BLOOM

don't play with your food, play with your pliable tableware

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Figure 1.

ABSTRACT

Products are often designed to encourage mass consumption through improved product function and/or following aesthetic trends. When the main intent of a corporation is to sell products, designing for emotional intent and lasting product attachment is often neglected. However, designing for emotions through tactile connection can be a tool for product durability, significantly benefitting the user and the manufacturer downstream.

Tableware is comprised of functional pieces of homeware that, when interacted with daily and over a prolonged period, can become mundane. Therefore this research seeks to use design to transform this potentially mundane interaction into a mindful, multi-sensorial experience to prolong the lifespan of tableware and enrich the eating experience. An iterative, practise-based process produced a pliable food vessel that increases our emotional experience in both individual and shared dining scenarios by activating an enjoyable haptic experience.

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Fig. 2.

CONTENT

02 thesis declaration

04 abstract

06 acknowledgements

09 list of figures

11 introduction

14 project aim

15 context review
15 emotional attachment & experience
20 the dining room at home
- case study: the history tablecloth
- case study: ActuEater
- case study: EATSY
- case study: Suzugami
- case study: Gamification of tableware

27 the tactile experience

28 opportunity

30 method
- initial concepts
- understanding the dining space
- chosen concept to develop
- initial design criteria
- initial concept prototyping
- development
  - refined design criteria
  - material exploration
  - aesthetic development
  - colour and foot design
  - texture

51 refined prototype and final design decisions
- dishwasher test

53 bloom

58 design critique & testing

59 conclusion

63 appendices
64 work cited
66 bibliography

LIST OF FIGURES

Figure 1	Bloom, Personal Photograph by Clara Gan, 2022.
Figure 2	Bloom with snacks, Personal Photograph by Clara Gan, 2022.
Figure 3	Desmet, Pieter. Basic model of product emotions. 2002, Diagram, "Framework of Product Experience". International Journal of Design, 2007, page 6. Jordan, Patrick. 4 Pleasure Framework. 2000, Diagram, Designing Pleasurable Products: An introduction to the New Human Factors. CRC Press, 2000. Norman, Don. Three Levels of Design. Text adapted into a diagram. Emotional Design: Why we Love (or Hate) Everyday Things. Basic Books, 2007, page 65 - 89.
Figure 4	Rossman, J. Robert. 5 types of experience. 2019, Diagram, Columbia University Press. Designing Experiences. Columbia University Press, 2019, page 40.
Figure 5	The History Tablecloth, 2006, Photograph, Goldsmiths College, University of East Anglia, Lancaster University, https://research.gold.ac.uk/id/eprint/4719/1/p199-gaver.pdf.
Figure 6	ActuEater, 2008, Photograph, https://saranabil.com/pages/ActuEater.html.
Figure 7	Lim, Jexter. EATSY, 2020, Photograph, designboom, https://www.designboom.com/design/eatsy-tableware-aid-visually-impaired-07-14-2020/.
Figure 8	Suzugami, N.d., Photograph, Shokunin, https://www.shokunin.com/en/syouryu/#:~:text=Suzugami%20is%20an%20item%20that,compressed%20and%20extended%20many%20times.
Figure 9	Design Council. "The Double Diamond: A universally accepted depiction of the design process". Design Council, 1 October 2019, https://www.designcouncil.org.uk/our-work/news-opinion/double-diamond-universally-accepted-depiction-design-process/.
Figure 10	28 Initial Concept, Sketch by Clara Gan 2021.
Figure 11	Understanding the dining space diagram, Image by Clara Gan, 2022
Figure 12	Diagram of dinner observation, Diagram & Images by Clara Gan, 2022
Figure 13	Diagram of dinner observation, Diagram & Images by Clara Gan, 2022
Figure 14	Diagram illustrating design opportunity, diagram by Clara Gan 2022
Figure 15	Wire and duct tape material, Personal Photograph by Clara Gan, 2021.
Figure 16	Velcro prototype, Personal Photograph by Clara Gan, 2021.
Figure 17	String prototype, Personal Photograph by Clara Gan, 2021.
Figure 18	Prototype 1, Personal Photograph by Clara Gan, 2021.
Figure 19	Prototype with more wires, Personal Photograph by Clara Gan, 2021.
Figure 20	Prototype where wires do not join at centre, Personal Photograph by Clara Gan, 2021.
Figure 21	Prototype with varied wire configurations, Personal Photograph by Clara Gan, 2021.
Figure 22	Prototype with hexagon and web wire configurations, Personal Photograph by Clara Gan, 2021.
Figure 23	Prototype creating segments using a hinge, Personal Photograph by Clara Gan, 2021.
Figure 24	Adding more segments to test form, Personal Photograph by Clara Gan, 2021.
Figure 25	Another segmented prototype, Personal Photograph by Clara Gan, 2021.

Figure 26 Prototype with hard centre, Personal Photograph by Clara Gan, 2021.
Figure 27 Prototype with hard base and centre, Personal Photograph by Clara Gan, 2021.
Figure 28 Material Venn Diagram, Diagram by Clara Gan, 2022.
Figure 29 Silicone and tie wire material trial, Personal Photograph by Clara Gan, 2021.
Figure 30 Silicone and MDF material trial, Personal Photograph by Clara Gan, 2022.

Figure 31 Two material trials: one with a solid centre, another with a ring, Personal Photograph by Clara Gan, 2022.
Figure 32 Two silicone and ceramic material trials with different formations, Personal Photograph by Clara Gan, 2022.
Figure 33 Array of samples, Personal Photograph by Clara Gan, 2022.
Figure 34 Experimenting with different thickness of silicone and filling the edges of aluminium, Personal Photograph by Clara Gan, 2022.
Figure 35 First full scale prototype, Personal Photograph by Clara Gan, 2022.
Figure 36 Different angles and details of full scale prototype,Personal Photograph by Clara Gan, 2022.
Figure 37 Silicone colour experiments, Personal Photograph by Clara Gan, 2022.
Figure 38 Drawing texture with a whiteboard marker to trial texture aesthetics, Personal Photograph by Clara Gan, 2022.
Figure 39 Screenshot of CAD texture trial, Image by Clara Gan, 2022.
Figure 40 Process of making refined prototype, Personal Photograph by Clara Gan, 2022.

Figure 41 Different angles of refined prototype, Personal Photograph by Clara Gan, 2022.
Figure 42 Prototype in dishwasher, Personal Photograph by Clara Gan, 2022.
Figure 43 Close up shot of Bloom, Personal Photograph by Clara Gan, 2022.
Figure 44 Bloom, Personal Photograph by Clara Gan, 2022.
Figure 45 Two sizes of Bloom, Personal Photograph by Clara Gan, 2022.
Figure 46 Detailed shot of Bloom, Personal Photograph by Clara Gan, 2022.
Figure 47 Bloom in dining context, Personal Photograph by Clara Gan, 2022.
Figure 48 Function of Bloom, Personal Photograph by Clara Gan, 2022.
Figure 49 Bloom with the user, Personal Photograph by Clara Gan, 2022.
Figure 50 The user pouring popcorn into Bloom, Personal Photograph by Clara Gan, 2022.

Figure 51 Top view of Bloom, Personal Photograph by Clara Gan, 2022.
Figure 52 Bloom with earlier prototypes, Personal Photograph by Clara Gan, 2022.

INTROD

UCTION

As the first in my family to graduate with a degree majoring in industrial design, I am often asked what an industrial designer is and why I chose this field of study. I often gave generic answers, but it was only after I graduated and made the long drive home from Wellington to Christchurch that I had a chance to reflect on what I'd learnt. It was then I realised my happiest memories were trips to IKEA with my family. As a child, going to a brightly coloured blue and yellow furniture showroom where I could go from 'room-to-room,' sitting on sofas, pulling drawers, pressing lightswitches, and holding kitchen utensils pretending to cook—that was my kind of fun. My interaction with products in the space became so enriching and memorable because it engaged the visual and haptic sensory elements. The visually engaging designs piqued my curiosity to touch, feel and see if I could manipulate the product through movement.

I was first introduced to the concept of emotional attachment when I read Jonathan Chapman's Emotionally Durable Design (2005) during my Honours research project investigating sustainability. Chapman's book was an eye-opener as I realised that designing with emotional intent can be a method of creating sustainable products. People cherish products much longer when they develop an emotional attachment to the product. This concept was reinforced by understanding the design work by Yueyun Song (2016), who employed an emotions-based approach to strengthen the attachment between people and everyday objects. To achieve this, she looked into change and transformation to facilitate emotional attachment (Song, 2016). Chapman's and Song's explorations of emotional attachment inspired my research into designing homeware that facilitates positive connections.

To narrow down my topic, I reflected on another cherished memory: family dinners. The dining room was the most vibrant in my house because food naturally brought us together. The more I thought about it; the home dining area facilitates a range of multi-sensorial experiences. It was an area where food was accompanied by stories from our day, an area that can be experienced individually or with others. Dining is a social activity that engages all of our senses. This enriching part of a home inspired me to apply an emotions-led design approach to the dinnerware experience.

This research initially explored dinnerware from a functional perspective where it can evolve alongside users to form positive emotional attachment (refer to diagram 1 in appendices). Through an inductive research approach to the home dining experience and an iterative design process, the opportunity became evident to trigger curiosity and emotional responses through a multi-sensorial experience with a particular focus on tactility. Bloom, a pliable food vessel, is the resulting design response to facilitate a creative haptic experience in the dining area.

THIS PROJECT AIMS TO...

...explore visual creativity and tactile experience in home dinnerware for enriched product engagement.

To respond to the aim, the approach chosen for this project was a combination of inductive analysis with an explorative iterative design process. This approach allowed a better understanding of the kinds of opportunities that can elevate the sensorial experience in the dining space. This will be elaborated in the method section of the exegesis.

EMOTIONAL ATTACHMENT & EXPERIENCE

Attachment is a connection between two or more things. This connection can be physical, chemical and/or abstract. The origins of attachment between people and objects stem from maternal substitution during child development due to their mother's absence (Lee and Hood 1). Such objects include blankets and soft toys because, for a child, their attachment to these objects is a way to bring comfort from their anxieties. This concept transcends to adulthood with different objects. Therefore, this implies that we naturally form attachments to objects, although the reason "why object attachment persists into adulthood remains unknown" (Lee and Hood 3).

Correspondingly, emotional attachment is the emotive bond between two or more things, both tangible and intangible. Emotions are core to human existence. Our emotions drive our behaviour and motivations when interacting socially and with materials surrounding us (Schifferstein et. al 379). Designing for emotions has been a recent approach because we are beginning to understand that disregarding our emotions would be ignoring the fact that products are designed for humans (Schifferstein et. al 379). Currently, the three most notable approaches to understanding how to process product experience and emotions are Patrick Jordan's pleasure approach, Don Norman's process-level approach and Pieter Desmet's appraisal approach (Schifferstein et. al 386).

Norman's and Hekkert and Desmets' approaches provide a base theory for understanding experience in relation to emotions. The main difference is that Norman provides an overview of the stages, acknowledging that a variety of factors can influence the experience, but Hekkert and Desmets' approach focuses more on the emotions evoked from the experience between products and users. The latter approach also acknowledges that a user's pre-emptive concern can influence the appraisal of the product, meaning the informed emotional

decision can be influenced by personal bias. Jordan's approach solely focuses on pleasure emotions. His four pleasure framework reflects the types of pleasure that create a positive experience and stimulates positive emotions.

Despite being similar, all three approaches have limitations because they each focus on different areas of processing emotions (Figure 3). Norman's approach explores the depth of the experience between human and object in relation to emotions by categorising the process into three phases: the visceral, behavioural and reflective phases. Like Norman, Desmet's approach analyses product experience but has a specific focus on human-product interaction. Desmet identifies that the interaction requires concern, stimulus, and appraisal—the three main variables to provoke an emotional response (Desmet & Hekkert 6).

Jordan's approach, on the other hand, exclusively focuses on the emotions relating to pleasure and developed the four pleasure framework (Jordan 13). The development of this framework stems from the fact that users seek emotional benefit after products fulfil their function and usability criteria (Jordan 6). These approaches are useful for understanding the complexities that arise in design.

Attachment to products will involve emotions because emotions inform our experience and have the power to influence our decision to keep or discard things (Norman 9 - 10). However, to understand the impact of emotion on an experience, we must look at what experience is. The definition of experience is extremely subjective, but this project will define experience as the ongoing, conscious interaction with your surroundings.

