

# The Study of Fridge Management Usage

A Report Focused on Understanding the Real Problems of  
Fridge Habits that Lead to Wasted Food

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## **General Problem**

Households often face challenges managing their fridge inventory, leading to overlooked food items, food waste, and financial loss, especially when they are busy. Food waste is a significant global issue that contributes to resource depletion and greenhouse gas emissions. In Canada alone, over 50 million tonnes of food waste are generated annually, with 60% of it being avoidable through improved planning and awareness (Made in CA). Household food waste is a major contributor, underlining the need for innovative solutions to promote better food management. Despite its environmental impact, food waste also poses a financial burden, with the average Canadian family potentially saving hundreds of dollars annually by reducing waste. Furthermore, a 2019 survey by the International Food Information Council Foundation found that food waste is top-of-mind for only 34% of consumers while grocery shopping, indicating a gap between awareness and action (Informa Markets). Addressing this problem would not only reduce environmental impact but also ease the financial strain on households, making it an appealing target for intervention.

Through the iterative process of creating a collective mind map and filling in knowledge gaps through research, we widened our understanding of the problem scope. Analyzing the key pain points of the problem, we recognized the inconvenience of finding ingredients, of overcrowded fridges, and of poor organization. Issues like food visibility, time constraints, and lack of awareness of what is in the back of the fridge often lead to spoiled food and financial loss. There may even be health risks such as food poisoning. Existing solutions, such as meal kits or smart refrigerators, are either too expensive or not accessible to all households, especially for students, large families, or those living with roommates. Based on these insights, we formulated complete and incomplete POV statements (appendix).

Better fridge management can provide many benefits like improved meal planning, but most importantly it will save households time and money, while reducing food waste. This is what led us to our focused problem statement: **"People need a tool that helps them track what is in their fridge because they don't want to waste food and money"**. Our group attempts to address the challenges experienced by fridge management habits of busy households, working professionals, and students and to mitigate the larger impact of food waste.

Based on our background research, we defined the primary, secondary, tertiary and facilitating stakeholders:

**Primary User:** Someone who has control over what they eat daily, and has primary control over their fridge organization for the people they are responsible for feeding if any. (e.g. gets groceries or take-out, puts items in the fridge). Examples of these users include but are not limited to busy full-time students, students with multiple roommates, working adults and parents.

**Secondary User:** Someone who does not have complete control over what they eat daily (someone else cooks for them most, if not all of the time, someone who does not usually keep track of what is in the fridge) but may interact with the fridge occasionally whether it is to cook or eat. Examples of these users include but are not limited to full-time students who eat out daily and students living with their parents

**Tertiary User:** Those affected by the system's success. Examples of these users include but are not limited to grocery stores, food suppliers and waste management systems.

**Facilitating:** Anonymous Chimera (our team)

Combining the user definitions and data from our field studies we developed primary personas:



### CHRIS P. LETTUCE

Age : 20  
Occupation : Full-Time University Student  
Lives with : 3 roommates

**Organization**  
[Progress bar: 25%]

**Time Management**  
[Progress bar: 25%]

#### GOALS

- Keep my food organized in the fridge and easily differentiate it from my roommates' food
- Prevent over-buying unnecessary food to save money when grocery shopping
- Easily meal prep with available and fresh ingredients from my fridge

#### NEEDS


- Keep track of what food I have available in my fridge and what food is approaching its expiry date
- Be able to easily identify my food items from my roommates' food
- Effectively use my fridge space to prevent overcrowding, as well as, his roommates taking active care of their fridge space

#### HABITS/BEHAVIOURS

- My roommates and I have our own designated shelves
- Organize food based on consumption priority. Higher priority items (eg. fresh produce) are placed in more visible places. Lower priority items (eg. sauces) are placed in fridge compartments or behind higher priority items
- Before grocery shopping, go through fridge inventory and write down needed food on a list for meal prep.
- Freeze food that will not be used within 3 days

#### PAIN POINTS

- Roommates and I move our food around and do not label our containers, leading to disorganization and food being forgotten.
- Overcooking food leads to large portions of food being not eaten in time and having to be thrown out



### FRIDA SPAYCE

Age : 35  
Occupation : Full-Time Worker  
Lives with : Partner and Two Daughters

**Organization**  
[Progress bar: 25%]

**Time Management**  
[Progress bar: 25%]

#### GOALS

- Effectively organize fridge space so that meals and food items prepped for the week are easily visible and accessible
- Have healthy and fresh options for meals or snacks that satisfy dietary needs and preferences of my family members
- Organize fridge space to prevent cross-contamination of different food groups since I have family members with dietary restrictions (vegetarian, vegan, etc.)

#### NEEDS

- Keep track of what food items other family members use
- Reminders to myself and my family of what food items are approaching its expiry

#### HABITS/BEHAVIOURS

- Cook in large quantities for family
- Buy groceries based on a shared list between family members, containing ingredients needed for meals of the week
- Avoid purchasing discounted food we do not need so that I do not over buy food

#### PAIN POINTS

- Often overcook for meals. This leads to lots of leftovers that become less desirable to eat over the week
- When going on trips, we need to throw out perfectly good food that will expire during the trip. This wastes food, money and time.

## **Field Studies**

After conducting background research about the problem and taking into consideration the feedback from the studio critiques, we identified the following incomplete POV statements:

- **Students who live with roommates need to keep their fridge space organized because ...?**
- **Working parents must track what other family members use in the fridge because ...?**
- **Students need ...? when grocery shopping because ...?**
- **Students and working parents need ...? because they can run out of fridge space.**

**...? because they forget about food and it goes to waste.**

From these incomplete POV statements, we identified the following knowledge gaps to address in our user research:

1. **What kind of “fridge failures” do busy individuals experience?**
2. **What are the most common or important “fridge failures”?**
3. **What are the main causes of these “fridge failures”?**
4. **How does sharing a fridge with other primary users affect another primary user’s experience?**
5. **What kind of strategies do primary users use to avoid these fridge failures? What works and what does not?**

Initially, we were planning on releasing a questionnaire alongside conducting interviews to allow our participants additional time to respond. However, we purposely chose a questionnaire to use as a tool to quantify and prioritize the type of fridge failures we are going to address with our solution. Therefore, based on the feedback we received after our presentation, we decided to conduct our interview first to gauge what fridge failures people experience rather

than making assumptions that may bias the questionnaire participants. This approach helped us avoid narrowing the scope prematurely and ensured we addressed the root issues.

Initially, we planned to conduct a diary-style observation where users would track what food they threw out over four days, with interviews before and after the study. We wanted to see if participants' perceptions of their fridge habits matched their actual behaviour. However, after receiving feedback from our peers and our TA and reconsidering our timeline, we decided to drop this approach. The time constraints meant we wouldn't gather much data since most food wouldn't spoil within just four days.

## **Interview**

The purpose of the interview was to gain a deeper understanding of people's current fridge management habits and behaviours. By asking people to walk us through strategies for completing certain tasks related to using the fridge, we aimed to understand the real challenges they perceive to experience while trying to manage their fridge.

By learning how individuals organize, prioritize, and plan their food storage and consumption, the interview sought to identify "fridge management failures" and the emotional and practical reasons behind their food purchasing or discarding behaviours. The interview also aimed to gain valuable insights into existing strategies people use to work around their pain points and identify improvement opportunities.

The best way to fill the identified knowledge gaps was through a semi-structured interview because it required a higher level of comprehension of the issue from a personal viewpoint that we wouldn't have known by ourselves. It also allowed for an objective comparison of ideas in the problem space.

The protocol for our interviews included participants first being asked to sign consent forms before the interview began, in which the interviewer went over the purpose of the study and the expectations for the interview. The participants were asked to join a scheduled Zoom meeting, which they consented to being recorded. The participants would then be asked a series of questions by the interviewer for around 10-20 minutes, after which investigators would review, analyze, and process the data gathered.

Our interview was targeted towards our primary and secondary stakeholders, with questions added or removed for each interview instrument based on which stakeholder category the participant fit into. In total, five primary stakeholders and one secondary stakeholder were interviewed for this study. Those recruited as primary stakeholders were students living with roommates, families, or alone (Full-Time Students and Part-Time Students) and working Parents/Adults who have primary control over fridge organization (buying groceries, putting items in the fridge, etc.). Those recruited for the secondary stakeholder category were students living with roommates, families or alone (Full-Time Students and Part-Time Students) and family members who interact with their fridge occasionally and are not often responsible for cooking meals for themselves or keeping track of what is in their fridge.

