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Meal Pod

Team

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Our design research effort was highly collaborative; for all prior assignments and brainstorming sessions, we would gather together for a couple of hours each week to discuss and work together on the necessary tasks. Sometimes, we would split up into two different groups to grab meals with various subjects in order to gain more insight into their eating habits and observe modes of food waste. Otherwise, we would find a time each week to gather and finish tasks such as sketching our ideas for the user interface, discussing our project vision, and constructing written assignments together by both writing up and reviewing each other's written summaries.

Problem & Solution

Food waste is a growing issue in most industrialized areas of the world. Over a third of all food produced globally goes to waste, and if food waste were a country it would be the 3rd largest emitter of greenhouse gases after China & the USA.¹ As a result, food waste is considered one of the most pressing environmental threats of our time. And since it is perpetuated by both the business practices of corporate bodies and living habits of individuals, food waste ends up being a multifaceted problem.

We propose to help reduce the problem of food waste at the community level, by building a mobile application that would help users connect with other people living nearby to form local food co-op groups. Since most ingredients come in bulk, users oftentimes end up wasting food items by not being able to consume them in time. Thus, the application promotes the sharing of raw ingredients and supports meal planning when users attempt to organize meal menus and times with other users. As a result, the design aims to reduce food waste in both the individual and communal spheres. We named the app “Meal Pod” as a metaphor for how whales engage in cooperative eating in pods so food doesn’t go to waste.

¹ FAO. Food Wastage Footprint Impacts on Natural Resources. FAO, 2013.

Research Goals, Stakeholders & Participants

Goal

Our design research aimed to determine how different groups of people waste their food through observing their eating and disposal habits. We accomplished this through a series of contextual inquiries (CI) with both undergraduate and graduate students to gain a broader understanding of how food waste is perpetuated at the individual level. From these different groups we could then narrow down a specific population to target with our design that would be feasible and have impact, which we found to be young, single professional adults in urban areas.

Research Methods

We conducted several CIs of when undergraduate students eat in dining halls and order food, as well as when graduate students grocery shop and prepare their own meals, because we believed that it was the most hands-on approach to tackling our problem. By observing eating habits closely, we could better discern the factors that contribute to food waste, as well as receive direct answers to any of our questions.

For *Undergraduate CIs*, we conducted CIs of students eating in the *dining hall* focused on how students decided the type of food to eat, determined food portion sizes, and treated leftover food. These CIs were performed under the guise of a dining hall facility investigation to avoid drawing attention to and thereby skewing the process of wasting food. We also conducted CIs of students *ordering food* in restaurants focused on how students determined food order size and handled leftover food.

For *Graduate CIs*, we conducted CIs of students *grocery shopping* focused on how students determined portion sizes for ingredients, factored in food expiration date, and if they knew what they wanted to buy prior to entering the grocery store. We also conducted CIs of students *preparing meals* for themselves focused on how students estimated ingredient sizes, determined portion size for the people they were cooking for, and handled storage/discard of leftovers.

Stakeholders and Participants

The design focused on undergrad and graduate Yale students. While many undergraduate students eat in dining halls and occasionally order food, graduate students typically shop for groceries and cook for themselves. Thus, these two groups provided multiple perspectives for the problem of food waste. In total, we studied nine participants as listed below by their aliases.

1. *Ronald* is an undergraduate student on the meal plan and eats all of his meals in Yale's dining halls. We conducted a CI with him in the morning, while he was rushing through his dining hall meal to get to class. He did not eat much due to the time crunch.
2. *Victor* is an undergraduate student on the meal plan, but occasionally eats out. Victor doesn't eat meat from animals with four legs and likes to experiment with his meals. We conducted a CI with him during dinner in the dining hall.
3. *Megan* is an undergraduate student who often eats her meals as soon as the dining hall opens and stays for no more than half of an hour. We conducted a CI with her during lunch in the dining hall.
4. *Ashley* is an undergraduate student on the meal plan and often orders burgers from the Grill when she doesn't like the options provided to her by the buffet. She tends to get other food while waiting for her order. She doesn't think too much about wasting food. We conducted a CI with her during a long dinner in the dining hall.
5. *Sarah* is an undergraduate student on the meal plan who likes to eat out once a week. She orders dishes she knows that she'll like and looks out for their overall nutrition. She packs her leftovers to-go, and eats them when she doesn't have enough time to eat in the dining hall. We conducted a CI with her during a long meal in a restaurant.
6. *Kate* is a graduate student who lives in an apartment with her fiancé and cooks her own food. She is vegetarian and does not eat out very often. She plans out her meals before buying groceries. We conducted a CI with her after she came back to her apartment from grocery shopping to observe her handling of the groceries.
7. *Alyssa* is an undergraduate student who often organizes events that have a variety of food, from chicken nuggets to Chinese hot pot. She attempts her best to determine the amount of food she'll need for her events in order not to waste food or money. We conducted a CI with her as she picked up and distributed food for an event.
8. *Lara* is an undergraduate student who, "[does] not waste food." She lives off-campus and tends to cook most of her meals. She is very mindful of her social environments when choosing what to eat. We conducted a CI with her over dinner.
9. *Stephanie* is a graduate student who lives in an apartment by herself and cooks her own food. She swaps meals and ingredients with another graduate student around once a week when she has leftovers. We conducted a CI with her after she came back from grocery shopping to observe her handling of the groceries and eat a home cooked dinner.