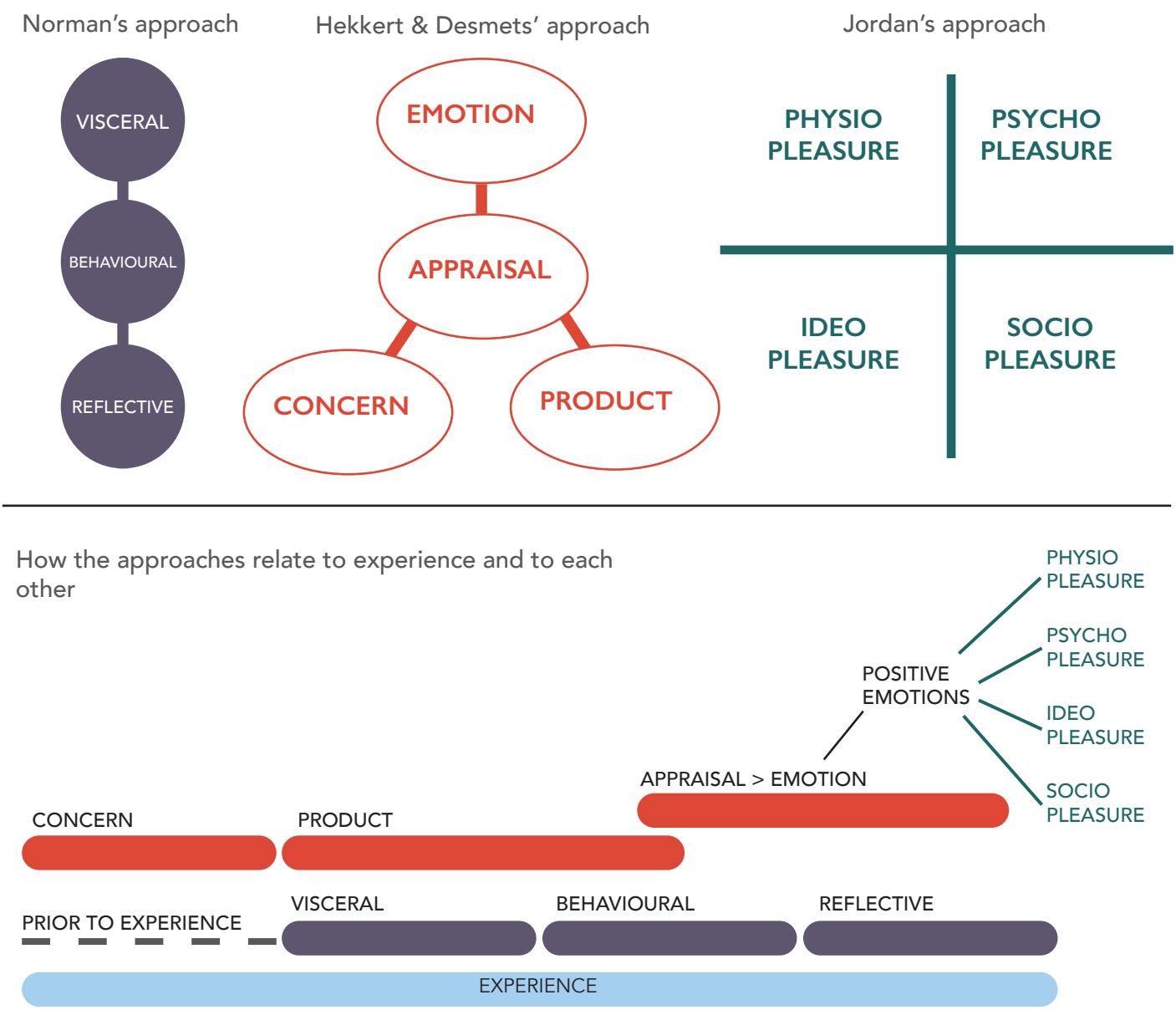


Fig. 3. The three design for emotion approaches, (Adapted from Norman, Desmet and Jordan).

Experience, according to Rossmand and Duerden, consists of three key phases: the anticipation, participation, and reflective phase (9). These phases consist of sequential interactions between the participant and the product or space. The anticipation phase is prior to the actual experience, where the user will either make a preemptive judgement based on previous experiences they have had or be apprehensive about a new experience. When the participant actually engages with the product or space, this is known as the participation phase, where the actual engagement informs the participants about their experience. The participants will then enter the reflective phase, where their engagement from the participation phase will influence how they process the overall experience (Rossman and Duerden 12).

Rossman and Duerden's three phases are similar to Don Norman's approach to product emotions processing levels mentioned earlier. Norman's visceral level is the surface level, and it is the level that indicates the initial reaction a user has to a product (Norman 65). The behavioural level starts to involve the analysis of the product experience and focuses on the use, function and performance of the product. Then the reflective phase consists of understanding the product experience that just occurred. In relation to Rossman and Duerden's three phases, the visceral level would be the transition between the anticipation and participation phase because the emotions felt are based upon the initial encounter with the product, yet users still have their preemptive judgement. The behavioural level is the participation phase, where users interact and discover the product's function and usability. Lastly, both have a reflective phase where the knowledge accumulated derives from the users' knowledge from the anticipation phases and the understanding developed from the behavioural phase.

Emotions are felt at all phases of experience and have the power to influence the outcome of an experience. The combination of emotions, experience and time creates a story, a memory, and, when it comes to design, the narrative of the product is what leads users to form an in-depth emotional attachment. This was illustrated in The Meaning of Things by Csikszentmihalyi and Rochberg-Halton (1981), where they interviewed people about objects that they considered special. The responses conveyed that people formed emotional attachments to objects not because the objects possessed the initial usability qualities. Instead, the value of the objects stemmed from the memories associated with that object (qtd. in Norman 48). Memories are created from experience. This research also demonstrated that the same product has different meanings at each person's stage of life (Csikszentmihalyi 117).

I chose to look into the experience aspect of emotional attachment because research highlights the fact that each person's experience is unique. As Desmet and Hekkert's appraisal theory demonstrates, appraisal mediates between product and emotion and people will not appraise the same product in the same way (61). Appraisal theory also demonstrates that our emotions play a vital role in the processing of any experience. Our emotions help to define and differentiate between a good or bad experience.

Activating positive emotions when interacting with tangible and intangible products provides multiple benefits. It engages users to be curious, think creatively, cope with stress, and problem solve. According to psychologist Barbara Fredrickson, this perseverance will aid users in overcoming challenges and potentially lead to products being kept for longer (qtd. in Norman 19). Overcoming challenges provides users with a sense of achievement and the product as a reward. In addition, keeping products longer lengthens the product life cycle, which will provide less waste in our growing landfill, making it more sustainable. Hence, from a user and sustainability standpoint, it is critically important to facilitate positive emotional attachment.

There are 5 types of experiences someone can experience: prosaic, mindful, memorable, meaningful and transformational. (Rossman and Duerden 32)

TYPE OF EXPERIENCE	DEFINITION
PROSAIC	AUTOPILOT
MINDFUL	EFFORTFUL MENTAL ENGAGEMENT
MEMORABLE	EMOTION
MEANINGFUL	DISCOVERY
TRANSFORMATIONAL	CHANGE

Fig. 4. The five types of experiences.

This project will focus on the mindful experience with memorable, meaningful and transformational experiences being the subsidiary focus. Mindful experience is the main focus because it is the type of experience that encourages the users to make an effortful mental engagement and to "shift out of mental autopilot mode" (Rossman and Duerden 34). A more effortful engagement will facilitate more curiosity and creative interaction, especially with homeware and other objects that people will engage with on a daily basis. While daily interaction may become a ritual, most people end up taking the monotonous interaction for granted. Thus, altering the daily interaction into an effortful engagement enables curiosity and promotes the continuous desire to discover the object in-depth with each interaction. Triggering positive emotions through fun is one method of preventing monotonous routine, a method which will be elaborated on in the case study section.

Experience goes hand in hand with emotional attachment. The origins of designing for emotional intent stem from the understanding that product experience is often more important than the product itself. Experience can mediate an emotional bond, engaging our senses to become memorable. A notable example would be the Build-a-Bear Workshop. It is an experience where you can personalise and customise your own soft toys. The physical participation experience increases the valuation of the product, enhancing how consumers cherish the product (Norton 3). Build-a-Bear consumers can choose the kind of soft toy they want and select clothes and accessories for their toy (Build-a-Bear). The act of decision-making in the building process stimulates the consumer's senses and creates mental engagement to make the experience memorable. The care in creating the soft toy is how an attachment is formed to the product. Build-a-Bear's success reflects two factors: that the experience engages multiple senses, and the narrative of the experience they've created makes them memorable. Therefore, I aim to engage the senses as I explore the opportunity to facilitate an effortful mental engagement in my design.

Similarly, meal kit home delivery services like My Food Bag or do-it-yourself cake in a box kit are other examples of altering the experience. These kits make the cooking or baking experience more enjoyable while providing participants with a sense of accomplishment when their physical effort turns into a delicious treat (Norton 3). The success of the experience is that the companies who design them provide the tools, ingredients and recipes and gently guide participants in the right direction. They take away the participants' frustration with meal planning and grocery shopping by guaranteeing meals and treats that have been developed to have a positive outcome.

THE DINING ROOM AT HOME

"A house is a museum, an exhibition of the changes in the way life has been lived." (15)

- Edwin Heathcote

As mentioned, we interact with homeware on a daily basis, and this interaction is inevitable. However, this experience can become prosaic when the action of the user using the product becomes autopilot (Rossman 33). Over a prolonged period of time, a prosaic experience has the potential to be positive, negative or neutral. When used daily, the experience can become a ritual where one only uses the product for its function and feels no emotional attachment to it. Hence, I seek to design a mindful experience in which the experience is mentally effortful, using homeware as the medium to facilitate a positive emotional attachment.

Over time, the home has become a space with a wide range of connotations. It can simply be a space that we feel safe and comfortable to be in, a place representing personal and collective familial roots and memories, but it can also be seen as merely a piece of property (Heathcote 7). I have always found home such an enriching place in which to witness a person's story through objects; this was what drew me to homeware design. Each home reveals vibrant memories and can reflect the identity of a person and a group living together.

After reflecting on emotional attachment and experience in relation to home, it led me to realise the best room in the house to design a product for is the one with the most social engagement. The dining room is the most vibrant part of the house because food naturally brings people together, and it is a prominent social point of gathering in all cultures. Historically, the dining room was vital to bourgeois culture as the ability to feast and entertain guests in the dining room is a symbol

of wealth (Heathcote 54). However, "modernism and communism radically changed dining habits, the whole meaning of dining as well as the social status of people, in particular women" (Heathcote 55). Now, with the introduction of an open-planned kitchen, the dining area often becomes part of the kitchen as well, where it is "big enough for everyone to be together while food is being prepared" (Heathcote 12). This demonstrates how meal-making and eating are becoming increasingly social. It has become a space for gathering and shared enjoyment regardless of whether it is for dining or not.

Consuming food is primal as it is key to our survival. However, the consumption of food is also ritualistic. Food and eating became social events as well as "a building block of community, a symbol of hospitality, friendship and love" (von Drachenfels 21). However, the formality and structure of dining we have today stemmed from the prosperity that resulted from the Industrial Revolution (von Drachenfels 23). The Industrial Revolution brought a wave of unprecedented prosperity resulting in many households having the wealth to employ help to cook and serve multi-course meals. However, the deterioration of formal dining began in the twentieth century with World War I as more working opportunities in munition factories and offices arose which made household help harder to find. In addition, the Great Depression that followed made it even harder to afford help, therefore solidifying the idea of informal dining. Further deterioration of the traditional dining experience followed during and after World War II when servicemen returned, and people needed to conserve costs. As a result, it made no sense to retain the construct of a dining room and instead, a "space at the end of the living room" (von Drachenfels 24) was reserved for dining.

Today, our increasingly busy lifestyle perpetuates informal dining simply because "most people neither have the time nor the inclination to entertain in a formal manner" (von Drachenfels 26). Instead, more of us are eating alone because more of us are choosing to live alone (Spence 130). As a society, we are growing more isolated, and government-mandated lockdowns during the COVID-19 pandemic only strongly highlight the need for us to bring back human connection within our society. The solo dining that is occurring more these days has "a negative impact on people's physical and mental well-being" (Spence 131), and this needs to change because, as mentioned at the beginning of this section, dining is social. Therefore, the opportunity arises to relook at our current dining culture to bring back the socially engaging elements.

