

# WASTED POTENTIAL

AN EXPLORATION INTO FOOD WASTE

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**Field:**

Industrial Design

**Main Theme**

The exploration of potential prevention and disposal methods of food waste and people's willingness to put effort in to change habits

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Institute of Design

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This project follows NSD guidelines.

Names and information of participants have been anonymised accordingly.

Unless stated, the illustrations and images used are my own.



# Abstract

Initial research made very clear the huge opportunity surrounding food waste to either reduce the amount produced or make better use of the waste itself. Several concepts and methods were explored to address this challenge, from product focused solutions to the inclusion of a service. The aim was to improve the users' relationship with food and encourage a behavioural shift to lower their waste's impact.

How could products influence users to adopt a more sustainable approach to food waste?

The project's line of enquiry, combined with user feedback, changed the focus from waste management to waste prevention. Through a systematic approach the food journey was mapped highlighting the fridge's central role.

The result is SVING, a conceptual fridge design that improves a user's relationship with their fridge in their own homes, in their own kitchens, in the way they stored their provisions. SVING gives the user a greater overview of the contents of their fridge, while improving accessibility to the contents at the back. The new layout makes it harder for users to ignore or hide items in their fridge making them more likely to use it or throw it away responsibly. The project hopes to help the user produce less food waste and be more considerate of its effects.

# Motivation

Having started life in the developing world, I was brought up in a house where food was valued and as little as possible was wasted. This was in stark contrast to later life in the United Kingdom where the throwaway consumer society shocked me. There is a lack of social justice surrounding food as the hidden impact costs are not paid for by the consumer, a world away from the food producers. These negative externalities mainly impact the environment.

In the year of COP26, the 2021 UN Climate change conference (COP26, 2021), I found myself dwelling upon mankind's duty to manage their waste and its perpetual disregard to do so. My curiosity was sparked by how this pattern of behaviour has developed an acceptance of neglect and constantly discarding unused products. Governments take years to implement policies in a top down approach to tackle this problem, but action can be taken by individuals to help improve the world we all live in.

With this mindset, my focus was narrowed down to the controllables: an individual's or a collective's responsibility in their immediate community and the differences that can be achieved. A sense of ownership can and should lead to action and participation.

The vast and daunting nature of this problem makes it even more challenging, as there are endless opportunities to enact change and just as many mediums in which to implement them, as well as the mediums these changes can be done through. As a product designer, I believed a product/family of products could be one such medium to help encourage users to minimise their impacts on food waste.

I aim to investigate lines of reasoning using both product and service design, because I believe designers have a prerogative to cultivate a deeper understanding of the relationship between human experience and our impact on the world. A singular product will not solve this problem but every improvement, no matter the size, is valuable in tackling this global problem.

In my diploma I wanted to showcase my love of research, analytical skills and hands-on approach to develop a project that helps tackle this area. I hoped to utilise my engineering background, my willingness to explore and rapid prototyping skills to create a product which would contribute to a behavioural change in users' interactions with food waste.

**'If food loss and waste were a country, it would be the third biggest source of greenhouse gas emissions'**

Inger Andersen, Executive Director,  
United Nations: Environment Programme, 2021

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# INTRODUCTION

# Background & Context

**“1/3 of all food produced for human consumption is wasted.”**

(FAO, 2015; Gustavsson, Cederberg and Sonesson, 2011, p.V)

This quote on its own shows food waste is an area with great potential for change, whether it be trying to reduce the amount of waste generated or making something useful from the waste itself. We live in a world of increased food travel distance, where users the world over have access to exotic foods grown thousands of kilometres away and a large portion of this well-travelled food is not eaten. Food wastage is a major problem with a domino effect of consequences, so it needs to be addressed. The only way to tackle a problem of this magnitude is through a series of small steps and changes.

Food Waste refers to the decrease in quantity and quality of food as a consequence of decisions made by retailers, food service providers and consumers (FAO, 2011).

The UN has set the Sustainable Development Goals helping set milestones for everyone to work towards. For this project goal number 12 “Ensure sustainable consumption and production patterns” is particularly relevant, especially target 12.3 “By 2030, halve per capita global food waste at the retail and consumer levels and reduce

food losses along production and supply chains, including post-harvest losses” and target 12.5 “By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.”

Reducing food waste would not only help reduce the impacts of the waste itself but also potentially aid the 9.9% of the world’s population in a state of hunger.

Studies have shown users may prefer to go shopping less frequently with the risk of wasting food rather than shopping more than once a week. (FAO, 2014) The variety of choice presented to users is partially a reason for waste. (de Gorter 2014) Low food prices drive generation of food waste. (World Bank, 2020)

Despite people’s increasing awareness of environmental impacts, food waste is still a growing problem, with 42% of young professionals considered to be ‘high’ food wasters (Lyndhurst et al. 2007). The fact that approximately 60% of food waste is edible highlights it is a question of neglect and socially acceptable practices.



**“Food waste also burdens waste management systems, exacerbates food insecurity, making it a major contributor to the three planetary crises of climate change, nature and biodiversity loss, and pollution and waste, this is Sustainable Development Goal 12.3 aims to halve food waste and reduce food loss by 2030.”**

United Nations, Goal 12 Department of Social Affairs (2021)

Developing an understanding of current research is essential (Martin & Hanington, 2012) to create something new and useful. Using this knowledge, my project looks at the potential ways to minimise, repurpose and sustainably dispose of food waste.

The data presented in the charts (pictured right) shows that not all discarded food has the same impact. This is due to a multitude of factors:

- How it is disposed of
- How far it has travelled in its life cycle
- Type of food
- Storage methods required to preserve it

As one can see despite a larger quantity of food being discarded during production and post-harvest handling their carbon impacts are lower. As the food will have travelled only a fraction of the distance it would have taken to reach your local retail store and is often disposed of in a sustainable method (seed/feed for crops and animals).

In the UK and Australia 1 in 5 bags of shopping is thrown away without being consumed, this means approximately 20% of what people are willing to spend on food could be saved (West London Waste, 2014) (Food Bank Australia).

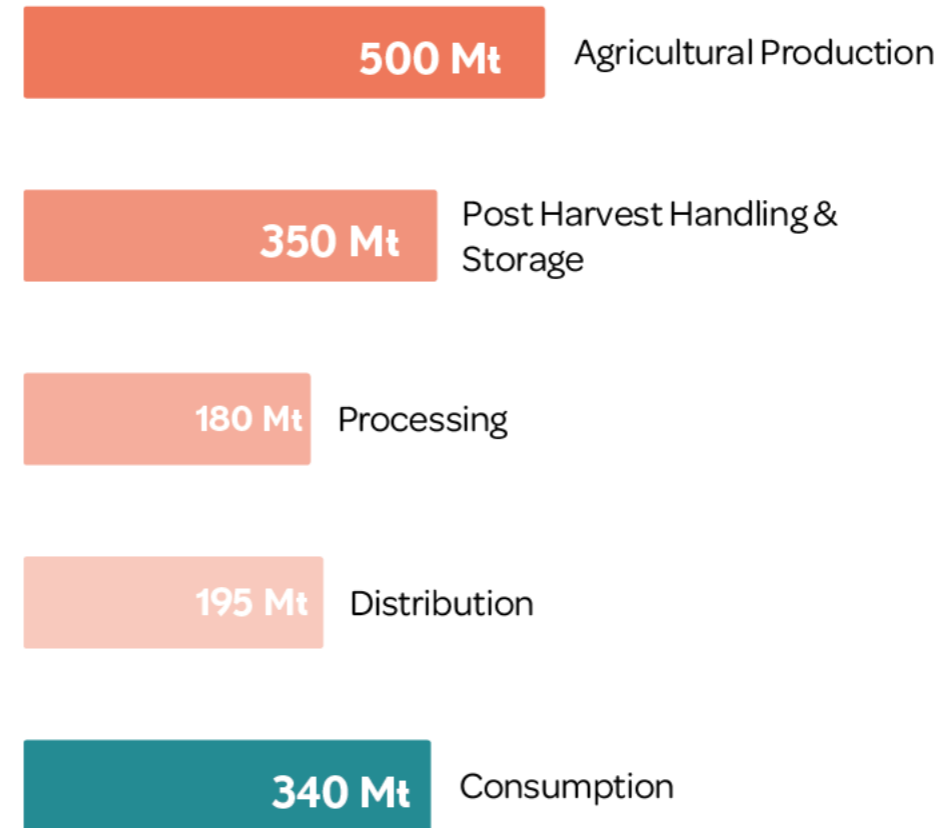
Designing to encourage sustainable behaviour to reduce the environmental and social impacts of a product is a complex problem in itself to tackle. A product can be used by the designer to shape the user's perception, learning, and interaction (Lilley, 2005). Being mindful of both user and the context, I reviewed the extent of the influence I could have with my design direction. The method of behaviour steering appealed as it enhances a user's capability

to reduce their food waste. I could cater to more sustainable behaviours by facilitating the adoption of better habits regarding food waste.

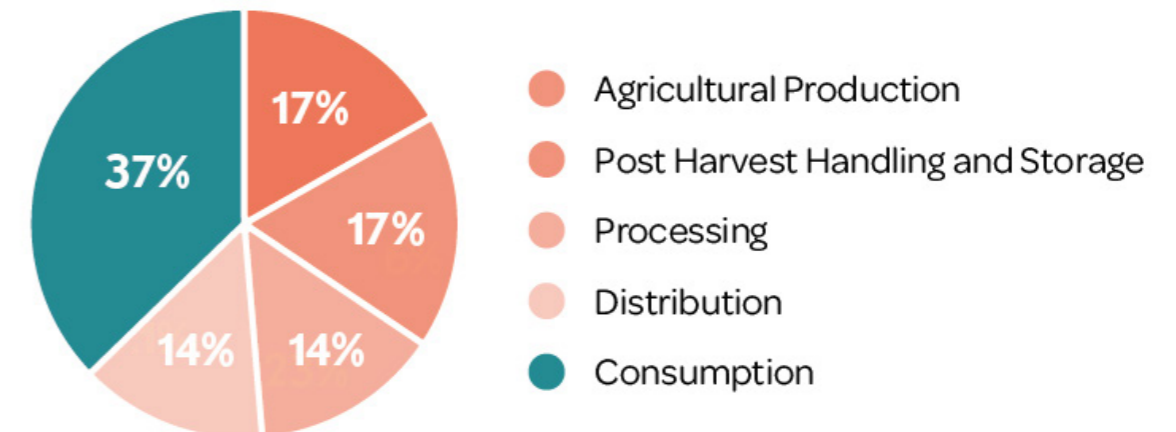
In order to instigate change, various design approaches were taken to tackle the problem using a bottom-up approach. The goal of the project was to enable consumers to improve their understanding and recognition of the impacts of food waste, and provide a product to enable them to actively reduce their personal food waste impact.

## Food Waste by Volume

Adapted from Food Wastage Footprint - Impact on Natural Resources, FAO 2015



## Carbon Emissions Contribution by Phase



Adapted from Food Wastage Footprint - Impact on Natural Resources, FAO 2015



# APPROACH & METHODS

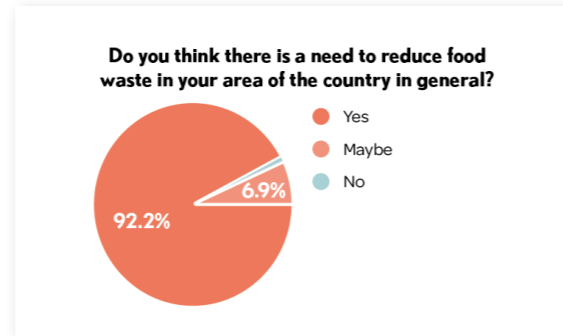
# Approach & Methods

A multi-strategy approach provided the opportunity to gain insights from more than one point of view. The following pages describe the methods used to uncover opportunities and spark the right questions to inspire further ideation. Data was unpacked into manageable sizes through the aid of visual formats depicting patterns, anomalies, and similarities, proving useful to leverage insights against one another.



## Desk Research

This was critical for establishing a foundation and base line understanding for the topic area.



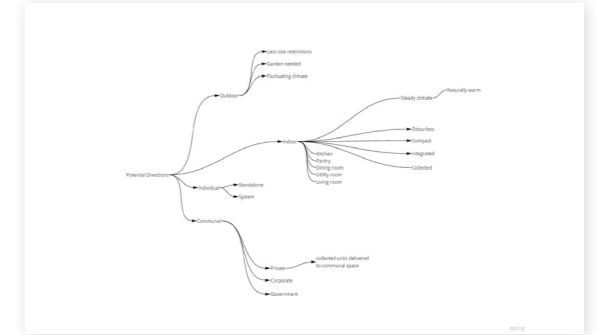
## Questionnaire

To align the desk research with user's thoughts and understand the public's conceptions for form requirements.



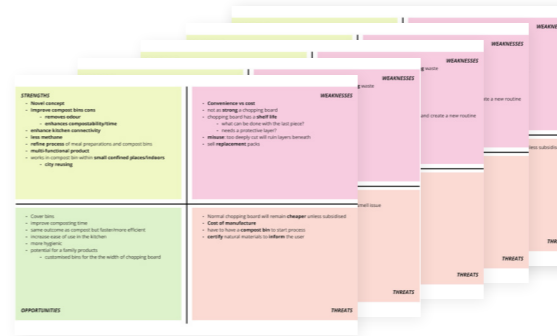
## Semi-structured interviews

Open line of questioning was used when interviewing users and professionals to obtain a broad range of opinions.



## Mind Mapping

This method was used to map out research and insights gathered in such a way to easily find themes and anomalies.



## Concept Analysis

This was critical for establishing 'next steps' in the process. It helped me make decisions and identify what should be pursued.



## Co-Design

By giving a group of people a task of assessing the problem and challenging them to find solutions helped reduce the intimidation factor of the solution and generated new ideas



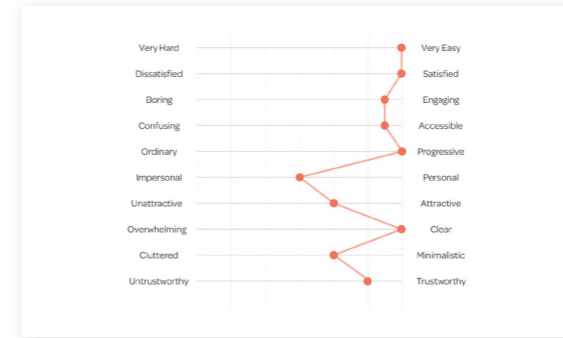
### Rapid Modelling & Testing

Giving concepts form was necessary to test sizes and how the product could be made.



### Scenario & A/B Testing

Seeing concepts put through real life scenarios helped to contrast proposed designs against previous designs. This gave a deeper understanding to norms and user values.



### Design Review Questionnaire

I sent out an online questionnaire to collate the reception to the concept, which provided a broad range of views, suggestions and potential design improvements.



### Semi-Structured Interviews with Professionals

A review of the final design, after development, allowed for knowledge share and the proposed design's potential reception to the market.



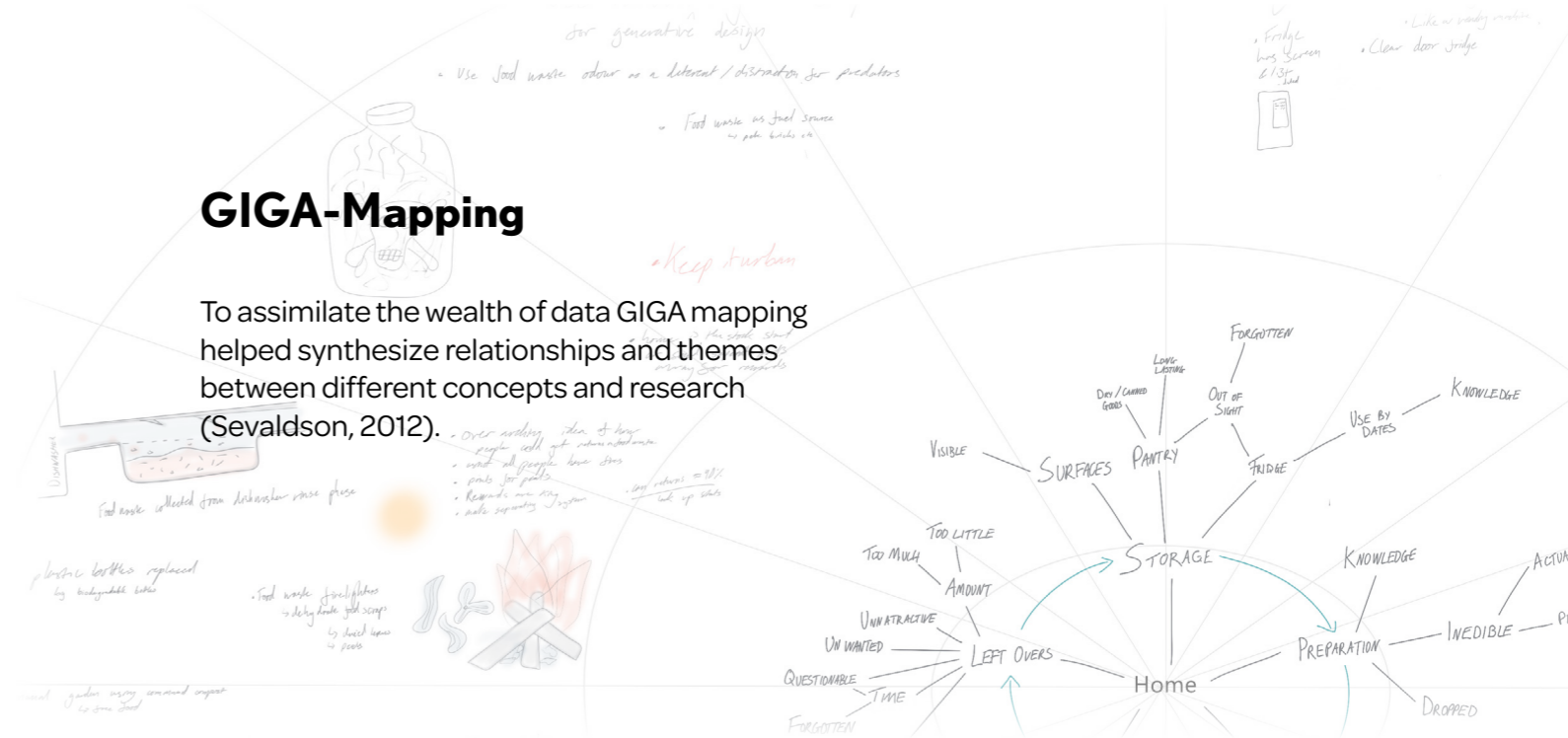
### Pivot Testing

This was pivotal to develop a product that would actively be useful to the user and improve the efficiency of the solution.



### Period Test

Leaving the concept with a user over a 3 day period was valuable to understand and reflect on their interactions with the product.



# PROCESS

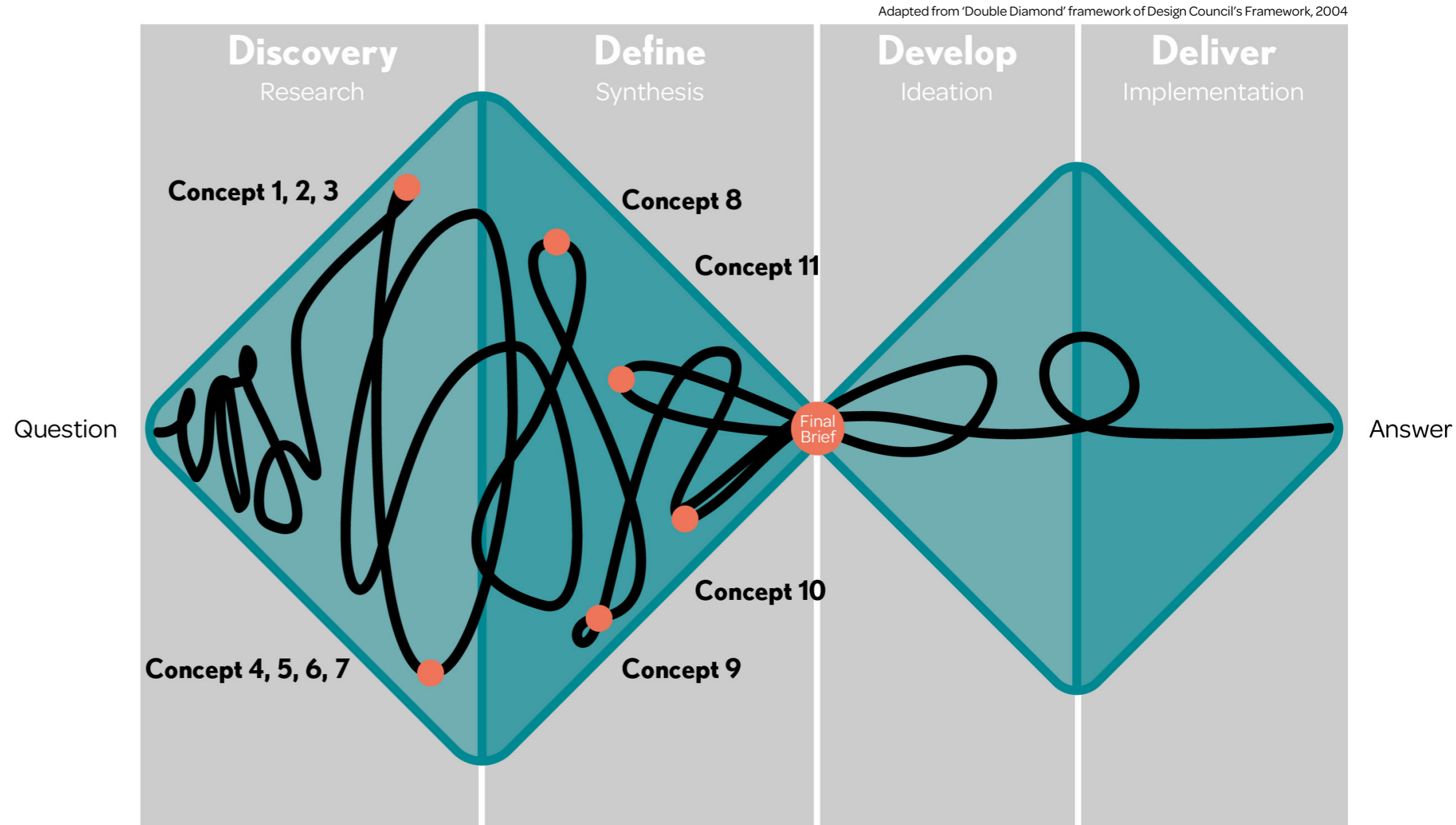
## Model Followed

Food waste is a wicked problem. A problem so complex, open-ended and ambiguous, that it requires a deep understanding of stakeholders and solving it requires an innovative multi-disciplinary approach combined with design thinking (Buchanan, 1992). To help structure this project, I utilised the Double Diamond framework. The two diamonds represent my process of divergent thinking and convergent thinking to tighten the definition of a project brief and outcome.

The infographic pictured represents the true nature of the design process. I spent more time in the Discovery and Define diamond due to the complexity of the wicked problem and established design is not a linear process.

### Key:

- Concept 1-3: Bio Digester, Composter, Chopping Board,
- Concept 4-7: Stock Making, Fire Lighter Making, Single Use Cutlery, Peelable chopping board (fridge take 1)
- Concept 8: Fat Candle
- Concept 9: Product/Service of 1-5
- Concept 10: Vending machine
- Concept 11: Fridge



# Defining the Problem

To formulate the initial assumptions the 5WsH method was used. These questions helped reveal the target user group and their tasks, tools, technology and environment using secondary research and personal insight (Ross, 2015).

## What?

Reduce the impacts of food waste by either prevention, ensuring responsible disposal or making use of the waste.

## Where?

The home with the main focus on urban environments.

## When?

The project will aim towards a concept that would fit into society in the near future (next 10 years). This setting might vary according to the explorative nature of the project and a more futuristic concept might be unearthed.

## Why?

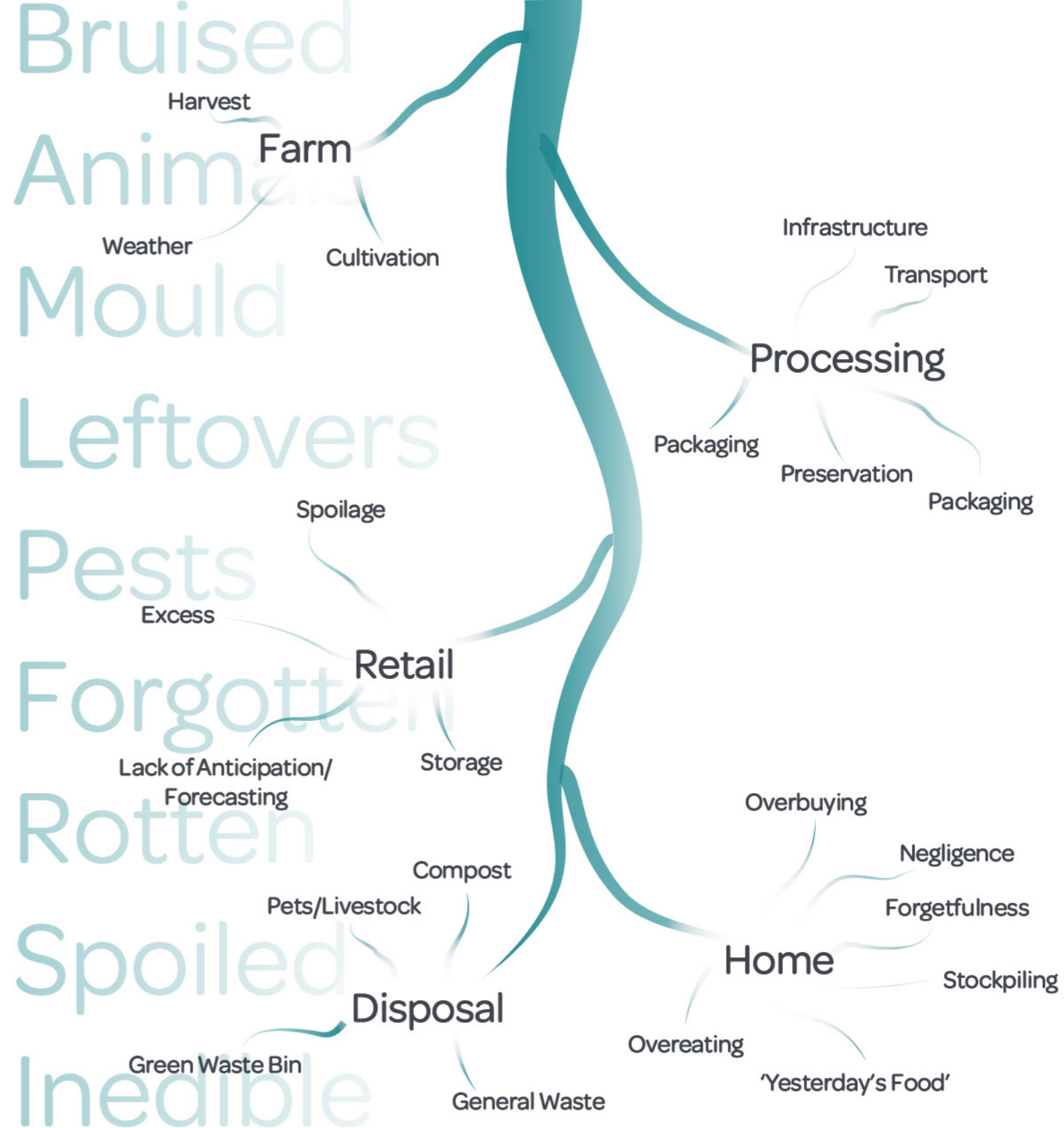
Food waste is a global issue that takes a back seat in most user's eyes as it's degradable, but if food waste was a country it would be the 3rd highest Greenhouse Gas emitter.

## Who?

The focus is on the urban professional, who has a busy life but wants to do their part to reduce their environmental impact.

## How?

I will initially explore several design directions to see what the potential is in the area, the most promising idea(s) will be taken further and developed into a feasible concept.



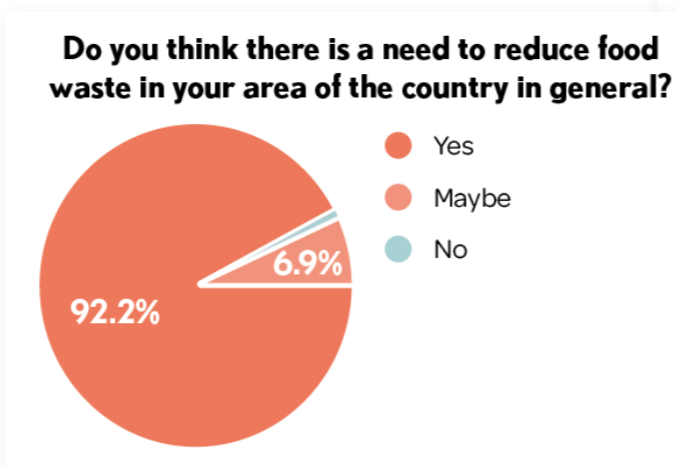
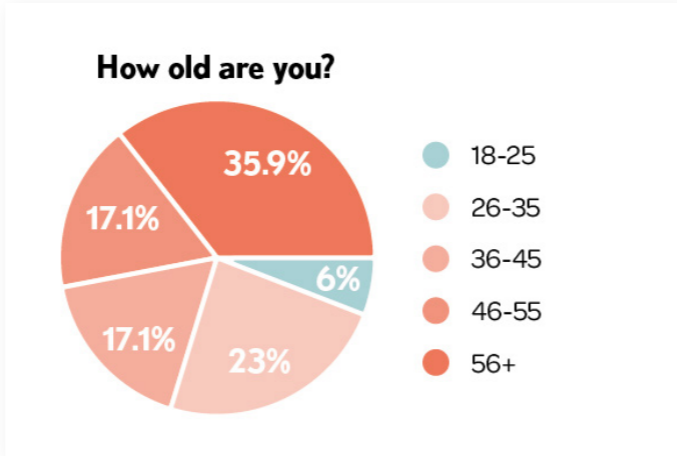
# Insights

A questionnaire was conducted throughout the first stages of secondary research to give me a prompt overview of the topic. Participants were recruited from friends and family who fit the age range, 18-55+ years old, which had deliberately been kept broad. There was a need to include a variety of adults from different backgrounds to identify a real problem area for food waste in the home and the social impacts that affect new thinking. The questionnaire was designed to be anonymous to allow respondents to share as little or as much as they wanted.

