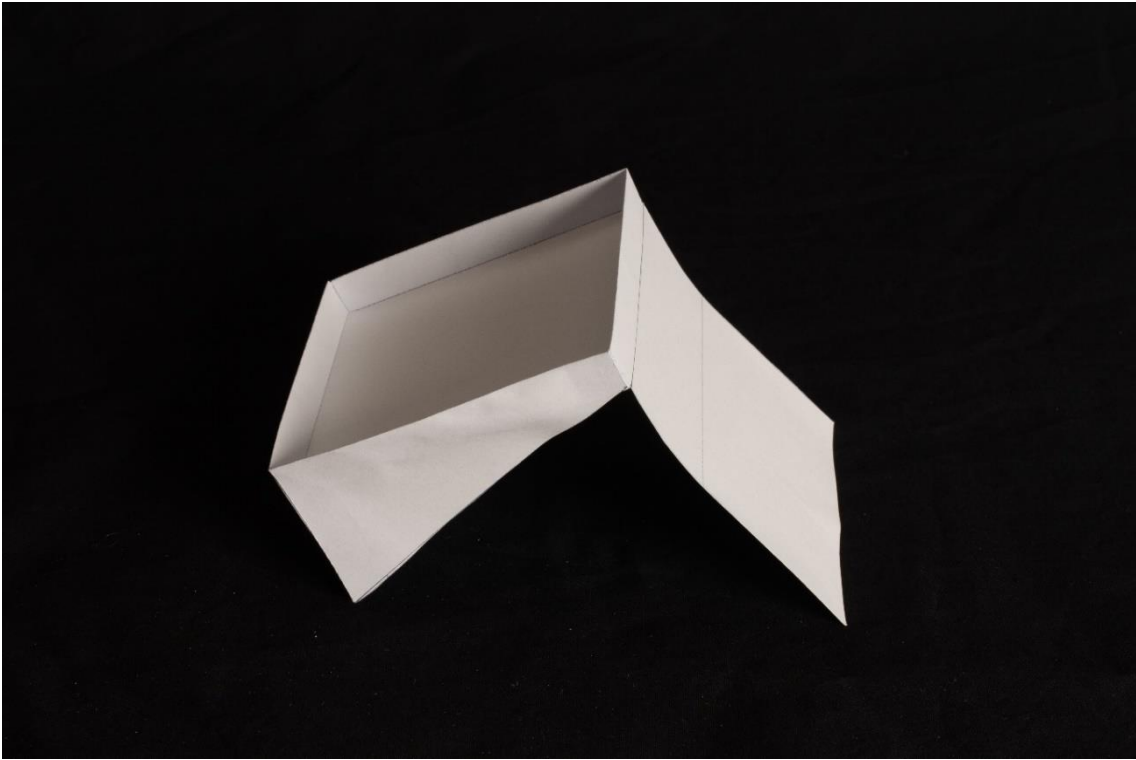


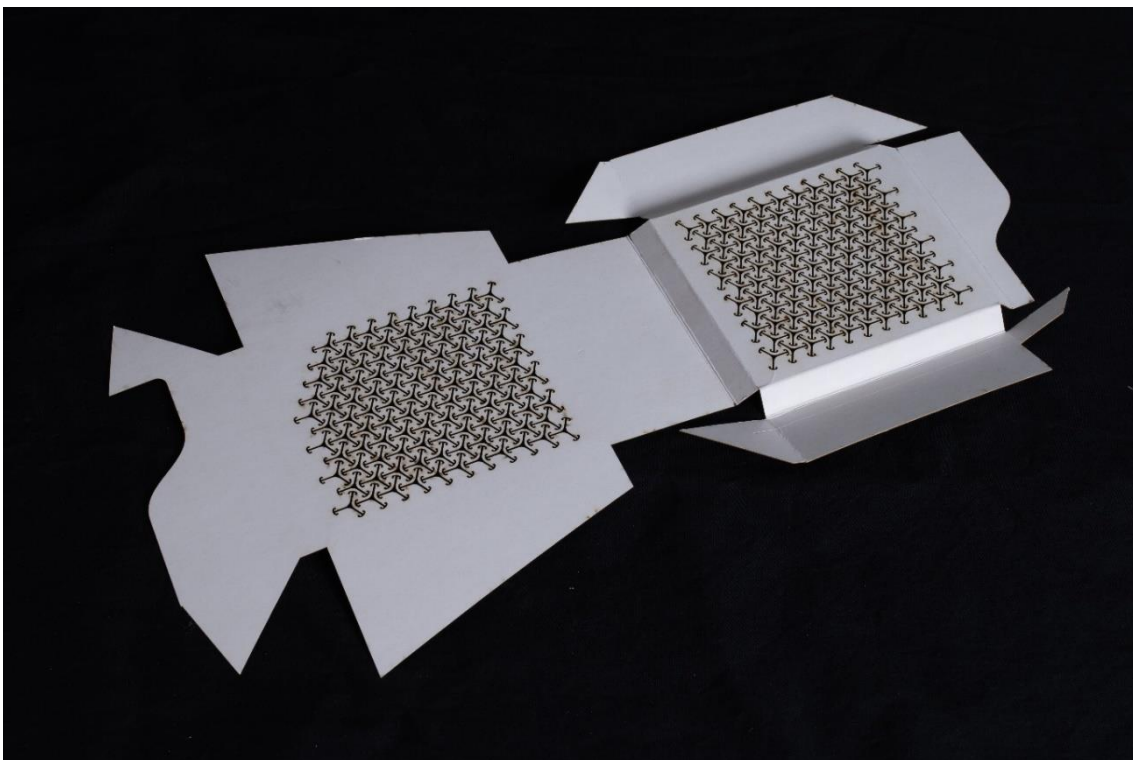
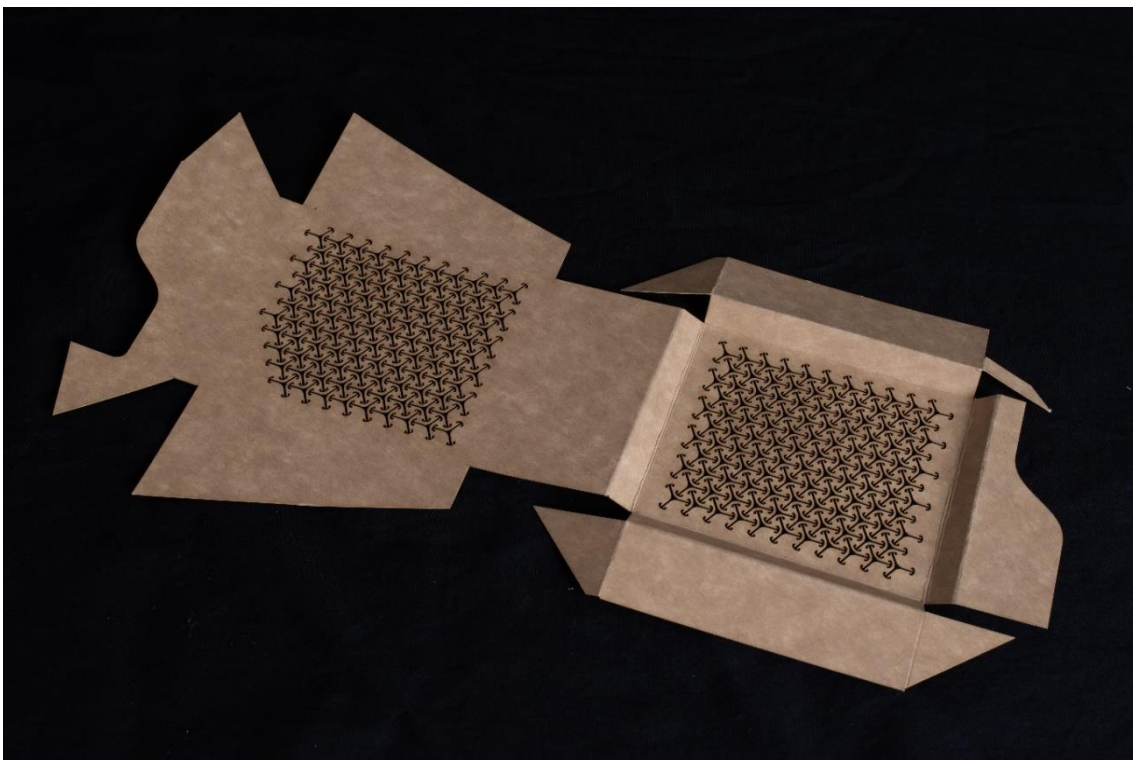