As nourishment is still a daily ritual, over a prolonged time, the process can become repetitive. What makes the dining experience novel is a change to the experience. This could be eating with new people, eating new kinds of food, special occasions, and new sensory experiences. Restaurants are recognising that dining is beyond just food, they are selling consumers an experience, and therefore there have been more experiments in enhancing the dining experience through a multi-sensorial experience (Spence 200). Two notable examples would be when playing ocean noises can elevate the taste of oysters, and playing "sounds of the English summertime enhances the perceived fruitiness and freshness of strawberries" (Spence 208). However, in relation to home dining, the following case studies demonstrate methods to facilitate a sensorial experience when dining at home.

CASE STUDY: THE HISTORY TABLECLOTH

Fig. 5. The History Tablecloth, 2006, Photograph, Goldsmiths College, University of East Anglia, Lancaster University, https://research.gold.ac.uk/id/eprint/4719/1/p199-gaver.pdf.

This case study was a cross-university collaboration that seeks to alter the product engagement with a utilitarian product from a purely functional product to a product that facilitates open-ended interaction (Gaver, et al. 199). This project aimed to enhance an everyday household routine rather than disrupt it. The resulting product is a tablecloth made from "a flexible plastic substrate screen-printed with electroluminescent material printed to form a grid of lace-like elements" (Gaver, et al. 200). "When objects are left on the table, cells beneath them light to form a halo that glows over a period of hours, highlighting the flow of objects in the home" (Gaver, et al. 199). This prototype was tested in a volunteer household for a period of four months, where the owners were given limited but basic information about the product in order for the research team to gain insights into the artefact experience in context (Gaver, et al. 204 - 205). Despite being in a singular household, it was recorded that more than 20 people interacted with the object.

The findings of this case study were positive; the owners of the household, identified as G and B, felt that the prototype did enhance their home. Firstly, they liked that the tablecloth was designed to integrate into people's lives rather than the other way round (Gaver, et al. 207). Secondly, a favourable comment was made about the light not fading instantly after the interaction, as an instant reaction would have made the user feel self-conscious as though it was reacting to a person's every move. The delayed reaction made it seem like the artefact had "a life of its own" (Gaver, et al. 207). Owners of the house "became sensitised to features of objects placed upon the table and their traffic through it, and how all of this impacted upon their interpretative appropriation of the Tablecloth." (205)

The case study demonstrates that there is further potential for interactive experiences through this kind of technology to be used in a dining setting. The fact that it illuminates in different places every time prolongs the novel experience and enriches the user's curiosity as to where the tablecloth remembers the placement of the objects. This does not mean that the novelty wouldn't wear off, but prolonging curiosity helps with sustained engagement.

This experience engages the visual and tactile senses. The tactility arises from the interaction when users place objects down on the table, and this action produces a visual reward through illumination. The owners' feedback suggests that there is a high potential for this product to foster positive emotional attachment because it creates the opportunity for users to undergo all three phases of Norman's emotional attachment approach.

CASE STUDY: ACTUEATER

Fig. 6. ActuEater, 2008, Photograph, https://saranabil.com/pages/ActuEater.html.

Similarly, ActuEater is another cross-university collaborative research project that aims to enhance the interaction with an everyday artefact. In this case, the artefact is a table runner used on a dining table with incorporated shape-changing interfaces. This investigation aimed to make the dining space more interactive and take this as a design opportunity to explore new aesthetics. (Nabil, et al. 327) Two prototypes, ActuEater 1 and ActuEater 2, were developed and tested to see if "digital technology should or could be used to change and/or enhance the eating experience." (Nabil, S. et al. 328) In both prototypes, ShapeClips were repurposed to create the table runner's ability to offer "dynamic and customisable shape-changing" (Nabil, S. et al. 329). The aim of ActuEater 1 was "to allow for discoverability" (Nabil, S. et al. 330) and to facilitate that, an animated wave motion was created based on the number of people that participated in the tactile interaction with ActuEater 1. This prototype provided an understanding of the need to further develop the user interaction experience and the aesthetic, which led to the development of ActuEater 2. ActuEater 2 has the ability to "change shape more subtly, slowly and silently, which makes the whole experience more organic and less mechanical" (Nabil, et al. 331).

This is another project that demonstrates the use of technology to foster interaction and arouse curiosity during a dining experience. Again, this case study illustrates the potential of introducing interaction to a dining experience, in particular, through a decorative artefact. The commonality between the previous case study and ActuEater is that the products aroused participants' curiosity to discover what more they could get out of the experience they were presented with. The experience was different enough that it was novel, and there was enough room for discovery. It also reflects that an everyday artefact we may disregard as purely decorative and lacking novelty has the potential to be enhanced to increase user engagement, in this instance, through technology.

However, within these two case studies, the product itself moves and changes with participants putting in minimal effort. This infers there is room for further facilitation of haptic experience to transform participants' curiosity into a deeper memory in a home environment. These case studies focus on the interaction users have with everyday objects in a dining environment and suggest a reassessment of our relationship with everyday objects. This means there is a potential for altering our informal dining experience.

CASE STUDY: EATSY

Fig. 7. Lim, Jexter. EATSY, 2020, Photograph, designboom, https://www.designboom.com/design/eatsy-tableware-aid-visually-impaired-07-14-2020/.

Eatsy by Jexter Lim is a set of tableware consisting of a plate, bowl, cup and utensils designed for the visually impaired (Azzarello). The designer has added food-safe silicone flaps to the rims of the tableware and silicone at the ends of the utensils as textures to guide the visually impaired. Visually impaired individuals rely heavily on senses such as hearing and touch. Hence, the addition of the silicone flaps aids users in three different ways; how to scoop food onto utensils, direct the users where to drink and pour the liquid and prevent mishandling with the use of silicone.

This case study demonstrates the value of one material, silicone, in creating tactile differences in order to communicate function. In addition, Lim's quote, "dining is something that we usually take for granted," was inspiring for this project because it reminds us that daily interactions can be different when we lose an ability. This study reflects increasing the tactile experience of a piece of tableware that people interact with daily can be a communication tool for a product's function.

Current multi-sensorial dining experiences focus primarily on enhancing the flavour of the food or the dining experience of eating out. Examples would be; Ben Houge's innovative sonic installation (Spence 209) and the sensory spoon that tries to enhance the taste and flavour of the food (Spence 95). In terms of tableware in a home environment, the research looks more closely into the product experience between people and products rather than the whole dining experience. As presented in the History Tablecloth and ActuEater, the use of technology to enhance the dining experience has the potential for further research, but I decided against exploring that avenue because technology can distract the users from the core experience (Spence & Piqueras-Fiszman 6). Eatsy is an example that technology is not necessarily a requirement to enhance a dining experience. The heightening of our senses can be effective in providing an enriching experience.

CASE STUDY: SUZUGAMI

Fig. 8. Suzugami, N.d., Photograph, Shokunin, https://www.shokunin.com/en/syouryu/#:~:text=Suzugami%20is%20an%20item%20that,compressed%20and%20extended%20many%20times.

Suzugami by Syouryu is a set of flexible plates made from tin "that can be moulded and shaped like origami" (Rodriguez) in many different ways. Its malleable property allows it to be unfolded and flattened using a Koro, a rolling pin, to return the plate to its original form. Its reusability is due to the crafting of the product where "each tin piece is repeatedly compressed, extended and rhythmically hammered, so it won't wear down after each use" (Rodriguez). This case study illustrates a potential material for this project.

This product's ability to be folded in multiple ways and retain structure creates a balance between creativity, fun and structural stability for the product to serve its function. It demonstrates that the manipulation of the tin sheet strengthens malleability.

The material's qualities and food-safe properties create potential opportunities in this project. On the other hand, this tableware requires an added accessory, a rolling pin, impeding ease of use being separate from each other. The added limitation to Suzugami would be that it doesn't fully explore multi-use functional aspects of the product. It can only create a shallow enclosed vessel but would not be able to create a deep enclosed food vessel like a bowl.

In comparison to the History tablecloth study and the ActuEater project, Suzugami solely focuses on tactile interaction without the distraction of technology. The focus allows users to discover the product more through touching and bending it in various directions. It creates an intimate interaction between hand and product, something that I would like to bring into the experience of my product. In comparison to Eatsy, where both have tactile experiences, Suzugami affords more play and creativity.

CASE STUDY: GAMIFICATION OF TABLEWARE TO INSTIL HEALTHY EATING HABITS IN CHILDREN

In addition to the case studies presented, two more research projects: EducaTableware and FunEat, are worth mentioning because they illustrate elements of fun with a sensory interaction to create a positive experience and encourage healthy eating habits for children.

EducaTableware is computer-augmented tableware that is embedded into a fork-looking device that will provide audio feedback when users are eating with it (Kadomura, A. et al.). This gamification approach was successful because children were eating more food they disliked as a result of their interaction to trigger sound-emitting feedback. Similarly, FunEat aimed to encourage healthy eating habits through a dinner plate system with technology that guides children through an interactive animation (Zhao). Both these examples alter the dining ritual and use technology to stimulate sensorial interaction. These projects highlighting tableware with sensorial elements can heighten an experience, making it positive and memorable. As mentioned, technology has the potential to be distracting therefore, the sensorial interaction and elements of play are what I choose to take from these two case studies. Play is often associated with children, just as these case studies have demonstrated. However, I would like to bring these elements of play through physical interaction with tableware as a way to initiate positive experiences for a range of people.

THE TACTILE EXPERIENCE

Our skin is the largest organ (Schifferstein 53) therefore, touch is the first sense that initiates our engagement and understanding of the world (Schifferstein 41). We touch and feel as babies before we fully develop sight, hearing and taste. Therefore, it is touch that serves as a vital guide to sensory interaction. It informs us about what is safe and lets us know how to feel. As this project is seeking a design for emotions approach, it is only natural that the tactile experience needs to be explored.

Tactile perception is based upon movement, and this provides various types of interactions (Schifferstein 46). These movements and interactions aid in establishing emotions, and the combination of all three leads to our understanding of an experience. A tactile experience is unique for an individual because there will be inaccuracies when verbalising feelings and sensations. This is what drew me to this sense with the aim to enhance emotive experience and connections.

Smell and taste are often the senses that are believed to be crucial to eating, but in a dining experience, tactility is just as important. There are many variables that can cause the success and failure of a tactile experience within the dining area. Texture, weight, and temperature are various forms of the tactile experience and provide stimuli responses. Texture informs consumers about the kind and quality of the food, which can alter an experience (Spence 105). A recent study reflected that people found ginger biscuits spicier "when served from a rough plate than from a more traditional smooth plate" (Spence 106 - 107). The weight of a bowl in your hand affects your value perception, with evidence suggesting heavier bowls provide users with more satisfaction (Spence 106).

In addition, the warmth felt when hot food is placed in a bowl or when a warm drink is in a cup provides a "friendlier" and welcoming feeling (Spence 106-107). The combination of the warmth, weight and texture of a bowl can stimulate an attachment because it provides a reassuring feeling to the user (Spence 106).

In relation to Norman's design for emotions approach, predominant tablewares trigger mainly the visceral and behavioural phases. Case studies like EATSY, EducaTableware, and FunEat suggest that activating the senses can alter our dining ritual. This alteration makes the experience novel which will allow users to go through Norman's behavioural and reflective phase more easily. The heightened sensation it brings to individuals provides opportunities to activate participation with tableware in order to facilitate emotional attachment.

OPPORTUNITY

Emotions and experience are interconnected, which makes them a natural topic of exploration in relation to facilitating a positive emotional attachment with a product. Dining is a fundamental part of our day-to-day life, and over time, dining experience and etiquette evolve. This daily ritual, with a higher potential of becoming mundane, presents an opportunity through design to become more meaningful by incorporating the intentions of designing with emotions to engage our senses. Dining is often regarded as involving smell, taste and sight, while touch is more of a functional aspect. Therefore, there is an opportunity to view the significance of touch from a different perspective, enhancing its current functionality by designing tactile elements that will ignite curiosity and discovery of the product. This project is an attempt to use touch to stimulate the emotional attachment between people and products using Norman's designing for emotions approach.

DESIGN RESPONSE

METHOD

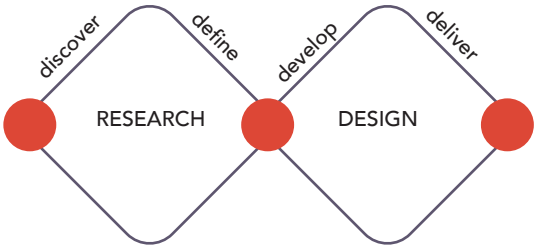


Fig. 9. The Double Diamond diagram from The Design Council UK.

