



A Sole for Nature

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A Sole for Nature

Communicating nature based play through the design of
toddlers footwear

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Abstract

As children grow and learn, they are grasping how to navigate through their natural environment, and the shoes they wear should support that, not hinder it. This research aimed to engage parents to understand how a shoe could become a catalyst for encouraging children to engage in outdoor play and adventure. This was achieved using visual language tools such as semiotics and affordances through a communication framework, to design footwear for toddlers.

An action research and human-centred design mixed methodology was used to understand the research context, engage with participants and experts and act upon the findings through creative and iterative making methods. This research project was conducted in partnership with Bobux children's footwear company, who aided in the development of concepts and production of the final prototype. Through this research project, I interacted with participants – customers, experts, and parents – to actualise the decisions that led to the final outcome.

I found that children's footwear was often stiff and heavy and did not provide the tactile feedback of the ground underfoot, potentially limiting a child's connection with nature. Through the development of this research, I developed a shoe that was more flexible and responsive to the varying terrain a child may walk on. The final outcome demonstrated how a visual communication framework could be used to design a product that alluded to its purpose more thoughtfully and intentionally than what had been observed in the current market.

Glossary

Shoe Last - A shoe last is the solid form around which a shoe is molded. The fit of a shoe is completely dependent on the shape and volume of the shoe last.

Sole - The bottom of a shoe, slipper, or boot. sole. verb. soled; soling.

Insole - A removable sole worn in a shoe for warmth, as a deodorizer, or to improve the fit.

Shoe Upper - The entire part of the shoe that covers the foot. The upper of a shoe consists of all parts or sections of the shoe above the sole.

Footbed - The footbed is the inside part of the shoe that runs under the bottom of the foot and attaches to the upper with stitching.

Barefoot Footwear - A style of lightweight running shoe based on the position of the foot when barefoot, with little or no difference in height between the heel and the sole.

Shod - Wearing shoes.

Unshod - Not wearing shoes.

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01. Positioning the Research

Positioning the Researcher:

I identify as an adventurer. I have grown up with nature at the centre of everything I do. My relationship with the surrounding natural environment is deeply rooted. As a result, I have wanted the designs I produce to embody this connection.

I started my research journey with limited knowledge of technical footwear design. I had previously completed an adult rehabilitation footwear project, using barefoot principles for strengthening the foot. This project was concluded at the concept phase, without producing fully realised prototypes, and relied heavily on CAD models. At the end of the project, I was left feeling like there was much more I wanted to learn about footwear design and how shoes can be used to connect a person with the ground underfoot. I realised that I had an interest in designing shoes that served a greater purpose than just to be fashionable.

Positioning the Research:

Moving into this master's research project I had a preference for designing outdoor shoes that reinforced a message of connection with the ground underfoot. This happened to align with Bobux International's core message and a partnership project was formed. I agreed on a project which aimed to help communicate Bobux's core message more effectively through the shoe itself, rather than through advertising and packaging.

This project did not specifically set out to address sustainability (e.g. product life cycle analysis etc.), due to the scope of the research question. However, I aimed to implicitly explore notions of sustainability by encouraging children and parents to venture into nature, providing them a reprieve from an urban day-to-day life, to build a nurturing relationship that inspires future generations to love and care for the environment.

Preface:

This research was impacted by Covid-19. This meant that there may have been more opportunities for developments that could have been made, but I worked to the greatest of my abilities given the circumstances. The Covid-19 lockdown and subsequent restrictions resulted in difficulties in recruiting participants, spending time in the Bobux offices learning about the footwear making discipline, and constraints in Bobux offshore manufacturing constraints which altered the production methods of my final prototype.

02. Contextual Review



02.1. Footwear and Feet

The Shoe:

A shoe is defined as an outer covering for the foot to provide a protective layer (Shoe | Footwear | Britannica, n.d.), but the shoe has far more significance than just that. Shoe-making has evolved from a primarily functional purpose into an industry where design has become seemingly as important as function (Dolita Shoes, 2021).

Shoes have been a marker of division in society, where they, together with clothing and adornments, have signified wealth. Examples of this have been seen in Ancient Greece, where shoes could only be worn by free citizens to be distinguished from slaves (Morgan, 2021). Meanwhile in Rome, the more laces on a sandal, and the thinner the sandal's sole, the higher the rank of the soldier (Dolita Shoes, 2021). As society has progressed, this hierarchy through footwear has been seen through the use of colour, material, and pattern use (Sancaktar, 2006).

Going even further back, into the Prehistory (2.5 million BC – 1250 BC) and Antiquity (1250 BC – 476) eras, footwear was basic but was depended upon to survive (Dolita Shoes, 2021). Humans were influenced by the climate, vegetation and condition of the soil. Nature controlled their lifestyles and therefore, their understanding and connection with nature was arguably stronger than what it is now (Bossan, 2012).



Figure 1. Dolita Shoes, (2021). Stone age footwear.

In western culture, without the social restrictions and rules surrounding what we can now adorn our bodies with, for the most part we can wear whatever we desire, and as a result of this, the barefoot community has seen an increase in interest of turning back to our primal origins through barefoot footwear (Bossan, 2012; Hollander et al., 2016).

Shoes are an important part of keeping children's feet protected from sharp or harsh objects that are on the ground (sticks, glass, thorns etc.) and also keep feet warm and dry (Dolita Shoes, 2021). The barefoot shoe movement encourages people of all ages to have their feet as close to nature as possible while still providing protection for the feet (Vivobarefoot NZ | Barefoot Shoes | Minimalist Footwear, n.d.).

Child Foot Development:

Watching a baby grow and develop can be a marvel, both emotionally and scientifically. Rapid changes are seen as the child builds the skeleton needed to get where they need to go. In the early stages of a child's life, their anatomy hasn't been obstructed by the urban environment that we live in (Cucuzzella, 2017). Cucuzzella (2017) explained that the aim of children's barefoot footwear is to protect the child from shoes that may intrude on the natural development of their anatomical foot structure (e.g. stiff and rigid shoes).

As discussed, barefoot footwear encourages a closer connection with nature which has been suggested to improve proprioceptive abilities (understanding of body in space), and encourage the building of a relationship with nature (Hanscom, 2016; Hollander et al., 2016). Barefoot shoes provide a wider area for the toes to move in naturally. A thinner sole and flexible construction help to activate muscles, tendons and ligaments as the foot can better feel and respond to inconsistencies with the ground underfoot (Cucuzzella, 2017).

Morrison et al. (2018) explained how using children and infants to conduct gait analysis can be challenging, especially in conducting studies over a large period of time. Challenges may include ethical and regulatory protections for children and accommodation of the children's development (physical, cognitive and emotional) (Field et al., 2004). Many relevant studies regarding the biomechanical effects of barefoot shoes on foot development have been conducted in environments and cultures where shod walking is a conventional practice (Morrison et al., 2018).

Despite this, there are suggestions on the potential impacts that wearing standard (shod) footwear could have.

Research found many lower extremity changes in normal foot development in the first four years of a child's life (Cucuzzella, 2017). During these early development stages, most of the child's foot is made up of cartilage, which is slowly transformed into bone as the child ages. The foot of a child is very different to an adult's foot. Children's feet are widest across the phalanges (toes), whereas adults feet are typically widest at the tip of the metatarsals (see figure below) (Cucuzzella, 2017). Cucuzzella (2017) stated that if our population wore wide toe box shoes that supported this natural shape throughout development (up until the age of 18 to 19 for girls and age 20 to 21 for boys), it would be likely that most adults' widest part of the foot would also be across the toes (phalanges). This study highlighted the need for shoes to support that natural growth, not restrict it (Cucuzzella, 2017).

An extreme example of bad foot health and the restriction of natural movement was Chinese foot binding. The range of motion in the ankle of a female who had their foot bound was reduced by at least 60% (Reznikov et al., 2017). While this would not occur from modern-day footwear, this example can be used to illustrate how kids who wear rigid shoes could potentially encounter issues with the foot's natural growth as the foot bones mature (Cucuzzella, 2017).

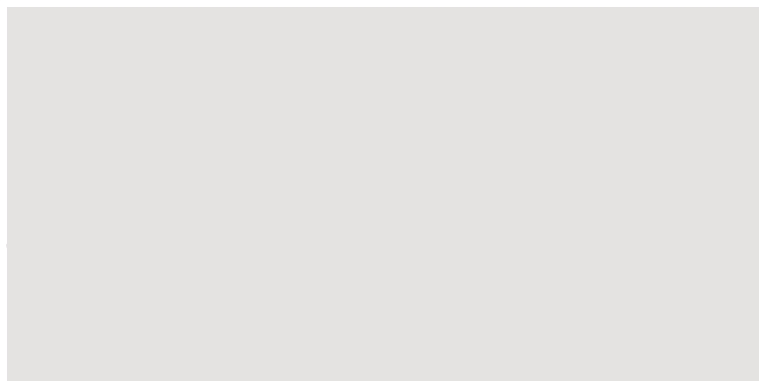


Figure 2. Foot Bones, (2019). Anatomy of the foot, highlighting the metatarsal bones.

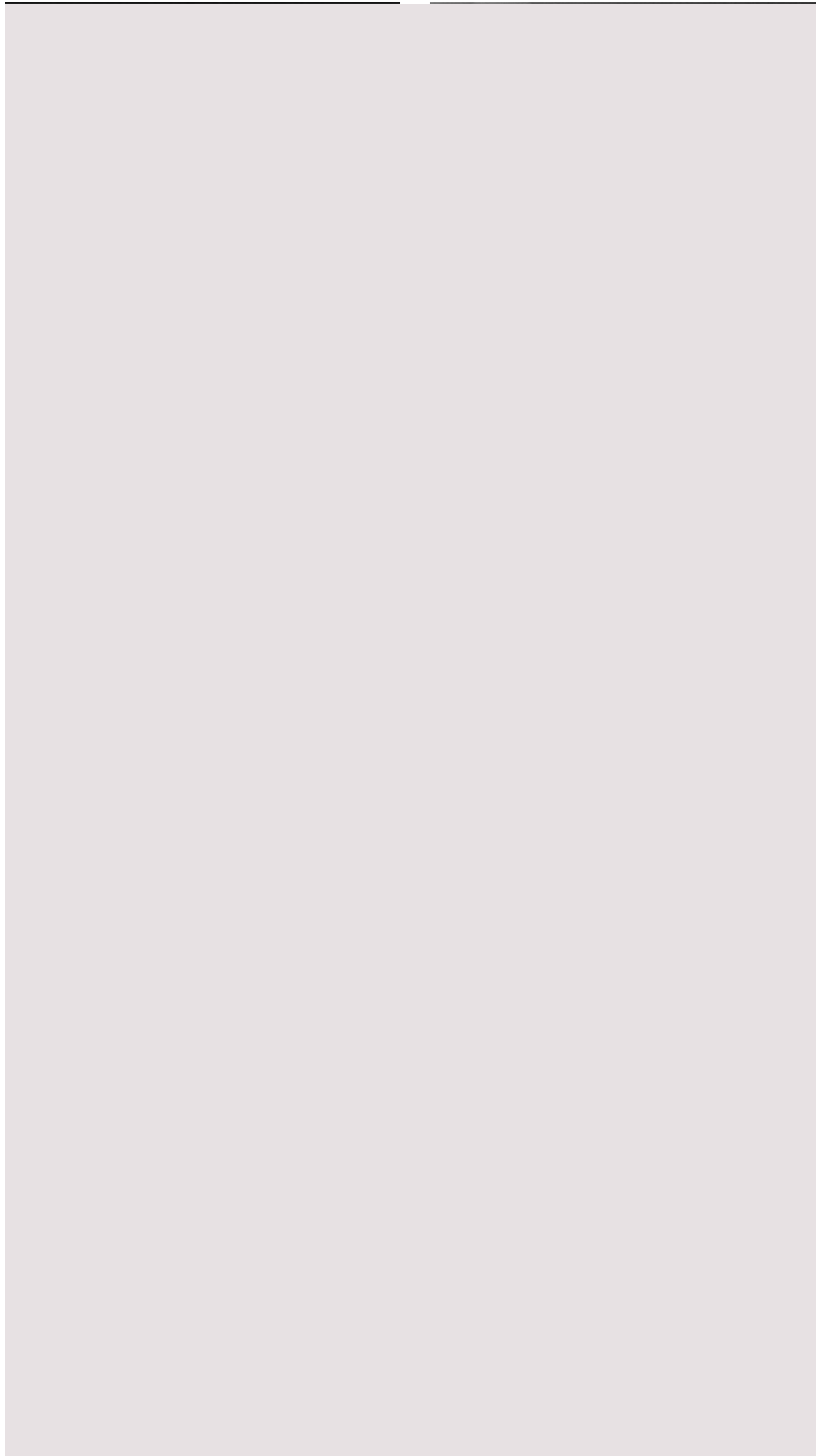


Figure 3. Top Left: Shiatis & Hwang, (2014). 7 Month old X-ray; Top Right: Jones, (n.d.). 2 Year old X-ray; Bottom Left: Chen et al., (2014). 3 Year old X-ray; Bottom Right: Kecler-Pietrzyk, (n.d.). 7 Year old X-ray. Figures demonstrated the dramatic changes in bone structure and the transformation of cartilage to bone from seven months to seven years of age.

Cowgill et al. (2010) asked how the young human skeleton responded to the challenge of standing upright and taking its first steps. This research wanted to test whether babies' bodies can change and respond to exercise and load similarly to adults. The structure of young leg bones from a horizontal cross-section was oval compared to an adult's teardrop shape. By the age of 5-6, these bones had developed into the adult shape. The study found that the body was laying down more bone on the sides of the legs to resist the forces of side-to-side movement of young children toddling back and forth (Cowgill et al., 2010). Cowgill et al. (2010) used this evidence anecdotally to support how a child's skeletal framework could change over time as their movements change. This indicated that the natural structure of the foot could be changed through children wearing rigid shoe, suggesting that barefoot shoes could be beneficial in supporting the skeletons growth (Cowgill et al., 2010).

This was also observed by Bates et al. (1979) in adults with pronating feet. Participants who had used prescribed rigid foot orthotics for at least one year were recruited. They were recorded running on a treadmill under three conditions: barefoot, test shoe, and test shoe plus orthotic device. The study suggested that functional mechanisms of the joint had adjusted due to the orthotic device.

More recently, Aibast et al. (2017) conducted a study that looked at the foot structure and function of Kenyan children and adolescents who were habitually barefoot and those who were habitually shod. The short-term effects determined greater foot strength in habitually barefoot children and adolescents. This was linked to a more significant amount of time spent engaged in daily physical activity by habitually barefoot children and adolescents compared to those who wore shoes. Despite the contradictions found in academic research of whether barefoot shoes are better or worse for children's foot health, research has linked the connection with nature to greater foot strength and well-being by spending more time active and outside (Aibast et al., 2017).

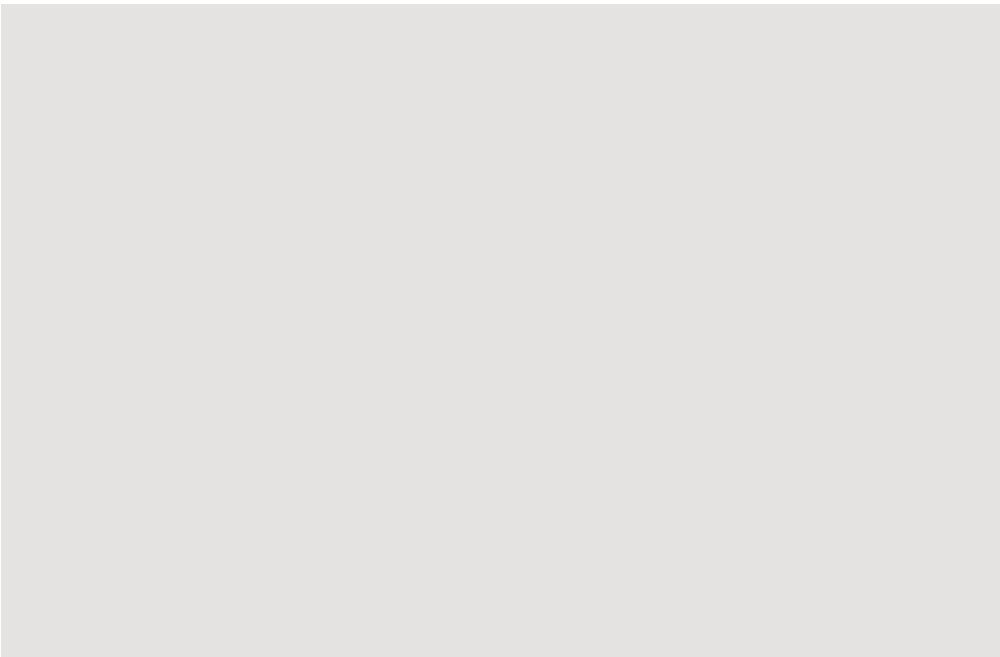


Figure 4. Cowgill et al., (2010). Comparison in shape of infant to adult leg bone, demonstrating how the skeleton is capable of changing through development.

The role of proprioception in barefoot shoes:

Lephart et al. (1997) defined proprioception as “a specialised variation of the sensory modality of touch that encompasses the sensation of joint movement (kinaesthesia) and joint position (joint position sense)” (pp. 130-131). Sensory receptors used for proprioception were found in the joints, muscles, skin, ligaments, tendons, and vestibular and vision centres. These sensory receptors input afferent information (impulses from a sensory nerve) to the central nervous system, about body position, balance, and tissue deformation (Lephart et al., 1997).

Minimalist footwear has been shown to improve dynamic postural stability (proprioception) in short-term studies (Whitehead et al., 2016). Studies suggested that by minimising thickness of material between the foot and ground, the foot responded to inconsistencies on the ground surface more effectively (Franklin, 2018). In contrast, standard athletic shoes (thicker sole and stiffer construction) ‘mute’ these proprioceptive benefits (Whitehead et al., 2016; Franklin, 2018). While these studies were conducted on adults, Franklin (2018) stated that minimalist footwear was a viable alternative irrespective of age.

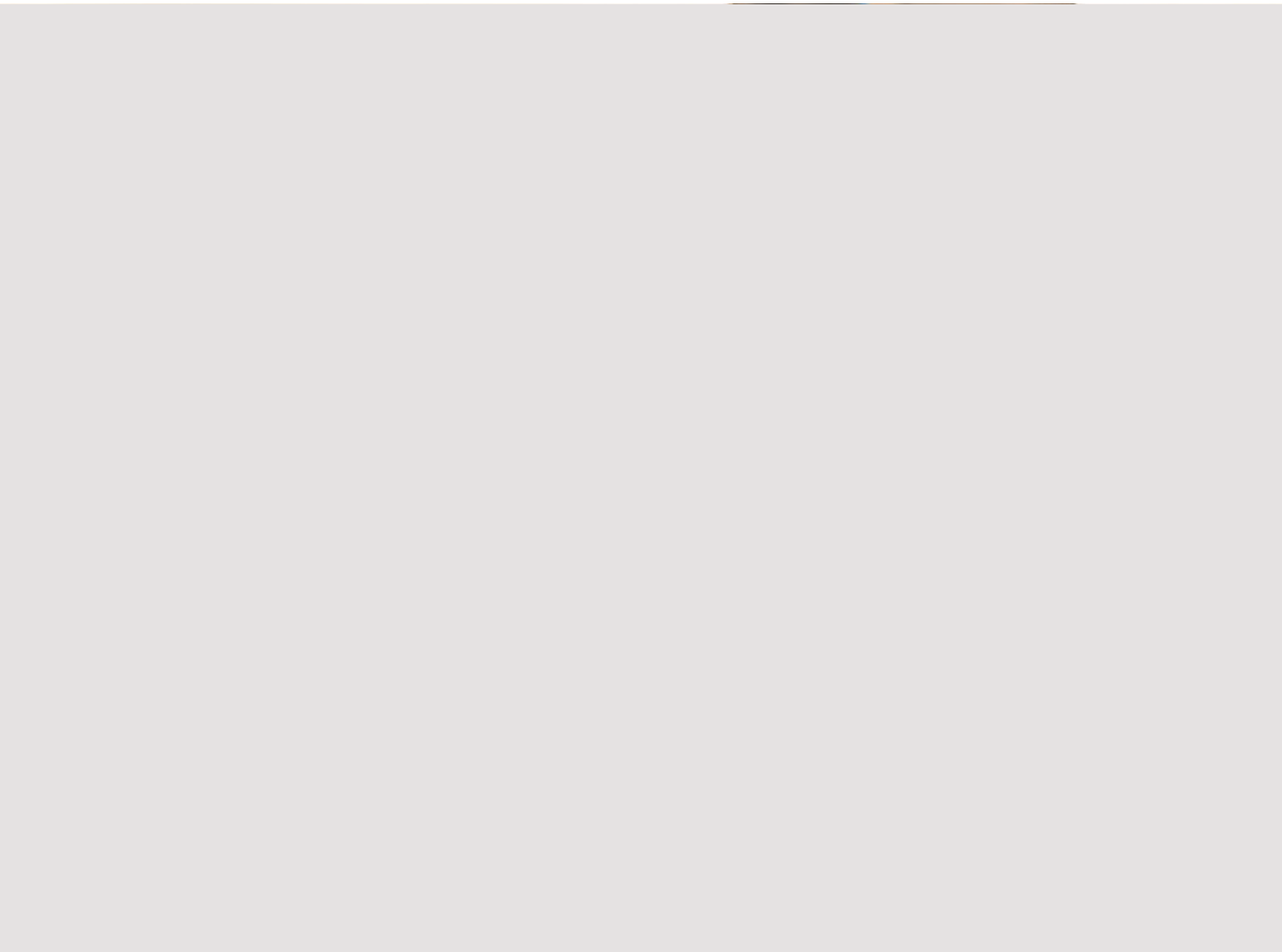


Figure 5. An Overview of Anatomy and Proprioception, (n.d.). Child walking over a log, using proprioception to understand where her body is in space, aiding balance.



02.2. Contradictions in Academic Research

Where does this Research Sit Among the Contradictions

The importance of footwear choice in influencing structural development and long-term foot health is heavily discussed and debated amongst scientists and researchers. Due to the lack of research conducted on children's foot development explicitly, the topic still lacks scientific credibility.

There is limited evidence of debate in academic literature that children should be wearing shoes for protection, especially in the concrete urban jungle we live in today. However, what is discussed is the developmental, biomechanical, and clinical perspectives, benefits, and drawbacks of minimalist footwear versus hard-soled (shod) shoes (Morrison et al., 2018).

Early studies that looked at the effects of footwear on foot development have focused on the medial longitudinal arch and its morphology based on footwear style. More recent research has begun to observe the effects of footwear on the function of people's feet. A study conducted by Echarri & Forriol (2003) that measured static footprint in Congolese children aged 3 to 12 years, investigating the foot morphology, concluded that footwear had an insignificant impact on the morphological structures of the feet. In contrast, Rao & Joseph (1992) observed the static footprint of 2300 children (of a similar age to the previous study). They reported a direct link to closed-toe footwear and poor development of the medial longitudinal arch. Flatfoot was more common in those wearing closed-toe footwear and the least common in barefoot children. Rao & Joseph (1992) concluded that closed-toe footwear had detrimental effects on foot development.

There are multiple studies (Ashizawa et al., 1997; Barnicot & Hardy, 1955; D'Août et al., 2009; Kadambande et al., 2006; Sachithanandam & Joseph, n.d.) that discussed the characteristics of foot morphology in habitually barefoot and habitually shod individuals over the longer-term. Habitually barefoot individuals showed wider and larger feet (relative to body length) (Hollander et al., 2017). A limited amount of evidence suggested that habitually barefoot individuals had more pliability in their feet, while habitually shod individuals generally had stiffer feet (Kadambande et al., 2006).

The long-term effects of barefoot and shod children and adolescents concerning motor performance, health and biomechanical outcomes are still to be determined (Hollander et al., 2017; Morrison et al., 2018). Because of this, there is a limit to the conclusions that can be drawn for clinical guidance. This debate can only be continued by the synthesis of current, relevant and unbiased research. Hollander et al. (2017) recommend that in the future, studies should include randomly assigned cohorts of barefoot and shod adults (or children) who regularly participate in daily exercise or activity. By creating such parameters, the gap in research of longitudinal studies surrounding this context may be addressed.

While there may not be proven podiatric reasoning for minimalist footwear, there may be numerous other benefits. Children may be more connected with the ground underfoot, have an increased awareness of their body in space (proprioception), greater stability and may even spend more time in nature (Whitehead et al., 2016; Aibast et al., 2017). This is a strong incentive to encourage parents to purchase this footwear style for their children.

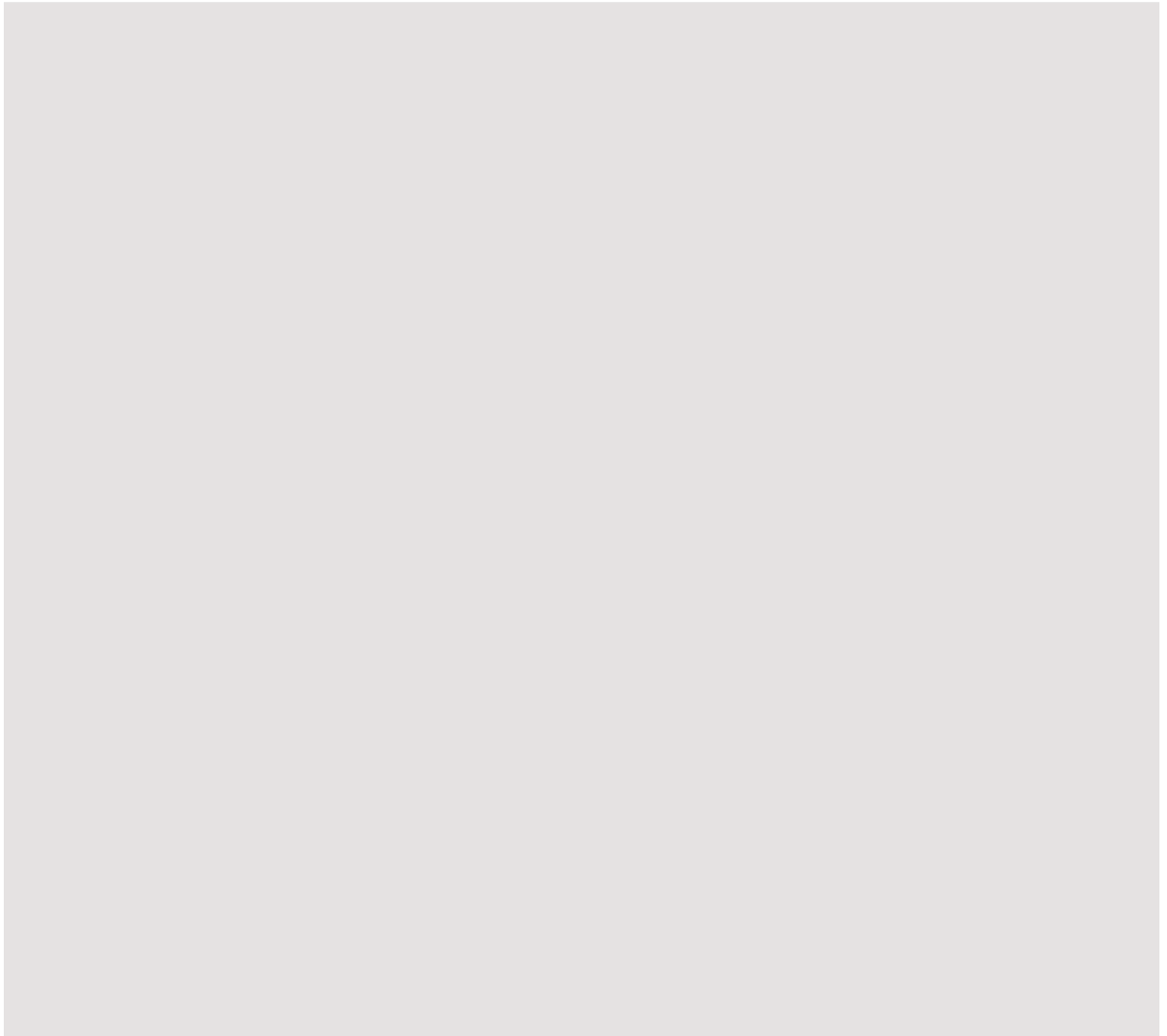


Figure 6. What Even Are Barefoot Shoes? | GROUNDIES® TrueSense Barefootwear, (n.d.). Comparison of stiff and cushioned shoes vs minimalist/barefoot shoes, demonstrating the amount of material between the foot and the ground for both styles of shoe.

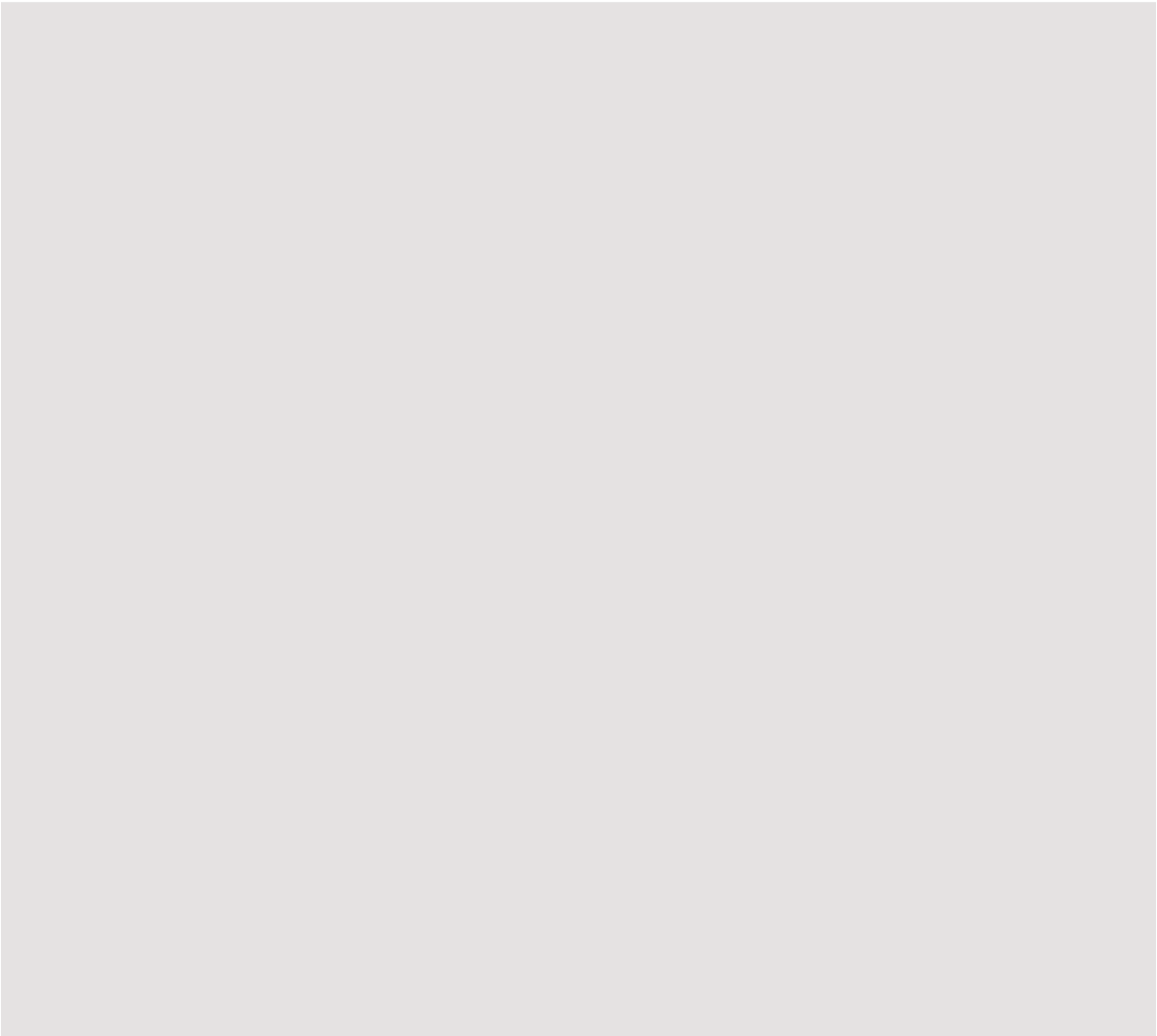


Figure 7. What Even Are Barefoot Shoes? | GROUNDIES® TrueSense Barefootwear, (n.d.). Comparison of stiff shoes vs minimalist/barefoot shoes which have an open toe box shape allowing for the toes to spread and move naturally, rather than being constricted by the shape of the shoe.



02.3. Framing the Research

Connection with Nature:

The book “Last Child in the Woods” discusses how we can save our children from Nature-Deficit Disorder. The author links the disconnect from nature in the “wired generation” to trends such as the rise of obesity, attention disorders and depression (Louv, 2005). Louv (2005) was one of the first academic articles in a growing collection of research that indicated exposure to nature could be critical for a child’s healthy physical and mental development. The book quotes a fourth grader stating, “I like to play indoors better ‘cause that’s where all the electrical outlets are” (Louv, 2005, p2).

As described previously, Aibast et al. (2017) conducted a study that looked at the foot structure and function of Kenyan children and adolescents who were habitually barefoot and habitually shod. The short-term effects determined greater foot strength in habitually barefoot children and adolescents. This was linked to a more significant amount of time spent engaged in daily physical activity by habitually barefoot children and adolescents compared to those who wore shoes. Despite the contradictions of whether barefoot shoes are better or worse for children’s foot health, research has linked the connection with nature to greater foot strength and well-being by spending more time active and outside (Aibast et al., 2017).

As discussed in the child foot development section, Aibast et al. (2017) discussed that children who were habitually barefoot typically spent a greater amount of time engaged in daily physical activities compared to habitually shod children. The conclusions of this research was that being barefoot could encourage children to spend time outdoors. I drew assumptions from this research which supported the design of a shoe that was grounded in nature. I aimed to communicate connection with nature while also using that communication to encourage the user to engage with nature.

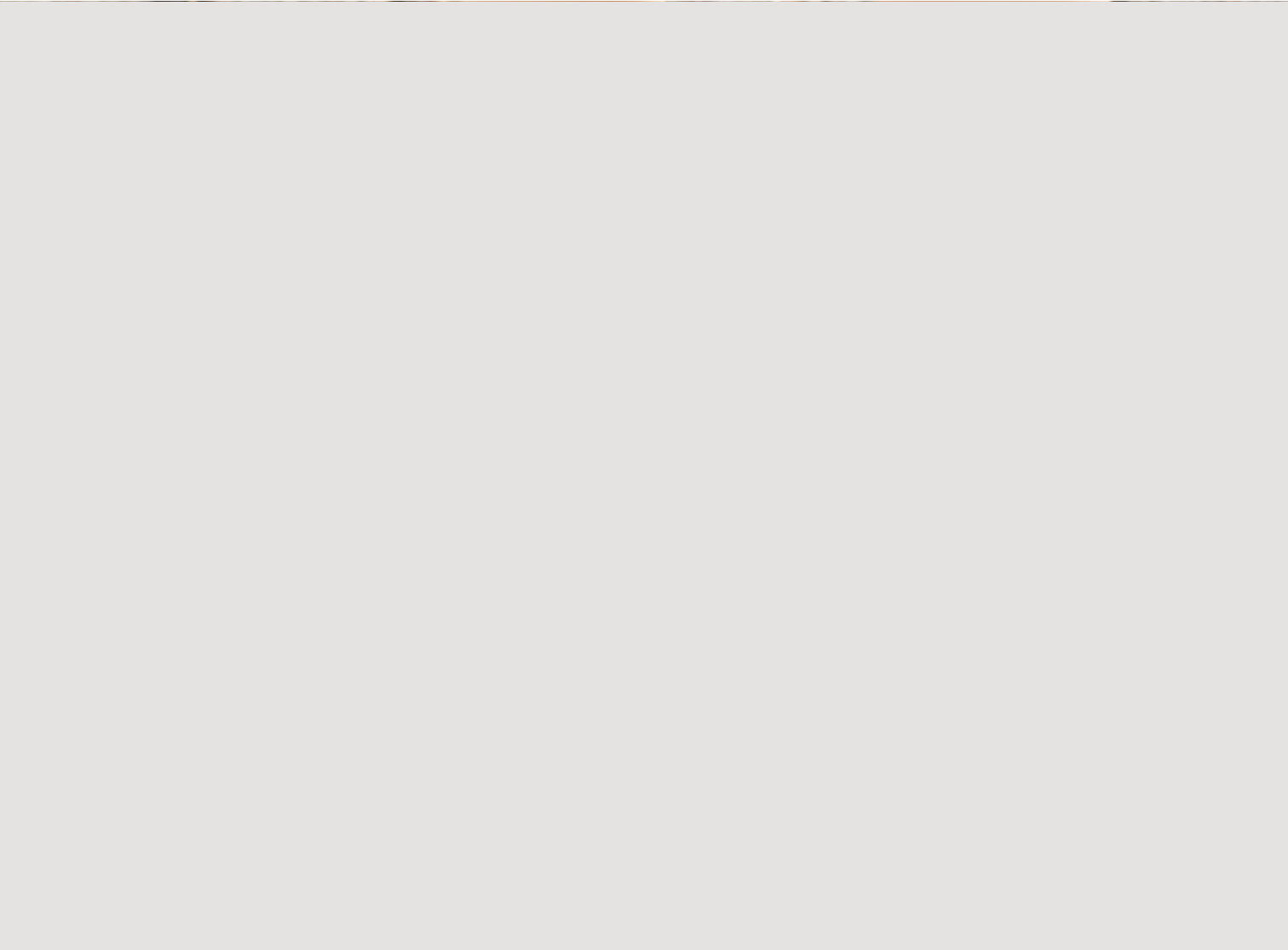


Figure 8. Premium Photo | Happy Childhood in the Nature. Bare Kids Feet on Soil, (n.d.). Child playing in the outdoors.

Communication through Semiotics and Affordance:

The research undertaken in this project centred around how to best communicate foot health and connection with nature to the consumer – a parent/caregiver. This was achieved by exploring the complex discipline of semiotics and weaving it into the project to support key design decisions with the aid of other visual communication methods such as affordance and human-centred design.

Semiotics can be structured as a discipline, a theory, and a methodology; it is an extension beyond words (Peirce, 1992). The fields that semiotics have been applied to are diverse, such as anthropology, advertising, cultural studies, and of course, design (Lawes, 2002). Semiotics brings to light the meaning behind products or services (Boradkar, 2010). This meaning is intentionally ‘designed’ into products with purposeful intent. This master’s research paid attention to what needed to be communicated to the consumer and focused on ensuring those signs were received.

Semiotics revolves around the concept that the world is full of signs, with Peirce (1992) arguing that the world could be composed exclusively of signs. However, what is a sign?

Signs in the semiotics discipline are a lot more complex than what a layperson may understand (road signs, toilet signs etc.) A sign is, in essence, an object or image that signals something more. A road sign, for example, will signal an action that a driver may need to take. If that same thinking around what a sign is, is transferred to a high quality office chair, that chair may signal an excellent seating experience, and further that, it may signal success, intelligence, authority etc. (Boradkar, 2010).

To unpack ‘signs’ and discover what they mean, the study of ‘signs’ requires an understanding of the unspoken cultural and societal conventions that

highlight modern communications, determining how people make sense of their surroundings (Lawes, 2002). Lawes (2002) stated that when several people interpreted an object in the same way, at least part of the reasoning was drawing on shared cultural and societal resources.

Charles Sanders Peirce, an American pragmatist, and Ferdinand de Saussure (a Swiss Linguist) are recognised as the two founding figures of modern semiotics (Boradkar, 2010). Peirce and de Saussure built the foundation that now makes up the semiotic discipline. Peirce (1992) classified signs as consisting of three things, symbols, icons, and indexes. A symbol has no direct relation to the object but is accepted to stand for it out of convention, symbols are culturally learned. The alphabet and punctuation marks are good examples of this: the relationship between the letters, their shape and the corresponding sound of the letter has to be learnt. Icons closely resemble the thing, object or concept with a direct imitation. An icon of a tree will look like a tree, an icon of a bin will look very similar to a bin. Indexes derive meaning through observation and experience of the material world and don't resemble the object. Rather, they resemble something that may imply the object or concept. A smile can be seen as an index of being happy, in the same way as a red light is an index to stop. Some indexes are natural, and it can be assumed that most people would understand it, but some indexes are learned (like a red traffic light meaning stop) (Bradley, 2016).

Adding to the three forms of a sign are the signs' denotative and connotative meaning. Boradkar (2010) explained that a sign always referred to something which denoted an accepted meaning. Denotation is the more obvious or literal sense of what the object does or is. In footwear, the denotation of the product is a shoe that is worn and walked in. Roland Barthes (1915-1980) was one of the significant scholars who built upon Saussure's semiological system. He suggested that signs could also connote additional meanings that were not obvious first-hand, referring to socio-cultural and ideological implications (Eagleton, 2014). An example of the connotations of a shoe may be that it

protects, provides warmth, and may display wealth, conspicuous consumption and status.

Although semiotics has become an established practice, it does not appear to be widely studied and practised by designers in the industrial design community. For example, a company may contract a semiotician for a particular aspect of a project rather than have them involved in an entire design project (Lawes, 2002). It is common for companies to incorporate more understood methods such as affordance and human-centred design into the design and development of products (You & Chen, n.d.). While these are essential methods in the industrial design discipline, it is frequently mistaken that these methods (and other research and design methods) can replace the need for semiotic expertise or insight (Lawes, 2002). This may be due to a lack of understanding of how semiotics can be used to approach a subject and how ensuing ideation and products created could provide more accuracy in how a product will be understood by the user (Lawes, 2002).

As discussed above, semiotics provides a method of analysing and documenting data unpacked from a product. It can provide objectivity in a design process that helps to purposely communicate elements of the design/system to users (Lawes, 2002).

Another visual communication concept known as “affordance” was used alongside semiotics in this master’s project. This term was coined by American psychologist James Gibson (1966) who described affordance as what an artefact could “offer” the animal, referring to the primal instincts of humans or other species. Donald Norman then brought the idea of affordance into the design realm explaining that an affordance is not a property that is attached to an object, it is a relationship with an object. The existence of affordance in a relationship is dependent on the properties of the object and the abilities of the agent that is interacting with the object (Norman, 2013). Examples of this are a chair, which affords sitting; a pen, which affords writing; and a shoe,

which affords walking. Unlike semiotics, however, affordance considers the behavioural components of humans concerning the meaning of an object (Gibson, 2014). As someone's condition or state of being changes, the function of an object changes as well. For example, as someone progressively gets more tired, objects may appear to serve as a chair, e.g., a wall, box or even the floor (Boradkar, 2010).

It is noted that designers may make subjective design decisions throughout a design process (Hoxha, 2014). As their knowledge and understanding of a topic deepen, it is commonplace for a designer's assumptions to influence their design practice based on their tacit knowledge and intuition (Hoxha, 2014). Using affordance in design may rely heavily on a designer's intuition, which is an effective method of communicating the function of an object. However, there is a risk of bias in decision making (Diver, 2018).



02.4. Bobux

Bobux Design + Natural Movement:

This research project partnered with the New Zealand children's footwear company Bobux. Bobux prioritises comfortable shoes designed specifically to the shape of children's feet instead of the industry standard of miniaturised versions of adult footwear (Cucuzella, 2017). Cucuzella (2017) explains that children's shoes are typically too rigid, preventing natural movement. This is due to the construction of the shoe mimicking adults' footwear. Essentially, the same materials are used but scaled down to children's shoe size and the stiffness to user weight ratio is often not factored in. The result is a shoe that cannot be flexed sufficiently due to the user not having the weight and strength to allow these shoes to move naturally (Cucuzella, 2017).

Bobux uses flexible materials to aid in movement and growth (Toddler Shoe Design | Bobux, n.d.). Bobux shoes have 3mm thick soles that allow children (ages 0 to 8 years) to connect with the ground underfoot, both psychologically and physiologically.

Bobux focuses on "Natural Movement" to support natural foot growth while recognising that shoes are required for thermal insulation and protection against injury. Bobux claims to recognise the importance of allowing free and natural movement (Toddler Shoe Design | Bobux, n.d.). Bobux shoe styles change through the early development stages e.g. crawling and learning to walk, with soft-soled shoe styles in early development, into a more structured shoe style with a thin and flexible sole and upper.

The Soft Sole is designed for babies and “crawlers”, made with a suede sole, soft leather upper and an elasticated ankle. This shoe is flexible to allow for children's tummy time and rolling movements in the development stage. Children's feet tuck under with the top of the foot pressed against the floor for crawling. The sole and heel do not restrict this movement in this type of Bobux shoe (Soft Sole Leather Baby Shoes | Bobux, n.d.).

The Xplorer shoes are for babies edging closer to walking, pulling themselves up using furniture. Their feet are in the beginning stages of forming, building the groundwork which will allow them to eventually stand. Their feet are chubby and soft, with flat pads and no arches. The Xplorer shoe flexes with the child's movement, providing more durability and protection in this development stage than the Soft Sole while still providing the comfort and natural movement needed for natural growth (Xplorer Stage | Bobux, n.d.).

“First walkers” wearing the Step Up shoe style are gaining confidence in walking around; they are learning balance and are wobbling about, occasionally falling over. Their feet have developed and their heels have formed to support their weight. The cartilage in their feet is starting to form into bones, but their feet still have a layer of fat and are rounded. There is no arch or achilles yet, but that will come soon. The step-up shoes have harder wearing soles for walks outside and keep the stability and flexibility features that Bobux is known for (Baby's First Walking Shoes | Step Up | Bobux, n.d.).

The Bobux Philosophy:

“Our shoes should be comfortable, adjustable, durable, breathable, flexible and they should communicate their purpose but, most importantly, our shoes should be loved” (Toddler Shoe Design | Bobux, n.d.).