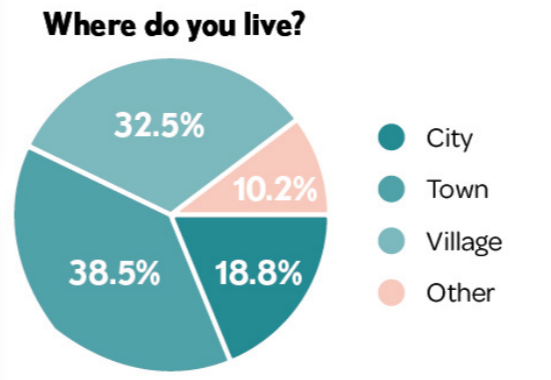
Targeted feedback along with secondary research identified the following key problem areas:

- Target age group indicated to be 26-55+ that typically afford to make conscious decisions about their social and environmental impact
- Live in urban areas in compact living circumstance
- Vast majority of those questioned saw the need to reduce food waste and are looking to curb their food waste habits
- Participant’s were less worried about the amount of food they wasted suggesting they struggled to quantify their waste or did not understand the impacts of food waste
- The fridge is the focal point of food storage in the kitchen
- Most common judgement of food’s end-of-

life was through its visible condition and/or smell, sell-by dates and over-purchasing

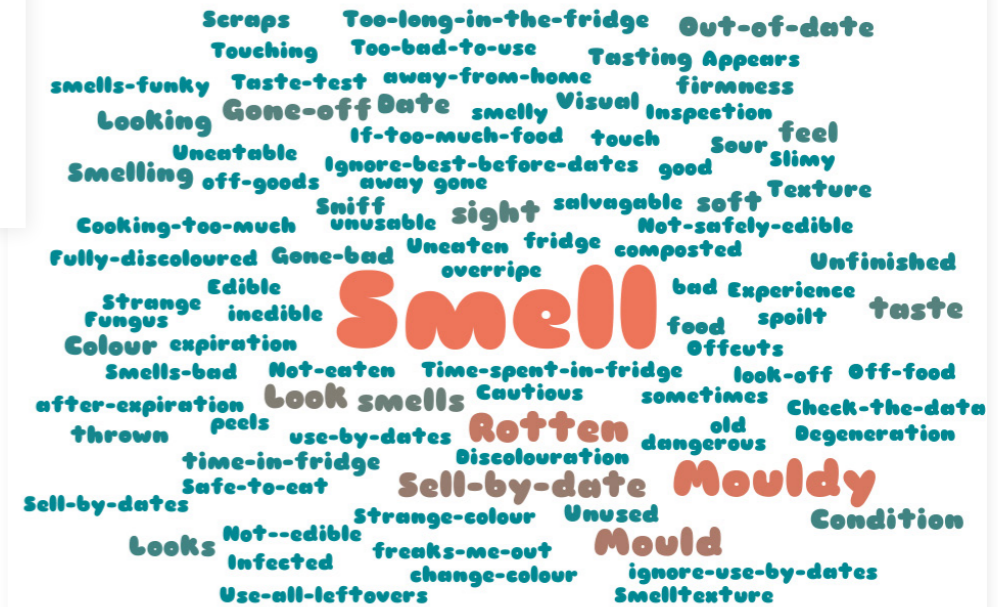


Initial Questionnaire Results (Appendix 1)



Word clouds based on words frequency in answer to the stated topics

How to Store Perishables:

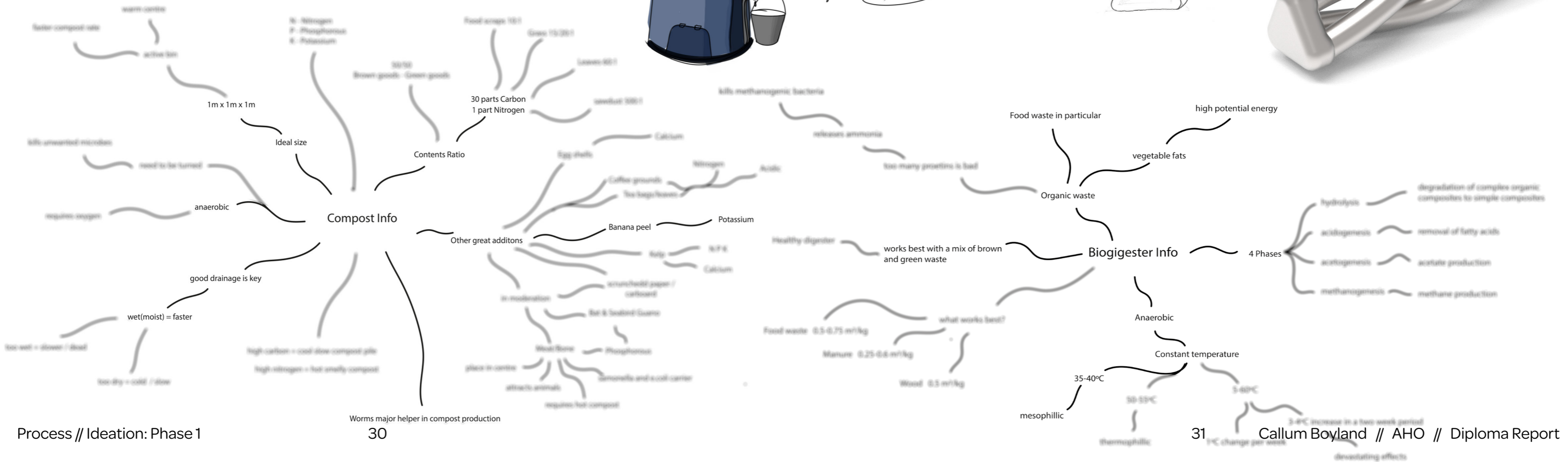
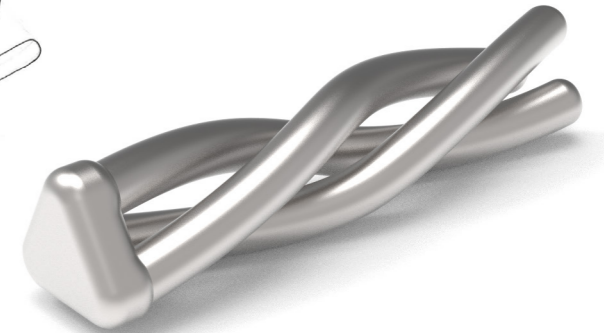
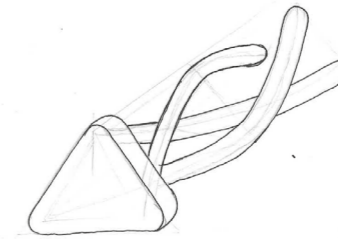
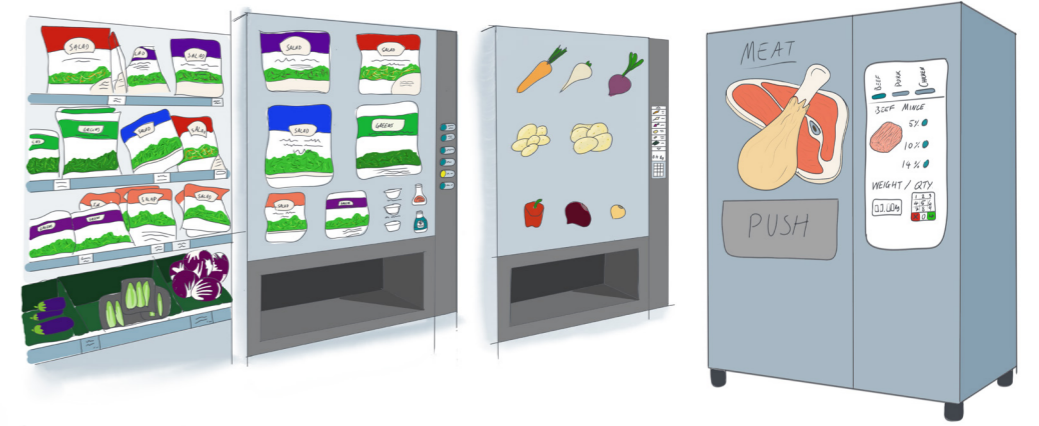
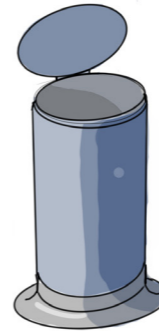
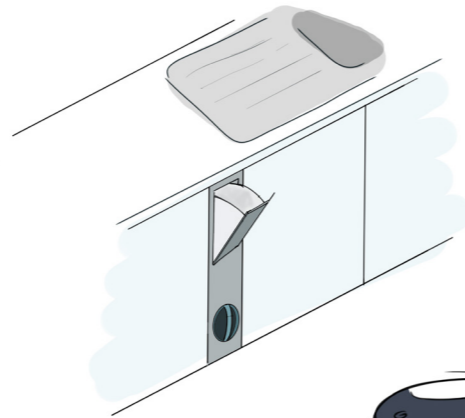


# Ideation: Phase 1

## Initial

The initial research heavily influenced the design direction, towards compostability and biofuel. I looked at the potential integration of compost into the urban environment and reducing the negatives of this experience. I used mind maps to categorise the ideas.

However the further into the design process I got into these areas the more I felt like I was just reformatting an existing set of products, although this could still prove beneficial.





# 5 Ideas

Desk research led my concepts to target compost and biodigesters. The markets for these areas are already saturated with products, so a new set of concepts needed to be generated.

I categorised the food journey in the home into these main areas:

- Storage
- Preparation
- Cooking
- Eating
- Left Overs

Blue sky thinking led to a plethora of ideas, of which four were taken forward to explore further:

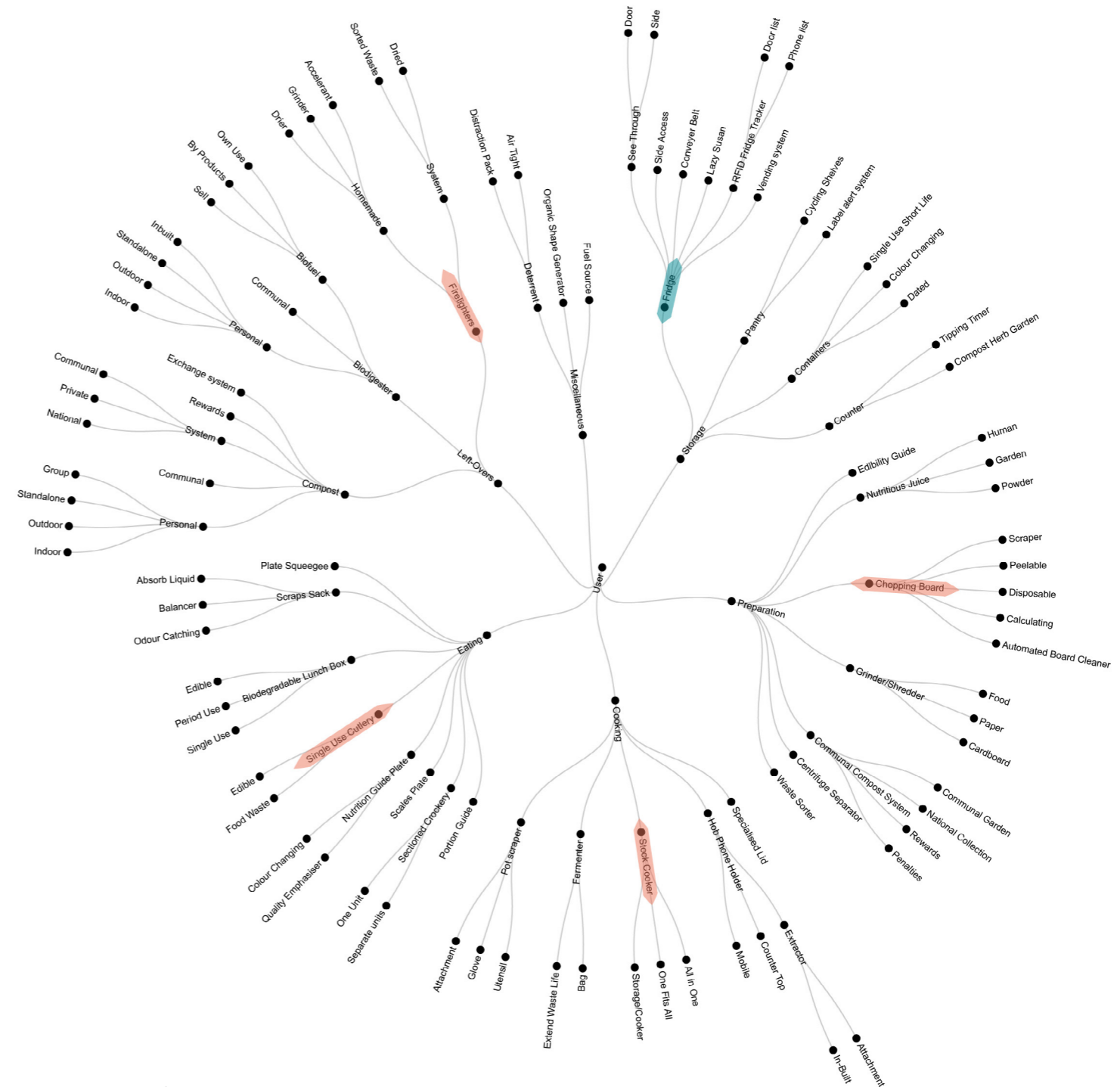
- Food waste firelighters
- Stock making/fermentation - potential service link
- Peelable chopping board
- Single-use cutlery - Edible/made from food waste

The fat candle was added later as a discursive idea.

The concepts were picked for their potential and their alternative nature compared to previous design directions. The designs shifted from product focussed to the potential integration of a service.

A range of methods were employed to explore these topics - user discussions, mapping, sketching, desk research, experiments and home

research. The primary method used was mapping due to the broad nature of the exploration, allowing thematic analysis.



Radial Tree of Ideas

## Firelighters

An experimental concept looking into a new potential use of food scraps other than existing methods and uses. The principle behind the concept was to give your food waste a second life. Acting as a reward for the user for disposing of their food waste in a more environmentally friendly way, lighting a fire is a satisfying task.

Initial desk research was not straightforward on this topic as little has been done in this area; although experiments have been done on the burning of high starch and high sugar powders, mainly for impressive visual experiments.

### Experiment

I conducted an experiment to test the flammability of food scraps to test their viability of being firelighter 'fuel'. I used a random selection of food scraps from my cooking as my test sample. These were tested in two different states (fresh and two weeks old) and two different forms (sliced and granulated).

### Method

Preheat the oven to 60°C, to act as the dehydrator. The scraps were cut into thin slices and spread out on a baking tray. These were then placed in the oven for a total of 3 hours, they were removed at 45 minute intervals where a sample of each scrap was removed to test their flammability.

### Outcomes

The order of flammability followed the sugar content of the foods.

Sweet potato proved to be the most flammable, this was expected due to its lower starting water content as well as its natural oils and high carbohydrate and starch content. They also proved to be the only item that could hold a flame without encouragement.

Red onion skins could hold a flame only with encouragement and the rest would require the addition of an accelerant to hold a flame.

The thickness and form of the scraps played a large role in speed of dehydration and flammability of the product.

The addition of a wrapper to hold the granules resulted in a fast burn with incomplete combustion of its contents.

Important factors in relation to flammability:

- Liquid content
- Form
- Sugar content

The results of the experiments proved that although it was possible to create flammable food waste it was too labour and energy intensive a process for it to be viable domestically.



Firelighters Experiment: Baking food scraps, chopped and granulated



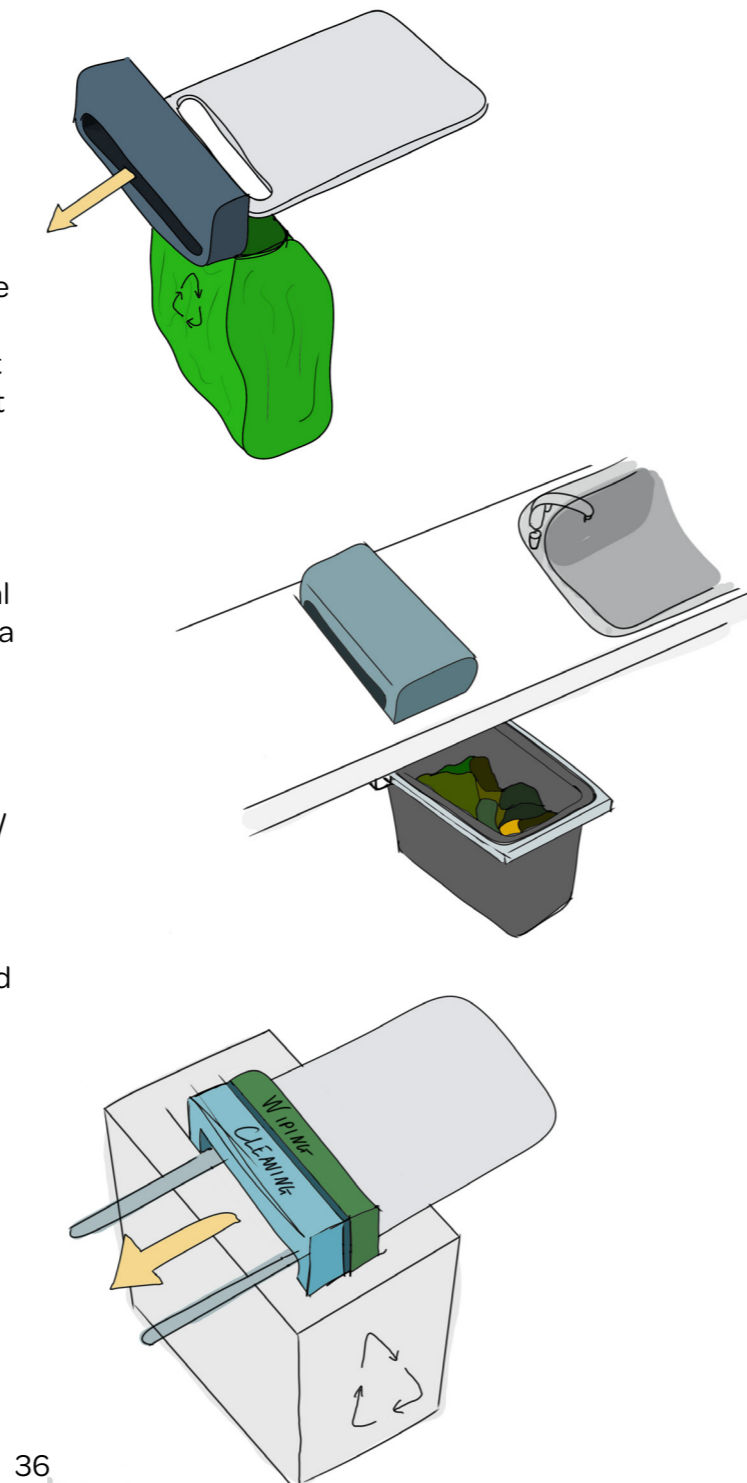
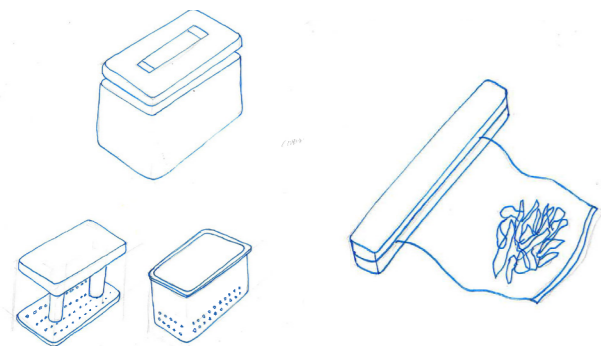
## Peelable Chopping board

To improve the urban composting experience by reducing the smell and mess of the process. The top layer of the chopping board could be peeled off and wrapped around the food scraps during the preparation stage. This peeled sheet would act as a carbon/nitrogen balancer for the user's compost bin, in order to make a drier, less odorous compost bin for the urban user, due to the lack of brown waste to be added to their food waste.

However, this is a concept directed at those living in city/urban areas with reduced access to external composting. Others may still enjoy the benefits of a less odorous food waste bin.

This concept would add an extra step to food waste disposal. Why does it need to be attached to the chopping board? Could it be a separate bag/sheet you can add to the food waste bin instead?

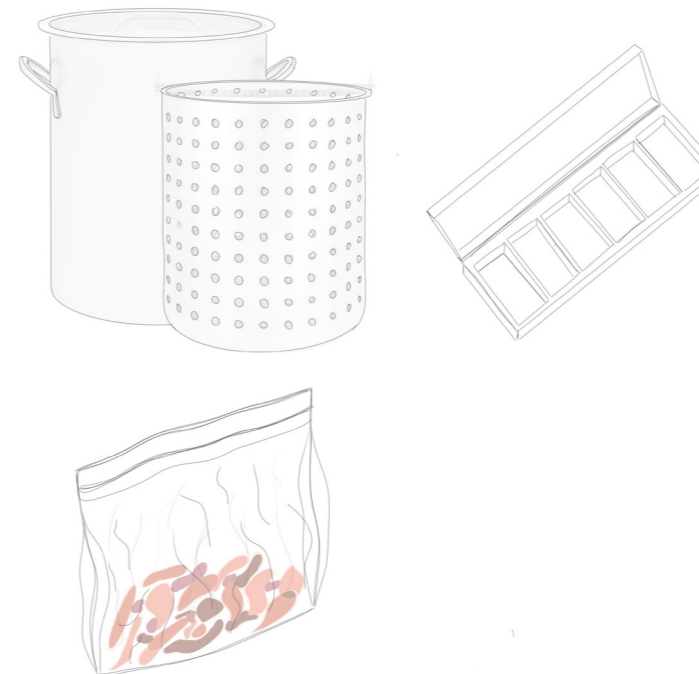
For these reasons, and the material science focus on developing biodegradable material to withstand the blade of a knife and flexible enough to wrap around, I did not pursue this concept.



## Stock Making/Fermenting

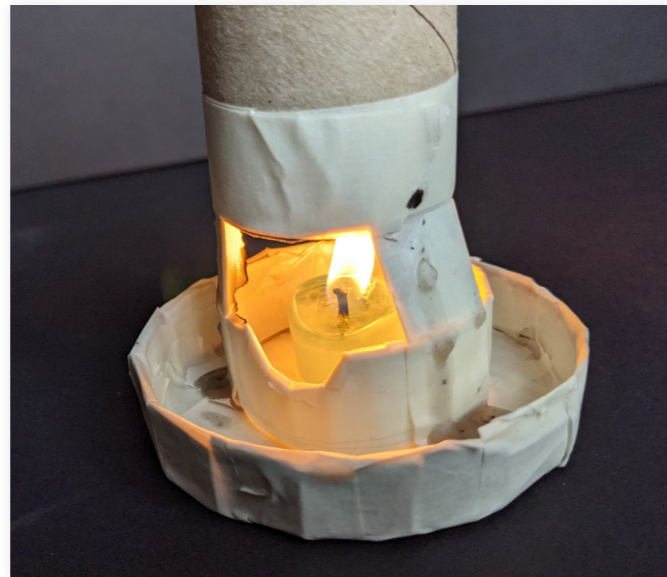
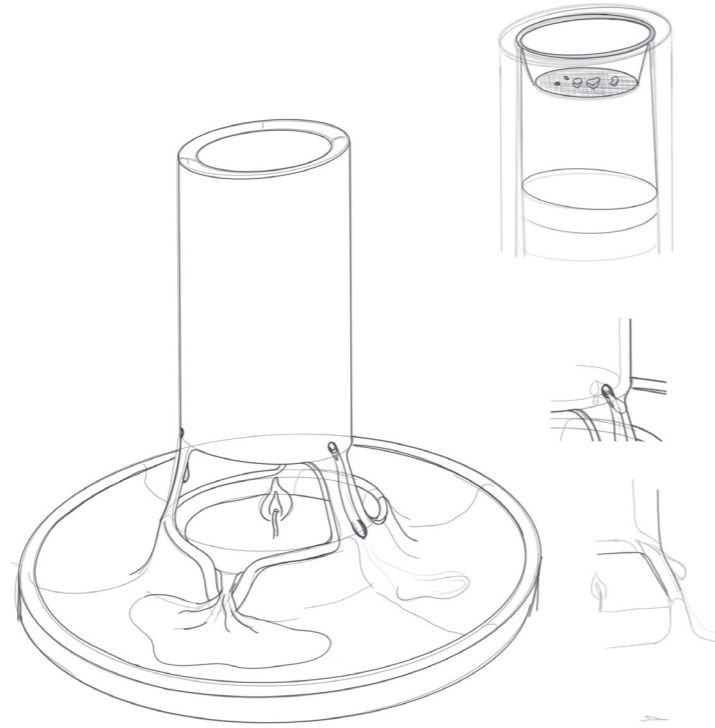
Purchasing surplus short shelf life foods, fresh fruit and vegetables, leads to more food waste in the home (Moreno, L., & Hoover, D. 2017). Users find themselves forgetting about items or not using them within their edible state. Lack of food knowledge, and/or time restraints, leads users to throw away food before fermenting items or making a stock (Lyndhurst et al. 2007).

A service/product concept was developed looking to simplify the process of creating stock or other products. The challenge in the kitchen is making a product that fits pans of all shapes and sizes and getting the food processed before it is too far along the decomposition timeline. Health and safety would also prove an issue within the service because of the loss of chain of custody. The concept would only be possible using waste produced during the processing of processed foods.



## Fat

At home, there are substantial contributors to fat waste in city sewage systems. Imposed regulations for the disposal of oils in the catering sector have diminished its impact, however, the habits of households remain (HLPE, 2014). This results in the creation of fatbergs, consisting of non-biodegradable products glued together by solidified fat. In order to prevent this occurrence, I looked into potential uses of fat in the kitchen to prevent it from going down the sink. Commercial kitchens often collect their excess fats and dispose of them through biofuel companies; however domestic kitchens don't produce on a comparable scale for this option to be viable. Previously people used fat to make all sorts of products from candles to storing it in grease tins to cook with. I merged these two concepts into a fat flavour enhancing cube to cook or use as a dipping sauce similar to your olive oil and balsamic vinegar.



Fat Candle Rapid Modelling

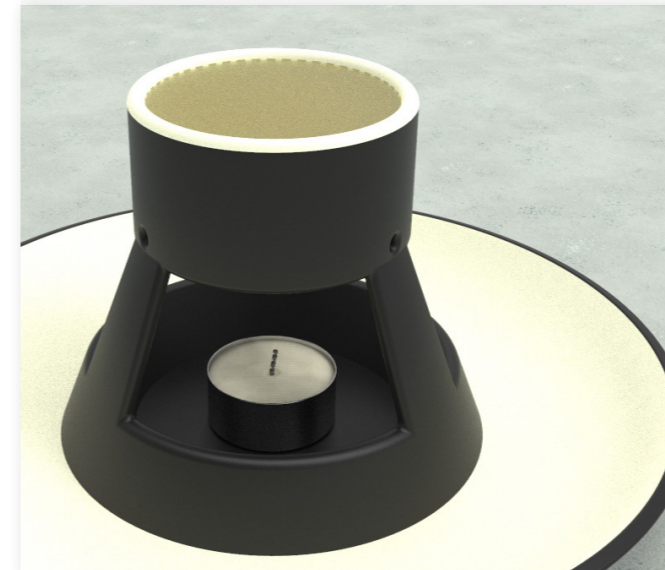
## Single-Use Cutlery

This concept investigated the potential use of food waste to manufacture edible and biodegradable cutlery.

Single-use plastic products are a massive environmental problem in society today with 4.25 billion items of single-use cutlery being thrown away in the UK alone each year, with only 10% being recycled. (Heck, 2021)

Today, existing edible cutlery companies use similar base ingredients using flours made from rice and cereals that are then baked. Users were not comfortable eating using someone else's food scraps as utensils without knowing the origin of the food scraps.

A solution would be to use food scraps generated during the production stage of processed foods for transparency. This would also remove the inconsistencies found in the quality of waste submitted by the public. Yet this focussed on reducing food loss in industry rather than food waste and detracts from an industrial design-themed project. Food science would be necessary for the right composition of ingredients.