The double diamond is the process model used for this project because it best communicates the divergent and convergent thinking used in this exploration. It consists of four main phases: Discover, Define, Develop and Deliver (Bell). The Discover and Define phase is the research and understanding of the problem. Develop is where potential solutions to the problem are being explored through prototyping and testing. Deliver is the delivery of the best solution.

This project looks at our current dining habits and seeks to understand how to introduce a new dining ritual. To find an opportunity, an inductive analysis was conducted in the Discover phase of the double diamond. Through observation of a dinner experience at home, it helped to pinpoint an area of the dinner experience to explore and accentuate the tactile experience. It also provides me with understanding to encourage users to move beyond the visceral and behavioural phases and into the reflective phase. After understanding the dining experience more fully, I began ideating multisensorial dining experience concepts in the Develop phase. I achieved this by alternating between 2D sketches and 3D model making to refine the chosen concept before using an experimental research method to create the material required for this project. Material explorations became an important part of this design research.

Sketching and 2D and 3D Model making

At a lower fidelity prototyping stage, sketching and 3D model making were used to develop the function of the product. It was also done in order to decide on the best material that I could use to achieve the form and function of the concept. During the developmental stage, 2D digital model making through CAD allowed me to quickly generate iterations and rapid prototyping before 3D model making that would inform me about the scale, weight and functionality of the product to create the product experience. Design development balances the functional versatility of the product, elegant aesthetics and facilitation of curiosity to participate in the product experience.

Material exploration

Thorough material exploration is undertaken to achieve the design criteria of the product. This is because currently, there isn't a food-safe material that will achieve the level of structure and flexibility stated in the design criteria. To experiment, all materials were made from off-the-shelf products due to accessibility to materials for prototyping. This will be elaborated on in the development section.

Fig. 10. Illustration of 28 initial concepts for a multi-sensorial dining experience.

INITIAL CONCEPTS

I began broadly ideating multi-sensorial ways in which people could interact within the dining space. Concepts ranged from engaging a specific sense to a variety of senses and concepts requiring either active or passive interactions (Fig. 10). Simultaneous with concept generation, I began to analyse our day-to-day dining experience, and once I had narrowed down the aspect of dining I would like to explore, I conducted a series of observations.

From the 28 initial concepts, the four concepts that stood out to me were: (#1) the placemat that produced unique sounds when specific tableware was placed on them, (#9) the Russian Doll tableware set, (#22) the dining table that allowed you to play retro games and (#21) the tableware that could be folded and flattened again. On reflection, these concepts involved interaction and stimulated two or more senses. They also have elements of discovery, play and opportunity to be conversation starters when with others. The strongest, however, was the tableware that could fold because it had functional value along with an aspect of creative tactile manipulation.

UNDERSTANDING THE DINING SPACE

I began to deepen my understanding of the sensorial touchpoints people make within the dining experience through analysing the process and activities of creating the experience (Fig. 11). Specifically, within a home environment, a full dining experience can be broken down into four essential parts: organising and planning, preparing and making the food, dining and cleaning up. As I reflected more on this process, I gravitated towards exploring the dining experience itself. As explored in the context review, the meaning and mode of dining have changed significantly due to our modern lifestyles. Today, we eat based upon necessity, as well as enjoyment. However, necessity does not necessarily mean the process is enjoyable. With repetition, the ritual can become mundane and facilitate negative emotions. In addition, if we think of the dining experience as a story, the dining section is the climax of the experience arc (Lupton 11) and can be experienced solo or with others. The range of potential touch points and interactions reflect possibilities of altering our current dining ritual to benefit the user.

Initially, I made a dinner observation within my flat to explore what our current dining experience was like. My flat consists of a mixture of three young female professional and postgraduate students who are 23 and 24 years old. The diagrams on the following pages illustrate this observation (Fig.12 - 13).

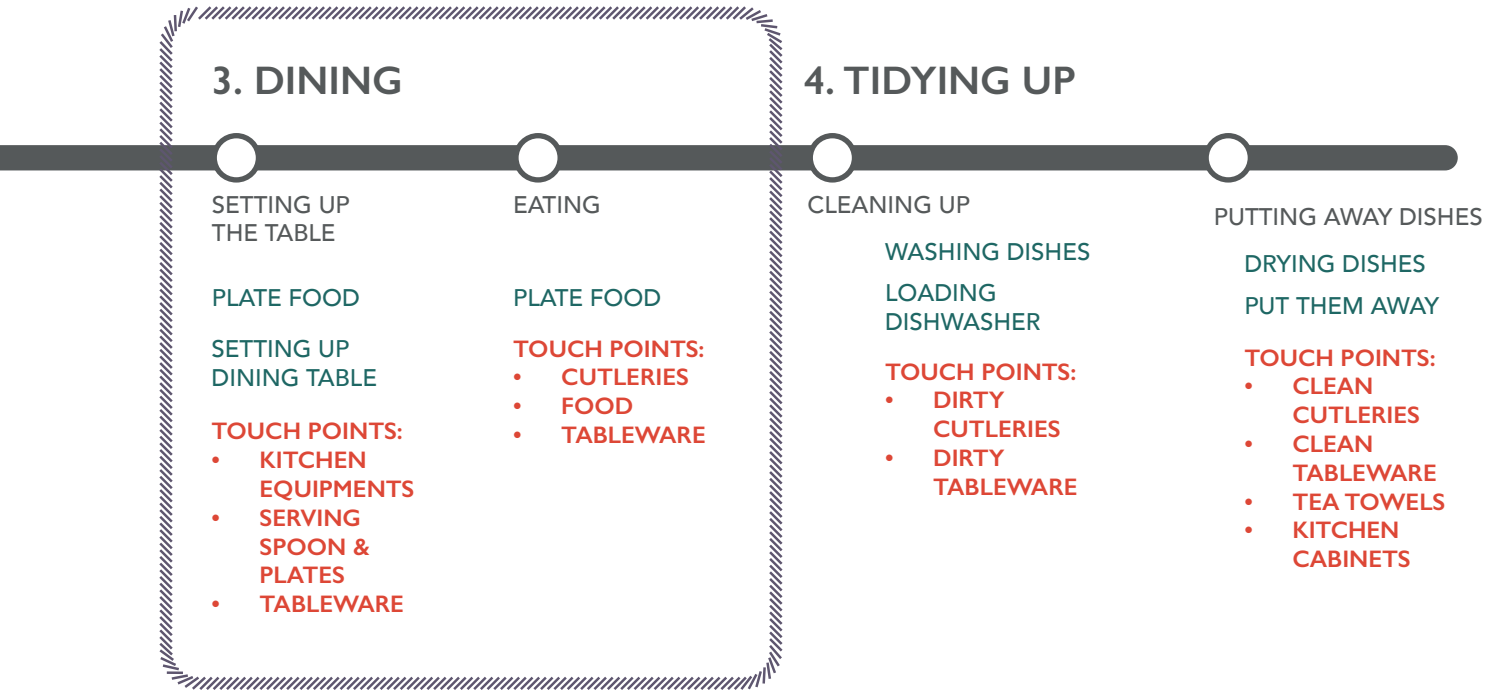


Fig. 11. Diagram showing analysis of a dining experience.

DINING AT HOME ON AN ORDINARY DAY

1. Plating the meal

2. Cutting into bite sized pieces. Fork used to anchor whilst knife cuts the piece.

3. Eating. The fork punctures food so its easier to move into mouth.

4. Resting position of hands whilst chewing.

5. After swallowing food, cutting more bite sized pieces.

6. Repeat of steps 2, 3 and 4, until all food has been eaten or until user is full.

*noticing the person eating uses knife to also help hold food in place so that food gets punctured by fork.

* Varying food combination on fork reflecting despite food arranged in sections, person eats it together rather than separately.

* Resting position again whilst chewing.

*Last mouthful

7. Finished eating, inedible food gets put in the rubbish/ compost and tableware and server get put in dishwasher

1. Scooping out ice cream with spoon.

2. Unloading ice cream into bowl.

3. Getting more ice cream with spoon.

4. Unloading more ice cream into bowl.

5. Pushing ice cream against bowl so ice cream can be on spoon.

6. Ice cream.

DINING AT HOME VARIATIONS

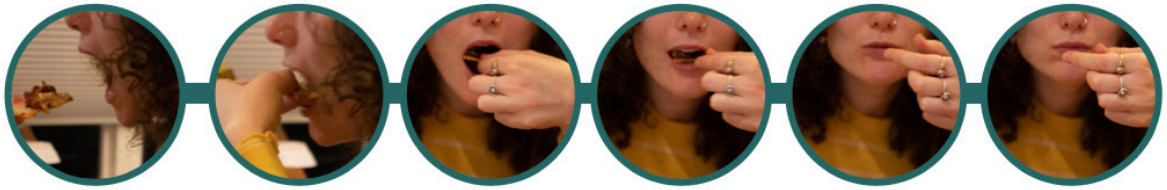
VARIATION 1

1. Plating the meal

2. Making food bite sized.

*Notice that this person is using a combination of hand and fork. The fork this time is shovelling the food on to the chips.

3. Eating. This time the hand is the utensil.



Sequence of images showing the action touch points: food in hand, followed by food in mouth.

Fig. 12. Storyboard sequence of dining observation.

Fig. 13. Variation of dining sequence shown through storyboard.

My dining observation reflects that the choice of tableware and cutlery for an ordinary dinner is predominantly functional. Plates were chosen if the food was more spread out and requires cutting. Bowls were chosen to prevent the food from spilling out, and if the user only wanted to use one piece of cutlery, they could still scoop or puncture the food with the help of the side of the bowl. In addition, working as a kitchen assistant during my studies, observing customers eating at a cafe further enforced the idea that tableware serves a functional purpose rather than facilitating an emotional attachment. Customers were often initially intrigued by the plating of the meal through sight, but the novelty soon disappeared when eating, and customers were more engaged with the interaction they were having with others at the table rather than the tableware itself.

CHOSEN CONCEPT TO DEVELOP

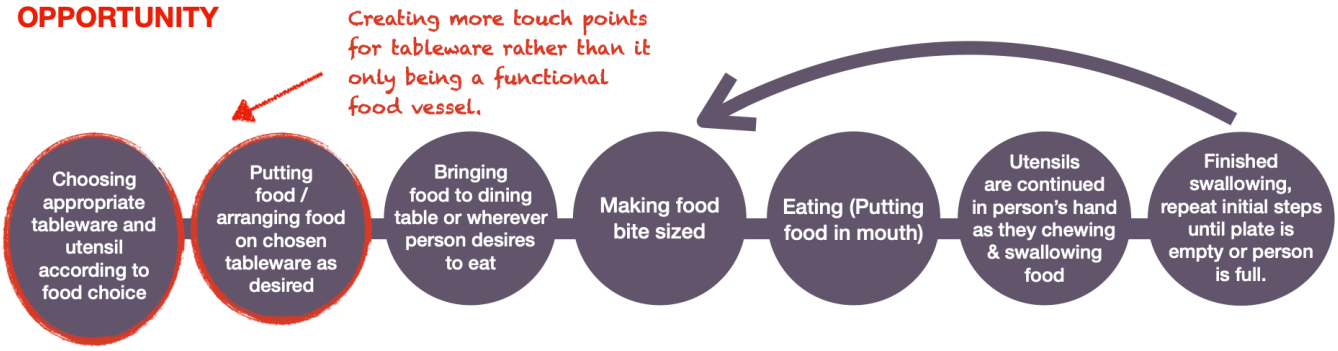


Fig. 14. Diagram illustrating design opportunity.

The chosen concept was a vessel that changes from something flat like a plate to an enclosed vessel like a bowl. It has the capacity to bend in a variety of ways but still fulfils the traditional function of being a plate or a bowl, as desired by the user. The variety of bends allows for users to interact and discover both the material and the product form. It provides users with a chance for more time with the product, allowing the potential activation of the haptic and visual senses to evoke emotions. The combination of the senses and emotions allows for the processing of the experience to go through Norman's visceral, behavioural and reflective phases (Lupton 63). Through prototyping, the variety of bends creates multiple aesthetic forms, and while each form will not necessarily be like the next, the vessel will still have the ability to return to a relatively flat original shape.