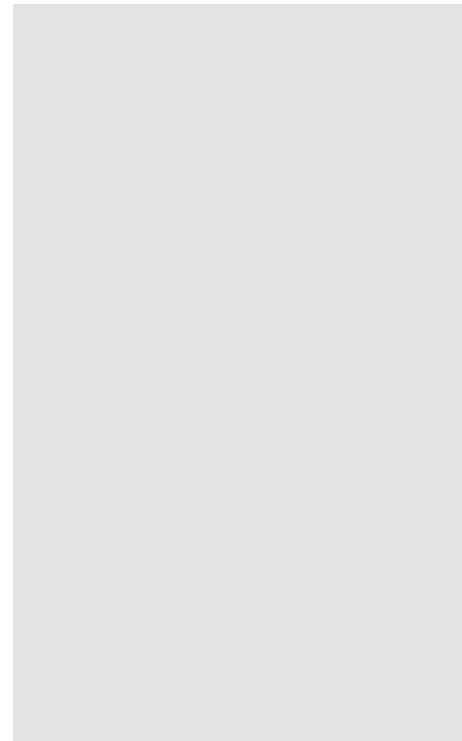
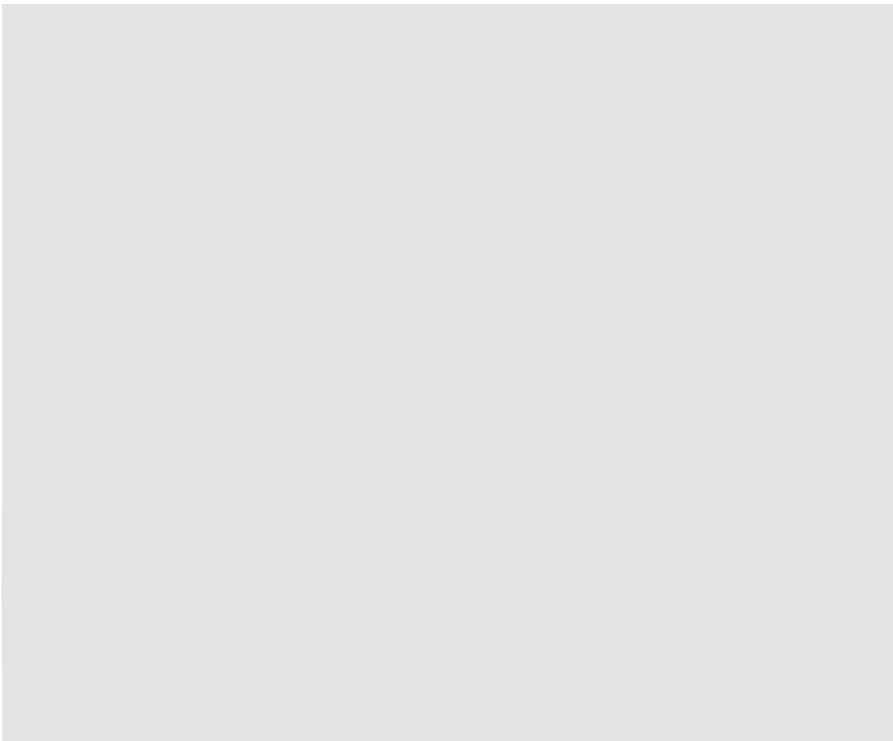
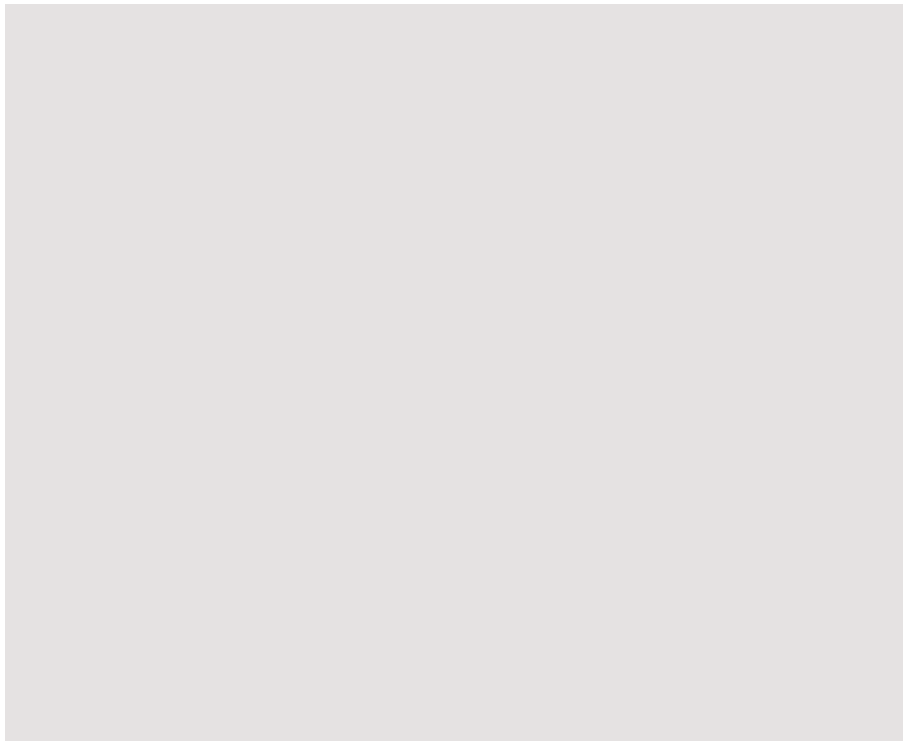


Figure 9. Left to right: Spekkel Grey Soft Sole | Bobux, (n.d.). Bobux Soft Sole shoe; Go Smoke Xplorer | Bobux, (n.d.). Bobux Xplorer Shoe; Desert Caramel Step Up | Bobux, (n.d.). Bobux First Walkers/Step Up Shoe.



The Bobux Gap:

As stated in the Bobux philosophy, communication of purpose is a core element of the brand. The company has noted that over the years, communication has migrated from the product itself to the marketing of the product using visual (photographic) and written mediums to tell the story of the products purpose (Bobux, personal communication, 24 March 2021). This is an effective method of communicating with the consumer when selling in an e-commerce environment where the user cannot physically see the shoe, pick it up, and absorb visual and tactile information. However, in a retail environment Bobux is sharing 'wall space' with numerous other competitors. Consequently, it can be challenging to make their shoes stand out and communicate the company's purpose to the retail consumer in the first moments that they interact with the shoe (Bobux, personal communication, 24 March 2021).



Figure 10. Buy Baby, Toddler & Kids Shoes Online NZ | Bobux, (n.d.). Bobux Children's Shoes.



02.5. Positioning the Research

The Unknown Surrounding Barefoot Research:

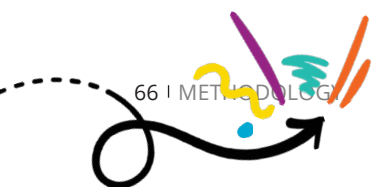
This master's research used the barefoot philosophy as a way of helping to ground the project in nature, based on Bobux's core elements: flexibility, movement, healthy feet, nature and adventure.

Following the discussion surrounding the contradictions in academic research of the effects of barefoot shoes on foot development in children, there needs to be an acknowledgement of the positioning of this research concerning these contradictions. Barefoot footwear, in the academic realm, is a relatively uncharted territory. While barefoot activity has been studied, overall there is little evidence for clear conclusions to be drawn (Morrison et al., 2018; Franklin, 2018). Through this project, my role was not to thoroughly unpack the science behind barefoot footwear. Still, understanding this science was essential to bring an academic/scientific point of view to a design-based project. What I was not doing in my research was adding to the discussion of barefoot vs shod, instead I followed Bobux's stance of prioritising natural movement. No matter how people interpret the research contradictions, there are still many benefits to wearing natural footwear other than biomechanical, developmental, and clinical benefits (Whitehead et al., 2016). This research primarily focused on communicating the key elements of a Bobux shoe and its connection with the ground underfoot.

The Research Question:

This review formed a holistic understanding of the contexts surrounding my project. Through the reflection on foot health and connection with nature using semiotics and affordance as a facilitation method, I have been able to create a framework for my research through the following research question:

How might visual language tools such as semiotics and affordance be used to better communicate connection with nature and encourage outdoor play in the design of footwear for toddlers?



03. Methodology



03.1. Timeline

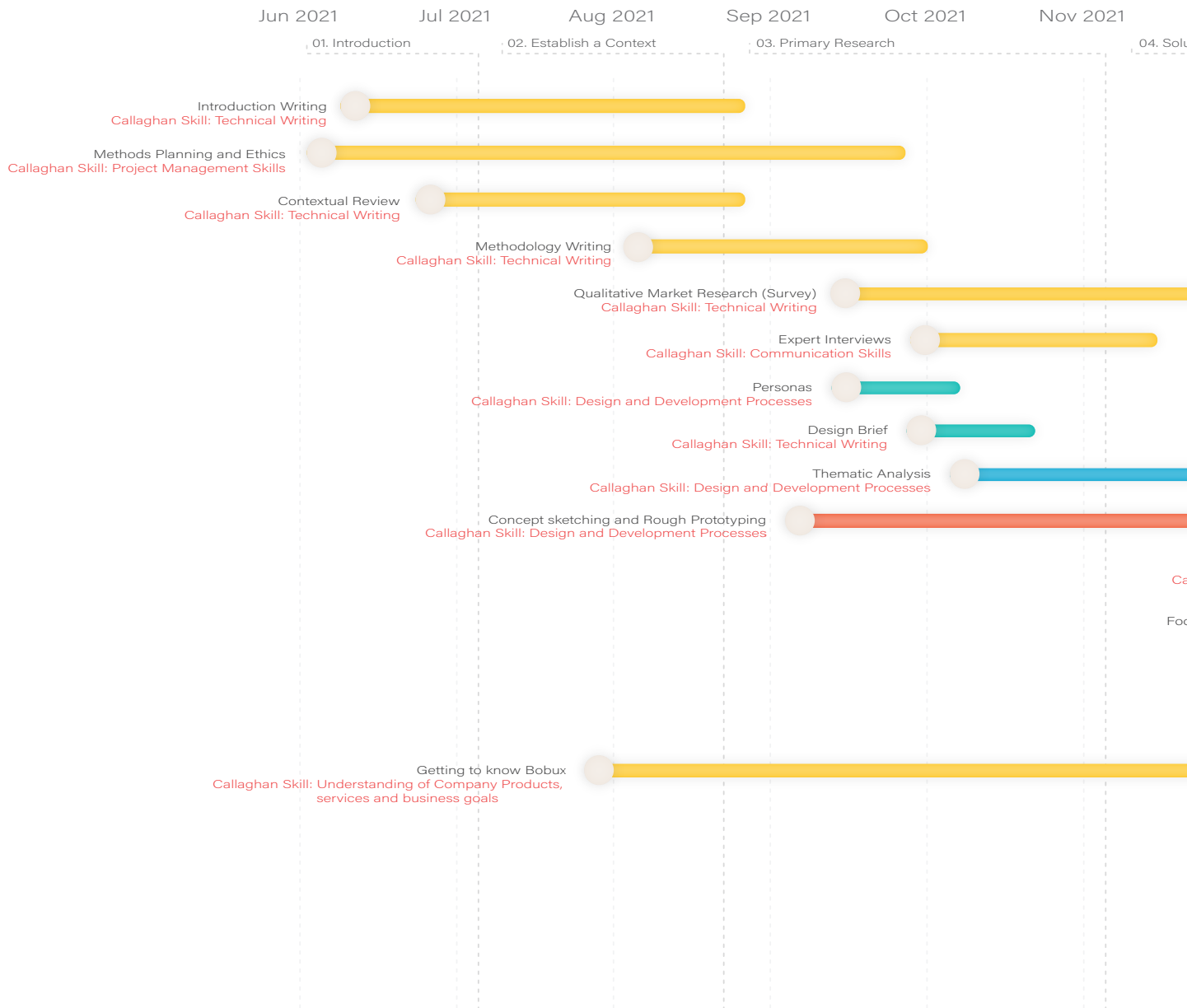
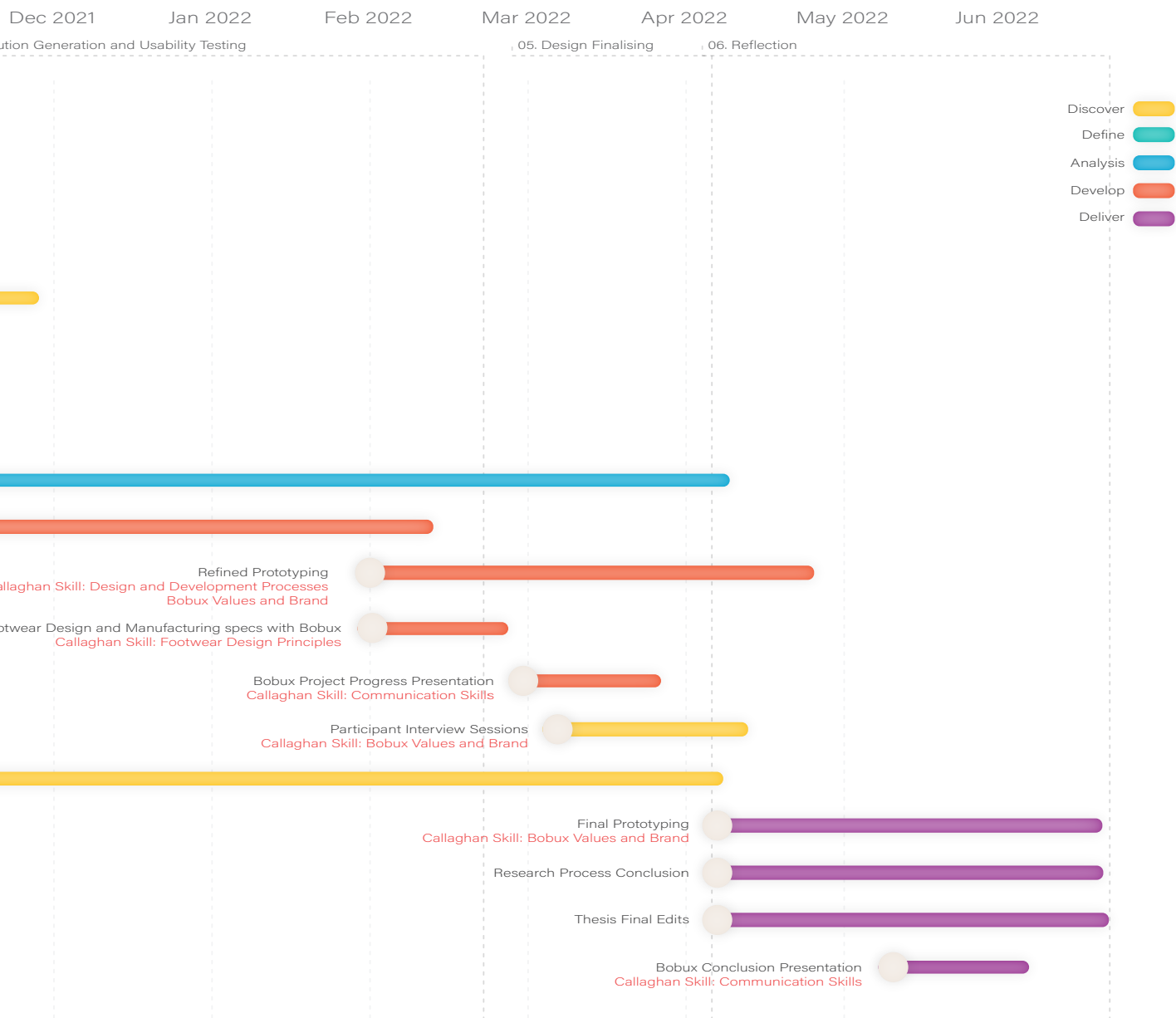


Figure 11. The research timeline.





03.2. Methodological Frameworks

Action Research:

Action Research centres around solving a problem where a social practice needed to be changed, using participatory methods alongside a cyclical and iterative process of planning, acting, observing, and reflecting in an organised and documented manner (Swann, 2002). Action research was traditionally a social science-based methodology. However, as design practice has changed from the twentieth century into the twenty-first century, designers have recognised the similarities between design processes and Action Research. Consequently, Action Research has become a recognised method of solving design problems (Swann, 2002).

Design Processes often follow a similar structure to action research. Design research also follows a cyclical and iterative process of problem/research – analysis – synthesis – execution – production – evaluation. Designers will continue to iterate various ideas until one idea is refined to the point that the initial problem has been solved effectively (Jones, 1992).

Design as a discipline evolved rapidly after the Second World War. Prior to that design decisions were often made using a linear process that was quite subjective in its nature, particularly in Industrial Design (Swann, 2002). This evolution combined traditional design/art-based practices such as intuition, problem-solving, holistic thinking and self-expression alongside social science-based practices using quantified data and the inclusion of users, consumers and the public into the developmental process. Combining methods from the two disciplines allowed for a process that helped designers to use informed intuition and rational judgment together (Swann, 2002).



Figure 12. (Top) Swann, (2002). Action research diagram; (Bottom) Jones, (1992). Double Diamond Design Process.

Human Centred Design Research (HCD):

HCD is an approach that aims to help designers/people “humanise” the design process, focusing on the people for whom the product or service is being designed (Norman & Draper, 1986). Consequently, those that use HCD in their practice, often work with the users of the product/service and learn from them to develop an outcome that fulfils their practices, needs, and preferences (Steen, 2011).

Design theorist Don Norman created a set of HCD guidelines that have become a universally recognised framework for designers and other industries to help them to achieve better usability outcomes (Harte et al., 2017; Norman, 2013).

As an approach, discipline, or methodology for the design and development of interactive systems and products, HCD is applied to make these systems more usable by bringing people into the design process, using their knowledge to identify problems accurately and make the system more usable (International Organization for Standardization, 2019). Using HCD can have benefits such as improved productivity, enhanced user well-being, avoidance of stress, increased accessibility and reduced risk of harm (Harte et al., 2017). Harte et al. (2017) stated that this can be achieved by following the four defined phases that make up the HCD process. (1) Identify who the user is and their context of use; (2) State the requirements of the user; (3) Generate design solutions; and (4) evaluate the validity of solutions against the requirements. The HCD process helps to ensure that the solution has gone through an iterative cycle so that the final outcome addresses the user’s needs.

Van Der Pan et al. (2003) and Van Kleef et al. (2005) stated that users may prefer a product they are accustomed to rather than focusing on a future outcome. This may be due to customers struggling to articulate their needs or imagine what their needs might be. This in turn can cause the designer to imitate existing products and halt the forwarding of research and development. Combining an Action Research methodological approach with Human-centred Design, where a cyclical, reflective and analytic process is applied, could help to mitigate prejudice and bias in the design outcome (Swann, 2002).

This research project integrated HCD into the Action Research methodology by building the four design phases of HCD discussed previously into the Action Research stages of discover – define – develop – deliver. HCD was required because the research focused on the parents experience with the product from the retail environment to its use. Every decision that was made through the development considered how it would affect the user.



03.3. Research Methods

The following section describes the methods used in this research to make up the four stages of the design process.

Project Management - Timeline Planning:

Timeline planning is a graphical tool representing a period where important events are noted (Oxford University Press, 2021). Specifically, in research, timeline planning can be used to organise the different stages of a project (Gigante et al., 2017). In a project with multiple phases and complexities, timeline planning is essential in implementing set actions within appropriate periods to reach the desired outcome of a project (Nadler, 1980).

Collaborative design environments need good project management (Berryman, 2002). Few designers work alone - whether the project has multiple people from varying disciplines who are directly involved, or the designer is leading the project individually and bringing people in at different stages to provide specialised input. Berryman (2002) states a preliminary timeline should be created, with an overview of time commitments, deliverables and dependencies in order to identify conflicts and bottlenecks before they occur.

A timeline was used to help organise and plan activities throughout the research. As the research progressed and developed, so did the timeline, with multiple iterations continually evolving.

Contextual Review:

A contextual review is an activity conducted by researchers as a tool for critical and analytical unpacking of the scope of enquiry (Gray & Malins, 2004). A contextual review should discuss what is known in the field, identifies the gap/s in knowledge that the researcher's project will explore, and defines a rationale for how and why the research should fill that gap (Gray & Malins, 2004).

A contextual review differs subtly from a literature review (Jesson et al., 2011). They are similar tools for unpacking a scope of inquiry. However, a contextual review is often viewed as being unsystematic, qualitative, or lacking in rigour, compared to literature reviews that are more rigorous and systematic analyses (Griffiths, 2004). Literature reviews typically analyse what is considered "academically accepted" in the said field of study. In contrast, contextual reviews examine sources and disciplines that may not be deemed "academically accepted" (e.g. consumer products, artworks, critical design etc.).

Due to the cross-disciplinary nature of my research, it was appropriate to use a contextual review to unpack my scope of enquiry critically and analytically (Barnes & Melles, n.d.).

Literature relevant to my research focus was analysed in the contextual review. For example, I explored literature surrounding children's foot development and how companies could use footwear to aid that development. Alongside this, the review looked at ways design could be used as a tool to better communicate to consumers, by investigating the application of semiotics, affordance, and human-centred design. Literature was sourced through the AUT library (and data bases), Google Scholar's research database and supervisor and peer recommendations.

Qualitative Market Research - Customer Survey:

Qualitative market research helps researchers understand and explore the “how and “why” behind the “what” of people’s behaviours, attitudes and motivations. This method uses dialogue and evocation with participants instead of controlled measurement seen in quantitative research to understand the problem (Imms & Ereaut, 2002). Qualitative market research is a helpful method in unearthing user information from a particular service or product. Imms & Ereaut (2002) outline the primary aims of market research as supporting understanding and sense-making. As Ansoff (1957) explains, market research plays a part in both market and product development. Market development aims to determine how to maintain strength in the market by measuring customer satisfaction (Hague et al., 2004). Market research in product development exposes the unmet needs of users/customers and provides a better understanding of foreign markets (Hague et al., 2004).

Qualitative market research provided me with a greater depth in understanding of customers’ views and level of knowledge surrounding Bobux footwear. This research also acted as a source of creativity in obtaining inspiration, ideas, and innovation, to design based on real people’s thoughts and opinions. Market research had a role in multiple avenues of my research investigation. It showed the customers’ unmet needs as a starting point for new product development (NPD) and gave insight into customer understanding of existing product features. These two avenues gave me a greater understanding of areas that needed improvement and exposed the strengths and weaknesses in the Bobux product line that needed to be highlighted and brought through to the NPD.

In order to conduct the survey with participants, the research followed a formal process of ethical review prior to starting, which is discussed in the ethical considerations section of the methodology chapter.

AUTEC approval was granted 02/09/2021 (ethics number 21/280).

Participants were existing Bobux customers who had agreed to be on Bobux’s email database. Participants were required to be parents or legal guardians of a child/children aged between 1-4 years old.

Bobux sent out an invitation email to 200 customers who had registered their interest in receiving emails from Bobux and 19 responded and completed the survey. Potential participants were emailed with an information sheet about the research, its purpose, and what the survey aimed to achieve. The information sheet stated that consent was implicit in the completion of the survey. This information sent to potential participants contained a link that took them to an anonymous survey platform (Qualtrics). Consequently, any data collected was not able to be associated with any specific Bobux customer, nor did Bobux employees have access to the data.

The survey initially asked for information such as the number of children and their ages; this helped ensure I was surveying the correct group. The survey then asked multiple open-ended questions that could be written into a textbox, the questions were as follows:

If you think Bobux shoes are helping children's feet, please try and explain how you think they are helping. And if not, why not?

If you trust Bobux shoes, what is it that makes you trust them? And if not, why not?

These questions helped me gain insight into the strengths and weaknesses of how Bobux communicated their brand message. It also helped me to understand how parents may prioritise various footwear elements in the shoes they purchase for their children, as an example, podiatrist approved was a high priority for many parents.

The survey data was compiled and reviewed three weeks after it was sent out. The responses were summarised to illustrate any major themes which were kept for later reference. The insights taken from the survey were used as points of discussion in subsequent expert interviews. They were also reflected upon during the ideation stages, drawing on those insights to help build various product concepts.

Interviews:

Interviews are used to acquire specific knowledge, led by a researcher who asks questions surrounding the respondents 'system of relevance' (Littig & Pöchhacker, 2014). Interviews allow researchers to focus on questions that have an acute relevance to their scope of enquiry and allows respondents to go into more detail (Collins, 2018). The expert interviews in this research were semi-structured (Gray, 2009). This semi-structured approach allowed the interviews in my research to move with more fluidity, while still ensuring that required issues or questions were covered. The order of questions may also change as the conversation progresses, allowing for a more natural, conversational flow (Gray, 2009). In this research, two participant groups were interviewed as follows.

In order to conduct the interviews with experts and participants, the research followed a formal process of ethical review prior to starting, which is discussed in the ethical considerations section of the methodology chapter.

AUTEC approval was granted 02/09/2021 (ethics number 21/280).

Expert Interviews:

Potential experts were identified and contacted through information in the public domain or the supervision teams professional networks. The potential experts were contacted via the researcher's AUT email or through LinkedIn, inviting them to participate in the research. After an expert responded with their interest, they were sent an information sheet and a consent form to be signed before the start of the interview. The meeting time was arranged and agreed on by both parties. The participant's names were kept confidential in any notes or analyses and in the research documentation. 2 expert interviews were conducted via Zoom. Experts were selected based on their relevance to the research. The interviews were both approximately 30 minutes in length.

The interviews asked specific questions about products that the experts had worked on that indicated a strong use of visual language cues to convey information. I then asked broader questions to reflect on their collective experience across a variety of projects. Questions were structured similar to the following:

If you have used semiotics, affordance, etc. how have you used them for better communication of products?

How do you think subtle design cues in a product can impact consumer response?

Can you think of any times where you have used these design analysis tools? What were they?

Have you observed any improvements in consumer understanding by making certain communicational changes to a design?

The interview notes were reviewed and the audio recording was transcribed. The responses were summarised in a document and key insights were drawn. These insights helped inform the ideation stage of the design process.

Participant Interviews:

Potential participants, parents or caregivers (over 18 years of age) who had children between the ages of 1-4 years, were invited via Facebook parenting groups. Digital Posters were posted online asking potential participants to contact the provided email address and get more information about the study.

An information sheet and a consent form was sent to the participants who had emailed for more information. From there, a meeting date and time was arranged that was convenient for the participant. Due to Covid restrictions the meetings were conducted on Zoom.

Participants were required to give oral consent before the interview commenced. Out of the five potential participants who responded initially, two participants followed through and were recruited for user interviews. Despite the aim of 5-10 participants, Covid restrictions meant that I could not get the exposure required to recruit a larger number. It was likely that due to Facebook algorithms and the amount of posts from the Facebook pages that I used, only a limited number of people were exposed to the recruitment post.

Three sectional footwear prototypes were posted to each participant prior to the interview day. The participants were asked to examine the features of the prototype. They were then asked to describe what their initial impressions of the shoe concept were, prompting them by asking question such as “what are three words you would use to describe this shoe” and “what do you picture your child doing while wearing this shoe”. The proceeding questions aimed to understand the parents’ wishes for their child’s future (both for the child and for the world they are growing up in), and then attempted to understand how the shoe fit into that world – if at all.

The notes and audio recordings were reviewed following the participant interviews. The responses were summarised in a document where insightful

data was highlighted. These insights were used to make amendments to the footwear prototypes before the final design prototype was produced.

These participants were not anonymous to the supervisor team or researcher. The participant was not interacting with any of the other participants. The participants' identities were anonymised and protected in any notes or analysis for the research documentation.



100% POLYESTER
PREMIUM comfort & quality for your baby!
SIZE: 75cm x 100cm
LuluLaby
DREAMS

Research Probes:

Within participatory design research, 'probes' can aid in conversation and co-creation with participants (Sanders & Stappers, 2008). Mäkelä (2007) explains that the action of interpreting an artefact creates a setting in which the participant can – with greater ease – find the words to reveal the knowledge it embodies. The responses to these probes can aid in the research direction and can be used as a source of inspiration for further ideation in the research (Mäkelä, 2007). In the interviews with participants, shoe prototypes were used to encourage conversation and unpack the participants' impression of the shoes. The participants' opinions and feedback were critical in the decisions made for the final shoe prototype.

Figure 13. An example of research probes which were used in the participant interviews to encourage conversation.

Case Studies:

Case studies support an empirical inquiry to examine objects, systems, individuals etc., in a real-world context (Yin, 2009). Case studies are a valuable tool for improving understanding of a topic, increasing conviction, and increasing experience (Gray, 2009). They can be used as both a qualitative and quantitative method because multiple sources of evidence can be examined, such as interviews (qualitative) and archives (quantitative). The conclusions deduced from case study examinations tend to be objective in nature (Gray, 2009). Yin (2003) explains that a generalisation cannot be made from one case on its own, which is why this method encourages examining multiple examples, similar to how scientific enquiries are conducted.

I found case studies through recommendations from expert interviews, supervisors and peers. I examined two cases of children's toy designs, looking specifically at the company's core message, and how they communicated that message through the product itself. I used different sources such as website reviews and statements from award judges to determine how successful they were at achieving the communication of the product.

Personas:

Personas are used to provide a snapshot into a particular demographic that are likely to use a product or service the designer is researching (Howard, 2014). The purpose of generating a persona is to help make research insights visible and summarise the user's goals and behaviour patterns to design a product or system where the user's needs are of the highest priority (Chang et al., 2008). Personas need to be based on valid field research, using customer demographic information such as average age, gender, socio-economic status, ethnicity etc. Alongside this, interactions with several customers can help to understand their motivations and behaviours to gain a holistic understanding of who you are designing for (Pruitt & Grudin, 2003).

Bobux provided me with survey data from their customers which was reviewed and compiled by their marketing team. The findings supported three different customer profiles who would likely be purchasing Bobux shoes. The three personas helped to create a more tangible outlook on who the design was catering to. The personas also helped to identify where to recruit participants for user interviews.

Design Brief:

A design brief is helpful in defining a project's objectives and strategy (Dankl, 2015). Human centred design can be used to create an effective brief by putting the people you are designing for at the centre of it (Norman & Draper, 1986). The brief is used at the start of a new project and may be redefined throughout the project. It explains the stakeholder's goals in that particular assignment clearly and concisely (Dankl, 2015).

The insights and analysis from the primary research were used to form a design brief that highlighted the needs and opportunities this research could address. The brief included guidelines around aesthetics, function and purpose, manufacturing, and consumer needs. The brief took many complex ideas and refined them into a manageable document that was effective in communicating the objectives and guidelines to stakeholders such as Bobux, the examination panel and supervisors. The design brief was used to quickly give guidance, especially when the project felt like it was going off-track.

Thematic Analysis:

Thematic analysis (TA) was used as a method to interpret qualitative data. Guest et al. (2011) explains that there are numerous ways to collect data and also to analyse it. TA helps to create a systematic form of analysis, which as a result, forms credible answers to research questions and objectives of the study (Guest et al., 2011). This form of analysis focuses on the ability to analyse data in a wide range of ways – it is flexible – and it can be guided by different theoretical frameworks (Smith, 2015).

This research used thematic analysis to unpack surveys, expert interviews, and user interviews throughout the project. After each event, an in-depth reflection of the interactions was written. Critical statements were addressed by highlighting and annotating their meaning and relevance to the research. They were then compared to previous interaction reflections. Thematic analysis drew attention to patterns and consistent themes to create a structured documentation of each interaction. The outcome of the interactions and my reflections were used as an axis for decision making and direction, becoming a critical influence in the design process.

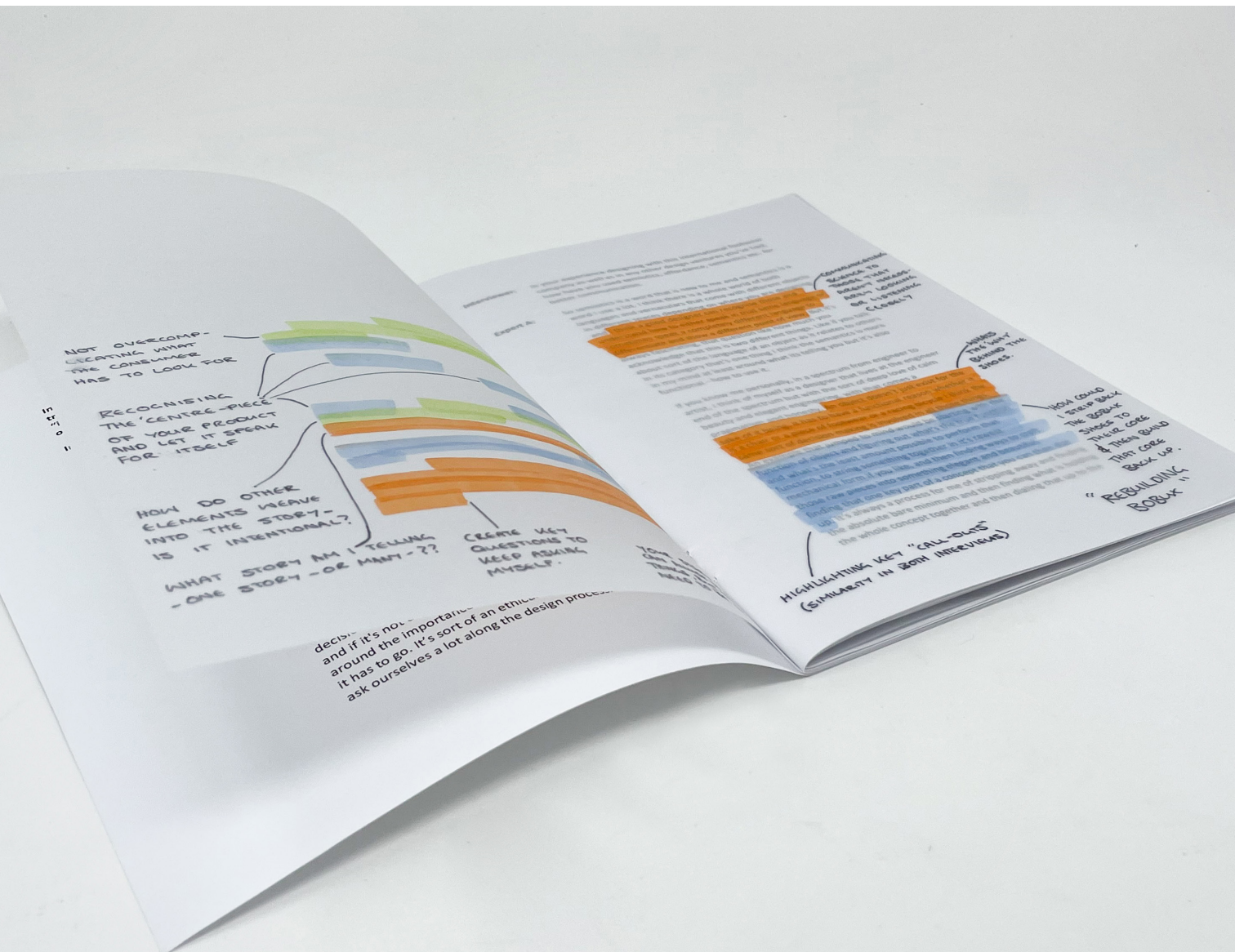


Figure 14. Thematic Analysis of the survey, and interviews conducted throughout the research.

Mood Boards:

Mood boards are two or three-dimensional compilations of imagery or objects that intend to express desirable product attributes visually, with suitable images. This determined design language can then be applied to the designed product (Garner & McDonagh-Philp, 2001). Mood boards are seen as both a tool for research development and a method of communication to both the designer and stakeholders, showing direction, colour schemes, forms, textures, etc. (Garner & McDonagh-Philp, 2001).

I used mood boards to explore possible aesthetic and communicate ideas that I could apply to my design. I took inspiration from images of nature and children playing in nature, along with children's toys, children's footwear, and outdoor equipment, using search engines such as Google, Instagram and Pinterest.

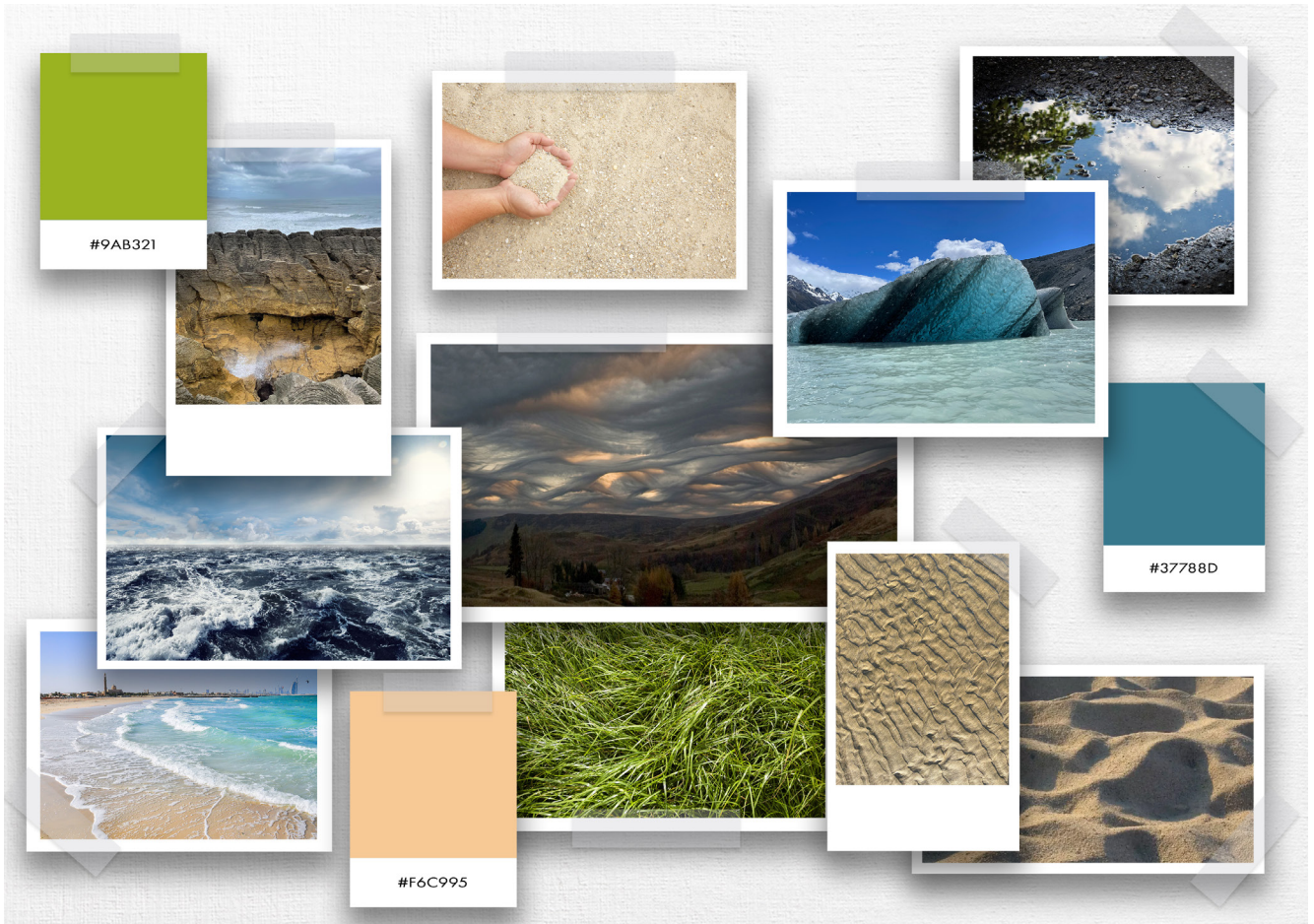


Figure 15. Moodboard.

Brainstorming:

Brainstorming is a well-known method for the rapid generation of ideas, particularly within the creative industries (Wilson, 2013). The goal of brainstorming is quantity rather than quality, encouraging wild ideas or building upon/modifying previous ideas during a session (Kunifuji et al., 2007). Brainstorming aids in divergent thinking, a critical element of the design process, making room for left-field concepts that may be more effective than previous solutions (Wilson, 2013).

I used brainstorming at multiple stages throughout the research. For example, brainstorming was used to explore possible research topics within the context of footwear design at Bobux. Brainstorming was also used during the synthesis stage of the design process, to reflect on the insights and analysis from literature, surveys, and interactions to help rapidly generate new concepts.

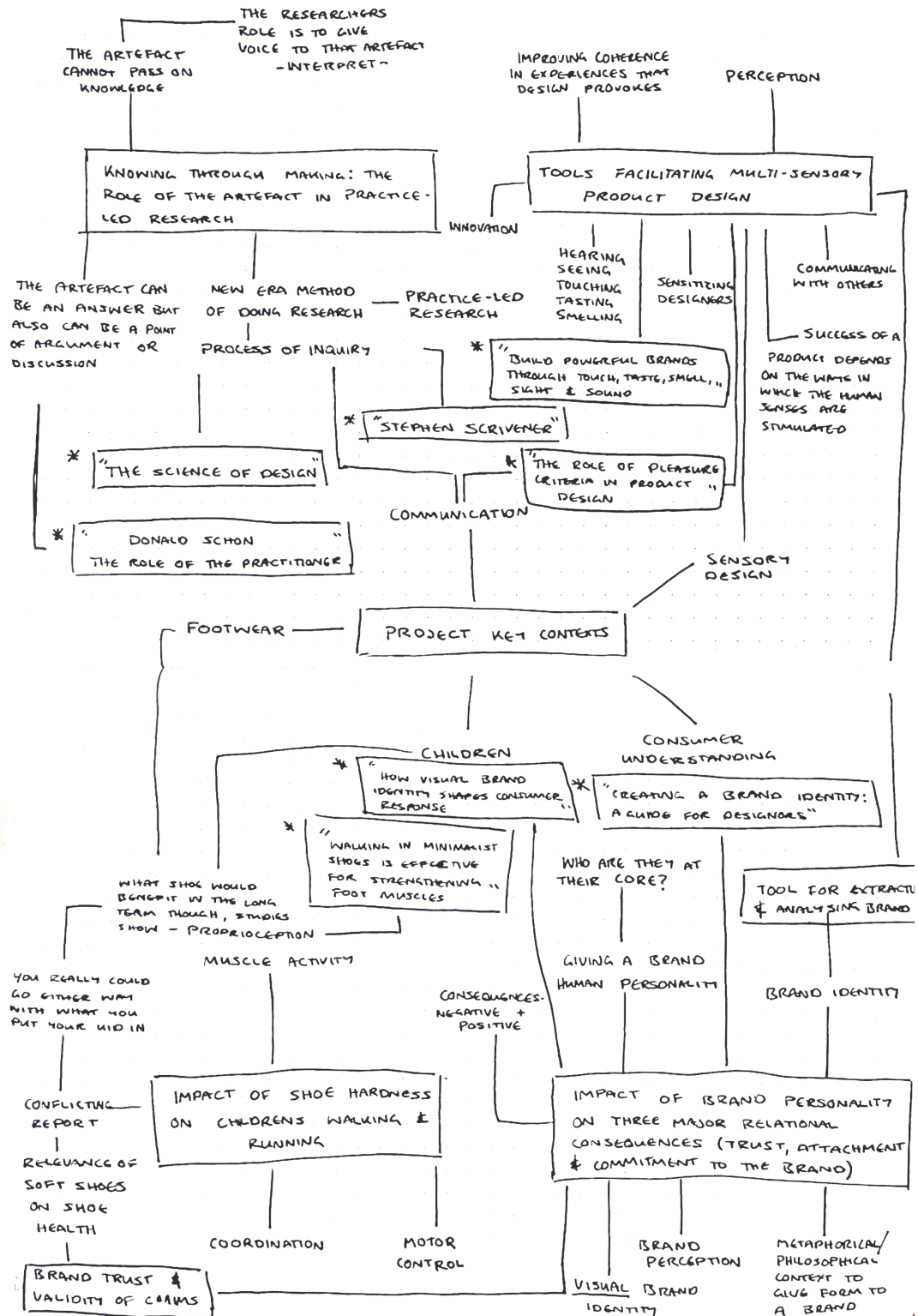


Figure 16. Brainstorm to help define the project.

Sketching for Ideation:

Sketching is a method of effective visual communication that has become a design industry standard (Hua, 2019). Sketching is used to generate, develop, and communicate ideas or concepts, often more efficiently than other ideation methods (Jonson, 2005). Sketching may take on different forms throughout a project, ranging from low-quality rapid ideation to high-quality communicative sketches along with 3D sketch models (Hua, 2019). Low and high-quality sketches are typically used cyclically, aligning with the iterative process in an action research methodology (Jonson, 2005; Swann, 2002).

Sketching was used throughout my research as a method of creation and communicating ideas. It was used to explore and understand ideas, and to present concepts and bring attention to the aesthetics and functionality. In the early stages of the research, rough sketches were created with the purpose of idea exploration. As the research developed, 3D sketch models were used to develop ideas in more detail. Sketching was used alongside other methods to form a collection of concepts that effectively communicated the purpose and intent of footwear. Concepts were tested and refined as the research developed, with later developments focusing on intricate details of communication, aesthetics, and functional elements.



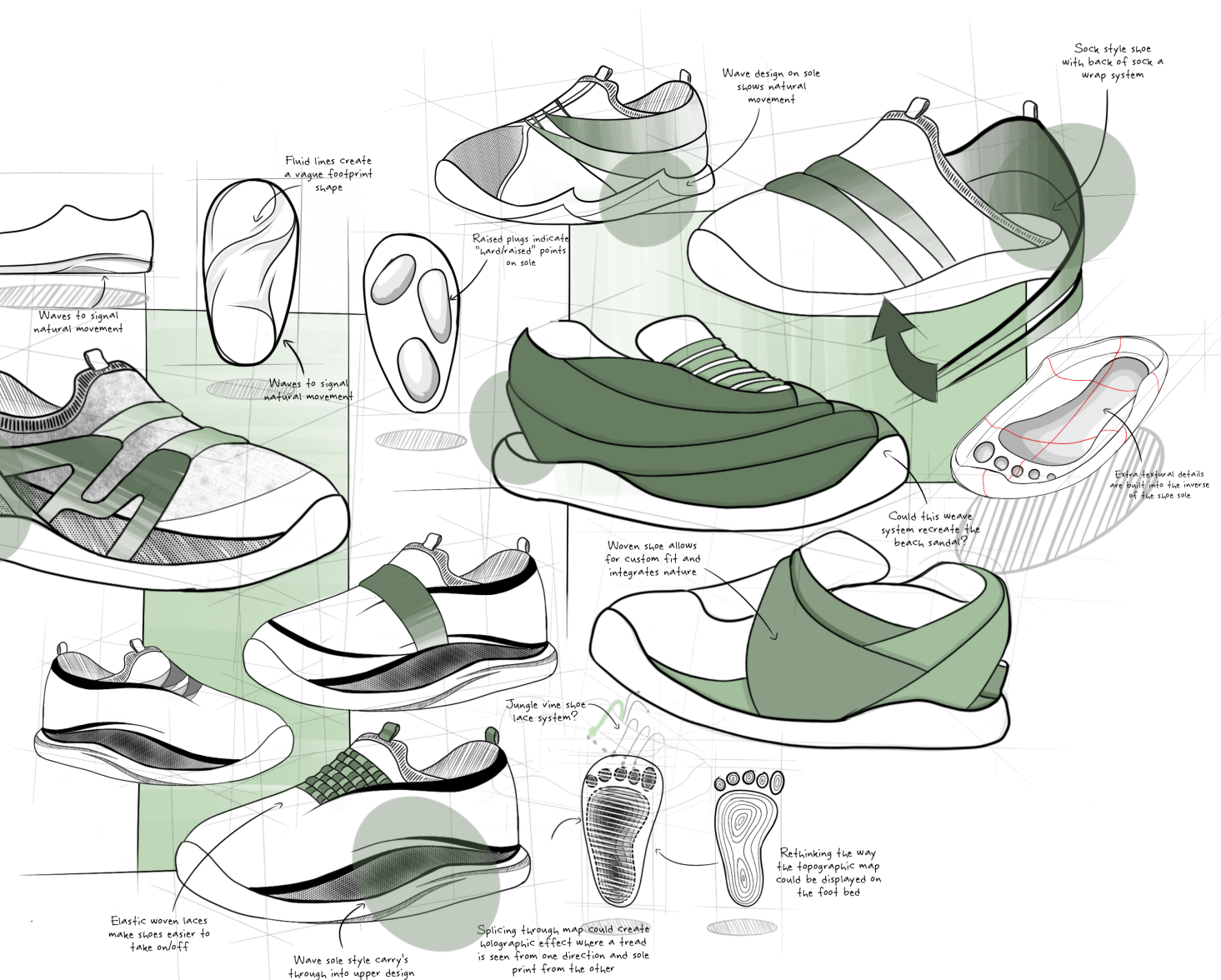


Figure 17. Example of sketching for rapid ideation.