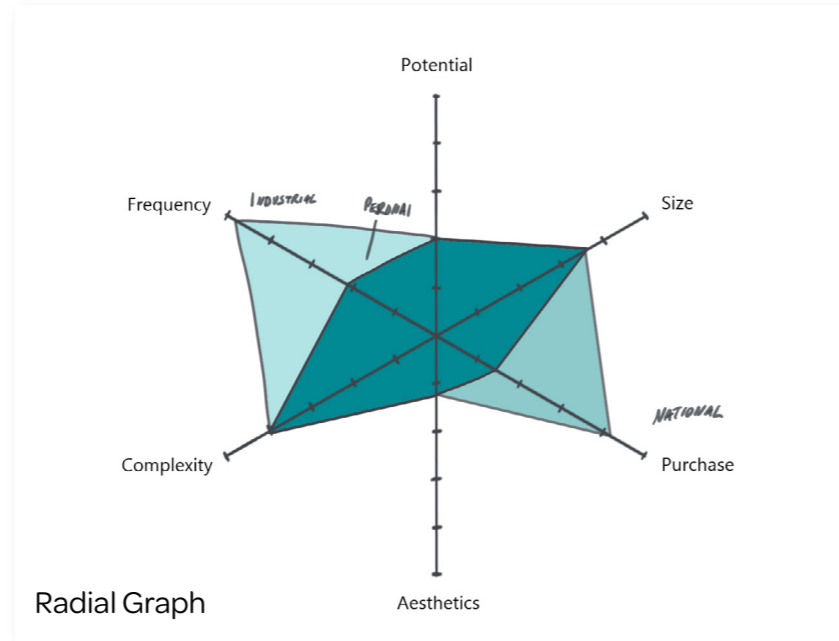


Fat Candle Rendered in CAD

# Concept Analysis

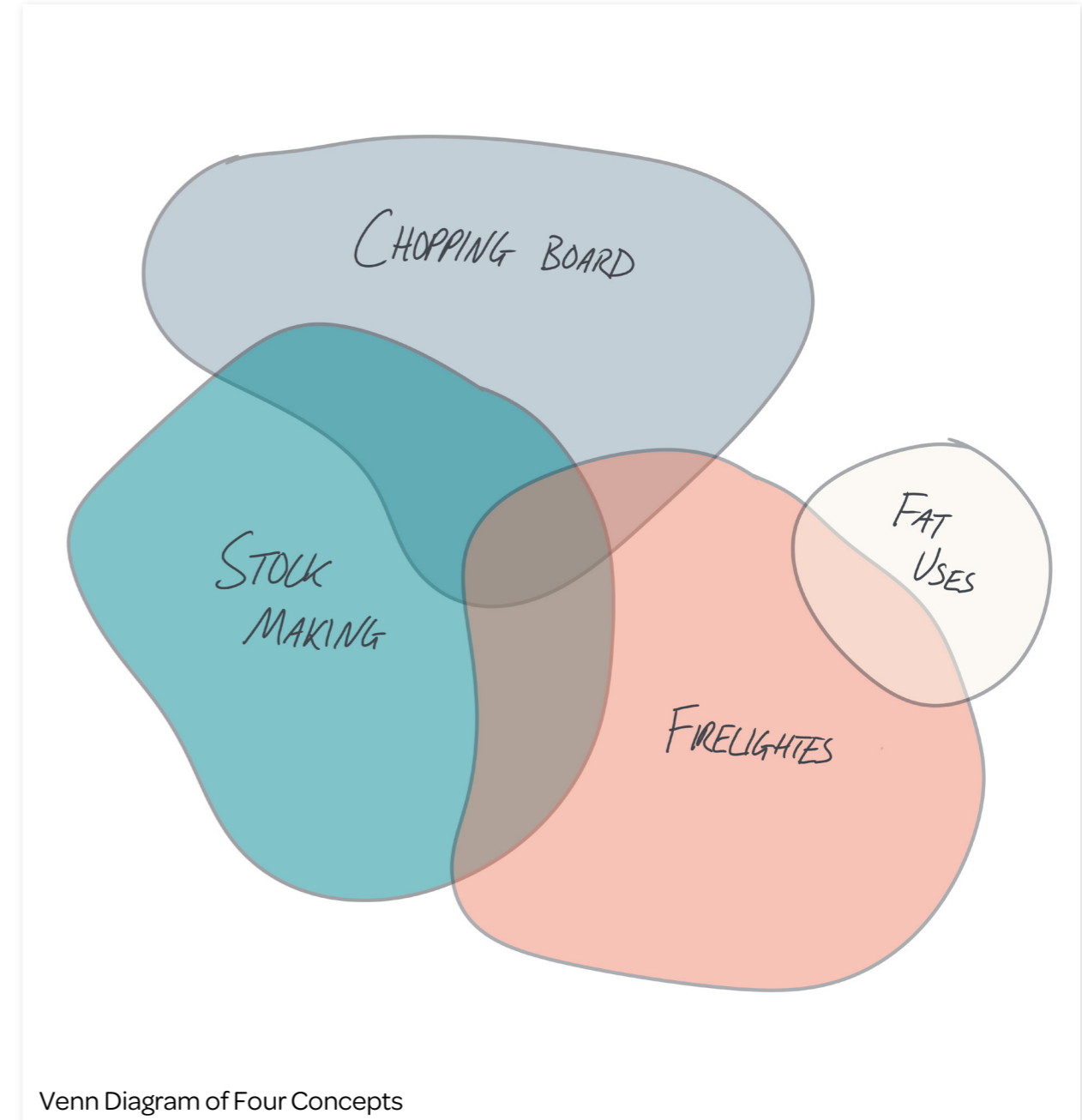
I evaluated the concepts using a common set of criteria to assess their strengths and weaknesses. This was done in two different methods: radial graph and SWOT analysis. I was able to assess the pain points and feasibility of each concept which prepared me for talking to industry experts.

I found potential commonalities and complementary features between the four of the five concepts and proposed to marry them all as a family of products/services as shown in the Venn diagram.



<p><b>STRENGTHS</b></p> <ul style="list-style-type: none"> <li>Novel concept</li> <li>Improve compost bins cons             <ul style="list-style-type: none"> <li>removes odour</li> <li>enhances compostability/time</li> </ul> </li> <li>enhance kitchen connectivity</li> <li>less methane</li> <li>refine process of meal preparations and compost bins</li> <li>multi-functional product</li> <li>works in compost bin within small confined places/indoors             <ul style="list-style-type: none"> <li>city reusing</li> </ul> </li> </ul>	<p><b>WEAKNESSES</b></p> <ul style="list-style-type: none"> <li>Convenience vs cost</li> <li>not as strong a chopping board</li> <li>chopping board has a shelf life             <ul style="list-style-type: none"> <li>what can be done with the last piece?</li> <li>needs a protective layer?</li> </ul> </li> <li>misuse: too deeply cut will ruin layers beneath</li> <li>sell replacement packs</li> </ul>
<p><b>OPPORTUNITIES</b></p> <ul style="list-style-type: none"> <li>Cover bins</li> <li>improve composting time</li> <li>same outcome as compost but faster/more efficient</li> <li>increase ease of use in the kitchen</li> <li>more hygienic</li> <li>potential for a family products             <ul style="list-style-type: none"> <li>customised bins for the width of chopping board</li> </ul> </li> </ul>	<p><b>THREATS</b></p> <ul style="list-style-type: none"> <li>Normal chopping board will remain cheaper unless subsidised</li> <li>Cost of manufacture</li> <li>have to have a compost bin to start process</li> <li>certify natural materials to inform the user</li> </ul>

SWOT Analysis



# Conversations with Industry Professionals

I talked with industry professionals to determine the viability of my ideas.

## Chefs: Bent Stiansen and Tore Namstad

We discussed systems utilised to tackle food waste in industry. They liked the reward system approach but found that the ideas required too many steps or knowledge to be implemented. Incentives work and inspire users to overcome the lack of knowledge being a major role in the production of food waste with produce not being used to their full potential or thrown away when still edible due to a use by date on the packaging. Their product suggestions were:

- A portion cheat sheet
- Scales to measure these portions
- Visualising waste

Leading to a concept combining a bin with scales that would be linked to a reward system. The amount of food purchased vs amount of food thrown away could be gamified and establish accountability. There were concept pitfalls: easy to cheat by throwing food away in general waste and no simple way to check.

## Dorthe Gill Brudvik, Director of Private Brands, at COOP

In a video call we talked about the feasibility of implementing the services associated with my concepts.

The stock making service was a non-starter due to the break in custody (as expected). She saw potential in the delivery of waste food, for a discount/reward, similar to the PANT system (Infinitum, 2021), however she was unsure as to the monetary benefit of processing this food into either compost, biofuels, or animal feed for a farm associated with the company.

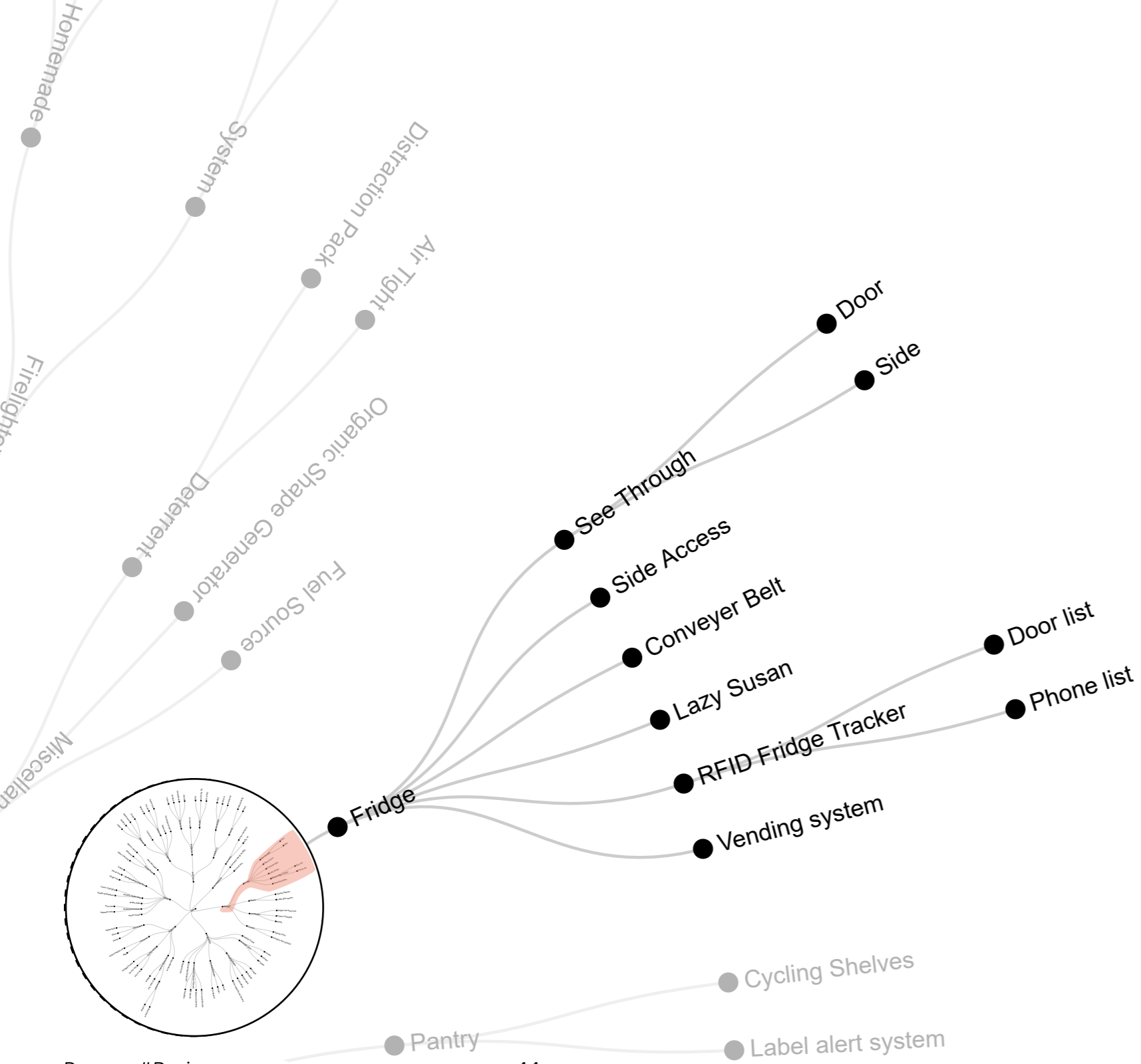
We discussed the issues of disposing food beyond its shelf life in store. Food stores are in need of a way to separate food from its packaging at disposal – without coming at an extra cost. Packaging has a much longer lifespan than the products they protect. This highlights the issue of packaging and volume per package vs disposability and quantity desired by the user.

Through this process, I found that the concepts had either steered away from product design or had reached an impasse with current infrastructure and user ideologies.

Discussions with my supervisor helped me re-evaluate my concept development and led me to address an earlier, product-based concept, to redesign a fridge to meet the user's needs.



Meeting with Chefs



# Review

The breadth and depth of the topic areas caused the research and exploration phase to take longer than expected, this was exacerbated by the difficulties and uncertainties within the handling of food waste.

After further discussion with my supervisor, the decision was made to revert to one of my initial ideas, the redesign of the fridge, as it had a heavy industrial design focus. It would focus upon reduction of food waste by prevention.

## Why the fridge?

An industrial product at the centre of users' everyday interactions with food and the generation of food waste, but has also had minimal evolution since the creation of the electric fridge in the 1920s.

# Redefining the Problem

To frame the problem areas of fridge use, I crowdsourced images from users to obtain visual cues of the state of their fridges.

My assessment of the raw contributions:

- Many fridges looked like organised chaos
- You can only view the items at the front of the shelves
- Fridges offer a large storage capacity with organisation left to user interpretation
- Users created their own structure with boxes used to stack

A questionnaire was devised to assess user's relationship with their fridge and how their shopping habits might affect their food waste.

I have compiled the results below:

- Cater for 2 people on average
- The fridge needs to store 2 weeks worth of shopping and users find they need to sort their food storage weekly - implying that food is wasted
- Users worry about the amount they waste and are happily receptive to change
- While users say they can see all items in their fridge, they still find food going out-of-date before they eat it
- Responses vary from the research in terms of how much food they throw away in a week. Maybe the sample in question is more aware of food waste, or users found it

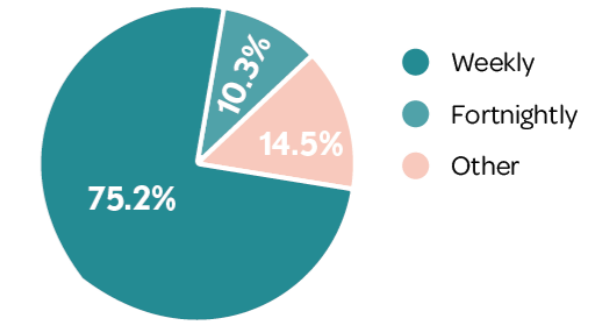
hard to quantify, or there was an element of shame in admitting to more food waste.



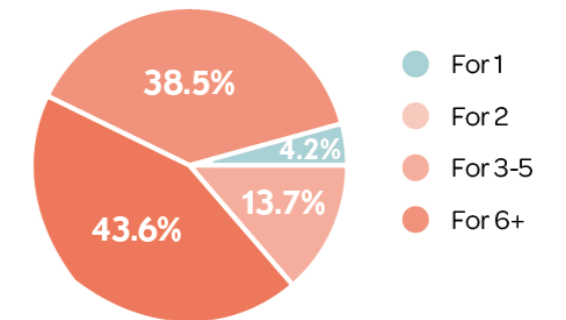
Crowdsourced Fridge Images

Results from Fridge Questionnaire (Appendix 2)

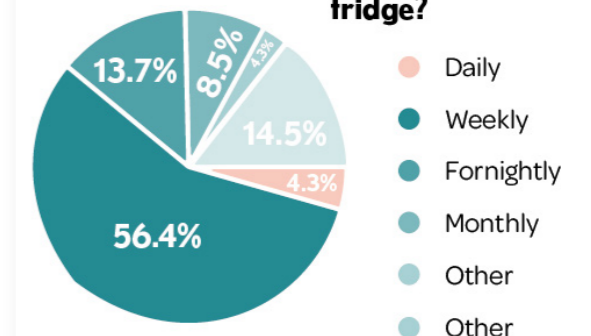
## How regular do you shop?



## Do you shop for yourself/others?



## When do you sort through the food in your fridge?







## Journey Mapping

Journey maps helped visualise the different interactions and pain points user experiences from purchase to food waste (Design Council, 2013). Documenting the stages of an experience identified opportunities for improvements.

# Co-Design

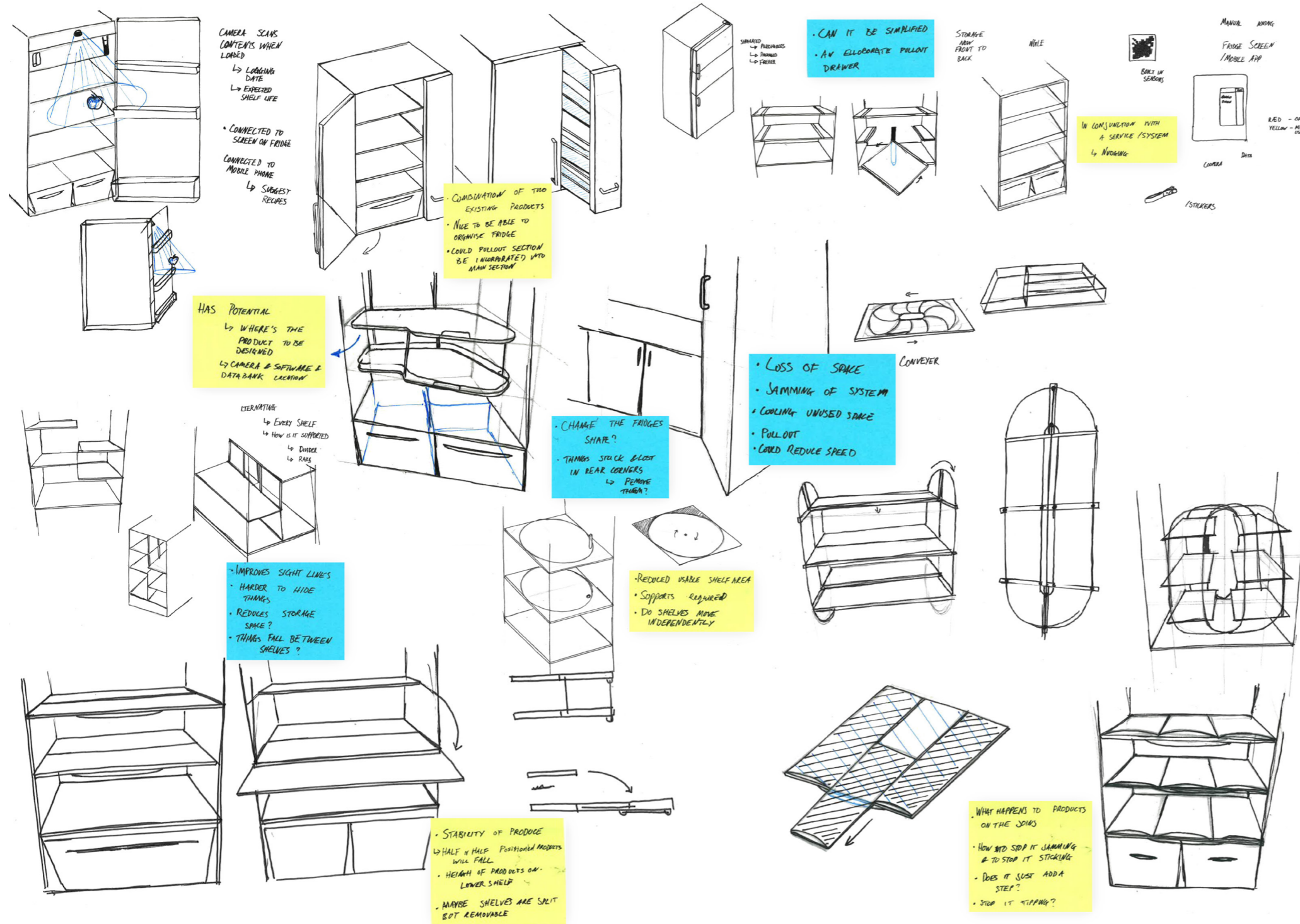


Co-creation workshops were used to collaborate with others and help validate and define the direction of the project. It proved most beneficial to talk to people, both peers and outside of the project, to ideate beyond my previous thoughts.

To foster innovation after the first and secondary research, a semi-structured workshop was carried out. The participants were presented with a snippet of the research to provide a base starting point while still allowing creative freedom. A combination of individual and group tasks allowed for an active discussion of ideas

Google Crazy 8s is a sprint method for ideation to get creative rapidly (Google Ventures, 2013; Knapp, 2013). Eight ideas were generated per person with an eight-minute time frame. The ideas were based upon a brief summary of the research and the context of the project. Post idea generation the workshop was split into a discussion of all our ideas and what we could match up together or distinguish as a progressive concept.

# Ideation: Phase 2



I combined some of the discussed Google 8s concepts with my trail of thought, inspired by new trains of thought, to best explore their opportunities to address the subject matter.

## Incremental vs Radical

In order to make a meaningful change to the user's relationship with the fridge, it was decided a radical change was required, thereby encouraging the user to be more proactive.

## Problem Defined

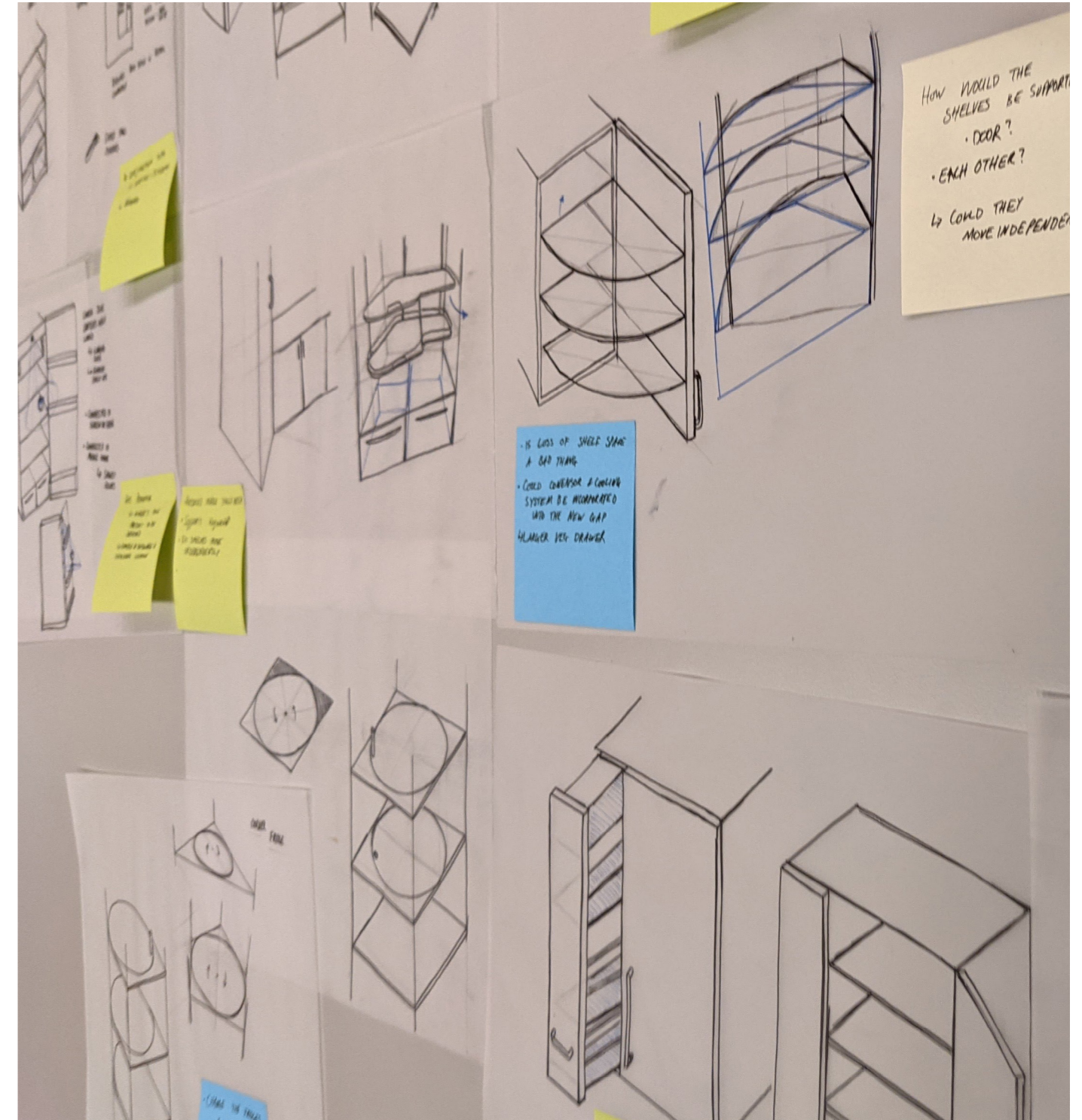
Users often employ the out of sight, out of mind tactic with their fridge; current fridge layouts limit the user to a 2D image of the fridge allowing them to only see what is at the front.

Task Goals addressed:

- Reduce the opportunity to lose or hide items
- Increase awareness of bought items to stop overbuying
- Increase the visibility of food items' condition as a reminder

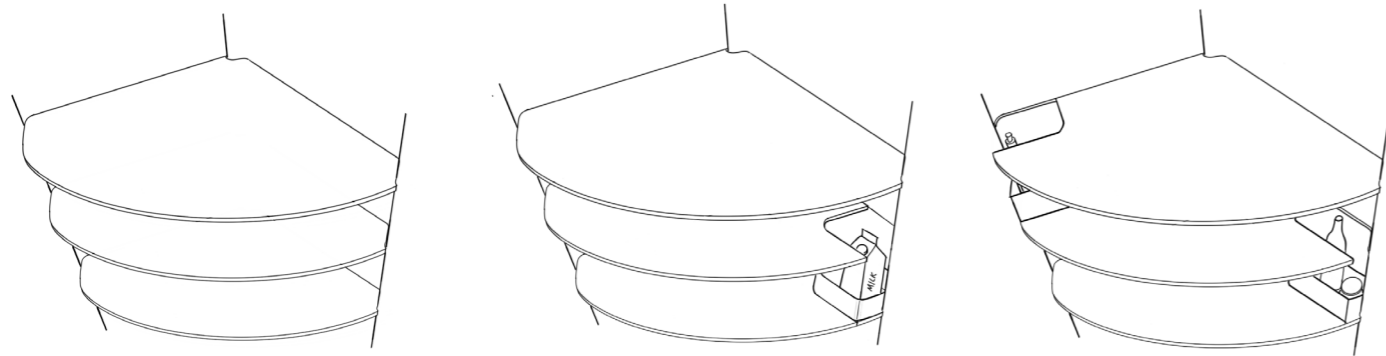
## Reflection

The required knowledge and scale of secondary research available for this project weighed me down, resulting in a longer period spent in the define and develop process than desired. It is a fine balance when to stop reading and analysing data and move on to the next section, especially as this project is of great interest to me. I should have taken a synopsis and moved on sooner, but the time spent in this section led to a greater understanding of the topic and its intricacies.



# PRODUCTION

# Prototyping



Cardboard prototypes were made to test the design concept and highlight any potential pain points.

Upon trialling the shelves being attached to the doors, it lost the typical fridge door storage space for jars and open bottles. To solve this, I ideated along the lines of using specialised sections amongst the shelves for the bottles and jars. With the possibility they could be stored against the colder section at the back of the fridge.

I added a rail on the far wall to prevent the shelf from drooping. However, this only partially solved the problem, as fridges are wider than they are deep, so the shelf is not a full quarter circle. This resulted in the shelf still being unsupported in the final section, thus discounting this design.

An issue, raised through the prototyping, was that the shelves attached to the fridge door would make the fridge tip toward the user. The initial solution was a handle system that allowed the user to select one shelf at a time by gripping different parts of the handle.

The discovery from both the supportive rail and the tipping fridge led to the understanding that it was not workable to attach the shelf to the door but rather to the body of the fridge with a rail support instead.

This raised the question of where should the centre of rotation be located?