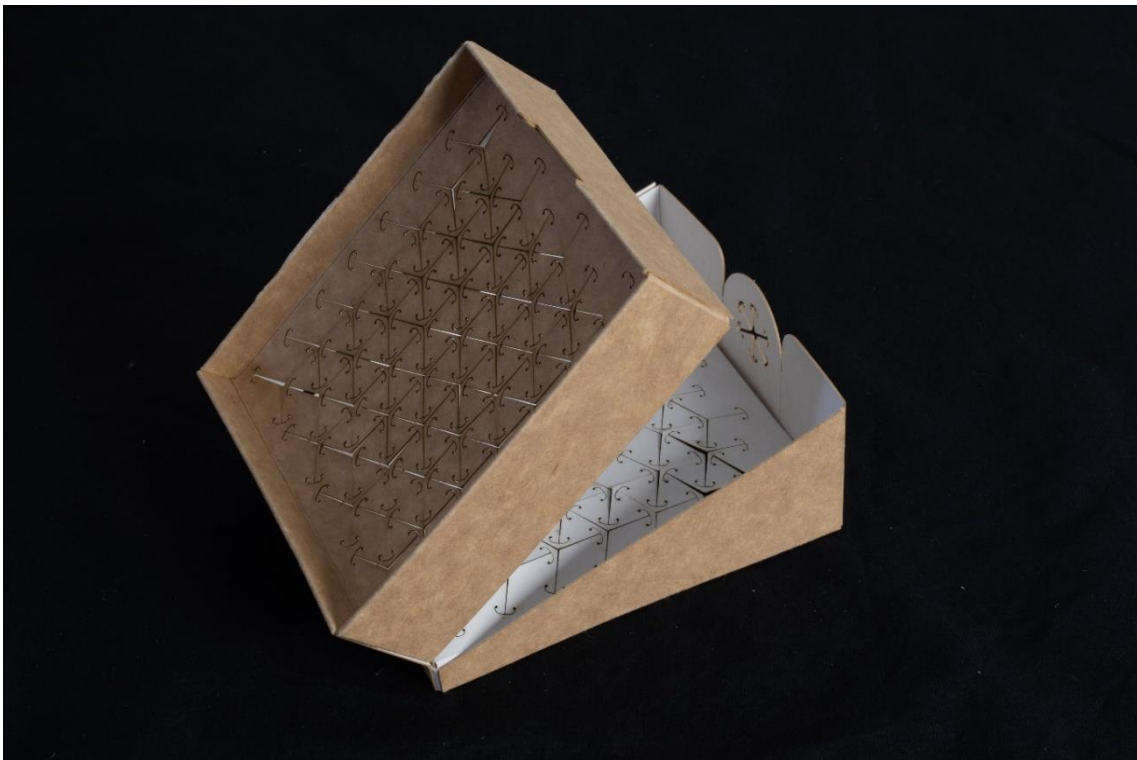




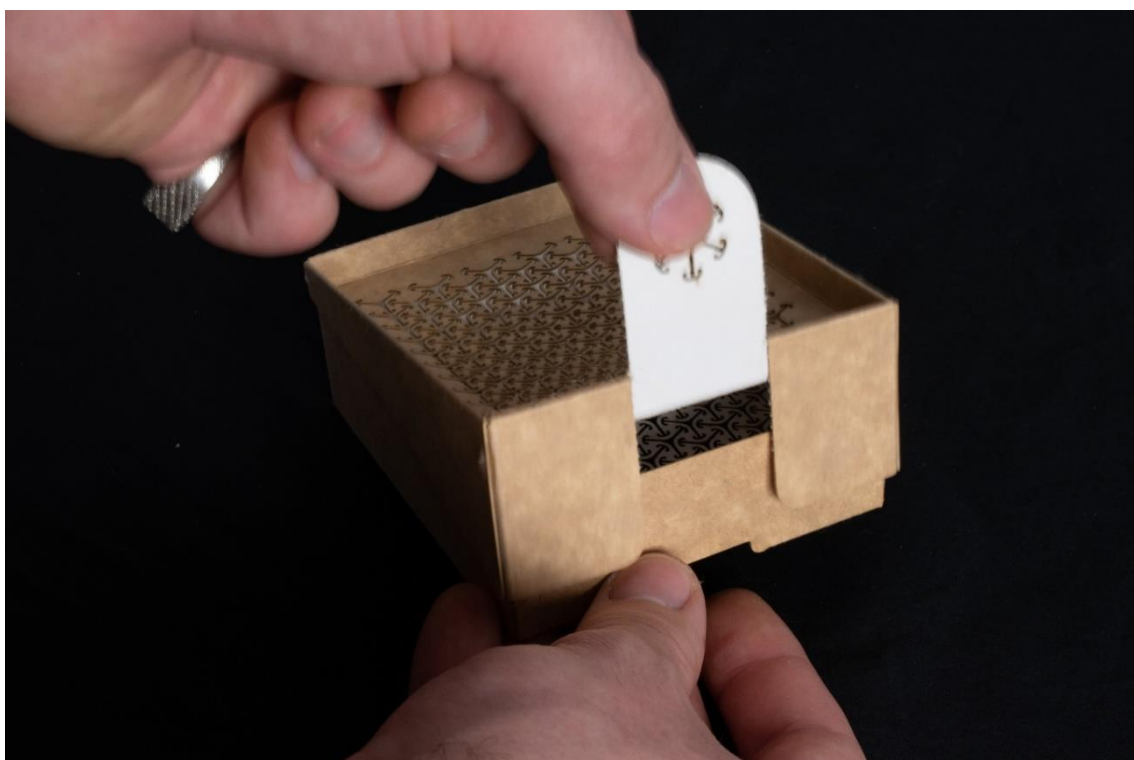


The final development of this concept, seen in fig. 58, was to add an offset at the top of the box and to test out a version of the kōwhaiwhai that had no sections of material removed, plus some other features.