Prototyping:

Prototyping is a three-dimensional design method that aids in designing, testing, and implementing a product (Tripp & Bichelmeyer, 1990). The terms prototype and model are often used interchangeably in design disciplines to describe a pre-production representation of a system, service, or product. Prototyping is used throughout the design process to determine appearance and functional features before manufacturing (Hallgrimsson, 2012). A prototype is helpful in predetermining the success of a product (Camburn et al., 2017). Following the action research methodologies iterative process, prototypes are often refined and produced many times. Each refinement, aims to solve problems through various testing methods appropriate to the problem (Hallgrimsson, 2012).

Throughout my research, prototypes ranged from low-fidelity to high-fidelity. I began with prototypes made with low-cost materials such as scrap fabrics, tape and extruded foam. These prototypes helped to give three-dimensional form to concepts that I found difficult to communicate/explore using drawings alone. This also helped to create objects that were more tangible when communicating ideas to peers, stakeholders or participants. As my concepts developed and became more complex, I moved into more accurate forms of prototyping, using computer-aided design (CAD) and additive manufacturing (3D printing) along with low-quality injection moulding of silicon. These were used to explore specific elements of function, communication, and aesthetics more accurately. In the stages of more advanced prototyping, I used materials similar to those used in Bobux's manufacturing, such as polyurethane rubber, alanine leather and fly knit fabric.

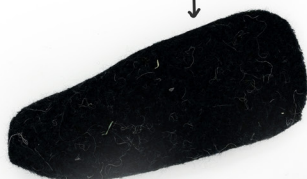
For the final stages of presentation a high-fidelity prototypes was produced. The rubber sole was produced at an external rubber 3D printing facility overseas. The fly knit fabric was sourced from an existing footwear product. The leather was sourced from a New Zealand based supplier. This prototype

was used to communicate the research outcome and highlight how I had made communication improvements to the shoes. The final prototype produced aimed to replicate what would be displayed in store so that stakeholders could clearly understand the proposed shoe design's aesthetics, functions, and purpose of the proposed shoe design.



Figure 18. Example of prototype iterations.

Testing the wool sole with different wool fibres



The underside of the felted sole, one a stiff fabric for shape retention



Combining the texture of the wool with the appearance of the grass



Crafting own felt material with specific grass colours to recreate that connection with the ground through a visual medium



Felt wool sole insert in a Bobux shoe model



Computer-Aided Design (CAD):

Computer-aided design (CAD) is an effective method of creating accurate three-dimensional realisations of designs, using various computer software for construction (Brown, 2009). CAD allows the designer's vision to be converted into a detailed three-dimensional model at a low cost, with an ability to make changes rapidly and efficiently (De Guzman et al., 2004).

Throughout the research, I used a combination of the computer software SolidWorks 2021 (3D CAD Design Software | SOLIDWORKS, n.d.) and Rhino 7 (Rhinoceros 3D, n.d.). Both software platforms have different functional benefits and drawbacks, therefore selecting the right software at the appropriate stage was necessary for the most efficient CAD model construction. The CAD models produced were used to create digital renders as well as provide inputs/generate digital models for 3D printing. In addition, CAD was used in the initial stages of the project to rapidly explore the form of shoe sole concepts. In later stages it was used to create accurate models for advanced and detailed prototyping. CAD was essential for creating many iterations of prototypes, rapidly and accurately, to a higher level of refinement, compared to handmade prototyping. The final CAD model was modelled to the specific dimensions of the Bobux shoe last. This was essential when working with a company that manufactured goods on a large scale (Bobux).

Figure 19. Example of CAD modelling of shoe design.

Evaluation Matrices:

I used various evaluation matrices to examine which designs were the strongest, using objective criteria and ranking certain elements on a point based scale. These matrices were used when I found myself invested in certain concepts that might not have been adequately meeting the criteria of the design brief. Horizontal/vertical market analysis, and product ranking systems were used. After establishing product concepts, I ranked them with evaluation matrices based on selected criteria from the brief (Krishnan & Ulrich, 2001) Through this ranking system, I was able to identify the most successful concepts and then refine them individually to a higher level or combine elements of various concepts to form a refined concept direction.

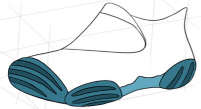
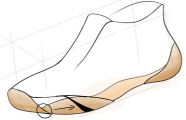
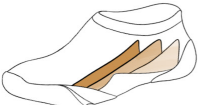
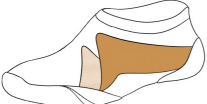
	Flexibility and movement	Connection with nature	Adventure	
	7/10	7/10	6/10	20
	5/10	3/10	3/10	11
	7/10	5/10	4/10	16
	5/10	4/10	4/10	13
	6/10	6/10	4/10	16
	7/10	6/10	5/10	18
	7/10	6/10	6/10	19
	8/10	8/10	7/10	23

Figure 20. Evaluation matrices of shoe sketch ideation, using design criteria to rank concepts.

Reflective Practice:

Reflection is used by Designers and researchers to develop and apply knowledge relevant to the research (Crouch & Pearce, 2012). Reflection is a critical part of an action research methodology, and is the final stage of the cyclical process (planning, acting, observing, and reflecting) (Swann, 2002). Researchers can use reflection after completing tasks within a project or upon the project's completion. Reflection can be used as a way to discuss how the findings and results bridge the gap in knowledge in the relevant field of research. As such, reflection can be a way to help the design go through multiple cycles of improvement (Crouch & Pearce, 2012). Reflection may aid in improving practice, understanding any assumptions made and the limitations of practice (Crouch & Pearce, 2012).

Throughout my research, I wrote a detailed fortnightly reflection and wrote my daily thoughts and findings in a notebook to accurately record every stage of the research process. This allowed for regular reflection of the work completed and a record that I could look back on for reference when making critical design decisions.

Ethical Considerations:

People are central to the human-centred design methodology. This meant that people outside of my supervision team needed to be involved in the research. Through this research I generated critical insights from expert interviews, surveys, and interactions with participants. As such the research needed to be viewed through an ethical lens for it to be conducted safely, respectfully, and with dignity.

The research followed a formal process of ethical review prior to starting. I had to justify why this research could potentially benefit the wider research community. In the case of this research, I focused on helping Bobux to better understand the form language of the products they were putting on children's feet.

After consulting with Bobux employees and the ethics advisors, I decided against involving children in the research as the children were too young and would only provide limited useful data, as I would only be able to observe them interacting with the shoes (not wearing them). Since the research focuses on the communication of shoes in a retail environment and throughout the products use, parents would typically be the audience to purchase the shoes. Therefore I decided that I would select parents or caregivers for the surveys and interviews. This decision made the research significantly lower risk ethically, as I was not working with a vulnerable population.

Potential risks were mitigated by a rigorous ethics approval process, ensuring participants' privacy, protection, and participation. The ethics proposal was conducted in accordance with the AUT Ethics Committee (AUTEC).

AUTEC approval was granted 02/09/2021 (ethics number 21/280)

04. Documentation of Research



04.1. Bobux and the Market

Bobux Brand Evaluation:

In the early stage of my research, I set out to better understand what Bobux's priorities were and how they could inform my design approach. For example, I attended a Bobux run workshop where staff members and myself analysed Bobux's position in the children's footwear market, in relation to the customers perception of the brand, Bobux's values and their product offering. The workshop explored ways Bobux could make their products align closer to this brand map, but also aimed to find opportunities to position some of their products in a new space.



Figure 21. McCondach, (2021). Bobux Brand Map – How Bobux see's themselves as a brand, and what they aim to communicate through marketing and the product to the consumer.

Following the creation of the brand map, the current Bobux Shoe range was reviewed. This “product matrix” exercise (on the right) was conducted with Bobux staff and aimed to identify where the Bobux products sat on a horizontal/vertical scale against criteria selected by Bobux. The purpose of this was to identify trends in the product range and find opportunities for areas that could be explored.

By observing the empty and congested spaces on the matrix, created from the placement of the Bobux range, it was clear that the product range was not widespread across all of the corners of the map. A significant number of styles congested the middle of the map.

An insight found was that the “summit” shoe style was placed a lot further out towards “versatile” than any other shoe in the range. The style was made for the outdoors and its key feature was that it was quick to dry. This shoe stood out to me when comparing the range to Bobux’s “personality values”. I found that the Summit shoe style appeared to align the closest to Bobux’s “adventurous” and “playful” values. I found that a lot of their range fell into the day-to-day wear category, and many shoes could be described as a shoe for formal occasions (church, dinners, weddings etc.). I recognised an opportunity to develop a shoe that focused on encouraging kids to be playful, adventurous and immersed in nature. The current “summit” shoe rated low on the artistic and enriched vertical scale, showing that it was quite a basic shoe that was technical in its manufacture and its performance but lacked aesthetics. Chattaraman et al. (2016) stated aesthetic perception to be a strong driving factor in product purchasing decisions.



Figure 22. Bobux product matrix, with the products placed onto the chart after discussion amongst the workshop team, based on staff opinions.

As I was exploring how consumers interpreted the purpose of Bobux shoes in a retail environment, it was essential for me to see how Bobux shoes were presented to the consumer. I conducted a field exercise at various children's stores to observe and document footwear display areas.

I found that in general, children's footwear was typically presented quite differently from adult footwear. Display spaces were more cluttered and filled with a large variety of brands. There were typically few visual aids such as signage to help explain the difference between certain brands. It appeared that because of the lack of shelf space in many of the stores, the brands were not clearly separated. Alongside this, many brands used similar colours to each other (earthy tones and pastel colours) without clear logos or identifying marks between them. This caused the visual effect of all the brands merging into one.

These insights helped me to understand the kind of environment the shoe I designed would be going into. This field exercise further highlighted the need for a shoe that communicates its purpose to the consumer and stands out on the shelf to increase interest in the product in-store.



Figure 23. In-store photographs at a children's store, demonstrating the retail environment that this project discusses.

Market Evaluation:

The additional product matrix that included competitor products was helpful in determining whether I had identified a niche area in not only the Bobux product range, but also in the market in general. The matrix helped me to quickly identify “empty” spots which the market was not filling. Comparing the wider market matrix to the Bobux matrix demonstrated that the opportunity area was a lot smaller with competitor shoes taken into consideration. For example, I identified Clarks and Naturino in the matrix as brands that had certain products that pushed further into the corner of natural/flexible than any other major market competitor had. Vivo Barefoot showed strong visual cues of flexibility but did so using rubber materials that looked artificial, so they were placed low on the vertical scale. The Vivo Barefoot visual cues for flexibility were noted for use later in the development process. The competitor matrix helped me to visually see how some other brands were moving into the barefoot/natural space which Bobux was not.

Not all brands and shoes were able to be analysed in this product matrix due to resource restraints. The brands that were used were seen as relevant competitors to Bobux. The analysis used a broad range of shoe brands and styles, that provided an overall impression of those areas of the market that were congested, and areas for opportunities and innovation.

I concluded from the product evaluation that there was an opportunity to develop a flexible and natural shoe that was more versatile – a shoe that could stand up to the tough conditions of children’s outdoor play – and still look stylish and desirable to the consumers.

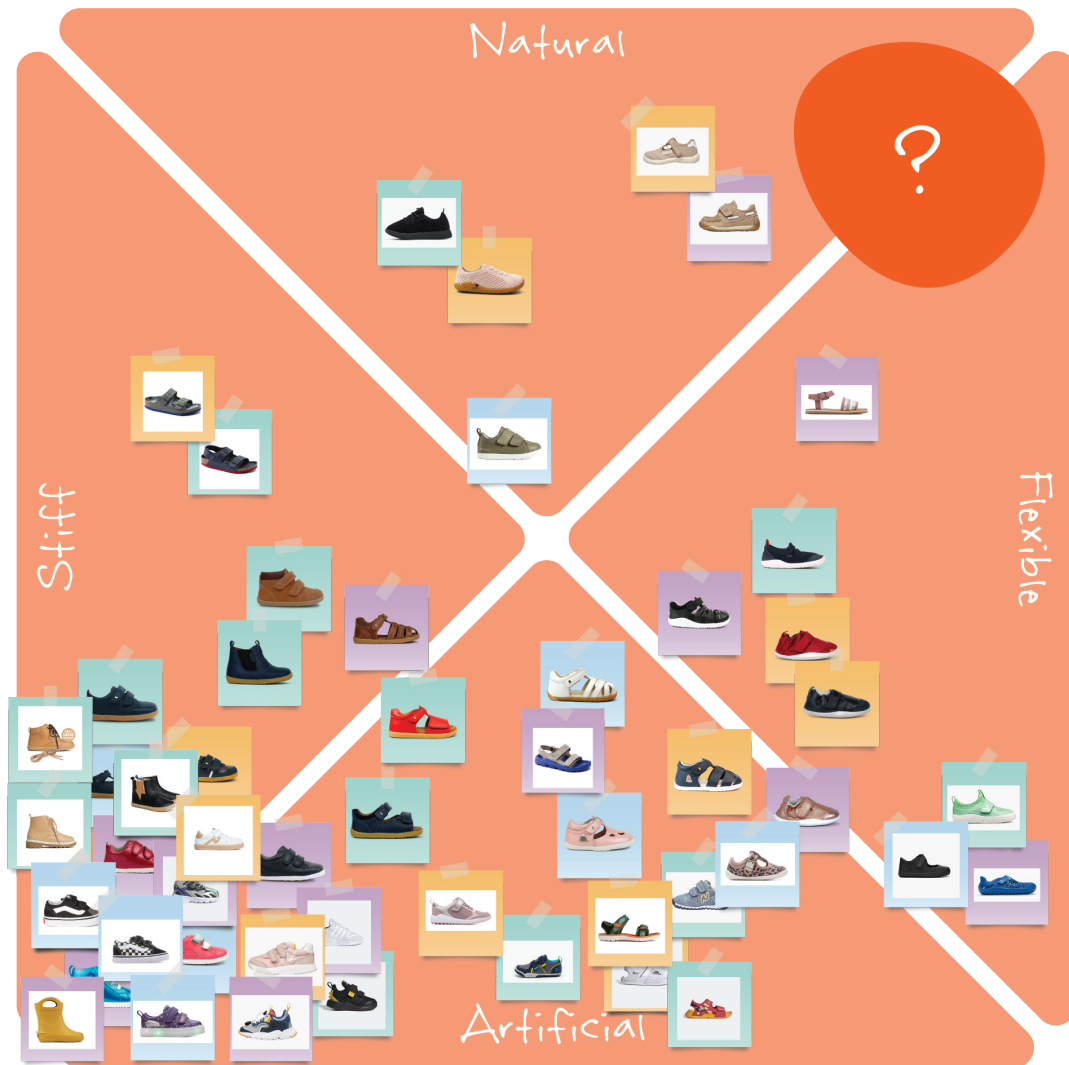


Figure 24. Product matrix of the Bobux product range plus various market competitors. Based on my own analysis of the products. Competitors included: Allbirds; Adidas; Plae Footwear; Pretty Brave; Clarks; Vans; Birkenstock; Naturino; and Vivo Barefoot.



04.2. Customer Data

Personas:

The following section was based on a survey conducted by the Bobux marketing team. It collected a wide range of insights about the Bobux customer base. All of the survey respondents were placed into three separate persona categories.

Bobux emailed 31,500 customers and received 4000 responses. The responses were analysed by the marketing team and each survey was categorised into one of three persona groups.

The insights taken from the Bobux customer data helped me to understand the specific group of people that I am designing for. The “Lisa” persona made a number of mentions towards a “sportier” shoe. Statements suggested that they were more inclined towards Nike sports shoes, mainly because Bobux doesn’t have anything similar in their own range.

Sarah

Life Time Value (The amount the customer would spend on Bobux specific products over their lifetime): \$374

Priority: Sarah's highest priority is her kids.

Sarah is a 25 to 44 years parent. She has a medium to high income and typically has 2 kids who are younger on average, most likely to be a confident walker and an infant. Sarah learns of Bobux through friends, family & shoe stores. Sarah is price sensitive but still loyal to Bobux's comfort, quality and foot health principles. 5% of the Sarah profile are grandparents.

Sarah describes herself as kind, caring and fun.

"They're always good quality; healthy for feet and attractive shoes; and I am familiar with the sizing so can buy online. With this better quality brand I am able to pass them on to the younger kids/friends/family or resell to recoup some of the costs; as opposed to cheap shoes which fall apart after one season."

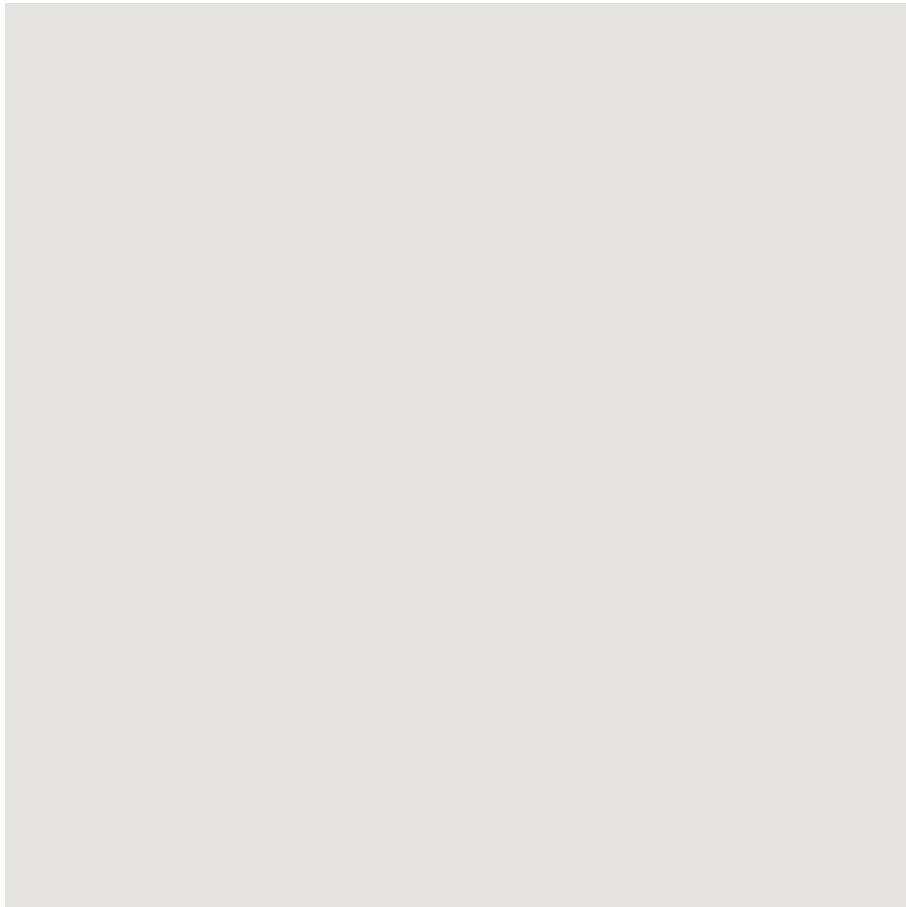


Figure 25. (602) Pinterest, (n.d.). The customer persona took insights from Bobux customer data, highlighting specific trends and issues.

SARAH

"More sales. I love buying shoes! but more affordable for families who struggle and still need good shoes. I give all my old old ones to families who can't afford them."

"They are expensive so it's a stretch sometimes to afford them. A loyalty programme would be great as have bought so many pairs

"Reduce the price point a little. When the preference is to buy Bobux, it's very expensive."

Figure 26. McCondach, (2021). Highlighted quotes from customers who fit the "Sarah" demographic.

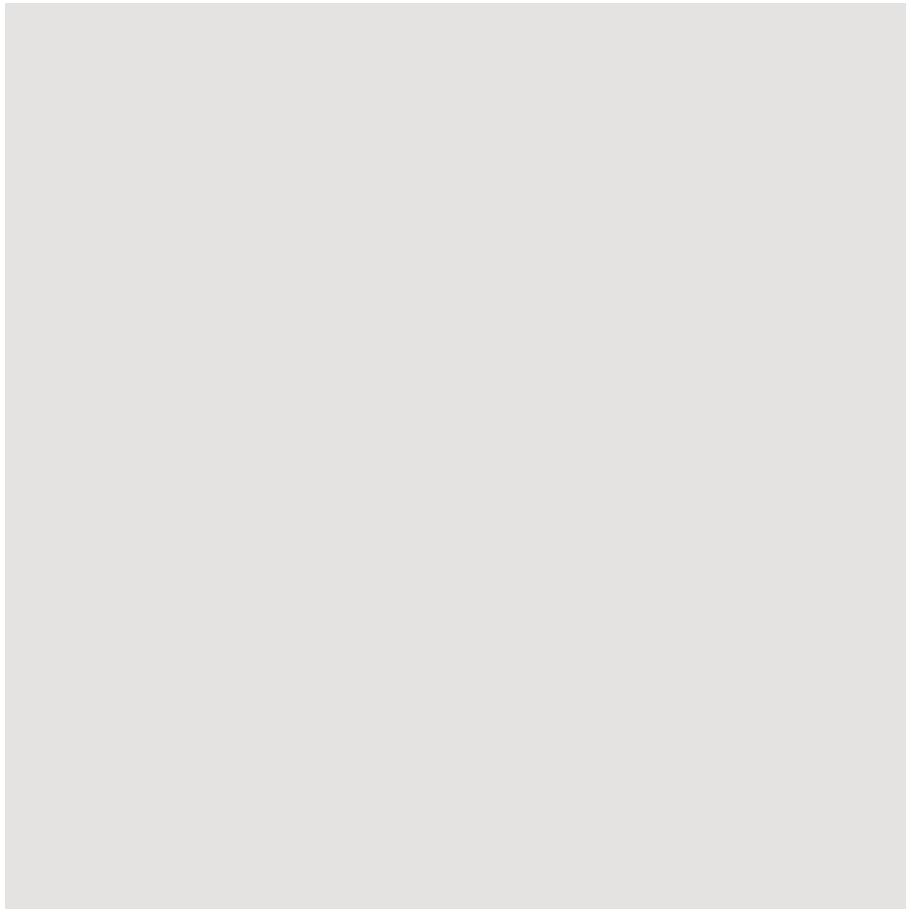


Figure 27. Mum with Kids and Laptop - Ebuyer Blog, (n.d.) The customer persona took insights from Bobux customer data, highlighting specific trends and issues.

MELISSA

"Extending sizing for the older kids so we can keep buying them."

"I currently have three children I need to purchase shoes for. I'd love some more economical options for everyday wear so I can continue to choose Bobux."

Also; a shoe recycling programme would

be good - where customers can return the shoes once they are finished with them and the materials can be reused in some way."

Figure 28. McCondach, (2021). Highlighted quotes from customers who fit the "Melissa" demographic.

Melissa

Life Time Value (The amount the customer would spend on Bobux specific products over their lifetime): \$258

Priority: Melissa's highest priority is her family.

Melissa is more likely to have confident preschool walkers and school-age kids. She is much wealthier than Sarah and Lisa, yet more price sensitive. Melissa is quite likely to buy and sell second hand. Melissa is more likely to have responded to social media and online advertising.

"Style; kids like to wear them; I buy one pair as they are 'good' shoes so they go with everything (including dressed up occasions – we don't go to too many of those!), and another (usually on sale) so they have comfortable hard-wearing shoes for day care."

Lisa

Life Time Value (The amount the customer would spend on Bobux specific products over their lifetime): \$207

Priority: Lisa's highest priority is fashion.

Lisa owns the most kid's shoes, and has more kids, but often older kids. She is wealthier than Sarah, but is likely to have more shoes than both Sarah and Melissa (20+). Lisa prefers to shop in-store and is the least likely to value "podiatry endorsed" and less likely to be concerned whether the child likes them.

"Design, fit and the excellent online sizing calculator have worked well for me. I have always tried to buy the shoes in a shop first to get them fitted properly but have never been able to find the size. Now with the virus, I don't waste my time in a shop."

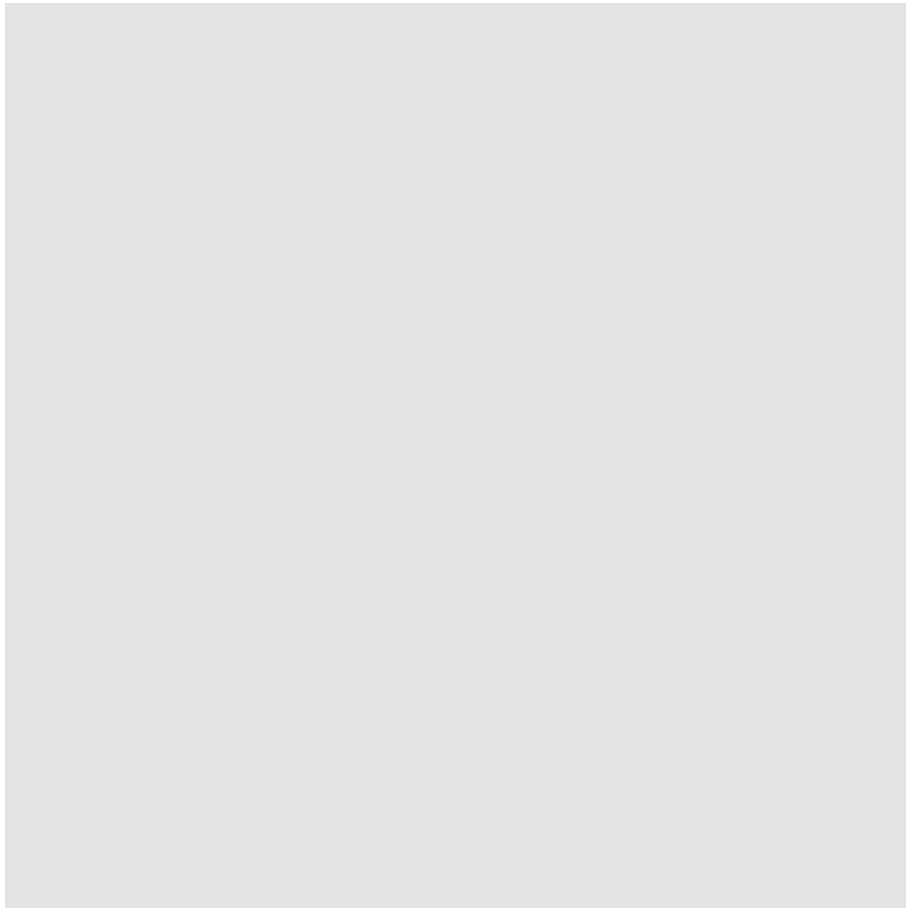


Figure 29. sarahreade, (2018) The customer persona took insights from Bobux customer data, highlighting specific trends and issues.

LISA

"Kids now are starting to like Nikes for active use - I don't feel like any of the Bobux products quite fit for this use"

"Stylish design and good quality. Have read that they are one of the premium brands but still competitively priced."

"Be more available in my local independent shoe shop; classic styles and value for money."

Lisa has 49 references to a more "sporty" shoe from survey data.

Figure 30. McCondach, (2021). Highlighted quotes from customers who fit the "Lisa" demographic.

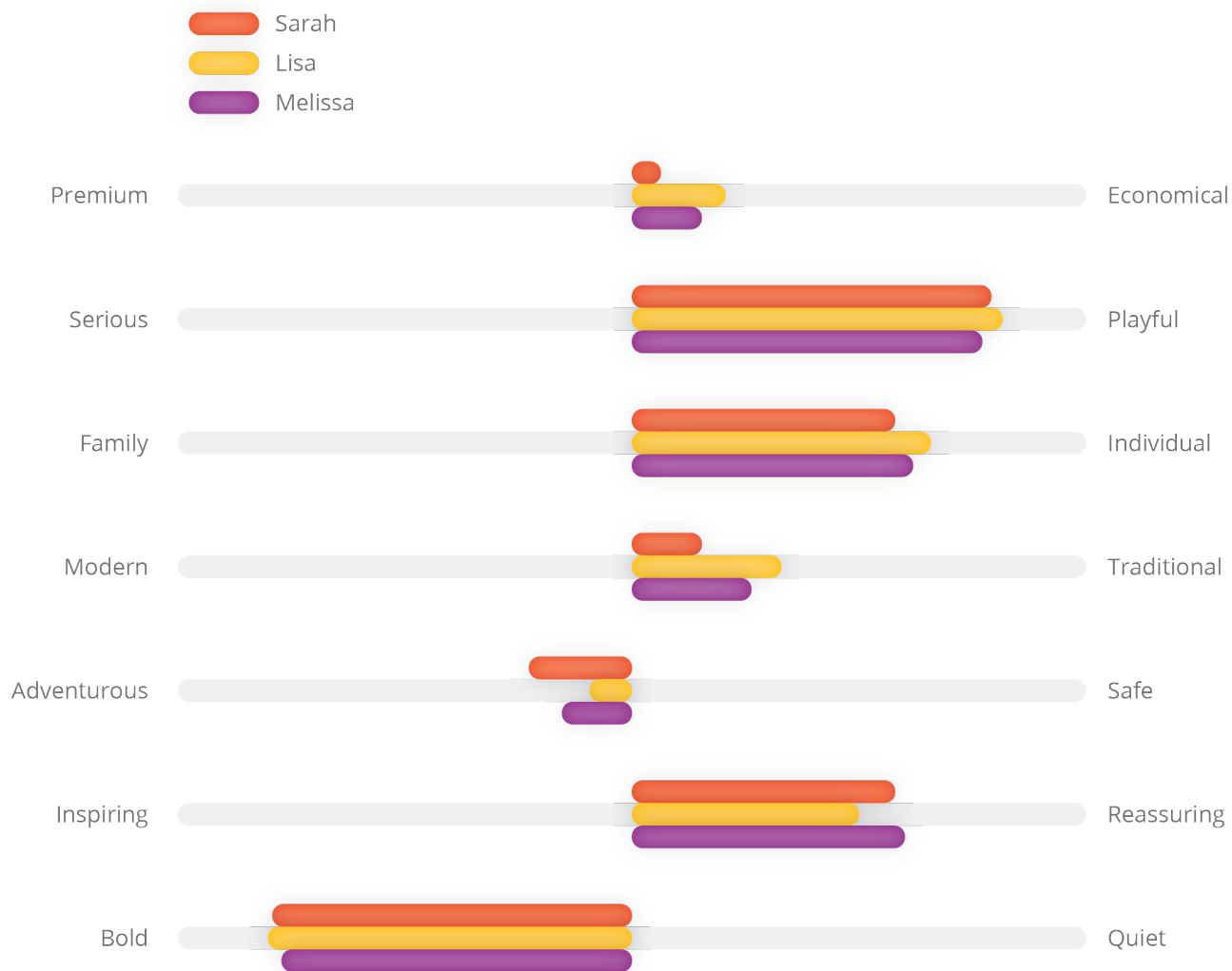


Figure 31. McCondach, (2021). Highlighted quotes from customers who fit the “Lisa” demographic. Sliding scale chart based on the three Bobux personas’ perception of the brand. All personas typically skew very similarly to each other.ed

How Customers Perceive the Bobux Brand:

Customer data was collected by the Bobux marketing team about the perception of the brand. Each response was categorised into a specific persona category, and then an average was made for each scale set. I found this data set useful in highlighting where I may have made assumptions about the brand that were not true to how the customers had perceived it.

Bobux stated its personality values as: “we are adventurous, playful, and overflowing with knowledge.” Based on this statement, I had assumed that the customers would rank Bobux further to the left on the adventurous/safe scale. I saw this as a strong opportunity to push out the adventurous side through an outdoors shoe that encouraged adventure, as suggested by the “Lisa” persona. Seeing that customers saw the brand as playful (in the sliding scale chart to the left) was helpful, as the existing Bobux products could be used as inspiration in creating a playful shoe. I wanted to make sure that the shoe I designed reflected the strong skew towards “bold” on the bold/quiet scale, the shoe needed to make a statement and stand out amongst the shelves of other shoes. In order to achieve this, I needed to reflect on the market analysis and produce concepts that were not seen in the observed shoe style, and rethink what a children’s outdoor shoe could look like. I would use methods such as evaluation matrices and participant interviews to measure whether the concepts were achieving the desired skew for each of the criteria on the sliding scale.

Expert Interviews:

I talked to experts that had made an impact in the design world for their use of communication in the products that they (or their company) have designed. These expert interviews were used to help increase my understanding of how I can approach using semiotics, or other visual language tools, to better communicate the purpose of a product.

I interviewed two designers, each of whom provided a different lens of communicating product intent. Expert B came from a Visual Communications background and through his career had combined that with industrial design, so the lens he viewed my project through was quite different to that of a traditional industrial designer as it was with Expert A.

In order to analyse the findings from the interviews, I printed a booklet that was layered with an opaque paper that allowed me to highlight and annotate key findings. I separated the findings into three categories: semiotics/communication comments; materiality comments; and general/other design comments/advice. By separating the findings into colour-coded sections, it helped to quickly identify patterns and consistent themes, documenting each interaction with an organised approach.

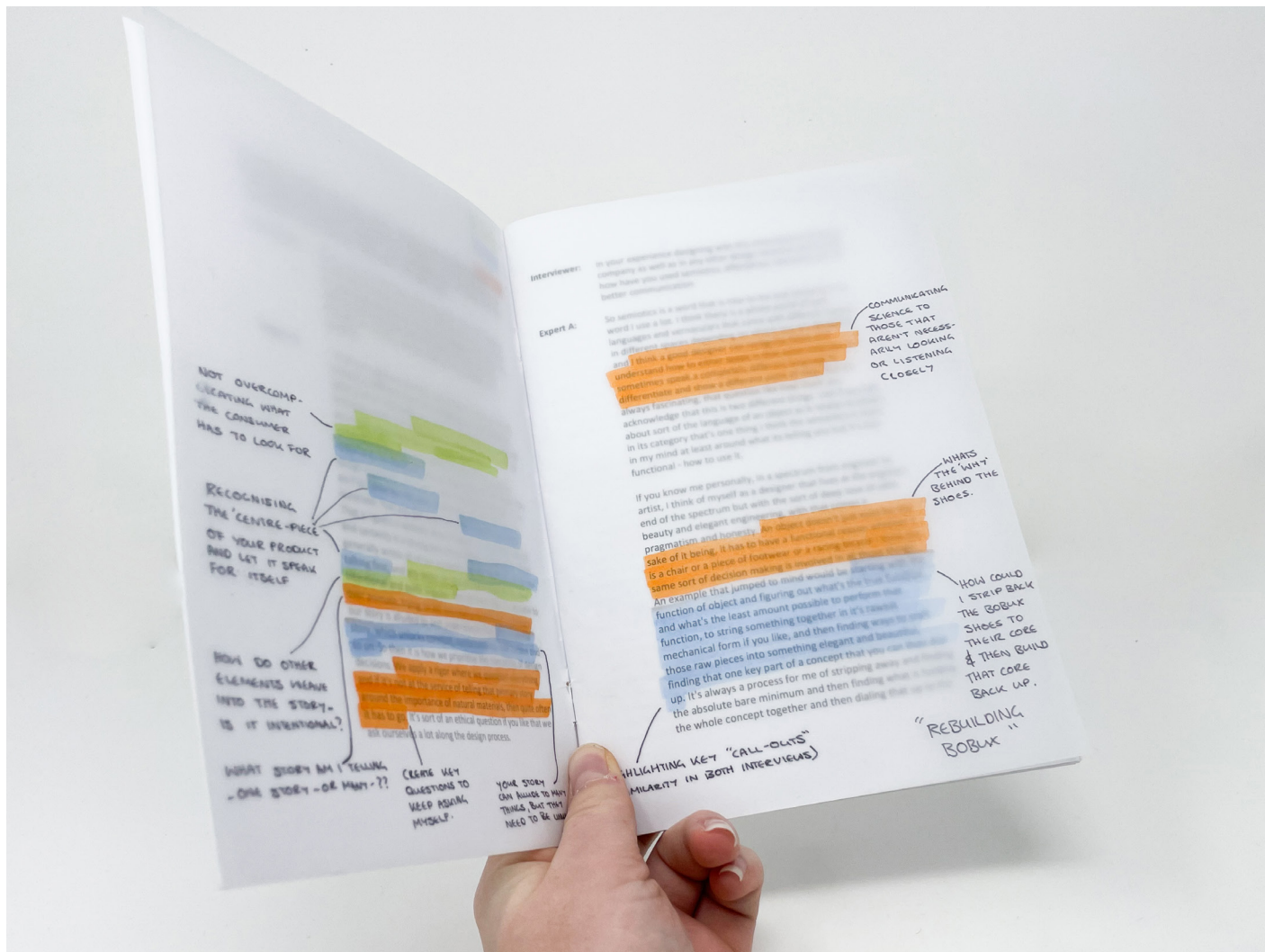


Figure 32. Thematic Analysis from the expert interviews.

Expert A:

Expert A explained the process he used to communicate information in the products he designed. He found it helpful to recognise the “centrepiece” of your product, and that piece should speak for itself, with no written language surrounding it. When designing the centrepiece, it should not be overcomplicated, the consumer should find it easy to identify and understand. There will also be other elements that are important to the brand/product story, and they should be weaved into the product as well but should not be highlighted in the same way as the centrepiece. The story that is being built through the product can allude to many things, but all those things must be linked, otherwise, the design of the product may feel disjointed and confusing for the consumer.

Expert A gave an example in the interview about a trail shoe the international shoe company had just released, and how many brands design shoes with soles that look like they're aiming to rip up nature (angular and sharp treads) which is counter-intuitive to the purpose of getting out into nature (peacefulness, tranquillity and preservation of the environment).

The interview with Expert A was helpful in understanding designing beautiful products that are also functional. The expert gave multiple examples of ways the international footwear company had defied market norms and he explained how they set a point of inspiration from the beginning and used that to influence the design process. As an example, a particular artwork may be used as inspiration or a collection of images on a mood board.

Expert B:

Expert B expanded on what Expert A had discussed around “call-outs”. He explained that the design and communication of those callouts in your product will be essential to its storytelling. Whether that be at the forefront of what you are designing or used as background information when the consumer investigates further into the product.

Expert B explained that it can be helpful to understand the parents purchasing motivations in order to identify key call-outs and develop a customer profile (persona). When these callouts are targeted at the parents, it may then become a beacon for a parent, potentially encouraging purchase.

Building on how personas could be used to step into the shoes of the customer and understand what motivates them, Expert B discussed how it is important for the product to speak to the nature of why the child really needs it. With the Bobux shoes, for example, children are often quite content running around barefoot, so how can it be communicated that these shoes are like being barefoot but provide the children with additional natural and health benefits. Further to that, being able to communicate why these benefits are worth spending the money on and going through the frustrating process of getting children's feet into the shoes.

Expert B had spent some time working on products that involved interaction between the parent and the child in a retail environment. He explained that while the parent may be purchasing the product, using imagery that resonates with children can create an opportunity for that initial interaction between a child and the product. If a child demonstrates interest in the product that may in turn draw parents to interact with the product as well.

Summary:

- A “centrepiece” to draw attention to in your design can be beneficial in creating a strong communicative product story. Other elements can also be incorporated into that story, which can add to that centrepiece and the story of the shoe.
- There are other ways to communicate certain things without following “market norms”, by considering visually designing things in a different way while still achieving the same functional benefit, corners of the market may become more accessible.
- In a retail environment, having a product that attracts both children and parents may be important in encouraging purchase. If a child is interested in a pair of shoes, that can create an opportunity for the parent to interact with the product.

From the interviews, I considered how it was important (at this stage) of the research to identify the key callouts in the shoe that needed to be the focus. I identified these callouts as Nature; Movement; Comfort/Home; and Grip. These callouts were used to structure the design brief which informed decision making in the design process.

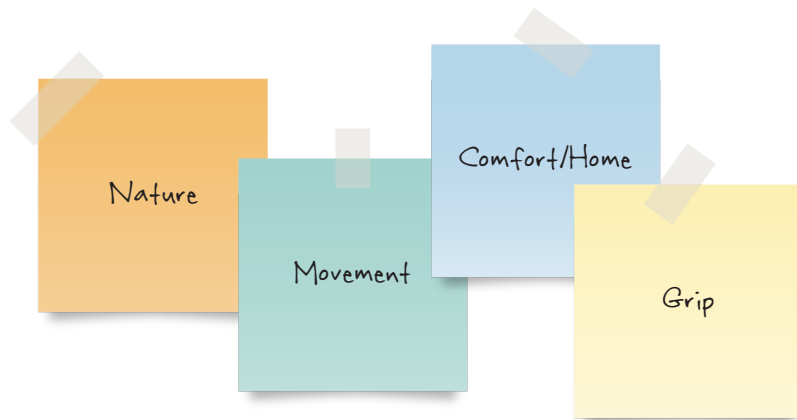


Figure 33. Key callouts that I wanted to consider while designing the shoe, and woven into the final design output.

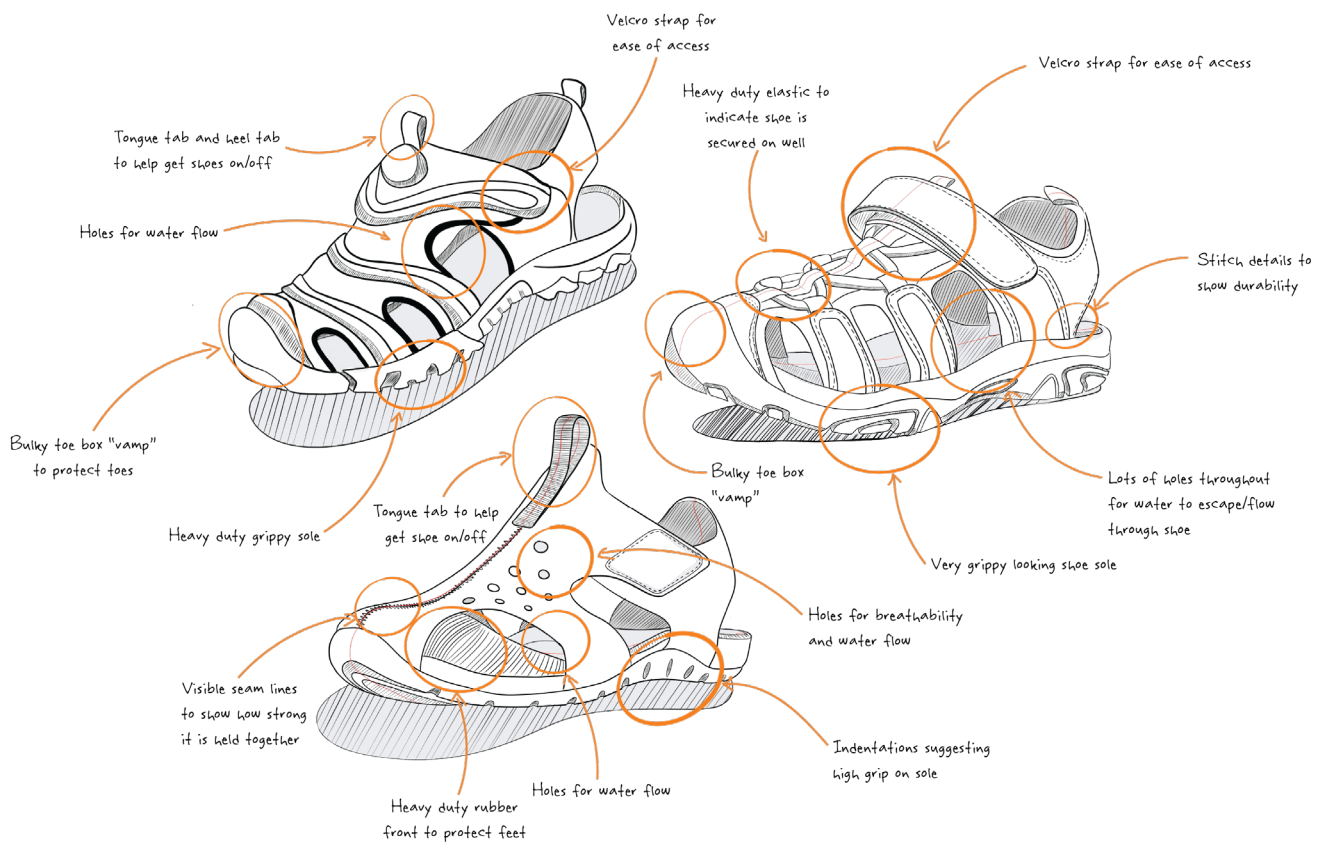


Figure 34. Sketches based on existing market products Breakdown of the components of the traditional outdoor kid's shoe.

I reflected on insights taken from my interview with Expert A, where we discussed how just because the design industry typically follows trends, it doesn't mean that you need to follow them as well. As an example, reimagining how trail shoe tread can still be grippy without having such aggressive angular tread patterns that are typically seen in this style of footwear. Looking at my own project, I considered other ways that I could design an outdoorsy, adventurous shoe, without it looking like a traditional beach shoe.

From this exercise, I decided to strip the "traditional outdoor shoe" down to its key design cues and performance features, and then look at different methods of communicating those features, to build it back up as an elegant shoe, designed to be a part of nature – not an intruder.

I looked at some common children's footwear styles for beach/outdoor wear and unpacked some of the common elements seen on these shoes. When comparing the outdoor shoes to the matrix scale that was conducted on the Bobux products and competitors (figure 23. and 24.), it would have been placed in the bottom right corner, along with their summit shoe style. This was due to the versatile nature of these shoes (waterproof, durable, high tech), but similar to the summit, it also lacked aesthetic appeal, which positioned it down the low end of the vertical scale.

Bobux as a company was created by a New Zealander who wanted his kids to grow up getting to play in nature. While the company has come far since then, most shoes are not upholding the original intentions of the brand. This reflection showed the potential for a product that highlighted the original message of nature being central to a child's development.



04.3. Applying Semiotics

Developing a Framework:

After going through the contextual review, I very quickly realised there was an opportunity to develop an understanding of the use of semiotics in the design of footwear. I used various literature (Lawes, 2002) (Mamaghani et al., 2014) to form a toolkit to aid in the analysis of products and concepts. I investigated various ways of applying semiotics to a design application and found methods in Lawes' (2002) Journal Article to help extract a deeper level of analysis from an object of study. I used these Semiotic methods to construct a "card pack" to create a more structured approach to unpacking products and concepts (Shown in the image on the right).

While resources were available to learn about the application of semiotics, these were often in literature-heavy, academic articles. It was not surprising that designers opted for using more commonly recognised design methods to connect with their users (You & Chen, n.d.). There was a large amount of literature discussing the contexts, history, and explanation of semiotics, which is vital for learning about the discipline. Despite this, it was challenging to find a practical framework for applying semiotics to industrial design, which would help incorporate semiotic elements into the "soft" features of a design.

I decided that because of the limited literature around using semiotics in the application of design, particularly in Industrial Design, I would attempt to develop a framework that could help me, and potentially be used to help support other product designers to more effectively incorporate semiotics and intentional communication into a product. This framework was developed, tested and refined, alongside the shoe development, using the shoe as the primary test of the efficacy of the framework as discussed throughout the following sections.



Figure 35. Card pack “toolkit” based on Lawes’ (2002) recommendations for a semiotic process to follow for a more structured approach to unpacking a product or system.