Initial Cardboard Prototyping

# Pivot Testing

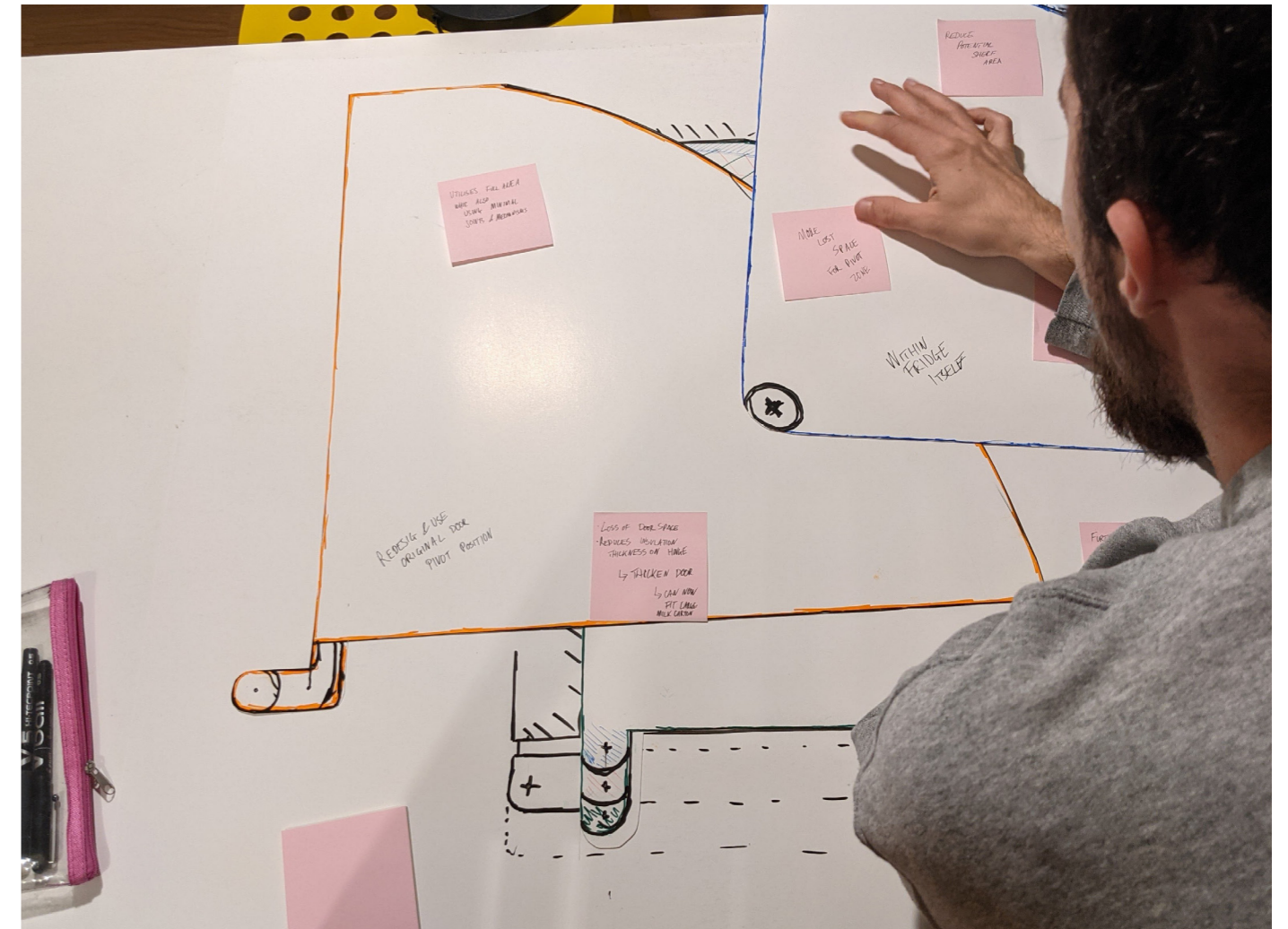
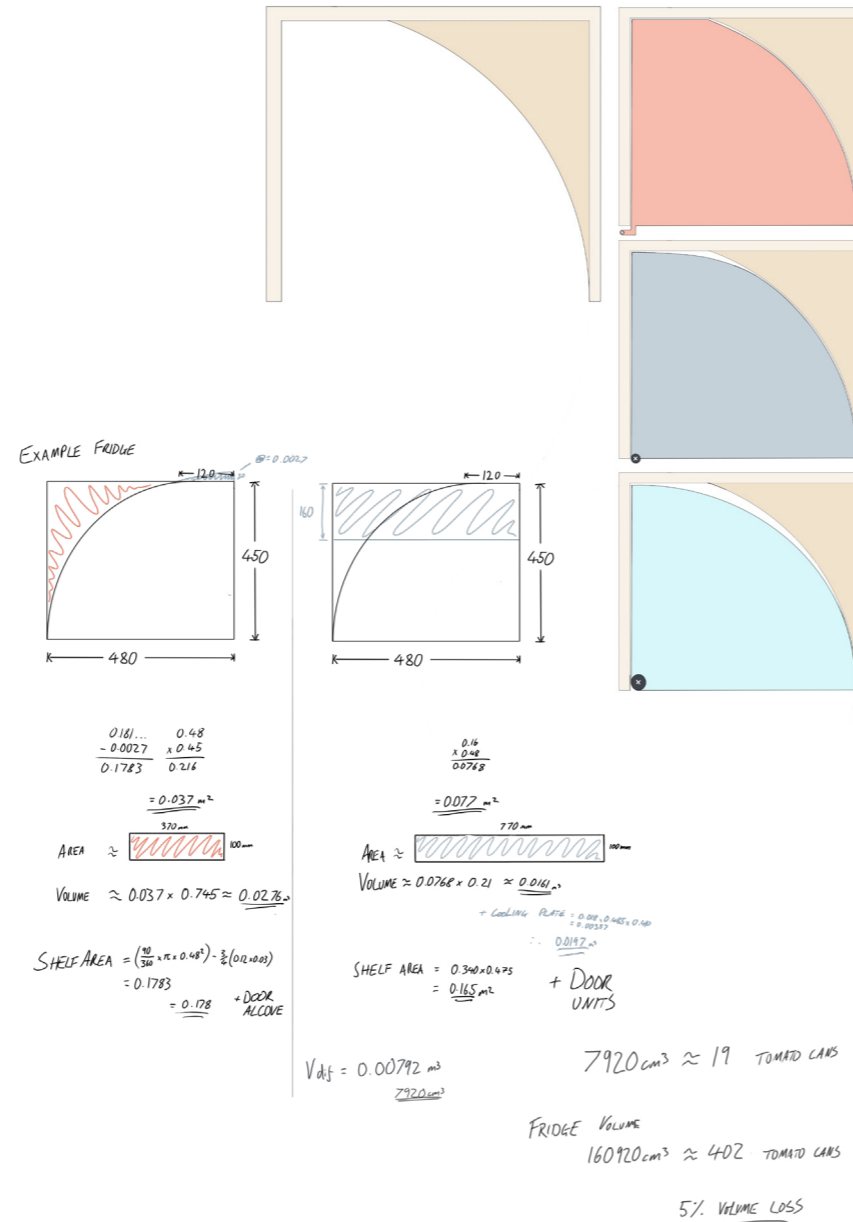
Full scale cardboard mock-ups were made to test the effects of different pivot points to allow for space optimisation of the shelf. It worked out that locating the pivot within the fridge itself would be the most efficient.

Another question that needed answering was: what percentage of volume was lost due to the curved corner? A 5% loss of space was the calculated value for the fridge I was using to make my prototype. This percentage would change depending on the dimensions of the fridge.

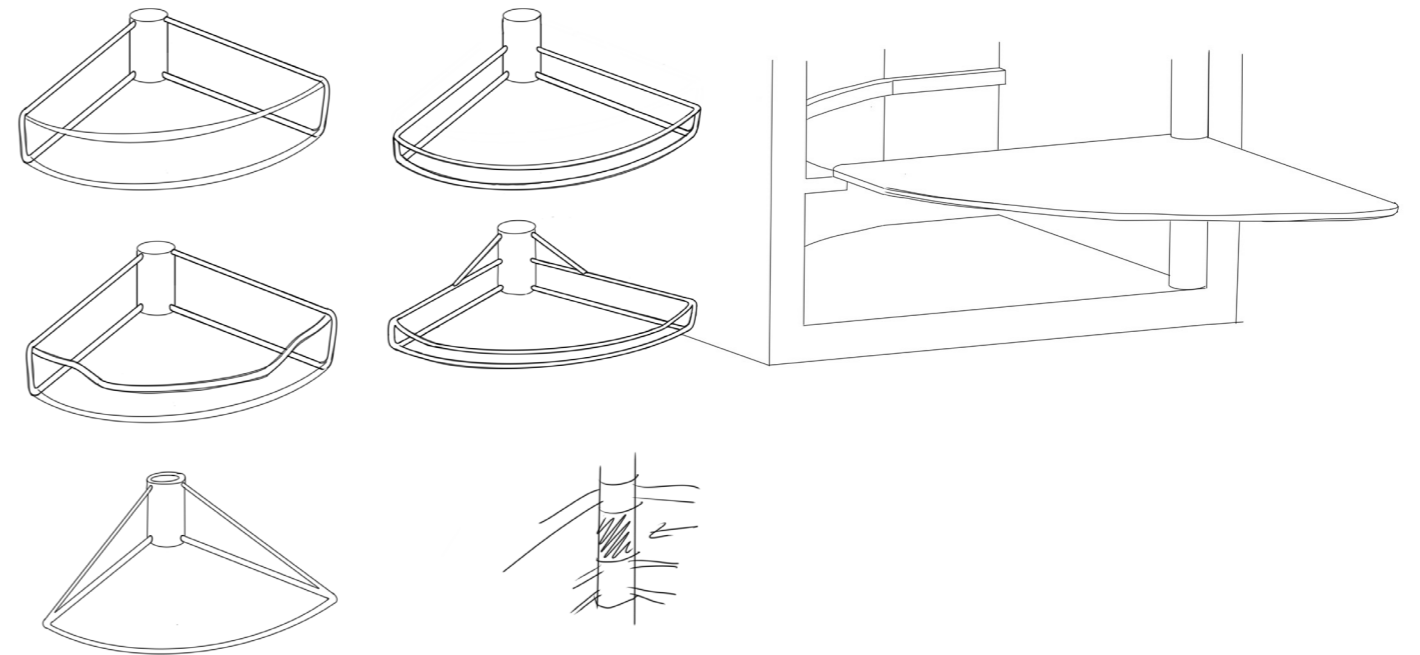
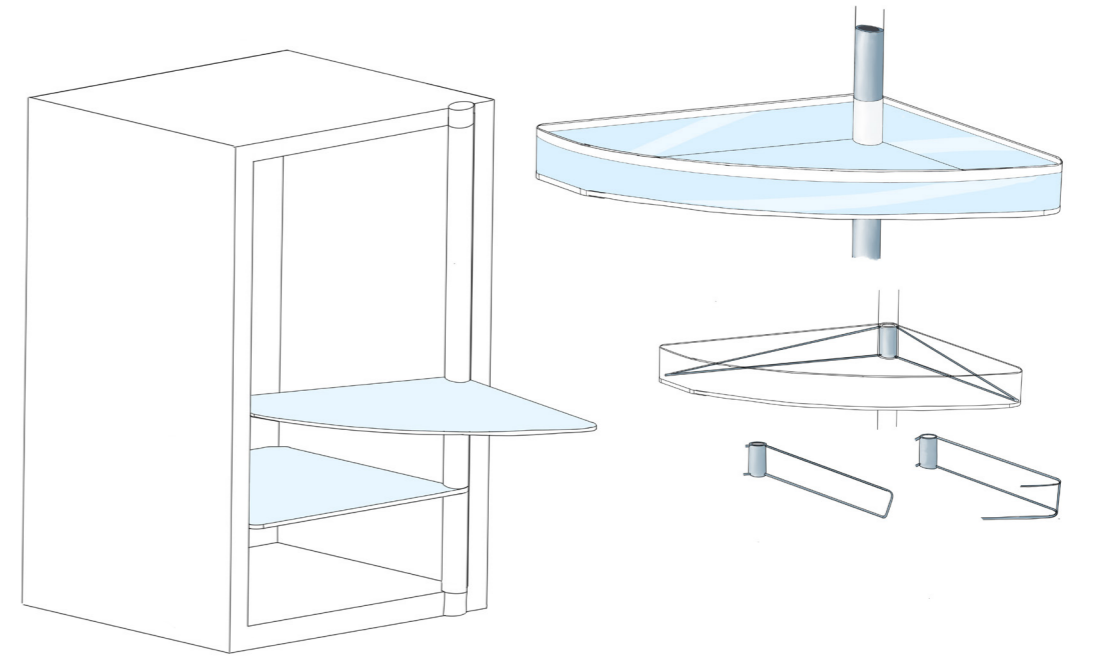
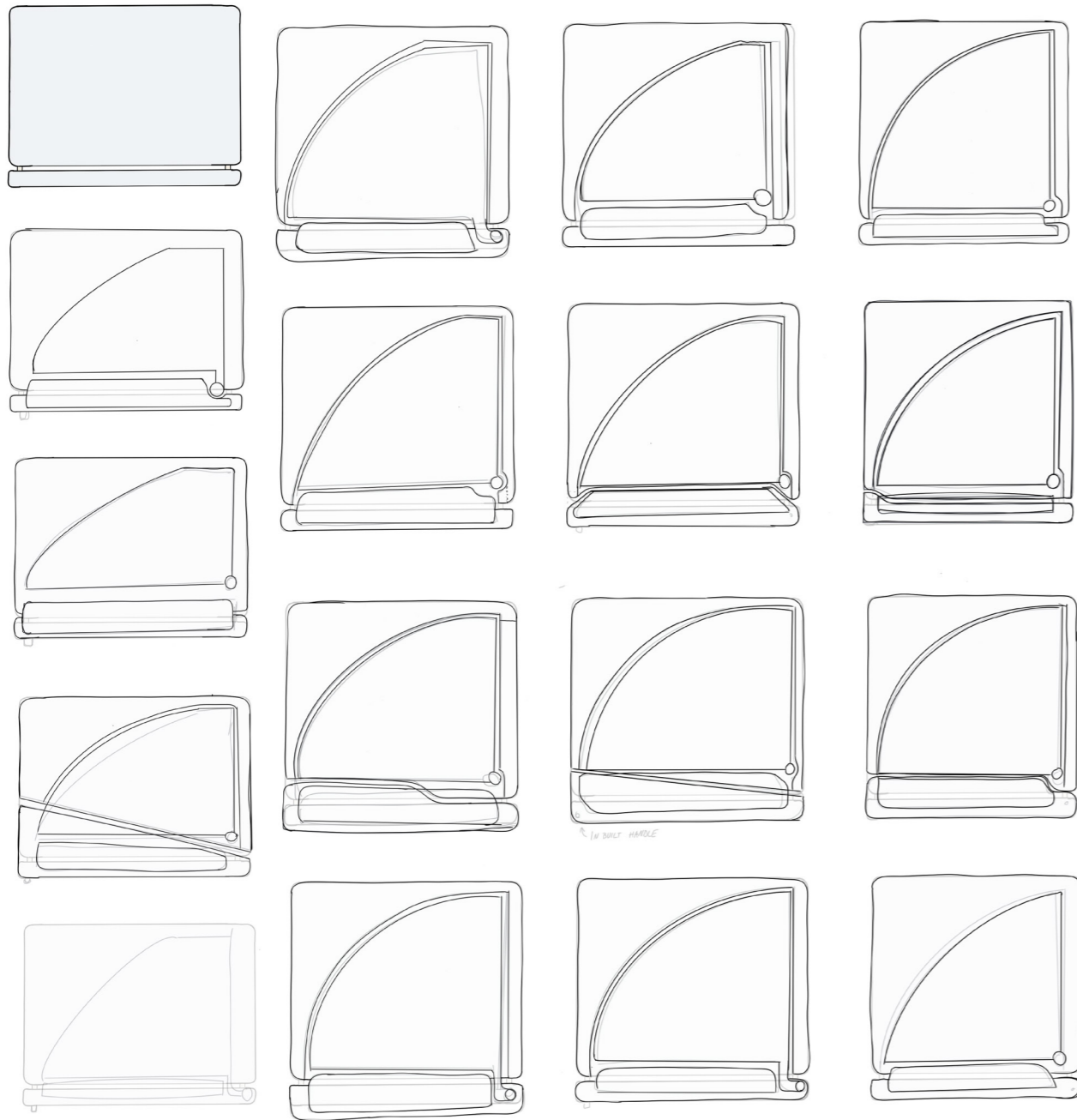
With the shelves no longer being attached to the door, we could regain the desired door storage areas. The internal layout needed to be redesigned to accommodate the reintroduction of the door shelving sections into the design.

The shelf was no longer supported by the door and needed to rotate independently. Therefore it needed to be more robust and self supporting. I explored the addition of a support frame/cage for the individual shelves. This would in turn allow for a removable tray to be developed to make the shelves easier to clean.

I prototyped methods to support the shelf when fully extended. Both a telescopic/sliding rail that extended with the shelf and a static catch system were tested to determine how they might be implemented in the design.

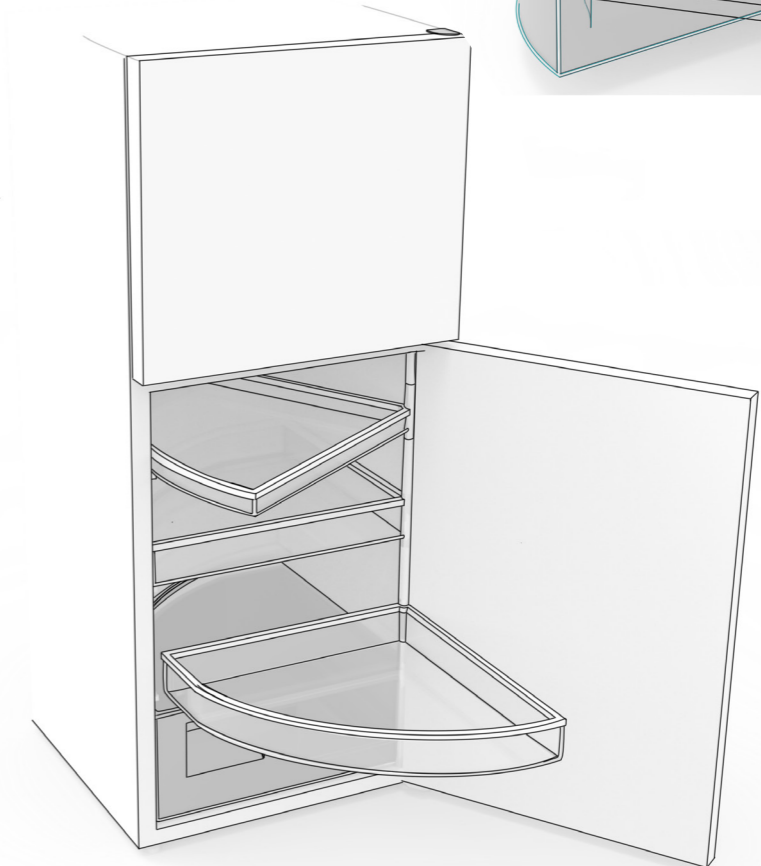
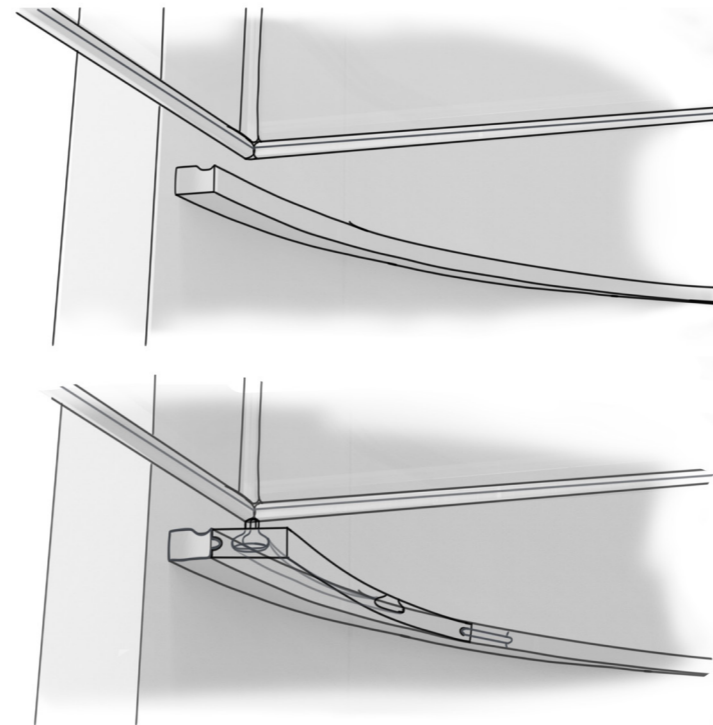
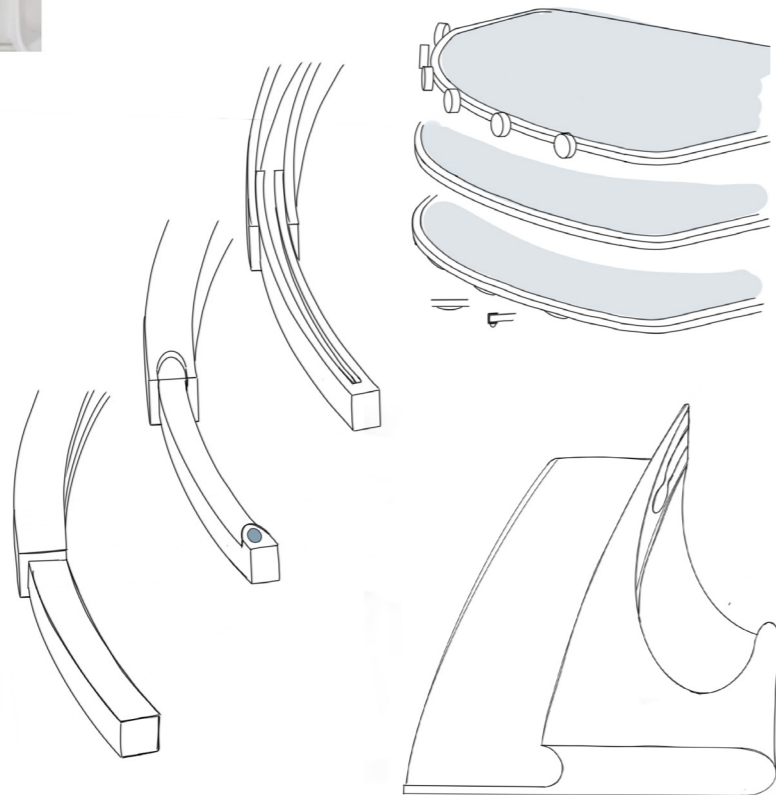
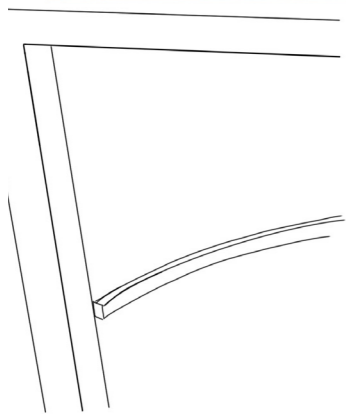
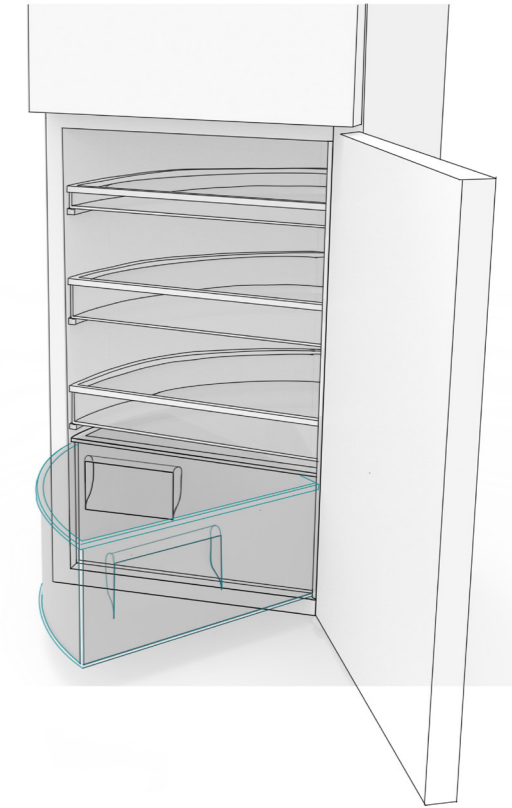
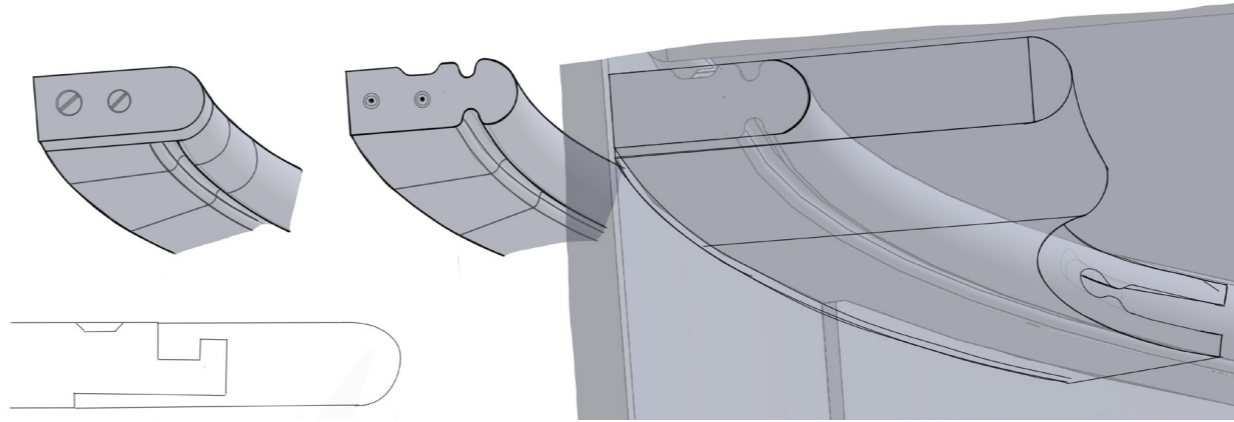
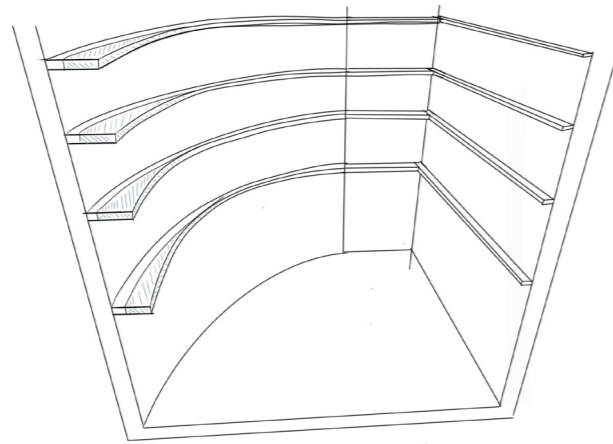


# Pivot and Shelf Development





# Support Mechanism Development





Testing Tray Height



Weight Position Test

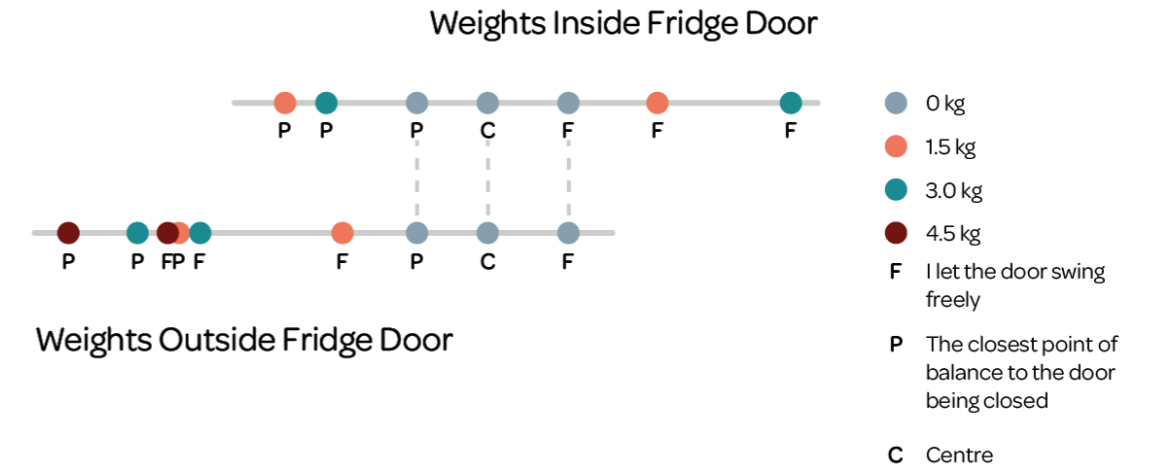


Production // Prototyping // Rapid Testing



66

## Rapid Testing



Final Resting Point Results From Weight Position Test

With a rough concept of the internal layout being completed, the finer details could be worked on.

The height of the sides to the shelves, which had several factors constraining their design.

- Providing structural support to stop the shelf drooping
- Stopping items from falling out if swung out quickly
- Acting as the handle to the shelf itself
- Minimally impeding the user's use of the shelf

I tested the effects of weight positions in relation to the shelf's pivot position. This was transferable to the shelves as well as the door itself. The results were surprising in the fact that the weight loaded

in front of the pivot point resulted in the door swinging out a shorter distance rather than when it was located on the inside(back) of the door, giving me more free reign when deciding the pivot point due to the minimal difference found.

# User Testing



Fridge A



Fridge B

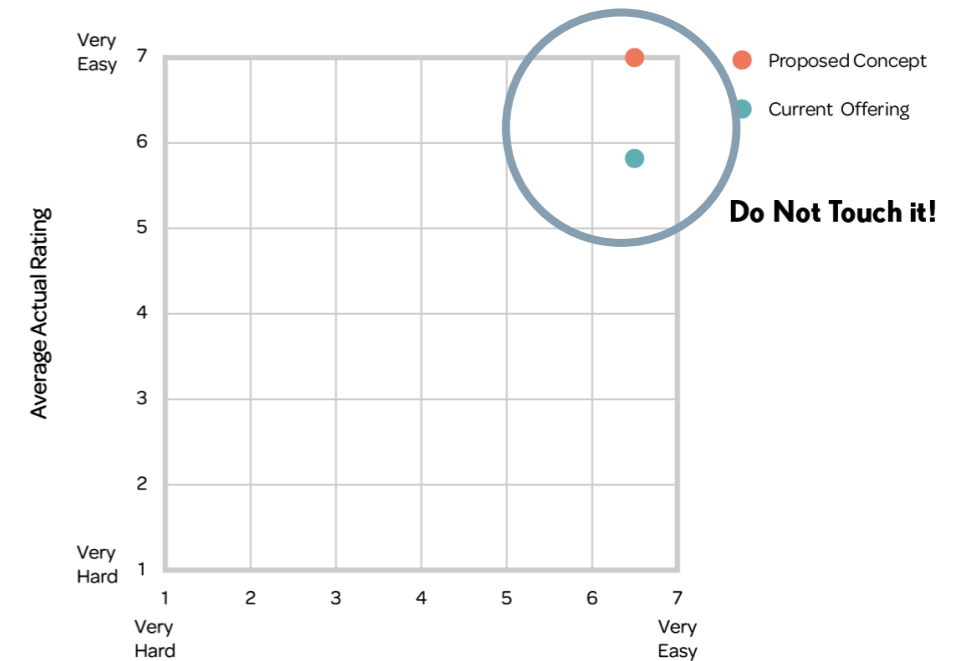
## Expectation Measure

Scenario and A/B testing ([Appendix 3](#)) was used to influence the design of the fridge by recognising the role satisfaction plays in identifying usability issues. I collected satisfaction data from 8 users in the form of quantitative surveys and qualitative observation in order to compare my proposed concept against the current fridge offering.