This vessel will be an addition to our dinner experience, sitting between the meal preparation and consumption phases, altering a recurring habit and becoming a new ritual. It disrupts the current dining experience by adding a necessary tactile-driven task to facilitate discovery, play, and decision-making prior to eating. The added experience serves as a functional aspect of the product as well so that users can shape their tableware to what is required for the types of food that is prepared for the meal. This provides users with choices for how they would like to configure their tableware whilst allowing users to be creative and use their imagination for how to achieve their desired shape. The ultimate goal is to facilitate tactile interaction, as well as conversations between people at a dining table.

DESIGN CRITERIA

Reflection from my dining observation led to the development of initial design criteria for my concept.

Product Criteria

Made of a material that is:

- Flexible (Able to bend to shape)
- Able to accommodate for hot and cold food
- Non-porous
- Able to accommodate different food types (Eg. From solid to more fluid & liquid food)
- Able to withstand structure - for when cutlery leans against the edge
- Malleable (Pliable) enough for a wide range of people

- Visually, 'gently' guide users on how to use product
- Product should not be too light that it tips over when no weight is in it but not too heavy. Similar weight to current tableware.

Product Aesthetic Criteria

- Fits a contemporary dining space
- Shows the wire structure if the wire pattern enhances the aesthetics, otherwise hide the wires
- Not too many colours
- Simple, clean
- Should visually look cohesive when multiple products are on the table
- Fluid & organic
- Visually compliments the food

Experience Criteria

- Encourage creativity
- Recognisable as a plate / bowl
- Easy to use
- Easy to clean
- Easy to store

The chosen concept presents the opportunity to explore materials in depth in order to achieve the final product.

PROTOTYPING

Fig. 15. Flexible material created with tie wire and duct tape.

To achieve my concept, 3D prototyping was my method of choice to begin research. The movement aspect of this concept was essential. Therefore, I wanted to use materials to create low-fidelity prototypes of how my concept will function. To achieve this, I laminated galvanised steel utility wire with duct tape to simulate the waterproof quality that the tableware will have and the flexible and structural capabilities. The outcome allowed me to bend the form into various directions and shapes. I began to understand the limitations in terms of the directional stretch from the duct tape and wire movement in certain directions if there wasn't adhesive to prevent it.

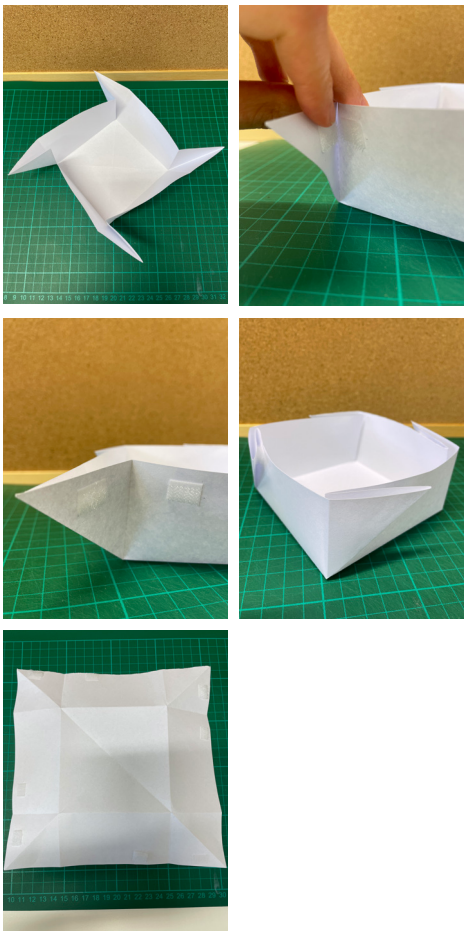


Fig. 16. Velcro prototype.

The prototypes in figures 16 and 17 attempted to explore various methods of securing a flat piece into an enclosed vessel. Methods considered were magnets, velcro, string, and an exterior metal skeleton. The velcro prototype (Fig. 16) was also used to simulate the magnet idea. When comparing the experience between the metal wire and duct tape, and the various methods of securing, the latter is restrictive in terms of creativity and doesn't provide users with the freedom to transform the product into any shape they wish. It was restricted in form from flat to enclosed. The additional materials such as magnets, velcro, and string also feel very utilitarian and are not common materials associated with dining and food. This lacks the warmth of the experience that I would like to provide in my design. The restricted and controlled nature of these prototypes also illustrated a lack of creative opportunity for the user.

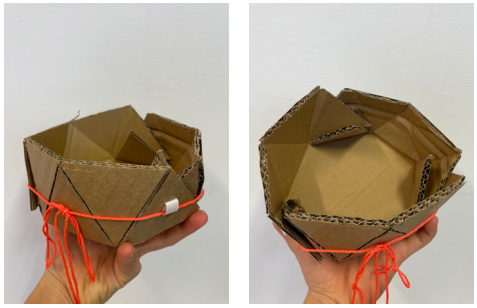


Fig. 17. String prototype.

After my initial understanding of the low fidelity wire and duct tape materials, I wanted to discover the possibilities and limitations of this malleable sheet material in terms of the silhouette and form and the levels of rigidity for the structure. The following images reflect my experimentation.

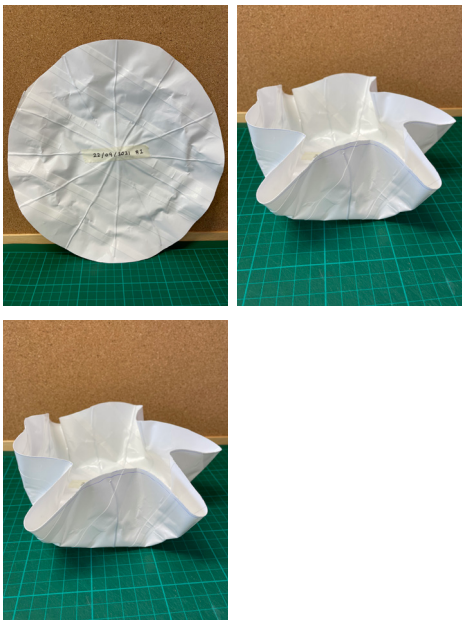


Fig. 18. Prototype 1.

The prototype in figure 18 showed a high level of pliability as well as rigidity in maintaining structure. It allowed the manipulation of a variety of silhouettes. I found the wire laminated with duct tape encouraged and engaged users to interact and bend its shape. The capacity of the wire to retain its structure provided less frustration if a user created the desired form and the product returned to its original state immediately after creation. Therefore, this became the continued method of low-fidelity prototyping.

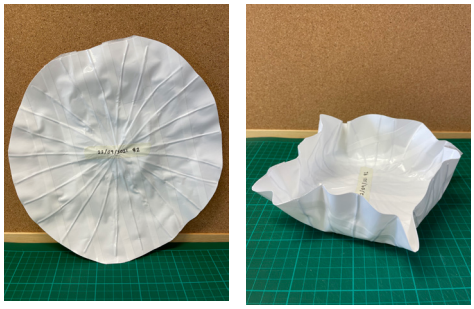


Fig. 19. Prototype with more wires.

The number and placement of wires were tested with respect to rigidity and pliability with multiple samples. The two images on the top right are examples to test the difference in behaviour if the metal wires were not joined at the centre. However, this concept was not carried forward at this point because having a hard centre limited the number of configurations. My next phase of exploration looked into various metal configurations and potential segments for users to partition different types of food.

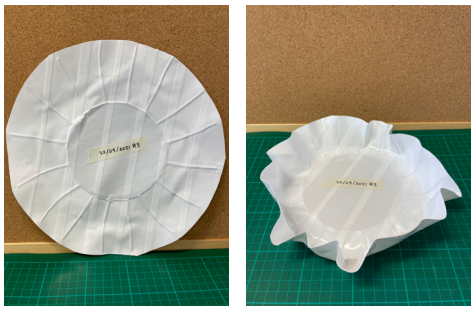


Fig. 20. Prototype where wires do not join at centre.

Fig. 21. Prototype varied wire configuration.

Figure 21 and 22 prototypes show different wire configurations attempting to create segments to partition a meal. From these prototypes, it reflected that it was difficult to create segments from the wire structure due to the one-direction stretch of the duct tape. Therefore to create segmentation, I did the following prototypes with an additional method, using the tape as a hinge shown in figure 23.

Fig. 22. Prototype with hexagon and web wire configurations.

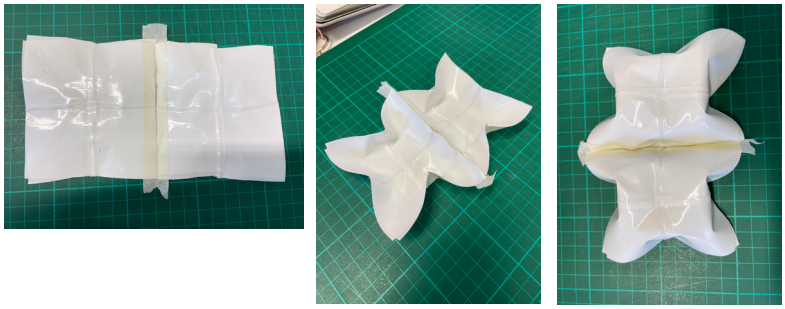


Fig. 23. Prototype creating segments using a hinge.

Fig. 24. Adding more segments to test form.

Fig. 25. Another segmented prototype.

The segmented prototypes, as shown in figures 23, 24, and 25, conveyed that despite their flexibility, they were visually and physically restrictive. It was decided not to produce segmentations in my product because this prototype illustrated a limitation for users to be creative.

These prototypes explored having a hard centre so that the product might be more functional in terms of users being able to cut food on this vessel. To prototype, I used cardboard to demonstrate shape variations, as illustrated in figure 26 and 27. Despite being more functional, this appeared to restrict flexibility in creativity and play. Thus, discontinuing this direction of exploration.

Fig. 26. Prototype with hard centre.

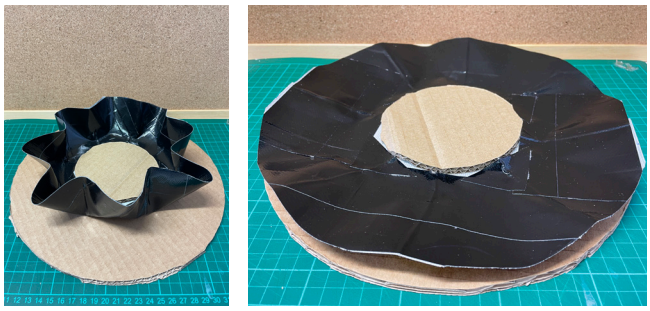


Fig. 27. Prototype with hard base and centre.

The use of duct tape and wire material was useful for initial tests but did show limitations. The two materials behaved differently in relation to each other, and the wires moved independently, causing problems for relevant analysis. If not held down securely, the wires moved out of shape. Therefore, I began to look into making higher fidelity prototypes with the decision to resolve the materials that fitted the criteria for final prototyping.

DEVELOPMENT

Refined design criteria

The refined design criterias were established in terms of function, aesthetic and experience, based upon the understanding of the low fidelity prototypes.

Function

This vessel needs to be made of a food-safe, pliable material that can accommodate different hot and cold food types, varying in viscosity. It also needs to be structurally stable to be able to withstand weight from cutleries leaning against the edge. It will also give users a sense of security in using the product.

Aesthetic

The aesthetic of this product should be simple and clean so that it visually complements the food as well as the contemporary dining spaces. If visual texture is added, it should be subtle and not impede with colour and the tactile texture. The colour should not be overly bright and overwhelming.

Experience

The appeal of the product should invite users to interact with it and encourage fun and creativity for the user to discover various forms they can create. It needs to be pliable for a variety of people, and the function of the vessel as both a plate and a bowl must be recognisable. There should be different textures, and users should have a pleasant haptic experience. Last but not least, it needs to be easy to clean and stacked for storage.