Following 3 pages, Fig. 58. Final box concept with kōwhaiwhai that had no sections removed.







The third concept, the bowl, was inspired by the way a piece of paper folded itself when I pushed it over a round object. I followed the folds created on the piece of paper by hand at first and cut and folded it until it formed into a closable container. This was then cut out of card and developed further, including finding some issues around paperboard thickness and delamination/tearing when folding it, and creases appearing in places that I did not want them. This development process can be seen in fig. 59.

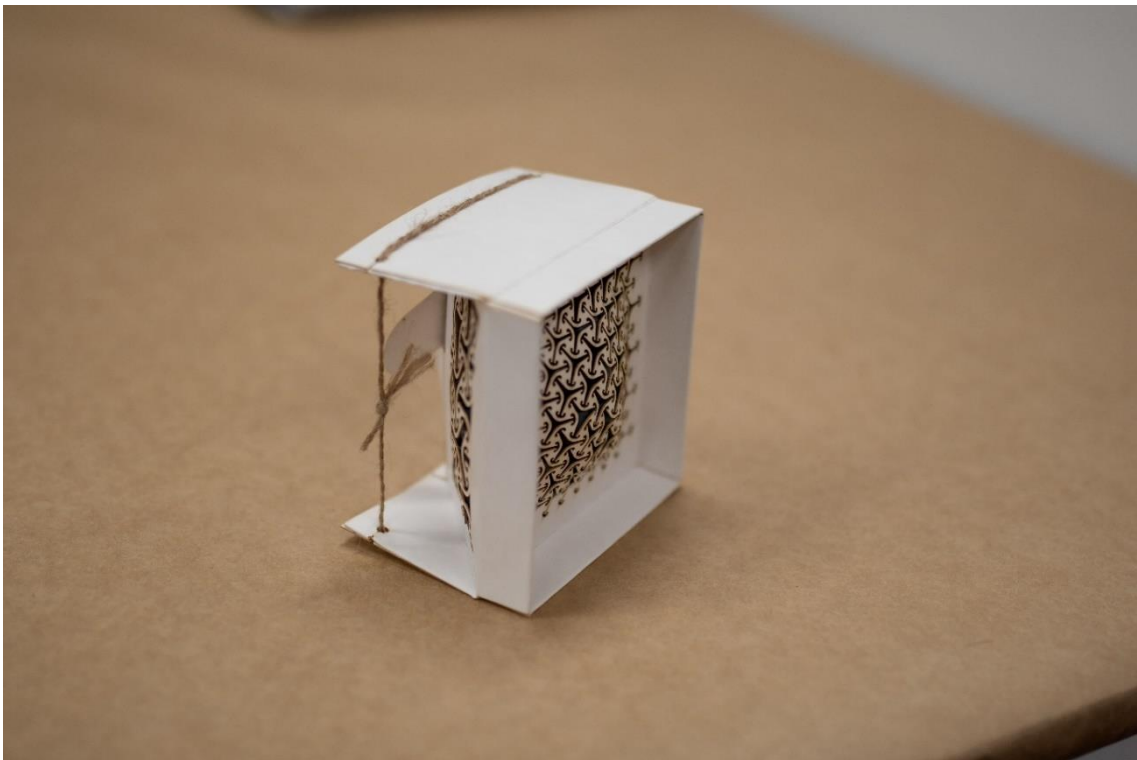
Image below and following 9 pages, Fig. 59. Detailing the initial development of the bowl concept, including experimenting with methods to keep it closed. This also includes some images demonstrating material failures.





















From this point, I decided that the bowl concept would be the one that I would continue with. The reason for this was that I felt the bowl had the following advantages:

- Presenting the berries in a way when opened that was accessible, well presented, and made them feel like they were on display and precious.
- It stacks well on top of each other, a big advantage for when it is boxed up for shipping.
- It has a clear and distinct place where a safety seal can go.
- It is the most novel and interesting.
- I think it makes the best use of the large and small kōwhaiwhai, where the fruit can be seen, and it is not putting a lot of pressure on the large kōwhaiwhai.

This led me to develop this concept further, experimenting with different clasps on the top, positioning and spaces for branding, and cutting a curve into the folding baffles on the side. I also experimented with a different method for offsetting the bottom of the punnet, but I could not make it work with the rest of the design. There were also some issues fixed such as the meeting point of the two halves of the top of the box bending. These developments can be seen in the following figs. 60 to 64.

Page over top, Fig. 60. Showing the bending issue of the two top halves.

Page over bottom, Fig. 61. Showing the curves cut in the side baffles, and to the left of the image, a solution to the bending shown in fig. 60.