The Expectation Measure, created by Albert and Dixon (2003), investigates the degree to which the expectations of users are met. First, I asked the user to assess the scenario and each of the tasks, complete the tasks, then rate the task again. All the while I was observing their thoughts and actions

within the scenario for both the proposed design and the current offering. This helped understand how the users acted, their thoughts and feelings combined to direct the design to be more satisfying.

The proposed design was seen to identify the correct needs of the user better than the current offering. Users expected to find the tasks easy and they were, as seen in the expectation measure. Based on the expectation and experience ratings, both fridges were distributed in the 'Do Not Touch it' design strategy with the rotary design above that of the current.





Fridge A



Fridge B

While users were impressed with the new mechanism, concerns arose from an assertion found in the memory task due to only a marginal improvement in results.

- A= 5.2
- B=5.7

Upon reflection, this task was the least relevant as a measure between the two designs and would be better to a period testing setting. However, observations during these tasks proved incredibly insightful, I as I witnessed participants change both behaviour and positioning between the two scenarios. For example, having to crouch less with scenario B than for scenario A.

## Memory Task Results

On average, users remembered more products with the proposed design vs. the current offering.



## Period Testing

The proposed design solution was tested with the user over a period of four days. The purpose was to gain deeper insights into how receptive the target audience, young professionals, would be to the design. They were to use the fridge as normal and note their comments and concerns to discuss at a later date.

It would have been ideal to have run this test for longer, to build an understanding of the relationship between the user, this design concept and the combined effort to reduce waste in the kitchen.

However, the results from this testing were largely similar to the A/B Scenario testing:

### Positives

- Clear overview of everything on the shelf, so much so they could not hide or lose items at the back of the shelf.
- The active movement of physically pulling out the shelf to use it to its full potential
- The conscious decision whether or not to pull out the shelf
- How swinging a shelf out actually improves sightlines to items on the shelf below
- Felt it was intuitive to use

### Questions

- Would they be able to test and use a full version if it is produced?

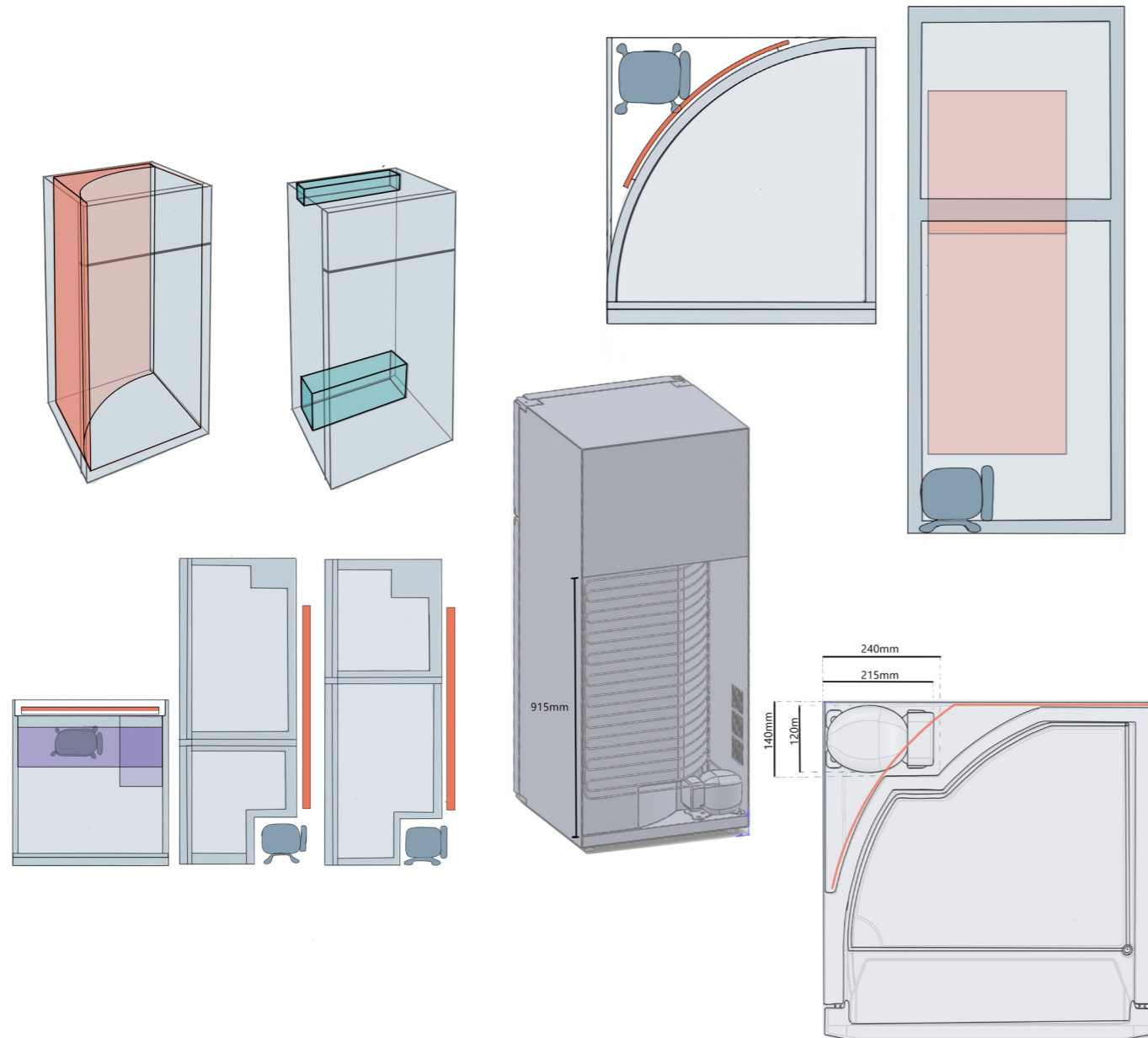
- What are the changes in functionality with fridges of different heights?
- Would a retrofit option be available?

### Critiques

- Multiple shelves would have made the functional prototype more immersive



# Design Engineering



Consequent to taking a deep dive into fridge manufacture and their components, it was established that there were two different size categories: American and European fridges. American fridges are 15-30cm deeper than European equivalents. I chose to focus on the European market, which has an average width of 0.55-0.65m and depth of 0.55-0.65m, to suit my target audience: catering for the urban individual with smaller, compact kitchens.

Specific component research was performed to produce a minimal viable product ready for manufacture rather than a purely conceptual design.

A stereotypical fridge design using an existing compressor is one of the more complex parts of the fridge system, to redesign a bespoke one to fit in the corner of my fridge would prove expensive, while only gaining 4 litres of fridge capacity. It would also be time consuming, thus it was decided to use an existing compressor model.

The compressor's size and shape (Appendix 4) were the design limiting factor, with my engineering background I knew the compressor could be redesigned to fit in the corner space of my design. However, during my research, I found that the compressor shape had remained unchanged over the years, due to its capability to be used in fridges of all shapes and sizes. Instead of taking the liberty of tweaking the compressor's layout, I explored

more innovative options, such as scroll and magnetic levitation, used in commercial settings instead of the existing domestic methods.

The current standard is to have the compressor at the bottom in a cuboid void at the back of the fridge/freezer resulting in a half shelf in the coolest part of the fridge.

The area above the compressor was still dead space that could be further utilised.

The rotation system that I have implemented results in a void at the back corner of the fridge, so I explored whether this could now be used to house the compressor, light system, as well as curving the condenser into the now curved void allowing the freezer located above the fridge to be a little deeper.

# Reflection

The fridge is an integral part of everyday life, so challenging its design is no small task because people are naturally resistant to change. Throughout the design process user testing was essential, alongside full scale prototyping, as measurements of small details are important when it comes to products you use every day.

Ideally, this design sprint would have taken place over a longer period, allowing for further refinement of concepts and testing of additional features. However, with the use of rapid prototyping, discussions with fellow designers and user testing, fast design decisions were made. This resulted in a product with the potential to take different directions while staying true to the initial aim of this diploma: to reduce food waste or make better use of waste.

The speed at which decisions had to be made helped ensure a linear direction of this process resulting in a clean, efficient work-flow, which I carried into the design aesthetics of the product.

If more time was available, further exploration into each potential direction would be undertaken to ensure the achievement of the highest product potential. The user testing would have been done over a longer period of time, and included the addition of a second shelf in the functional prototype, which would have resulted in more precise feedback.

# OUTCOME



## Overview

SVING is a new fridge design that aims to help improve a person's relationship with their fridge. By providing convenient and tailored storage methods, SVING enables behaviour change. It is harder to hide, ignore and forget about food, while also reminding them of what they still have.

Users expect a fridge to function for the purpose of storing food and improving food life. It is an engineered product with a list of required features and components. Although the capacity for domestic fridges has changed significantly since the invention of the electric fridge, why has the layout stayed the same? SVING challenges fridge design, while enhancing circulation and giving access to all areas.

SVING's design incorporates an active element, the use of a physical action and a conscious decision. This unique swing out feature also increases visibility of what is situated on each shelf to ensure you know exactly what you have before shopping for more.

While providing an innovative method of storage, SVING primarily acts as your everyday fridge, and helps users make conscious decisions of what they need. It is harder to hide and forget about food with the SVING rotary shelf system. The product streamlines the ability to check food items before they go off, reduces the chance of buying duplicates, and makes it easier to extricate items at the back of the fridge.







## How it Works

SVING contains shelves that can be rotated out of the body of the fridge. This increases user access to the contents stored at the back of the fridge while also providing them with a greater overview of the contents of their fridge.

The shelves rotate around a singular pivot pole; this simple design removes potential parts that could get stuck or break. The shelf grip is located on the opposite side to the pivot pole making the design intuitive to use.

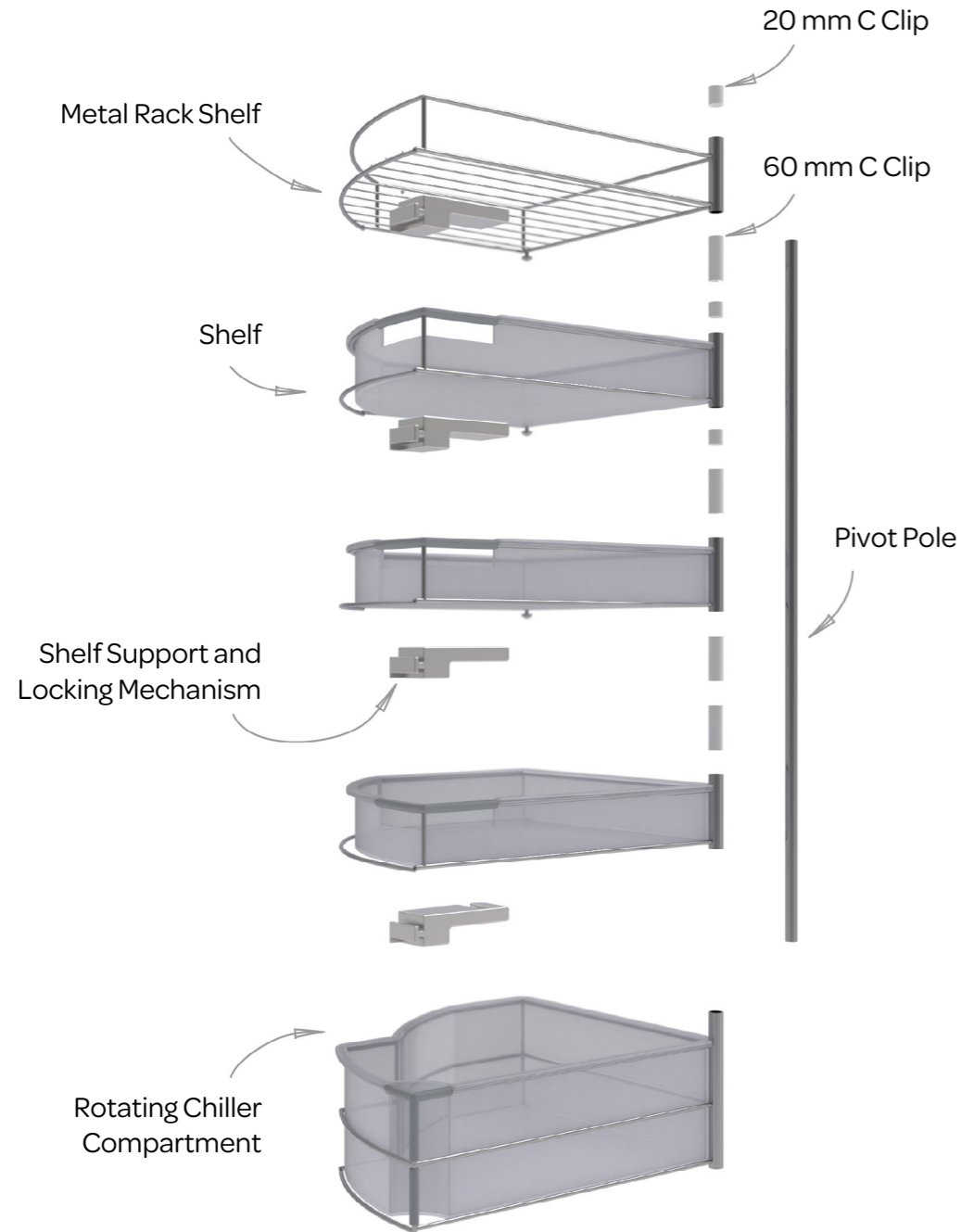
SVING utilises a removable shelf support and locking mechanism that catches the shelf upon rotation. This stops the shelf from swinging out too far and provides support when the shelf is fully extended.

There are three shelf types:

- A deep bottom shelf
- 3 standard shelves
- A shallow metal rack shelf

[Link to animation](#) (also in Appendix 3)





The bottom deep shelf works as the chiller drawer for fresh produce. Due to the unique layout of the fridge, this chiller compartment is now larger than existing fridges as the compressor only takes up one corner of the bottom shelf rather than half of the bottom shelf.

The metal rack shelf provides a place to store jars and smaller items for easy access, as well as items that need better circulation.

The spacing between the shelves is adjustable; this is controlled by the positioning of C clips spacers. These come in 2 sizes: 60mm and 20mm. Spare C clip spacers will be provided with the fridge to allow for full customisation.

## Instructions

1. Remove the tray section of the shelf to be moved unless it is empty, in which case it is the user's choice as to whether they remove it or not.
2. The user will then slide the shelf support and locking mechanism backward off its rails and remove it.
3. The next step is to remove the C clips so the shelf can slide to the desired height upon which the shelf can be moved to the desired height and the C clips can be put back into place.

# Conversations with Stakeholders

## Start Up Kitchen Company

Through my supervisor, I contacted a start-up company whose ambition is to redesign the kitchen industry. They are designing kitchens with sustainability at the core. They are therefore interested in the reduction of waste both in design and production and through influencing behaviour in the kitchen and at home. They want to help people to live in a more environmentally friendly way, to recycle more and waste less, through their kitchen design and using digital solutions and services. They were therefore interested to hear my thought process and research around user behaviour related to food buying, preparation, storage and waste.

I gave a presentation of an overview of my concept journey to their team at their office and asked them for feedback on both concept and design direction of the rotary fridge.

They understood the challenges I was facing with regards to the solutions for waste reduction around a conceptually new fridge, and suggested that I worked further on certain aspects. They highlighted some areas that could be developed in more depth for example in some of the following areas:

- Drawer sections
- Labels on the drawers - fixed or removable
- Storage of bottles lying down
- Integration with smart technology
- Variation in sizes

The team liked the idea of being able to get a better overview of what you had in your fridge but also raised the question on volume lost due to the shelves rotating rather than sliding out. They counter-balanced this with some potential uses this corner space could house:

- Lighting instruments
- Cooling systems
- Offsetting the curved wall to improve ventilation/air circulation

The team questioned the use of a rotary pull-out system rather than a drawer system as drawers would remove the dead corner space. I highlighted the improved accessibility to the back and side of the shelves when they are rotated out. This raised the question: 'Why not both?'

One of the team also highlighted that the proposed design makes it easier to clean the fridge as all the shelves can swing out for a quick clean and that the shelf trays can simply be removed for deeper cleans. This correlated with responses in the user survey.

### Actions subsequent to the meeting

Distinctive styling - The design was very functional, efficient and felt like it needed a slight rework to make it more approachable, through further refinement and potentially adding new features to make it really stand out. I softened the engineered feel with the addition of curved features and reshaping the grip point. I chose to maintain this design language through the design by applying it to the exterior by removing the sharp corners. This in turn made it more distinctive and also fit into most kitchens' design aesthetic.

### Chiller drawer and bottle rack

These design tweaks were already underway prior to the meeting, with the addition of a detachable rack system for the shelves as well as a lid to the bottom drawer.

### Housing of cooler systems

I consulted with the Principal Engineer at Bryden Wood (an international company of technologists, architects, and engineers) about the housing of the fridge mechanisms in order to find out what could be improved to make it more efficient and reduce the corner space. This discussion resulted in a gain in internal space and the options of either a chilled, filtered water dispenser or a heat exchange unit with the main components situated in the void section above the compressor.

### Labels on drawers

This was another addition that was already under consideration before the meeting, but had not been implemented yet.

## Future Development

There were a number of suggestions arising from the meeting which held potential and warranted investigation that would need to be reserved for the development of the next prototype, due to time limitations.

### Integration with Smart Technology

My research identified new developments in food product barcoding to include use-by dates, giving potential for a barcode reader/sensor to identify when an item is about to go off. The team suggested the light on that shelf changes colour or the shelf nudges itself out a little to give a moving visual indicator.

### Ventilation and Circulation

The improvement of a stepped back curve, to allow for more efficient cooling, however not to encourage an active airflow when the door opens, as an influx in oxygen will only hasten the rate that the food will go off. This has been covered, in part, with my consultation with the Principal Engineer.

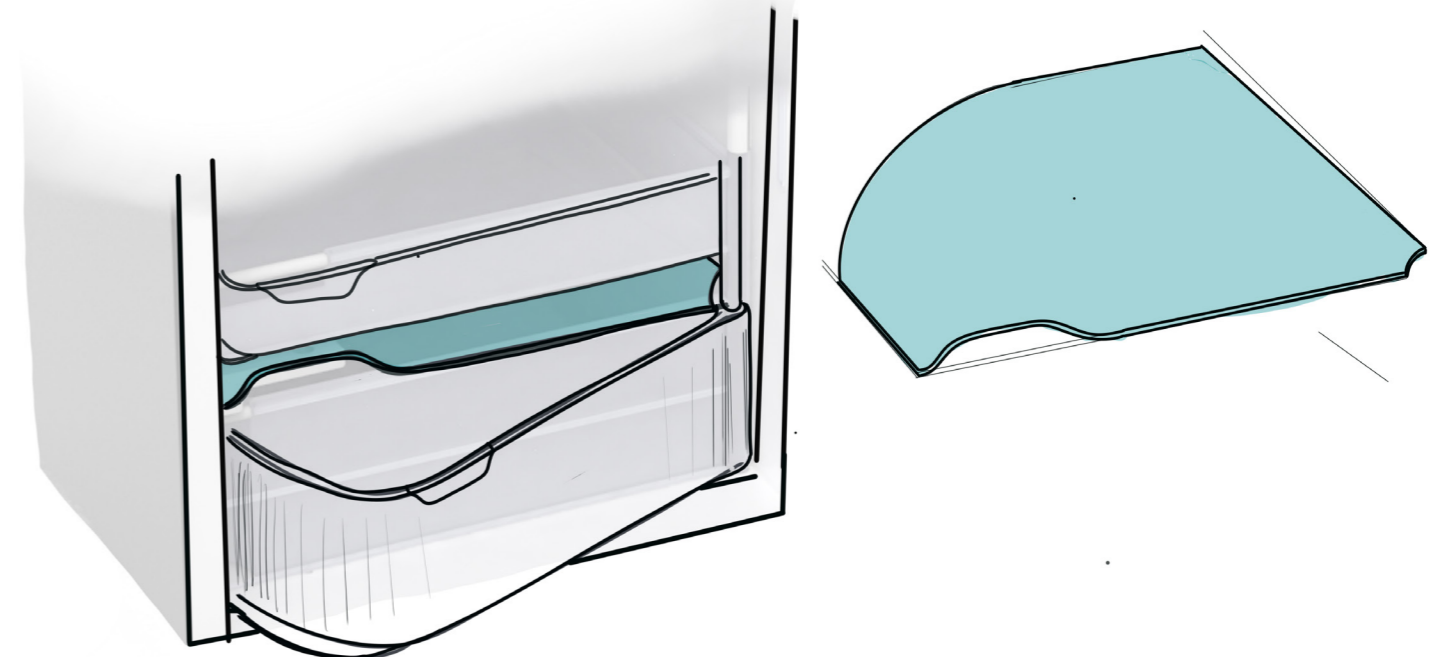
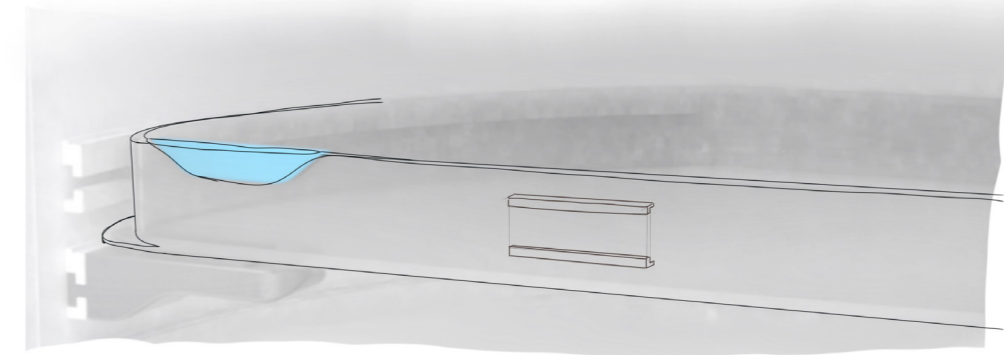
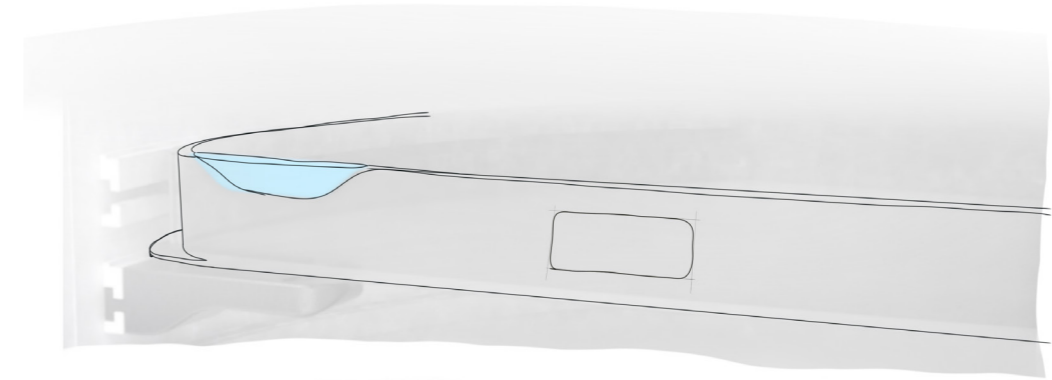
### Why not Slide then Rotate?

I had steered away from drawers as they are currently used in under-the-counter fridges, but also because their effectiveness depends on the height of the fridge, even more so than my rotating method. However, if the shelves slide out before rotating, then it has both options, but this would require a more sophisticated mechanism which in turn leads to more potential points of failure.

This could be something to investigate further in the future; but the mechanism would require a lot of testing and refinement in the next phase of development.

### Gratitude to the Start-Up Team

I am grateful for the time given, their encouragement and ideas shared. They instilled confidence in my design abilities and the concept.



## Commercial/Industrial Refrigeration Engineer

After carrying out extensive desk research, I was fairly confident in the functionality of the design, nonetheless, I contacted an expert in the industry to gain design confirmation. I posed potential directions and changes to the engineering expert that could be made, but would deviate from current industry standards.

### Component Positioning

I set up a video call with a commercial/industry refrigerant engineer. He had no problems with the layout of the fridge and the positioning of the components. He informed me, due to the space above the compressor, there was no need for the side vents.

### Condenser Placement

I queried whether the condenser could be doubled up on the curved section, removing the need to have the condenser wrapped around the back of the unit. The Engineer did not see this as a problem, especially if I installed a fan as well. This meant that the condenser space could be reduced even further, allowing us to gain another 10 mm depth to the back wall gaining c.4l capacity to the fridge. This extra space above the compressor could be used for other purposes:

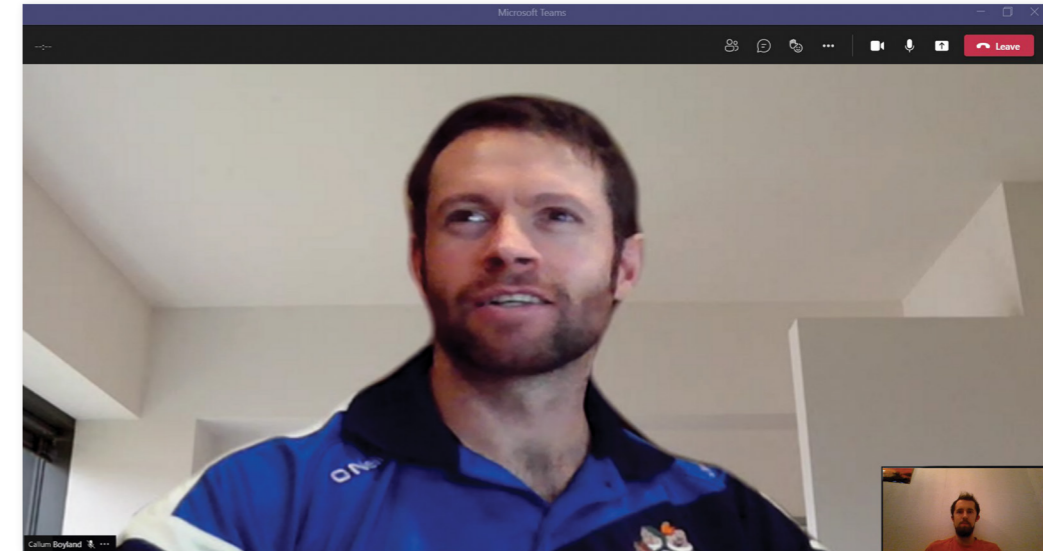
- A chilled/filtered water reservoir
- A heat exchanger

These would offer users the ability to have a water dispenser and/or wash their hands in warm water using the excess heat generated by the compressor and condenser. Their introduction would require the fridge to be plumbed in, which more fridges are doing in the current marketplace.

### Refrigerant

The majority of similar fridges on the market run on refrigerant 134a in their system. Be that as it may, during my research I found that R134a had a very high global warming potential (GWP) - 1430. Given that >750 is considered to be high, the R134a is too high to fit within the sustainability mindset of this project. It was then discovered R134a will be phased out by 2030 and will be illegal to sell by the end of 2023.

I had found other refrigerant types with lower GWP (R513a, R290, R1270), but was unsure of their compatibility with my system. I posed this question to the engineer who had his own suggestions, R1234xy, R1234xe and R290 being the most notable. To ensure system compatibility, the engineer phoned the manufacturers of the compressors directly, who suggested refrigerant R290. Ideally, this could be done as a straight swap of refrigerant with no need for changing other components. R290 has a GWP of 3 making it far more environmentally friendly than the original R134a.