MATERIALS EXPLORATION

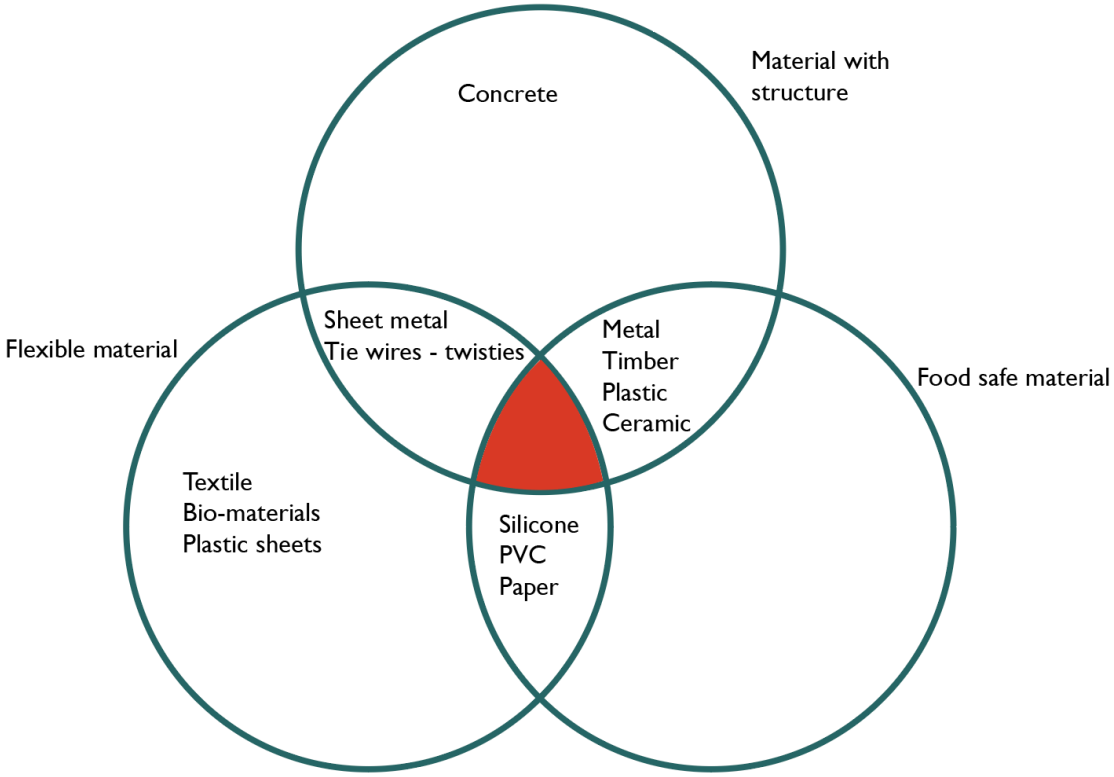


Fig. 28. Venn diagram reflecting current material and their propterties.

To fulfil the design criteria, a materials exploration was conducted to investigate available materials that were food safe, flexible and could enable structure, as shown in the Venn diagram (Fig. 28).

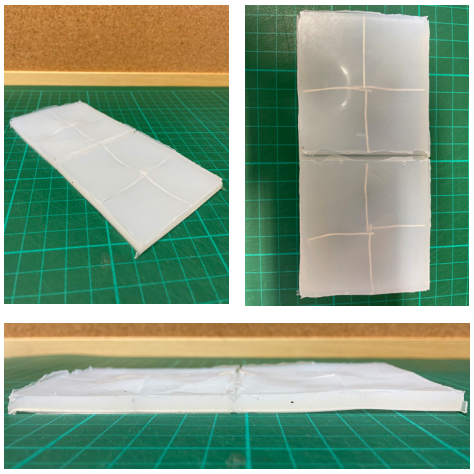
Through a process of elimination, the combination of silicone and metal was deemed the most appropriate to experiment with. 4D materials were considered as they have the ability to form shapes but with the aid of external factors such as heat. In relation to food, this would not be practical to create a bowl because it will lose its shape when hot liquid is poured into the material. Biomaterials were also researched and were not considered suitable due to their stage of experimental development. While having sustainable attributes, they were not chosen due to stability factors. Some biomaterials are able to biodegrade with heat and are not necessarily food safe.. Hence, they were disregarded at this stage of the project but could be investigated for future use.

Silicone is a flexible material that can be food safe. It can be cast into a variety of shapes and can have structure when it is of a higher grade of shore hardness. However, the higher the grade, the more silicone loses its ability to remain flexible. It is also not able to maintain a required level of structure unless it has been moulded into shape. Metal has ductility and malleability properties and will stay the same after bending without returning to its original form. Therefore, due to its malleability, metal was chosen as the secondary material to help silicone retain its structure.

Silicone and metal already have associations with dining. Silicone is mainly associated with bakeware, grips or baby tableware. It is able to withstand high temperatures, maintain its moulded shape whilst remaining flexible, and will not shatter when dropped. Metal is usually

associated with cutlery, pots and pans. This is due to metal's property of being able to conduct heat and being able to be sharpened to cut food. There are some pieces of tableware that are made from metal, but it is not as pleasant because of the sound produced when cutlery hits or scrapes the metal. It also naturally provides a cold sensation and will only be warm when conducting heat. For example, hot soup in metal bowls will make the bowl difficult to hold. Silicone's association with baby tableware means that this material might not be welcomed in an adult dining setting. Therefore, this project will aim to find the balance in creating value and beauty from the combination of silicone and metal.

The case study, Suzugami, inspired me to choose metal as one of the materials (Rodriguez). Suzugami illustrated the opportunity for metal to easily transform from a two-dimensional piece to a three-dimensional shape.



I opted for store-bought silicone and wire because they were accessible to make multiple experiments and prototypes. Dragon Skin Special Effect Silicone by Smooth-On was used because it behaved similarly to Smooth-On's food-safe silicone and was more cost-effective. The initial wire chosen was 0.9mm thick galvanised steel wire. Figure 29 shows the initial experiments of the combination of the material. This experiment demonstrated a user would be able to bend the metal and the silicone well to retain shape. The challenge was making sure the wire would not move out of place and puncture the silicone.

Fig. 29. Silicone and tie wire material trial.

Attempting to add functionality with hard material

Eating with a knife is inevitable because it is part of eating to cut large chunks of food into manageable bite-sized pieces. So adding a hard material to experiment with was an attempt to make the product more functional.

LAMINATING SILICONE WITH LASER CUT WOOD

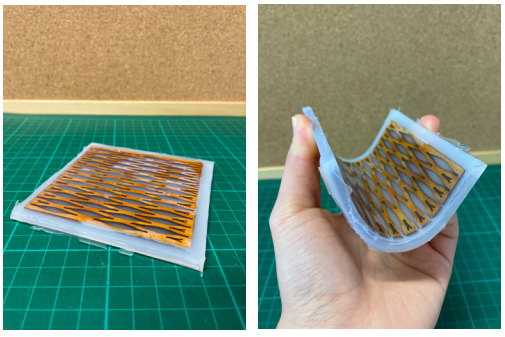


Fig. 30. Silicone with MDF material trial.

Figure 30 shows the attempt of incorporating wood as a hard material to help give silicone more structure and create a potential surface for cutting. The MDF wood was laser cut to make it flexible, but the holes created problems for food being lodged on the uneven surface. Therefore, silicone was used to fill the holes to make a smooth surface and alter the material to be waterproof and food safe. The silicone fulfilled its function in this material and moved well with the wood without tearing. However, this was not the desired outcome I would like to achieve because it was only flexible in one direction and was unable to hold a specific structure. Despite the wood preventing users from cutting the silicone beyond the wood, the knife still cuts into the silicone, causing crevasses where food can get stuck. Therefore alternative materials were considered for further exploration.

SILICONE, METAL WIRE AND AIR DRYING CERAMIC EXPLORATION

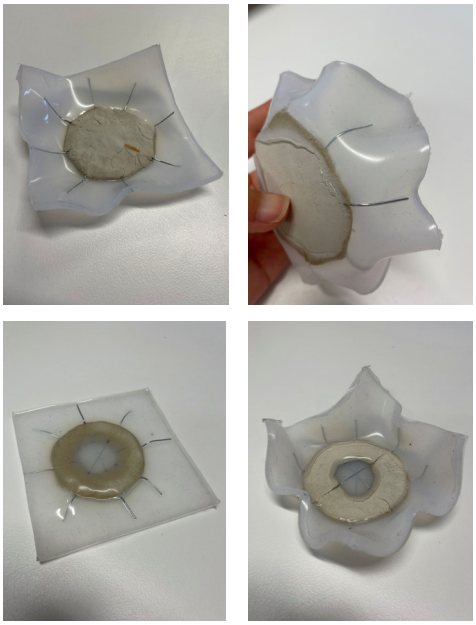


Fig. 31. Two material trials: one with a solid centre, another with a ring.

Ceramic was a material that I saw potential in combining with silicone and wire as a hard material. Ceramic is another material that already has strong associations with dining, and silicone needs a rough surface to grip. Silicone also has the ability to grip itself through co-moulding. Hence my attempt at combining these materials. Air Drying clay was used to test the possibility. However, air-drying clay is not ideal due to the time taken to dry and an even longer process when combined with silicone. This sample also demonstrated the water content from the clay causes the wire to rust, which would not be ideal for tableware. It also does not give the aesthetic appeal that typical ceramic tablewares have. However, the hollow-centred sample was more appealing due to the product looking less visually dense. This led to my experimentation with a kind of fire clay that is appropriate for a novice like me.

SILICONE, METAL WIRE AND TERRACOTTA CERAMIC EXPLORATION

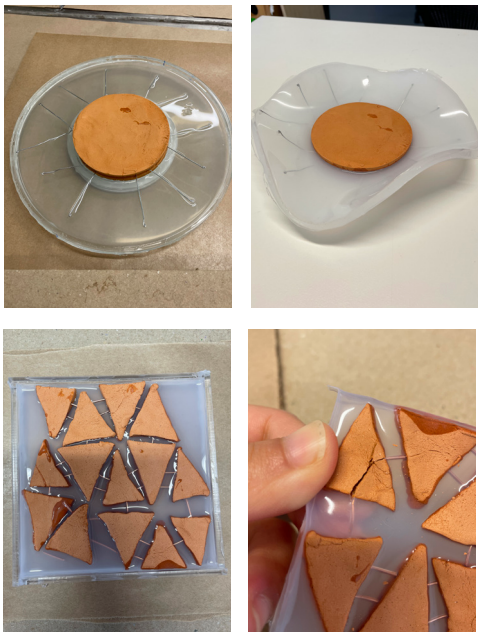


Fig. 32. Two silicone and ceramic material trials with different formations.

The images on the left (Fig. 32) show my various experiments with silicone, wire and bisque fired clay. Like the air drying clay experiments, silicone was able to grip well, and the wire was able to bend. However, the opportunities to bend in a variety of forms were limited, and the prototypes were brittle and cracked within a short span of time, making this not ideal for tableware.

Reflecting on my ceramic experimentations, adding a hard material was complicating the refinement process of this concept. I felt that it was focussing on the function aspect rather than on the user-to-product interaction. The weight difference between ceramic and silicone will make it easier to tear and also restrict the areas in which users are able to engage through touch. From this point onwards, I revisited silicone and metal and continued my experiment with only two materials.

Fig. 33. Array of samples showing different combinations of wire types, silicone shore hardness & thickness.

Extensive controlled experiments were carried out to narrow down the shore hardness and type of metal used. Figure 33 shows the experiments I created to test the tactile and flexibility factors. I experimented with silicone samples that are shore hardness 10 and 30 to test the flex difference. The wires used for this experiment were store-bought, ranging from 0.9mm to 1.6mm thick. The types were brass, copper, aluminium, galvanised steel and stainless steel. This experiment proved that the thicker wire was preferable for bending. 2mm diameter aluminium was the best with silicone. Therefore, after identifying aluminium as the metal of choice, experimentation followed to test the internal shape, in particular flat aluminium, to identify differences in the behaviour of the material. Samples from this experiment showed that samples with varied silicone thickness caused less strain on the silicone, reducing the chances of the wire tearing it. It also visually looked lighter and delicate around the edges, a feature incorporated into the aesthetic criteria.

This next set of experiments looked into flat aluminium. The samples below demonstrated that the preferred silicone and aluminium combination for both shore hardness 10 and 30 silicone was flat aluminium between 2-3mm width thick. This proved not too brittle or too difficult to bend. If it was too difficult to bend, it posed a higher risk for the aluminium to tear the silicone.

This led to my next stage of experimentation to find the correct gradient thickness of silicone for flat 2mm wire before I trialled a full-scale prototype.

Fig. 34. Experimenting with different thickness of silicone and filling the edges of aluminium.

This set of samples demonstrated that 2mm thick silicone on the side was best to compliment the 2mm width aluminium (Fig.34). The filing of the aluminium and rounding of the ends helped with not piercing the silicone (Fig.34). These samples also demonstrated that if the wire was situated perfectly in the middle, it would not easily puncture the silicone.