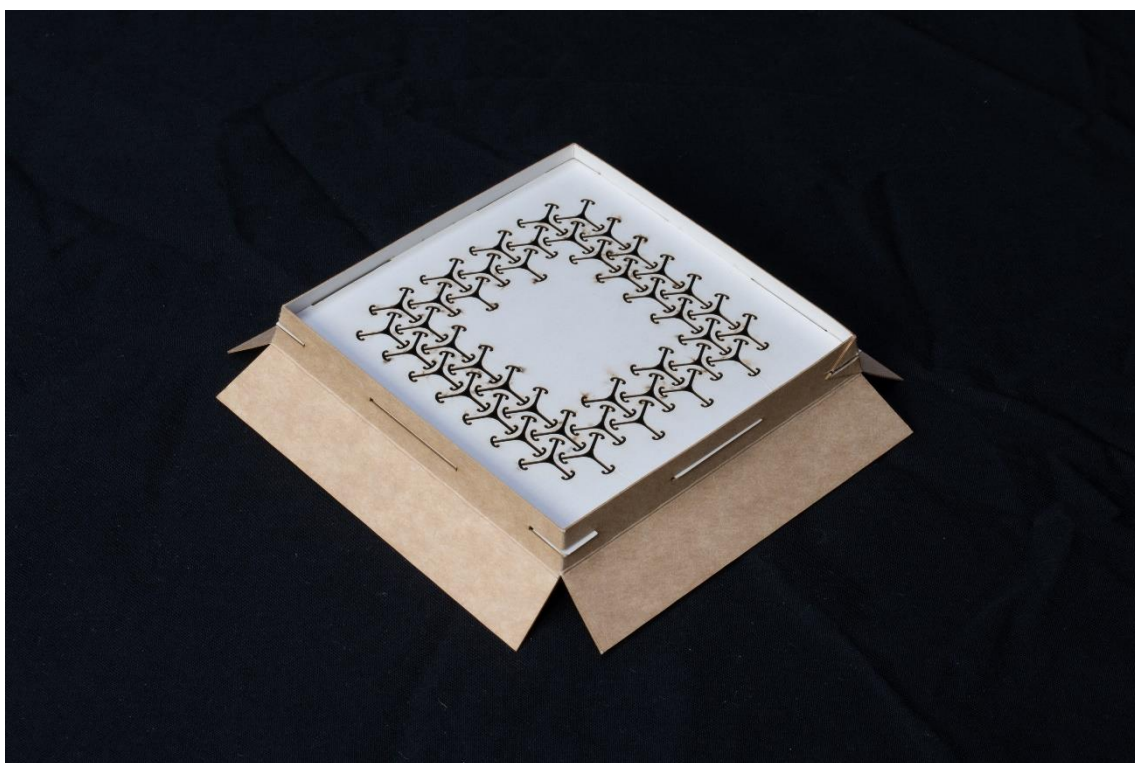




Fig. 62. Showing a late-stage concept with annotations on it.

Page over top, Fig. 63. A hand drawn and cut concept for a clasp.

Page over bottom, Fig. 64. An experimentation into a different method for offsetting the bottom of the punnet using interlocking slots and tabs.



This then marked the end of the development process, and through applying the last methods for fixing issues and refining specific parts of the design, I arrived at my final.

## 5. Final Design

The following Figs. 65 and 66 shows a blank of the final design, and various angles of the final design, including it opening, and demonstrating how it stacks.

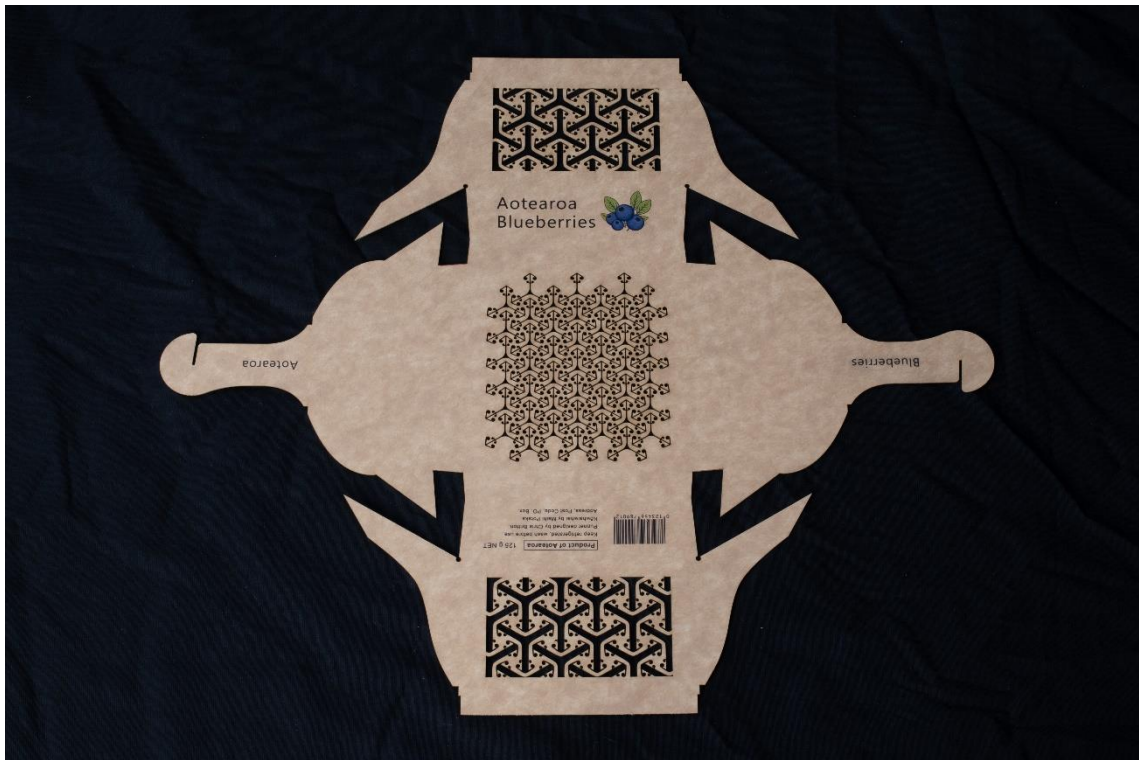
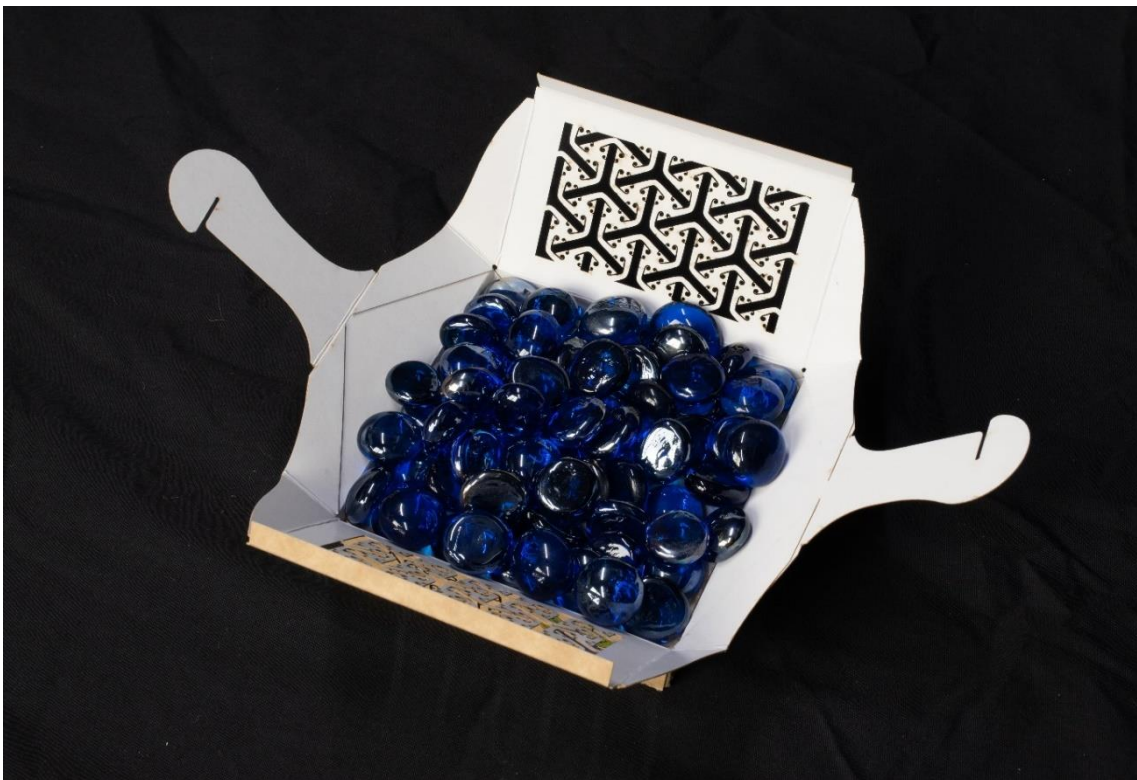


Fig. 65. Printed cut blank of the final design.