### Compressors

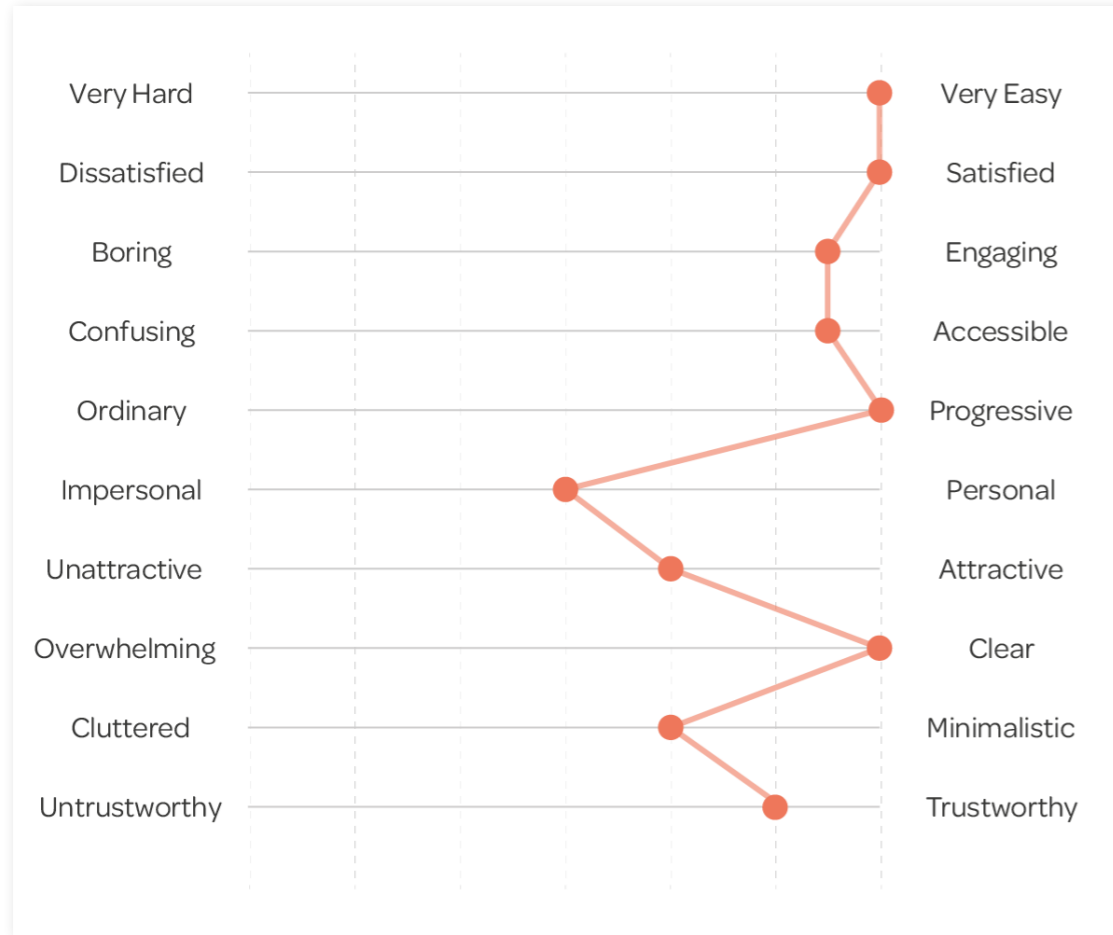
We talked about the types of compressors and the potential layouts for the various components, in particular how the compressor and condenser can be located on top of the fridge as done in commercial settings. This raised the issue of noise and height issues for taller fridges and a need for changing other components.

The compressor manufacturers also said that they had no intention of changing the format or layout of their compressor unit system in the near future, as the industry was happy to work around the current layout and size of their components. The manufacturer did say it was possible to make the changes, however they had no intention to do so until industry required it.



## Design Review: Results & Anecdotes

Semantic Differential Scale used in Online Review to help interviewees describe attributes



### Highlighted Quotes Extracted from Questionnaire

"...(those with) disabilities will be able to operate this design more easily than a traditional fridge set up."

"I would be concerned of the shelves cracking/spilling or breaking"

"The revolving fridge would allow for easy access to what's inside without needing to have the door open and lose temp."

"... would the revolving shelves increase/decrease the space available for storage? Would it have any impact on energy efficiency? Would there be incremental cost"

"It facilitates ease of use with and easy removal for cleaning if required."

"Space savings of the fridge area could be a concern (cut off corner areas) but like that you can get to the back of the shelves easily"

"Sometimes we resist things just because we haven't seen them, but in general terms I think the idea is good."

"I think it's a clever design and would certainly help visibility and accessibility for certain items."

"...it may help to colour code or label where foods should be placed to optimise space and longevity of food."

"The use of bottles or large items storage below the counter could be the draw side down and back"

"There is weight of food on the shelves that there is a strong counter balance on the strain on the rotating arm will have potential to drag the shelf down."

"Love the revolving shelves concept. It is invariably the bit and bobs at the back of the shelves that can get over-looked!"

"I would worry of space lost in a smaller flat with the fridge door space area containing components."

"...certainly help visibility and accessibility for certain items"

# Design Review

I reviewed the design with people who could propose grounded solutions based on real-world experience and tested design principles to make me think smarter. To evaluate the interviewed stakeholders' interest I categorised the power of their unique needs and how they would influence the success of the design, thus helping me to manage their suggestions and invaluable insights.

The Start up, my supervisor and I agreed on the fact that SVING needed to be a feature point in the kitchen and with distinctive styling. This echoed with the results from the user's online review regarding the average ratings of 'attractiveness' and 'personability'. I added softer edges that echoed the key selling point of the design, rotating shelves, for brand consistency.

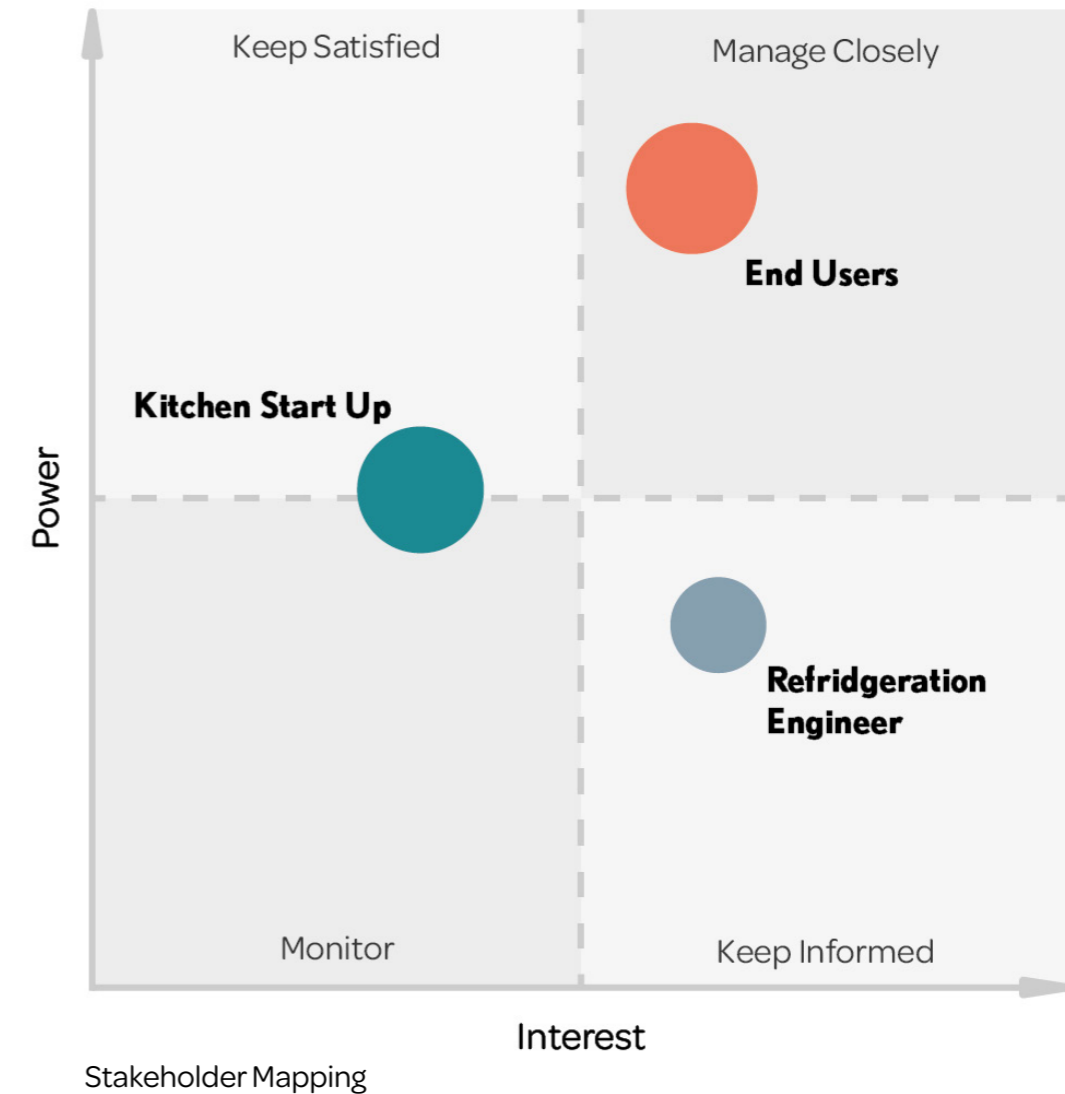
When the designer team questioned the pivot mechanism, I anchored to the engineer's assessment of SVING where there were no issues with the pivot placement to compromise performance or functionality. The space economy had ensured better placement of the fridge's components.

Results from the user's online review stated they were receptive to the design (Appendix 5), and it's improvement to accessibility and visibility, but they did not understand the use of the corner to store the fridge's components. This could be explained by the exploded view of the fridge that did not include the internal fridge components.

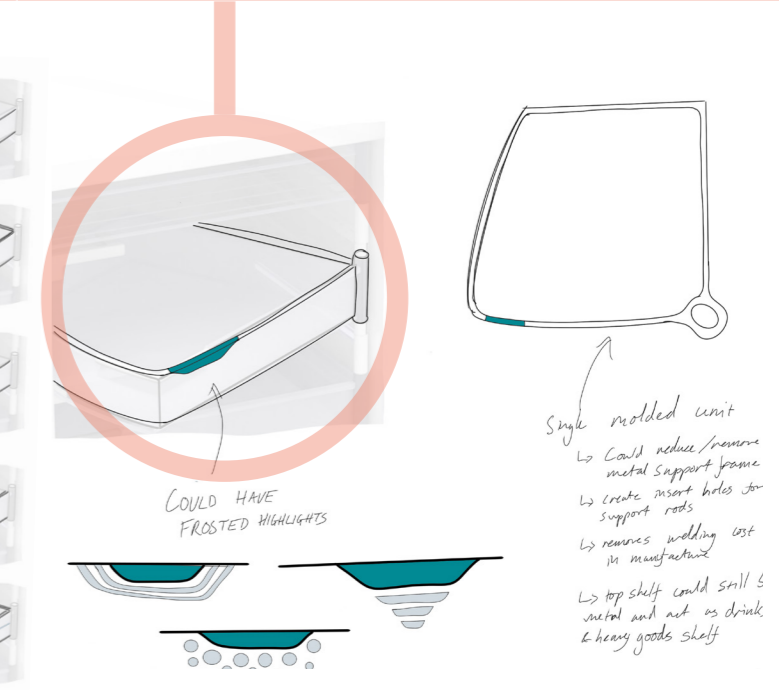
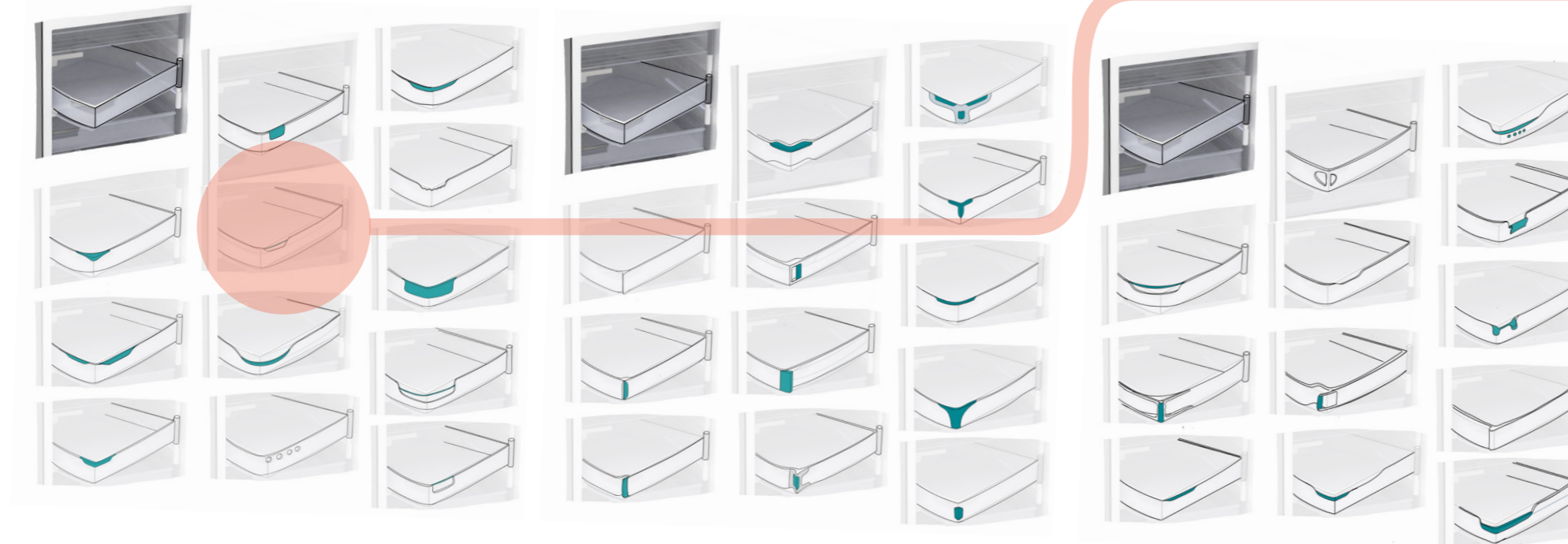
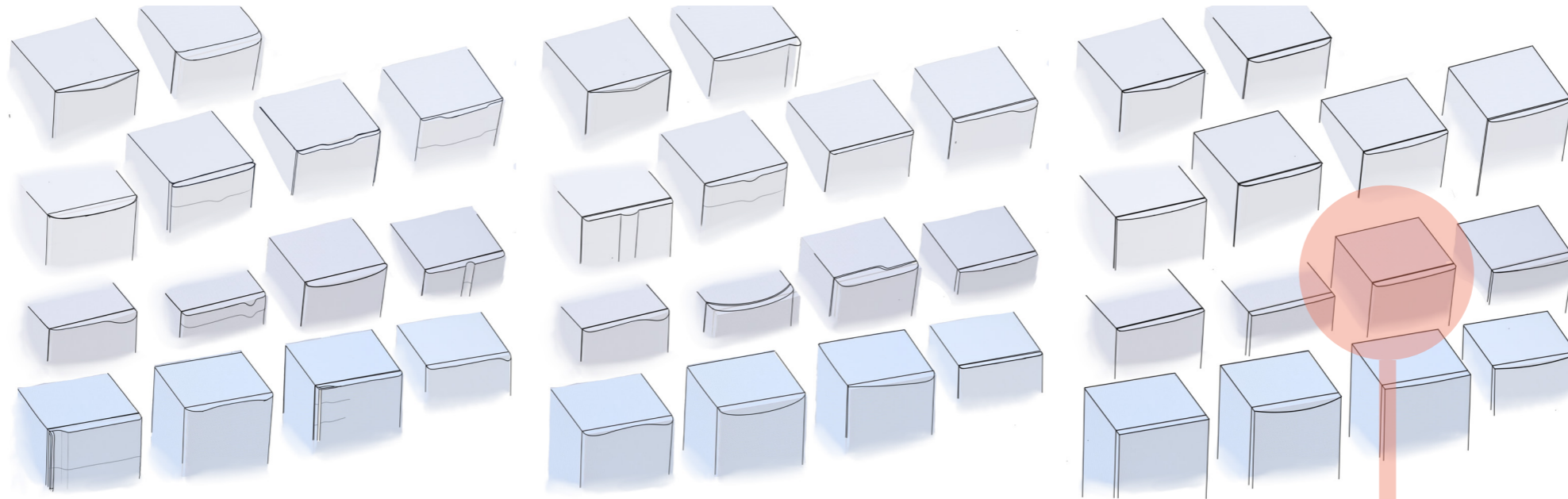
However, user's highlighted important assets SVING provided for accessibility for disabled users. This made me think profoundly about the impact a design can have on day to day life. I accounted for the suggestions of labelling to enable users to organise their fridge and reduce forgetfulness.

It was hard to not identify too closely with the idea because of the time and effort spent on the project. I had to learn to be external and independent to my work. I challenged myself to be adverse to the natural inclination of taking offence with feedback and instead be genuinely concerned about getting the concept 'right' and shifting the concept to the next level.

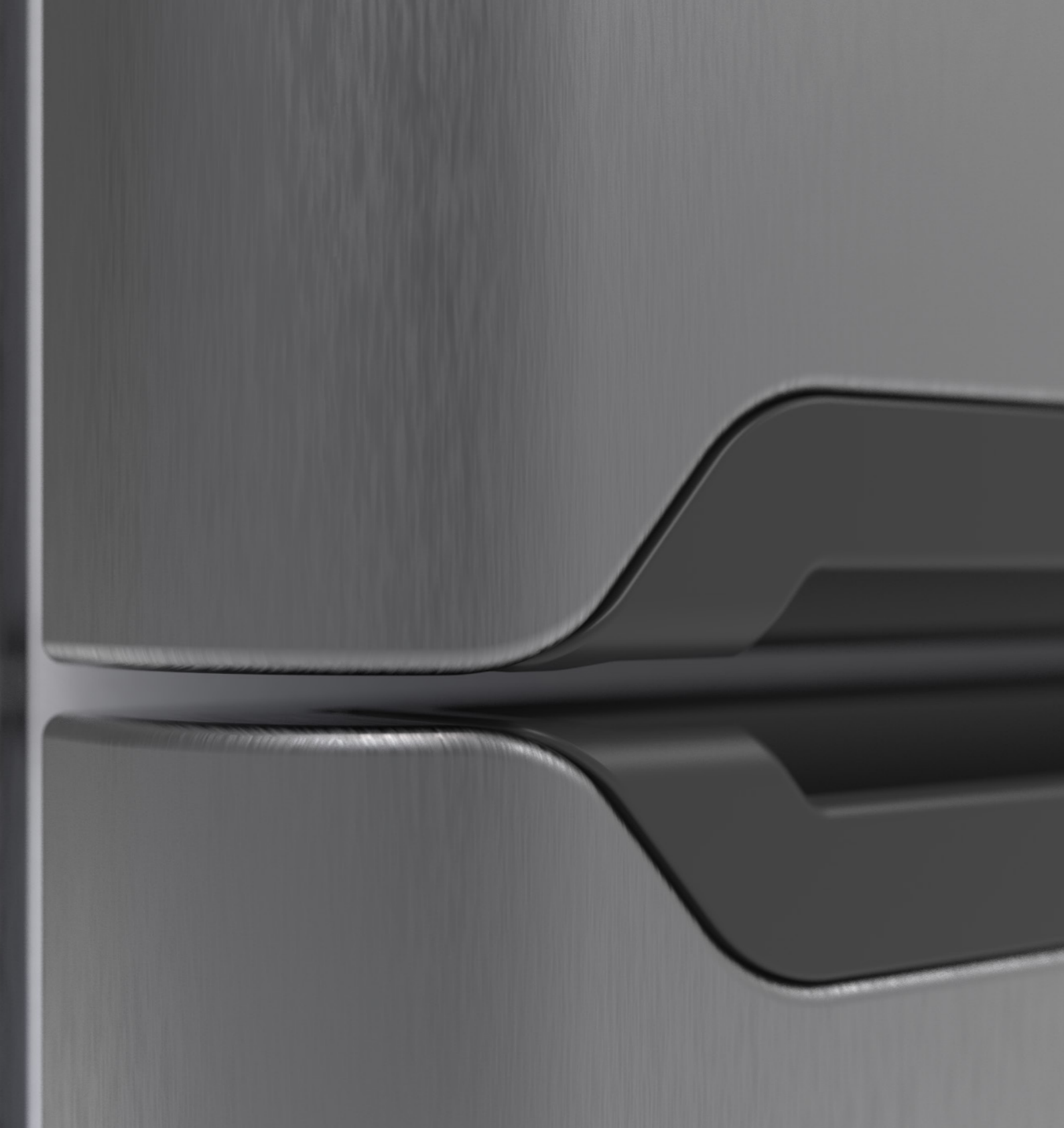
Adapted from 'Mendelow's Matrix' from Nielsen Norman Group, 2021

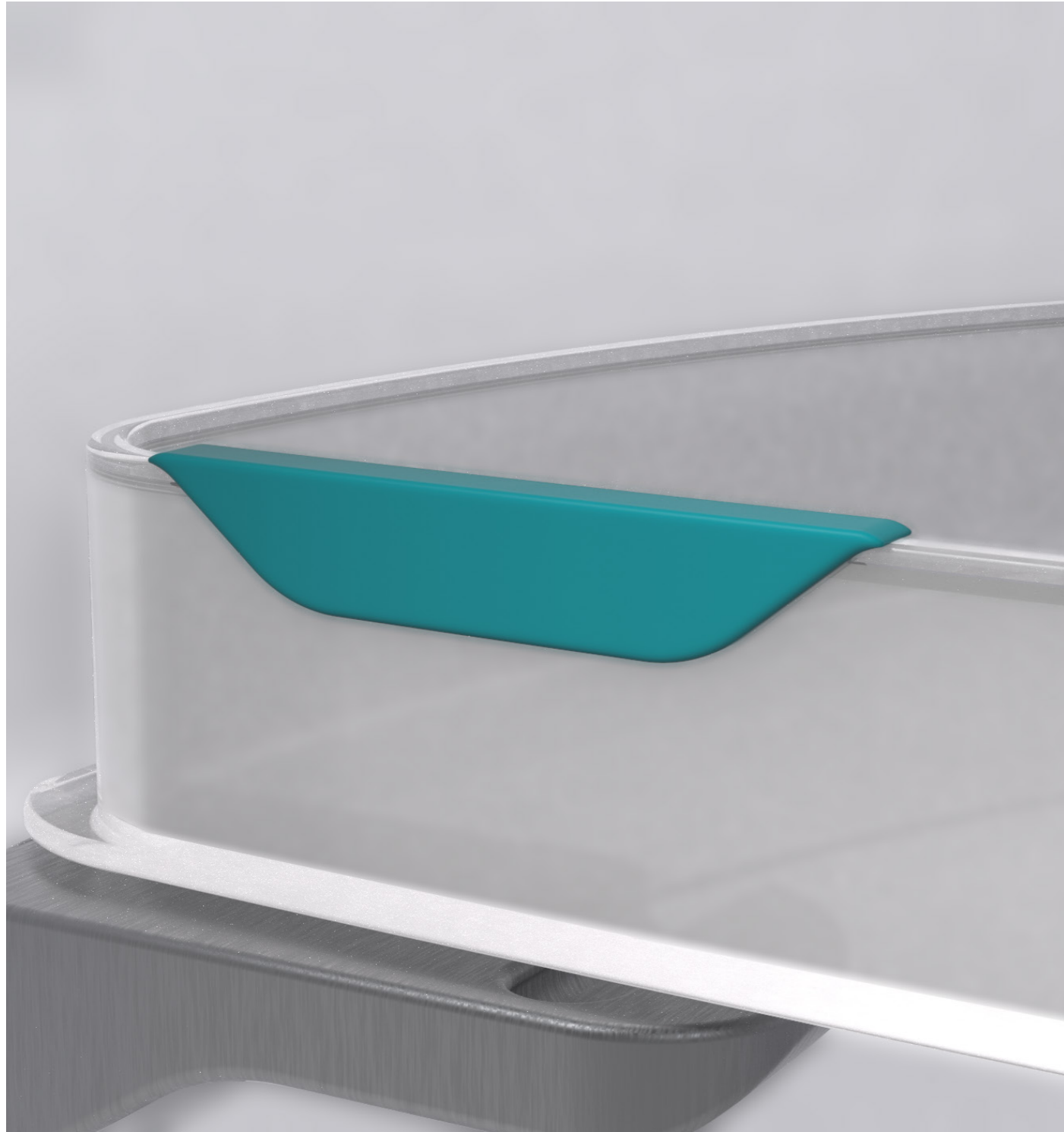


# Design Development









# Functional Prototype



Marking Out 'Fridge' Box



Glueing 'Fridge' Box



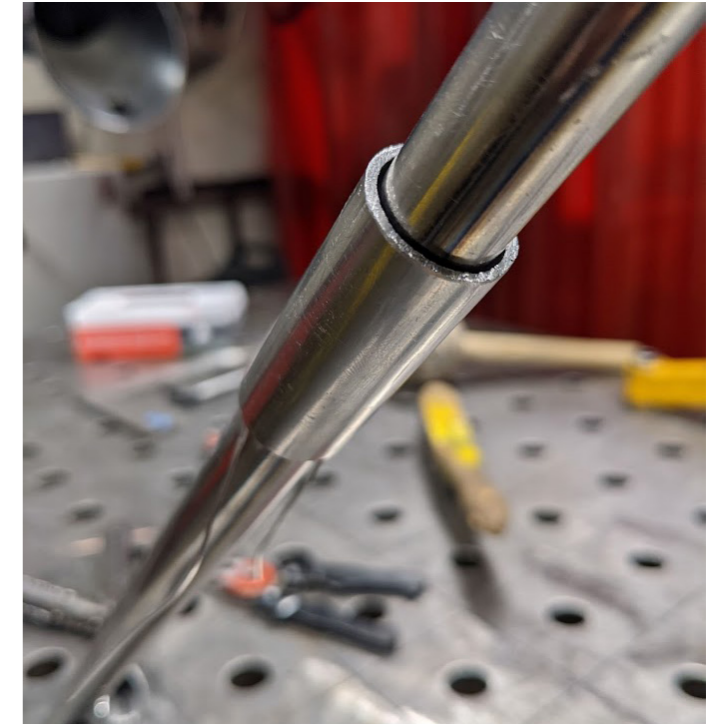
Cutting Pivot Pole to Size



Grinding Shelf Supports



Filing Shelf Frame Sections



Testing Fit Between Pivot Pole and Shelf Frame



Tacking Frame Together



Outcome // Functional Prototype







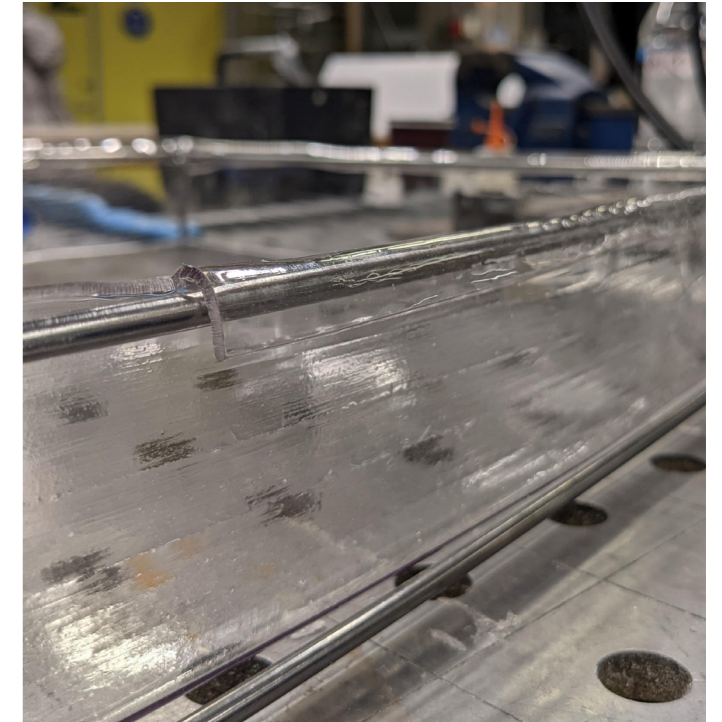
Sanding Mould Down to Size



Checking Moulds Fit



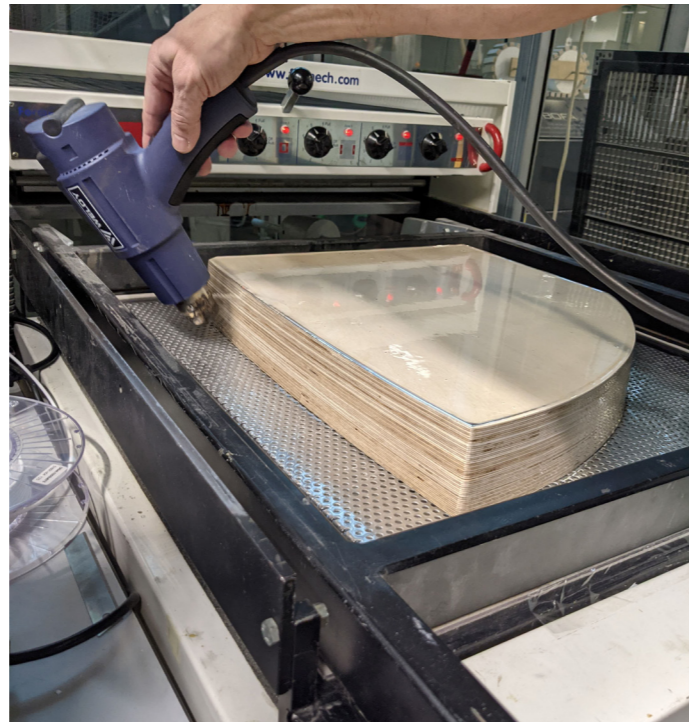
Forming Tray Around the Frame



Tough to Form Smoothly



Outcome // Functional Prototype



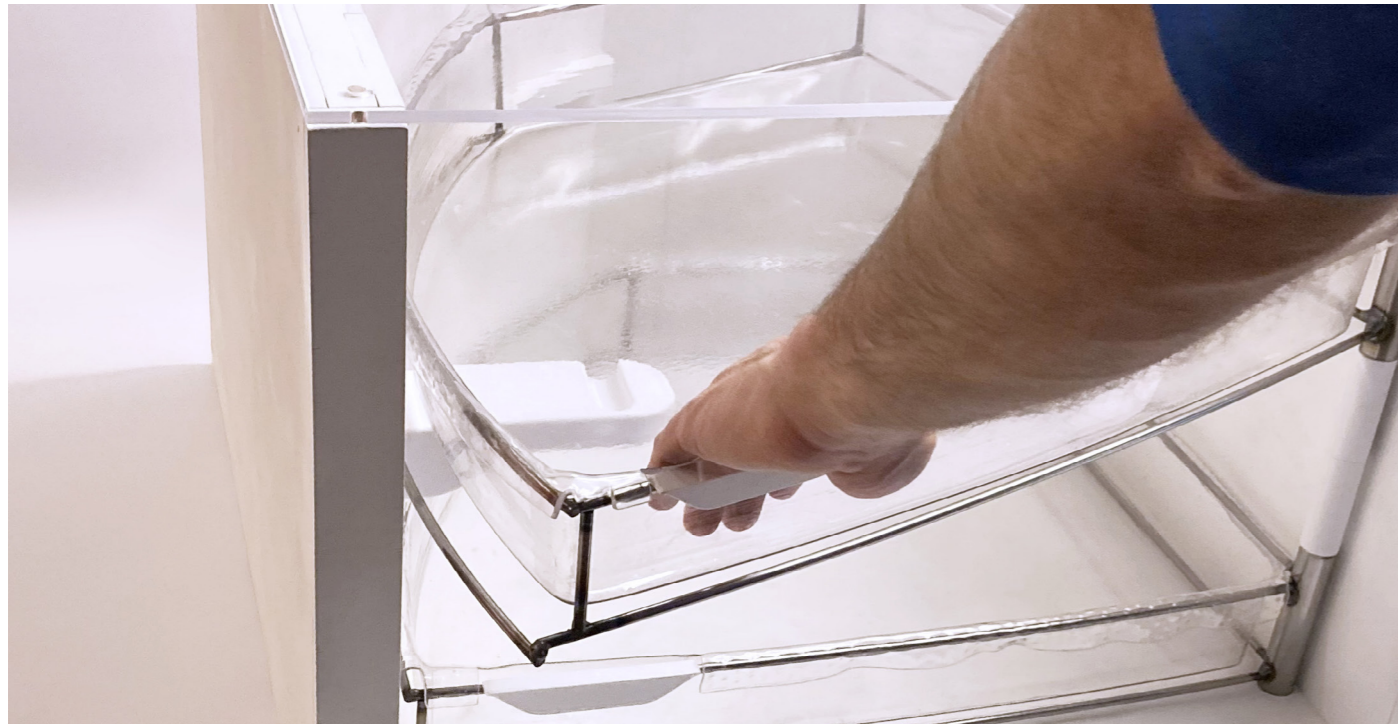
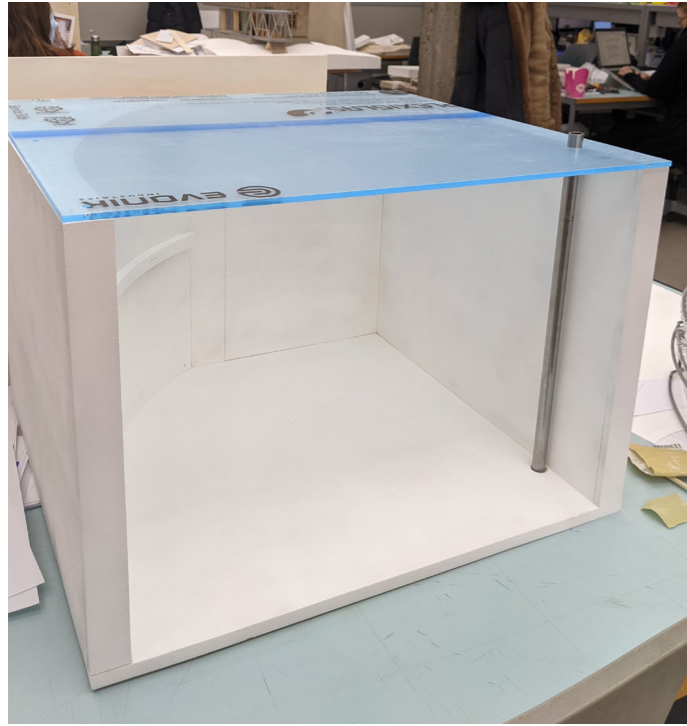
112

Vacuum Forming Tray



Checking Tolerances

113



# REFLECTIONS

# Reflection

Before the project started I knew a diploma targeting food waste was always going to prove challenging, though I was unprepared as to the scale of the problem and its intricacies. This made the project a little more daunting, but also made me more eager to tackle this challenge.