AESTHETIC DEVELOPMENT

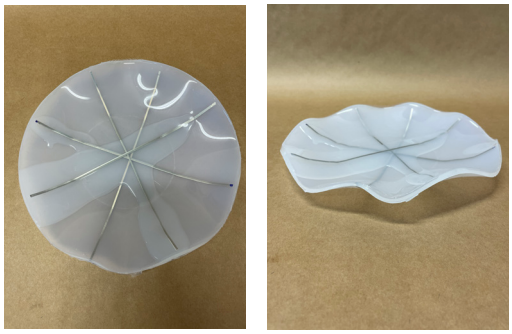


Fig. 35. First full scale prototype.

To assess the form of the design, I revisited the duct tape and wire prototypes to determine the pattern shape. From the earlier prototypes, I decided that the flattened shape would be circular because it would draw familiarity with current tableware. I felt that there needed to be a sense of familiarity to ease users' apprehension of a piece of tableware that will be made from the unusual material of silicone and aluminium. The shape of a circle was also more practical. When users enclose it, all the sides can be the same height. In addition, when the sides fold upwards, it creates a visually pleasing flow of undulating lines. The number of wires dictated the malleable shape and edge.

I experimented with five, six, seven and eight sides. Less than five sides made the structure seem insecure, and beyond eight sides, the material became more rigid and aesthetically overcrowded. Therefore, eight sides had the preferred balance between the aesthetic and structural integrity of the product. Users can shape the bowl to their own desirable aesthetic, drawing on their own individual associations.

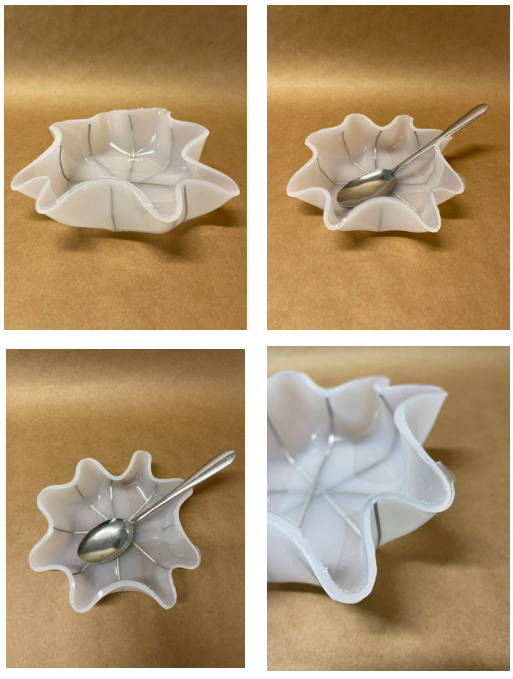


Fig. 36. Different angles and details of full scale prototype.

Figure 36 shows the first full-scale prototype using shore hardness 10 silicone and 2mm width and 0.9mm thick sheet aluminium. It reflected the function I wanted to achieve with the flat aluminium's ability to be malleable and sturdy enough to hold the shape of the silicone. At this stage, the silicone was found to be too thick and tacky to touch, which was thought unpleasant. Various experiments shown in fig. 34 suggested that 2mm or 3mm width of 0.9mm thick aluminium was preferable.

COLOUR AND FOOT DESIGN

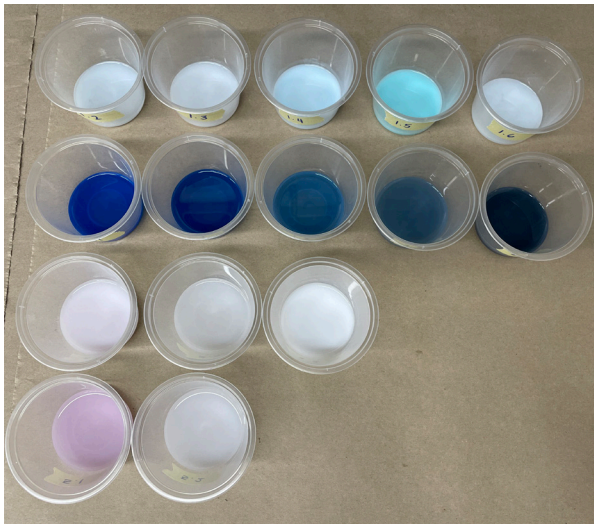


Fig. 37. Silicone colour experiments.

Most tableware is found to be white because the colour of plates influences our perception of the food we consume, including the intensity of the flavour (Spence et. al).

From the colour experiments in figure 37, I opted for a blue that had tints of grey and black because they were more neutral and could complement a wider variety of dining settings and existing dinnerware.

From the full-scale prototype shown in figure 36, I decided to have a top and bottom face of the vessel. This restricted the form options when bending the product but decreased the chances for the aluminium to work-harden quicker and snap. This decision led to a rounded/half semi-circle foot to balance the vessel.

TEXTURE

Fig. 38. Drawing texture with a whiteboard marker to trial texture aesthetics.

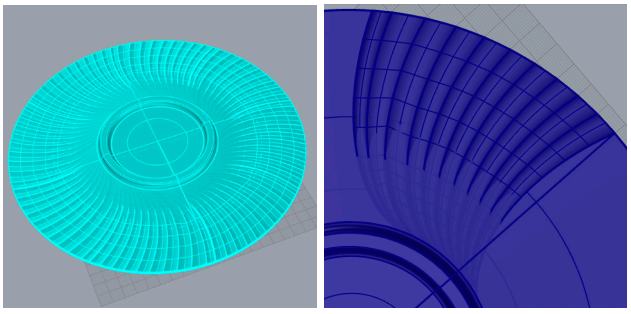


Fig. 39. Screenshot of CAD texture trials.

The intention to add texture was to visually guide the users to where the hidden metal is placed on eight sides as well as a tactile experience. The inclusion of a texture will visually change as shown in figure 38.

I used CAD (Fig. 39) to simulate the texture to assess the aesthetic and sampling for the tactile experience. I favoured the subtle texture that came from the PLA 3D prints for the final outcome.

REFINED PROTOTYPE AND FINAL DESIGN DECISIONS

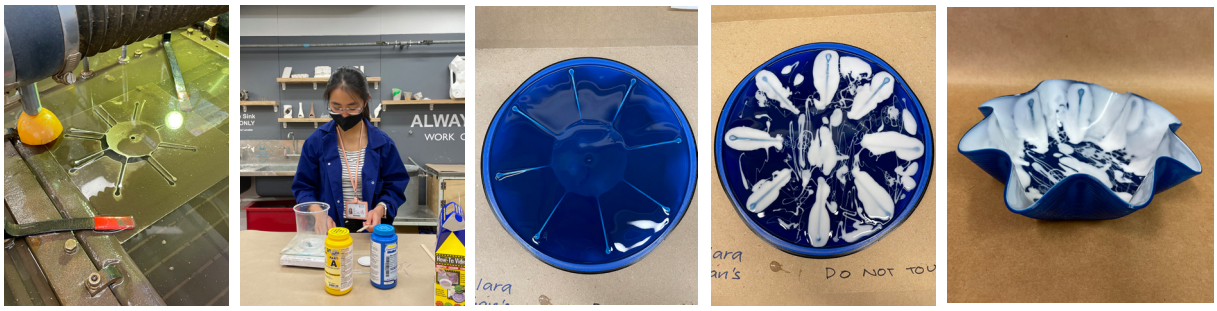


Fig. 40. Process of making refined prototype.

Fig. 41. Different angles of refined prototype.

The aim of the following prototype (Fig. 40 - 41) was to see a 1:1 scale prototype with a foot, the correct shore hardness and amount of silicone, potential colour and metal structure in order to understand the process of making the final model as well. The process required to make this model included waterjet cutting 0.9mm thick aluminium, and casting it with shore hardness 30 silicone.

This refined prototype was resolved to produce my final mould. It conveyed that the foot was the right size and the rounded edge complimented the curves created when manipulated into a bowl form. The hint of the metal structure added to the aesthetic of the current vessel, and the irregular duo colour areas make each casted vessel unique. I carried out further experiments with the vessel being a singular colour in shades that were opaque and translucent before determining the final colour. The texture from moulding in a 3D printed mould formulates a gentle flow that changes each time both visually and through tactility, which strongly correlates to my intentions. Despite designing the thin edge, this was too fragile, and this mould illustrated foreseeable issues of aluminium placement in the centre. To combat this, it was decided to make the silicone 1mm thicker and to add a location in the middle of the mould so the aluminium would rest in the middle. Afterward, the vessel was backfilled. I subsequently made the locators on the aluminium component purposefully designed because it will be visible.

DISHWASHER TEST

Cleaning is a necessary aspect of dining, and for convenience, many users will use the dishwasher. As silicone and metal in this project are physically joint rather than chemically combined, these materials are still independent. I wanted to make sure that the silicone would insulate the metal and prevent the metal from expanding, causing it to rip the silicone. This test proved a consistent result, with no discolouration and no extra tears or bends.

Fig. 42. Prototype in dishwasher.

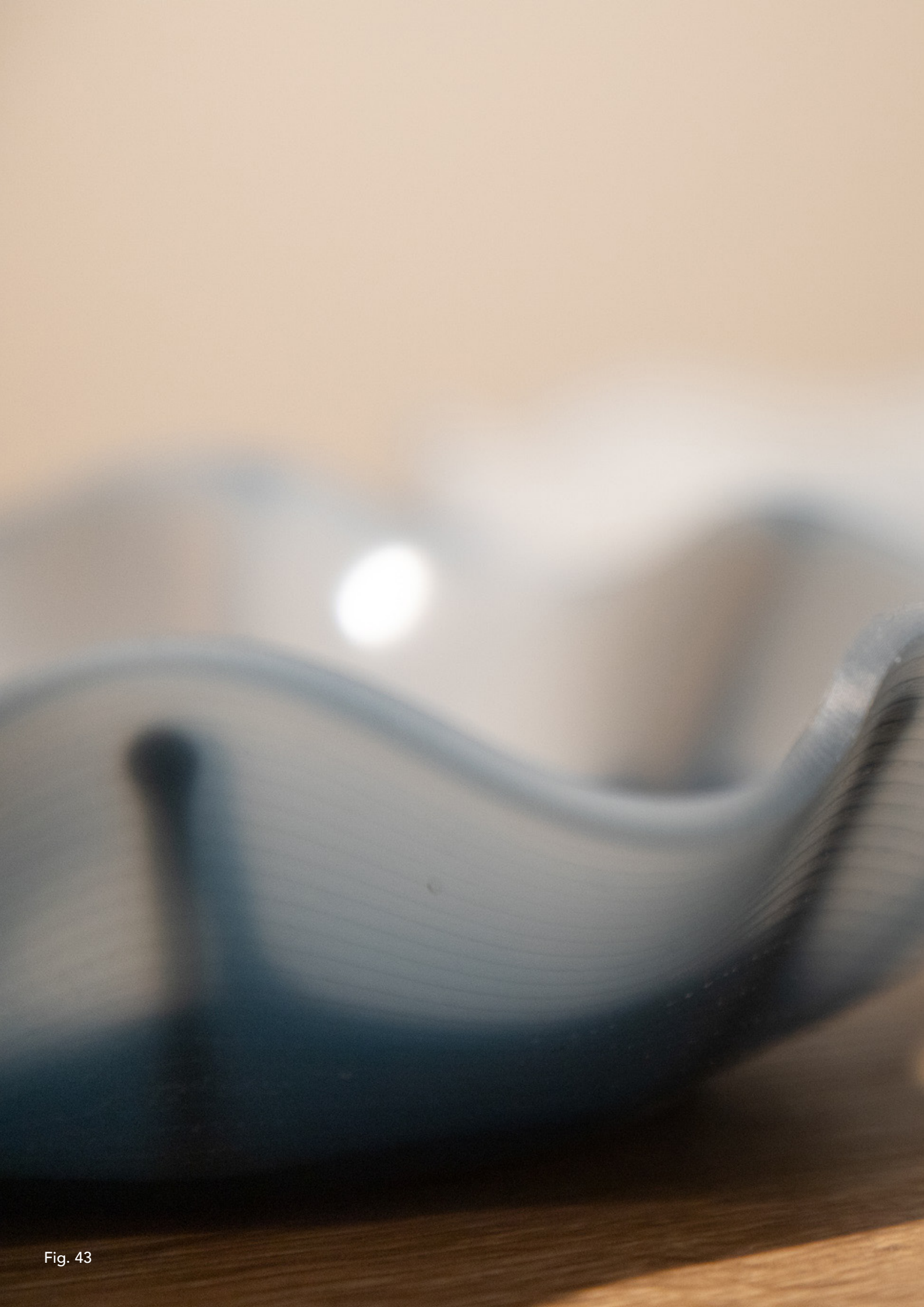


Fig. 43


BLOOM

Fig. 44

Bloom is a pliable food vessel with the ability to interchange between a flat plate-like vessel and an enclosed bowl-like vessel. Its flexible ability, made from food-safe materials, serves a functional purpose, allowing for users to bend the tableware to their desired shape depending on the food prepared; but also facilitates creativity and discoverability between user and product through an intimate tactile interaction.It comes in two different sizes, 270mm diameter and 180mm diameter, suitable for a variety of food items. It has a translucent coloured aesthetic with a glossy face and matte-finished bottom to mimic the elegance of glassware. The visibility of the metal structure allows users to visually understand the impact their bends are making on the product. This product can be experienced individually or in a group setting where it could foster communication and a shared experience at the dining table. This vessel is designed for people who are open-minded to new experiences in an informal dining setting. Bloom aims to demonstrate that the act of participating in a haptic experience will elevate our conscious interaction and create opportunities for the product experience to facilitate positive emotional attachment.