The participants were then asked various questions regarding their fridge organization, experiences with fridge failures, how living with others impacted their food management habits, and what fridge management strategies they have tried both in grocery shopping and at home to prevent food waste.

## **Key Findings: Interviews**



The team conducted interviews to better understand how people manage expiring food and their fridges, as existing solutions like meal-kit services and smart fridges didn't seem to address the full scope of the problem. The interviews revealed that meal prepping is a common strategy among participants to reduce waste and guide grocery shopping. Some preferred to cook smaller portions or freeze excess food to prevent leftovers from spoiling. As one participant mentioned, "I try to reduce waste by not overcooking and not overbuying... I'll freeze the other two [chicken breasts] in the freezer." Another common method was using technology, like Google spreadsheets or lists, to track what's in the fridge. However, these methods were less effective if participants forgot to update them regularly; as one interviewee shared, "I've tried keeping an inventory of items on my phone, which helped for a while, but sometimes I forget to update it." This shows that participants see food waste as an issue and use different strategies to prevent it, despite their limitations. (Knowledge Gap 5)

Moreover, the motivation behind the interviews was to understand fridge failures without bias. Throughout the interviews, participants were allowed to talk freely and identify common worries and failures they experienced about fridge management. The first failure was a lack of fridge space and organization; this often caused them to forget what food they had, especially when stored in unlabeled containers. One participant stated, "It's really easy to forget... if it's not visible... when you open the fridge... like it's in a container and you can't really see what's inside". Another failure that was noted was not being able to keep track of expiration dates. As one participant noted, "One challenge I face is keeping track of expiration dates on multiple leftovers or ingredients, often getting things pushed to the back" (Knowledge Gap 1). These insights were used to design questionnaire questions to see if other participants shared similar experiences with these fridge failures.

Finally, a major challenge from the interviews was sharing fridge space with roommates or family members, leading to confusion over food ownership, misplaced items, and rearranged shelves. One participant noted, "...me and my two roommates... we all eat the exact same things... So sometimes I just forget whose food it is." This made it harder for participants to keep track of their food, often causing items to be overlooked or forgotten. This confusion sometimes led to hesitation in using certain items, resulting in food spoilage (Knowledge Gap 4).

## **Questionnaire**

After analyzing the interview results, we conducted an anonymous online questionnaire aimed at our primary and secondary stakeholders. We used mostly closed-ended questions to easily quantify the results and make participation more accessible.

The interviews helped us understand how people manage their fridges, their habits, their decision-making when discarding food, and the types of failures they encounter. The questionnaire aimed to measure how often these fridge management issues occurred and to see if similar behaviours existed among different users. By understanding which challenges were most common and frustrating, we could explore how users' habits might contribute to these issues. The interviews also helped us to build the definition of primary and secondary users by giving us an insight into the difference in lifestyle and fridge-interactions between interviewees.

All of the data we collected focused on a key issue backed by statistics from our research: how do these behaviours contribute to fridge food waste? Questions about how people decide to throw out food, what gets thrown out, and what aspects of managing, purchasing, and consumption habits cause fridge failures were designed to pinpoint areas that need improvement to reduce food waste.

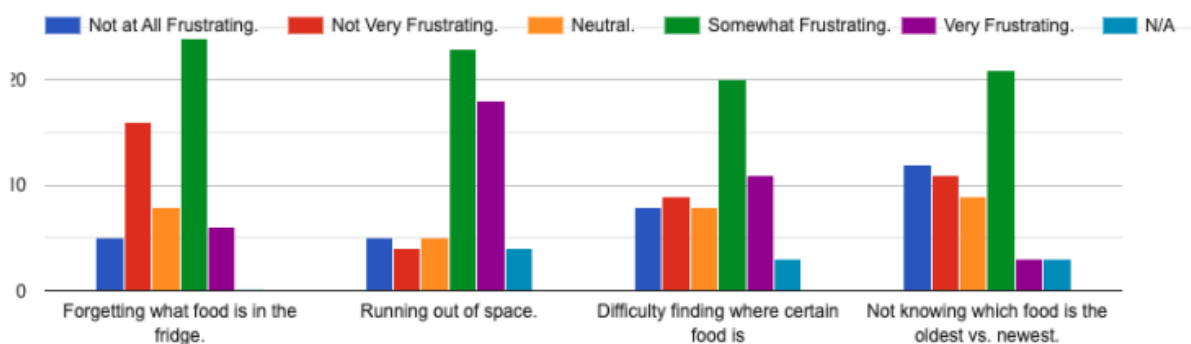
To distribute the questionnaire, each team member reached out to 8 primary and 8 secondary stakeholders. We calculated this number based on the need for a minimum of 15 responses per group and an assumed 30% response rate, as we learned in class (Let  $n = \#$  of people each team member needs to reach out to per stakeholder group,  $m =$  minimum  $\#$  of respondents per stakeholder group,  $t = \#$  of teammates,  $0.3 =$  expected response rate.  $n = m/(0.3t)$ ). In total, we received 59 responses - 40 from primary stakeholders and 19 from secondary - exceeding our target.

## Key Findings: Questionnaire and Interview Combined

\*We indicated the knowledge gap each finding contributed to by tagging them in the following format “(Knowledge Gap #)”

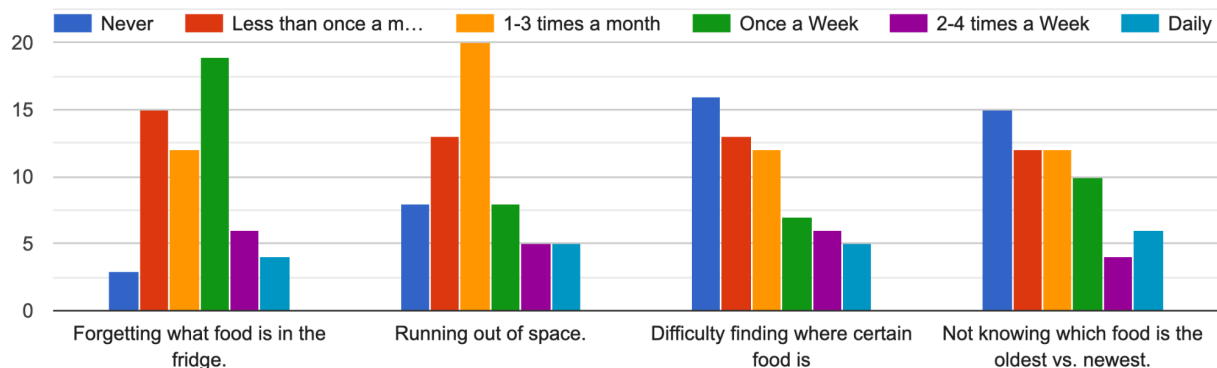
Through the questionnaire, we found that although ‘running out of space’ is not the most frequent fridge failure people experience, it is a fridge failure that causes the most frustration: “My roommate may forget to throw out food so I have to wait for her to do so, sometimes I do this as well - which leads to us running out of space” “We have leftovers after most meals, so there is little space in the fridge.” This surprising data informed us that running out of fridge space is an important pain point that we should address in our solution. (Knowledge Gap 2)

Rank the following fridge management failures based on **how they make you feel**.



Another takeaway was that the main cause of food waste is due to users forgetting what is left in their fridges (Knowledge Gap 3). The questionnaire results showed that “forgetting what food is in the fridge” is by far the most common “fridge failure” that both primary and secondary users encounter, with 49% of respondents saying they experience this at least once a week. In the interviews, many participants shared that their goal when shopping was to avoid overbuying and wasting food. However, open responses in the questionnaire showed that these strategies often fall short. People still overbuy, often because they shop without a plan or don’t check their fridge first due to time constraints. This suggests that users might be open to a new solution that helps them remember what’s in their fridge, potentially reducing food waste.

Rank the following management failures by how frequently you experience them.



Our field studies pointed out that forgetting about food in the fridge is often due to poor organization (Knowledge Gap 3). Interview data revealed that disorganization and limited fridge space lead to items being pushed to the back and forgotten. One participant shared, “A big challenge for me is keeping the food organized and keeping track of what’s in the fridge...it’s really easy to forget... if the fridge is not organized.” Similarly, a questionnaire respondent noted,

“items are stacked on top of each other and hidden from view, which causes me to forget about items I have purchased.”