Due to the nature of the project, it took a vast amount of research to hone in on a solution. The depth of my research created a tangible focus on how to contribute to the eventual stoppage of food waste. To be critical, the abundance of work had compromised my timeline of working, condensing the time spent on choosing a design direction.

Time continued to be a constraint throughout, limiting the exploration of ideas and user testing. If more time was available I would have liked to test the functionality of the second shelf in the functional prototype with users, which would provide a more comprehensive feedback than my online user review.

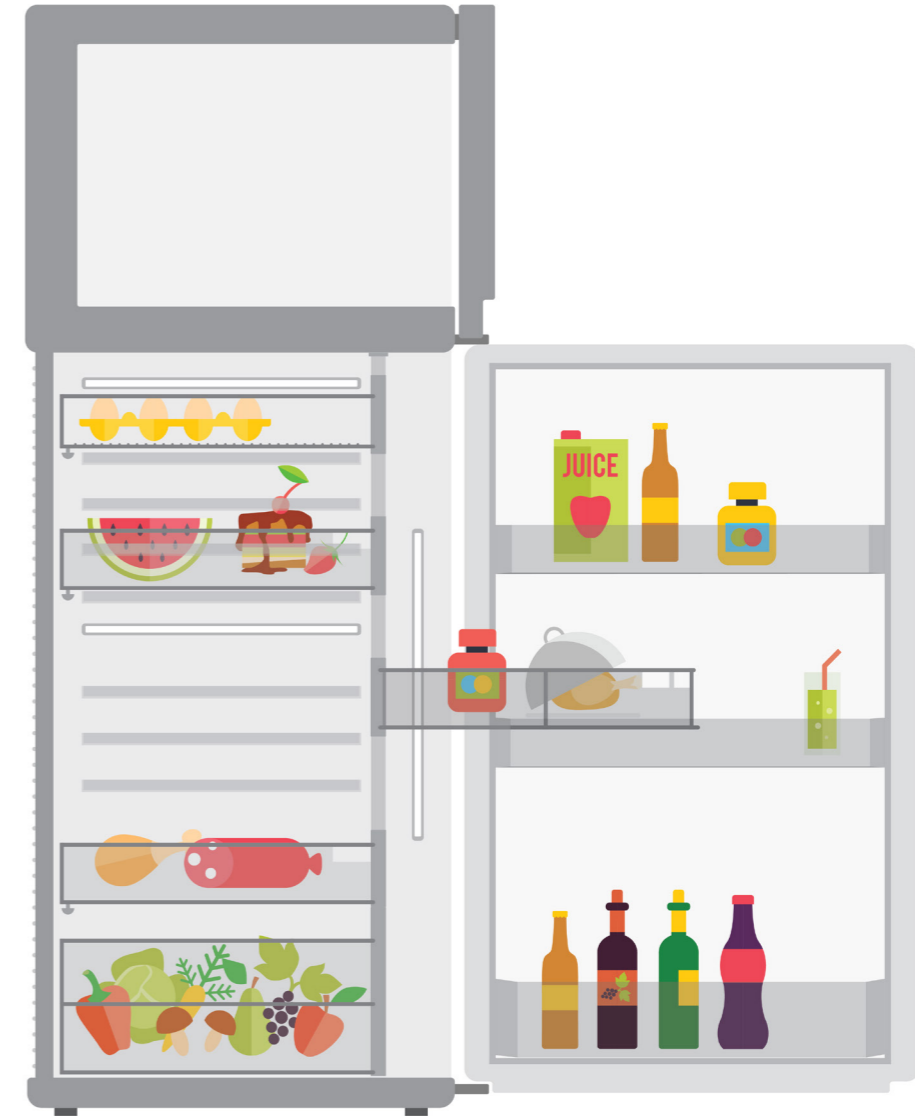
Time constraints were beneficial to making design development decisions. I was able to maintain progress in this condensed design sprint, while learning to flourish in a pressured environment.

I found the project both hard graft, with a tremendous learning curve, and rewarding, with really positive feedback from prospective users. This was exemplified through the functional

prototype's success which utilised my hands-on skills to best showcase SVING's rotary system. Visually, I would further develop the aesthetics of the fridge to create a potentially iconic fridge.

SVING, and the journey of its development, provides an incremental step towards helping users to prevent food wastage, through a physical approach that also encourages a behavioural change, acting as a stepping stone for further development.

Cross Section Illustration



# Conclusion

Extensive exploration into potential ways to help reduce the food waste problem was undertaken with a focus on how products could encourage a behavioural shift in the user. A broad range of methods were employed (desk research, sketching, mapping, rapid prototyping, informal interviews, testing, questionnaires, formal and informal interviews, co-designing, functional prototyping and CAD modelling) to aid in the exploration, development and explanation of these areas. The areas explored helped reveal pain points within the journey of food and in particular its disposal, highlighting the complexity of even the smallest tasks.

The goal of the diploma was to provide a product that would encourage users to re-evaluate their regard for food and help them make the step towards a more sustainable relationship with food resulting in a lower waste footprint. SVING both aids the user in their interactions with food in the kitchen and also reduces the chance for users to hide from the truth of their waste.

My hope is SVING as a product and the journey of its development provides users and readers with a tool to help a behavioural shift in their approach and to take responsibility for their own food waste.

# ACKNOWLEDGEMENTS

# Acknowledgements

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Mosse Sjaastad and Jomy Joseph for their conversations in and around the topic and suggesting potential methods and directions that could be taken.

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Friends, relatives and acquaintances who rallied to complete the user questionnaire, voluntarily asking their friends and family to complete the form.

My family, who provided moral support throughout the project as well as their keen eyes and feedback when proof reading the report.

In case I have not been inclusive, my sincere thanks to all those who touched my project and held my arm in support.

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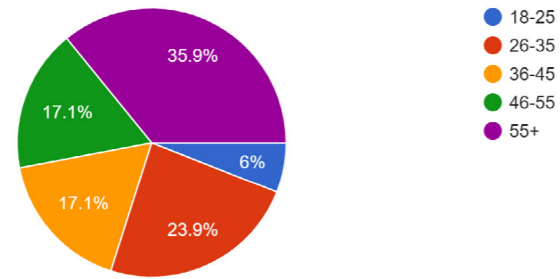
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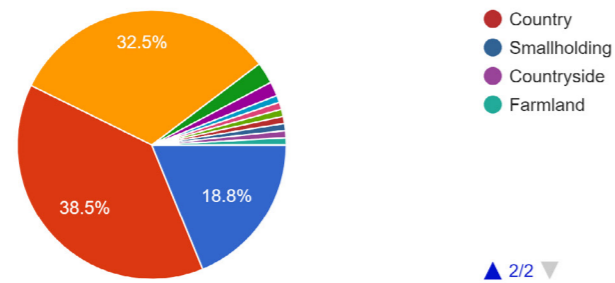
# APPENDIX



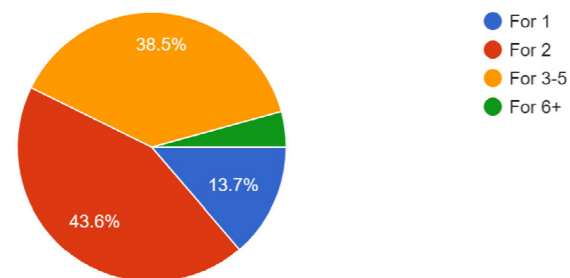
How old are you?  
117 responses



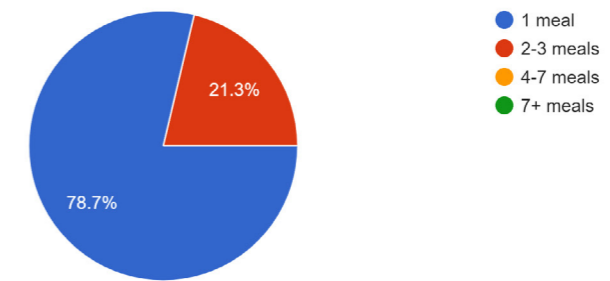
Where do you live?  
117 responses



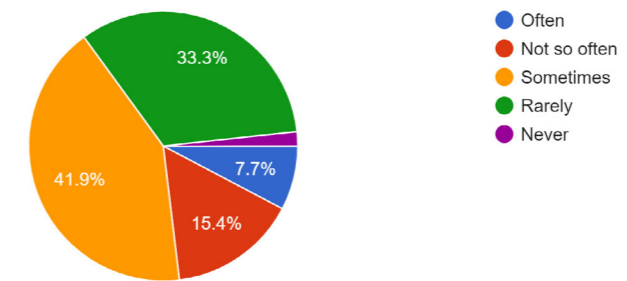
Do you shop for yourself/others?  
117 responses



Do you have any idea how much food you throw away in a week?  
108 responses

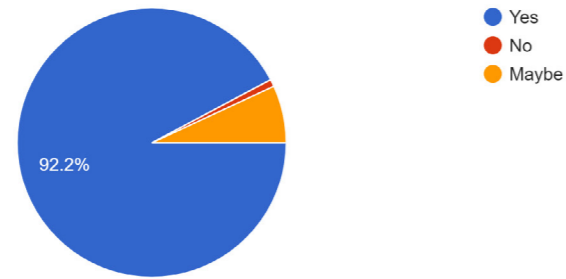


How often do you find food goes out of date before you eat it?  
117 responses



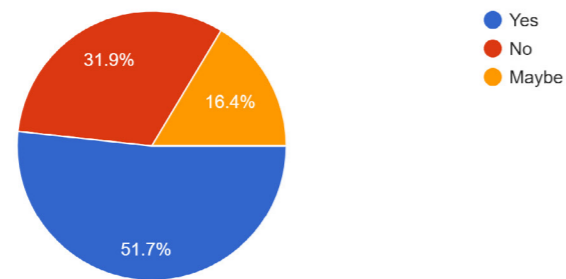
And do you think there is a need to reduce food waste in your area in and in the country generally?

116 responses



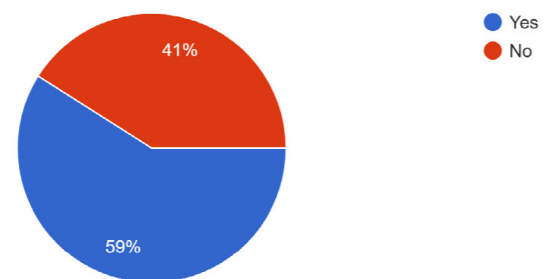
Do you ever worry about the amount of food you waste?

116 responses



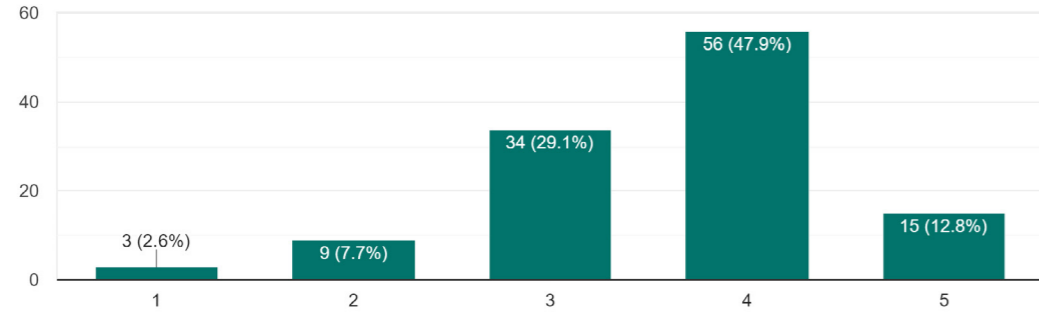
Have you ever changed a routine to try to reduce the amount of food wasted?

117 responses



# Appendix 2 - Fridge Questionnaire

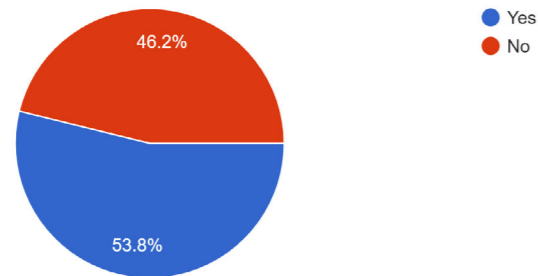
Describe the current state of your fridge  
117 responses



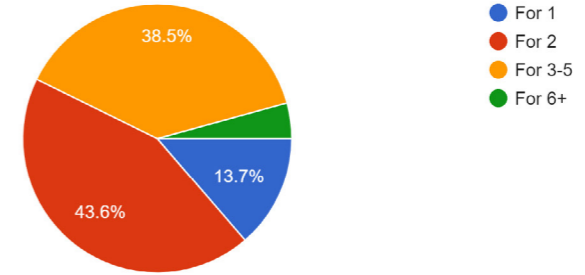
Cluttered

Organised

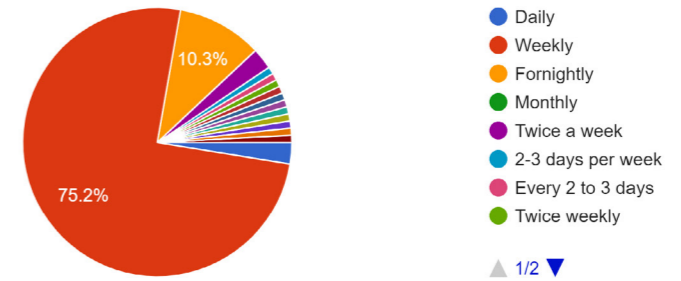
Can you view all items in your fridge?  
117 responses



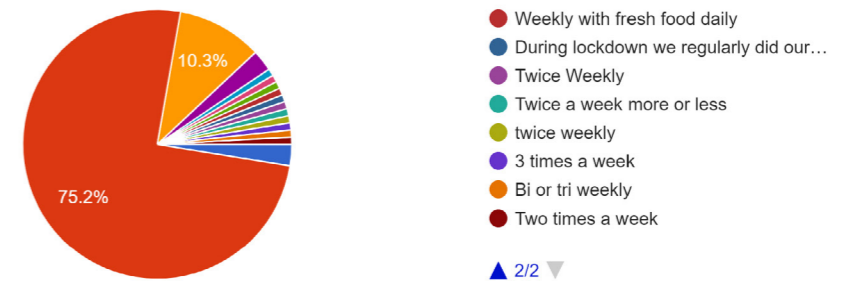
Do you shop for yourself/others?  
117 responses



How regularly do you shop?  
117 responses

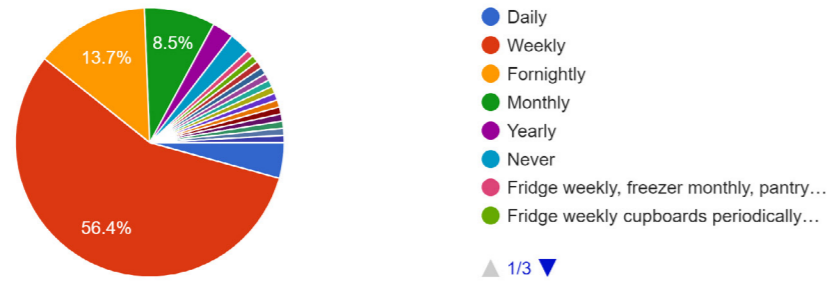


How regularly do you shop?  
117 responses



When do you sort through the food in your fridge, cupboards, other storage?

117 responses





## Appendix 3 - Video Links

[Click here to access the Wasted Potential Diploma Folder:](#)

Containing the following:

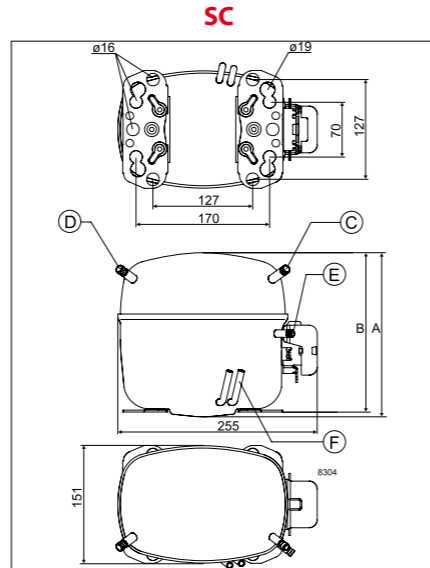
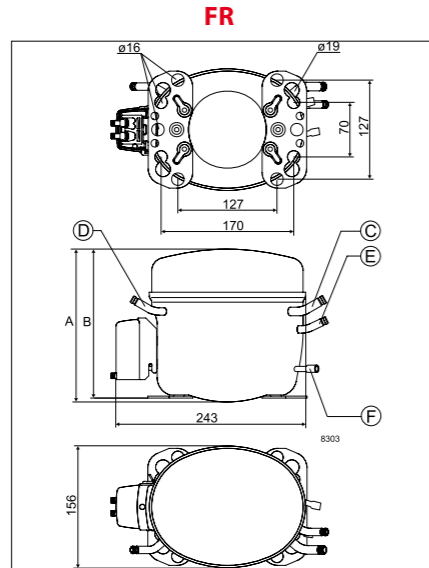
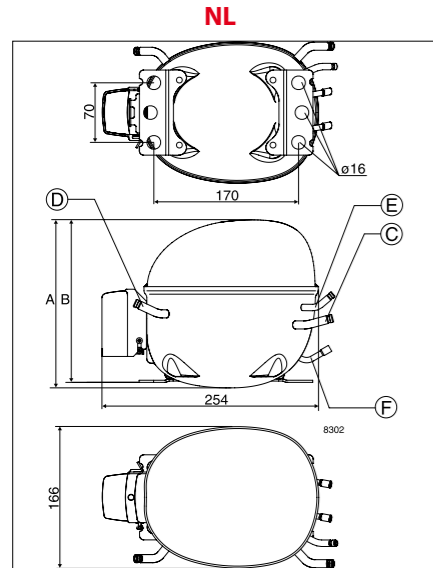
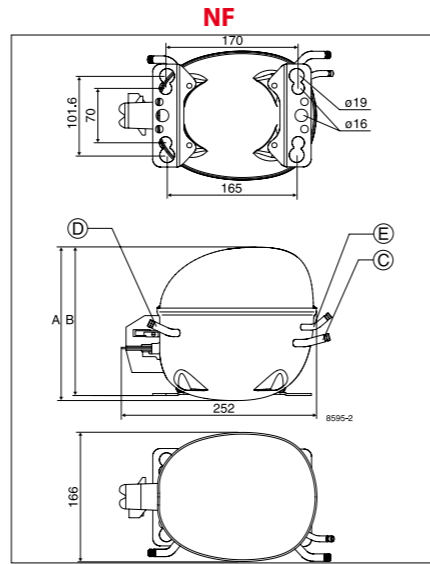
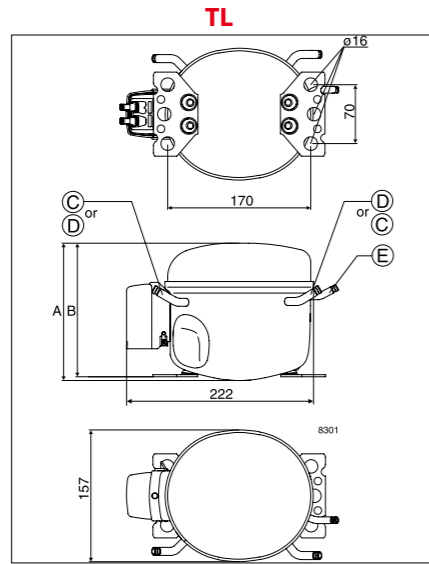
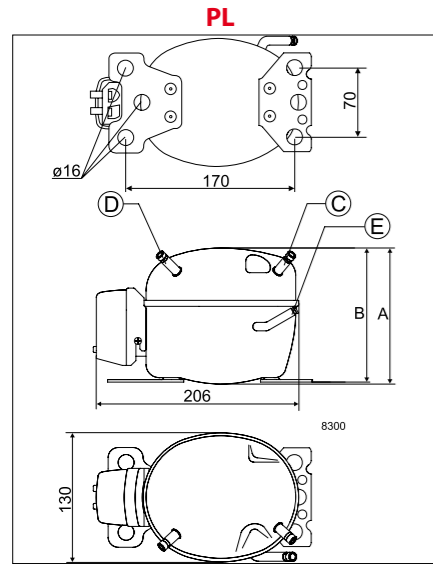
**1. Scenario and A/B Testing Example**

**2. Animation:**

How SVING Works

**3. Pivot Weight Position Experiment Example**

# Appendix 4 - Compressor Data



Quick reference

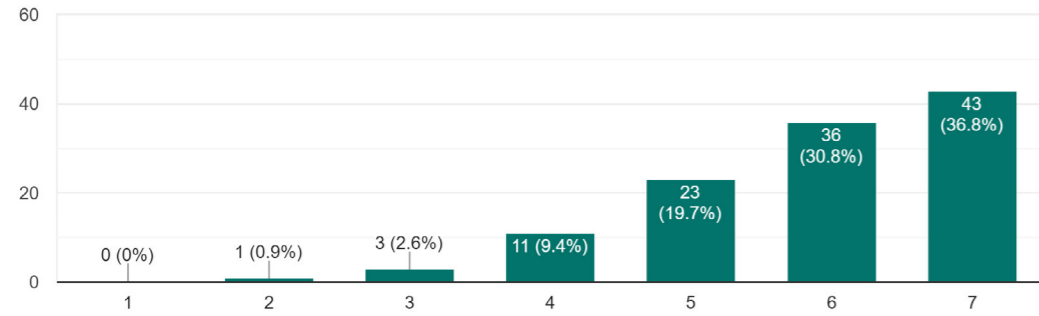
R404A - R507 - R134a - R290 220 - 240V 50 / 60 Hz

Refrigerant	Compressor	Code numbers	Horsepower (approx.)	Capacity (W) at test conditions											Power consumption (W)	Displacement (cm <sup>3</sup> )	Recommended compressor cooling at ambient temperatures								
				Evaporating temperature (°C)													32°C			38°C			43°C		
				-20	-15	-10	-6.7	-5	0	5	7.2	10	-10	-5			LBP	MBP	HBP	LBP	MBP	HBP	LBP	MBP	HBP
R134a	PL35G	101G0250	1/16	39	53	69	82	89	112	140	153	172	67	74	2.00	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	
	TL2.5G	102G4251	1/16	51	69	90	106	116	145	179	196	219	84	93	2.61	S	S	S	S	S	S	S	S	S	
	TL3G	102G4350	1/12	59	81	106	125	136	170	211	230	258	96	108	3.13	S	S	S	S	S	S	S	S	S	
	TL4G	102G4452	1/10	80	107	140	165	180	226	280	306	342	118	130	3.86	S	S	S	S	S	S	S	S	S	
	TL5G	102G4550	1/8	107	139	178	208	224	278	341	372	414	149	167	5.08	S	S	S	S	S	S	S	S	S	
	NL6.1MF	105G6660	1/6	141	189	245	288	312	390	482	527	588	187	206	6.13	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	
	NL7.3MF	105G6772	1/5	179	236	304	356	385	480	591	645	719	227	250	7.27	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	
	NL8.4MF	105G6879	1/4	213	277	353	412	445	553	679	741	825	261	289	8.35	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	
	NL10MF	105G6885	1/3	266	346	441	513	554	687	843	919	1028	323	360	10.10	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	
	NL11MF	105G6151	1/3	292	380	485	565	609	756	927	1011	1125	360	404	11.15	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	
	NLE10MF	105G6888	1/3	262	343	440	513	554	688	845	922	1038	347	398	10.10	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	
	FR6G	103G6660	1/6	124	171	226	267	290	365	452	494	552	172	194	6.23	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	
	FR7.5G	103G6690	1/5	142	193	254	299	325	408	505	553	618	194	220	6.93	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	
	FR8.5G	103G6780	1/4	171	228	298	351	381	478	592	647	722	231	261	7.95	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	
	FR10G	103G6890	1/4	188	250	324	380	412	516	638	697	779	265	296	9.05	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	S	F <sub>1</sub>	F <sub>2</sub>	
	FR11G	103G6980	1/3	233	307	395	463	501	628	780	851	957	317	357	11.15	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	
	SC10G	104G8000	5/16	183	268	369	445	486	618	764	833	925	290	322	10.29	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	
	SC12G	104G8240	1/3	252	348	464	553	603	768	960	1054	1182	355	400	12.87	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	
	SC15G	104G8520	3/8	290	424	568	672	728	908	1110	1207	1340	440	497	15.28	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	
	SC18G	104G8820	1/2	394	526	684	804	870	1087	1337	1459	1624	507	568	17.68	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	O/F <sub>1</sub>	F <sub>2</sub>	F <sub>2</sub>	
	SC21G	104G8140	5/8	453	606	793	934	1013	1269	1561	1700	1889	575	643	20.95	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	
	SC21MFX	104G8120	5/8	530	682	866	1006	1085	1343	1645	1793	1996	657	726	20.95	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	
	GS26MFX	107B0700	1	754	989	1266	1476	1591	1970	2411	2626	776	856	26.30	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
	GS34MFX	107B0701	1 1/4	998	1296	1648	1918	2063	2550	3115	3392	1008	1108	33.80	S	S	S	S	S	S	S	S	S		
TL2.5G	102G4251	1/12	60	80	105	124	134	168	208	227	253	96	107	2.61	S	S	S	S	S	S	S	S	S		
TL4GH	102G4455	1/8	118	160	190	208	264	328	360	403	439	156	176	3.86	S	S	S	S	S	S	S	S	S		
NL6.1MF	105G6660	1/5	165	223	292	344	374	470	581	636	718	247	277	6.13	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>		
NL7.3MF	105G6772	1/4	216	283	363	424	458	570	700	763	856	275	310	7.27	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>		
NL8.4MF	105G6879	1/3	245	325	420	492	532	664	818	893	1000	311	353	8.35	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>	F <sub>1</sub>		
NL10MF	105G6885	1/3	312	406	518	603	650	807	989	1079	1234	373	421	10.10	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>	O/F <sub>1</sub>		
SC12G	104G8245	3/8	248	370	519	632	696	907	1157	1280	1449	388	446	12.87	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC15G	104G8526	1/2	308	468	641	766	834	1049	1292	1409	1567	470	534	15.28	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC18G	104G8823	5/8	432	573	745	879	955	1207	1506	1654	1858	511	577	17.68	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
TL4DL	102U2038	1/6	196	229	281	324	349	432	527	571	631	203	221	3.86	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
FR6DL	103U2680	1/4	317	385	471	538	576	698	840	907	999	354	388	6.23	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
NF7MLX	105F3720	1/5	543	666	756	805	964	1142	1227	1341	1499	391	437	7.27	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC10MLX	104L2506	1/2	546	687	855	981	1051	1278	1537	1662	1849	518	556	10.29	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC12MLX	104L2606	5/8	669	838	1038	1188	1272	1542	1852	2001	2211	620	667	12.87	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC15MLX	104L2869	3/4	829	1038	1285	1471	1574	1909	2293	2511	2784	780	845	15.28	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC18MLX	104L2139	7/8	968	1210	1497	1712	1832	2220	2665	2944	3254	860	931	17.68	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC18MLX.3	104L2146	7/8	1018	1266	1557	1779	1898	2292	2743	2964	3314	878	952	17.68	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
GS21MLX	107B0502	1	1096	1394	1748	2018	2164	2650	3211	3483	3843	965	1046	21.20	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
GS26MLX	107B0503	1 1/4	1426	1810	2254	2586	2764	3351	4022	4345	4765	1213	1319	26.30	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
GS34MLX	107B0504	1 1/2	1929	2408	2953	3358	3575	4283	5088	5476	5946	1725	1885	33.80	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
NF7MLX	105F3720	1/4	489	618	768	879	940	1134	1362	1470	1634	473	521	7.27	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC10MLX	104L2506	5/8	646	816	1015	1164	1246	1510	1812	1958	2149	612	672	10.29	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC12MLX	104L2606	3/4	773	970	1199	1370	1465	1770	2118	2286	2500	729	801	12.87	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
SC15MLX.2	104L2803	7/8	915	1145	1418	1623	1737	2107	2531	2735	3000	860	931	15.28	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>	F <sub>2</sub>		
TL3CN	102H4380	1/10	128	161	200	228	244	294	351	381	431	135	144	3.13	F <sub>1</sub>	F <sub>1</sub>	F<								

## Appendix 5 - Online Review

How easy or difficult do you think it will be to use this fridge?