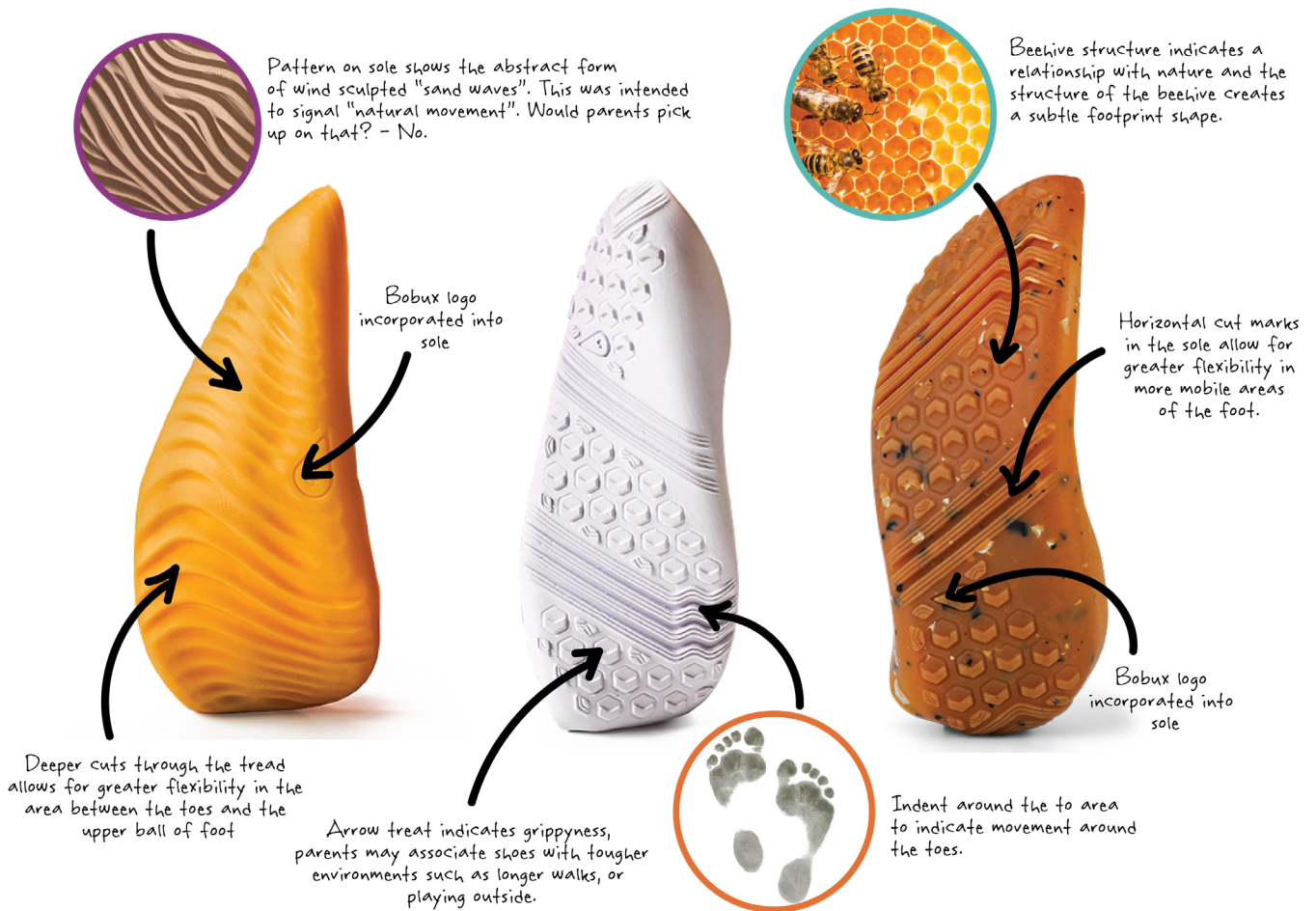


Figure 36. Analysis of the current Bobux shoe soles, using the card pack developed from Lawes' (2002) semiotic process recommendations.

I investigated the current Bobux shoe soles, specifically looking at what the tread may be communicating. This helped me to identify what Bobux had and had not been doing well. I used the card pack that was based on the semiotic analysis methods in Lawes's (2002) journal article to assist me. Each of the cards gave specific instructions for things to look out for in an image or a physical product, to help identify communicative points. I used the 'cards' that focused on visual signs, textural structure and visual emphasis.

The analysis using the cards helped me extract more information from the tread pattern on the right, but it also seemed quite an aggressive and angular tread pattern that didn't seem very "friendly" as a children's shoe. The other tread style that mimicked the sand pattern appeared to be too abstract and would likely not provide the consumer with additional information about the purpose of the shoe.

As a result of this investigation, I realised that the shoe sole could be an effective way of providing a lot of communicative information about the shoe. As tread patterns are hidden on the bottom of the shoe, it wouldn't greatly affect the overall aesthetics of the shoe. This exercise left me asking "How can I best utilise the design of the shoe sole to convey the intended information without compromising the overall aesthetic?"

As a semiotic analysis exercise, I studied two popular brands of footwear products. The concept of semiotics was familiar to me, but I was unaware of how to apply it to unpack subtle visual cues. The results identified that based on my product design education, there was an opportunity for me to unpack products much more deeply.

I aimed to extract more information out of products than I had previously, using the card pack that I had created. I felt I needed to use a more methodical approach to extracting data and insights.

I found that the card pack helped to identify different signs in the shoe I was investigating, but I still struggled with the analytical element of drawing insights. Again, I felt I could understand at a surface level what the product was communicating, but it felt like there was still so much subjectiveness when using this approach.

I then investigated how semiotics can be used in a design application and its effectiveness. As this exercise had forced me to reflect on whether semiotics was the most appropriate tool for this research project.

By narrowing down semiotic application into the design field, I found that literature suggested a multi-disciplinary approach using various design tools such as affordance, user research, roleplay etc. to more effectively analyse through an objective lens. The process of solely using semiotics to establish a products communicational process would be incredibly challenging, even for an expert in the field, and the data transmitted would likely not be precise (Hoxha, 2014). Exploring semiotics more, I discovered that there was a lot more that needed to be considered, such as better understanding of the customer regarding the interpretation of a product.



Dynamic
namics an
plays on ti



Figure 37. (Men's Tree Dasher 2 - Natural Black (Blizzard Sole), n.d.). Analysis of Allbirds Tree Dasher, using the card pack developed from Lawes' (2002) semiotic process recommendations. I unpacked adult's shoes rather than children's shoes, as I found the visual cues clearer in many of the adult's shoe styles. As a designer with minimal experience in unpacking visual communication through products, I wanted to conduct this exercise with products that helped me to unpack at a deeper level, to improve my analysis skills.



Figure 38. (Adidas UltraBoost 21 Shoes - White, n.d.). Analysis of the Adidas UltraBoost, using the card pack developed from Lawes' (2002) semiotic process recommendations.



Boost) denotes
a higher
standard footwear

Side profile emphasises its
streamlined characteristics

Colour gradient fades to white
to suggest speed or "boost"



04.4. Data Collection & Analysis

Customer Survey:

Following the investigation of the market and where I should position my design research in that market, and then looking at how semiotics can be used within that design research, I conducted surveys with the Bobux customers. The aim of these surveys were to provide me with a greater understanding of customers' views and their level of knowledge surrounding Bobux footwear.

The survey responses were compiled into a booklet, which was printed out and to help with annotation, tracing paper was placed between all of the pages. This allowed for easy highlighting and writing notes over the survey while still being able to read the survey data and the notes separately.

I separated all of the key insights into three separate categories: Assumptions made (not factual); comments on podiatrist recommendations; and consumers showing understanding of the Bobux product.

Common assumptions made by the participants were that the shoes were made in New Zealand (they are designed but not made). Many participants viewed the shoes as safe and supportive, which typically related back to the podiatrist's approval. Half of the participants believed the shoes were created by a podiatrist, some even thinking paediatricians were a part of its creation. There were repeated statements of the shoes being supportive.

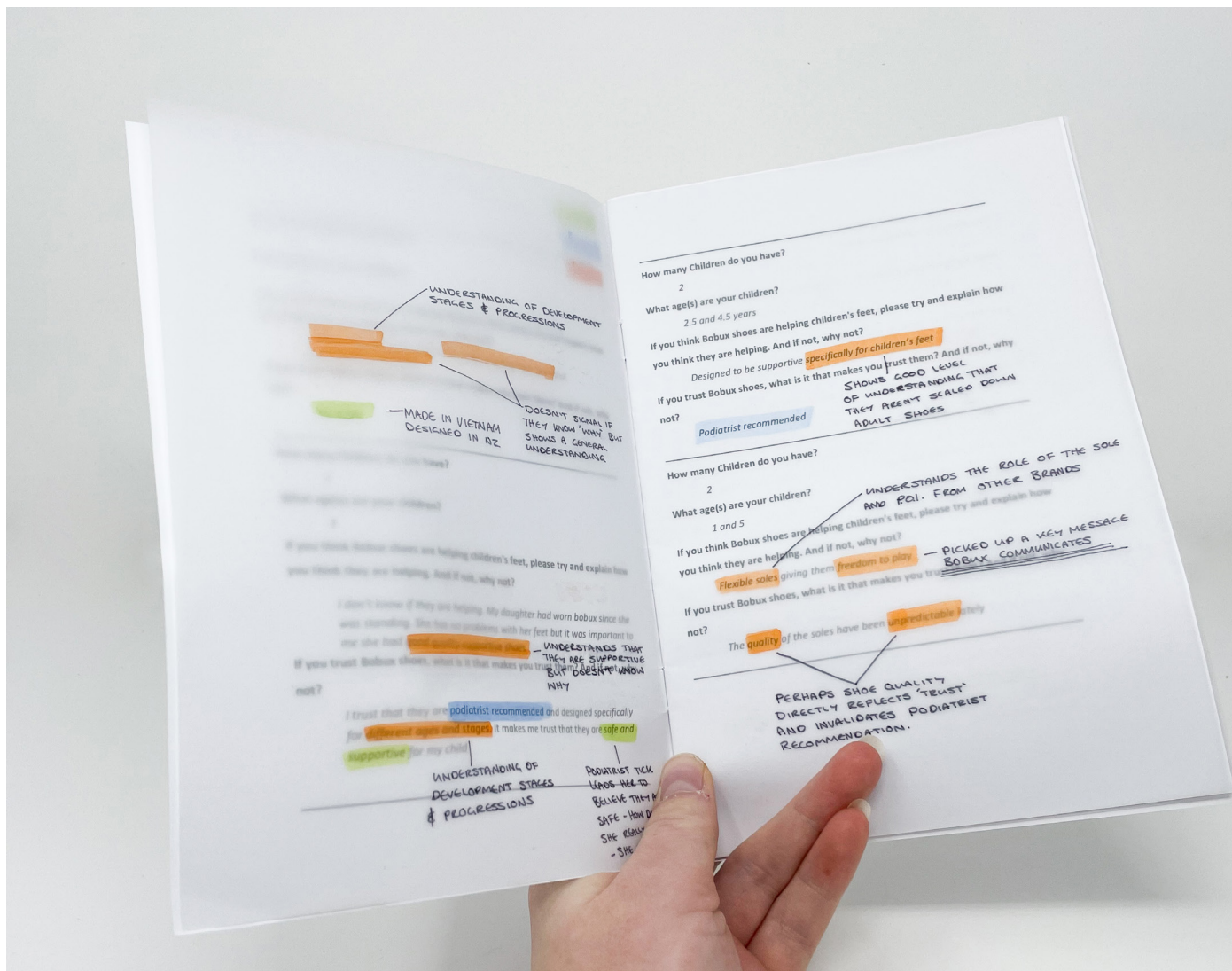


Figure 39. Thematic Analysis from the customer survey.

These responses demonstrated how people can form assumptions about a brand or a product. Many of the assumptions made in the survey haven't been stated explicitly by Bobux, so it is unclear how the assumptions may have been formed. Other comments such as the shoes being supportive (good for the child's foot health), may be true to the brand, but it is clear that from the survey data, a large number of the participants had little idea as to why the shoes may be supportive.

There were seven participants who commented on the podiatrist's recommendation being the primary reason they trust Bobux. The shoes have been approved by a Podiatrist, however, it is important to acknowledge that one Podiatrist's recommendation may be very different from another Podiatrist, as there is a lot of contradicting academic research on minimalist/ barefoot footwear (Hollander et al., 2017; Morrison et al., 2018). While there is such uncertainty and limited information around what footwear is healthy for children's feet, a Podiatrist recommendation may be misleading to consumers.

I found it interesting how the Bobux customer generally understood what Bobux shoes were trying to achieve, despite making general assumptions and relying on the podiatrist's tick of approval. Most participants showed an understanding of the development stages and progressions and that the shoes are made specifically for children's feet at each of those appropriate ages and stages, using words such as "ergonomically designed" and "heroing foot health". Some participants highlighted the flexible nature of the shoes and commented on how the shoes give kids the "freedom to play", a key message that Bobux communicates through its marketing. One participant noted that the shoes keep them safe from sharp or hot surfaces, which suggested they may understand that that is the purpose of the soles being so thin – to get as close to barefoot while still protecting the foot. A small number of the participants also picked up on a major focus of Bobux which is foot health, making comments such as "healthy footbed" and "prioritising foot health". From the results of the survey, I concluded that there was a significant gap in

the existing customer's understanding of the key elements that Bobux wants to communicate for their products. I realised that if the current customers did not fully understand their intentions of Bobux regarding their shoes, then customers who have never purchased Bobux shoes before, and see the shoes for the first time in a retail environment, may misunderstand the purpose of the Bobux product and therefore fail to engage with the brand. The shoe that I designed in this project needed to help the consumer understand the product and engage with it, using strong visual cues that indicate the brand message.

In order to achieve that level of understanding and engagement, visual language tools were helpful in analysing how well the designs were communicating product intention. Incorporating semiotics and affordance, alongside evaluation matrices and participant interviews into the design process helped to separate my own preferences from what the best design directions were.



04.5. Case Studies

Brave Dave:

Woolkin (Woolkin, n.d.) product “Brave Dave the Fire Engine” is a modern take on a children’s toy. Eliminating the plastic seen in many mass-produced toys, Brave Dave presents a minimal design and uses natural materials that help to tell the story of the product, calling attention to its sustainable nature.

Woolkin identified six key elements in the toy’s design: antibacterial, breathable, fire-resistant, toxin-free, sound-absorbing, natural and renewable. Brave Dave was the highly acclaimed Purple Pin (top submission of product design category) winning artefact, in the 2019 Best Awards, with judges describing it as a nature-inspired toy that demonstrated the importance of growing healthy imaginations, through a tactile product (Designers Institute of New Zealand, n.d.).

I selected “Brave Dave” as a case study as I felt that Woolkin did a great job at weaving many complex elements into the visual language of the fire truck. This product highlighted to me the importance of how material can be used to inform the consumer about key elements that make the product so different from competitors. I found that the minimalist style of the product created a clear space to recognise the two primary materials used, wool and timber. I quickly associated these with natural/sustainable materials, adding to the story behind the Woolkin product. By creating a strong character presence of “Brave Dave” a toy fire truck, the company also drew attention to the fire-resistant feature of the Woolkin brand.

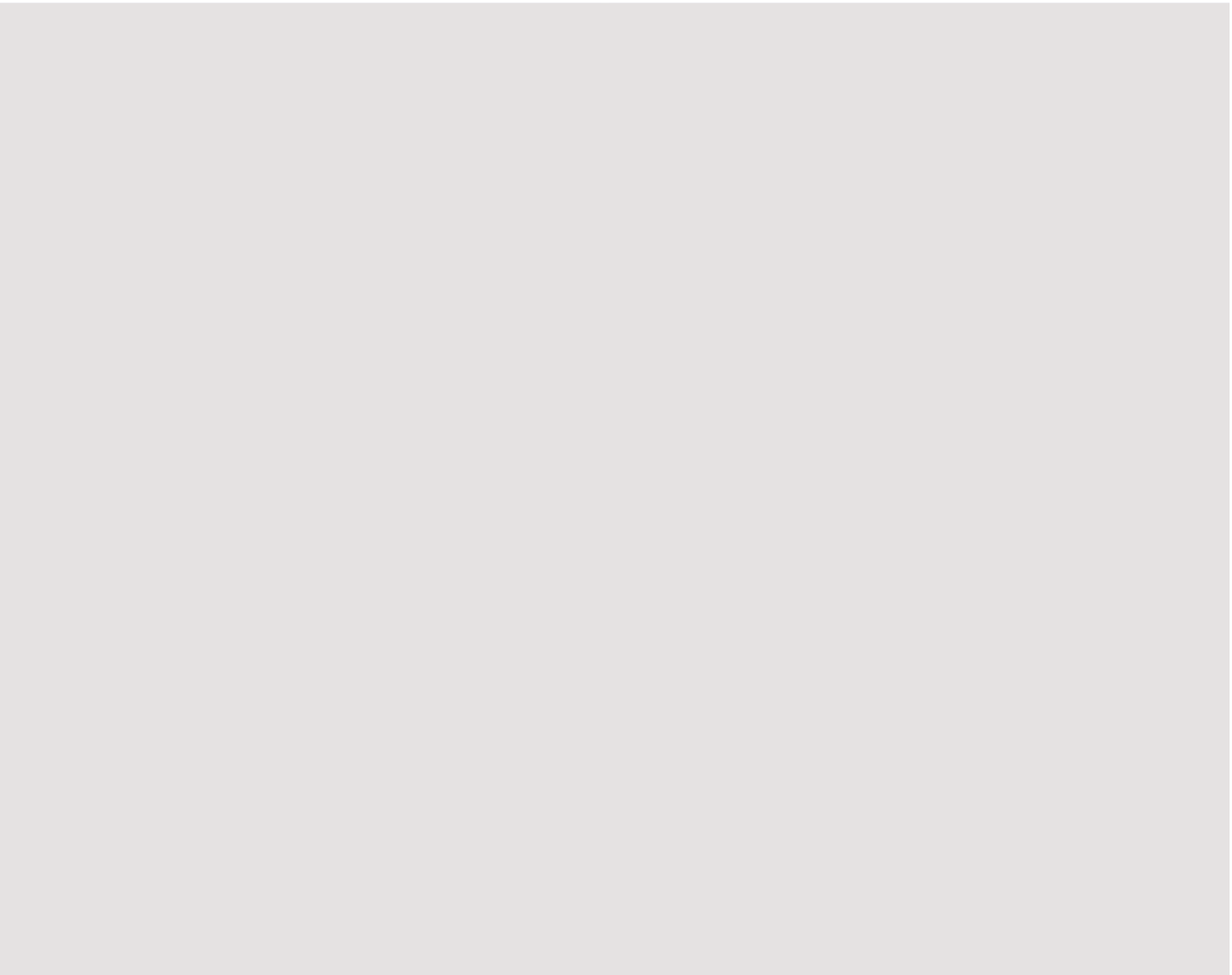


Figure 40. Brave Dave the Fire Engine, (n.d.). Brave Dave the Fire Truck.



Figure 41. Classic Balance Bike, (n.d.). Early Rider.

Early Rider:

Early rider (Early Rider, n.d.) is a children's bike company that promotes itself as a means to explore the world around us. The Early Rider Classic balance bike was marketed as a product to help children discover how they can competently and confidently be mobile and explore independently. I had come across this bike while at a beach and had seen a 2-year-old (approx.) playing on the Easy Rider bike. The bike does not have pedals so the child's legs were used for balance, it seemed as though it would help kids better understand how to balance when the bike was moving quickly, putting their feet up while rolling down a hill.

The light frame of the bike, which looks flat packed, creates the perception for an adult that a child could easily manoeuvre this bike around. The lack of components that could be dangerous for a child (gears, pedals, metal bars, brakes etc.) makes the bike seem more child-friendly, providing trust in the bike for the child to use it independently (Bayer, 2021).

Early Rider was selected as a case study because of their strong emphasis on adventure through play, something that was I was also trying to communicate through the shoe design. Through the simple visual language cues of this minimalist bike, it helped to communicate a strong message of independence, adventure and a means to explore. These elements were seen in not only the product itself (as seen online or in a retail environment) but also seen in the way a child interacted with the product.



04.6. Fieldwork Through Nature

Reflections from fieldwork across New Zealand:

After identifying the key callouts of Nature; Movement/Flexibility; Comfort; and Grip, I decided to spend some time during the research project travelling around New Zealand, reflecting on the natural environment, and how people interacted with it. Because the project aimed to design shoes that communicated a connection with nature, I wanted to document it through a lens that I was experiencing on this field trip. Demonstrating just how important it is for our future generations to be a part of the natural environment, rather than being immersed in technology (Louv, 2005; Hanscom, 2016).

Over the Christmas/New Year's period, I took a month to travel the circumference of the South Island, spending a lot of time at camps. Given that it was the Christmas/New Year's period, there were many young families who were travelling as well.

Reflecting on young families travelling made me consider the notion of the "New Zealand summer". It's the idea of spending time in the sun, on the beach, playing on the grass etc. I assumed that there was a shared understanding of how the outdoors may be ingrained in us as New Zealanders.

Along with the notions of the New Zealand summer, I also reflected on the idea of how we (humans) can become more grounded and connected with the earth surrounding us and more particularly with the ground underfoot. Whether that is how adults connect or how children connect, it is still important to understand our place in the ecosystem – despite our species' gradual urbanisation/industrialisation (Hanscom, 2016).

There was so much nature surrounding me as I travelled across New Zealand and I was immersed in a rich experience of connection. A feeling of being closer to my ancestors as I walked through both populated trails and remote areas, imagining that our ancestors have shared the same ground as I walked on. I took every opportunity to remove my shoes and experience the sensations that came with the different ground at varying altitudes and environments. Removing my shoes helped me to feel a deeper connection with the ground, as though my feet were a part of the web of roots and dirt lying beneath the surface of the ground. By feeling the intricacies of the ground's texture and surface, I felt encouraged to spend more time outside, exploring and adventuring.

This natural fieldwork resulted in strengthening my resolve regarding the project direction and the important role of nature in this research. By centring the project around connecting children with the ground underfoot, connecting with nature could represent not only the future of Bobux but also the future of our younger generation globally (Hanscom, 2016). I felt that there was something enchanting about children playing in nature, so designing a shoe that encouraged outdoor play became an essential part of the research project.

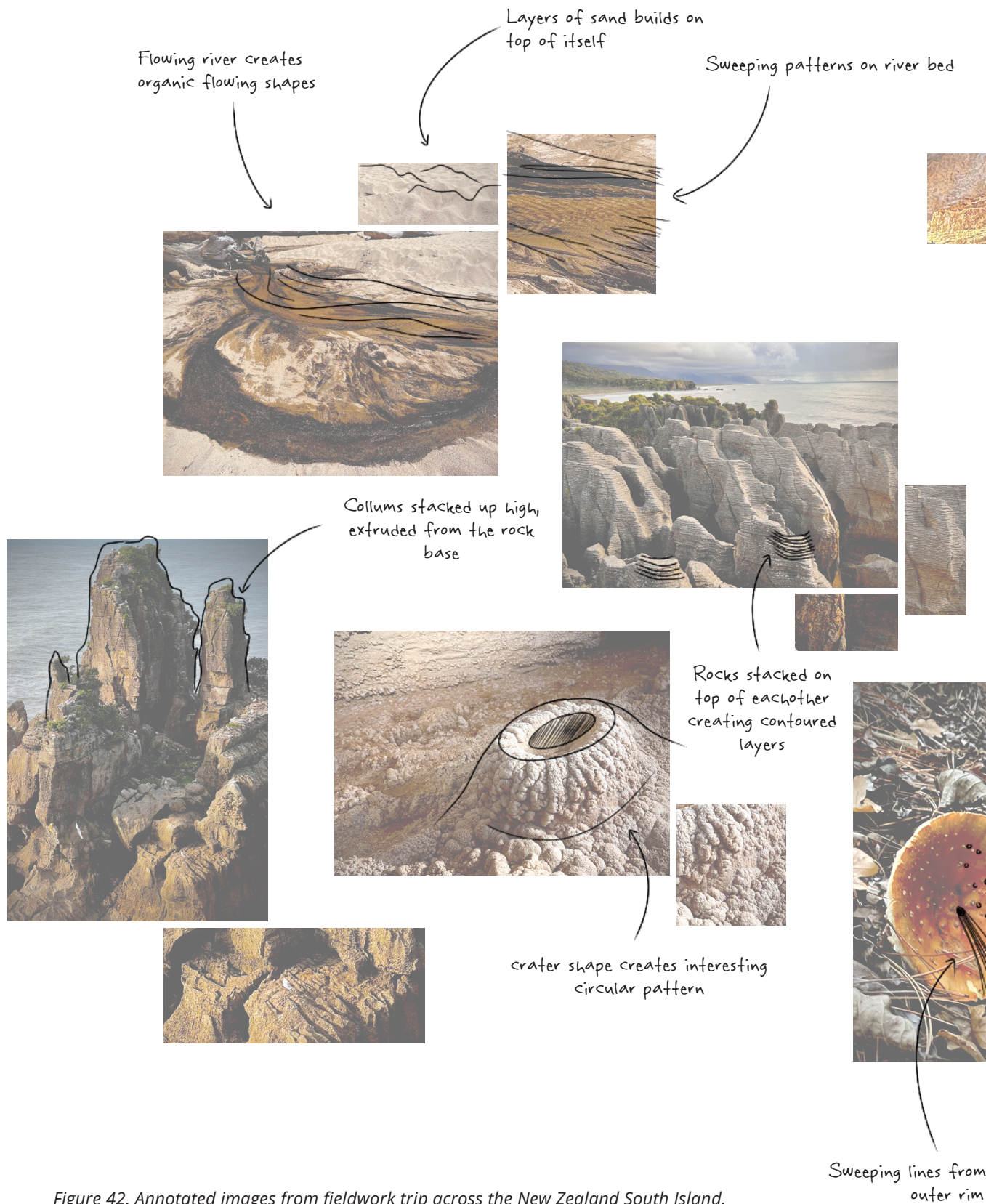
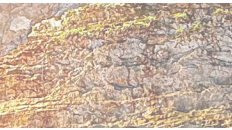
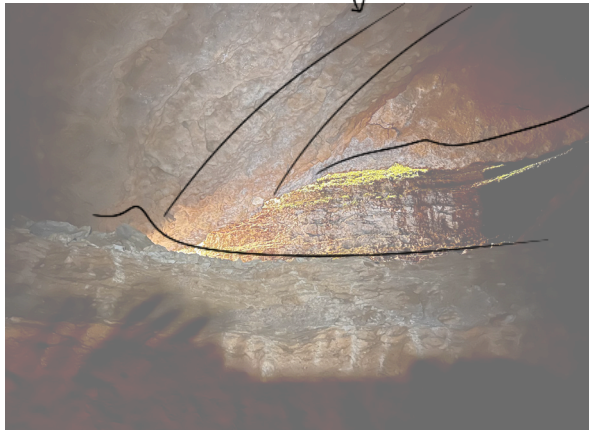


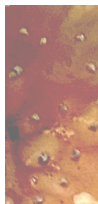
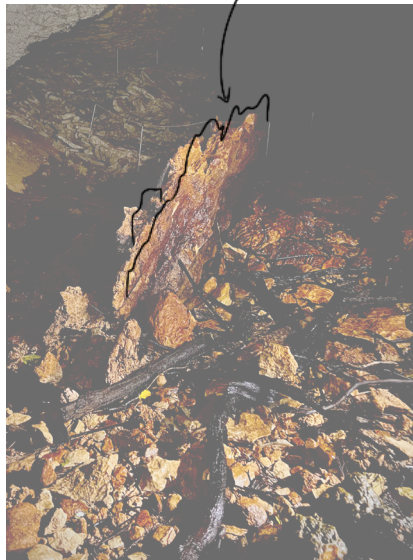
Figure 42. Annotated images from fieldwork trip across the New Zealand South Island.



Flowing lines make up
the cave mouth

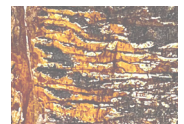
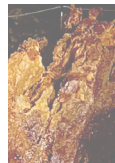
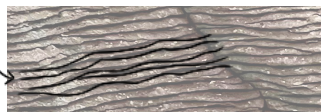


Jagged aggressive shap
of rock form

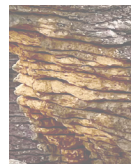
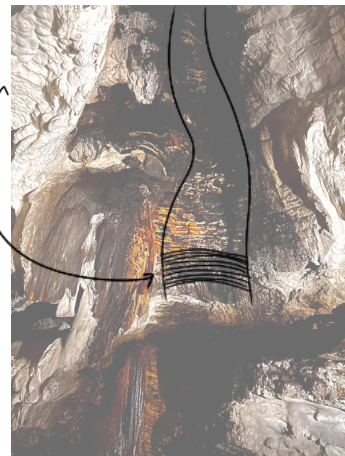


Dimples on surface

Layered rocks



Cave
contours on
walls



Interesting edge line formed by
the rocks

centre to

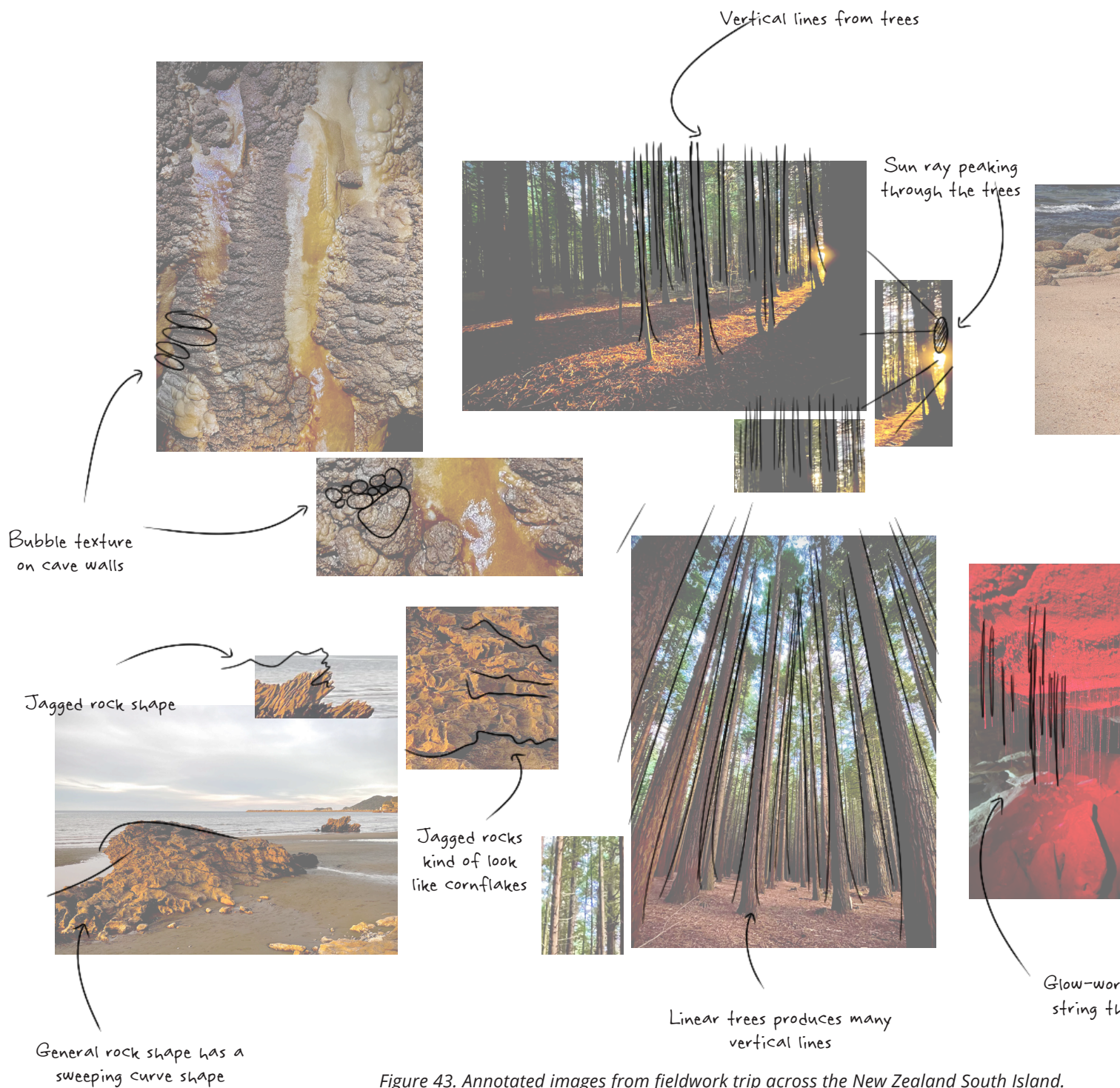


Figure 43. Annotated images from fieldwork trip across the New Zealand South Island.



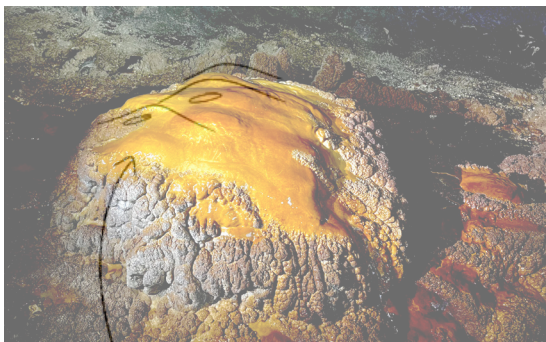
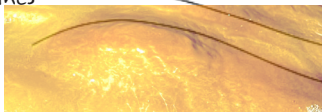
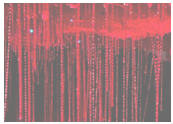
Dimpled texture on mushrooms



Rounded boulder shapes

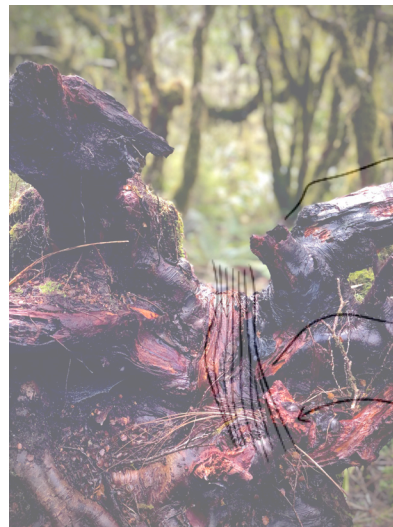


Bird beak has very smooth flowing lines

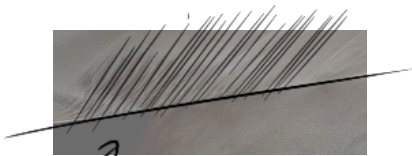


Honeycomb colour covers rock surface smoothing it over

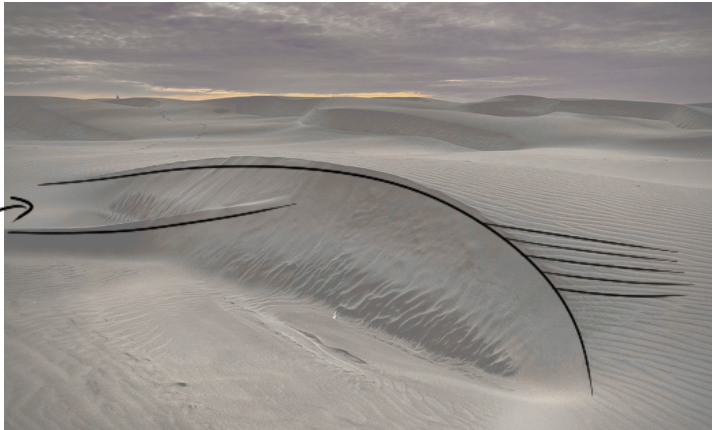
ms produce a vertical that looks like droplets



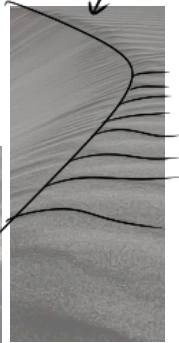
Smooth surfaces amongst jagged wood trunk



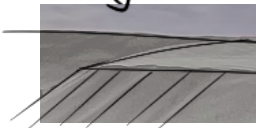
Very smooth and flowing lines produced by the sand dunes



The wind creates sand patterns that imitate tire marks



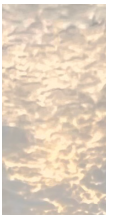
Vertical drops produce hard lines in the sand



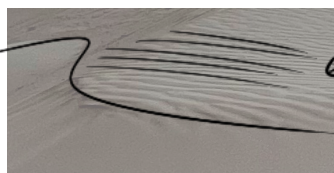
The wind movement shapes in



Sweep du



Line from a less harsh edge creates a subtle contour



Hard lines define the sand dune landscape

Directional sand movement produces natural contour lines

Figure 44. Annotated images from fieldwork trip across the New Zealand South Island.

nt creates bowl
the sand

ping contour gives the
nes visual interest



04.7. Initial Design Brief

A design brief to define the first stages of the research:

Once I had a better understanding of what I was wanting to communicate in the design of the shoe through the outcomes of analysing my primary research, I broke the project down into three development components: the shoe sole; the shoe insole; and the shoe upper. Each of these components incorporated the over-arching themes of Nature; Movement/Flexibility; Comfort; and Grip. These components were formed into a design brief that helped to inform the following stages of the design process.

The aim of the project from initiation was to redesign the Bobux shoe and create a prototype that acted as a visual suggestion for future Bobux shoe developments. This meant that the prototype needed to be designed in a way that the suggestions could be integrated into any Bobux style going forward. The current Bobux shoe sole and insole could be placed on any shoe style interchangeably, so these were considered the primary areas of development. Bobux produces over 300 upper styles (including colourway variations) every season, meaning that it would be outside of the scope of research to redesign a whole upper and expect it to integrate into each of the Bobux shoe styles. Therefore redesigning an upper was considered a secondary area of development focusing on designing specific elements that weren't style dependent, such as the logo and iconography.

1. The first development area was the shoe sole. Focusing on the connection with the ground underfoot, using tactile feedback and visual cues. I explored a variety of tread patterns and sole forms that focused on communicating specific themes. The shoe sole needed to have a lot of movement and flexibility to allow the child to move naturally with the ground underfoot. The grip was also important for the shoe sole, as this was a high priority element for the consumer. Durability was also important for the shoe sole as it was designed for the outdoors, so it would likely experience more wear and tear than a casual shoe.
2. The shoe insole was an important element that made up the shoe. This was the material that the child's underfoot would be touching, so there was an opportunity for the insole to provide tactile information that could recreate the feeling of being barefoot. The shoe insole needed to be warm; sweat-wicking; temperature regulating; comfortable; natural and durable.
3. The upper component of the shoe sole was considered a secondary development, as the design elements of the upper were informed by the shoe sole and insole. The upper was the first point of interaction with a parent looking at the shoe, so the elements that were designed to be incorporated into the upper needed to encourage the parent to explore the other components of the shoe (sole, insole).

Along with these three design components, the following were considered:

- Aesthetics – How can this shoe stand apart from others on a shelf, while still being desirable to the consumer?
- Manufacturing – How can this shoe be designed to align with existing Bobux manufacturing processes?
- End-User Experience – How can this shoe be designed to have a positive user experience for the child (and their relationship with the ground underfoot), and for the parent.

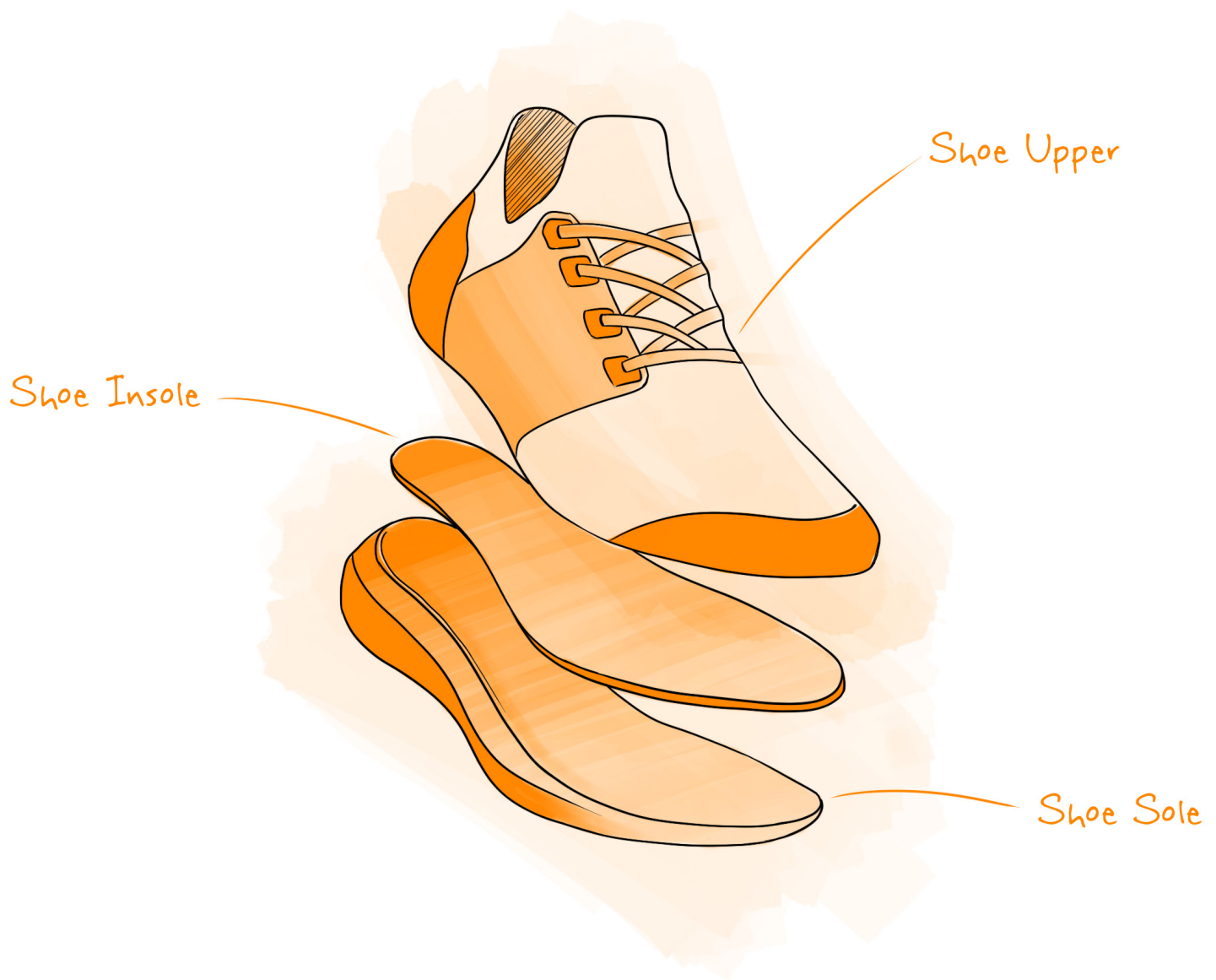


Figure 45. Exploded view of a generic shoe, demonstrating the different components of the shoe as a visual reference.

Bobux Requirements:

As the Bobux Philosophy stated, I needed to ensure that in designing the shoe, I also considered that it was comfortable, adjustable, durable, breathable, flexible, and loved. The shoe aimed to facilitate an emotional connection between the consumer (user and parent) and the shoe (Toddler Shoe Design | Bobux, n.d.; Naeini & Mostowfi, 2015). The grounding consideration of this project was that the shoe must communicate Bobux's purpose, as stated in their philosophy. Materiality and construction methods played a significant role in the output of this research. As this project focused on designing a new shoe for the Bobux product range, materials were chosen from Bobux's existing catalogue of materials and were designed for manufacture by one of their existing factories. When considering the cost of manufacture, developing a shoe similar to the Bobux range (with additional communicational elements incorporated) was the most robust method of producing a shoe that could realistically be mass-manufactured and sold by Bobux.

Stakeholders:

This research was conducted in partnership with Bobux Footwear. They provided me access to their offices, systems, database, and the staff's collective knowledge. As a result of this, Bobux was considered the main stakeholder in this project.



04.8. Shoe Development Map

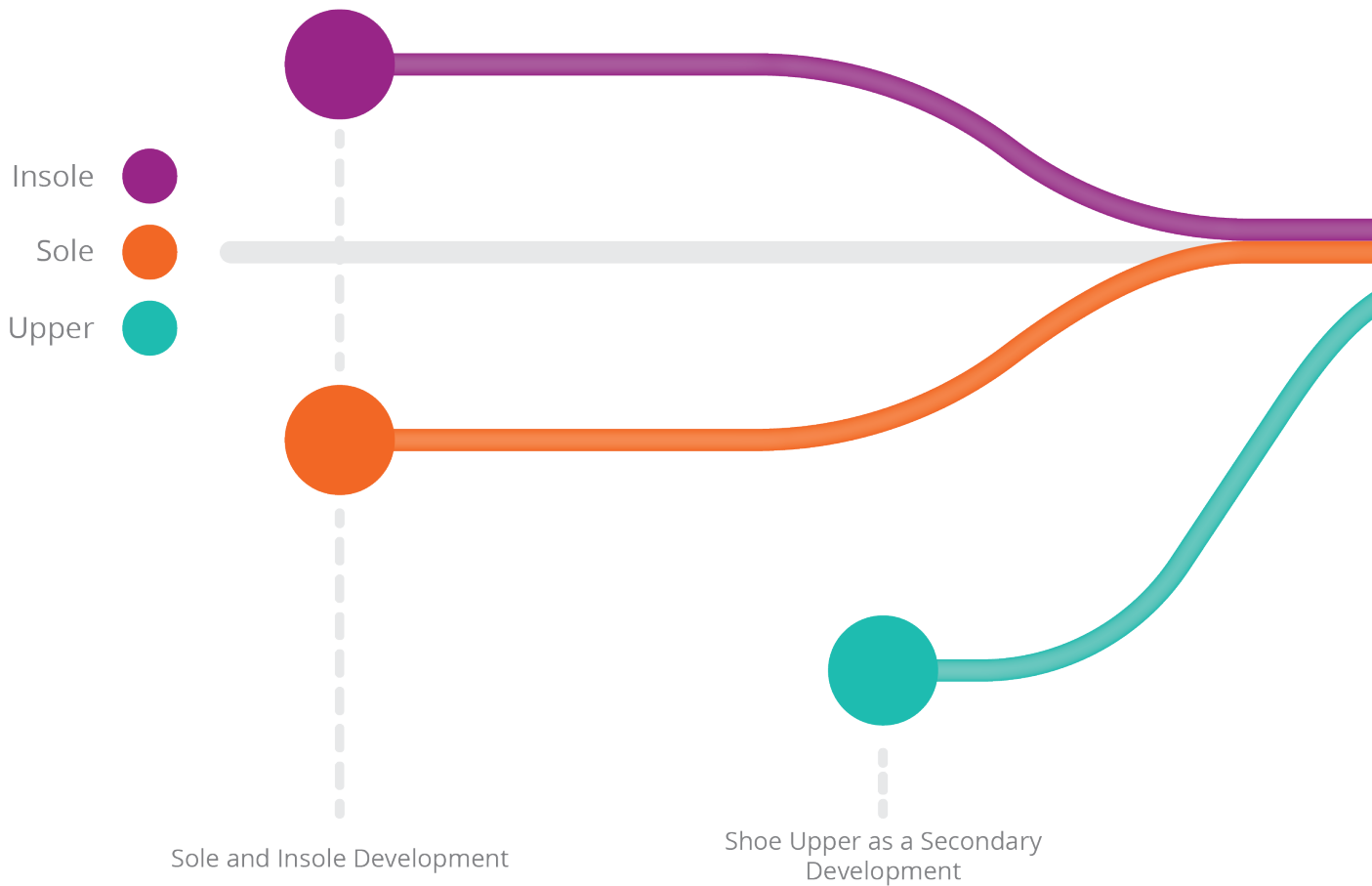
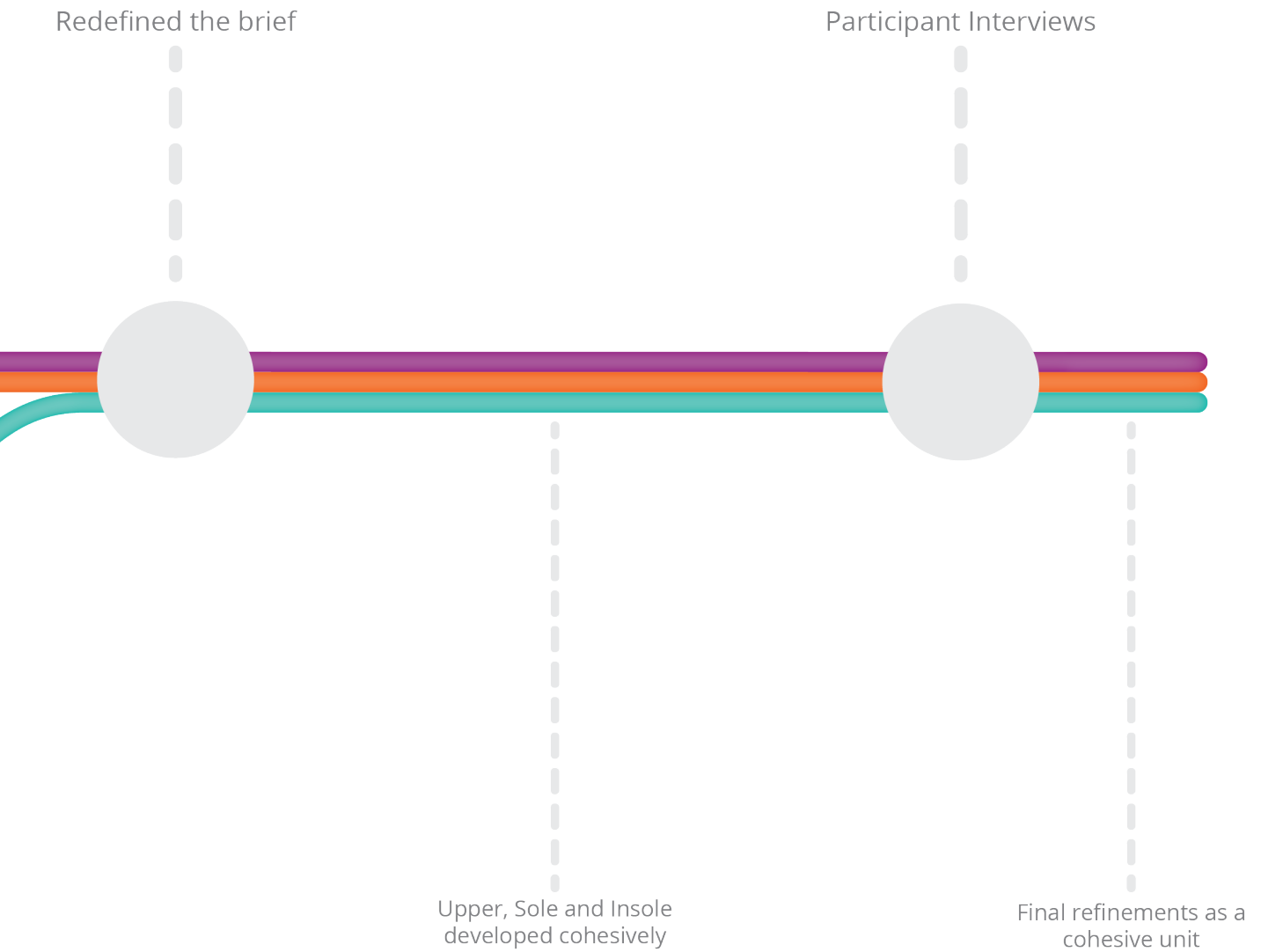


Figure 46. Map of the shoe development process for each of the three components, explaining how the following section is layed out.