Research Results & Themes

Design Research Results

We found a large discrepancy in the food preparation/consumption tasks performed by students who live off campus and prepare their own food compared to students who live on campus and

eat in dining halls. We also found that many factors influenced what food people choose to prepare or consume, including visual appearance, variety of meals, nutrition, and dietary restrictions. We found that the reasons food gets wasted varies tremendously, but addressing food waste is more feasible for students who prepare their own food.

Themes/Problems

Upon brainstorming, we discovered a variety of themes and subthemes that fall under the food waste problem. These themes include:

- **Reasons for Food Waste**
 - *Portion/Package size*: Single individuals waste food because the food packages available on the market come in sizes of 2 or more items. This concern was expressed by both Kate and Stephanie.
 - *Lack of variety*: Participants in our research wasted the most food when they did not like the variety offered by the dining hall. An example of this case is Ashley, who while ordering food from the Grill, continued sampling food and thus ended up with more food that she wanted to consume.
 - *Expired/Soon to expire food*: None of the participants tried to salvage expired or soon to expire food, i.e. composting, donating food. Even for the participant that wasted the least food (Kate), food that went bad was soon discarded. This helped us understand that we needed to tackle the problem of food waste with the mindset of maximizing the consumption of food purchased before it goes bad.
- **Choosing Food**
 - *Appearance of food*: Several of our interviewers expressed that they chose food based on its appearance. This made us realize that if they saw something slightly strange with the food, they would not consume it or even discard it.
 - *Planning meals for the week*: Out of all of our research participants, only Kate planned her meals. We observed that the participants who did not plan their meals wasted significantly greater portions of food.
 - *Variety of foods*: Almost all of our participants expressed that they liked to consume different types of food throughout the week. This search for variety led some of them to buy new food even when they already had food available in their fridges. To solve this problem, Kate opted for cooking meals on a daily basis. Stephanie, on the other hand, looked for meal buddies with whom to exchange food.
 - *Dietary restrictions*: As expected, dietary restrictions play a crucial role in deciding what type of food is to be consumed. Lara, in particular, was very mindful of this whenever she went out with other people because by choosing meals that she and her friends could all consume, the food was more likely to be completely finished.

- *Nutritional value of food*: Almost all of our participants expressed that they chose their foods depending on their nutritional value. This was particularly important in the process of buying groceries.
- *Amount of food (eyeballing)*: Almost all of our on-campus participants eyeballed the amount of food that they would consume at dining halls. However, this process was not always present because other themes such as variety of foods and food appearance took precedent, leading students to take more food than they would actually consume.
- **Influence of Environment on Eating Habits**
 - *Time constraints*: Some of our participants living off-campus indicated that they often did not have time to cook throughout the week and hence the food that they would buy would be wasted some times. Other students, Ronald for example, chose the amount of food he would get depending on the amount of time he had available to eat. In either case, time to cook and time to consume the food were important restrictions that we needed to consider in our design.
 - *Talking versus eating*: One of our participants indicated that she would order less food whenever she would go out to eat with friends in order to speak more. This minimized the amount of food she wasted.
 - *Serving food at events*: Through a CI with a student organizer that was in charge of a senior event, we discovered that food is less likely to be wasted if it is popular, easy to eat, and easy to share.
- **Eating Out**
 - *Handling of leftovers*: In the context of eating out with friends at a restaurant, leftovers were usually taken home to be consumed later. In the context of an event, the food leftover after the event was either given to any event participant who wanted to take it, taken by the organizers of the events, or shared on social media for hungry students to know the location of the food and take it. In all cases, people tried to save or distribute the food to minimize food waste. This could be attributed to the fact that no one wants to seem wasteful in the context of a group.
 - *Trying new foods*: Our CI with Lara helped us understand that the decision of trying new foods was influenced by both people's reviews of food through apps like Yelp, and the own user's experience within a restaurant. This is important for our design because as we observed in other CIs with students in dining halls, people are more likely to waste food when they are trying something new.