Following 6 pages, Fig. 66. The final punnet, how it looks when opening, and demonstrating how it stacks.















## 6. Testing

### 6.1, Experiential Testing

The purpose of this test was to gather information around the experience participants had when interacting with the punnet design. The focus was on finding out if the aims around kaitiakitanga, and making the produce inside feel precious, were being achieved.

This test consisted of presenting people with the punnet, getting them to open the punnet and getting them to eat some blueberries out of the punnet. At the end, they filled out a set of questions around the experience. This was done in a group, as I felt that a high-end fruit product like this would not often be bought for personal consumption but would usually be a shared experience. I also included three control tests, using a normal rPET fruit punnet, to ensure that there was a difference in experience between my design and a standard punnet design.

What I wanted to find out from this test was:

- The sort of semantic the punnet imparts on the fruit within.
- The sort of semantic the punnet itself had.
- How easy or difficult it was to open the punnet.
- The initial impression of the punnet, visual and contact.
- What the participant would do with the punnet after it is empty.
- If the participant thinks they would be drawn to the punnet, and why.

## 6.2, Findings

The overall result of this test was that the punnet excelled at providing the consumer the experience I was aiming for, and the control group showed that there was a strong difference in experience and interaction between the two punnets.

One critique that I received orally was that some people with limited strength or dexterity might find the clasp system difficult to use, and there was also a point made that someone that only had the use of one hand would also struggle. However, the control group also received feedback about being difficult to open too.

The full methodology and results for this test can be read in the appendices.

## 7. Evaluation, Reflection, Conclusion

An important part of the learning in this project was understanding where the information I have been using comes from, and what I have contributed to this, as part of the exchange of being able to use auxetic kōwhaiwhai in my project. Fig. 67 depicts this flow of knowledge, which also ties back into some of the kaitiakitanga aims.

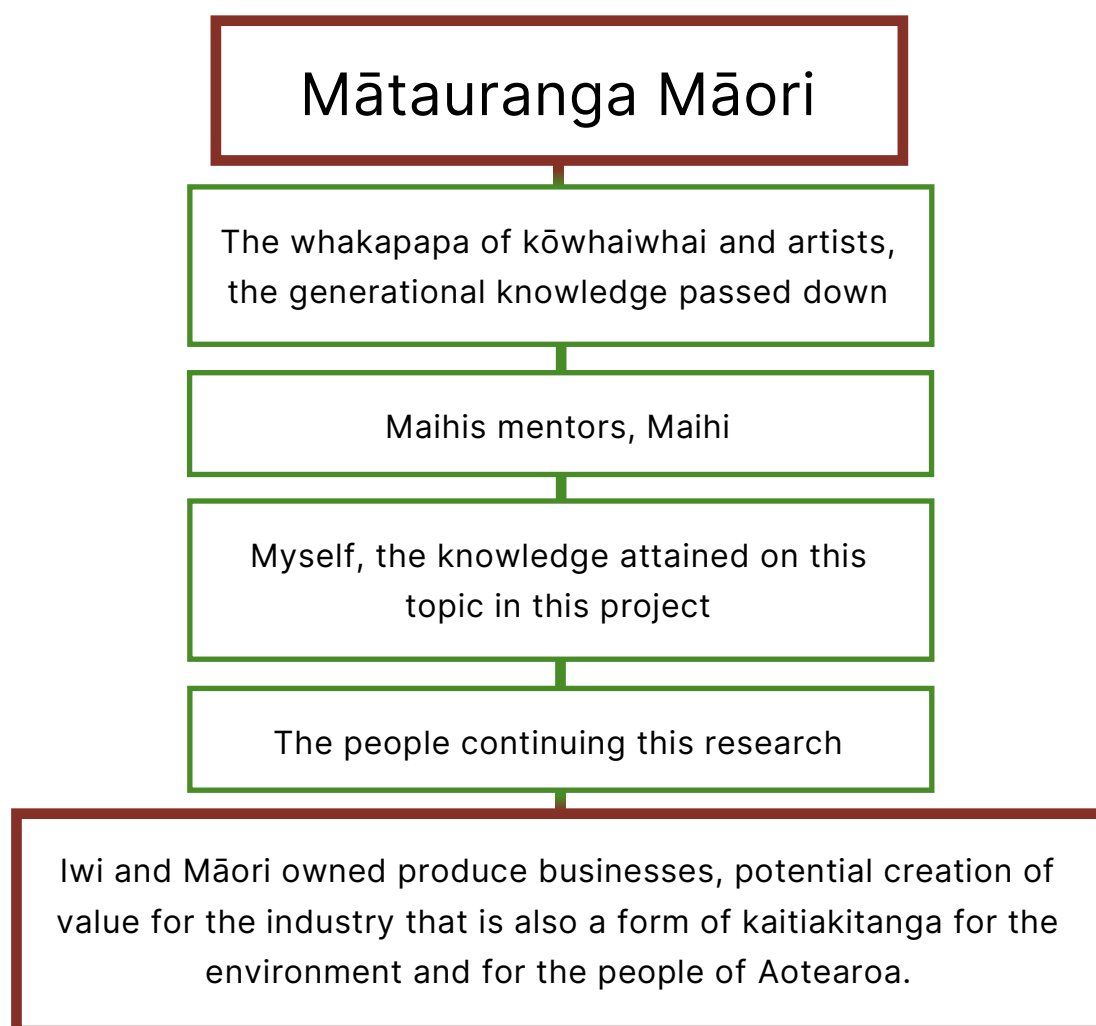


Fig. 67. Diagram showing the origin of the knowledge around kōwhaiwhai, and how the work I have done can benefit those working with auxetic kōwhaiwhai in the future.

Challenges in achieving the design aims for this project meant that there were frequently decisions that had to be made that went against parts of the criteria. Identifying these issues is useful as that knowledge then becomes part of the learning that can be taken away from this project, and is part of what is described in fig. 67.

Ensuring the kōwhaiwhai was used in a way that was appropriate was achieved throughout the project by listening to the guidance given by Maihi, and altering factors such as how the edge of the auxetic kōwhaiwhai was cut off, or ended. Other considerations included:

- Ensuring the kōwhaiwhai is visible in some form from above, and is not just under the fruit.
- That the auxetic properties are actually being utilised, with the potential for furthering the protection of the produce. This kōwhaiwhai exists to both be visual art and also to be an auxetic material.
- Following the guiding concept of kaitiakitanga.