117 responses

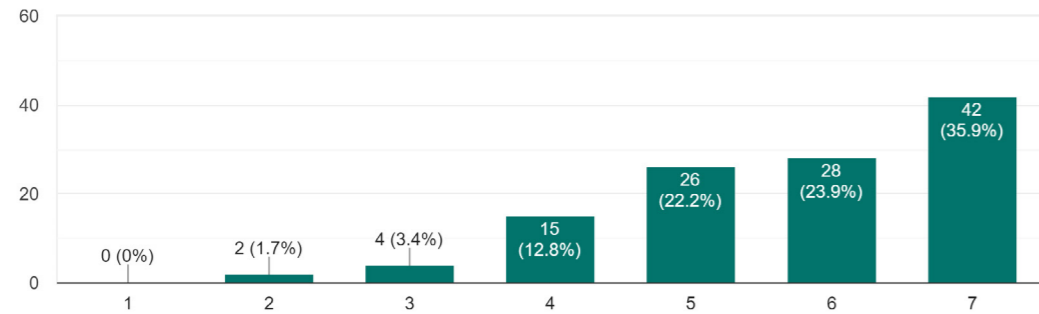


Very Hard

Very Easy

To what extent do you agree with this statement: I would be satisfied with using this fridge

117 responses

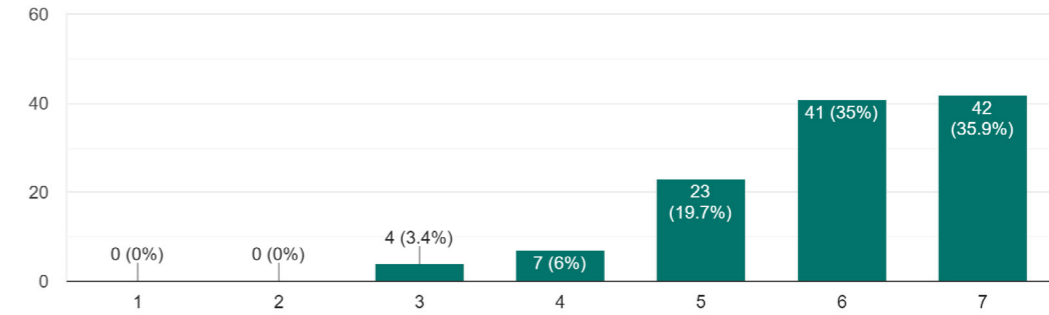


Dissatisfied

Satisfied

Please use the scale below to rate the design:

117 responses

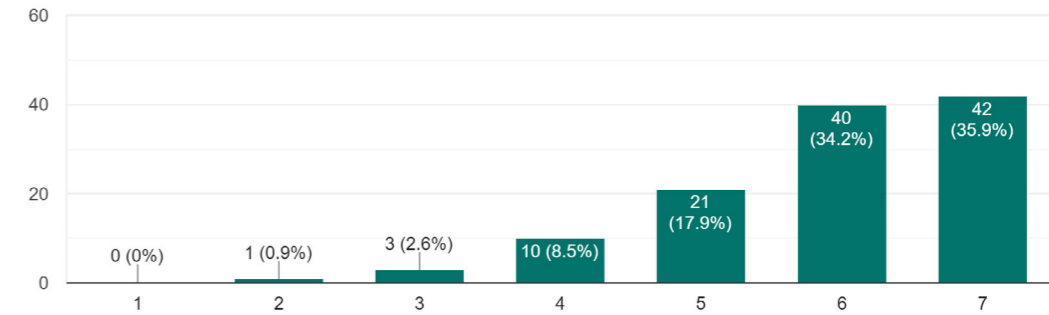


Boring

Engaging

Please use the scale below to rate the design:

117 responses

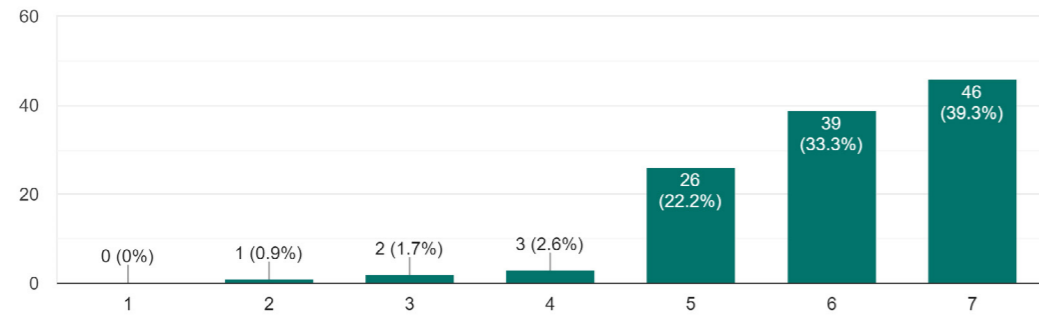


Confusing

Accessible

Please use the scale below to rate the design:

117 responses

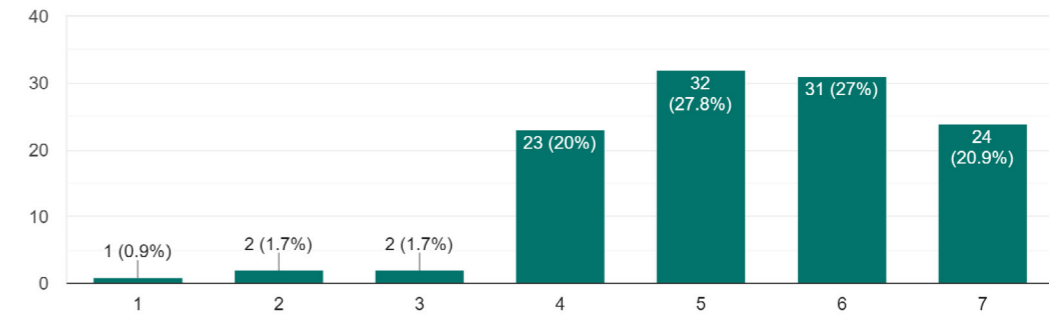


Ordinary

Progressive

7. Please use the scale below to rate the design:

115 responses

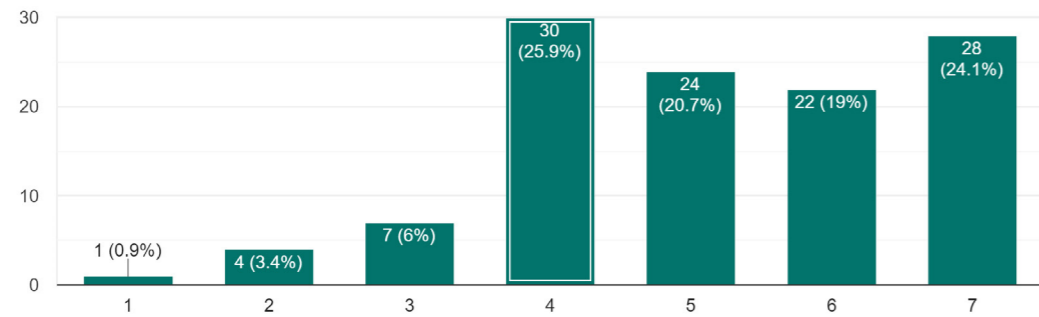


Unattractive

Attractive

6. Please use the scale below to rate the design:

116 responses

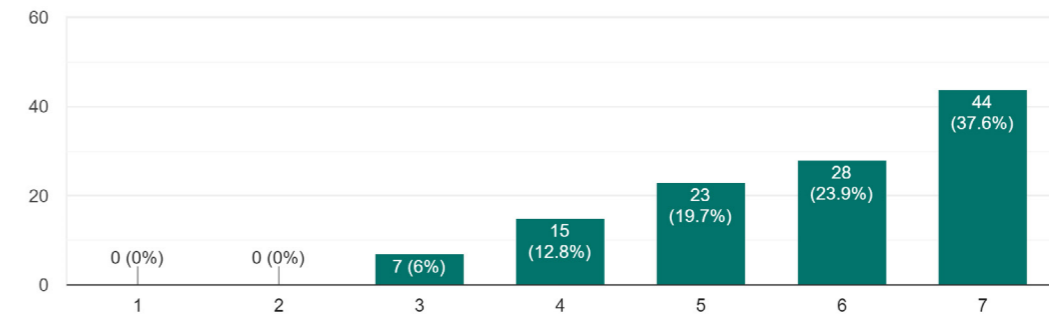


Impersonal

Personal

8. Please use the scale below to rate the design:

117 responses

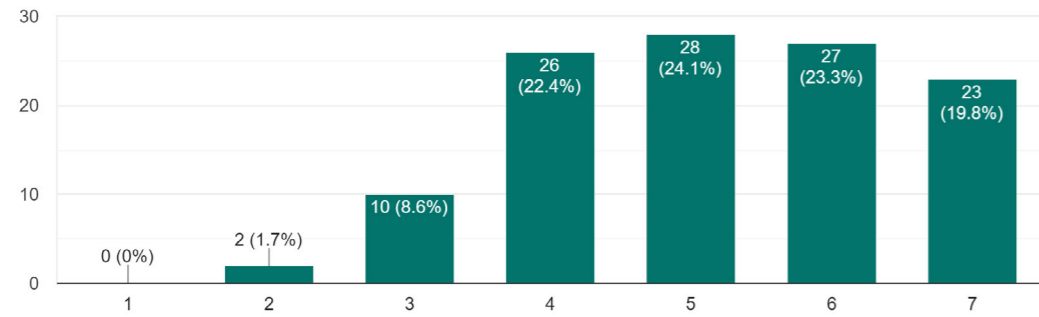


Overwhelming

Clear

9. Please use the scale below to rate the design:

116 responses

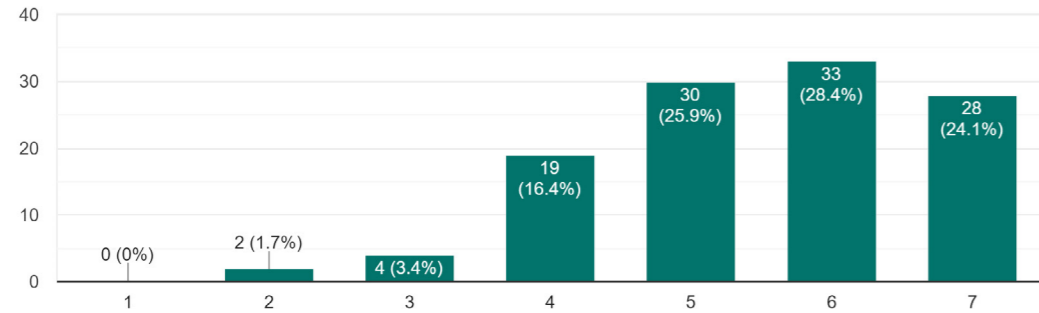


Cluttered

Minimalistic

10. Please use the scale below to rate the design:

116 responses

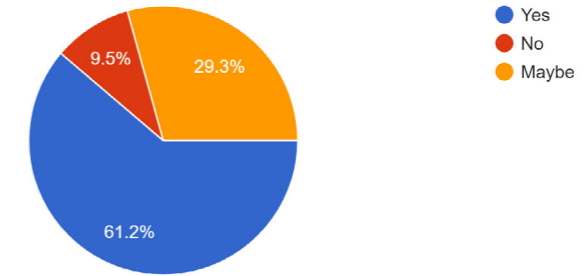


Untrustworthy

Trustworthy

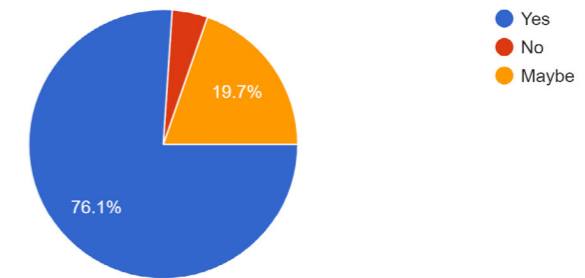
11. Would you use this fridge?

116 responses



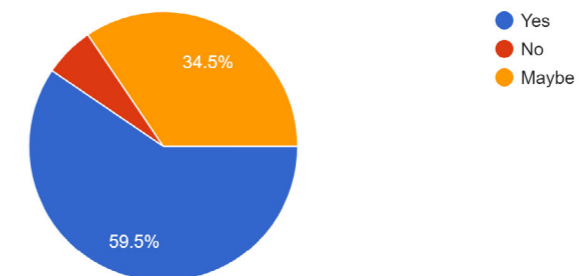
12. Will you be able to see the food items stored more easily?

117 responses



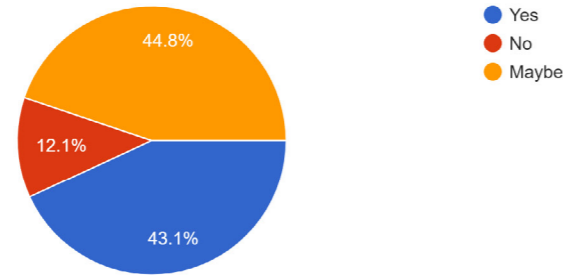
13. Will you be able to identify the items that need to be used sooner than later?

116 responses



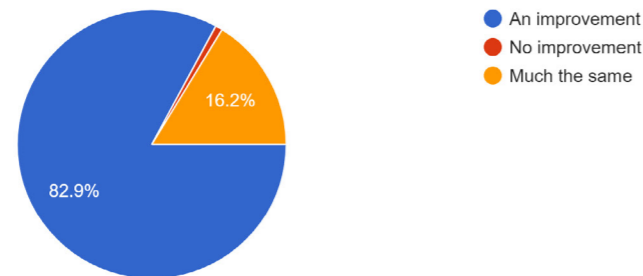
14. Do you think this fridge will help you reduce food waste?

116 responses



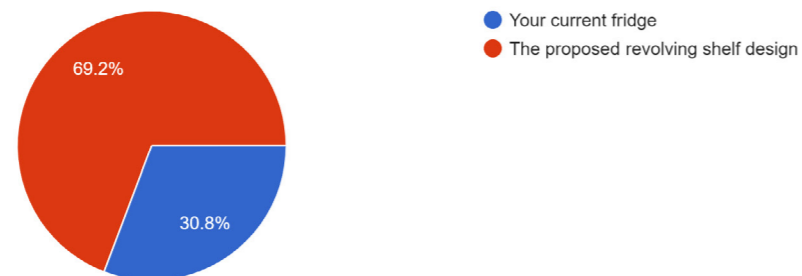
15. How does it compare with other products?

117 responses



16. Thank you for completing all the sections. I have one last question, please. Which design do you prefer?

117 responses



Key:

Blue: Suggestions

Pink: Worries/fears

Yellow: Interests

Green: Positives

**Suggestions for improvement. Please share your ideas:**

Distinctive styling or badging to show we have invested in a product of the future

Will it offer different chilling sections?

Such a novel concept to address the food waste guilt carry. I would worry of space lost in a smaller flat with the fridge door space area containing components

Often food waste occurs because items are not stored correctly so it may help to colour code or label where foods should be placed to optimise space and longevity of food.

It is unclear what the top compartment is for - is this the freezer? It seems a bit bare compared with the rest of the design.

I don't think I tend to browse my fridge but usually is quite goal orientated when I go to open my fridge. Therefore I'm not sure if the rotating feature will actually help me in terms of reminding me I have perishables to be used. Instead I would personally probably benefit more from a real time digital updating list of perishable with included date of purchase on the fridge door.

It may take time to get used to as it is unconventional but I can see the advantage because you can see the items. I also like that it's a simple design, it does not rely on technology. My only concern is if you load the revolving sections unevenly and the weight twists them. Could the far side be supported by a rail?

Think I would prefer for the shelves to roll forward like drawers rather than rotate. Have had those cupboards with revolving shelves in the past and always found them tricky/difficult to organise

I think the concept and objective is a positive one and I agree that having a better understanding of the food in your fridge could reduce the amount of household food waste. Personally I prefer a more traditional shelving configuration, mainly because I'm lazy and the thought of not just opening the fridge and seeing what's in it wouldn't please me. I think the current design may hinder the 'ease' of viewing the contents of the fridge.

From a cost point of view, in a traditional fridge the storage element is pretty basic (and I would imagine cost effective/cheap); so I would be concerned that for a basic fridge (no electronics, screen, ice dispenser etc.), this dynamic shelving strategy may affect the overall cost of the fridge. This could put it between markets in the fridge world?

Also, one good thing about traditional shelves, you can move them depending on the item sizes you have in the fridge. Would this design allow for change in shelf height?

Could utilise the space lost by the rounded shelves by fitting vertical drinks storage in the back corner for e.g. wine bottles/soft drinks which struggle to fit elsewhere

If I'm popping in the fridge to get butter I would be annoyed that I can't reach it due to the lip of the shelf trays. I understand they are a requirement so that when spinning them out the products don't fall off, but I don't think I would ever need to spin them out.

Also most of the time fridge doors can't open fully flat as they're in corners of rooms so I think it would be difficult to open as it would hit the door shelves

Also it reduces space in the fridge as the shelves aren't full rectangles (I appreciate this is to aid the spinning)

Finally, I think there are too many shelves that getting things into the fridge would be challenging. *I don't think people would adjust their position based on what they buy*, I think they would keep them in a position similar to their previous fridge

Sorry if this isn't helpful, I don't believe this will help the food waste issue. *I think encouraging consumer behaviour to plan better would be a better strategy such as a smart fridge which indicated what needed using*.

Not sure how going from sliding drawers to rotating doors might help. *If could find a way to stop losing a corner from each shelf it would increase space available in fridge*. Maybe a method of scanning in a receipt or uploading could make a stock of items in the fridge and estimated dates of going off - maybe this could be displayed on fridge door somehow on a screen.

I really like design of having shelves rotating outward - simple and very clever

*Space wastage of the fridge area could be a concern (cutoff corner areas). But like that you can get to the back of the shelves easily*. I guess one could arguably pack the shelf more closely thus negate the corner areas

A lot of stuff needs stability and moving shelves hinder stability in my opinion. But the visibility is improved.

I think drawers are more useful than revolving shelves (I have drawers in my grocery cupboard) but I think people who waste food because it is stuck at the back, will still waste food!

Challenges would be cleaning and capacity ( the rotating mechanism *means dead space in the rear corner*)  
I think this design would help for vegetables etc, so maybe a hybrid design would work. And *make sure the shelves are removable for cleaning*.

I like to have a *space for standing bottles*.

I see no room for improvement however the rear *left hand corner of the cabinet is wasted space!* Could it be used for shelves for small items?

I think the idea is good, be interesting to see *how this might fit into a context of a one bedroom flat to that of a 4 bedroom house*. Will those with *disabilities be able to operate this design more easily than a traditional fridge set up?* When thinking of waste, how *sustainable is the design and lifecycle of the proposed design*, have materials been *sources ethically and responsibly otherwise this may contradict* the purpose of the mission I.e., to reduce waste. It is an interesting concept and the data will hopefully guide you to an answer.

I think it's a clever design and would *certainly help visibility and accessibility for certain items*.

I would probably not use it however if all the shelves where of the rotating kind. Some things would still be better on a plain shelf. For example, it is still nice to be able to store some taller items on a shelf, rather than in the door. A taller item on a rotating shelf might be prone to falling over when the shelf is rotated, especially if it there are only a few items on that shelf.

Also, the *rotating shelf requires an additional step to retrieve something from the fridge*. Open door > rotate shelf > take item > rotate shelf back into place > close door. It's simpler to open door > pick item > close door. That said, *rotating shelves would certainly be a pick improvement for shelves cluttered with lots of small jars* for example.

I'd also be *concerned about strength of the shelves*. What are they made of? The plastic that many modern fridge shelves are made of cracks quite easily under stress.

The design also *needs to facilitate easy cleaning on the shelves and easy removal for cleaning if required*.

Overall, I think it's a good concept, but would be more likely to use a fridge that has a *combination of rotating shelves and normal shelves*. A rotating chiller shelf and maybe top shelf for smaller items combined with conventional shelves in between

I would be *concerned of the shelves cracking splitting or breaking*

I like the idea of this fridge design for organising food storage. I would be concerned about *strength of shelves for long term use*. For example *plastic draws in fridges often crack*, if the shelves were to do this it may reduce the longevity of the fridge and increase the amount of white goods going to landfill. *I like the open top section allowing flexibility for storing heavier items or awkward shape/size items*

People with *disabilities in general must be able to use it without any problems*

Design question. Fridge draws look to not fully utilise the space in the fridge.  
*Could to compartmentalise some of the shelves* - we end up putting containers in our fridge for cold meat, cheese, fruit, veg, yogurts, butter etc- could they be built in so everything had a specific home?

For a similar *size fridge to current or would the revolving shelves increase/de crease the space available for storage?*

The reason I prefer my current fridge is due to the lack of fridge space with this design. The round corners needed to make the shelves rotate is valuable storage space gone. I already struggle with storage space so would prefer the extra room. *I don't think it would be suitable for storing 2 litre bottles of drink laying down*. Also feel items may fall over from the motion of pulling the shelves out. Personally, I would fine shelves which pull out but straight ahead better, using rollers. Perhaps a little wire fence/guard at the front to ensure items don't fall but also improve storage space by allowing more to be packed in, whilst still allowing greater visibility of contents over a regular fridge design.

*My only worry would be that it wouldn't hold as much as a regular fridge*. I would also suggest that the shelves are see through so you could see at a glance what was in them. And maybe *comes with a wipe off pen that you could write the names of things on that shelf*, e.g. cheeses, meats, etc

My current fridge is wide and shallow and as such I do not encounter the problem of not being able to view items in the fridge. In fact I use a system whereby older items are on one side and new items are on the other. If however I had a more conventional fridge I would prefer this design, as it would make it easier to group older and newer items.

More shelves at eye level

Different models (bigger & smaller) other concepts as the fridge looks a bit boring maybe ones with digital thermometers, drinks dispenser and how your fridge would accommodate these things in unison with the rotation system

The nearly triangular room outside of the shelves should be used for compressor and heat-exchanger to maximize storage efficiency.

The door needs to open wide enough for the tray to come out enough to rotate. It might not work on a fridge that stands in a corner.

I heard recently that the crisper area at the bottom commonly used for vegetables is not as good for them as higher up. Could the basket/box area be moved?  
I like the adjustable height shelves.

I have a fridge freezer and prefer a large fridge

Like the idea of the revolving shelf, easy to see where everything is in the fridge

I answered Current fridge to the final question because I am familiar with it and know it meets my needs. There are too many unanswered aspects about the revolving shelf design. E. G. How robust are the shelves? Are the combinations as flexible as my current fridge. Would I'd have any impact on energy efficiency? Would there be incremental cost?

Maybe not all shelves revolving

My main concern would be if the shelf was revolving and coming out of the fridge would it be strong enough? I might worry that the revolving shelf could break or not be as sturdy as my current fridge shelves.

I really like the idea of being able to see everything easily, though actually the one shelf that I can't see everything properly at the moment is the top shelf where I keep all the jars.

This is Pretty much the only shelf that gets overlooked as there are too many jars in there and I can't see to the back so jars of stuff get forgotten unless I'm actually rummaging around for something in particular.

Most of the other shelves I can see everything and things tend not to get forgotten about.

The reason I love my current fridge is because it's a Smeg and we chose it for the style of the outer design as it's very visible from our living room as well as our kitchen, and it is so pleasing to have something that looks more beautiful. It would be helpful to see a real life version of your fridge to be able to assess the stability and robust nature of the shelves that swivel. But, a great idea. Sometimes we resist things just because we haven't seen them, but in general terms I think the idea is good. I would tend to go for a fridge which had only the very top shelf that could swing out, but that's just the way I organise my fridge, with too many jars right on the top!

It looks good.

I like to have lots of space so it feels uncluttered and I can store lots of food for my family.

I like the individual compartments as they will help maintain temperature control.  
Bottles (wine) need to fit on shelves not just in the door.  
Shelves will need to be strong for when extra-loaded. E.g at Xmas time.  
Fridge also needs to be able to stand up to teenage children yanking doors & shelves open.  
My fridge has a flip up shelf, would this be possible with your fridge?

The two things that spring to mind is wasted space with the curve and energy being wasted with it open more.

Looks excellent already!

This is a bit unfair since I have had a new fridge installed in the last week and as such am a bit biased towards my new fridge- which is much larger and has greater storage capacity. I do think the revolving shelves are a good idea if they go not break. My last fridge the shelves and door storage cracked and broke very easily which makes me question / hope that this design will be robust enough to manage daily use.

Reason for saying 'maybe' is that unless you pull out the shelf, you won't see what's on it. I guess if you use all the shelves then it would be fine - and actually I guess when you pull out one you see the one below, so it would probably mean you're able to view/check food easily.

Make shelf height adjustment easier

I think this is needed for the top shelf jars in the fridge.

There seems to be some waste of space because of the shape of the shelves. Will this space be used for other things, e.g. cooking units?  
Can you remove shelves for cleaning after spillages or leaks?

I would be slightly concerned with two aspects. Firstly cleaning of a deep-lipped shelf particularly one that is fixed around a hinge rod and therefore cannot be removed. It may perhaps be worth considering a system that would allow the shelves themselves to be removed. This would however affect my second concern and that would be structural integrity. With a single attachment point for each shelf, I would have some concern about each shelf's ability to bear weight. I am however sure that this can be accounted for in design.



Love the revolving shelves concept. **It is invariably the bit and bobs at the back of the shelves that can get over-looked !**

Most product are made to be seen for the side not the top so i would worry about not seeing what is what. But other than that it's probably makes easier to get to the things in the back.

I love the design and as I am short and think that the adjustable revolving shelves are a great idea. The freezer space could be bigger with a similar design to the fridge.

My current fridge has the freezer at the bottom which I prefer as I seldom use the freezer section

No suggestions.

I think it's good we have a corner cupboard with a similar design and much easier to see all the items

**Can you store bottles or larger item storage. Rather than rotate could the drawer slide forward and back**

Removable so easy to clean

None

I can currently see >75% of the items in my fridge, reduced to 50% immediately after a shop for a day or so. I feel that the **design limits my ability to scan without having to open the shelves**, more like a freezer than a fridge. **Mesh or wire shelves, plastic may mist or a low front may result in spills.**

**Clear fronted fridge would allow for easy access to see what's inside without needing to have fridge door open and lose temp.** Size of shelves could be bulky and take up more space - meaning lost space inside. I like the idea of moving shelves - would this mean it's not effective in a smaller kitchen space?

I much prefer the fridge compartment to be up high and the freezer down below. So annoying bending down all the time to the bottom shelf/drawers.

It doesn't look like there is space for **bottles** apart from in the door

**Water dispenser**

Might worry about shelves 'sticking'

Looks perfect

**I would like to know if the shelves are easily removed for cleaning purposes.**

I know that it is not shown in the design but retro colours would be good, also if **there is weight of food on the shelves that there is a strong counter balance or the strain on the rotating arm will have potential to drag the self down**