These themes suggest that people choose food for a variety of different reasons which in turn affects their level of food waste. Moreover, environmental constraints such as time and social context can influence people's eating habits.

Task Analysis

Who is going to use the design?

We found that the patterns of food waste between students who eat in the dining halls (often, those who live on campus) and students who prepare their own food (typically students who live off campus) are dramatically different. On-campus students and off-campus students approach eating with different tasks in mind, and a single solution is unlikely to work for both. Based on this results and our consequent brainstorming sessions, we have decided to address tasks performed by be young, single professional adults in urban areas. This particular population reflects the eating patterns that we found in the students living off-campus, and hence, we have data that supports our design choices.

What tasks do they now perform?

Planning food to buy at grocery store (one participant), managing ingredients (e.g., tracking expiration date), planning meals to prepare, buying groceries, deciding when to cook at home versus eating out, cooking, eating, choosing what food to get if eating out, and handling of leftovers.

What tasks are desired (to minimize food waste)?

Planning how much food to buy subject to individual and group constraints (variety of food, price, dietary constraints, etc), swapping/sharing meals or raw ingredients to increase food consumption and food variety, and managing time to cook meals as a group.

How are the tasks learned?

Through how one's environment develop one's eating habits, observing what friends and family do, through learning platforms (TV cooking shows, online tutorials), reading tips online or in books.

Where are the tasks performed?

Kitchens, grocery stores, restaurants, individuals' houses.

What other tools does the person have?

Online recipes, pen and paper (e.g., shopping lists), food/grocery delivery services, Yelp (online rating services for restaurants), meal planning apps.

How often are the tasks performed?

Eating happens about 3 times a day, meal planning and grocery shopping happens about once per week, eating out at restaurants varies (rare/not at all to every day), cooking at home varies (rare/not at all to every day), managing leftovers: varies (rare/not at all to every day).

How do people communicate with each other?

Texting friends to do food swaps, cook together, or eat out (not strangers who may otherwise have the ingredients you need and vice versa), talking with others in same house to determine what ingredients to buy, recipes in books and online.

What are the time constraints on the tasks?

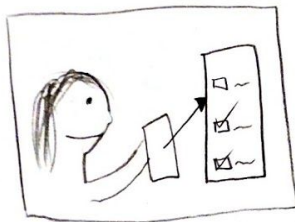
Eating on a time-crunch, schedule not allowing much time for meal preparation, shopping on the last day before an event, needing to eat.

What happens when things go wrong?

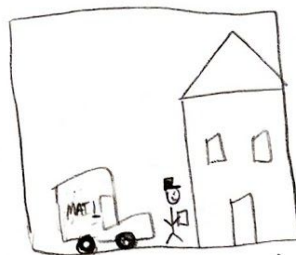
Edible food gets discarded, food is incorrectly prepared, ingredients expire and/or are discarded.

Proposed Design Sketches

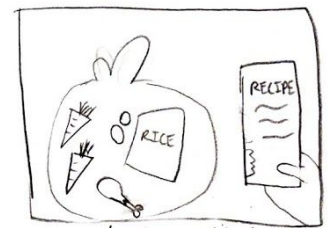
Design 1: Meal Delivery Service



1. ordering meals for the week
(taking into account
portion size as well)



2. ingredients delivered
to doorstep



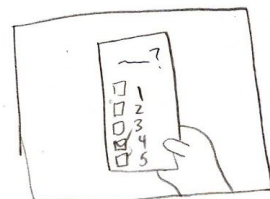
3. user checking that the
bagged ingredients are
specific to a meal



4. recipe is followed and
the resulting meal is
served!