The final design achieves the aims around kaitiakitanga through a few means, however there are also areas that could be improved on, which were mentioned previously:

- It would be highly difficult to manufacture, increasing power consumption and cost.
- It uses a lot of material, increasing power and resource consumption, and cost.
- The cost of manufacture increases the cost of the product, making it less accessible to people as a fresh produce. Therefore, it may not be following the narrative of kaitiakitanga of our people as strongly as it could.

In terms of achieving the kaitiakitanga aims stated, it is made of a more natural material, increasing the interpretation of it being a more natural product, and as shown in testing, this increases its perception of how eco-friendly it is, strengthening the link between the consumer and the natural environment. The interesting design also connects to kaitiakitanga points shown in fig. 2:

- An interesting, attention grabbing punnet draws people in and encourages interaction with a healthy food type.
- It provides further inspiration to create more sustainable packaging.

The goal of creating a design that utilised the auxetic properties of the kōwhaiwhai was a consistent technical challenge. The fact that the blueberries sit directly on top of a suspended auxetic kōwhaiwhai mesh demonstrates that this is being achieved, however this method has many drawbacks. Multiple issues stem from this, mostly because this requires the paperboard to be folded down and then back on to itself. This creates extra technically demanding steps in the process of manufacturing the paperboard carton, uses extra material, and takes up more empty space when shipping. All these points make the punnet more expensive to manufacture and increase the environmental impact of the punnet, going against many of the central ideas held in the kaitiakitanga framework of the project. This was a challenge seen in all the later concepts in chapter 4.2.

Overall there have been some outright successes with the design, proven by the results of the testing, and a lot of important information that came from difficulties meeting aims stated in the design criteria. Further steps to address these challenges could include:

- Proper consultation with manufacturers of paperboard cartons, to figure out a viable method to manufacture the auxetic kōwhaiwhai out of paperboard or another natural material.
- Definitive scientific research around how to create an auxetic kōwhaiwhai that protects the produce. This may

also include research into most viable fruits to package with this, and how it is applied to the package.

- Further development of the design, simplifying it while maintaining the visual interest. This visual interest could be achieved through the kōwhaiwhai and graphic design being applied to a simpler punnet design.

Initially I was also going to test if the design helped improve the protection of the fruit over the standard widely found rPET punnets. For this to be done correctly, an in-depth evaluation of the performance of the packaging in real world or simulated supply chain conditions would be necessary and is the logical next step. To undertake this testing some specialist equipment will be needed. This would require:

- Consultation with companies packaging and distributing blueberries will be needed to gain an understating of the conditions encountered across the supply chain as the packaging interacts with the physical and ambient environments.
- Large numbers of iterations altering the parameters of the auxetic kōwhaiwhai to understand what versions of it perform best in these circumstances.
- In depth knowledge of the properties of the materials used, and its reaction to different environments.

This would best be carried out in a thorough manner that provides definitive and complete data, in a project of its own, meaning it was not within the scope of this project.

To conclude, there are many opportunities presented by the idea of designing packaging with auxetic kōwhaiwhai, however the most important factor will always be ensuring the mana of kōwhaiwhai is upheld through understanding its whakapapa and cultural significance, the best method for this being to openly listen and learn from those that hold the mātauranga of the art form and the culture, and to realise that these are one in the same thing, as defined by te ao Māori. The knowledge that can be gained around the potential application of these auxetics, and the furthering of kaitiakitanga through applications of these auxetics

utilising sustainable, fibre-based materials has the potential to be incredibly broad and impactful.



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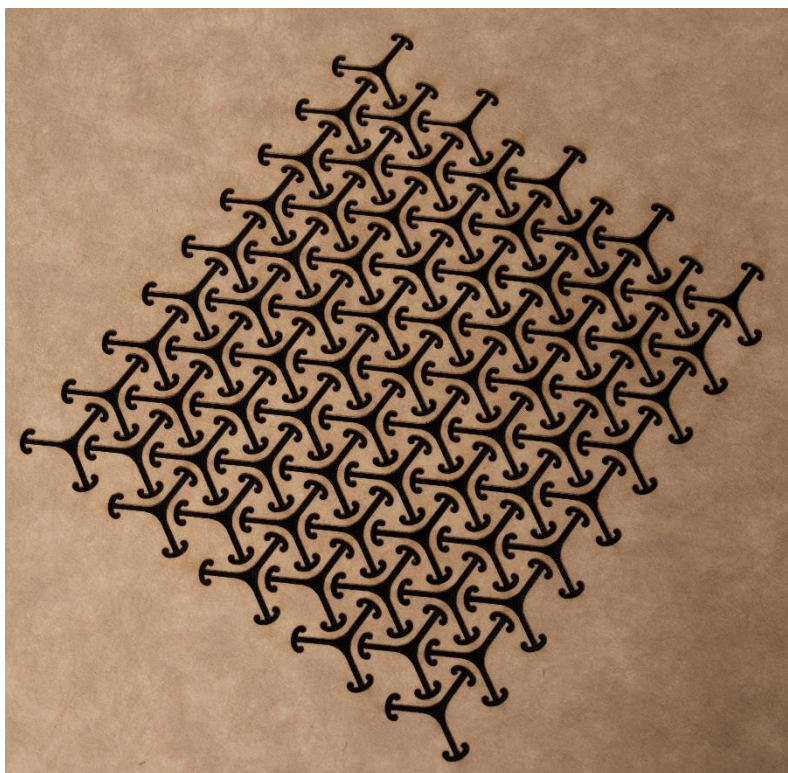
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## 9. Appendices

### 9.1, The Kōwhaiwhai Pūtoi Koiora in this Project

The two auxetic kōwhaiwhai Maihi created that were used in this project did not have names, but were referred to as mangopare (this was the earlier version used), and huaperi (the later development used).

#### Mangopare



This design is based on a traditional form seen in kōwhaiwhai that references the hammerhead shark, with the two koru at the end of each arm representing the head of the shark. Later on in the project I shifted from using this one to using the huaperi auxetic kōwhaiwhai as the mangopare auxetic kōwhaiwhai has little connection to intended use of my designs.

Huaperi

This design references aspects of food, food protection, and specifically blueberries:

- Each koru speaks of a blueberry on the bush
- The five points, or pentagon, created the four koru and the angle at the top of each arm represent the blueberry flower, which has a pentagon shape.
- The main arm of each part represents the supporting beams of a pātaka kai, a Māori food storage house that is elevated above the ground for the sake of protecting the food inside from animals and moisture.

The floor of the pātaka kai can be seen as the perpendicular intersecting line with a koru at each end half way up the arm or supporting beam component, and the roof is the angles line at the top with a koru on each end.

This auxetic kōwhaiwhai refers back to the narrative of kaitiakitanga and was much better suited for the purpose of this design.