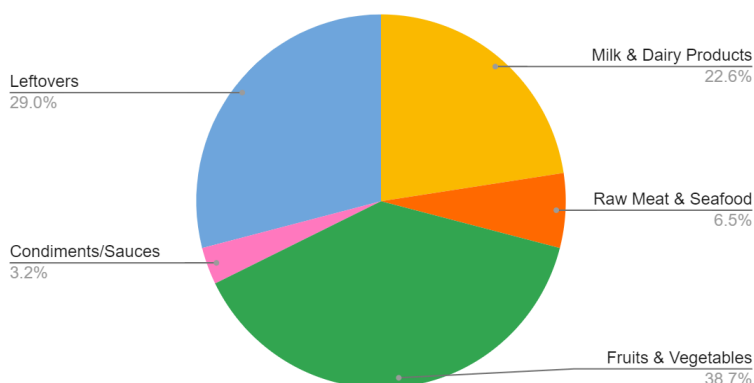
Certain items like leftovers or food in containers were especially difficult to manage, as they didn’t always fit into the existing fridge setup. As one participant explained, “...the leftovers can kind of be any way they fit. It’s just, however, it fits Tetris-wise, it’s gonna go in that way. So that is harder to manage.” Another added, “where it is in the fridge doesn’t tell you how old it is,” highlighting the challenge of tracking freshness.

Participants often described their feelings towards food waste as “frustrating,” “awful,” and “terrible” because they “hate wasting both money and resources” and “think about the bigger picture of the world.” The questionnaire aimed to identify the types of food that are most often wasted. The findings matched the interview insights: many prioritize eating foods that spoil quickly, like leftovers and fruits. The questionnaire confirmed that 98% of respondents had some fruit and vegetable waste, and 86% reported wasting leftovers. These foods become increasingly significant, as the percentage range increases of how much of the total food one throws out consists of a single food category,

(Knowledge Gap 2, 3)

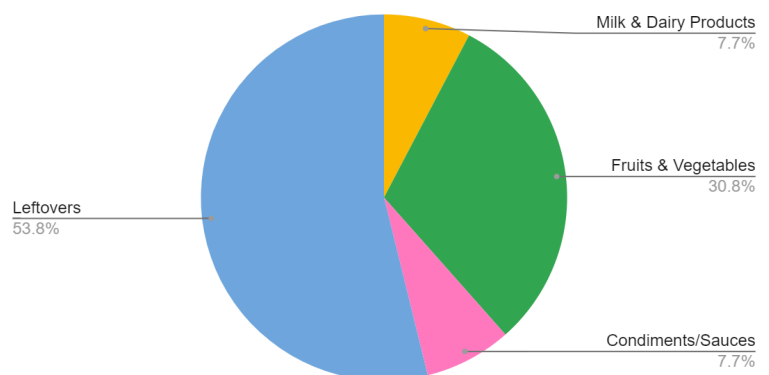
Food that Makes Up 41-60% of One's Food Waste

31 Answers that a Certain Food is in this Range



Food that Makes Up 61-80% of One's Food Waste

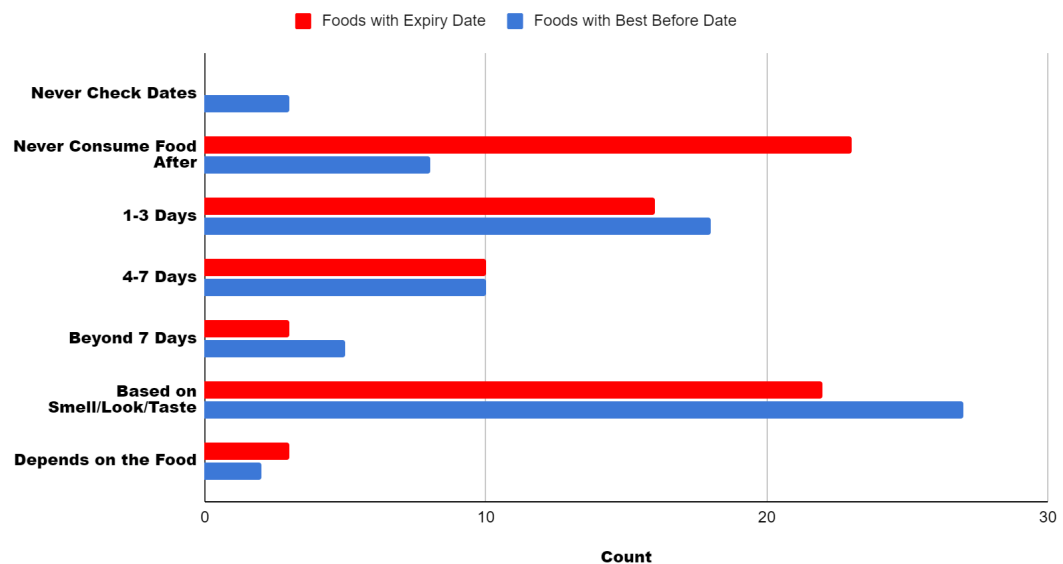
13 Answers that a Certain Food is in this Range



Furthermore, questionnaire data showed that given certain food conditions, over 60% of participants would eat food after the expiry or best before date has passed, and 94.9% freeze their food to extend its shelf life. From this, we learned that users would be open to accepting suggestions such as “consuming food a number of days after it expires” and “freezing their food to prevent it from going bad” as solutions to prevent food waste.

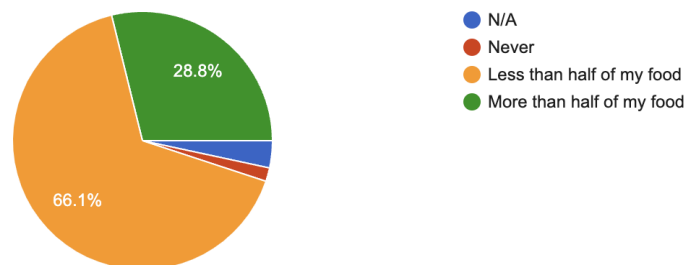
### How Much Time After the Date, Do People Decide to Throw out Food?

Analyzing How the Expiration vs. Best Before Date Affects When People Stop Consuming Food.



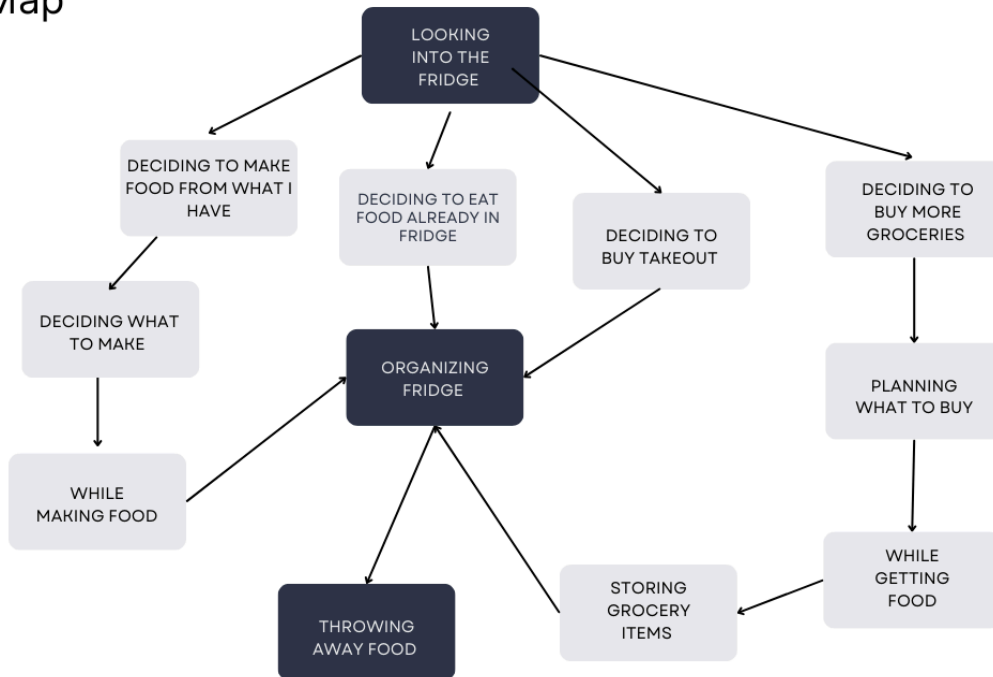
How much of your food do you put in the freezer to make it last longer?