5. other ingredients
for the week are
stored accordingly

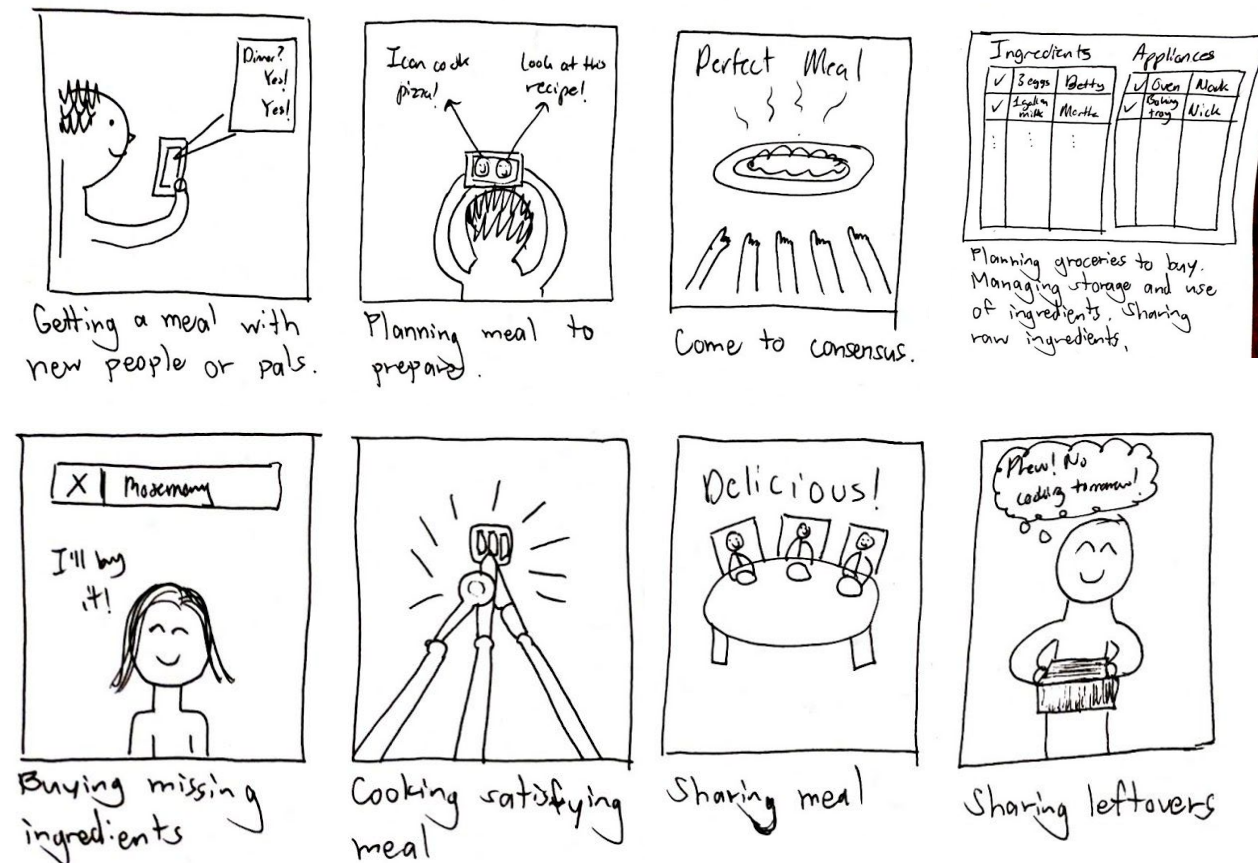


6. feedback form is
(hopefully) filled out
by the end of the
week

Weekly shipments of ingredients are delivered to users based on a meal list they create. The ingredients start with an estimated amount and increase or decrease based on how much is consumed. Users also receive recipes and cooking tips on their phone to help them properly store ingredients and prepare the meals they choose. At the end of each week users would fill out a