## 9.2, Testing Methodology and Forms

### Methodology:

The testing starts with the punnet being in a separate area to where the participant is introduced to this test. In the area that the punnet is in, the punnet will be on a stand, and there will be a table and chair. The participant will be introduced to the project unable to see the punnet, with the following statement:

“This test is to build a set of qualitative data around a design I have been working on for a blueberry punnet, through asking participants about what sort of experience they have with the design, and what sort of emotive response the punnet brings about. The punnet in question would be something that theoretically you would find for sale at the supermarket. This punnet could be first encountered in a variety of situations, such as at the supermarket, a social event, or being received as a gift. Please read the following instructions fully, and then follow them. While doing this, please think about what sort of emotive response the punnet is inducing for you, and how this impacts your impression of its contents.”

The participant will then be given a set of instructions:

1. Go into the space the punnet is in. Take mental note of your initial visual impression of the punnet.
2. Take the punnet and put it on the table.
3. Open the punnet.
4. Eat as many of the fruits inside as you like.
5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

The questionnaire will consist of the following questions:

- In a few key words or phrases, what were your thoughts when you saw the punnet?

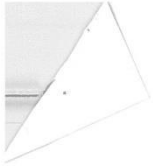
- Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?
- How easy was it to open the punnet? What issues did you have, if any?
- Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?
- What would you do with the punnet after eating its contents?
- Are there any other connections or connotations you felt were imparted on you by the punnet?

Food safety precautions include:

- the food will be from a new punnet every time the test is conducted.
- The food is rinsed in cold water prior to being put in my punnet design.
- The inside of my punnet design will be cleaned and sanitized, by wiping it down with a food-safe sanitising spray and a damp clean cloth.
- No food will be reused from test to test, they will be given to the participant of each test.

Only one piece of identifying information will be taken, which is the participants ethnicity. This is relevant because there may be differences in the reception of the punnet based on familiarity with Māori culture and arts.

The following pages contain the results of this testing. The ones marked "Design" used my design, and the ones marked "standard" were the control group.



## Test Participant Questionnaire

Please do not look at the back of this sheet until step 7 is reached.

The purpose of this test is to gather feedback on the experiential aspect of my design work, a fruit punnet with an auxetic kōwhaiwhai designed by my colleague Maihi Potaka applied to it.

This test is being conducted by Christopher Britton, for the purpose of completing his Master of Industrial Design degree at Massey University.

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christopher.britton1994@gmail.com

There will be only one piece of personal information gathered for this test, which is relevant establishing a background around how one might experience aspects of the punnet, please fill out below:

Ethnicity: AUSTRALIAN EUROPEAN

### Instructions:

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2. Take the punnet and put it on the table.
3. Open the punnet.
4. Eat as many of the fruits inside as you like.
5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type: Design Standard

Participant #: 1

### Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

LOOKED INTERESTING, WAS DRAWN TO THE TACTILE  
EXPERIENCE OF MANIPULATING (POKING) THE LASERCUT  
AUXILIARY STRUCTURE ON TOP.

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

YES, VISUALLY STRIKING AND, AS ABOVE, THE  
SLIGHT VISIBLE DEFORMATIONS OF THE UJ STRUCTURE  
WHERE IN CONTACT WITH THE CONTENTS MADE ME  
WANT TO PUSH AND POKE IT.

How easy was it to open the punnet? What issues did you have, if any?

FAIRLY INTUITIVE, A STRONGER AFFORDANCE TOWARD  
DIRECTION NEEDED TO 'UNCLIP' THE TOP COULD BE  
HELPFUL

Participant #: 1

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

IT IS MORE CONCEALED THAN A NORMAL PUNNET

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What would you do with the punnet after eating its contents?

PROBABLY FIDDLE WITH IT, DISASSEMBLE IT A BIT  
OR TO UNDERSTAND ITS MECHANICS THEN RECYCLE BIN.

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Are there any other connections or connotations you felt were imparted on you by the punnet?

MOSQUE - LIKE PATTERNING, GEOMETRIC 3D-ESQUE

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Participant #: 1

## Test Participant Questionnaire

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Ethnicity: NZ / European

Instructions:

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3. Open the punnet.
4. Eat as many of the fruits inside as you like.
5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type: Design Standard

Participant #: 2

### Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

*Well crafted, inviting, intriguing, organic, friendly*

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

*Yes - it is immediately visually different to other fruit packaging and the cardboard vs plastic would alleviate some consumer guilt.*

How easy was it to open the punnet? What issues did you have, if any?

*Super easy, the circular forms strongly indicate which way it opens - could maybe use one more visual indicator? eg label, sticker, engraving*

Participant #: *2*

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

The fruit feels fancier, almost suggest a kind of scarcity.

What would you do with the punnet after eating its contents?

Either recycle it or reuse if possible

Are there any other connections or connotations you felt were imparted on you by the punnet?

looking at it made me really want to touch it and interact with it, just to see what it would feel like.

Participant #: 2

## Test Participant Questionnaire

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Ethnicity: NZ European

Instructions:

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3. Open the punnet.
4. Eat as many of the fruits inside as you like.
5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type: Design Standard

Participant #: 3

### Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

Pretty, funky. Use of word Aotearoa is good.

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

Yes. The design and shape is quite unique so I would probably be drawn to it.

How easy was it to open the punnet? What issues did you have, if any?

It was easy to open, but I am able bodied.  
Difficult but doable with one hand.

Participant #: 3

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

It displayed the fruit well. Made the fruit seem more important.

The design was exciting, made me more interested in the contents.

What would you do with the punnet after eating its contents?

If it stayed clean / was washable I would probably use to re-gift something or for jewelry.

(it was clean today, just not sure how it would be if blueberries were in it for a few days) might cut out the patterned bits.

Are there any other connections or connotations you felt were imparted on you by the punnet?

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Participant #:

3

## Test Participant Questionnaire

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Ethnicity: NZ European

### Instructions:

1. Go into the space the punnet is in. Take mental note of your initial visual impression of the punnet.
2. Take the punnet and put it on the table.
3. Open the punnet.
4. Eat as many of the fruits inside as you like.
5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type:  Design  Standard

Participant #: 4

## Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

beautiful packaging, interesting opening.  
The smell of the wood holds a  
special association for me.

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

Yes, it looks beautiful / interesting  
its not plastic

How easy was it to open the punnet? What issues did you have, if any?

very easy. I opened it twice and  
the second time managed to  
do it with one hand.

Participant #: 4

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

Yes, the material, beautiful design and smooth opening made me feel excited about the fruit inside.  
~~The smell of the wood had~~

What would you do with the punnet after eating its contents?

Regift or Recycle

Are there any other connections or connotations you felt were imparted on you by the punnet?

The smell was a positive experience for me.

Participant #:

4

## Test Participant Questionnaire

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Ethnicity: Māori, Indian, Pākehā

### Instructions:

1. Go into the space the punnet is in. Take mental note of your initial visual impression of the punnet.
2. Take the punnet and put it on the table.
3. Open the punnet.
4. Eat as many of the fruits inside as you like.
5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type: Design Standard

Participant #: 5

### Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

- Holofractal kōwhaiwhai
- Beautiful & delicate, yet robust.
- "Make it out of wood!"
- The kōwhaiwhai reminded me of a common logo or recycling design I couldn't remember exactly what.