04.9. Outsole Development

The Bobux Sole

Looking through Bobux's product archives from the early 2000s and looking at how the shoe sole had changed over the years, I noticed that it used to resemble a footprint, with natural elements built into it – the sand, sun, and waves. They were trying to sell the New Zealand summer lifestyle, while also promoting the connection between feet and the earth.

The current Bobux sole has become more abstract, with the focus on the sand pattern to show the connection with the ground. There was the potential for the abstract pattern to be challenging for the consumer to easily interpret the meaning of the sand.

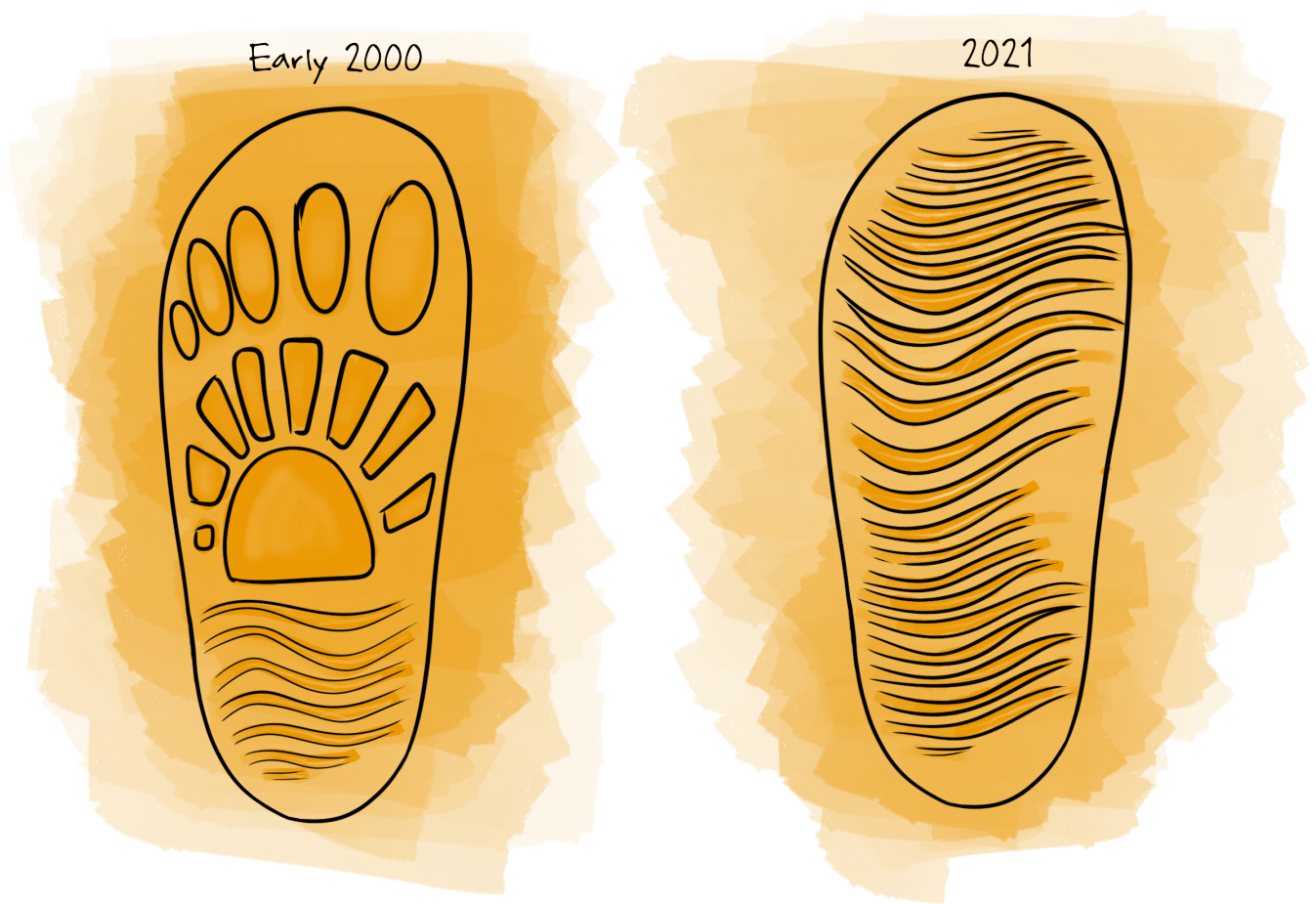


Figure 47. The Bobux Sole tread over two decades. From a sunny/beachy footprint to an abstract sand pattern.



Tread Ideation:

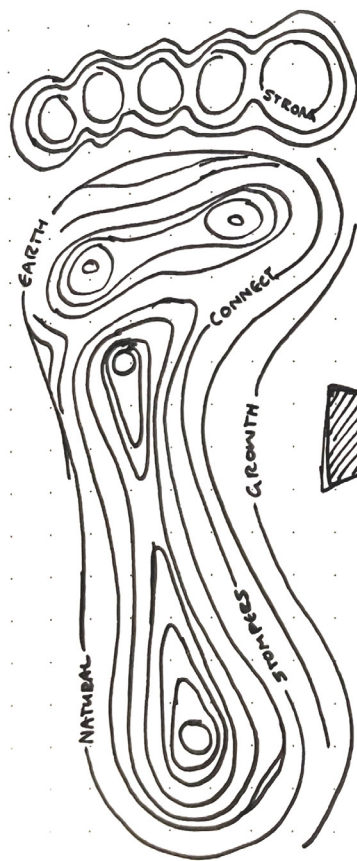
I started experimenting with different patterns on the shoe sole. Looking at how the purpose of the shoes could be communicated. I noticed that as these drawings are two-dimensional foot soles, which on a child's foot will be hidden, it could be useful to look at how these designs could curve up around the sides of the sole to communicate better with the consumer (especially when displayed on a shelf). As a result of this, I did some foam prototyping of foot soles, looking at how the pattern could be brought up around the sides of the shoe.

I used blue foam to bring some of my sketch concepts to life, I looked at using organic shapes, mimicking the foot sole shape both literally and through more abstract methods. The prototypes were very useful to see the soles as three-dimensional objects. These models allowed me to see how the sole would wrap around the sides of the shoe. More prototypes were needed to help me in producing a wider variety of creative soles.

Figure 48. Two-dimensional sketches and three-dimensional sketch models of shoe sole treads that could be developed.



Figure 49. Two-dimensional sketch of shoe sole tread pattern ideation.

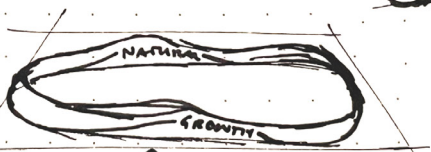
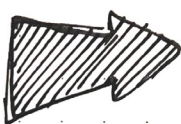


SIMILAR STYLE TO
WEBSITE STORY-
TELLING



INTERNAL SOLE
INSERT
TOPOGRAPHIC WITH
WORDS

INTERNAL SOLE WITH
STORY IN IT



THE LINES ROLL
UP SIDES OF SOLE



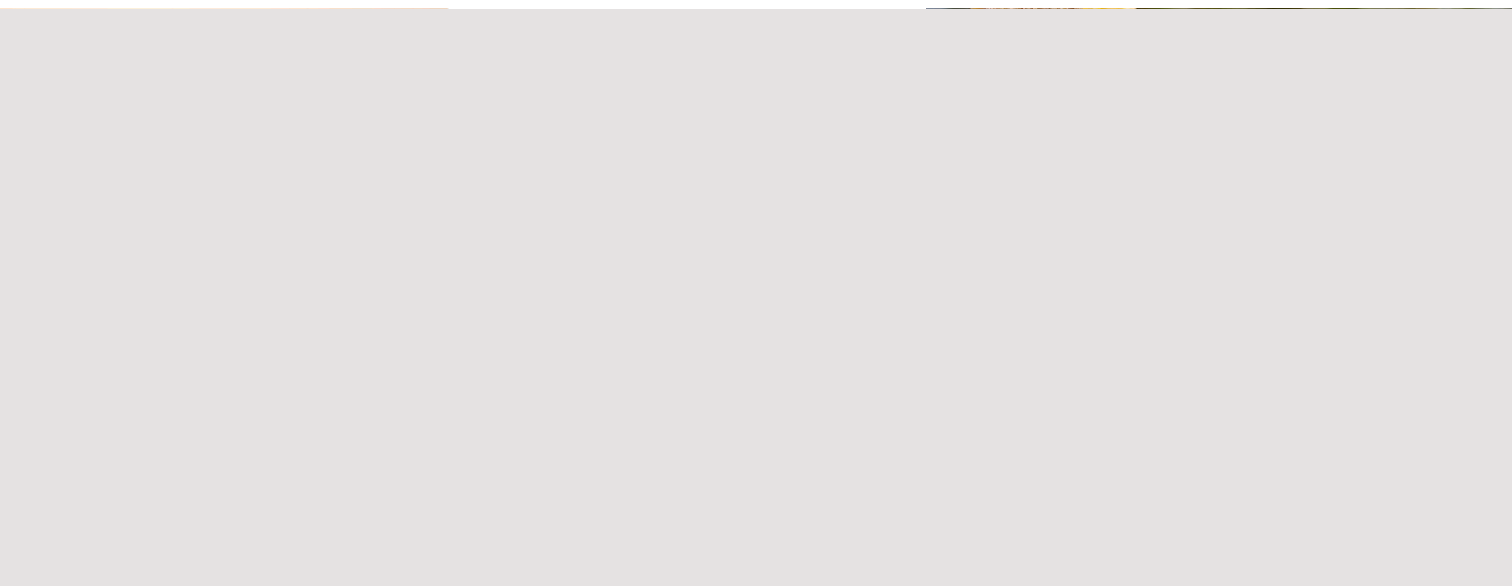
Figure 50. Tread print concept that focuses on telling the story with words, with insole integrated into the concept.

Competitor Tread Print:

A company that markets itself in a similar area to Bobux is Vivo barefoot. The company had brought out a children's shoe with a new sole style, that followed the topographic map style that I had started to investigate in my design ideation. This made me reflect on the designs that I was creating, that perhaps I was working at a surface level, creating obvious designs, and needed to dive a bit deeper.

I felt that this example of footwear had strong visual cues from the sole and did a good job of communicating the purpose of the sole, while still looking comfortable and "friendly". However, the insights from both interviews suggested that visual cues don't need to be "screamed out" through the design, which I felt that Vivo Barefoot had done in this tread print. Using visual cues in a subtle way could be a more effective method of communicating to the consumer.

There is a fine balance between literal and abstract in communication. Too literal and the design may look tacky, too abstract and the consumer won't pick up the visual cues that you have used (You & Chen, n.d.). It has been suggested that product perception and creative design play a large part in consumer purchasing decisions (Naeini & Mostowfi, 2015). It is important that the customer is able to pick up on the visual cues so that they perceive the product as it was intended. I realised that in future developments I needed to reflect on where the visual cues were sitting on the literal/abstract scale, this reinforced the need to develop a communication framework for the process.



*Figure 51. (VIVOBAREFOOT (@vivobarefoot) Instagram Photos and Videos, n.d.).
Instagram post from competitor Vivo Barefoot, who brought to market a shoe “Little
Sun” that has a similar tread pattern to some of the concepts I had been producing.*

Silicone and Rubber Prototypes:

I made these prototypes with the intention of creating both dirt and grass prints on the sole as a tread pattern, to look at how the natural substances would appear on the underside and what that would communicate to people.

However, the silicone got underneath both the grass and dirt, encasing it completely. Another prototype would be needed, where the dirt would be encased in a hard resin or similar and then the silicone could be applied after that so that it could be poured in and peeled out without going underneath the dirt or having any dirt attached to it on removal.

With the prototyping materials that I had available at home during the Covid-19 lockdown, I decided that producing complex textures like this would be better achieved through sketching or through CAD development.



Figure 52. (Top) Prototype using pinkysil silicone, with dirt on the base, aiming to produce a bumpy texture. (Bottom) Prototype using pinkysil silicone, with grass on the base, aiming to produce a grass-like texture



Figure 53. Polyurethane moulds with footprint embedded. Shallow imprint depth.



Figure 54. Polyurethane moulds with footprint embedded. Medium imprint depth.



Figure 55. Polyurethane moulds with footprint embedded. Deepest imprint depth.

These prototypes explored how I could use subtle footprint indents on the base of the sole as a separate element to the tread pattern to communicate the idea of creating a connection between the foot and the ground. I created three moulds of varying depths of the footprint indents. The intention of these prototypes were to observe how people interacted and responded to the imprinted moulds and based on people's responses, determined whether they could be used to help communicate the to the purpose behind the shoe.

Here I was also experimenting with how to create prototypes. I went through a discovery process of what I might have needed to know and do in order to give form to my concepts as I go through my design process. Working with polyurethane and silicone moulding, I began to discover what worked best and what was possible in terms of my design practice.

Responses From Peers:

I decided that as a method of reflection I would show these prototypes to my peers to get feedback from other designer's perspectives. I was hoping to gain an understanding of how my peers interpreted the models and the information they drew from interacting with them. I asked what the prototypes texture felt like to them, what they thought the footprint was trying to achieve, preferences of the different footprint heights, and I observed the way they interacted with the prototypes.

My peers found that the three footprint textured prototypes had very strong communicative design cues and a strong visual language. They were interested in how a pattern like this could be so subtle that it is hardly visible to the naked eye, yet if you ran your hands over it you could feel the slight bumps. They were engaged by the idea of the sole continuously communicating its purpose, particularly to the parents, by highlighting a child's footprint trail when walking in the sand or with wet shoes walking over the pavement. This provoked me to reflect on how I had been primarily focused on communicating this information at the time of purchase (in the retail store). There was an opportunity to incorporate 'hidden gems' into the shoe design, that could be uncovered through the use of the shoes, such as the footprint only being exposed by wet footprints or marks in the sand etc.

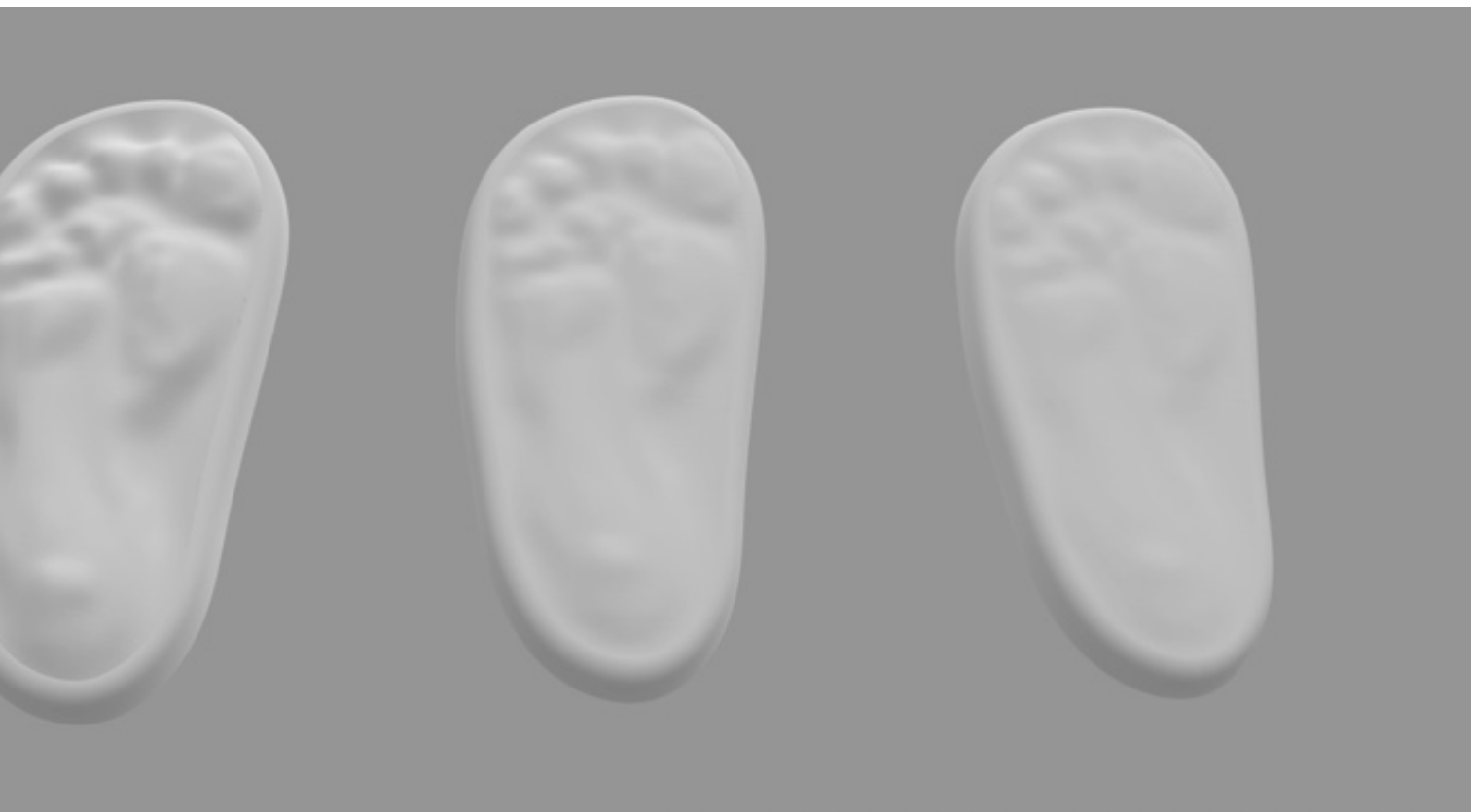


Figure 56. CAD model to better show the different imprint models, and the varying depths of the footprint bump height.

After observing how my peers interacted with the footprint sole prototypes, I wanted to document the tread print on concrete and wood to see how well the footprint would appear when wet, further exploring the idea of 'hidden gems' that can be discovered after purchase. By placing the prototype in water and then pressing it onto dry concrete and wood, a watermark footprint was left behind after the prototype was lifted. I did the same activity with the current Bobux soles, to compare the prints left behind.

I liked the concept that the sole could continue to communicate information to the parent even after purchase. By leaving footprint marks from the tread on any surface (sand, dirt, concrete/wood after jumping in a puddle), the parent might further understand how this shoe is an extension of the foot, rather than an addition to the foot.



Figure 57. Water marks from sole prototype onto concrete and wood, leaving behind a footprint shape.

I considered incorporating podiatric data into the footprint tread to determine where the higher pressure areas would be located to be best suited to a children's foot. I found data of paediatric foot pressure maps of children less than 2 years old, up to 5 years which demonstrated the average maximum force in different areas of the foot (Alvarez et al., 2008). This data was used to identify high-pressure areas of the shoe sole, which would need to have more consideration in the way the it was designed to prevent rapid wearing out, as that will be the hardest wearing areas of the sole. In response to this, the shoe would need to have either a thicker sole at that point, or a harder wearing rubber. I realised that this data also showed me that those high-pressure points of the foot were where the most tactile feedback from the ground would be felt.

This data was important to integrate into the shoe, as it has been noted that the structure of a child's foot is completely different to an adult's, especially between the ages of 0-5 years when their feet still consist of a lot of cartilage that slowly develops into bones (Cucuzzella, 2017).

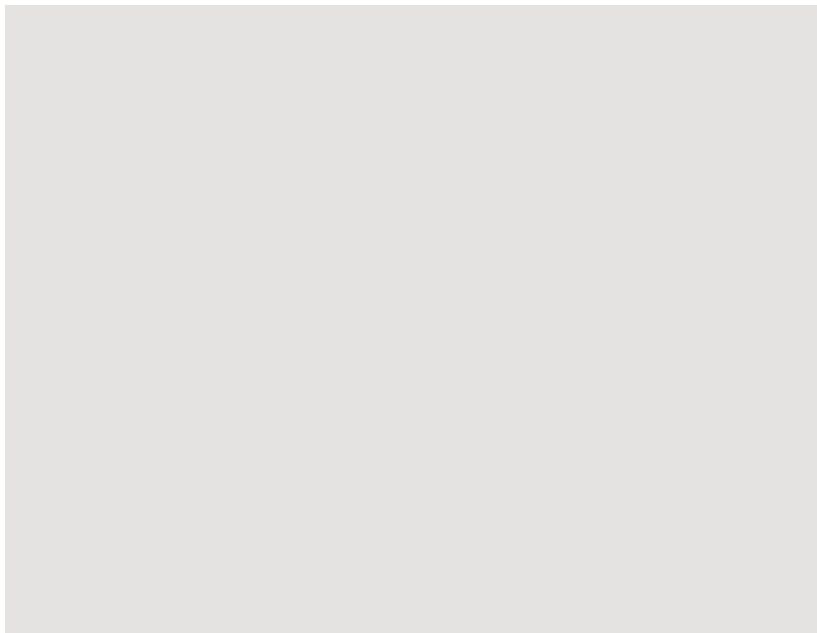
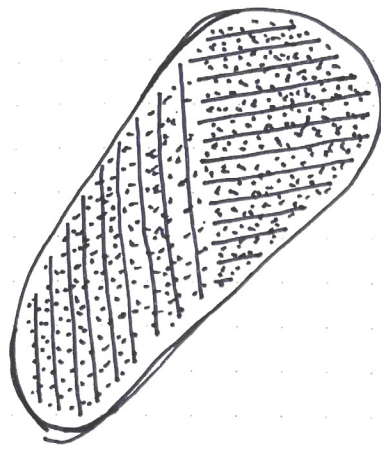
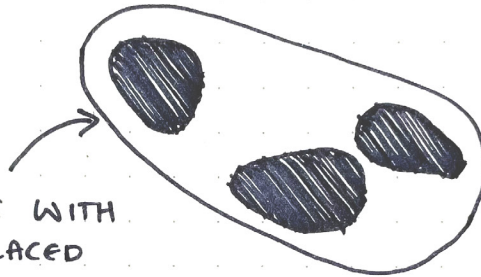


Figure 58. (Left to right) percentage of maximum force outputted from the foot of a child less than 2 years old; percentage of maximum force outputted from the foot of a child between 2-5 years old.

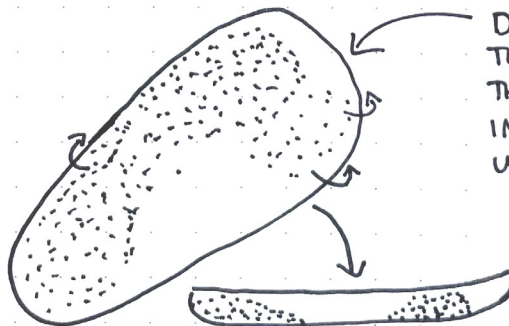


PLANTATION STYLE ROWS
FOR GRIP WITH SEEDS
SCATTERED THROUGHOUT

• COULD I MAKE IT LOOK LIKE VINE
ROWS OR ROWS OF TREES?



DARKER SOLED PLUGS WITH
SEEDS BUILT IN - PLACED
WHERE THE HEAVIEST WEAR
OCCURS SO THAT CHILDREN
SCATTER SEEDS AS THEY
PLAY IN NATURE.



DIRT TEXTURE IMPRINT
THAT WRAPS AROUND
THE SIDE AS A VISUAL
INDICATION AS TO WHAT'S
UNDERNEATH THE FOOT

Figure 59. Sketch ideation of tread prints with seeds integrated.

Seedling Sole Ideation:

I looked at how I could integrate the pressure map into the tread pattern using a “plug”, which is an additional piece to the base sole mould which is attached after moulding, allowing for different material composites or colours to be used across the sole. This could create the opportunity for a sole that was more customised to the shape of a child’s foot.

The project focused on communicating connection with nature, so I looked at patterns that mimicked rows of harvest, or dirt textures. I looked at the possibility of having seeds throughout the rubber of the sole, to encourage children to wear the shoes outdoors. This could have been a great selling point for the shoes – planting trees as you play.

This idea of seed soles was challenged when it was brought to my attention that the growing trend of seed dispersal through clothing and footwear could be a potential biosecurity threat to many countries. After looking into this further I found out that the increasing mobility of people around the world has made humans an incredibly effective method of plant dispersal (Lukács & Valkó, 2021). This is seen in tourists bringing in dirt and soil on the bottom of boots, tents, tramping packs etc (Ministry for Primary Industries, n.d.). There have been growing concerns around human-vectored seed dispersal that is built into clothing and footwear, being imported into countries, or brought in unknowingly in people’s suitcases (Lukács & Valkó, 2021).

This exploration helped me to consider what it meant to connect children with nature through this project. Because planting seeds as the child walks may not necessarily make a child tangibly feel connected to nature, whereas having more tactile interaction with the ground, and a shoe that has visual cues that indicate outdoor play could be a more effective way of making a child feel that natural connection.

Because most of my drawings had been a two-dimensional top view of the shoe sole (see figure 49.), I had not considered how wrapping designs up the side of the sole could help parents understand the shoe better, or at the least, invite them to look underneath the shoe when viewing it in-store. I was able to create rapid sketch models of shoes by using masking tape and wrapping it around a shoe last. I could then draw on the masking tape as I would on a piece of paper, to get a better sense of how the sole would look as a three-dimensional model.

I decided that building seeds into the shoe soles was not an effective way of encouraging children to play outside due to the international biosecurity risk associated. From here I had to investigate other ways that I could use these shoes to encourage children to spend time outside, building a relationship with nature.



Figure 60. Sketch model using masking tape and markers to create a three-dimensional representation of a two-dimensional sketch.



04.10. Insole Development

The Bobux Insole:

To start the development of my insole prototype, I first looked at the make-up of the current insole that Bobux was using on the shoes. The insole featured a very simple leather and foam material combination that was 1-2mm thick. The graphics included the size, logo, brand name, development stage, and the podiatrist's approval. The foam was slightly moulded to fit into the shoe, and had a small amount of apparent sweat-wicking patches on the leather that did not protrude into the foam.

Based on the findings from the customer survey, the podiatrist approval part of the insole would be likely the thing that the consumer took the most notice of and was one of the greatest factors in their decision making for purchasing the shoe. This is a feature that needs to be integrated into the insole through my development.

Alongside the podiatrist's approval, the size and child's foot development stage (crawling, walking etc.) should also be communicated in this part of the shoe as that is essential for basic consumer knowledge of any shoe.



Figure 61. Current Bobux removable insole using pig skin leather and open-cell foam.

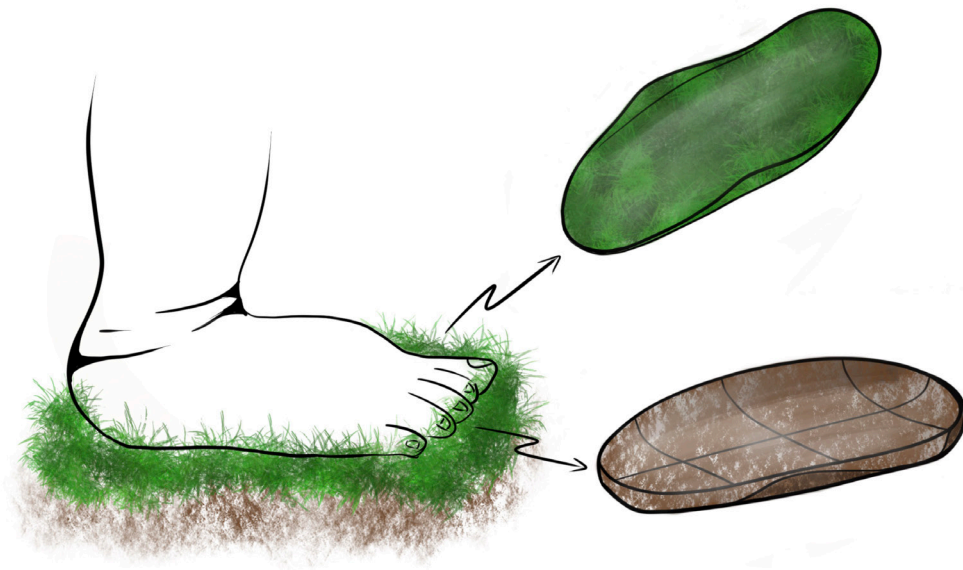


Figure 62. Children's foot on grass and soil, translated into the concept of integrating the grass and soil into the insole and sole design.

Natural Grass Insole:

A key element of the Bobux insoles is that they are thin so that the children are as connected and close to the ground as possible. The shoes are also meant to be worn without socks to minimise the additional layers between the ground and the foot sole.

Especially following my travels around New Zealand, spending a lot of time barefoot in the outdoors, I began investigating how to recreate a connection between a child's foot sole and the earth, while protecting them from nasties (sticks, stones, sharp rocks etc.) that are on the ground.

As a part of my design process, I was exploring the relationship between literal and abstract communication through the lens of a consumer product. I needed to find the "sweet spot" between these two so that the solution that I designed would be both desirable to the consumer while also communicating its purpose.

I looked at what I might be able to communicate through using artificial grass turf as a shoe insole, to allow children to still receive the sensation of grass underfoot.



Figure 63. Soil and grass placed on the inside of a Bobux sole as a quick sketch prototype as a visual aid for the concept.



I started this series of iterative experimentation by cutting out artificial grass and inserting it into a shoe sample. I found this to be a rich communicative prototype, which brought out discussions about how I can communicate the possibilities associated with making a connection to the earth more explicit in a shoe.

There were discussions surrounding how the feeling of walking on grass could be freeing to some children, especially children that are intentionally taking shoes off all the time, purposely walking/running around barefoot. However, there may be an opposite reaction to the direct grass feeling on the feet. For some, there may be a feeling of discomfort, particularly because of its artificial nature (plastic grass). Over an extended period of time, the foot could get itchy.



Figure 64. artificial grass turf cut out into insole shape, to be the contact point with the child's foot, giving them the tactile feedback of playing on grass while walking.

Progressing from the straight cut out prototype of the shoe insole, I wanted to investigate the visual cues that an imprinted shoe insole would communicate. I did two variations of this, with the imprint as a deboss (subtracting the imprinted shape from the grass) and as an emboss (subtracting the outside of the imprint so the imprint itself appears raised). Feedback from this iteration showed that the negative prototype had strong visual cues of “imprinting” on nature as well as giving cues of comfort similar to how Birkenstock (BIRKENSTOCK Sandalen und Schuhe | Offizieller Onlineshop, n.d.) uses foot indications to indicate a shoe insole that is form fitting to the user’s individual foot shape.



Figure 65. Artificial grass insole cut out with footprint embedded into the grass.



Figure 66. Artificial grass insole cut out with footprint embedded into the grass.



Figure 67. Artificial grass insole cut out with footprint extruded from the grass.



Figure 68. Artificial grass insole cut out with footprint extruded from the grass.

Following the experiment of using imprint indications to help communicate nature to the consumers of Bobux shoes, I started investigating various ways that I could create that imprint, while also taking into consideration comfort, and what the insole was visually communicating.

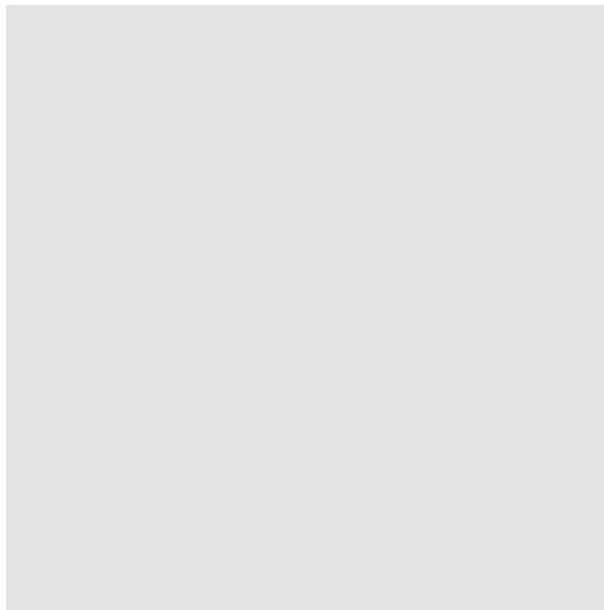


Figure 69. Birkenstock Sandals that show a mould for the toe area, which I interpreted as creating a visual effect of “customised to the wearer”, improving comfortability and grip to prevent the foot from sliding out.

Nature Through Felting:

I visited the AUT textiles lab where I experimented with the felting machine. This experimentation aimed to see what materials could be used to mimic certain elements of nature, like grass. To begin with, I used both recycled wool and merino wool to get an understanding of the differences between the variations of wool strands, how they performed and their physical properties. The Merino wool was a lot softer and felt more comfortable when in contact with skin, whereas the regular wool felt very coarse and itchy.

Alongside the textural and structural properties of merino wool, there are other benefits to using it as a garment material. Merino has a natural hygroscopic quality which allows it to absorb and desorb moisture from both the wearer's skin as well as the surrounding environment. This allows the material to be worn for longer periods of time without odour or microbial growth (Wrigglesworth, 2011). Merino fibre also naturally regulates temperature and ventilation, meaning that the shoe sole could be breathable and in turn, could manage the Bobux requirement of temperature control on the inside of the shoe (Chaudhari et al., 2004).



Figure 70. Test insoles using a wool felting loom, testing with various fibres such as regular wool and merino wool.



Figure 71. Felting test with merino wool insoles that match my foot size to be tested as an insole in my own shoes.

As it was challenging to test the comfort properties of the merino insoles when they are placed in children's shoes, I also used some of the felted merino vat (roll of loose wool) to create insoles that matched my own shoe size. This allowed me to walk around and experience the properties of the wool, to step into the shoes of the end-user quite literally.

My findings from this experiment were that the merino was incredibly comfortable to walk on, especially without socks, as I was interested in designing a shoe that could comfortably be worn barefoot. The material was soft, but it did not make my foot feel clammy in the way it might with a polyester felt.



After experimenting with basic felting processes, I moved into creating my own loose wool vat, where I had control of the colour strands and the layering within the fibre. This allowed me to create a vat that mimicked the colours seen in a bed of grass, and the nature of tufting allowed loose fibres to be pulled up, like that of grass, as opposed to a woven or knitted merino structure.

When discussing this experiment with supervisors and peers, it seemed to be a promising avenue of further exploration. This development was exciting and seemed to produce many ideas of ways to build upon it and improve its physical and communicative properties.

Figure 72. Project-specific felting testing, aiming to recreate a fibre to mimic the appearance of grass or moss.



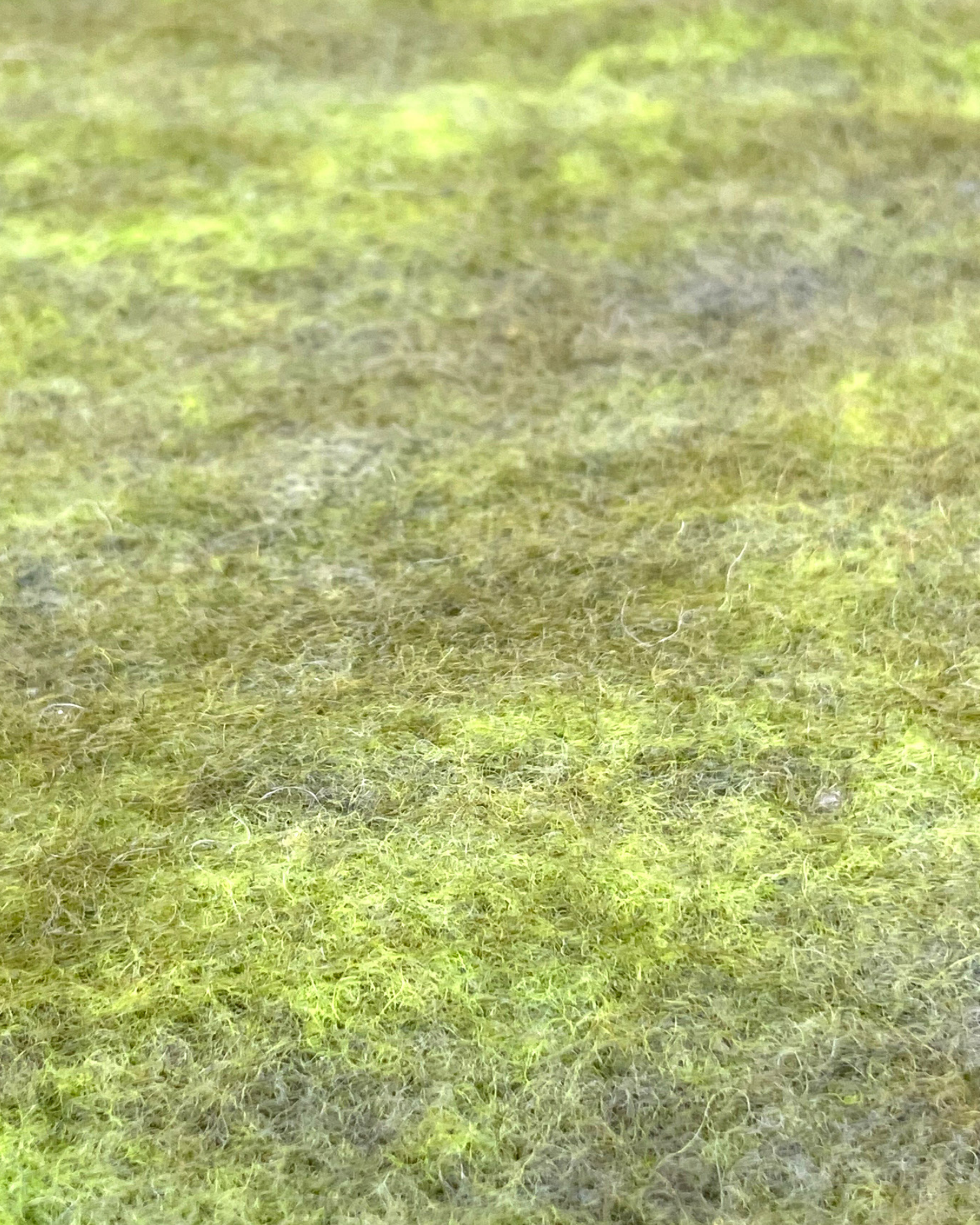




Figure 73. Project-specific felting testing, aiming to recreate a fibre that mimics the appearance of grass.





Figure 74. Grassy merino felted onto a piece of woven fabric, cut to insole shape and placed into an existing Bobux sole

One of the iterations of the green wool mat was felting onto a rigid woven fabric. Without this fabric, the wool could be stretched like bubble gum, whereas the fabric gave it structure, which would be necessary for a shoe insole. Using the rigid wool mat, I cut out the insole shape and inserted it into a Bobux shoe model.

I wanted to use this prototype as a direct comparison to the previous artificial grass sole. This was to help me understand where I may have lost or gained certain communicative elements. I used my peers to aid my analytical process, as it was challenging to view the prototypes through an unbiased lens as the designer.



Lots of comments about it looking "natural"

Might be too "uggbooty"

Hairy, so soft - wow, feels woolen
I am not wanting my sweaty feet in it - reminds me of ugs
Reminds me of slippers for household (indoor use)
Quiet

Mossy
Some sort of grass on plant material
Feels light + soft
Nature, swamp? Because of the shade of green

Soft grass, natural environment, wool, flat/even ground
Calm/warm/cozy
Organic material, comfortable, warm, seems suitable for warmer weather?

Movement and freedom highlighted

Sport days
Alert - excited to move
Free

Grass, itchy,
Less room to
Barefoot but

A rabbit petting zoo
Happy
Cozy - cushioned

Highlights nurturing / comforting aspects

Moss, carpet, grass-green
Warm - lots of heat, cushy
Fuzzy, nurturing, warm

Fake grass/moss
Feels soft to the touch but makes me wonder how it feels on the foot.
Tingly? Soft? Stretchy?

Might be too soft for day to day wear?

Grass, astroturf, sports - hockey, school
Feels a lot more uncomfortable, very hard/scratchy
Scratchy, enclosed

Scratchy and uncomfortable

Would be loud around in
Scratchy
Maybe I will with marks if

Figure 75. I asked my peers to reflect on the grass and wool insoles based on indicator questions. The image shows the insights based on conversations with peers about the grass and felt insoles.



natural
move
not

Artificial turf/rough grass,
plastic shavings (?)
Uncomfortable, itchy, ticklish
Feels like walking barefoot on
rough grass

Coarse, rough scratchy
Artificial grass that has been
worn, has been run on, trampled
Bounce when running

Sports, running, feet in the
grass - footprint
Nostalgic - primary school
days, running around on the
field
Natural

Uneven
Playful
Impression in the ground
Cushioned + more supportive
than flat ground, summer vibes

The grass might make
it seem natural

Imprint may seem
more supportive and
cushioned

(maybe) to walk
have ugly feet
i wear long term

A golf course with that
artificial feel of grass
Uncomfortable
Artificial, fake, not real,
scratchy

Grass, farm
Outside
Rough, natural

Slightly softer grass that has
been walked on compared to
navy shoe insoles
Feels more comfortable to walk
on than "new grass" with
different topography (for foot
pressure points)

Visually kind of scary to see
footprint, maybe I am just
scared of feet
I like #2 more because over
time it will turn into #3 and I
like breaking in shoes like Dr
Martens

Not good to give off
artificial - for a
natural focused shoe

Imprinted sole seems
more comfortable

Its nice for a shoe to
be "broken in" gives a
custom feel to it

It was interesting to see the responses and the information that my peers were able to retrieve from these prototypes, and I wondered how the comments from the lens of designers may differ from participants.

Key insights collected were that the felt texture may seem too much like a winter ugg boot, which may not be suitable for day-to-day use, otherwise, the consumer may interpret the shoe as a winter product. The felt insole gave cues of comfort and nurturing and the natural communication was picked up.

The grass sole inside the shoe (with no footprint in it) made the majority feel as though it would be uncomfortable to wear because of the artificial plastic in the grass. Feelings of spiking, tickling and itchiness were expressed. The concept behind the grass was picked up, that being the movement and freedom of a child playing in the grass.

The insole with the footprint embedded into the grass drew some interesting insights in contrast to the other grass insole. It was suggested that the imprint made the insole appear to be more supportive and cushioned. Multiple people mentioned that a “broken-in” shoe felt a lot more customised and therefore comfortable for the user.

I found the insights from the imprinted grass sole were valuable in understanding ways to communicate comfort and connection through the shape of the insole. The felted insole was on the right track but I needed to experiment with different ways I could mimic a natural “grassy” insole without it being so fluffy and winterised.



Figure 76. Latex poured over felted wool insole and moulded to a footprint shape to create the imprinted effect with the wool (attached to wool) and latex poured directly over footprint mould to be placed underneath the insole in the shoe (unattached to wool).

The experiments shown in the images on the left were iterations of the imprinted grass insole. I wanted to combine the wool insole with the concept of the imprint. The latex was supposed to hold the footprint form while also bonding to the wool. Because the latex was so thin, it held the shape when no pressure was applied but collapsed under any weight, which made for air bubbles underneath the insole. This test made me realise that the imprint didn't necessarily need to have the imprint built into the insole. It could be built into the inverse (top side) of the shoe sole. The Bobux sole currently does not utilise the top side of the rubber sole, but there is the potential to customise the design of the rubber to customise the fit for children (rather than a completely flat sole).



Figure 77. Development sequence of the shoe insole.

Testing the wool sole with different wool fibres



The underside of the felted sole, one a stiff fabric for shape retention



Combining the texture of the wool with the appearance of the grass



Crafting own felt material with specific grass colours to recreate that connection with the ground through a visual medium



Felt wool sole insert in a Bobux shoe model



04.11. Upper Development

Upper Design of Smaller Elements:

I began ideating upper shoe designs, seeing how I could pull the natural elements across the entire shoe. I based the sketches on Bobux's basic "grass court" shoe style. After this drawing exercise, I was concerned that this upper was morphing into a branding or decorative project, and there was no real creativity involved in the upper, making the shoe just another product on the shelf, rather than something that stands out.