59 responses



# Experience Map

## Experience Map



DOING	LOOKING INTO THE FRIDGE	ORGANIZING FRIDGE	THROWING AWAY FOOD
THINKING	What items do I have and what do I lack? What do I want to eat? Which items are mine? Should I get more food or use the food I have or eat out?	How do I keep the fridge clean, my items easy to find? How do I remember which foods I should consume first?  "Produce, veggies, and fruits are somewhere visible, and all the jars and the sauces are put away in the drawers because they're less used."	What can I no longer eat to ensure food safety and what do I no longer want to eat? What is taking up space that should be discarded? Not knowing what items are old enough to be thrown away.  "So where it is in the fridge, doesn't tell you how old it is, just because it's in the back, it doesn't mean it's the oldest."
FEELING	It's difficult to see what I have at first glance. I have to go through the fridge, which takes time and effort.  "Items are stacked on top of each other and hidden from view, which causes me to forget about items I have purchased."	Frustration from the messiness.  "I hate when I forget about certain foods that are hidden/moved, and they start to go bad."  "people moving stuff around... and then you lose track of where you put it."  "A big challenge for me is keeping the food organized and keeping track of what's in the fridge... it's really easy to forget... if the fridge is not organized."	Guilt from having to throw away food.  "It's frustrating when I have to throw away food because I hate wasting both money and resources."  "it's awful... because monetary waste... Then you always think about the bigger picture of the world, right?"

DOING	DECIDING TO MAKE FOOD FROM WHAT I HAVE	DECIDING WHAT TO MAKE WITH THE FOOD	WHILE MAKING FOOD
THINKING	<p>I have most/ all I need to make a meal. Should I cook a new meal?</p> <p>"I make sure to plan dishes that use the same ingredients for the next few days, just to make sure they don't go bad."</p> <p>BRIGHT SPOT</p>	<p>How can I use the food I already have? What items are still fresh?</p>	<p>How much of this food should I make?</p>
FEELING	<p>Wishing I could have more of ingredient X. Feeling disappointed because ingredient Y could have made this meal better.</p> <p>"I try to eat the old things, but if I'm constantly cooking new things then... it doesn't help because you can't eat that much."</p> <p>HOT SPOT</p>	<p>Difficult thinking of possible meals using the ingredients present.</p> <p>It's hard when some recipes don't use the entire amount, and there's extra ingredients leftover. I don't know what to use them for.</p>	<p>Require thinking to determine how long the food I made will last and how much space it'll take if I make multiple portions.</p> <p>Unsure if I can finish the whole portion.</p>

DOING	DECIDING TO BUY MORE GROCERIES	PLANNING WHAT TO BUY	WHILE GETTING FOOD	STORING GROCERY ITEMS
THINKING	<p>I ran out of item X. I cannot make anything from what I currently have. I am craving something I don't have.</p>	<p>How should I prepare meals? What am I missing? How much of each item do I need to get?</p> <p>"... smaller shopping trips to ensure I can use up all my food without waste."</p> <p>"I have a spreadsheet that I do every week before I do my groceries, about what I'm gonna cook that week... I go back to that"</p> <p>BRIGHT SPOT</p>	<p>Do I really need this item? Do I have enough storage for this item? How much of this should I get to last me X amount of time?</p>	<p>Where should I put each item in the fridge? How do I make sure I don't forget about this? How do I make sure this item is differentiated from my roommates? How do I make sure my roommate doesn't eat my food.</p> <p>HOT SPOT</p>
FEELING	<p>I wish I was able to plan out my ingredients amount better so I didn't run out of this specific ingredient I needed for a recipe</p> <p>"...my latest strategy is to get that produce box...I still have to go grocery shopping to complement what I get in those boxes... I usually go grocery shopping with a plan to shop specific ingredients to make the recipe."</p> <p>HOT SPOT</p>	<p>It takes mental effort calculating what I should buy to avoid over-buying or accidentally buying something I already have.</p> <p>"If I don't have a meal plan prepared for the week, then I usually end up with things that I don't use in my recipes."</p> <p>HOT SPOT</p>	<p>I need to evaluate my actions while buying groceries in order to prevent fridge management failures</p> <p>Questionnaire data: This challenge is usually caused by busy schedules and buying too much at once without meal planning</p>	<p>I find it difficult / frustrating storing items because:</p> <p>I need to keep my items separate from my roommates.</p> <p>I need to make sure the items are easy to find. I cannot find any space in the fridge.</p> <p>I already have this item in the fridge.</p>



DOING	DECIDING TO BUY TAKEOUT	DECIDING TO EAT WHAT IS IN FRIDGE
THINKING	<p>I do not like anything I have in the fridge, and it's too much effort to cook something with the ingredients. I currently don't have anything in the fridge. Everything in my fridge has gone bad. My roommate ate my food.</p>	<p>How do I know which foods I should prioritize to eat first?</p> <p>"I have a spreadsheet ...So then I can go in the fridge and look for that thing, and try to eat that first... is a good way to look back and keep track of the date."</p> <p>"Whichever will go bad first, I guess... leftovers and meal prep food... fruits especially, they go bad pretty fast."</p>
FEELING	<p>Frustration because of the lack of available food and having to store leftovers after.</p> <p>"One challenge I face is keeping track of expiration dates on multiple leftovers or ingredients, often leading to things getting pushed to the back."</p> <p>"but the leftovers can kind of be any way they fit. It's just however it fits Tetris wise, it's gonna go in that way. So that is harder to manage."</p>	<p>"It's difficult... because other people won't know what's new or what's old"</p> <p>"People don't label non-perishables with the date they opened it so it's hard to tell if they are still good to use or should be thrown out.</p> <p>It's frustrating when people leave empty/almost containers, because there's only a little left for me. (Questionnaire)</p>

## **Job Stories**

**When I am shopping for groceries, I want to know which items I need to buy and how much of each, so I don't buy unnecessary items and I can restock the fridge efficiently.**

This job story concerns a primary fridge user who is responsible for purchasing groceries so they can feed the people they are responsible for feeding. Evidence from the field studies supports that users tend to buy ingredients based on the meals they have planned and try to buy enough in advance to last until the next shopping visit, with 68% of respondents buying groceries weekly/biweekly. When users are grocery shopping, they want to know what food is in their fridge that is still usable and what food they will need more of, without having to waste time searching or making multiple trips to buy what they need. From the data gathered through our studies, a significant issue people frequently experience is forgetting what is in their fridge, especially when they are too busy to track this information or not knowing if another housemate has already bought an item. Users want to be prepared when they shop, so they don't just impulsively buy ingredients they won't use or too much of a food, because they hate the feeling of wasting money and having to throw out food that has gone bad.

**When I am putting food into the fridge or taking food out of the fridge, I want to have enough space to place foods next to similar food categories and I want to be able to find and easily recognize which foods are what so that I can remember what food I still have to eat.**

This job story applies to anyone using a fridge to store or find food. According to our questionnaire, running out of space and struggling to find specific items are two of the biggest frustrations. Many users try to organize food by sections or shelves, but size restrictions often

force them to put items wherever they fit, making it harder to manage. Users don't want to waste time searching for items or figuring out what's in containers. When the fridge is messy, it's easy to forget about food, making it harder to know what to eat before it spoils.

**When I have to share the fridge with other people, I want to know what items are being added/used up and where they are being placed/removed from, so I don't waste time searching for items, run out of an item unexpectedly, or forget about my food that I can't see.**

This job story centres around the frequent experiences when sharing a fridge with multiple users. The motivation of this user is to improve efficiency and remove frustration when sharing the fridge with other users. Having a tool that enhances organization and communication within a shared fridge space, ensuring that all users can manage their items more effectively and reduce food waste would improve the overall experience of shared living.

**When I'm preparing meals after a long day, I want to easily see what fresh ingredients are still usable in my fridge, so that I can make a meal without letting any of the ingredients go to waste.**

This job story addresses a common scenario where a busy user is looking for efficiency in meal preparation, especially after a busy day. The user's motivation is to avoid wasting ingredients while quickly deciding what to cook. The tool would need to highlight fresh or near-expiring items in the fridge, helping users prioritize those for meals. The expected outcome is both saving time and preventing food waste.