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

- Yes, because it's māori
- The kōwhaiwhai detailing isn't obvious from afar so I immediately wanted to examine it to see the meanings hidden in the design
- It is unique and not plastic

How easy was it to open the punnet? What issues did you have, if any?

Relatively, I think because it is so beautiful, I treated it more delicately than I needed to, out of fear of ripping it.  
The design of the folds was elegant as you open it, like hinges. Compared to the plastic ones that literally pop open and spill, this was a walk in the park.

Participant #: 5

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

Yes, it made me think they were premium organic products, and even that they may stay fresher for longer due to the materials / care in design.

What would you do with the punnet after eating its contents?

Depends on how well it maintains its integrity but likely cut out the kōwhiriwha, & frame / use it as toi in my home.

Are there any other connections or connotations you felt were imparted on you by the punnet?

Knowing mahi designed it (he is from my iwi, he won't know me though) felt amazing & a sense of pride - like 'kia ora chiz!' and made me care about this object as ~~the~~ our shared tūpuna have influenced ~~to~~ the ~~the~~ design of it.

Participant #: 5

## Test Participant Questionnaire

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Ethnicity: Kiwi / New Zealand

Instructions:

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3. Open the punnet.
4. Eat as many of the fruits inside as you like.
5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type: Design Standard

Participant #: 6

## Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

Beautiful. I love the colour - earthy & I love the shape. I love that it is small & strong looking. I feel like I am not worried about it getting squashed easily while I carry it around.

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

Yes absolutely. I like the shape, it's nice to have products that when you open them are not full of empty space. I like the minimalist design so I feel like it celebrates the fruit. I feel like the pattern looks like nature so I'm connected to the fruit and I am drawn to reading locally. I like that it is breathable & doesn't smell like plastic.

I love it. It's like a bra strap so familiar to open. Very durable so can open & close multiple times without tearing. I liked the sensation of opening because it opens slowly & there is a bit of resistance in the package - so it felt ~~so~~ cool.

It also looks like it is unfolding slowly & I love the stability of it. It has a spongy & strong bouncy feel. May visual surprises in the box opening experien. I like the green as it shows the colour.

Participant #:

6

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

Yup! It prompted me to respect the fruit. The fruit was laid out nicely within the box & I enjoyed seeing the design underneath so I didn't feel sad when I was eating the fruit.

What would you do with the punnet after eating its contents?

Might keep it for other fruits as it looks like it can store fruits well?  
otherwise recycle. If it didn't say blueberries at the box I made use of it as gift packaging for something else too.

Are there any other connections or connotations you felt were imparted on you by the punnet?

I would love to know how fresh this keeps the fruit - it looks like it has a great ability to extend the quality of the fruit.

I would love some information on the design related to blueberries in any way.

Do the blue berries stain the bottom of the punnet with colour or does it stay fresh.

Participant #:

6

It smells really nice :)!

I like the spray bottom.  
Nice to wash fruits inside the punnet too - easy :)

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Ethnicity: EUROPEAN

Instructions:

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5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type:  Design     Standard

Participant #: 7

Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

I THOUGHT IT LOOKED VERY PRETTY AND  
I WANTED TO OPEN IT. IT PRESENTED  
ALMOST AS A GIFT

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

YES BECAUSE I CAN TELL IT'S NOT PLASTIC  
AND THE DESIGN OF THE PATTERN IS  
INTRIGUING.

How easy was it to open the punnet? What issues did you have, if any?

WAS VERY EASY. DOABLE WITH JUST ONE  
HAND TOO

Participant #: 7

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

YES - I WOULD PROBABLY ASSUME IT WAS  
ORGANIC. ~~AND~~ I WOULD ALSO ASSUME  
IT'D BE BETTER PROTECTED DURING TRANSPORT  
AND HANDLING.

What would you do with the punnet after eating its contents?

~~AND~~ I WOULD SAVE THE CUT-OUT PARTS TO  
ADD TO CARDS FOR GIFTS OR AS A  
BOOKMARK

Are there any other connections or connotations you felt were imparted on you by the punnet?

A CARE FOR THE STATE OF ITS CONTENT.  
I PARTICULARLY LOVED THE AERATED BOTTOM,  
~~ESPECIALLY~~ GREAT FOR STORAGE AND  
WASHING.

Participant #: 7

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Ethnicity: Sri Lanka

Instructions:

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5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type: Design

Standard

Participant #: 8

## Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

Neatly packed

Not reusable

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

Maybe. Looks compact. But concerned about it being  
too compact - no breathing space - fruits can go bad

How easy was it to open the punnet? What issues did you have, if any?

Yes it was straightforward

Participant #: 8

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

Not really.

What would you do with the punnet after eating its contents?

Throw it. But would like one that can be reused.

Are there any other connections or connotations you felt were imparted on you by the punnet?

Not really.

Participant #: 8

## Test Participant Questionnaire

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Ethnicity: Pākehā

Instructions:

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5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type: Design

Standard

Participant #: 9

### Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

Boring, cheap-looking, unnatural, bad for  
the environment (plastic)  
Only positive is fruit was clearly visible

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

No, I don't like plastic packaging

How easy was it to open the punnet? What issues did you have, if any?

Fairly easy but a bit annoying/fiddly

Participant #: 9

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

Yes, I had the impression the fruit would be quite standard/typical of supermarket fruit - not premium or particularly fresh, and that it was probably imported.

What would you do with the punnet after eating its contents?

Try to recycle it, (with little hope of it actually being recycled!).

Are there any other connections or connotations you felt were imparted on you by the punnet?

label looked cheap and imported  
artificial  
wasteful

Participant #: 9

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Ethnicity: CROATIAN

Instructions:

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3. Open the punnet.
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5. Tip the remaining fruits into the provided bowl after eating.
6. Close the punnet again.
7. After completing these steps, fill out the questionnaire on the page over.

Thank you very much for participating

Tester to fill out only:

Test type: Design  Standard

Participant #: 10

### Questions:

In a few key words or phrases, what were your thoughts when you saw the punnet?

Plasticity

Canish

Unappealing

Would you be drawn to this punnet in a situation where you are seeing it for the first time? Why?

No - don't like the yellow. Australian map reminds me they're impacted -  
carbon emissions! would prefer something local. Bright colors were unnatural.  
Don't like the plastic packaging.

How easy was it to open the punnet? What issues did you have, if any?

~~Quite easy~~ no issues.

A bit annoying getting the two parts to separate (top + bottom).

Participant #: 10

Do you feel the punnet had an impact on how you viewed the fruit inside? If so, how so?

Yes - especially by reminding me they were out of season! Unappealing.  
But - clear package did let me see how fresh and ripe the berries were, which was useful. I could trust I knew what to expect inside.

What would you do with the punnet after eating its contents?

Recycle it and compost the tops of the berries.

Are there any other connections or connotations you felt were imparted on you by the punnet?

Australia - far away! Plastic reminded me of the impact of packaging.

Participant #:

10