My concern was that this project was supposed to be providing Bobux with some recommendations around how they could improve their range, and I didn't want to design elements that couldn't be applied to all their many shoe styles. However, this left me at a standstill because that meant I couldn't really create a new style that reflected the potential future of Bobux that I was trying to create in the sole and the insole, connecting children with nature. I was left stuck with no idea of how I could convey this message through their current styles.

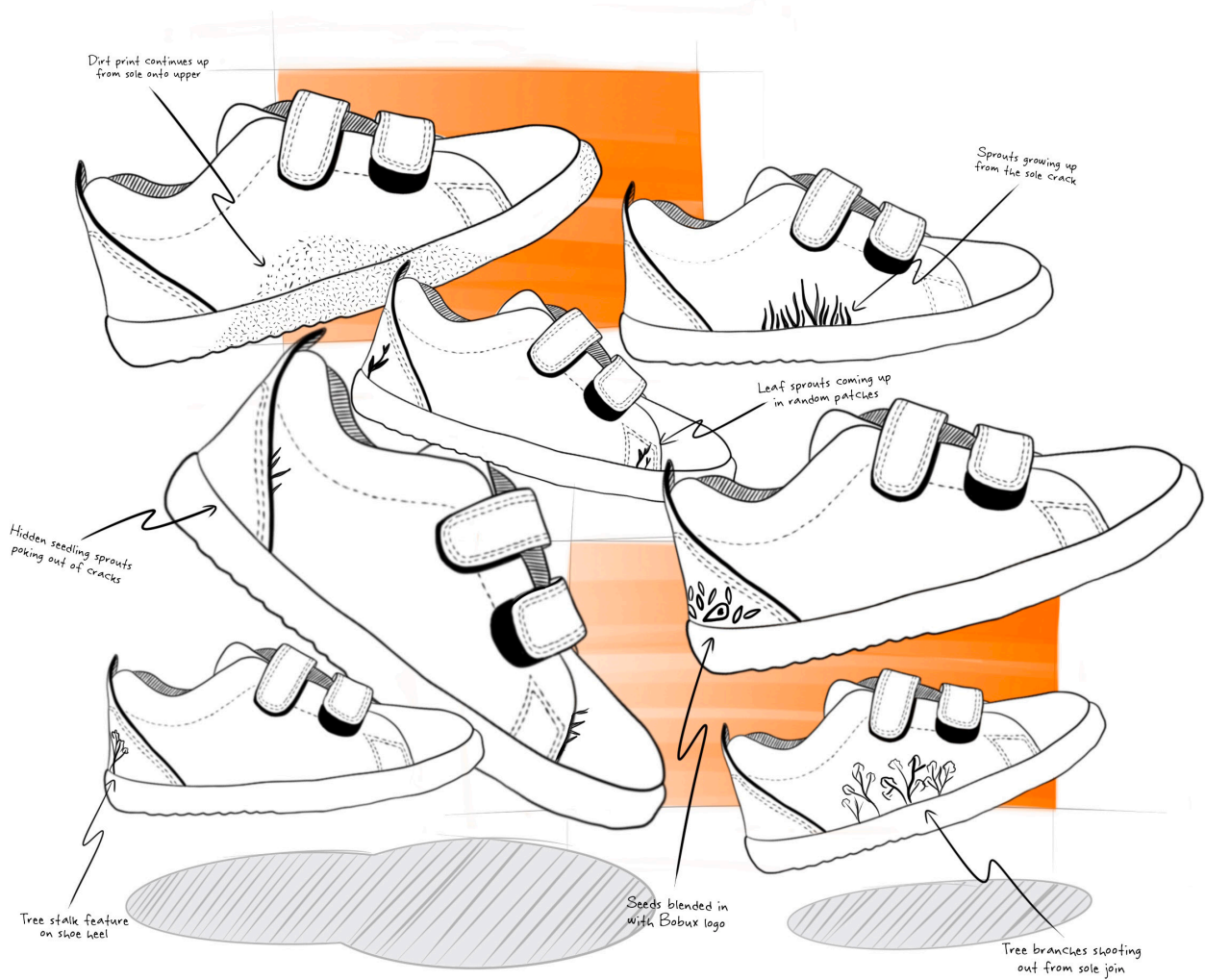


Figure 78. Bobux Grass Court shoe style, with nature-themed patterns drawn onto it as “cues” towards connection with nature.



04.12. Redefining the Brief

The Natural Path:

Taking another look at the project, and the initial design brief, I came to realise through brainstorming, ideation and prototyping, that there was the opportunity to push this shoe design a lot further than what Bobux was imagining, and a lot further than what was typically seen in the children's footwear market. I had been designing shoes that Bobux could implement into their market within one to two years, however, the designs that I was producing felt "safe" and I did not feel that they would stand out on the shelf. Realistically these shoes would not communicate to the consumer that they would help to build a relationship between the child and nature and that the shoes would help them to adventure and grow strong and healthy feet.

I decided to reframe the way I was thinking about the outcome. Rather than a shoe that can be used as a recommendation for future models, with set elements that could be directly translated into their own product style, I decided that I would design a "hero" shoe which Bobux could use as a guide for the level of innovation their other shoes should be aiming for in future developments. Providing Bobux with an opportunity to re-align with their original brand message.

It felt important to bring back the original Bobux brand message into the shoe, with children growing up in a world that is rapidly changing in regards to climate change, technological developments etc. (Polivanova, 2016). It is natural for parents to want their children to experience the same things that they did growing up in nature, which may become harder to access as the world changes. It is becoming less desirable for the new generation to interact with nature in the same way, in the face of technology and digital distractions (Louv, 2005).

Hanscom (2016), a pediatric occupational therapist, explained how balancing outdoor play with every day activities like schooling could make for stronger and healthier children. The rich sensory experience of the outdoors could improve the development of self-directed young minds (Hanscom, 2016).

As an outcome, I wanted to design a shoe that captured Bobux's core beliefs – but stripped back to their essence in the most simple way possible. This meant, designing a shoe that stands out from competitors on a shelf and communicates to the parents that these are the shoes for playing outside, splashing around in puddles or climbing up trees, and tells parents that this is the closest your kid will get to nature while wearing a shoe – and keeping their feet protected at the same time.

Reflecting on the key design elements that I had identified early on in the project, I still wanted to integrate these callouts into the product, but I found focusing on all of them was too much to do within the scope of this project. Recalling a comment that Expert A had made about having one key callout, any other callouts should be woven into that key theme. I decided to make “connection with nature” the key callout, and weave “flexibility” and “play/adventure” into the product through nature-centred visual cues. I realised that most of the previous callouts (grip, comfort, and movement) had really been functional requirements, rather than the shoe's holistic purpose.

From this point in the project, I decided to approach all three components (sole, upper and insole) with equal priority. The sole and the upper needed to be designed together, as they are directly connected to each other and needed to visually flow, rather than looking like two separate things that had been stuck together. The insole was developed at the same time as the sole and upper, taking insights from the developments made, but was still a removable component of the sole so it was not necessarily included in the sole/upper sketches.



03.13. Upper and Sole Design

Nature Centred Ideation:

I began exploring different forms of the shoe, specifically looking at the shoe upper in greater depth. In discussions with my supervisors, we concluded that these shoes were tending to look like adult footwear and the style was struggling to communicate my key themes of adventure, connection, and flexibility. These designs also looked very similar to traditional sneakers which could have been communicating certain things that were not intended. I was reminded that I needed to continue to go back to the question of “what is this communicating” and reflect on what I wanted to communicate.

After reflecting on the re-framing of this project, I realised that what felt like a large shift in my project, was just a different way of looking at health and wellbeing. My project title was “communicating good foot health through visual language in children’s footwear design.” It then became “communicating good foot health and connection with nature through visual language children’s footwear design.” I decided to highlight the connection with nature, and view the term “health” as a holistic health engagement, focusing on movement, activity, nature etc.

From there I needed to understand what holistic health looked like for a toddler. More specifically, what that looked like in a toddler’s shoe. Breaking down what shoe styles would “fit” when playing on the beach, in the dirt or grass, kicking puddles etc.

I also considered the role and significance of materiality, form, colour etc. in how the connection was communicated and realised that these elements would have a lot more impact on the overall story than I had originally thought.



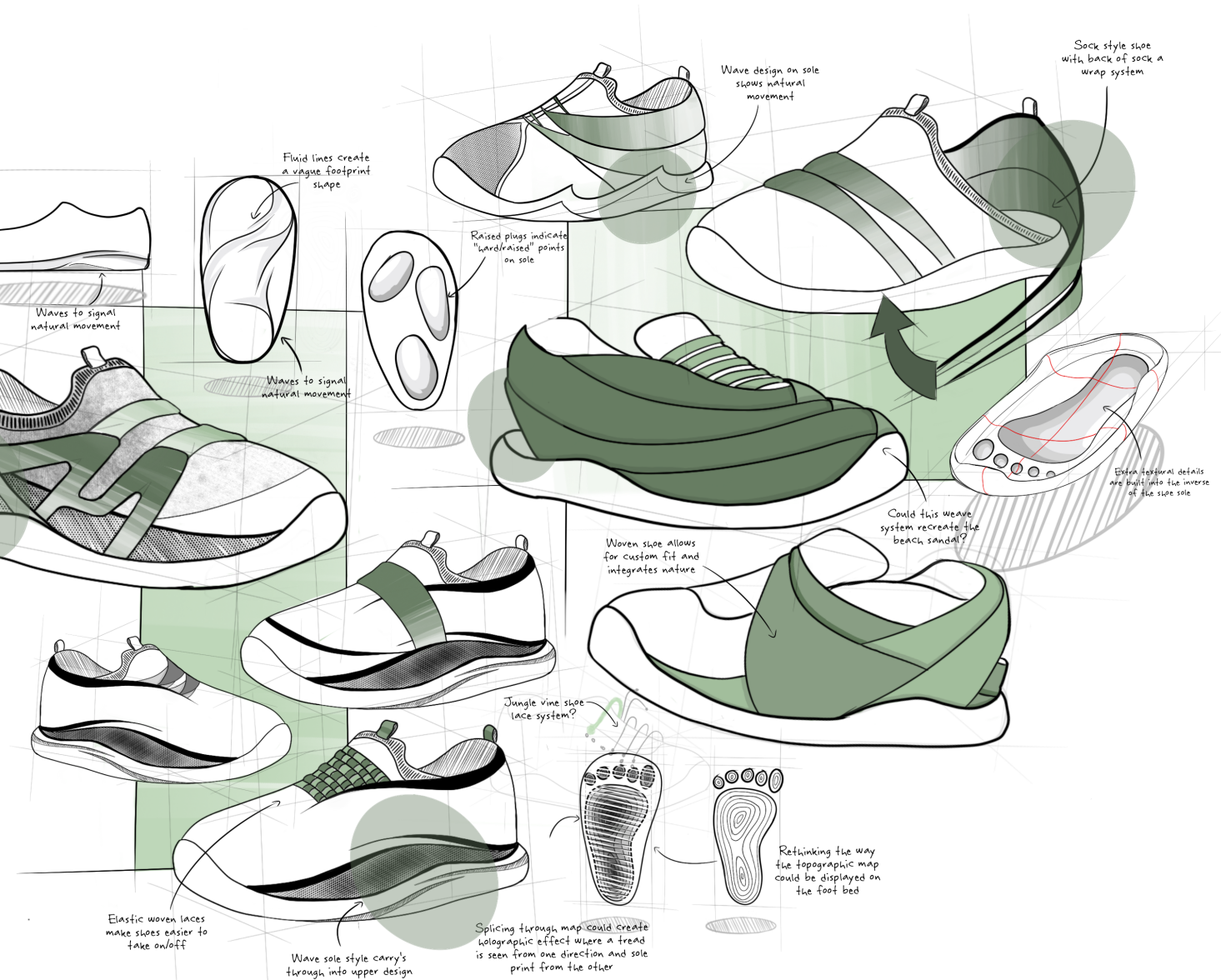


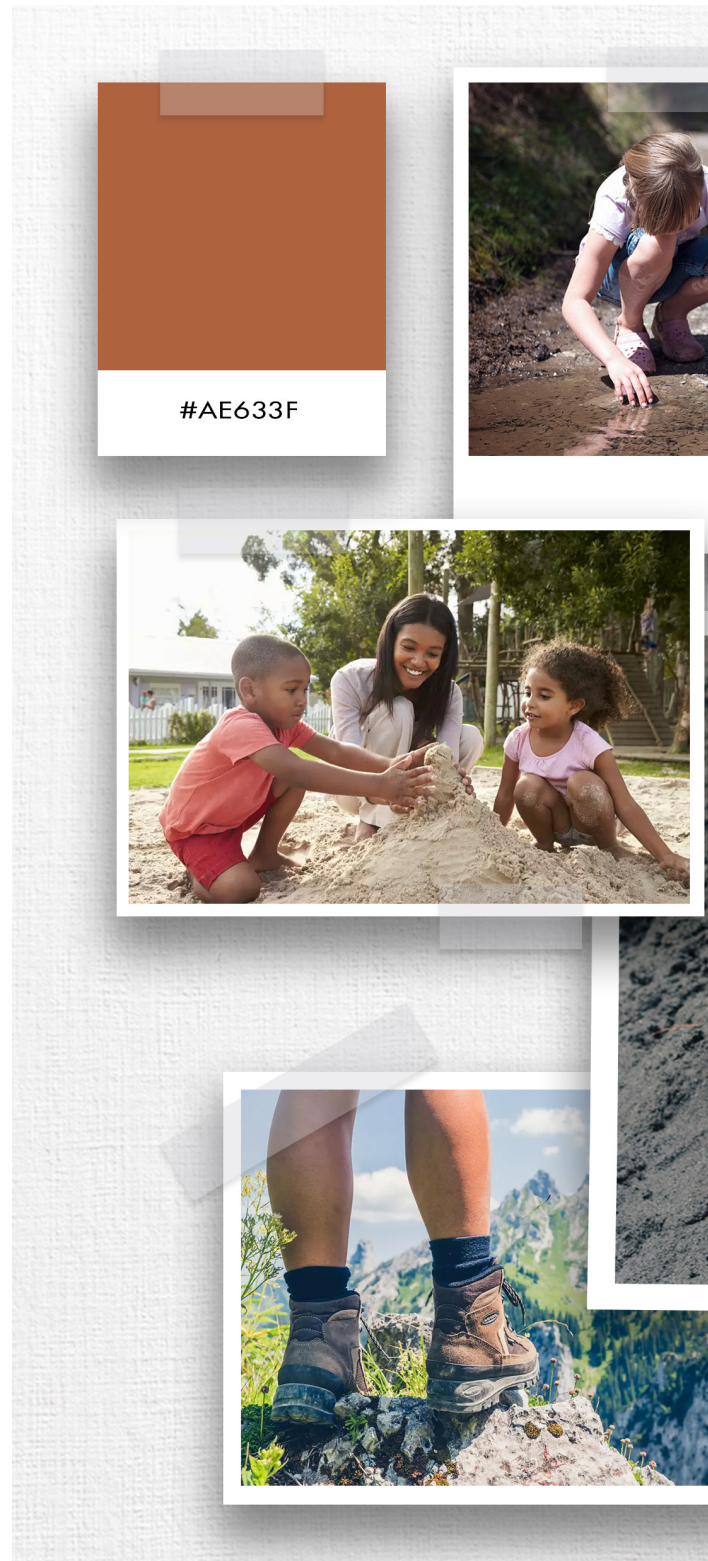
Figure 79. Sketch ideation focusing on the "natural" callout.

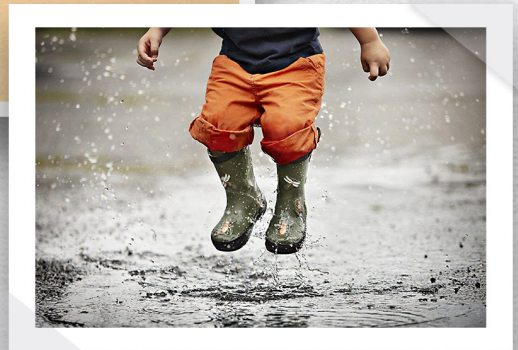
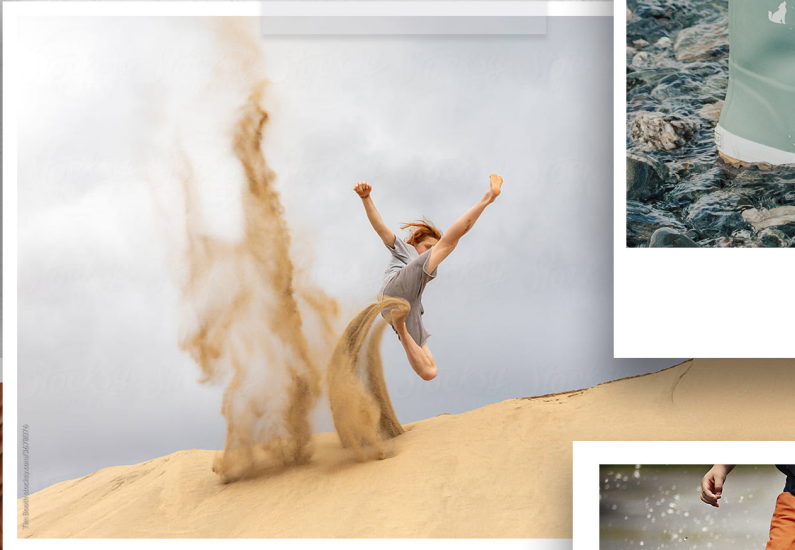


Figure 80. The masking tape sketch models were exploring selected concept sketches from the previous page, to visualise concepts as a three-dimensional object.



Figure 81. I put together a collection of images that represented play and adventure in nature. I used this lifestyle mood board as a visual aid to imagine where and how the shoes I am designing may be worn and where they may be used.





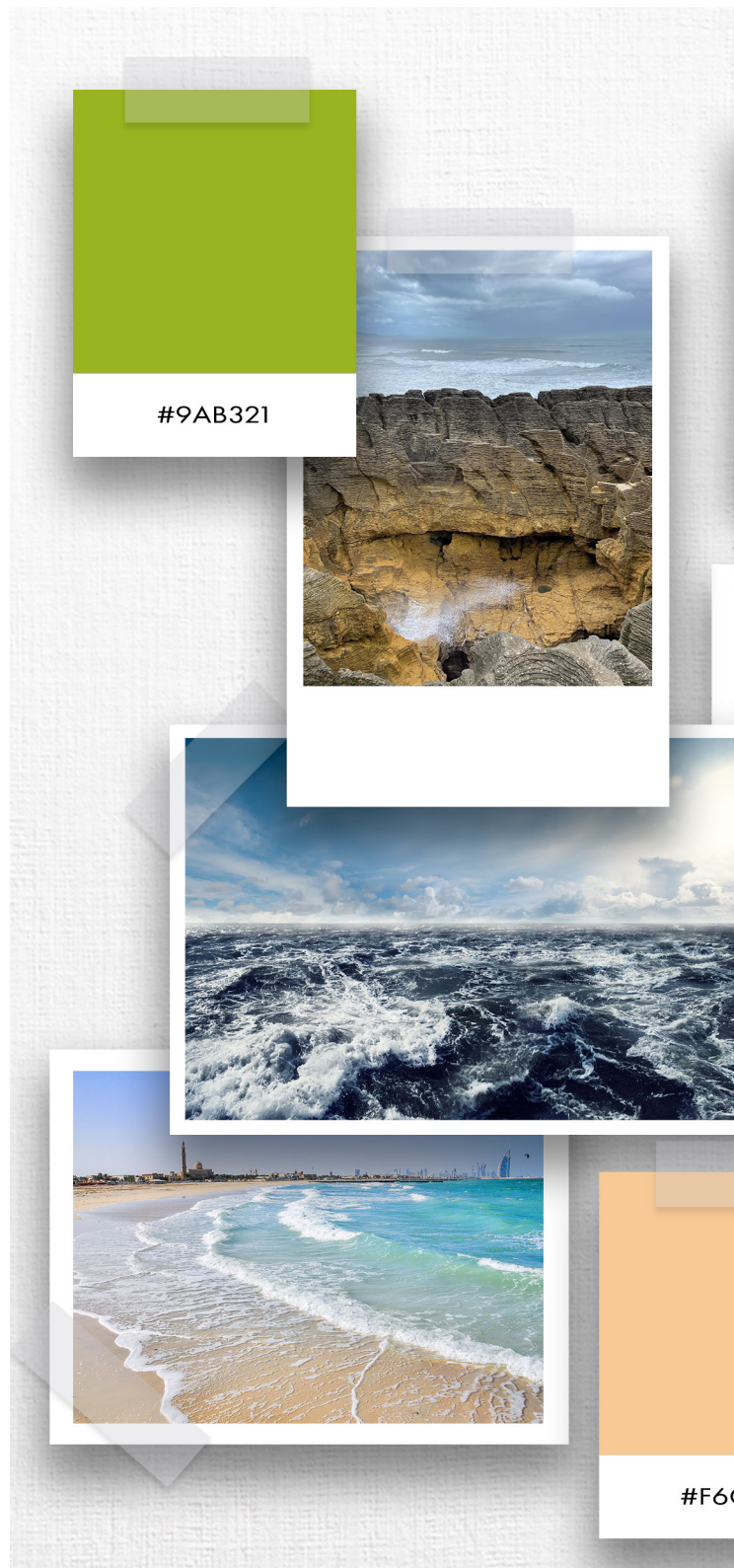
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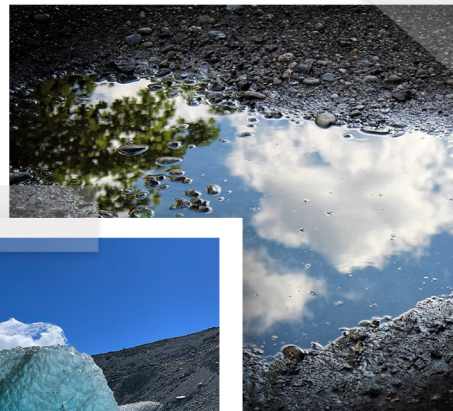
Figure 82. As I found myself designing shoes that looked better suited to adults footwear, I used this collection of images to help inspire me and remind me of who I am designing for. Children want to have fun with their toys and shoes.



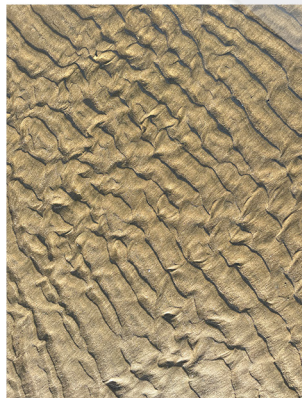
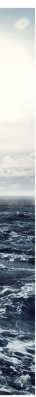


Figure 83. I put together a form mood board to inspire further ideation that centred around the key callout "nature". I felt these images reflected my own experiences in being connected with nature, I would use those personal experiences to help generate concepts.





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Moodboard Ideation:

The collection of the three mood boards helped provide me with inspiration for ideation. I used images of children playing outside, examples of contemporary children's footwear and toy design, and images of natural elements. I was particularly drawn to the natural element's mood board as an aid for ideation as I found the imagery to be an inspiration to create footwear sketches.

The focus of this exercise was to highlight natural elements whilst also designing shoes that were playful and childlike. I had been getting stuck on creating designs that mimicked an adult style. I needed to push myself to have a bit more fun with these shoes and think about what it was that a child would want to wear. At the end of the day, parents are buying the shoes, but children are the ones throwing them off when they don't like them. Children can also become engrossed with things they really love, which was something that I wanted for my design outcome.

I explored different forms, bulbous, wavy, organic, and looked at different ways the shoe sole could be designed while still meeting the functional requirements (durable, grippy, comfortable etc.). I was drawn toward the broken-up soles that didn't encompass all sides of the foot. I realised through this nature-based ideation that reimagining the visual and functional communication of the shoe soles could help me to push the boundaries of what is typically seen in traditional footwear design.

While my focus in this project was to communicate good foot health and connection with nature, it went a lot further than just communication. This product was also aiming to encourage parents and children to be a part of nature and do certain things in association with nature. This made me think about what a parent might want for the future of their child, what kind of interactions and relationships with the world and the environment, and whether this shoe aligns with that "want" for their child. I thought that this might be a beneficial line of enquiry when discussing prototypes with the participants in interviews.





Figure 84. Ideation based on the natural form mood board.



Figure 85. I continued iterating upon the top concepts of the previous round. Looking at how I could use natural and organic forms to communicate a connection with nature.

I continued iterating on the concepts that I felt were the strongest from the moodboard sketches. I focused on how the form could look smoother and more natural, and how I could still make the shoe childlike and playful.

One thought that I had during this round of iteration was how these shoes can be pulled on. I liked the idea of giving a child the independence to put on their shoes. The sock shoe would make it easier to put on themselves, as opposed to dealing with laces or Velcro buckles, however, I was concerned that the sock may be challenging to pull out, up and over the foot with the limited motor skills of children between the ages of 2-5 years. I looked at options of handles to help pull the shoe up but didn't land on any concept that I felt was cohesive with the shoe. I decided to side-line this idea for now and revisit it after I had a more set idea of the general shoe concept.

I played around with the style lines of the leather at the midfoot, looking at circles, angular lines, and more complex geometries, I settled on a triangular design that gave the appearance of a mountain range disappearing into shadows. This design followed the contours of the foot and would serve as a "wrap" for the side of the foot. This would give it more structure than just the sock alone, but not so much structure that the ability to move would be lost. The wrap on both sides of the foot would be joined at the top by two strips of elastic, allowing the foot to still slip in and out, but be snug around the foot once snapped closed.



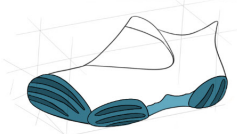
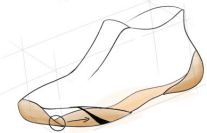
	Flexibility and movement	Connection with nature	Adventure	
	7/10	7/10	6/10	20
	5/10	3/10	3/10	11
	7/10	5/10	4/10	16
	5/10	4/10	4/10	13
	6/10	6/10	4/10	16
	7/10	6/10	5/10	18
	7/10	6/10	6/10	19
	8/10	8/10	7/10	23

Figure 86. Evaluation of the strongest concepts against the communicative criteria to see which to develop further.

I placed the top concepts into an evaluation matrices and rated each concept out of 10 against each of the criteria: Flexibility and movement; connection with nature; and adventure. By using this matrix, I was able to make a decision on project direction through a more objective lens. The bottom concept was the highest scoring against the criteria. I found that the concepts that scored lower had sharper lines that were less organic in style.

Latex Testing:

The previous sketch ideations were based on the use of latex to coat the areas of the sole that had been pinched in so that the shoe still protected the child's foot against sharp objects. Because of these ideations, I wanted to conduct a test to see how latex looked, felt and stuck to a knit surface and a leather surface. I found that the latex stuck very well to the knit material, as there was more texture on the surface to grip onto. It looked quite cheap and didn't actually do much to prevent sharp objects from piercing through the knit. The latex that was poured over the leather was unsuccessful as the leather was too smooth and non-porous that the latex just peeled off of the surface. I was hoping that I could use the latex to create the layered mountain appearance, but I decided to explore other methods of creating that texture.

After talking with a designer at Bobux about material properties, I decided that washable aniline leather would be most suitable for that area of the shoe rather than latex. The designer explained that across the cow, there are different thicknesses of leather. For the area that would bridge the gap between the soles to remain flexible, leather from the underbelly of the cow would need to be used, as that is very thin leather but still very durable.



Figure 87. Latex brushed onto knitted fabric and leather with a curved shape mimicking the sketches in figure 85. The latex looked tacky on the knit fabric but stuck well. The leather test did not work because the latex did not stick well to the leather.



04.14. Communication Framework

Functional and Emotional Design:

This research focused on communicating connection with nature and wove flexibility and play/adventure into that message. I wanted the outcome to reflect these things both functionally and emotionally, so I created a tool to map how I could break down each product development and assess it against criteria.

I considered how this framework might also be used by other designers to help change the way they think about the products that they are designing. The framework aimed to help heighten designs from a focus on primarily form and function, to incorporating emotive and/or holistic design into the process. The framework focused on challenging the designer to assess how a project's key considerations could also be considered at an emotional level (Naeini & Mostowfi, 2015). For example, at a functional level, flexibility could be considered as a shoe that a child can bend in half with their own hands and could twist and bend without breaking. At an emotional level, that flexibility provides a child with an ability to respond to the ground underfoot and build a tactile relationship that connects them with the earth.

This initial framework made sense for my project, but I felt that it was not yet meeting the need for guiding designers throughout their design process. My peers found it challenging to understand this diagram without it being explained to them, and even when it was explained, it was not clear as to how and where this would be applied to the design process of another project. As I continued developing concepts, I would test different variations of the framework to see what worked best for guiding my own personal process.

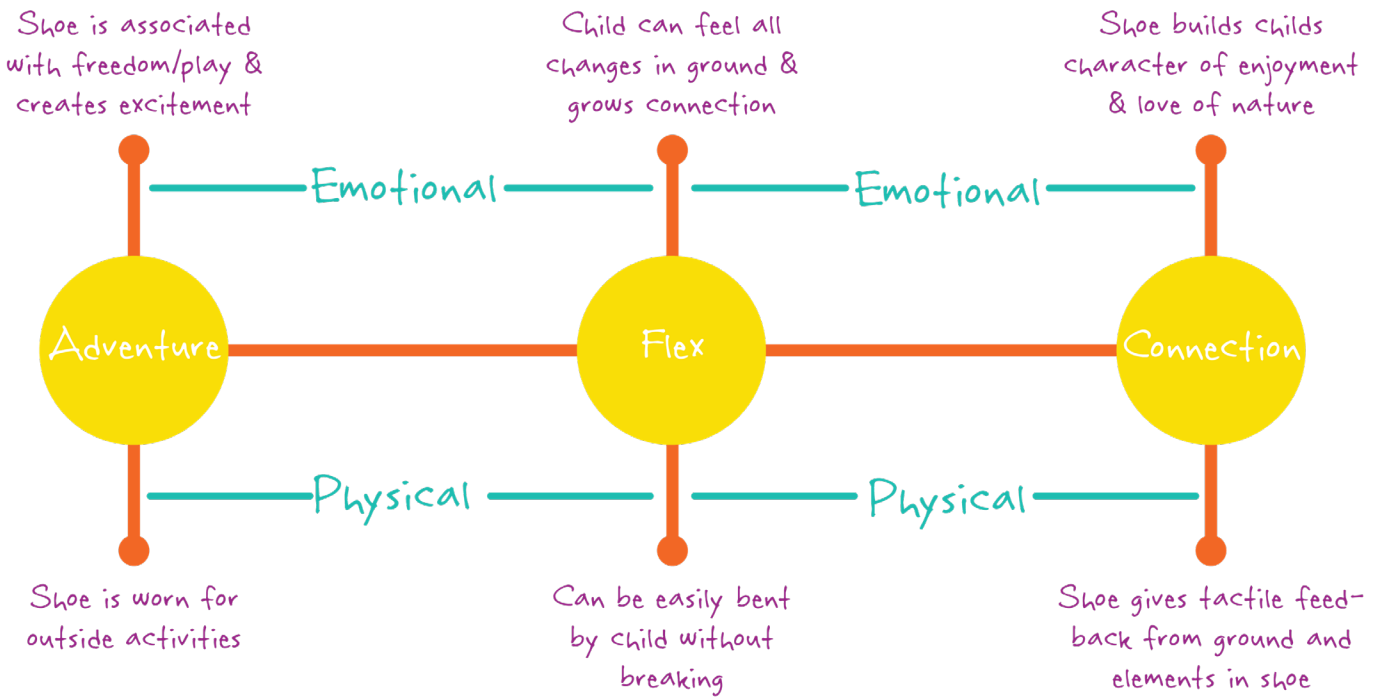


Figure 88. Initial designed framework for analysing whether the product design is communicating functional AND emotional elements.



04.15. Participant Interviews

Making the Participant Interview Prototypes:

My primary plan for the participant interviews was to produce one prototype that was one cohesive unit. In the lead up to the interviews, I was challenged with access to the workshop and had also contracted Covid. Because of this, I created 3 sectional models that highlighted different elements of the design. There were details from the sectional model that were missing so I also sent two pages of sketches to the participants to help fill in some information and tie the sectional models together better.



Figure 89. Shoe design was selected and slightly refined with a tread print, the prototypes for the participant interviews were based off of this sketch.

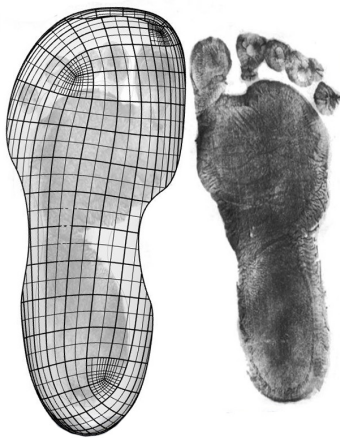


Figure 90. CAD development of the shoe sole for participant interviews on Rhino software. The Model was accurately designed around the Bobux childrens size 20 shoe sole shape. I built int a footprint indent based off of a 2 year olds footprint shape, and using the podiatric pressure mapping foot chart (see figure 58.).

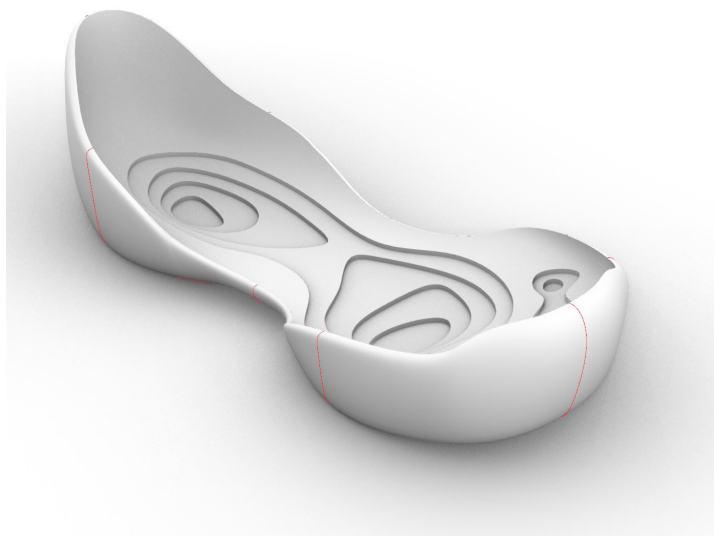
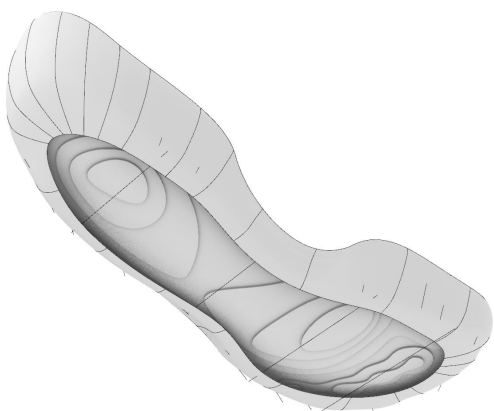




Figure 91. Four part mould of the shoe sole prototype produced for the participant interviews, the mould was used for casting polyurethane.

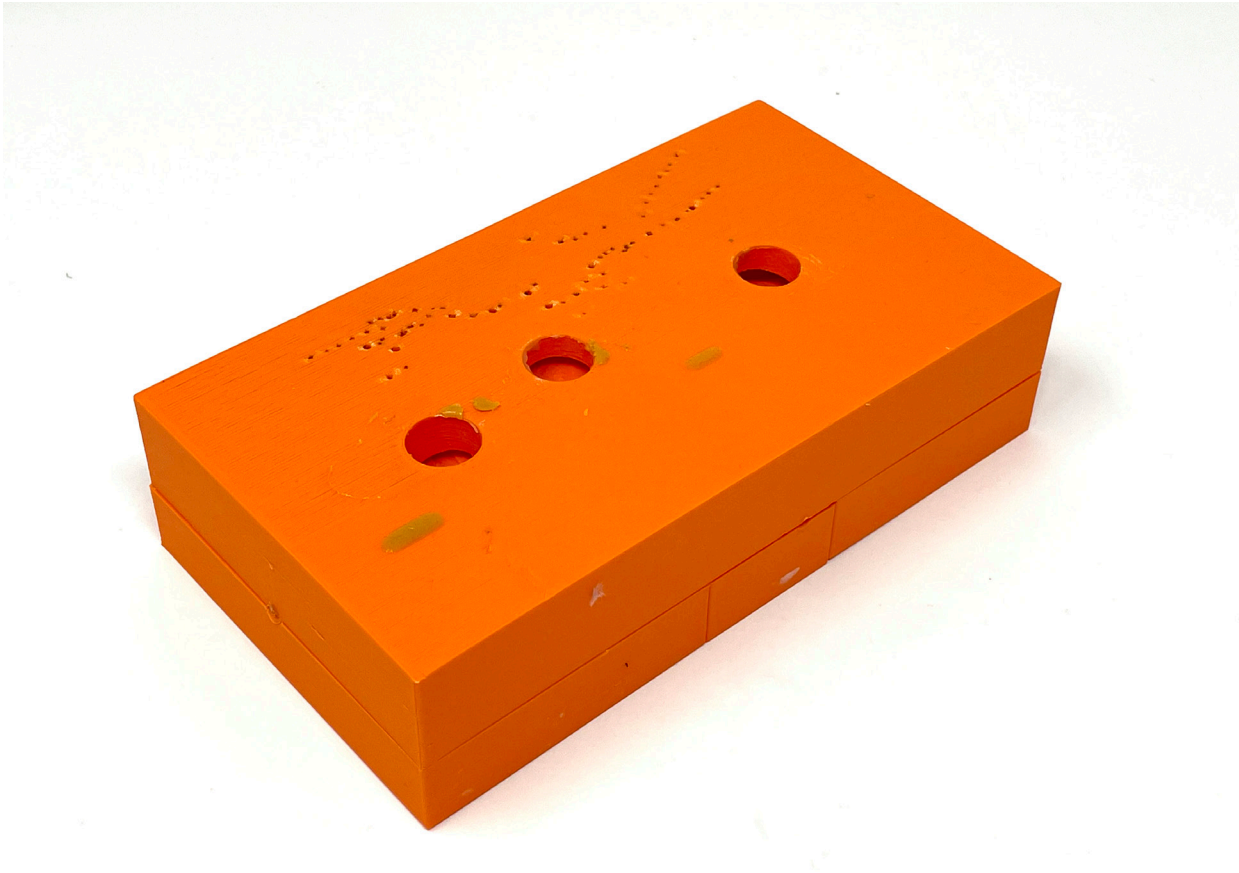




Figure 92. Early attempts at casting the shoe sole which broke apart or did not cure properly.



The Sectional Prototypes:

As I was producing concepts that were getting more refined, it was important to receive feedback to ensure that I was heading in the right direction. I posted to various Facebook groups advertising the study I was conducting and had five people respond to me. Of those people, two followed up after the information sheet was sent out.

I had hoped to recruit at least 5 people to take part in these interviews but there were challenges with Covid and the red light setting that New Zealand was under for an extended period. This meant that I could not recruit parents from daycares and kindergartens as I had originally planned. I recruited through an online platform, of which only a small number may have been my target participants (parents with children ages 1-4).



Figure 93. Contents of the parcel sent to each participant, with the blanket and a \$20 petrol voucher as Koha for their time.



Figure 94. Sectional model of the shoe upper for the participant interviews.

The first sectional model that was part of the parcel sent to participants was the shoe upper. This model demonstrated the use of a fly knit construction, allowing for a tight fit around the foot. The leather component showed how it would be connected to the sole but peeled away from the sock at the top to make it easier for the foot to get in and out of the shoe. The elastic across the top was used to show an easier system of use compared to buckles or laces.

This model would have had a sole attached but the upper knit prototype turned out slightly too small to fit into the sole, so they had to be two different models.

The shoe upper prototype was accompanied by a multi-view sketch that showed the complete design. It created a layered appearance that mimicked a mountain range. There were multiple possibilities of how this could be done. The leather could be layered up to create the depth effect, but this presented the challenge of how layering could be done in a way that didn't decrease the flexibility of the shoe. Another option was to use textures that were pressed onto the hide, still creating the mountain range, but on one sheet of leather instead.



Figure 95. Drawing of the details of the shoe upper that were not included in the sectional model due to time restraints.

The second sectional model was an unattached shoe sole that demonstrated the overall form, including the underside and the inside (which would normally be hidden from the consumer).

The model featured a narrow mid sole, which aided in the flexibility of the shoe, as it was not reinforced through the sides. The midpoint of the sole also used thinner polyurethane to allow more movement and flexibility. The back of the shoe cups up around the heel to provide the back with structure and durability, preventing the heel from slipping to the side of the shoe due to the knitted upper structure. The inside of the sole has a footprint indentation across the surface, meaning the sole is thinner at the points that put the most pressure on the ground. This allows for greater input of tactile feedback from the ground – to the shoe – to the foot. There was a corresponding sketch (figure 98.) that showed greater detail of the tread pattern and included an indented line around the bend point at the ball of the feet to aid in flexibility and movement of the sole.

This prototype was made up of Polyurethane rubber, which is what a shoe sole is typically made from. The shore hardness (density of the material) of this model was 50. Bobux shoe soles have an average shore hardness between 50 and 60.



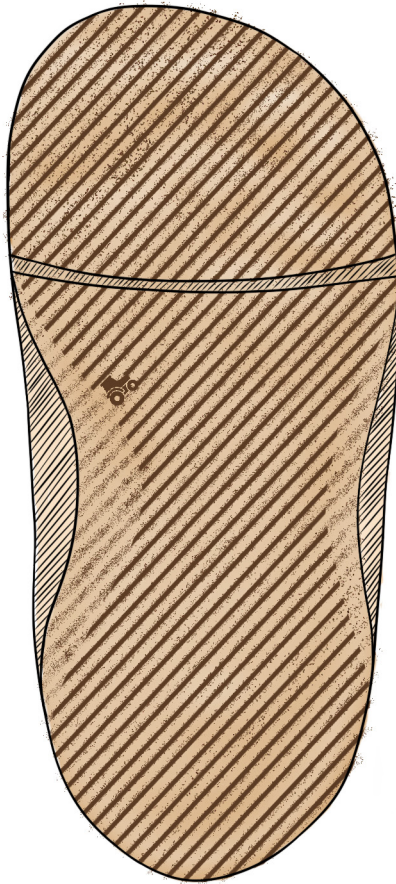
Figure 96. Polyurethane rubber moulded shoe sole sectional model, unattached from the shoe upper because of the time constraints in getting the upper to fit the sole.

The final sectional prototype was the shoe sole glued onto an existing Bobux style upper. The upper was used because the shoe sole was moulded around the same last as this Bobux shoe. The prototype was used to demonstrate to the participants how the shoe sole would appear on the bottom of the shoe once adhered.

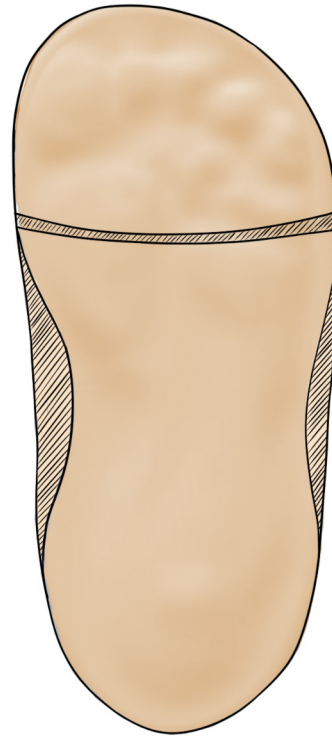


Figure 97. Polyurethane rubber sole glued onto an existing Bobux shoe upper to demonstrate how it would look when attached. The participant was asked to imagine that the knitted upper would in theory be attached instead of the Bobux white leather shoe.

Tread print



Texture underneath tread



Tread side view

Figure 98. Drawing of the shoe sole tread that were not included in the sole sectional model due to time restraints.

Alongside the shoe sole prototypes, I gave the participants a sketch image of the shoe tread and the surface that lay underneath the tread as this was not included in the physical model.

The tread pattern was made up of diagonal lines that represented rows of harvest on a farm. There was also a tractor that aided the consumer in understanding the meaning of the rows.

I had been hesitant to use icons throughout the project as a way of communicating to consumers, but acknowledging that this is a children's shoe, it is allowed to be fun and playful. I felt that the tractor did exactly that, it brought in a fun element that also aided in the communication of nature. I realised that it did not have to be explicit iconography to still provide information to the consumer.

The tread wrapped around the side of the shoe to encourage parents to turn the shoe over to see what was happening on the bottom of the sole.

A layer below the tread was a subtle contour of a footprint that would be almost hidden by the details in the tread but would appear to the consumer by running their hand over the sole or seeing the prints that a child would make when running across sand or water marks after splashing in a puddle of water.

The inner sent to the participants was the same green wool construction as had been developed in the insole development section, however, this time it had been felted onto a thicker woven fabric (crochet fabric) which gave it a sturdier feel and made it significantly less stretchy than previous wool tests.



Figure 99. Felted wool sectional prototype sole inner with non-stretch base.



Figure 100. Rough casts that were sent to participants.





Figure 101. Shoe sole glued onto existing Bobux shoe upper.





Figure 102. Upper prototype for participant interviews.



Participant Interview Reflection:

The participant interviews occurred in the final stages of the research. The participant sessions had been planned to occur during an earlier stage of the research, but because of limitations with Covid, such as recruitment challenges and delays in the project, the participant interviews were delayed. As a result of the delay, the interview sessions focused on a more refined design that was relatively close to what the final output would be. The participants gave feedback on potential usability issues that they identified and also helped me to understand how successful the visual communication of product intention was through the responses of the participants

I asked both participants to use three words to describe the prototypes, based on their first impression. The words they used were comfy; stylish; easy to put on; breathable; ergonomic; trendy. After getting them to explain why they used those words, I noticed that despite all the models, they mainly focused on the upper of the shoe. I assumed that this focus was because you typically only look at the top half of a shoe. A lot of shoes don't draw attention to the sole. One word that was particularly interesting was "ergonomic". Without any explanation of the purpose of the shoe, or any bias from the questions asked, one of the participant's first impression was that the shoe was designed to work in unison with the foot, she explained that the shoe looked like it would "move with" the foot.

The other participants stated that her child is very involved in playing outdoors and he spends a lot of time kicking footballs around because his dad is a footballer. Because of that, she doesn't own a single pair of children's sandals as they don't make sense for him and his outdoor lifestyle.