**When certain groceries in the fridge are nearing their expiration dates, I want to receive a timely reminder, so that I can plan whether to consume them or freeze them before they spoil.**

In this situation, the user wants to prevent food from spoiling, but they need a prompt or reminder. The motivation here is to minimize waste and ensure food is used efficiently. The tool's role would be to offer alerts or notifications when certain items are approaching expiration, allowing users to act before it's too late. The desired outcome is reducing avoidable food spoilage, which addresses both the financial and environmental impact of food waste.

## **Design Requirements**

Following extensive data analysis, we have identified five key design elements necessary for the solution.

### **1) Track what users have in their fridge**

The motivation behind tracking what users have in the fridge is to help them stay aware of their current fridge inventory, which in turn helps them effectively plan meals and avoid buying duplicate items. Knowing what is available can prevent unnecessary food waste and purchases, leading to more environmentally conscious decisions and saving money. The purpose of this design requirement is to create a system that improves food inventory access to support users in making smarter food consumption and purchase choices.

### **2) Track how much space users have left in their fridge**

This design requirement is motivated by our findings in user research, where users frequently mentioned that running out of space in their fridges was one of the most frustrating issues they faced. Many struggled with trying to fit new groceries into a packed fridge, which often led to items being pushed to the back and forgotten. By tracking how much space is available, users can better plan their shopping trips and avoid overbuying, ensuring they have room for new

items. This feature will help keep the fridge more organized, reduce the stress of rearranging items, and prevent food from being hidden and spoiled. Ultimately, this can lead to less food waste and a more efficient use of fridge space, making life a little easier for users.

### **3) Remind users of which foods are going to expire/go bad soon**

Based on our research conducted through interviews and questionnaires, participants commonly mentioned that they would forget certain food items were in the fridge, which led to the items expiring and having to be thrown out before they were used. The motivation of this design requirement is to ensure that users do not forget about food items that are about to expire and might not be easily visible or those items the user simply has not incorporated into their meal planning yet. Moreover, it also makes them aware of which food they should prioritize and incorporate into their next meals so that the food does not go to waste. This design requirement aims to help users stay accountable for food disposal and waste and mitigate the frustrations users might have when they discover expired items that were not fully used.

### **4) Suggest how to deal with expired/expiring food in their fridge**

Based on the data collected through the questionnaire, we found that many participants do not follow best before / expiry dates to the tee and would consume food beyond those dates if the food looks and smells safe. However, given that consuming expiring food is a time-sensitive matter, users could benefit from receiving suggestions on actions they could immediately take to deal with food that may be going bad soon. This would not only save them time but would also remove the mental barrier of having to come up with a solution on their own.

### **5) Assist users in organizing food placement in the fridge**

The purpose of this design requirement is to help users better organize where they place foods in the fridge, to prevent various frustrations that result from placing food items in a nonoptimal spot. From the interview and questionnaires, organizational factors are a significant cause of the frustrating fridge failures we identified and quantified. Running out of space, difficulty finding or remembering certain foods, and not being able to recognize what food is oldest can all result from the misplacement of food. Deciding how to place items in the fridge can take strenuous effort, and the problems associated with organization only become more complicated when the fridge is shared between multiple users.

## References

Blair, N. (2024, June 11). *Food Waste Statistics in Canada*. Made in CA.

<https://madeinca.ca/food-waste-canada-statistics/>. Accessed Oct 7th, 2024.

“Survey Finds Younger Consumers Most Concerned about Wasting Food.” *Informa Markets*,  
2019,

[www.newhope.com/industry-insights/survey-finds-younger-consumers-most-concerned-about-wasting-food](http://www.newhope.com/industry-insights/survey-finds-younger-consumers-most-concerned-about-wasting-food). Accessed Oct 7th, 2024.

## Appendices

### Field study protocols

#### Research Protocol

1. **Project Title:** “Interviews and Observations of Fridge Users”

2. **Investigators:** Names and email addresses of all members of the team.

Yuxi Zhang, [yuxii.zhang@mail.utoronto.ca](mailto:yuxii.zhang@mail.utoronto.ca)

Kelsie Fung, [kelsie.fung@mail.utoronto.ca](mailto:kelsie.fung@mail.utoronto.ca)

Izumi Ando, [izumi.ando@mail.utoronto.ca](mailto:izumi.ando@mail.utoronto.ca)

Wendy Wan, [wendy.wan@mail.utoronto.ca](mailto:wendy.wan@mail.utoronto.ca)

Anastasia Jivalcovschi, [anastasia.jivalcovschi@mail.utoronto.ca](mailto:anastasia.jivalcovschi@mail.utoronto.ca)

David Lee, [davidl.lee@mail.utoronto.ca](mailto:davidl.lee@mail.utoronto.ca)

3. **Purpose:** Our research aims to understand frequent fridge users to help us derive requirements for the design of novel interactive computational media that are intended to be useful to people who regularly use a fridge. A brief description of our design problem is: that people can struggle to keep track and manage what food is in their fridge, which can lead to financial loss and food waste.

4. **Process to be followed:** We will brief the participants about the purpose of the study, explain the consent form to them, and ensure that they sign the consent form. We will then engage the participants in a 10-20 minute,

semi-structured interview. We will also, with their permission, make observations as follows: observe the participant's fridge environment through photographs sent in by the participants.

**5. Participant selection:** Participants will be chosen from students, large households and busy professionals (those who work and are frequent users of their fridge). They will be identified via reaching out to friends, family and acquaintances and selected according to their degree of fridge usage, in terms of their level of contribution to the organization and management of their fridge and food disposal. In general, they will be characterized by their living environment (students living alone/roommates/families, busy households, busy professionals living alone/with partners) .

**6. Relationships:** Our relationship to the participants may be described as follows: friends, relatives (parents, siblings, close family, distant family), classmates,

**7. Risk and benefit:** There will be minimal risk to the participants, for example that they feel that they have wasted their time. The only benefit will be to contribute to the education of the investigators. Participants are free to withdraw before or at any time during the study without the need to give any explanation.

**8. Consent details:** We will brief the participants about the purpose of the study, and explain the **attached consent form** to them, and ensure that they consent to participate and sign the consent form.

**9. Compensation:** Participants will receive no compensation.

**10. Information sought:** The information to be sought is described in the attached protocol for asking questions in a semi-structured interview.

**11. Confidentiality:** Information will be kept confidential by the investigators. Names or other identifying or identified information will not be kept with the data. The only other use will be to include excerpts or copies in the assignment submitted, but names and other identifying or identified information will not be submitted.

## Consent Form: Fridge Management Study

I hereby consent to participate in a research study conducted by Kelsie Fung, Yuxi Zhang, Izumi Ando, Wendy Wan, Anastasia Jivalcovschi, David Lee for an assignment in University of Toronto Computer Science 318, *Design of Interactive Computational Media*.

I agree to participate in this study, the purpose of which is to to gain a deeper understanding of people's current fridge management habits and the real challenges they experience while trying to manage their fridge.

By learning how individuals organize, prioritize, and plan their food consumption, the interview seeks to identify "fridge management failures" and the emotional and practical reasons behind food purchasing/discarding behaviors. The interview also aims to gain valuable insights into existing strategies people use to workaroud these pain points and to identify opportunities for improvement.

I understand that

- The procedures to be used are:
  - you will be asked to join a scheduled meeting over **Zoom, which will be recorded**
  - you will be asked a series of questions by an interviewee for around **10-20 minutes**
  - you will be asked to **describe details of or take a picture of your fridge**
  - the recording will be reviewed, and analyzed by the investigators
- I will receive no compensation for my participation.
- I am free to withdraw before or any time during the study without the need to give any explanation.
- All materials and results will be kept confidential, and, in particular, that my name and any identifying or identified information will not be associated with the data.