Fig. 45

Fig. 46

Fig. 47

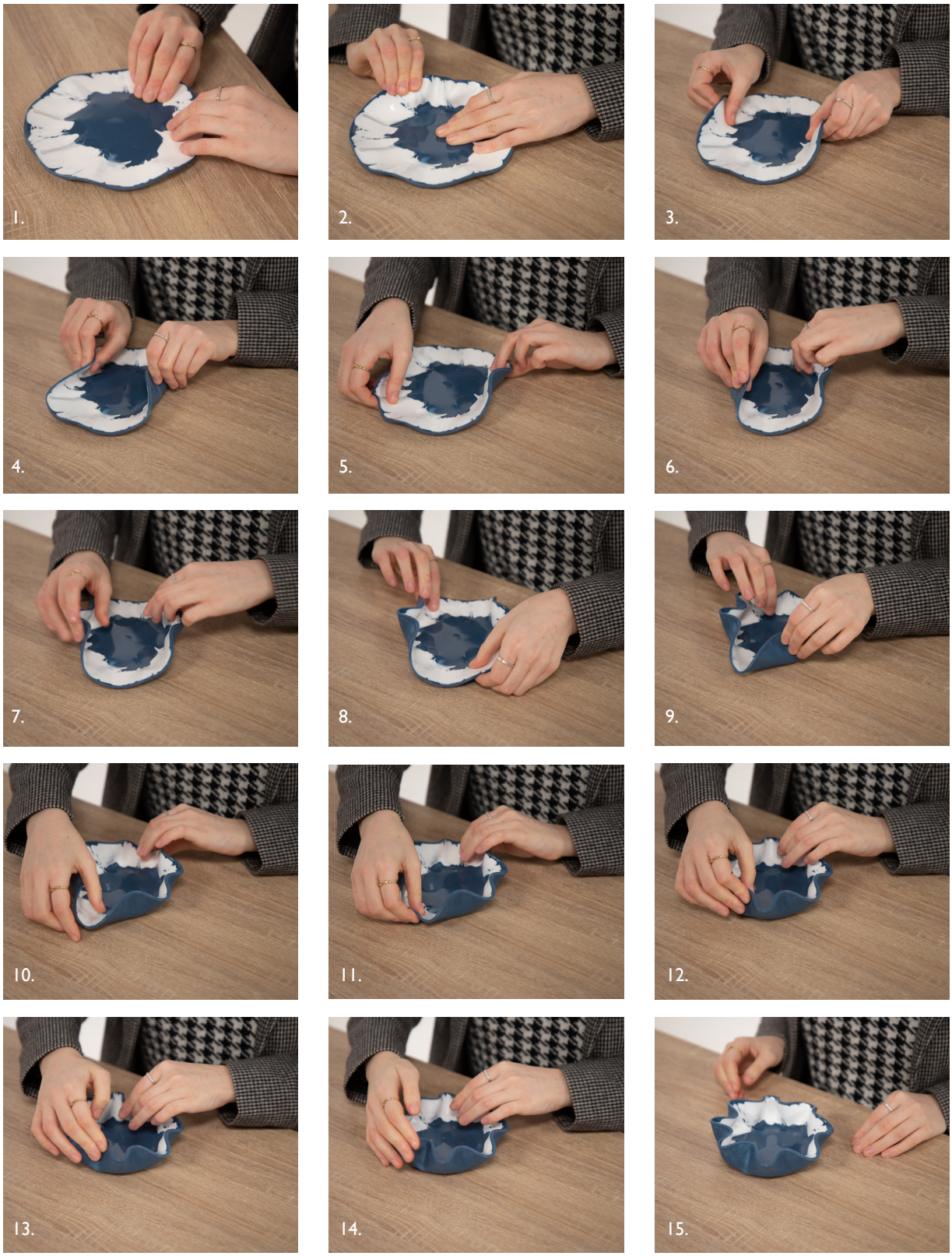


Fig. 48. Storyboard sequence of how Bloom becomes an enclosed vessel.

DESIGN CRITIQUE & TESTING

Fig. 49

Fig. 50

Informal testing was carried out with a small sample size of 15 participants who were postgraduate design classmates and peers between the ages of 22 to 30. The participants were asked to comment on the aesthetic appeal of the product, the tactile impact of the final prototype as well as the level of enjoyment and function. Common responses mentioned that the bowl's wavy lines give a "soft, organic, delicate look to a product that was glass or ceramic looking." Others have also stated, "the bowl is fun and beautiful to hold and touch," "[they] love the way it shivers and looks jelly-like," and "it feels like it belongs underwater." Many have remarked that the material choice versus the aesthetic outcome "had an element of surprise," which led to their curiosity to touch and interact with the product.

There have also been discussions on how convenient and pragmatic it can be to accommodate a versatile range of food types and even looks and feels sturdy enough to hold foods with viscosity. Bloom also "has potential applications to become bakeware or to be used as a product for inspiration to improve the current aesthetic of camping tableware." Even though the sample was limited in number, these informal discussions were positive and usefully validated my intent for the product; to ignite curiosity so that users would want to play, to invigorate reflection on their experience, and in a small group setting, encourage conversation.

Fig. 51

CONCLUSION

This design research explores how to facilitate positive emotional attachment to home tableware through a haptic experience. Our current interactions with tableware usually only address the visceral and behavioural phases of Norman's Designing for Emotions approach, as tableware is often seen as a purely functional product. Current tableware commonly targets the aesthetic, and usability and interaction are predictably the same. I discovered that altering the experience by disrupting the current dining experience may allow for positive, creative interactions and shared reflective states to happen. This project highlights that emotional attachment is a unique feeling for the user. Positive product bonds are unpredictable, but they can be facilitated through design with a considered understanding of emotional connection. Bloom, a pliable food vessel, became the design outcome for this exploration. Through inductive research and iterative design process, Bloom demonstrates that the intimate connection between a user's hand and the product not only facilitates the usability and function but provides users with the opportunity to create various forms to their own desire.

I learned through the design development the importance of extensive material exploration to meet my desired design criteria. This gave me the opportunity to understand the physical properties of silicone and aluminium so that I was able to cast and combine them to find a balance between material function, usability, tactile and visual appreciation. The unusual combination of silicone and aluminium for tableware illustrates the research potential for developing a flexible tableware material.

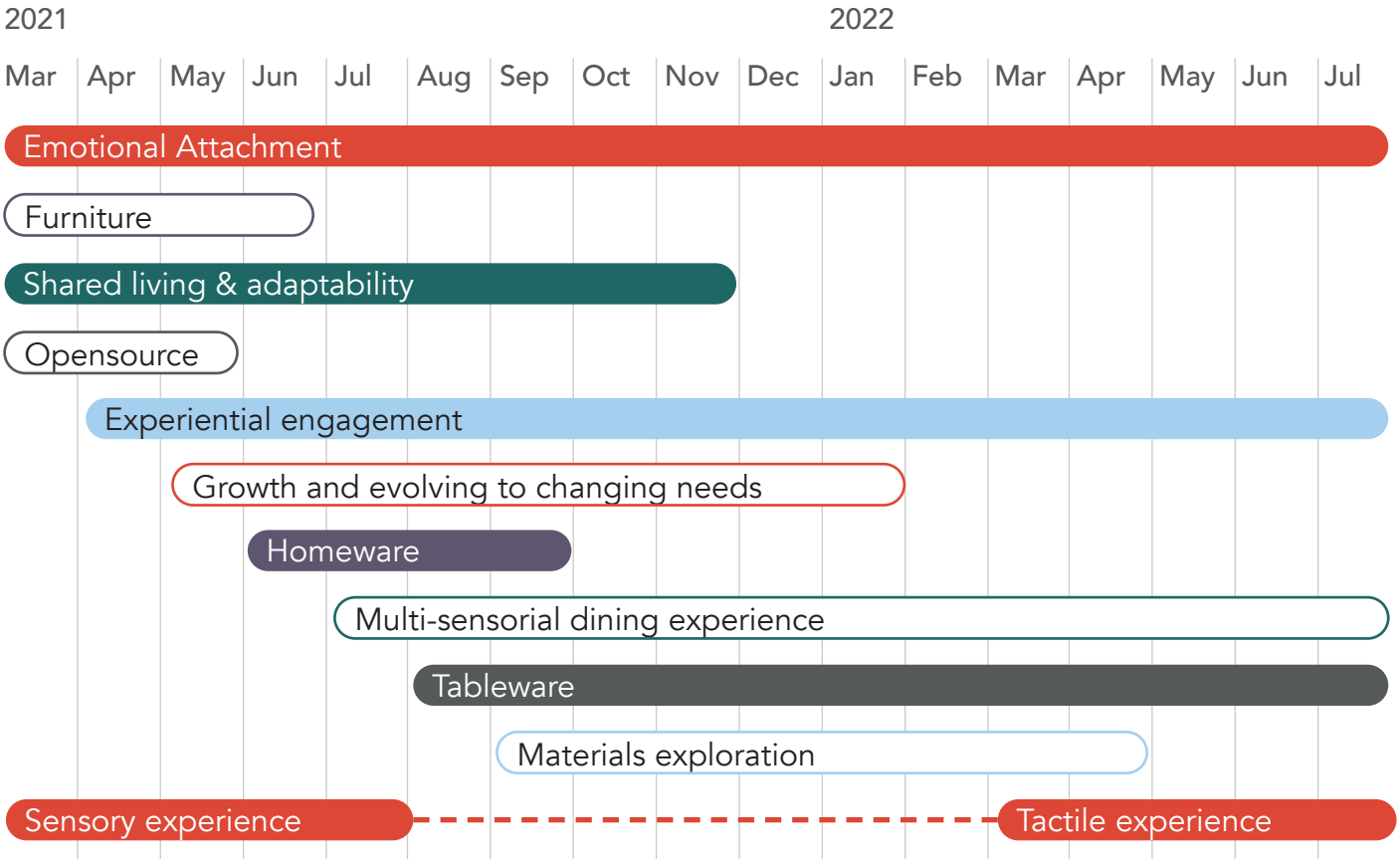
Bloom suggests one method of altering the dining ritual, but more experience design opportunities can be explored. This vessel is designed for users who seek a creative, fun, engaging and new dining experience. As discussed with the ActuEater and The History Tablecloth case studies, facilitating a tactile experience in tableware can offer emotional benefits for specific groups, and there are opportunities for further user-centred research in this area. By challenging conventional tableware, I hope that Bloom inspires future tableware innovations to enrich the dining experience with unprecedented designs.

Fig. 52

APPENDICES, WORK CITED & BIBLIOGRAPHY

DIAGRAM 1

Diagram 1 illustrates the topics that had been explored for this Masters of Design project.



PRESSURE TEST

In order to know how much force the silicone bowl would need to withstand, a pressure test was carried out to test the various pressures needed for food to be scooped onto the spoon. To achieve this, technicians at FabLab Wellington 3D printed a spoon with holes where a pressure sensor was able to be bolted on. Various viscosity of foods was trialled; cereal with milk, coleslaw, mashed potatoes and weetbix. Results proved that the weight when cutlery is pushing against the bowl to retrieve food is between 100g to 200g.

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