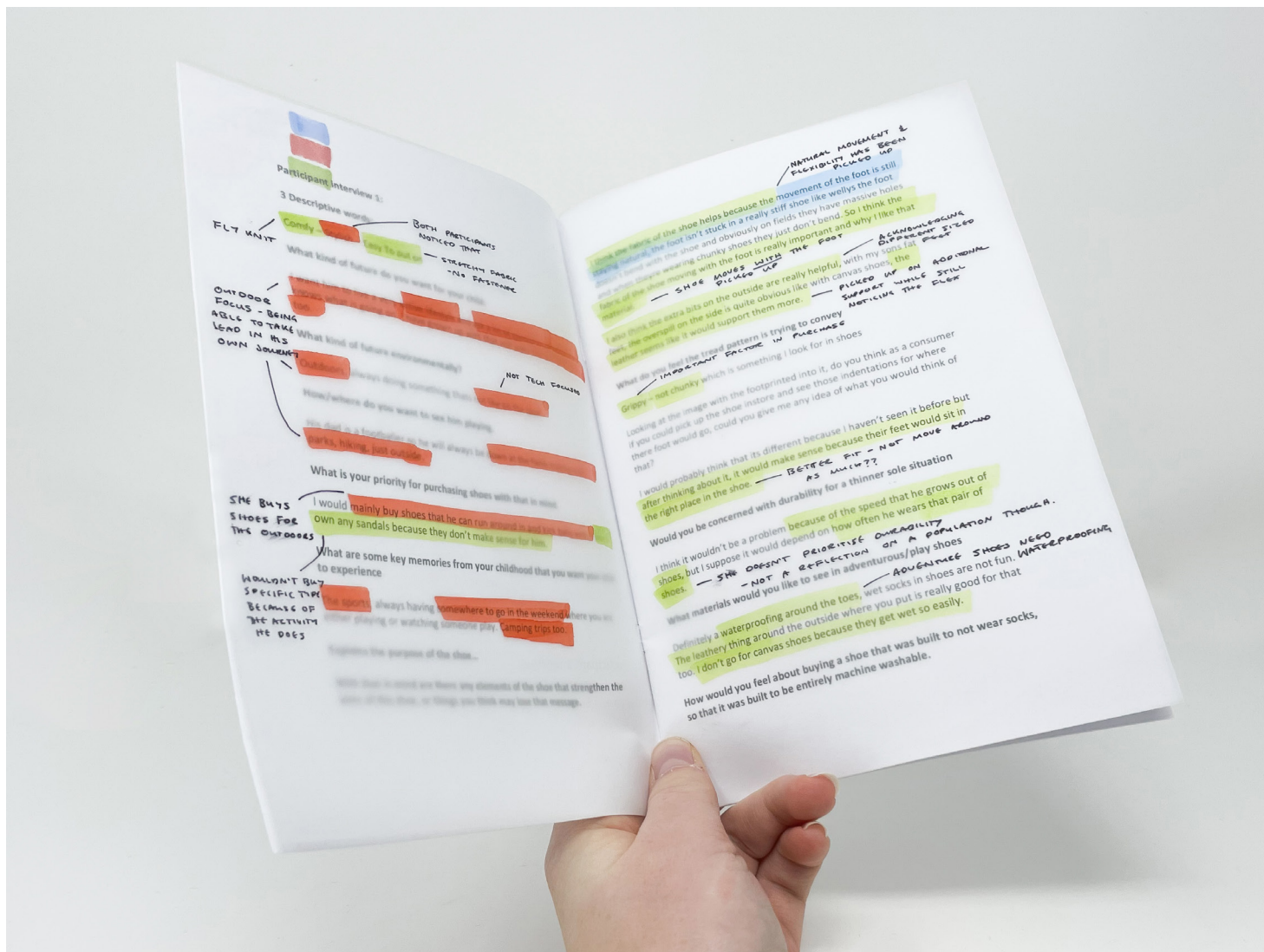


Figure 103. Thematic Analysis from the participant interviews.

Both participants picked up on the flexibility and natural movement elements of the sectional prototypes which was an aim of the interview session.

Participant A stated that “the movement of the foot is still staying natural, the foot isn’t stuck in a really stiff shoe.” Participant B stated that “the shoe seemed flexible so that the whole shoe can move with it, when the upper half is on the sole, it feels like there is heaps of bending.”

Participant B drew similarities in the style to wet shoes (beach shoes), which use a neoprene fabric. This was an interesting comment because I had used the Bobux Summit shoe style as a source of inspiration to redesign a more aesthetic outdoor shoe. And the participants had both commented on the shoes appearing “trendy” or “stylish”.

There were positive responses about the tractor on the bottom of the shoe tread, the participants both said that it was a cute feature of the shoe and made it look like a “little farm”, one participant said that without that tractor she would have no idea that it was a farm. This insight helped me to realise that using a simple icon can do a lot to help consumer understanding. I had hesitation in incorporating icons into the design, as I did not want to overwhelm the shoe with very literal design cues. However, this tractor made me realise that certain icons can be incorporated into the design in a way that is playful, fun and child-friendly, while still helping communicate certain elements to the consumer.

The ability to wash the shoes was a high priority for both participants. They highlighted the fact that if they are outdoor/adventure shoes, they will probably be getting muddy and dirty so they will need to be washable. Handwashing was a big no because of the extra time it takes. Because of the amount of washing that comes with having children, it would be much easier to chuck shoes in the washing machine. This insight determined the material choices for the final design. As an example, a higher quality washable aniline cow leather was used.

Participants were also wary of designing shoes that don't need socks. Hygiene was a major concern, but the warmth of the children's feet was a major concern. The socks also helped to slip the shoe onto the foot, especially for kids with chunkier feet.

One of the participants made a comment about how the wool feels quite fluffy and thick now but it looked like it would probably wear down quickly, she was concerned about how long the insole would last. Both participants liked that it looked warmer on the inside because they didn't like the idea of their children having cold feet, especially in a shoe where they are outdoors, jumping in puddles and getting wet.

Participant A highlighted how her child (and countless others) may have "chunky" feet, that have a lot of fat on them. Because of this, their feet can spill over the side of shoes that don't have enough structure in them. That is why a standard fly knit construction would have been concerning for the participant. Because of the leather that wrapped up around the side of the shoe upper, the participant felt that this was a really good solution that didn't restrict the shoe too much, and still allowed for plenty of movement with the fly knit, but still provided enough structure for the foot to stay contained inside of.

Communication Framework Application:

The questions that I asked the participants in the interview sessions aimed to understand where the shoes sat on the framework that I had developed. As an outcome of these interviews, I plotted where I felt the shoes sat on the vertical scale for each of the callouts.

The participants very quickly identified the shoe as an outdoors shoe, and a shoe they would have their kids wear for various nature-play activities. There was excitement about the shoe because of it being very different from what they had seen before and were excited to see how that might make it a better outdoors shoe. However, the participants didn't quite connect with how this outdoors shoe gives the child the freedom to adventure. I found that the "flexibility" callout communicated the physical and emotional elements best. They made comments about how the shoe seemed flexible and that the footprint imprint made the shoe seem like an extension of the foot. They also picked up on the physical properties of the "connection with nature" callout, noticing how the footprint in the sole seemed like it would pick up the feeling of the ground underneath the shoe. The shoe needed to focus on ways that the connection with nature scale can be raised to meet the emotional requirements.

I found the framework clarified where the design was sitting in communicating the key call outs. I wanted the next iteration of the framework to achieve a similar method of analysis but focus on different stages of the process. Explaining how the design can be analysed by the designer alone, peers, experts and participants.

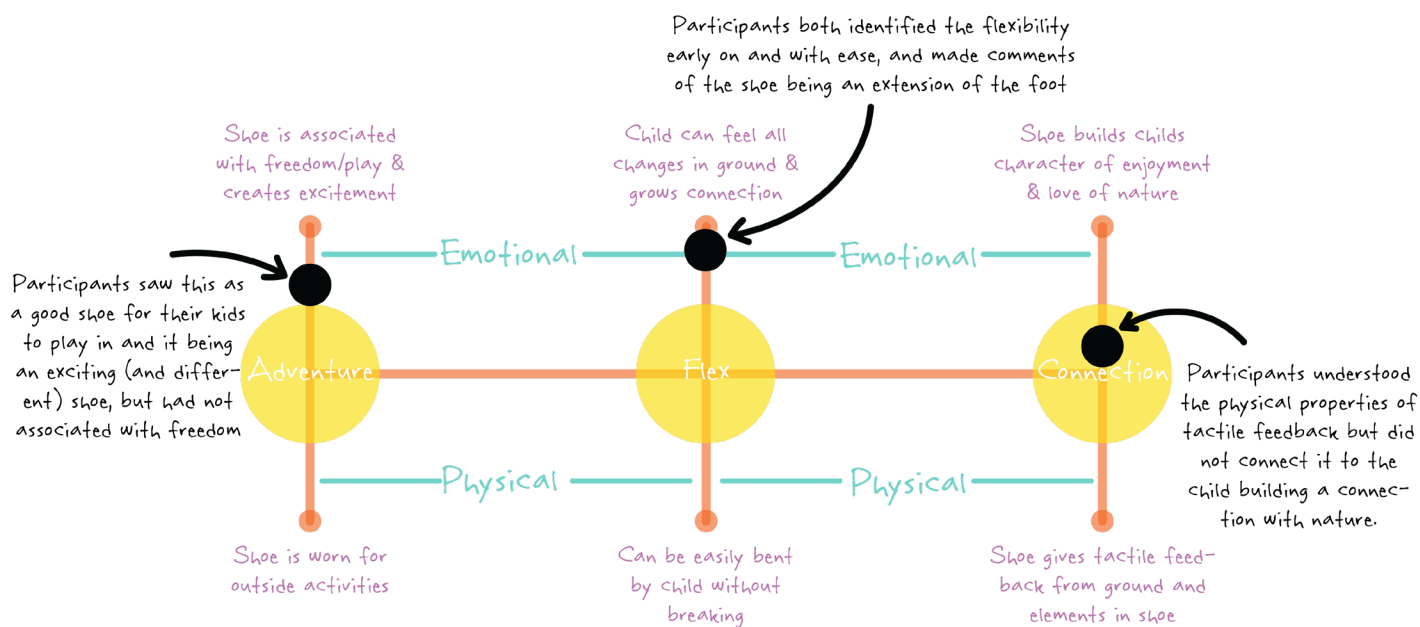


Figure 104. Communication Framework tested from participant interview results and findings.

After discussing the framework with peers, I realised that while the framework made sense to me, the way it was visually laid out may have indicated that you can either design at an emotional level, or at a physical level, not both. I wanted to communicate that in order to reach an emotional level of design, you first need to ensure you are communicating the function of the design. I also wanted the framework to be easy to use at many stages of the process (ideation, prototyping, analysing feedback from stakeholders, users etc.), whereas the current framework seemed better suited to the analysis of feedback from others, rather than the designer's personal analysis of the design.

From this point, I wanted to test different ways of laying out the framework to help it integrate into the design process more effectively, as well as help it to appear less linear (more circular).



04.16. Refining the Design

Consulting with Bobux:

Following the participant interviews, I consulted with staff at Bobux discussing possibilities for the design and to discuss its validity for manufacturing.

There were concerns that the extreme rounded shape of the sole would potentially be dangerous for children, because of their limited motor skills, it may make them unbalanced, which is something that Bobux has found in feedback from participants from previous shoe designs. The point that pinched in at the middle of the sole would naturally cause issues with stability because part of the sole is missing, however that can be counteracted by having sharper edges on areas of the sole that go all the way to the edge of the foot.

When discussing the design style of the mountain ranges pressed into the leather on the sides of the shoe, an idea was sparked about using the sole and the mountain layers, plus an additional material on the toe cap and the heel, to build up a strong side profile that gave the shoe depth (like a mountain range). I decided to play around with the idea through sketching and prototyping to see if it would add to the nature-centred design style.

I thought that the leather wrapping around the underside of the shoe would cause a bumpy edge that might be uncomfortable to stand on. When discussing how this could be managed in manufacture, it was explained to me that the leather can be skived (stripped down very thin) in certain areas and then a sewing machine can stitch it so that it sits almost completely flat on the underside so it wouldn't be felt by the child wearing the shoe.

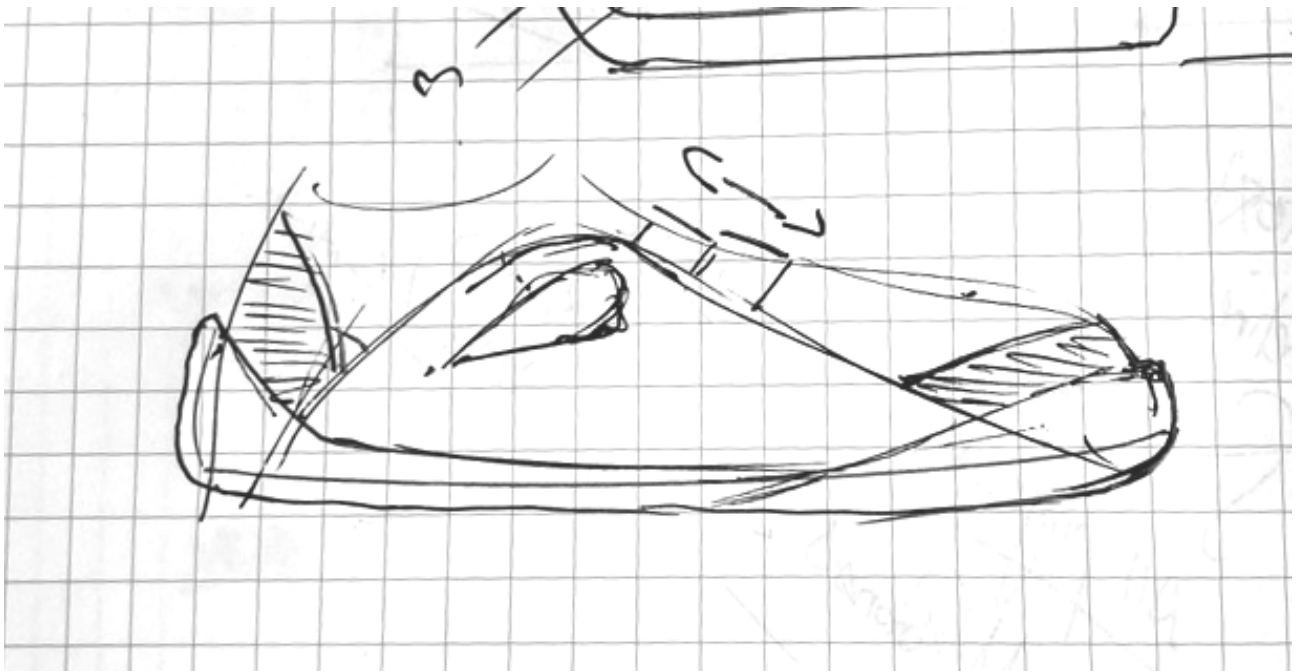


Figure 105. Sketch of how layers could be used to give depth to the side profile like a mountain range.

I needed to increase the height of the sole front to increase the waterproofing of the shoe and the durability as kids scuff their feet and toes quite a bit.

I had concerns around the tread print having a commercial agriculture focus by incorporating the tractor as I was trying to communicate connection with nature, with notions towards sustainability. Given that mass scale farming is quite resource intensive and unsustainable, this left me with hesitations towards this tread concept. However, everyone's experiences around farming are different, and to a child or even a parent, they may associate the tread print with playing in grass and running around with the sheep at a friend's house. I still wanted to develop this tread print as I thought it was a strong and playful concept based on the responses from the participants, but I wanted to develop it alongside two other tread styles as options for the Bobux tread print, or could all be used as tread prints.

I found that the elastic straps did not cater for children with really small or large feet because they were not adjustable at all. I wanted to develop a better elastic system that would allow it to be tightened and loosened as per the user, as well as to counter the elastic wearing out to give the shoe a longer lifespan. It would also be useful for the elastic to be removable so that it could be swapped out if it wore out, as that was the most likely shoe component to wear out first.

Following the meeting with Sam, I created a material prototype with a toe cap that utilised Bobux's dotted ceramic fabric (see image on right). This fabric is a soft and flexible fabric that has ceramic dots embedded onto the surface which would provide the toe area with additional strength and durability from scuffing. I looked at how the "mountain valley" side profile could be built up through other materials accenting the leather. I felt that this combination of materials resulted in too much visual distraction that took away from the leather, which was the focal point of the shoe. I also felt that the ceramic material intruded too high up onto the shoe at the toe area, and did not need to be placed at the heel end of the shoe.



Figure 106. Prototype upper with ceramic dot material on heel and toe cap.

Insole Digital Print Development:

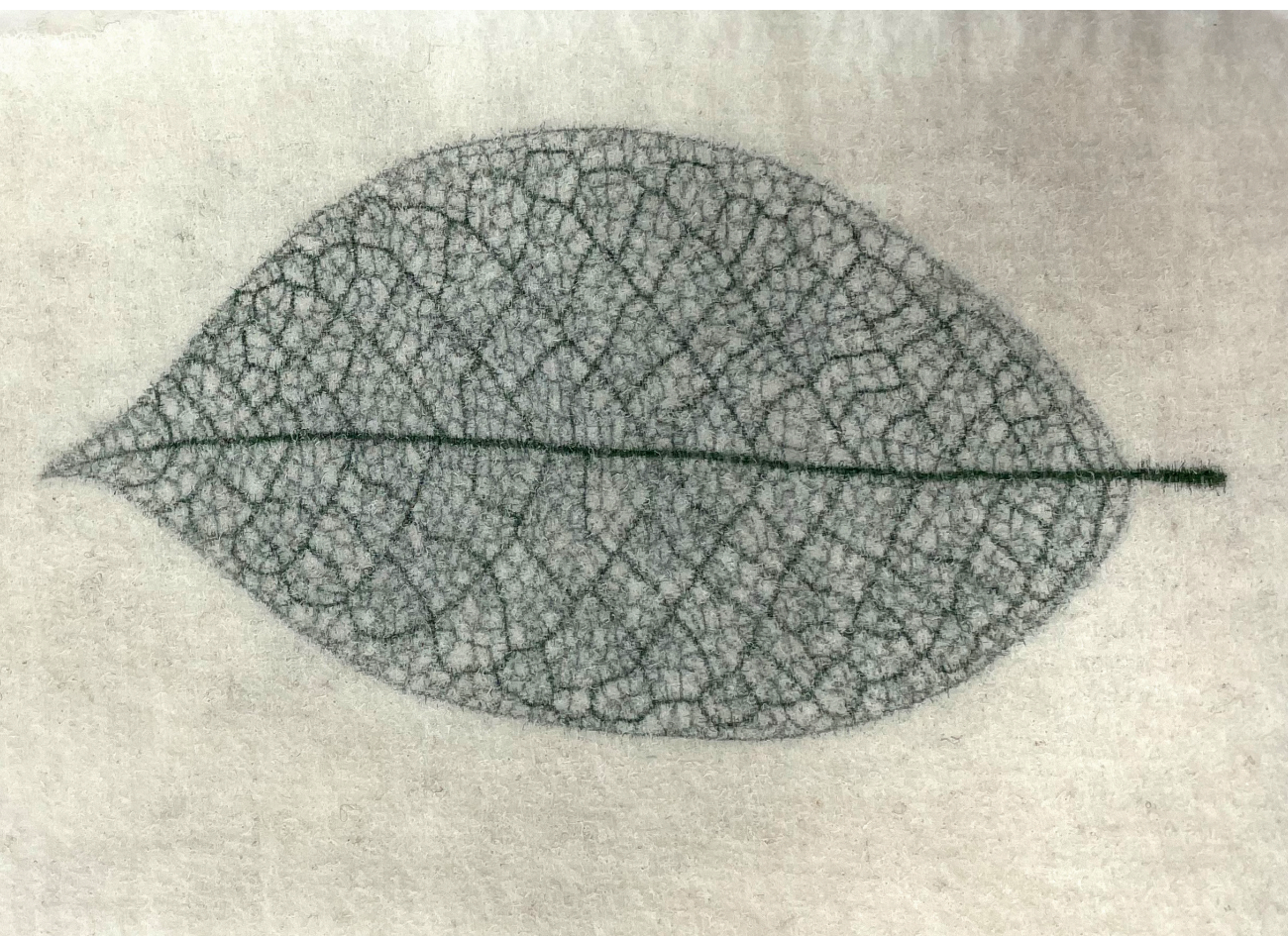
I conducted felting tests on various silk fabric digital prints. I used these prints to observe how the print patterns held up under the felting process. I was also testing different thicknesses of felt, and different methods of processing it through the felting loom.

The first test was with the moss looking print. I used two layers of the merino vat and did not back it with any material to make the sole more rigid. I found that this test felt quite flimsy, and the sole did not feel like it would be durable enough for an insole. The dark print also became hard to recognize as moss.

The second test was of the beehive print. I found this print to be the most successful in retaining the print pattern through the felting process, as the honeycomb structure was still very visible. The high contrast in the colours of the print was what helped it to stop the details of the print from 'bleeding' together. This test was only done with one layer of merino which was also too flimsy, adding a more rigid backing material to reinforce the insole would likely help this. The wool passed through the felting loom over 20 times to pull the wool through to the print side, which softened the silk without making it feel too similar to an ugg boot.

Figure 107. Moss (Top) and beehive (bottom) design felted digital print.





Following the beehive test, I used the dirt print to see whether the prints would show through if I halved one layer of the loose merino vat and put one half on either side of the silk, then ran it through the felting loom. I found this experiment covered up almost all the detail in the digital print.

Another digital print test was of a leaf skeleton. The high contrast of the green and the white meant that the pattern retained its detail but I felt that it didn't match the style of the exterior of the shoe.

Figure 107. Dirt (Top) and leaf skeleton (bottom) design felted digital print.



For the sand and the grass digital prints, I backed them with a crochet material, which was a loosely woven fabric that was quite rigid but still had gaps to help the wool push through the gaps and attach to the material. The sand print used only one layer of wool, whereas the grass used two layers, and the difference between the layer thicknesses was almost unnoticeable. Because of this, I decided that the final shoe insole should be two layers thick to help make the insole more durable.

I found the darker prints lost a lot of the detail as the needles passed over them, but the lighter/higher contrast prints held up well through the process. I found that more passes through the felting machine resulted in a softer finish on the top which was desirable for a shoe insole. After looking at different options for a natural insole, I felt that the grass pattern was still the strongest concept as it felt the most connected with the mountain style exterior design. The grass insole could become the 'detail' that you would see when looking at mountains closer, in the same way, the grass insole is what you would see if the consumer looked at the shoe closer. I wanted to test using higher contrast digital printing of grass texture, and also having less detailed grass and then running the prints through the felting loom to see if it then showed the detail of grass better.

Figure 108. Sand (Top) and Grass (Bottom) design felted digital print.

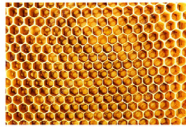
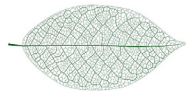
	Flexibility and movement	Connection with nature	Adventure	Comfort for the foot	Flow with outer design	
	8/10	9/10	9/10	8/10	9/10	43
	9/10	9/10	10/10	8/10	9/10	45
	9/10	9/10	10/10	8/10	9/10	45
	7/10	8/10	8/10	10/10	8/10	41
	4/10	7/10	7/10	5/10	4/10	27
	4/10	8/10	7/10	5/10	6/10	30

Figure 109. Evaluation matrices ranking digital insole prints to see what the most viable concept is.

After evaluating the options for the insole pattern print, I felt that the grass pattern was the strongest concept as it met the needs design criteria needs the best and I felt that it was visually the most connected with the mountain style exterior shoe design. The grass insole could become the 'detail' that you would see when looking at mountains closer, in the same way, the grass insole is what you would see if the consumer looked at the shoe closer. I wanted to test using higher contrast digital printing of grass texture, and also having less detailed grass and then running the prints through the felting loom to see if it then showed the detail of grass better.

Open-cell Foam “Footbed” Development:

I wanted to show the parent that the rubber shoe sole was formed to the foot's shape, and to do that I needed the material that joined the upper to the sole (the footbed) to follow the same form as the rubber sole. The idea behind having the footbed moulded to the sole footprint shape was that the wool insole would not be able to retain the footprint shape, and given that the insole is removable, the footbed may be visible if the parent took the insole out for washing. Bobux had been using a flat and rigid 1.5mm cotton material for the construction of their shoes, but this was not a mouldable material.

I found an open-cell foam similar to what Bobux had glued to the leather insoles (figure 61.). The open-cell properties of this foam help increase the shoes breathability, sweat-wicking and temperate regulation and is washable (Ortholite, 2019). I then 3D printed an inverse mould of the shoe sole footprint. I used the vacuum former in the AUT workshop to form the open-cell foam around the mould which then produced the shoe footbed. This prototype mimicked the shoe sole exactly, so it pinched in at the “waist” of the sole. However, for the upper to stitch onto the footbed, the footbed would need to mimic the bottom edge of the shoe last.



Figure 110. 3D printed vacuum forming mould (Top) and open-cell foam vaccum form shoe footbed (Bottom).





I edited the mould so that it would not be pinched in at the “waist”. I then conducted a wide variety of tests of vacuum forming the foam to see how the different methods of manufacturing could change the outcome. I tested having both sides of the foam face down in the vacuum former, as one side was glossier and one side matted. I also produced another mould which was the inverted version of what I had been testing on, which produced a softer appearance to the footbed, as it did not pick up the sharp edges and minor details of the mould.

I then glued a grey cotton material over the top of half of the footbeds to see whether the imprints were still visible and to get feedback from my peers about their preferences for a plain foam footbed or a material covered footbed.

Figure 111. Two 3D printed vacuum forming moulds, concaved and convexed to produce different appearances (harsh vs soft).

I asked my peers to choose their preferences of the eight prototype variations. The four grey material prototypes were quickly disregarded because of the material wastage and they couldn't easily see the footprint shaping. The softer edged foam models were also disregarded because it did not look as intentional. However, I needed to consider whether the parent might see the softer edges as more comfortable for their child to be walking on. Between the glossy and matted foam with the detailed pattern, the feedback was that the gloss looked more finished and intentional, especially with how it captured the contour lines of the print.

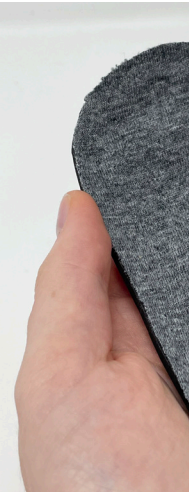




Figure 112. Eight variations of manufacturing techniques for the open-cell foam prototypes, half of the prototypes with cotton glued on, and the other half as only the foam.

I used one of the foam prototypes to test how it functioned as a footbed that the upper was stitched onto. I found that the foam held the form of the upper very well as the foam did not have stretch which provided the upper with more structure than a loosely woven material.

Figure 113. Shoe footbed stitched onto upper and leather flaps.



Sole Form Development:

Following the participant interviews and developing a polyurethane mould, I realised that the sole needed to be much thicker around the toe and heel edges, as it was too flimsy. Bobux had also suggested that the edges could be less rounded to provide greater lateral stability. I produced multiple iterations of CAD models and 3D printed them in PLA (non-flexible) plastic to gain an understanding of the form through a physical model.

The first two 3D print prototypes looked quite bulky around the entire upper edge of the sole and by making the sole less rounded, it made the sole look heavy and a lot less flexible. The following 3D print was thinner around the top edge but still had a lot of bulk through its profile. This model included the 'flexibility' contour around the toe area to help that area of the foot bend inside of the shoe.

Figure 114. (Top) Iteration testing lateral stability with a sharp angle between the ground and the vertical sole wall. (Middle) Iteration with the heel angle slightly more rounded out to make the sole appear less bulky. (Bottom) Perspective angle shows the thick upper edges creating the visual effect of a bulky shoe sole.

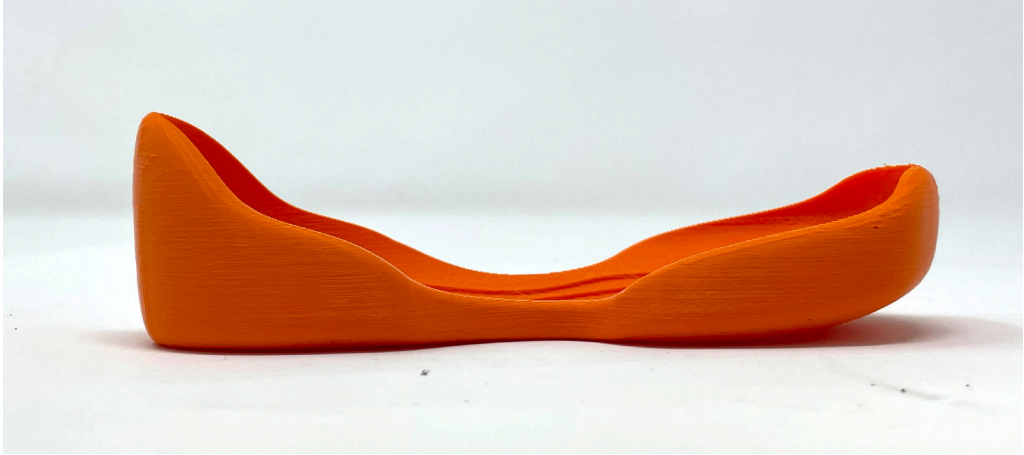




Figure 115. Iteration shows a lighter (less bulky) looking form, with thinner upper edges and a contour line through the toe box on the underside.



Based on this iteration, I produced a five-part mould that I used for a polyurethane experiment. This mould only had one pour hole that was quite small and needed to be syringed in. Because of this, it took too much time to pour and the mixture became too cured to continue pouring, resulting in a partial mould. Although this prototype was not fully moulded, it still showed me the cross-section of the shoe sole that I had designed and I realised that it was too thick (around 5-6mm at certain points) and was quite challenging to flex. The following iteration would have to be much thinner (3mm maximum at any point).

I found that the polyurethane moulds were producing bubbles and the edges of the mould were inconsistent. I decided following the production of this prototype that I would not continue to test using polyurethane moulding as the process would be quite resource intensive to produce manufacture quality prototypes, and better results could be produced from SLA printing to get a gauge on the form and then outsourcing printing to a company that produces high-quality TPU (flexible) 3D prints.

Figure 116. Five part mould for polyurethane casting.





Figure 117. Polyurethane partial mould, showing the contour line on the underside and the thickness of the model which needed to be reduced.





I 3D printed a shoe last and used it to draw a side profile of the shoe sole and the material to see how they could be placed on the shoe in a way that looked balanced. I found that by drawing with the vivid on the shoe last, it was easier to create balanced contour lines, which was challenging to do in drawings or in the CAD software.

Figure 118. 3D printed shoe last with vivid markings indicating possible new contour lines for the shoe sole.

Following the prototype iterations of the sole shape, I decided that the contours of the shoe sole upper edge should be smoothed out to match the leather piece. The sole was still looking very bulky and so I decided to integrate a contour line through the sole to create the visual effect of a thinner sole. I also reduced the depth and amount of contours of the footprint imbedded into the sole, from four millimeters to two millimeters at its deepest point. This meant that the child's foot would be less likely to feel the contour underfoot.

Figure 119. CAD sole development and 3D prints.





Figure 120. Final CAD form with contour through the sole base for flexibility.





Figure 121. 3D printed shoe sole in solid PLA plastic to ensure the look at the form along with the shoe last.





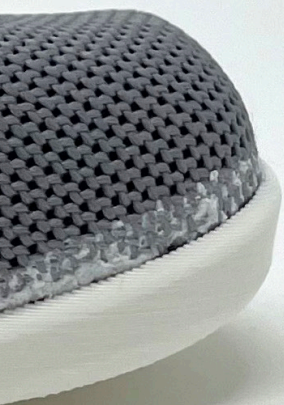


Figure 122. Testing the shoe sole form along with a fly knit upper (upper is sitting higher than it would as there is excess material between the sole and last).

For the final prototype, I produced a 3D printed TPU (flexible) shoe sole. This helped me to see the shoe sole as a fully realised concept and understand how it would flex and respond to a child's foot. The slit through the toe area on the bottom of the sole gave the front of the foot additional flexibility. On the top side of the sole, the debossed footprint did not feel harsh or sharp under the pressure of my hand, the contour lines felt subtle but still noticeable, and with the open-cell foam on top, there would likely not be any discomfort to the user.

Figure 123. TPU (flexible) 3D printed shoe sole.





Figure 124. TPU (flexible) 3D printed shoe sole.



Leather Toe Cap:

As the most recent iteration of the shoe sole did not come up around the toe as much so the shoe appeared lighter and more flexible, I decided to integrate a toe cap into the profile of the shoe upper. This would protect the toe and also prevent the shoe from wearing out as fast. The toe cap would be a suede leather material, placed behind the leather side flap, adding to the depth of the mountain valley side profile.

Figure 125. Suede leather being wet moulded and stretched around the shoe last.



Tread Print Development:

The previous iteration of tread print focused on a tractor ploughing rows of harvest. After concerns regarding the sustainable aspects of farming, I decided to produce two additional alternatives that could be used as suggestions for Bobux alongside refinement of the farming tread print.

I looked at how I could adapt the farming tread print to be less linear and curve around the contours of the footprint. I also wanted to add other icons related to farming alongside the tractor, such as a farm worker in the rows, sheep, cows, and possibly children playing.

I wanted to create a unique tread to New Zealand, nodding to Bobux's origin. I looked at mimicking the Southern Alps of the South Island, but I felt that it was quite busy and not playful enough for a children's shoe. I looked at ways to design it to be more minimal while still holding on to our New Zealand geography. I decided on a tread print highlighting the ridge line of our most famous mountains, from the top of the country to the bottom, with labels for each mountain so that it could be identified.

The final tread design focused on telling a story of camping, tramping and playing in the outdoors. The tread had walking trails that followed the contours of the foot, a campsite was integrated into the tread with tents and a campfire. Small icons of people walking the trails, as well as sheep and cows, were scattered around the tread print to bring in an element of fun for children, as though it could be a game of "eye spy".

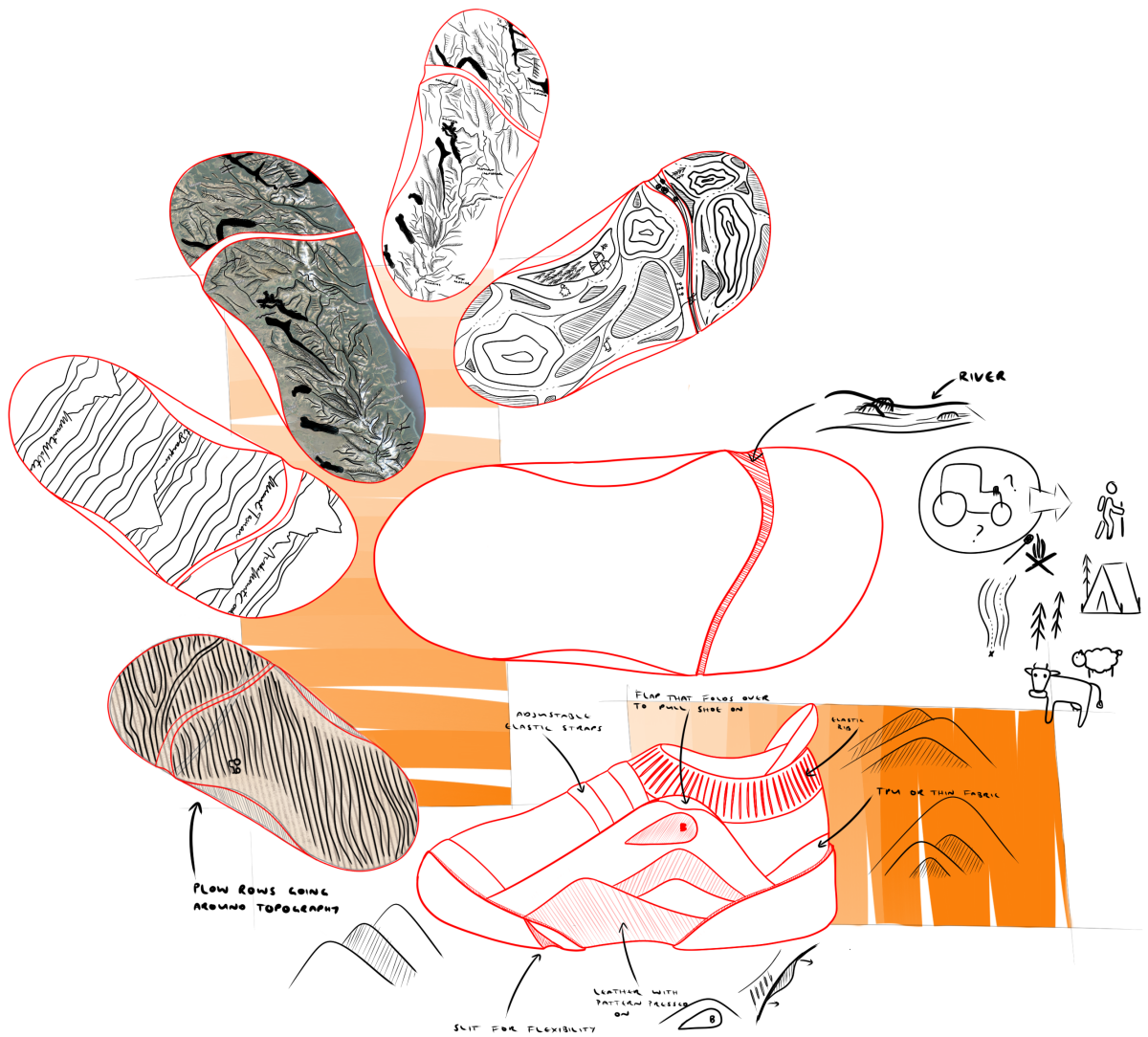


Figure 126. Tread print concept ideation.



Figure 127. Rough CAD model example of the mountain tread print applied to the shoe sole model.



Leather Stamp Development:

I was wanting to create visual interest on the upper by incorporating a subtle textured mountain detail in printing the leather that wrapped around the side of the foot. In order to do that, I produced an FDM 3D printed stamp that was then put under the weight of a concrete block on top of a piece of wet leather and left for four hours. The leather did not pick up the print from the stamp very well, which made me realise the stamp edges needed to be sharper and I needed to apply more force to the leather.

Figure 128. (Top) Stamp and leather. (Bottom) Leather with faint indication of stamp marking.





Figure 129. Stamp under the concrete block press.

I later produced an SLA 3D printed stamp, which allowed me to produce a sharper edge of the stamp as the SLA printer could produce finer details. I applied the stamp to wet leather but used the manual workshop press which would apply a greater amount of force onto the leather. The result of using the hydraulic press was more effective and produced an imprinted result that I felt looked quite polished but still playful. From there I wanted to refine the shape of the leather component so that it complimented the shape of the upper better. I would do this by creating a variety of iterations of shapes and sizes and then stitching them onto upper prototypes.

Figure 130. (Top) Stamp and leather. (Bottom) Leather with clear stamp marking.



Figure 131. Stamp under the hydraulic press.









As the stamp struggled to indent onto the finished leather that Bobux had provided, I tested the stamp using unfinished goat leather, which was much softer. The result of this came out with a very clear and pronounced imprint debossed into the surface.

Figure 132. Debossed imprint on unfinished goat leather.

After confirming the method of applying the texture to the leather surface, I developed the size and shape of the piece of leather to wrap around the sides. I made slow and subtle changes to the shape, increasing the height and changing the curves slightly every iteration. I also factored into the shaping of the top of the curve that the leather would be folded over (as flaps to help pull the shoe on and off).

Figure 133. Iterations of leather sizing to wrap around the side of the shoe.



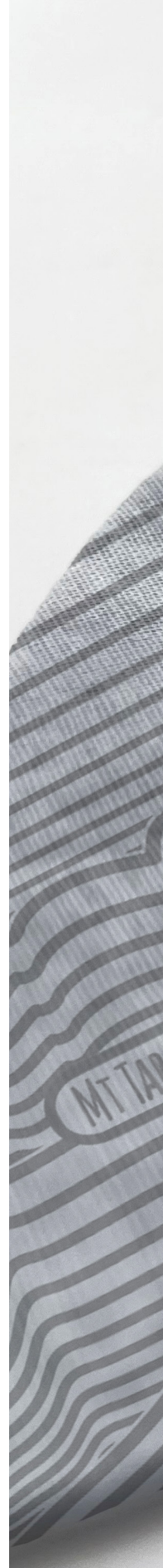


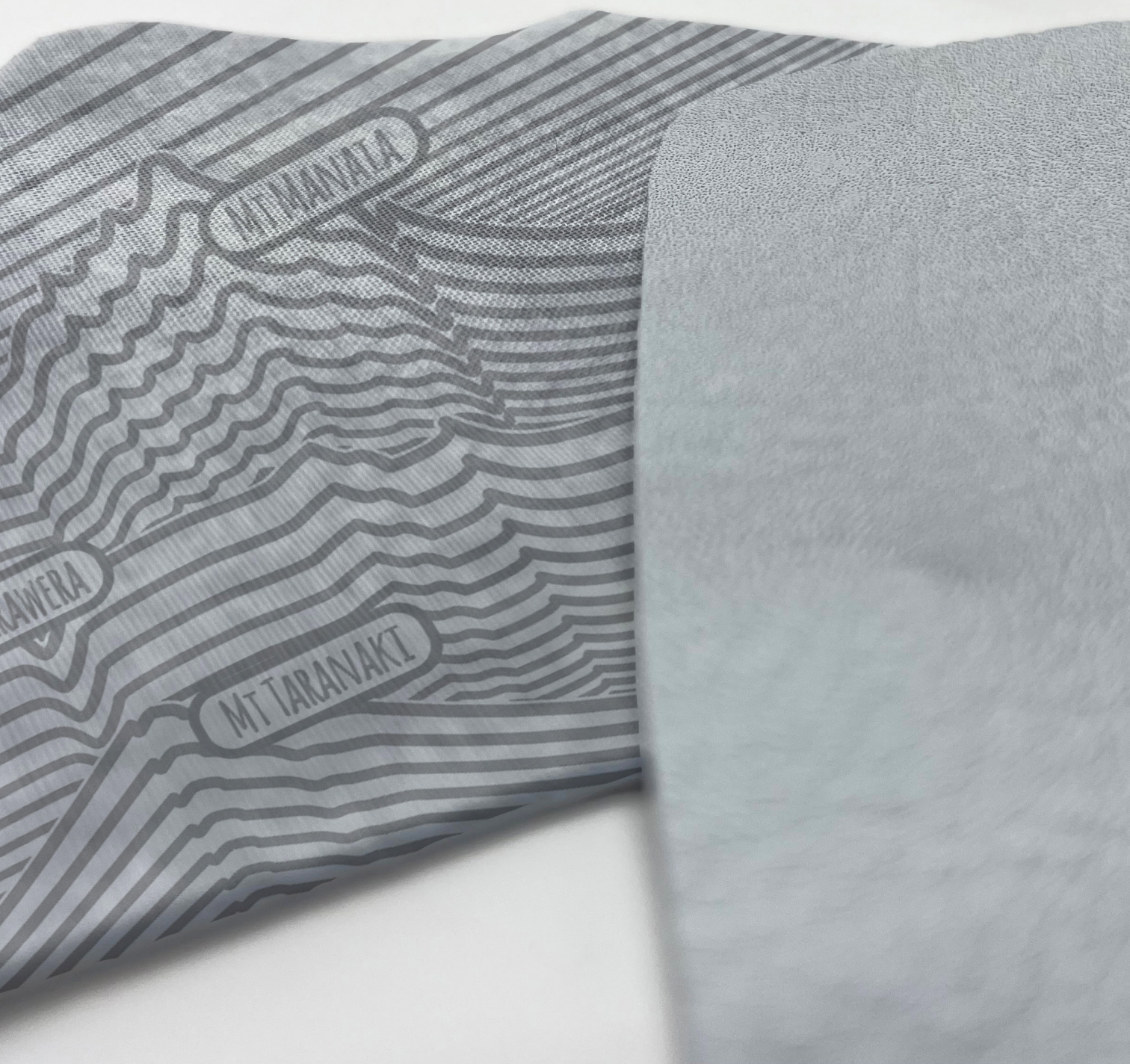


Figure 134. Demonstration of how the leather will roughly sit on the underside of the foot (sewn on), following the footprint contours on either side.

I found there was an opportunity to build a subtle design element into the upper of the shoe. I lined the interior of the leather flap with a woven material, which gave the soft leather more structure and would stop it from stretching when worn. I then printed the tread print detail lightly onto the woven fabric, which pulled in the elements from the tread into the upper.

Figure 135. Tread print graphic on the inside of the leather flap.

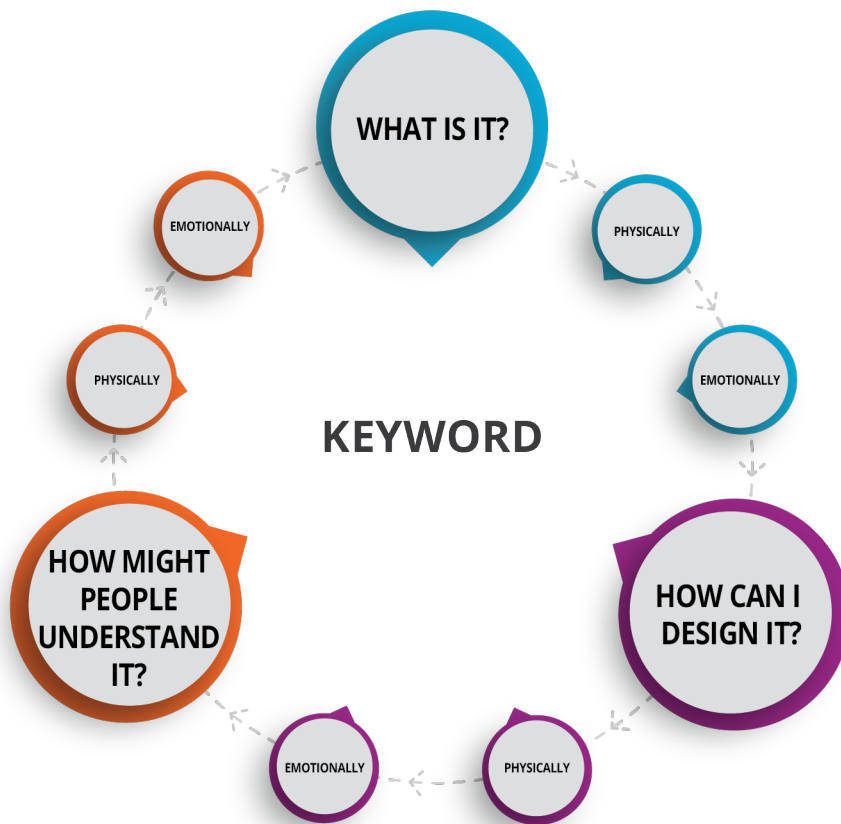


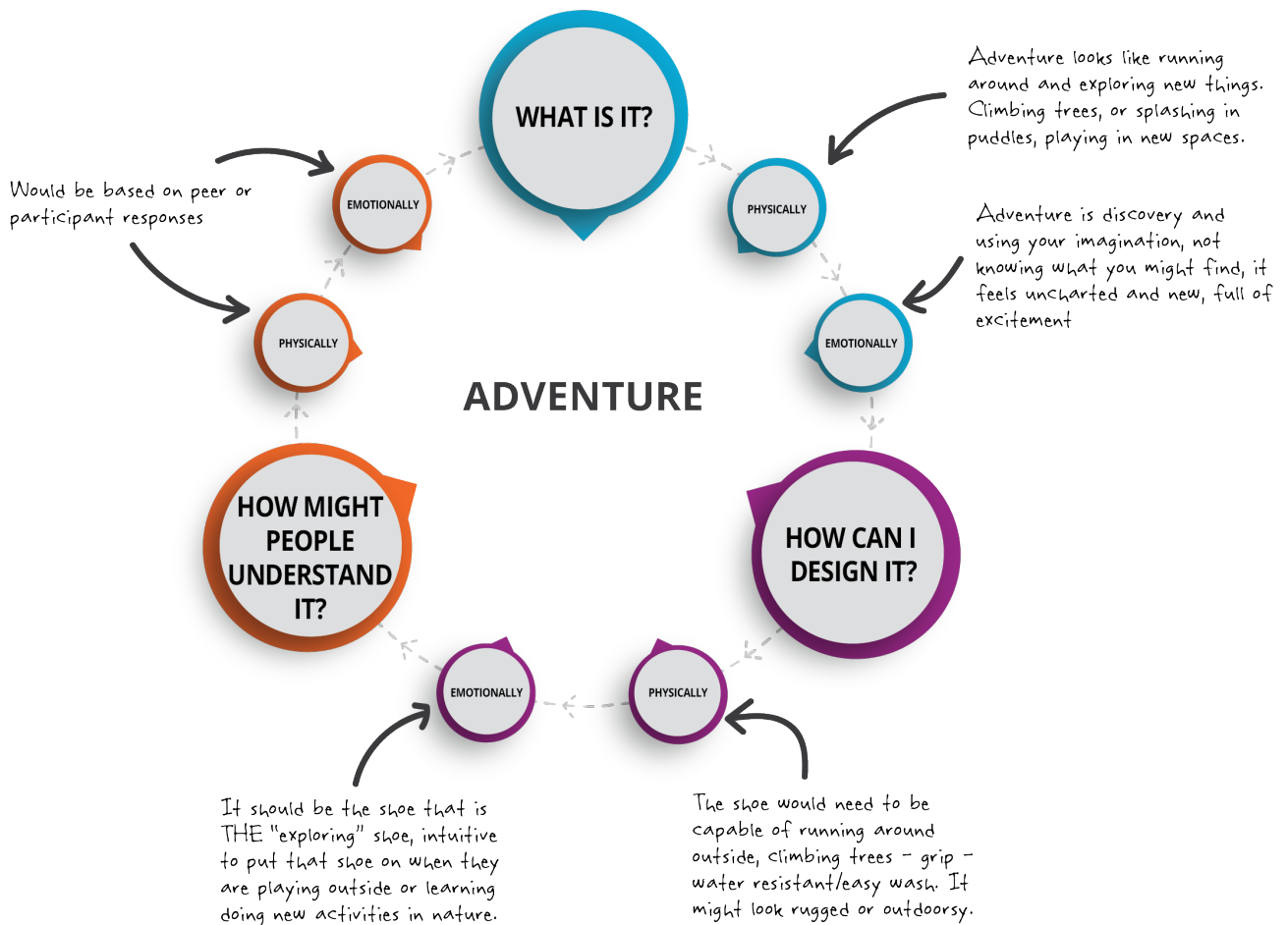


Communication Framework Development:

Following the previous iteration of the visual communication framework, the next development aimed to indicate that the design should communicate both functional and emotional elements rather than one or the other. It gave the designer the opportunity to go into greater detail around each keyword and gain a better understanding of how that word could be applied. It also walked the designer through the different stages of a design process, by understanding the application, how it can be applied, and analysing feedback from others. The stages were placed in a cyclical framework which encouraged reflection on how the design has been communicated and what can be improved in the following iteration.