### PARTICIPANT

Name (please print) \_\_\_\_\_



Signature \_\_\_\_\_

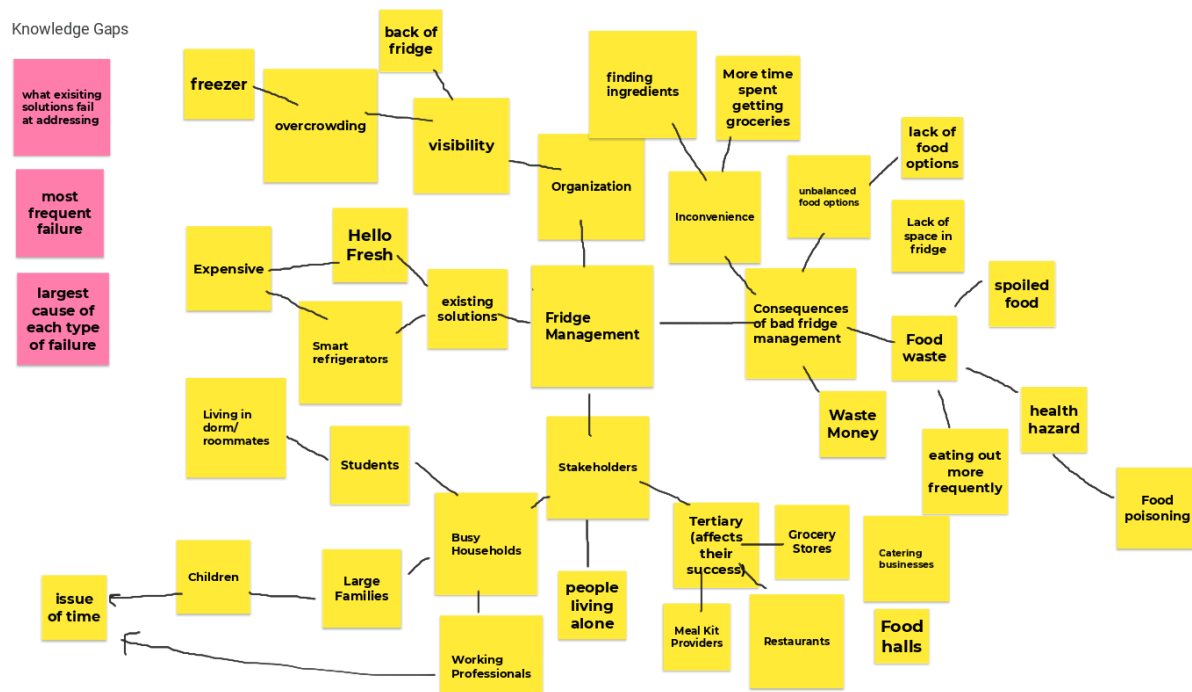
Date \_\_\_\_\_

## INVESTIGATOR(s)

Name \_\_\_\_\_ Signature \_\_\_\_\_

# Documentation of the process

## Mind map



## POV statement

### Complete POV Statements

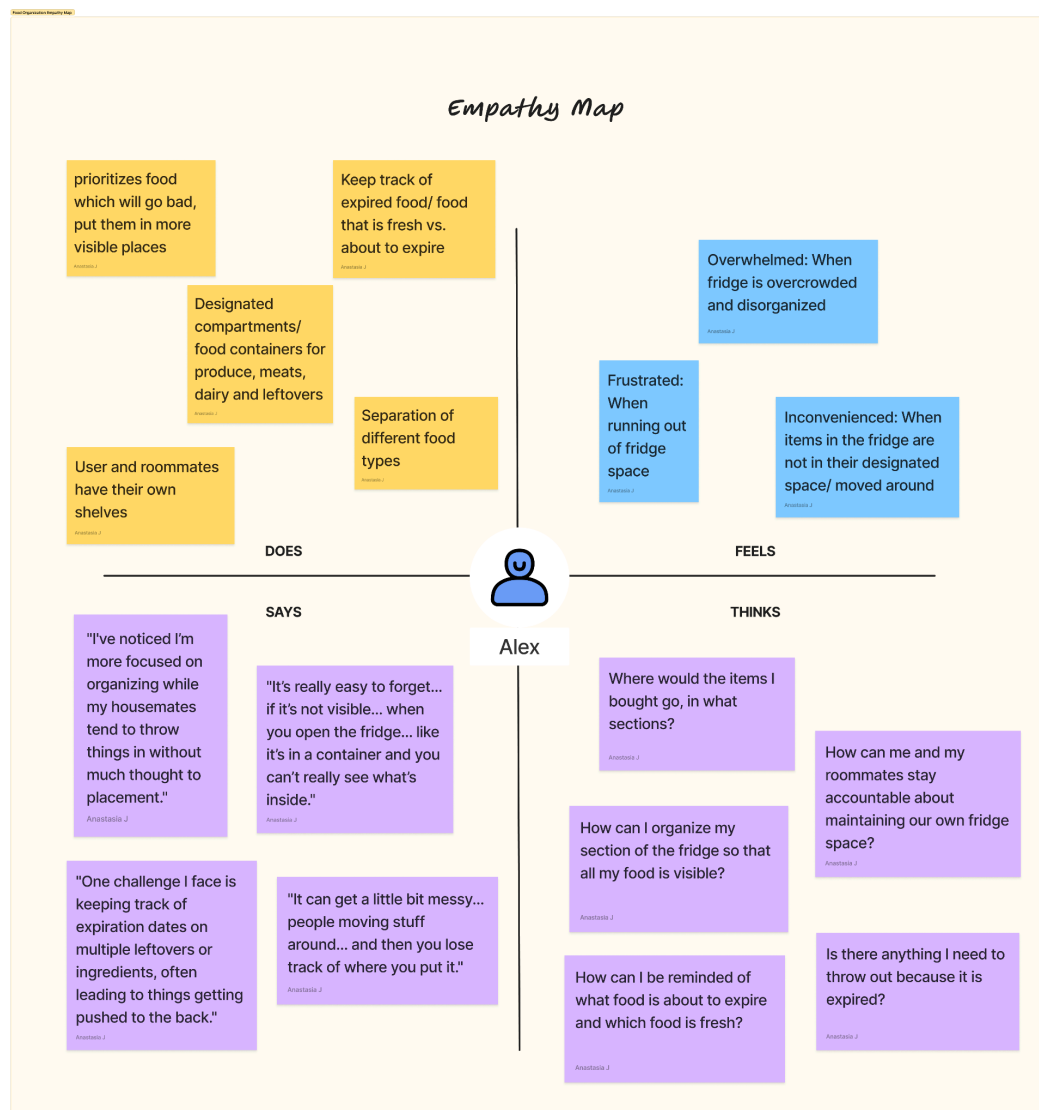
1. Busy households need a tool to manage bulk grocery purchases and prevent items from being forgotten or expiring.
2. Busy households need a system to track fresh and frozen food to avoid waste when meal plans change.
3. Busy households need a way to organize their fridge contents so they can easily find ingredients and plan meals, preventing waste.

### Incomplete POV statements

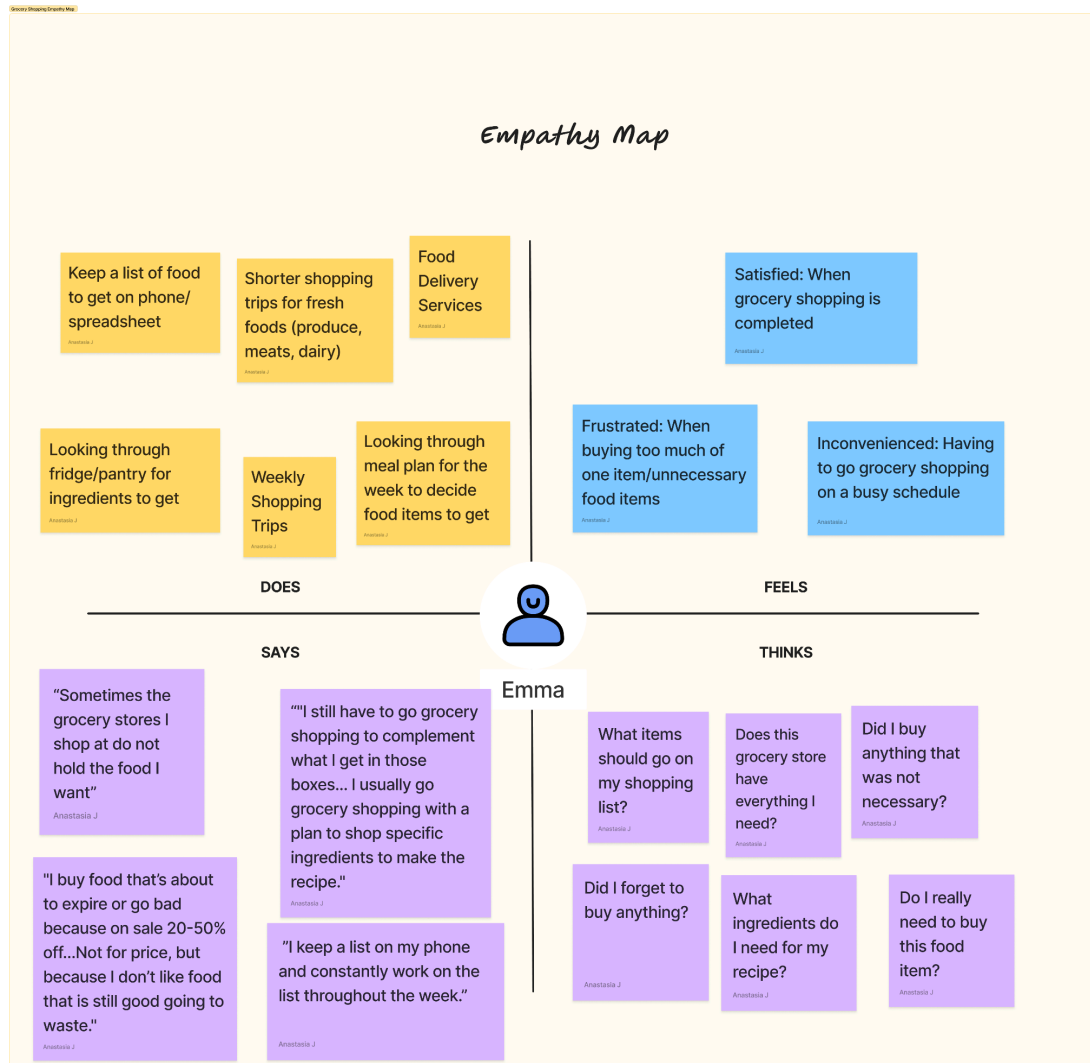
1. Busy households often overlook food items in the fridge because...
2. Busy households end up wasting food and money because...
3. Busy households might need to skip a meal unexpectedly because ...