Figure 136. Communication framework iteration.





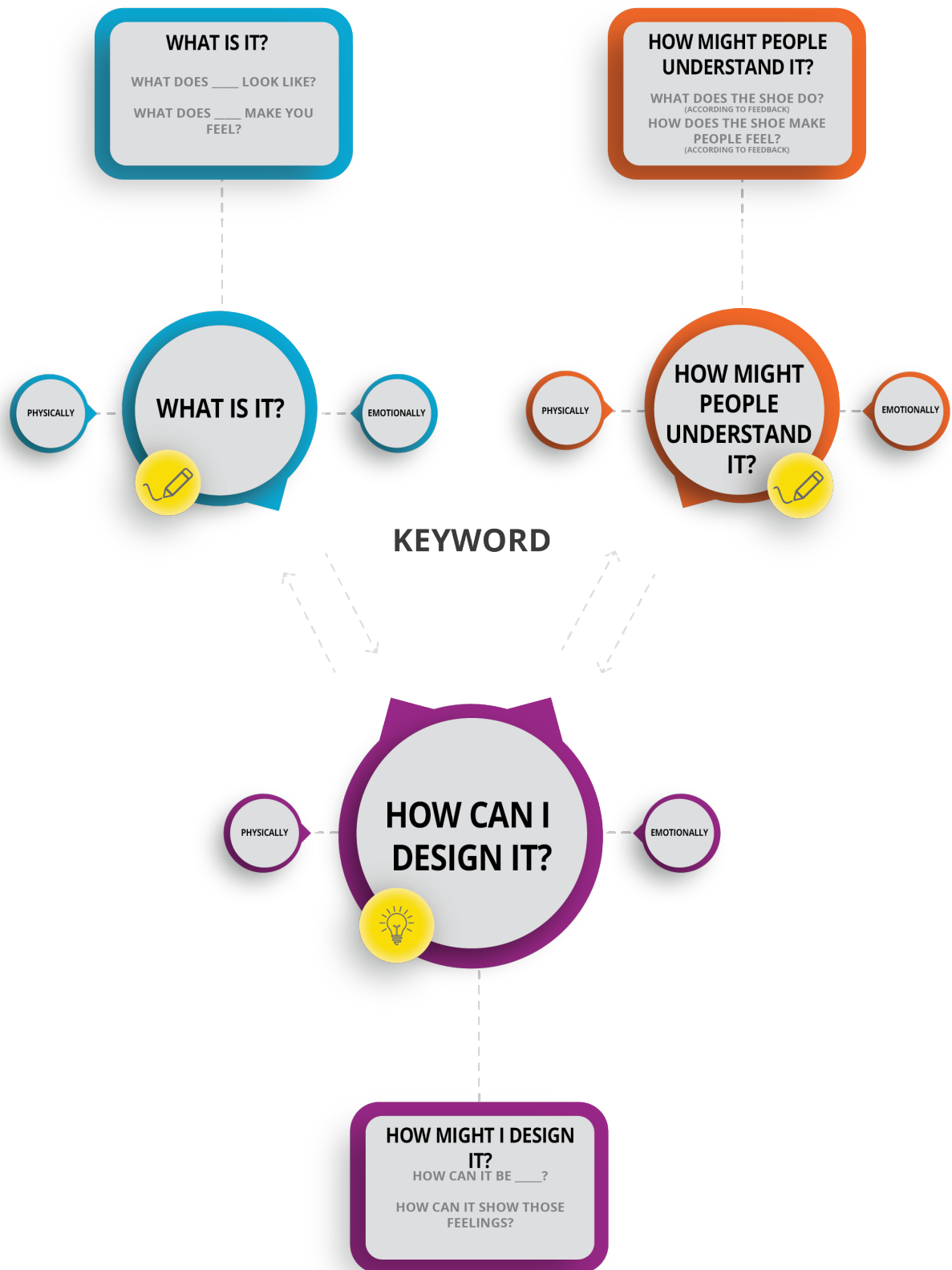
I applied my own keywords to this framework to test how effective it was in aiding my thinking. I found this framework more effective than the previous iteration as I felt as though it could be more naturally integrated into a design process. The structured circle made it feel like the first component had to inform the second component, and so on. For example, the design may inform people's understanding, but then the feedback from others may also inform the design. In response to this, I developed a new iteration of the framework, which had a more fluid and interchangeable order to how you could apply it to your own project.

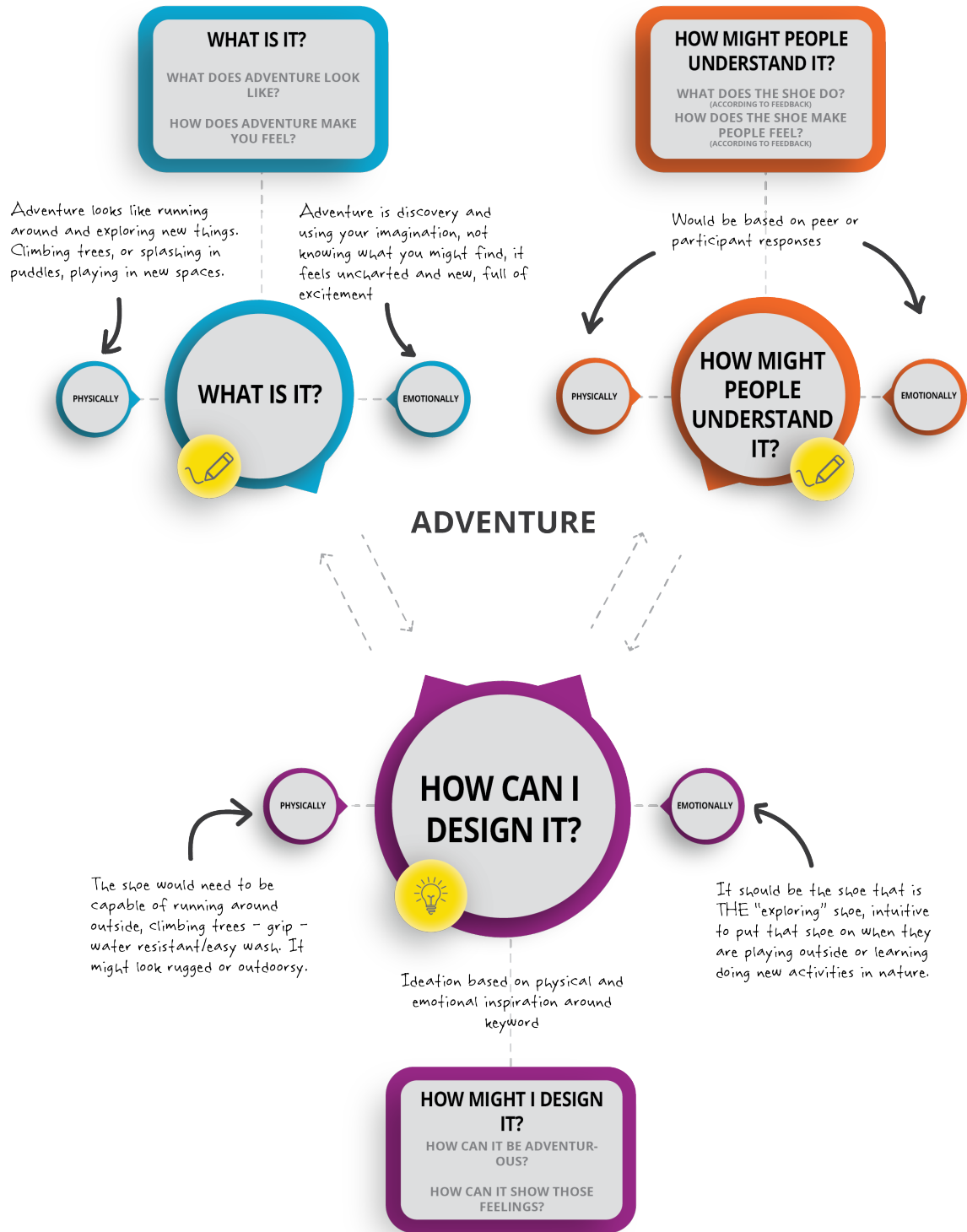
Figure 137. Communication framework iteration tested in the context of my project.

This iteration focused on how understanding the emotional and physical elements of the keyword, what it is and how people might understand it can feed into how that keyword can be represented through design. This framework still looped around and encouraged iteration, but it gave the flexibility of the order of how one thing may inform the other could be interchanged.

The framework aimed to help the designer understand what the keyword was on both a physical and emotional level and brainstorm keywords or sentences that came to mind. It also aimed to draw out feedback or insights from articles, surveys, interviews etc. and separate them into physical and emotional categories. From there, the brainstorming could inform design ideation. The ideation could then influence how you think again about what that keyword means and how others may understand your design.

Figure 138. Communication framework final development.





Again, I applied this framework to my own practice. The flow felt more natural and flexible, and I felt like the structure gave the user more opportunities to use creative thinking, ideation and interchange the order of the framework as it applied to the project at different stages. Within the scope of my research, I decided to finalise the framework here as I was happy with how it helped me to communicate the key elements into the final outcome.

Figure 139. Communication framework final development tested in the context of my project.

Finalising the Design Concept:

Through prototyping, I finalised the design concept, which was built as a rough prototype. The prototype featured a 3D printed flexible TPU sole that did not yet have the tread print built into it. Leather was wrapped around the side of the shoe, but the prototype did not yet have the mountain print debossed into the leather surface or the graphics on the backside. The shoe was tied together with an elasticated lace system which allowed the shoes to be pulled on and off easily, without the hassle of tying laces. The elastic was adjustable to cater for smaller or larger width of the foot. Due to manufacturing delays from Bobux, the knitted body was taken from another company's shoe, the sole was removed, and the upper was stitched onto this prototype. The flaps on the top of the leather were designed to help parents to pull the shoes on but also to indicate to children how they can pull the shoes on, helping them to find some independence and autonomy.



Figure 140. Final design concept as a rough prototype.



Figure 141. Final design concept as a rough prototype.



Figure 142. Final design concept as a rough prototype.



Figure 143. Final design concept as a rough prototype.



Figure 144. Final design concept as a rough prototype.

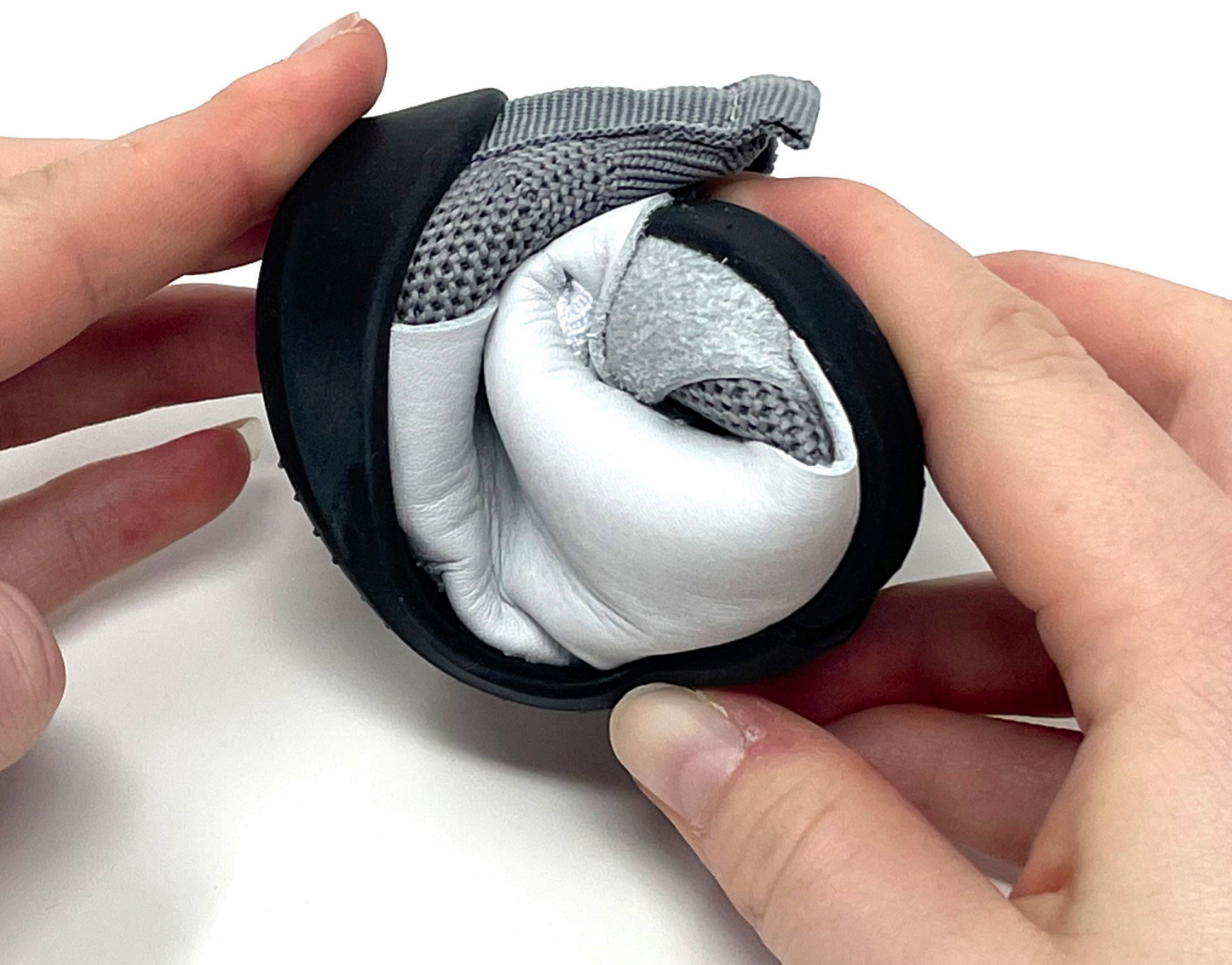


Figure 145. Final design concept as a rough prototype.



Figure 146. Final design concept as a rough prototype.

05. Finalising the Design



Figure 148. Footbed construction refinements using open cell foam.





Figure 149. Footbed construction refinements using open cell foam.



Figure 150. Footbed final construction.

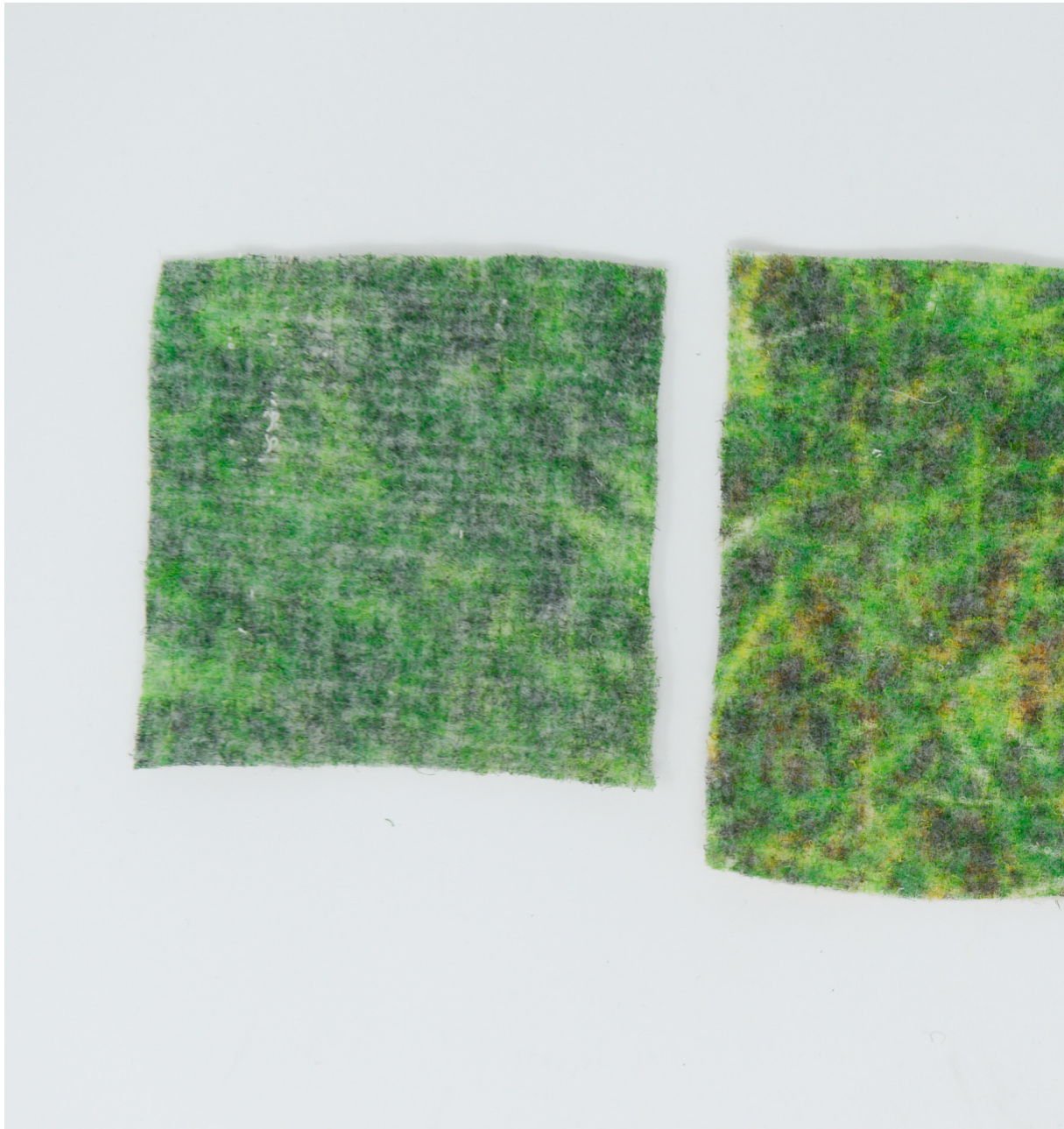


Figure 151. Three print variations of grass for insole pattern.

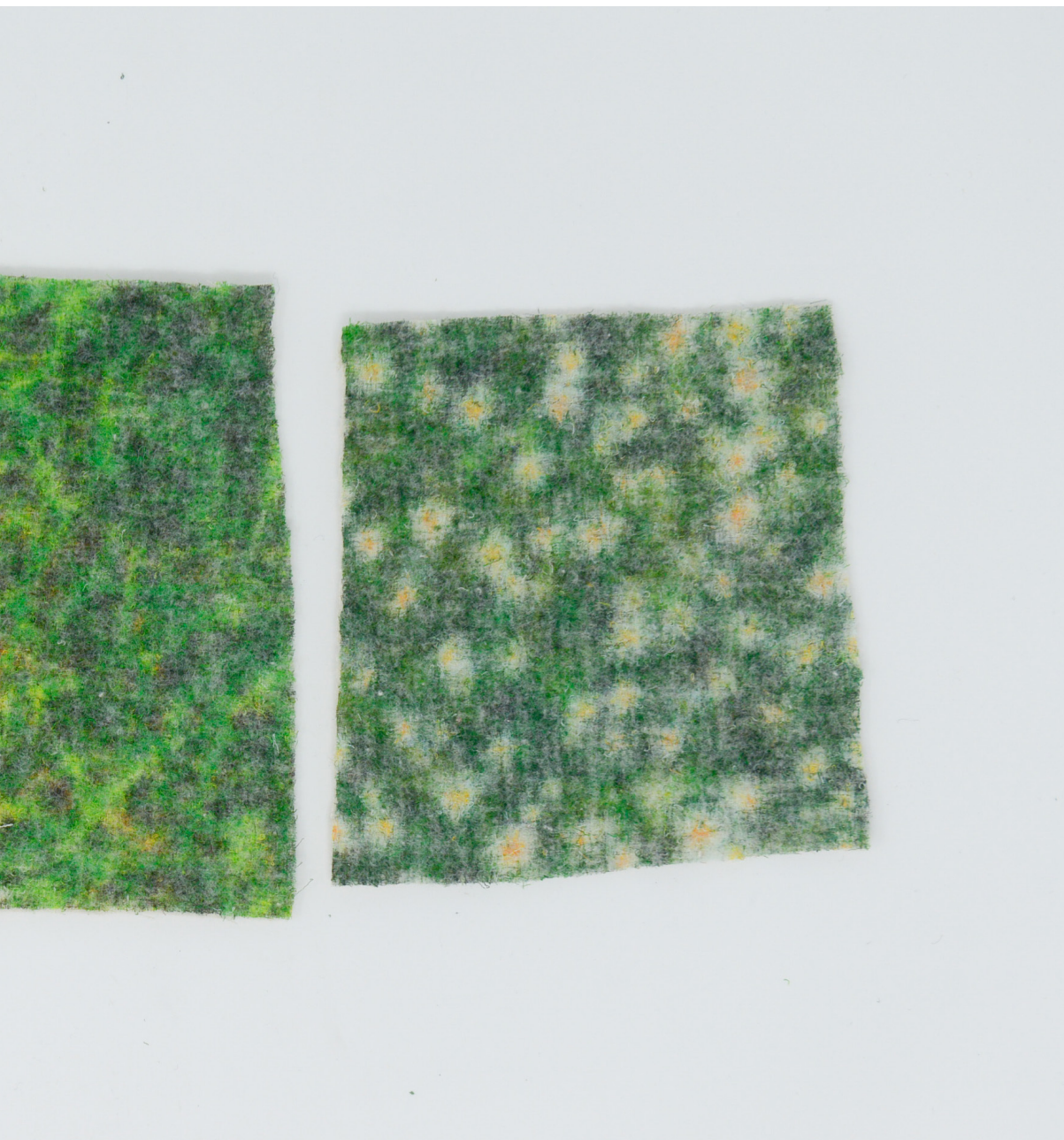




Figure 152. Chosen insole print.





Figure 153. Insole shown inside shoe with size sticker printed on.



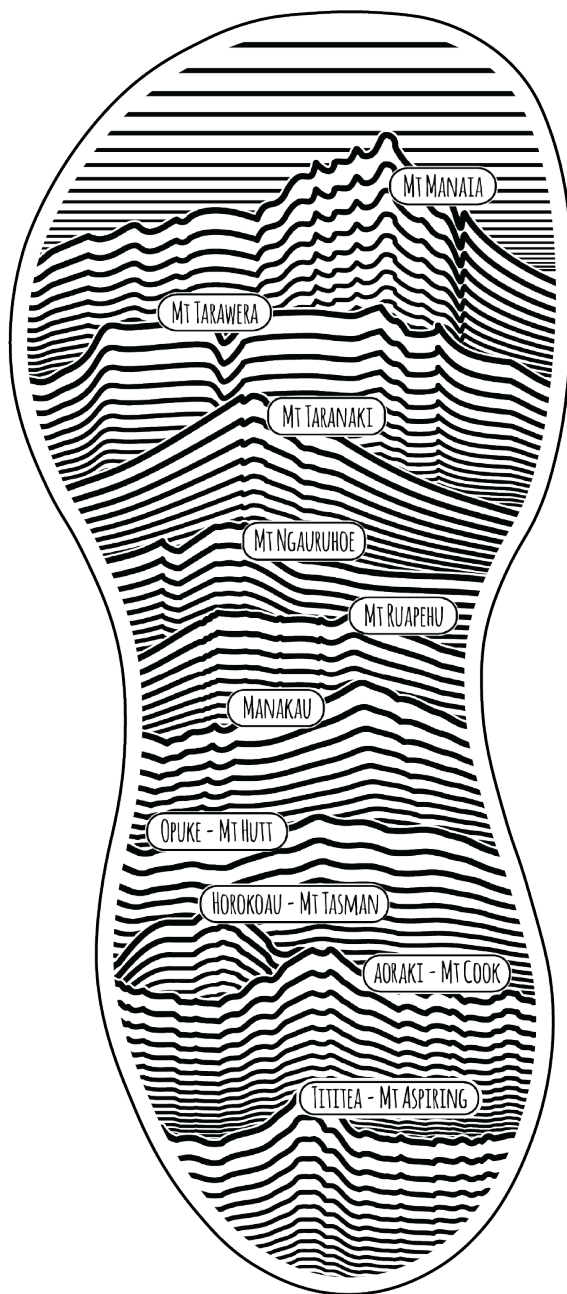


Figure 154. Three tread variations, each showing different forms of connection with nature.

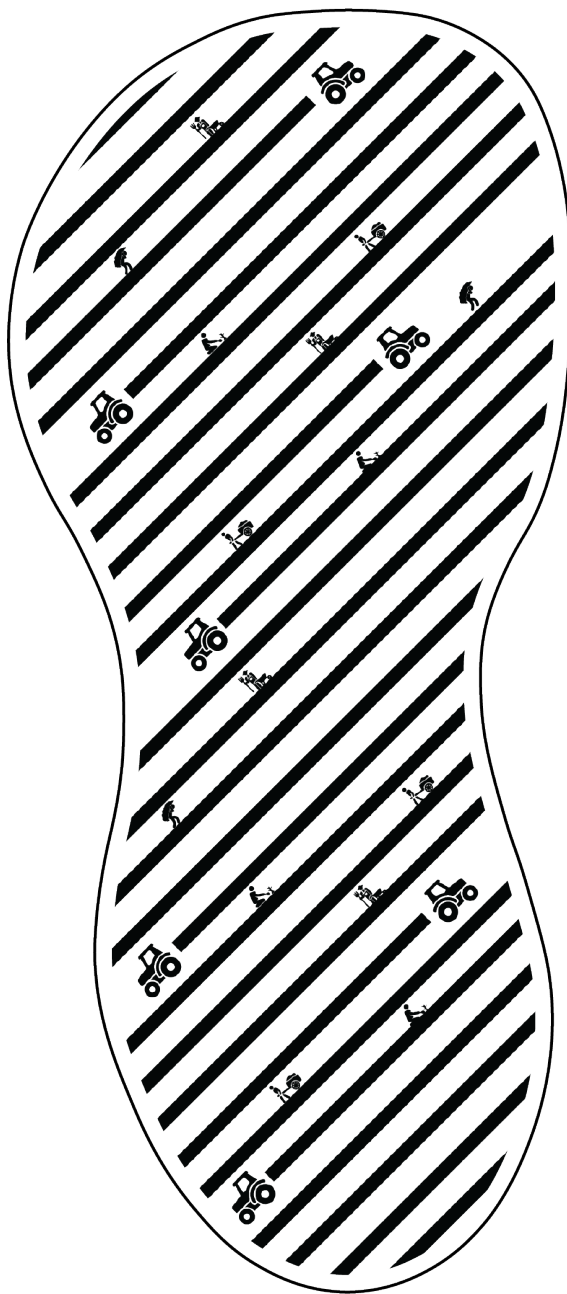




Figure 155. Test print in SLA showing one of the tread patterns with a more pronounced tread depth.





Figure 156. SLA tread print one with laser cut wood pattern demonstrating the print with higher contrast.



Figure 157. SLA tread print two with laser cut wood pattern demonstrating the print with higher contrast.





Figure 158. SLA tread print three with laser cut wood pattern demonstrating the print with higher contrast.





Figure 159. Tread options exhibited on a grass box, as displayed in examination.





Figure 160. Development of the shaping of the side leather piece to better compliment the shoe shape.





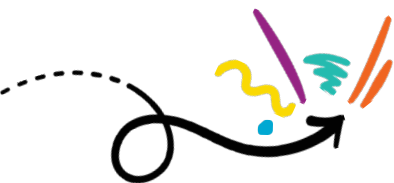
Figure 161. Exploded view of the shoe components.





Figure 162. Development of the shoe packaging displayed in the examination.





06. Research Outcomes



Figure 163. Table presented for examination, telling a story of my design process.





Figure 164. Final Prototype.





Figure 165. Final Prototype.



Figure 166. Final Prototype.







Figure 167. Final Prototype.





Figure 168. Final Prototype.





Figure 169. Final Prototype.





Figure 170. Final Prototype.





Figure 171. Final Prototype.





Figure 172. Final Prototype.





Figure 173. Final Prototype.





Figure 174. Final Prototype.





Figure 175. Final Prototype.





Figure 176. Final Prototype.





07. Discussion



06.1. Design Research Outcomes

The Shoe:

This research set out to explore how visual language tools such as semiotics and affordance could be better used to communicate good foot health and connection in children's footwear design. The outcome of this research introduced a shoe that provided a more tactile way for children to experience the ground underfoot. Past literature has suggested that children and adolescents who are barefoot (or wearing minimalist footwear) could be more inclined to spend more time outdoors than children in stiff footwear (Aibast et al., 2017). Based on the insights from the participant interviews, both participants identified visual elements of nature, flexibility and of the shoe being an extension of the foot, indicating that the design was potentially communicating a connection with the outdoors.

Because of the limitations of having only two participants who could not represent all Bobux consumers, the insights gathered did not speak on behalf of the entire customer base. However, I can find similarities in the participant's insights that can be used as data-led assumptive conclusions on the research.

The need for children to spend more time outdoors and build a relationship with nature was discussed by Louv (2005). He explained that free and natural play seems like an artifact of the past in the age of technology, but there is still a way to live with nature alongside technology. Children should experience enough nature to intuitively understand what they are missing, creating a yearning for nature that can be used as a powerful tool in developing nature centred children (Louv, 2005; Hanscom, 2016). The shoes designed in this research project aimed to fill that gap by heightening the tactile experiences with nature through movement and touch, to make children see the outdoors as a more alluring prospect than playing on an iPad. The responses from the participants reinforced that the shoes were likely meeting that aim.

The research conducted by Louv (2005) and Hanscom (2016) helped me to realise that I wasn't just trying to communicate nature through the shoe, but also to encourage parents/kids to be in nature. This gave my research a lot more purpose. It had felt like I was designing a means for an additional stream of revenue for Bobux. This realisation felt to me like I was actually helping the Bobux consumer to be a part of nature, which was important to me, as someone with a deep connection to the environment, and as a researcher, knowing that I am contributing to something important for the future generation.

By designing a shoe that aligned with the research reviewed throughout this project, I have used the recommendations from the wider research community around encouraging children to spend time in nature to develop a shoe that aims to connect with nature. Designing a shoe that embodies the academic literature discussed above and bringing that literature into the physical (product) realm is important in furthering this field of research.

The research asked the question: how might visual language tools such as semiotics and affordance be used to better communicate connection with nature and encourage outdoor play in the design of footwear for toddlers?

Through developing a communicative framework that applied my knowledge gained from understanding these visual language tools, I designed a product that demonstrated how form could be used to communicate a message to the consumer. While the final prototype was not tested with the participants, the feedback I received from earlier participant interactions indicated that this shoe was succeeding in the communication of connection with nature and encouraging outdoor play.

I developed a sole that was contoured to improve the tactile experience of how the child could feel and respond to the ground underfoot. The shape of the sole pinched in at the midfoot, which allowed for much greater flexibility across

the shoe, and also helped the child to gain proprioceptive awareness (where their body is in space). The heel and forefoot had a sharper edge (not rounded) to give the child greater lateral stability (side to side rolling movement) to prevent them from rolling over on their ankles while their body is still learning about how to respond to the ground underneath them.

The leather that wrapped around the bottom protected the edges of the child's foot from sharp objects, without the need for a stiff rubber as seen in many footwear styles. The leather helped to give the shoe greater waterproofing. It also provided a structure to the shoe that wasn't stiff, as the leather was not attached to the shoe at any point except for the bottom edge, which gave the knit fabric the ability to move with the foot without a thicker and stiffer fabric restricting it. The elastic laces also helped to encourage the movement of the knit fabric.

The insole was made up of the felted grass print, backed onto a rigid woven fabric to prevent the insole from stretching. The grass appearance of the shoe sole helped to indicate to the parents that the shoe is as close to barefoot as you will get while still protecting your kid from sharp objects.

The footbed underneath the insole was made from open-cell foam, which was contoured to match the rubber sole, this meant that the footbed moulded perfectly into the contours of the sole, elevating the feeling for the child that the shoe is an extension of their foot, rather than an addition to the foot.

The three options of tread print each aimed to demonstrate what outdoor play and nature may be perceived as in New Zealand. They tell the story of getting muddy on a farm, hanging with cows and playing on a tractor, tramping in the bush, surrounded by trees, pitching a tent and sitting around a campfire, and even admiring the mountainous terrain that runs from the north to the south of New Zealand. Each of these treads tell a slightly different story, but each share the same idea that your child is on one great adventure, and these shoes are designed to encourage and empower that.



Figure 177. Final design concept.



Figure 178. Final design concept.

The Framework:

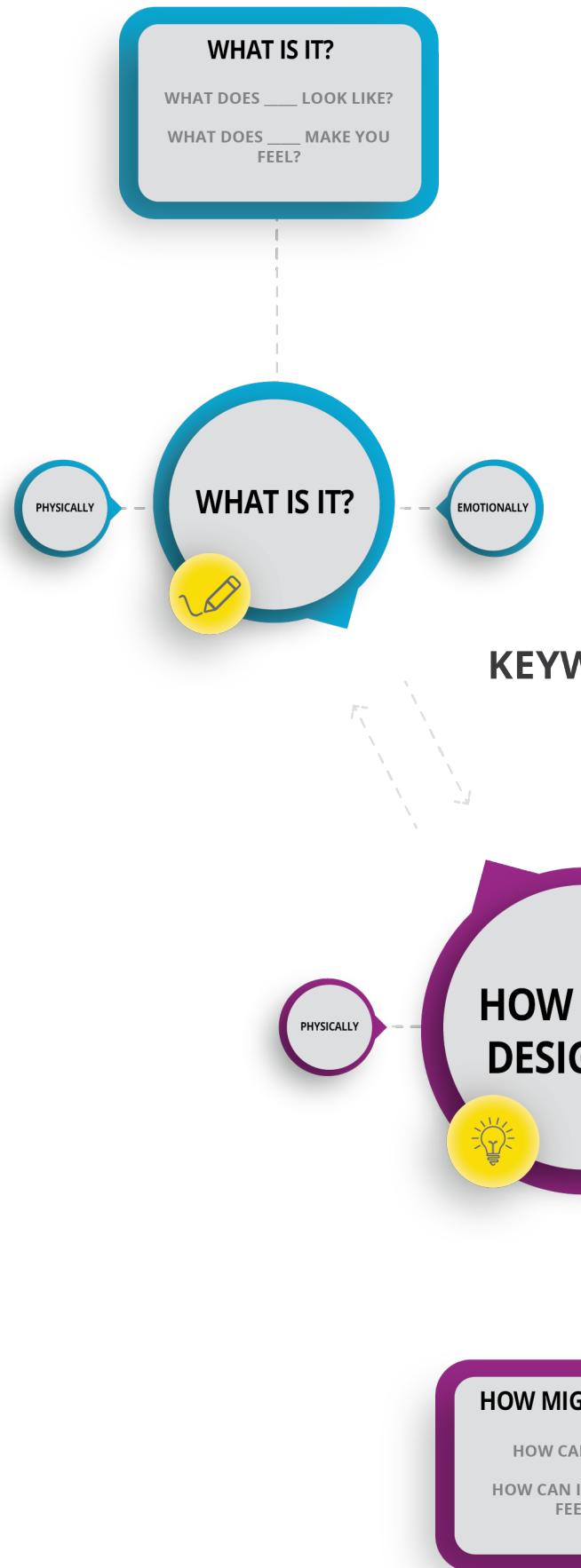
The framework that was created through the research project helped to highlight the need for emotional design elements, especially in an industry that has a strong focus on designing around the idea of function and form (Chattaraman et al., 2016). It has been acknowledged that determining the responses of consumers based on emotions, may be challenging for designers to predict (Naeini & Mostowfi, 2015). Throughout the research project, I began to understand the challenges of communicating emotional elements into the design, and as a result, I found it necessary to create a framework to guide my creative process.

While I consider the framework to be preliminary and still require additional rigorous testing and development through other design projects, I was pleased that the data collected from the participant interviews suggested the framework had helped the participants reach the desired conclusions.

This project was initially centred around using semiotics as a tool to better communicate the purpose of Bobux footwear, visually through the product. As I became more familiar with semiotics, I learned that its application in the field of design was complex because of its objective nature in a relatively subjective field (Hoxha, 2014). Its exactness and objectivity lead it to be regarded as not only a discipline but as a science as well (Hoxha, 2014). Semiotics also uses historical, cultural, and societal contexts to develop a product that communicates its purpose effectively with the user (Lawes, 2002). This was difficult for my project because I was partnered with a company that sold their products globally.

It was not viable to make decisions based solely on intuition and tacit knowledge (You & Chen, n.d.), however, I discovered that those decisions could not be made through semiotics alone (Hoxha, 2014). Other tools such as affordance, data analysis and the Human Centred Design methodology helped to make decisions that informed the direction of the design.

I found that there was limited information around the specific methods of semiotic application to the industrial design practice, I felt that myself and other designers may benefit from a framework that clearly unpacks a way of highlighting those key values. Developing the “form + function” as the baseline, and then helping to heighten that baseline to incorporate the emotional perception that a consumer may draw from the product.



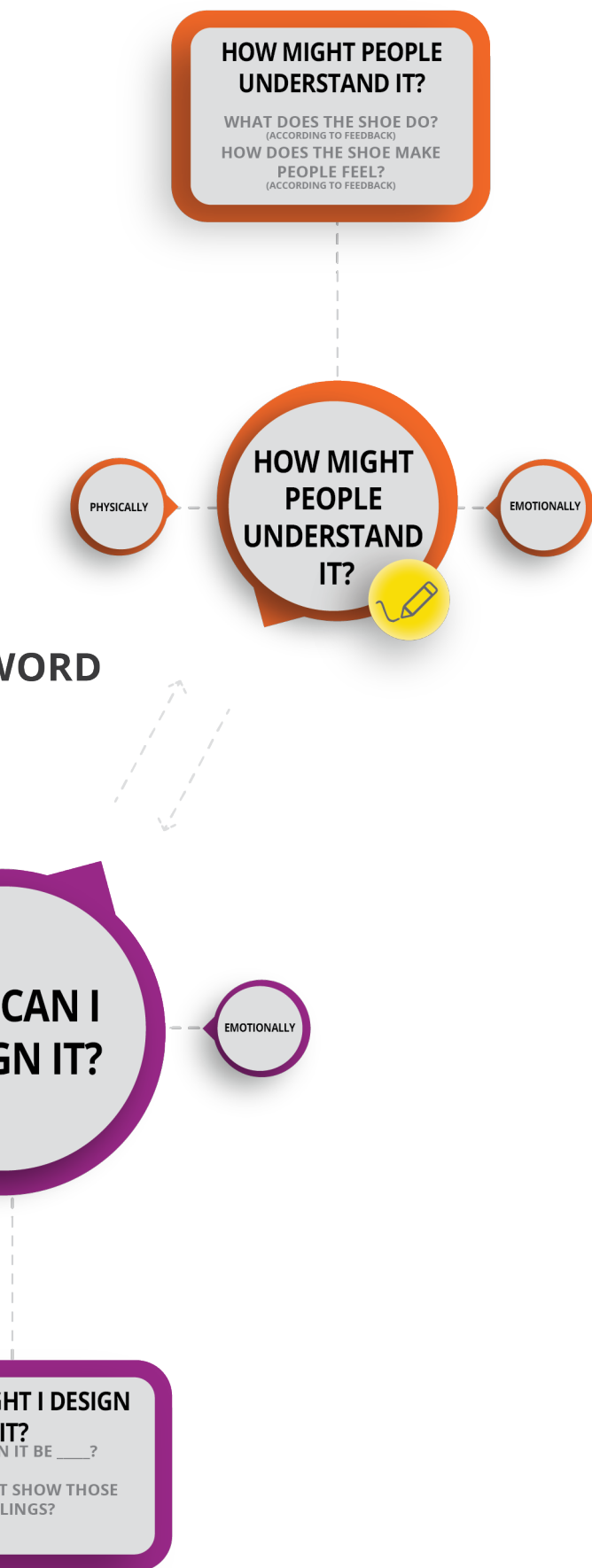


Figure 179. Final design of the communication framework.



06.2. Limitations and Recommendations

Covid-19:

As a result of the four-month Covid lockdown during the early stages of my research project, multiple areas of the research were impacted. During this lockdown, AUT facilities were closed and I could not work anywhere outside of the house. This meant that there was a delay in the production of prototypes, resulting in less development than I had initially planned for, and therefore fewer iterative cycles. Because of AUT being closed over this period, the studio space was also unavailable to work from, as were all other public spaces. As a result, I had to adapt to working from home, which I found to be a challenging location to design and innovate from. I also had concerns about what was going to happen and an uncertain future for both the design project and day to day life. There was a loss in connection with friends and family along with worries of myself and others getting sick. I found this a significant challenge in my research project, and I encountered several periods where I felt uninspired and unmotivated to work through the project.

I found that despite having challenges with producing creative work during the covid lockdown, this time was effective in completing some of the early writing such as the contextual review and methodology chapter. This writing helped me to make more sense of the project, especially in working through my own personal moral dilemma of the contradictions surrounding barefoot research in academia, (Morrison et al., 2018; Whitehead et al., 2016).

The project timeline was pushed out because of the lockdown, and subsequently, ideation, prototyping, and the production of a refined design that the participants could give feedback on were completed further into the project than expected. The insights gained from the participant interviews were used to help refine the design into a final output, but multiple iterative cycles

based on the insights could not be completed as had been initially planned, due to the time restraints of the project.

The recruitment of participants was impacted due to covid restrictions, as I had initially planned on recruiting participants by advertising posters at children's kindergartens. However, when kindergartens opened back up, parents could not come in with their children, meaning they would not get to see the recruitment poster. Instead, I used multiple relevant Facebook groups to advertise the research.

It was likely that due to the large number of daily posts from the Facebook pages that I used only a limited number of people were exposed to the recruitment post. Covid-19 may have caused people to not engage in new activities, being a lot more restrictive about what they would participate in, only a limited number of people were exposed to the recruitment post.

I also had to conduct the interviews via Zoom, because of the risks in meeting face-to-face with Covid-19 as well as the participants being located around New Zealand because of the Facebook recruitment method, rather than being based in Auckland. Fortunately, I was able to produce a prototype package for each of the participants that was posted to them, so they could still interact with physical models.

Defining the Brief with Bobux:

At the beginning of the project, both Bobux and myself were wanting a shoe design that could be integrated into all of their current products. This created a lot of limitation within my creative process and the designs that I was producing were reflective of that. During this stage of the research, I found it challenging to do any making. What I later realised was that because I was spending so much time making sense of how I should approach this project, I had forgotten that making can be used as a tool to aid thinking (Mäkelä, 2007). The value of making, as a designer, is immense. In an industry that builds its framework on making, I did not value it enough. This may have impacted the outcome of the project as there was a large amount of time spent going around in circles, designing concepts that did. However, I understand that I could not have reached the final outcome without first going through the steps of unpacking and understanding the project.

Using the insights collected from both expert interviews, where they both recommended using limited key callouts and focusing on heroing them through the design, I reframed my thinking around the project. Primarily focusing on connection with nature opened up a world of exploration that was untapped, and it made space for a lot more creativity. At the same time I became a lot more in tune with the project as someone who has a deep connection with the environment.

Future Steps:

I believe that the framework has a lot more potential for development. Through my research, I demonstrated the framework was useful to help me to design a shoe that could be used as a vehicle for the communication of Bobux's key messages and encouraging parents and children to interact with nature. Based on the results of this research project I believe the framework has the potential to help other designers to incorporate emotive design into a product outcome that communicates a message strongly.

Following this research, the project could be continued by either Bobux, or another external research partner to conduct multiple phases of research studies and subsequent product development. The first phase would be more one-on-one participant interviews where the participant interacts with the prototype. However, with a much larger number of participants so that the data can be more reflective of the Bobux customer base. The next phase would be to simulate a retail environment and observe how a parent (and potentially a child) respond to the prototype when there is a lot of distraction from similar products surrounding it, and what insights can be drawn from that. Finally, having the opportunity for the shoes to be wear-tested over several months in everyday life, with regular meetings with the parent to discuss how, where and when the shoes are being used.

Because of the scope of this project, validating the outcome of through the inclusion of children was not possible in validating the outcome. Parents would be the ones purchasing the footwear. It would have been insightful to see whether children were drawn to the shoe and if they responded positively or negatively to the shoe. However, the process of working directly with children was too challenging with respect to ethics, and recruitment, especially in the context of Covid-19. It was decided that involving children in the research did not outweigh the potential benefit from insights. If this research was to be continued, it would likely be beneficial to involve children.

This project did not specifically address sustainability in the form of a product life cycle analysis, due to the parameters of the research question. However, it must be noted that producing a sustainable product is paramount in the current environmental climate that we live in. There is an opportunity if this project were to be continued, especially if it was in the pipeline to be brought to market, a full life cycle analysis must be conducted and developments made to ensure that it creates a positive impact on the world and neutralises any carbon emissions.



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