## Empathy Maps

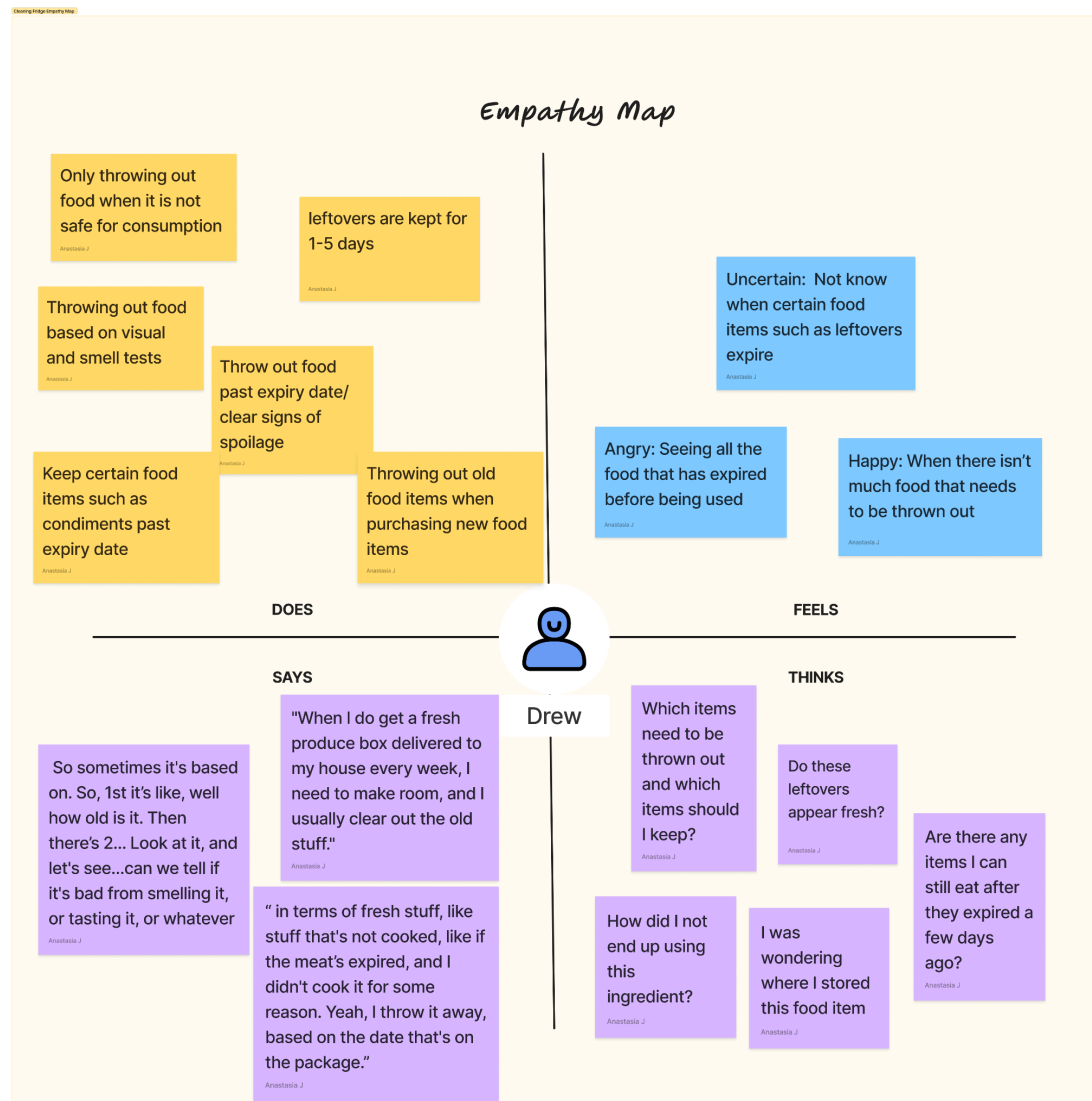
### Empathy Map: Fridge Organization



## Empathy Map: Grocery Shopping



## Empathy Map: Clearing Out Fridge/Discarding Food



## Data analysis documentation

### Key Findings

Interview	Questionnaire
<ul style="list-style-type: none"> <li>Participants interviewed all organize their fridge space based on the restricted designated fridge compartments available, and by certain categories for the shelves, however, when space is limited, extra items just get placed where they can fit.</li> <li>Participants living with roommates/others have designated sections to put their food items.</li> <li>Food usage is prioritized based on which foods are more</li> </ul>	<ul style="list-style-type: none"> <li>We can infer that people may be throwing out a lot of food because they forget what is in the fridge <ul style="list-style-type: none"> <li>Reason: many people report that they forget what food is in the fridge BUT many people report that they do not "overbuy" food</li> </ul> </li> <li>Produce is something that gets wasted more than others</li> </ul>

<p>likely to spoil first (i.e. priority is given to food such as meats, fresh produce, left-overs, dairy); frozen foods have less priority</p> <ul style="list-style-type: none"> <li>• Each user tended to have different methods of deciding what food they kept and threw out. Some users might keep food even though it has expired for a few days if there is no threat to its consumption, others might not.</li> <li>• Users will discard food that's considered spoiled by taste, smell, or visibly, but some might eat around the "bad" parts.</li> <li>• Heavily depends on the participant, their habits and upbringing</li> <li>• Reflecting on their experiences, users all felt frustrated by food items being wasted and spoiling before they could use the items mentioning both disappointment about financial and food resource waste</li> <li>• Reasons for Clearing Food: <ul style="list-style-type: none"> <li>• Going on a trip causes food to be discarded (either food still good thrown out before, or food that was forgotten and goes bad while away)</li> <li>• Fridge malfunction caused ice to build up in fridge</li> <li>• Didn't realize door was left open &amp; everything defrosted</li> <li>• forgotten/unchosen food → became moldy, not edible</li> </ul> </li> <li>• The key challenge faced by most respondents when managing and organizing food in their fridge revolves around tracking items and preventing food waste. A common issue mentioned is the difficulty in organizing leftovers due to a lack of designated space, which can lead to confusion about what is old or new, especially when there is no labeling system in place. This is further complicated when the fridge gets crowded, making it hard for others to find what they need.</li> <li>• While shared living creates issues related to space, ownership, and differing dietary habits, living alone allows for more personalized strategies such as meal planning and smaller, frequent grocery trips. Regardless of the living arrangement, limited fridge space and the need for careful planning are common themes that affect how individuals organize and manage their fridge contents.</li> <li>• Shopping plans are based on meal plans and grocery lists</li> <li>• Many have weekly trips to replenish fresh items, produce, and dairy.</li> <li>• some focus on discounts or use a produce box for variety</li> <li>• Some split larger trips for non-perishables and smaller ones for fresh items.</li> <li>• Based on the participant's responses, the most common planning strategies for deciding which items to buy when grocery shopping include: <ul style="list-style-type: none"> <li>• Meal planning and buying ingredients and food based on what they need for those meals</li> <li>• Keeping a list on phone and planning shopping trips according to what type of food they want to buy</li> <li>• The common goal for people's shopping strategies are to prevent over-buying and wasting food they do not use.</li> <li>• A common strategy is meal planning and 1 weekly shopping trip to reduce food waste, <ul style="list-style-type: none"> <li>• cooking smaller portions</li> <li>• freezing excess food</li> <li>• Google Sheets or list of inventories on phone</li> <li>• updating/viewing these systems can be inconsistent which affects the effectiveness</li> </ul> </li> <li>• Not</li> <li>• Others just rely on memory, which they admit is less effective.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- fruits/veggies <ul style="list-style-type: none"> <li>- (all but 1 respondent, for 54% of respondents, over 20-40% of their food waste)</li> </ul> </li> <li>- leftovers <ul style="list-style-type: none"> <li>- (86% throw at least some leftovers, for 50.8% of respondents, over 20-40% of their food waste, more leaning towards 50-100%)</li> <li>- Reason: the data on what % of food that gets thrown out</li> </ul> </li> <li>- Interestingly, many people self report that they check expiry frequently <ul style="list-style-type: none"> <li>- Reason: a little under 50% of people check the expiry data of their food at least once a week</li> </ul> </li> <li>- Pain points seem to be roommate related <ul style="list-style-type: none"> <li>- Reason: <ul style="list-style-type: none"> <li>&gt; suggesting they eat food n number of days after it expires</li> <li>&gt; reminders that there</li> <li>&gt; suggesting that they freeze their food</li> <li>&gt; remind roommates of their food, invite roommates to the app</li> <li>&gt; sending notifications to the household</li> </ul> </li> </ul> </li> <li>- Solutions people would be open to accepting <ul style="list-style-type: none"> <li>&gt; suggesting they eat food n number of days after it expires</li> <li>&gt; reminders that there</li> <li>&gt; suggesting that they freeze their food</li> <li>&gt; remind roommates of their food, invite roommates to the app</li> <li>&gt; sending notifications to the household</li> </ul> </li> </ul>
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Link to key quotes:

[https://docs.google.com/document/d/19WMN6pU9LnRaRYsm-TycDQ2LZH3M\\_p3k7DWEmCVMeUY/edit?usp=sharing](https://docs.google.com/document/d/19WMN6pU9LnRaRYsm-TycDQ2LZH3M_p3k7DWEmCVMeUY/edit?usp=sharing)

# Research instruments

Link to questionnaire

<https://docs.google.com/forms/d/e/1FAIpQLSfRAxak6kIXzWqCUPjx5QDvpU62O1TOF3AFtGca3uGX9sXEfg/viewform?usp=sharing>

Interview Instrument (Primary Stakeholders):

## Primary Stakeholders

1. Explain how you organize your fridge space. (if they show their fridge, use as prompt)
  - a. Could you walk me through how you would decide where to place food into the fridge? (Guided Tour Question)
2. How do you prioritize which foods to use up first?
3. How do you decide which foods to keep or which foods to throw out?
4. Describe a time you had to throw away food or clear out your fridge.
  - a. What do you think caused you to do this?
  - b. How does it make you feel when you have to throw away food?
5. Can you give an example of some challenges you face related to managing/organizing the food in your fridge?
  - a. What do you think causes these challenges?
6. If you live with other people, can you explain if that affects how you think about using your fridge?  
If you live alone, can you explain how that affects your strategy for managing food in your fridge?
7. How do you plan your grocery shopping trips? How do you plan what you are going to purchase before grocery shopping?
8. Describe any management strategies you have tried to decrease the amount of food you had to throw away. Were they effective?
9. Do you have any other comments you would like to share?
- 10.

Secondary Stakeholders:

1. Explain how you organize your fridge space. (if they show their fridge, use as prompt)
  - a. Could you walk me through how you would decide where to place food in the fridge? (Guided Tour Question)
2. How do you prioritize which foods to use up first?
3. How do you decide which foods to keep or which foods to throw out?
4. Describe a time you had to throw away food or clear out your fridge.
  - a. What do you think caused you to do this?

- b. How does it make you feel when you have to throw away food?
5. Can you give an example of some challenges you face related to managing/organizing the food in your fridge.
  - a. What do you think causes these challenges?
6. If you live with other people, can you explain if that affects how you think about using your fridge?  
If you live alone, can you explain how that affects your strategy with managing food in your fridge?
7. Describe any management strategies you have tried to decrease the amount of food you had to throw away. Were they effective?
8. **Are there any differences you have noticed between the way you and your housemates (who cook) use the fridge?**
9. Do you have any other comments you would like to share?

## Raw data

Link to interview recordings and transcripts

[https://drive.google.com/drive/folders/1saQ-osYvbFbTug9dtBxh0GPQWeDO4CHf?usp=drive\\_link](https://drive.google.com/drive/folders/1saQ-osYvbFbTug9dtBxh0GPQWeDO4CHf?usp=drive_link)

## Group meeting notes

9/17/2024 - Brainstorming

<https://docs.google.com/document/d/1zJfo0PuMWZfhOv7ZfudhYxDdAVp-MWnecsP6K77ZhFc/edit?usp=sharing>

## A1 tasks allocation

	Team Members					Task	Estimated Time Commitment (hrs)	Deadline	
✓	Kelsie			lee	Izumi	Problem & 2 Methods Presentation Preparation	2 hours (max)	Tuesday, September 24, 2024	
✓	Kelsie			lee		Complete & Incomplete POV Statements for Problem	1 hour (?)	Tuesday, September 24, 2024	The Problem - Presentation Planning
✓	Kelsie			lee		Background Research on issue	2 hours	Tuesday, September 24, 2024	SP1 Presentation
✓		Wendy				Mind Maps of Problem	1 hour	Tuesday, September 24, 2024	
✓			yuxi			Interview Protocol	2 hours	Friday, September 27, 2024	
✓		Anastasia			Izumi	Consent Forms	2 hours	Friday, September 27, 2024	
✓		Anastasia	Wendy		Izumi	Interview	2-3 hours	Friday, September 27, 2024	
✓		Anastasia				Determine & Reach Out to 1 Person Per Primary & Secondary Stakeholder Group (min. 3 total for observation or interview)	1 hour	Saturday, September 28, 2024	
✓	Kelsie	Wendy				Formulate Questions for Questionnaire	2 hours	Wednesday, September 25, 2024	
✓		Wendy		Lee		Determine Target Participants & Reach Out to 15 Primary & 15 Secondary Stakeholders (for Questionnaire)	1 hour	Wednesday, September 25, 2024	
□				lee		Written Report - General Problem	1-2 hours	Friday, October 4, 2024	
□			yuxi			Group Meeting Notes (at each meeting)	30 min	Friday, September 27, 2024	
□		Anastasia				Empathy Map	1 hour	Friday, October 4, 2024	
□	Kelsie	Anastasia			Izumi	Written Report - Field Studies Section	3-4 hours	Friday, October 4, 2024	
□	Kelsie		Wendy	yuxi		Analyzing the Gathered Data & Document	4 hours	Saturday, October 5, 2024	
□		Anastasia			Izumi	Personas (per user group)	2 hours	Saturday, October 5, 2024	
□	Kelsie	Anastasia	Wendy	yuxi	David	Job Stories (5 with paragraph) → written report (can split 1 per member?)	2 hours	Saturday, October 5, 2024	
□				yuxi		Experience Map → on written report	1-2 hours	Saturday, October 5, 2024	
□	Kelsie	Anastasia	Wendy	yuxi	David	Functional Design Requirements (5, paragraph) → written report (can split 1 per member?)	2-3 hours	Saturday, October 5, 2024	
□						Appendix	1-2 hours		
□		Wendy				Proofread report	1-2 hours	Monday October 7	
□									

10/1/2024 - Virtual Team Meeting

<https://docs.google.com/document/d/1k0T3o2Q7iKASeBYi72Pk9aw6Lohhq0hYvuL-p-fEKiE/e>  
[dit?usp=sharing](#)