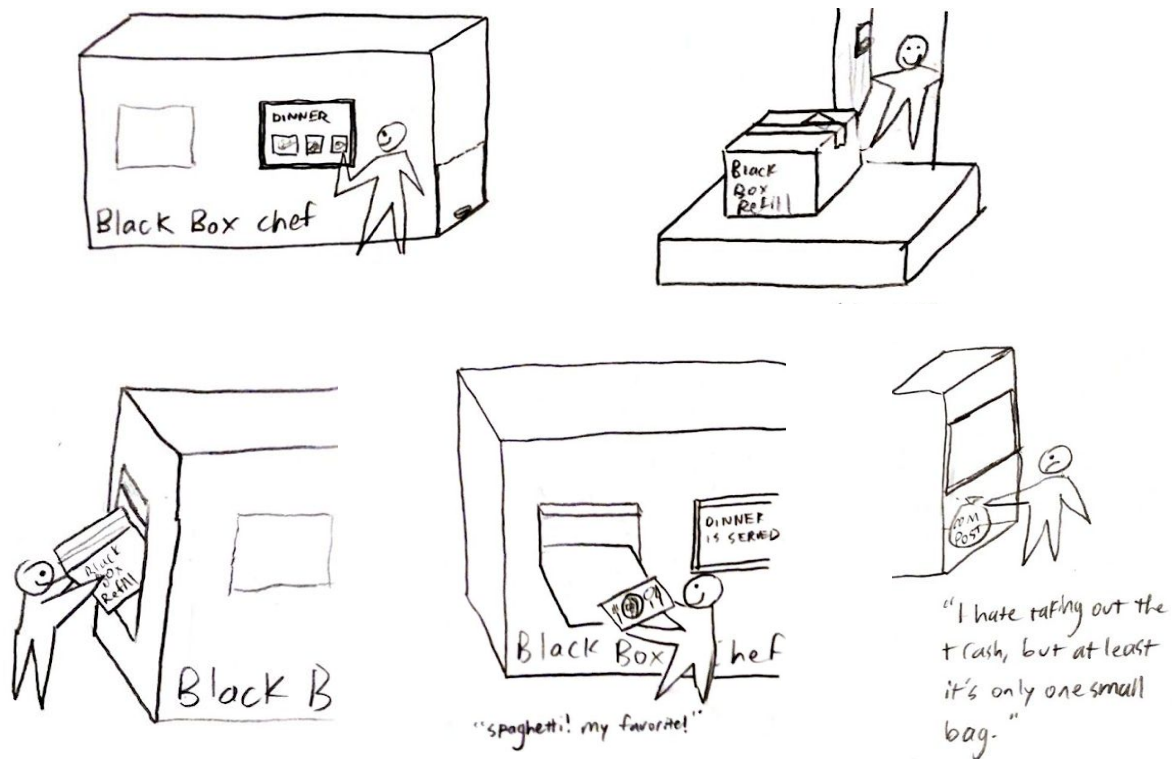
feedback form about the quality of the food and how much was wasted so portions and types of meals can be adjusted in the future. This design helps to support the tasks of planning meals to prepare, planning groceries to buy, managing storage and use of ingredients, and cooking satisfying meals.

Design 2: Local Food Co-op App



Users are grouped into co-ops (via an app) where they share meals. A major difficulty of living by yourself that leads to food waste is that packages often come in sizes meant for families rather than single people if you want to eat with variety, and so cooking in groups could potentially solve this problem. Another problem is managing time to cook and shop, and having each person in a group be responsible for those tasks in a rotation eases this burden. The app would also help to automate portions of meal planning by taking into account dietary restrictions, suggesting meals based on ingredients people already have, choosing meals that have a lot of shared ingredients, creating shopping lists based on meals, and assigning people to shop certain days of the week for specific ingredients. It also facilitates social interaction among individuals that may otherwise not have the opportunity to socialize over meals.

Design 3: Black Box Chef



Machines cook all of the user's meals. Users plan meals ahead of time for the machine to cook, and the machine orders mail packages of ingredients with exactly the right amount for each meal. As with the meal delivery service, food quantity is calibrated based on how much the user doesn't eat, or if the user wants more food. The machine stores, manages, and orders ingredients and assists the user in planning and cooking meals.

Chosen Design & Tasks

We chose to focus on the Local Food Co-op App. The Black Box Chef would likely be a large expense for single individuals, meaning less adoption, and the types of meals it could cook would likely be limited, so it may not achieve the user's goal of eating satisfying meals with variety. The Meal Delivery Service option was compelling, but a few services already exist that are similar. While our solution has some differences, the amount of food waste avoided by switching from an existing service to ours would be small. The Local Food Co-op App would primarily be targeted towards young, single, independent adults living in urban areas. In high-density areas, this app has the potential to achieve widespread adoption and there are no existing solutions like it (on a large scale), so out of our three ideas, this one would likely be the most effective at mitigating the problem of food waste.

Our research showed that individuals (in particular the graduate student Kate as opposed to the graduate student Stephanie) who plan meals waste less food since they know what and how many ingredients to buy and when to prepare meals to avoid wasting food. Helping to reduce the cognitive load by partially automating the tasks of looking up recipes, creating shopping lists, and suggesting when to buy certain ingredients would help beginners living on their own greatly and could free up more time to do other activities. Stephanie herself didn't methodically plan out her meals because it takes a lot of time, but this led to a lot of waste as she overbought food (not just due to packages being too large). Stephanie was also frustrated that food packages came in sizes meant for families rather than single individuals if she wanted to eat with variety, and so she swapped some of her ingredients and meals with another graduate student to help mitigate some waste. Kate didn't really have this problem because she lives with her fiancé and they cook together, and the package sizes are fine for couples, but she would have this problem if she were living by herself.

Based on these findings, we decided to focus on the tasks **planning meals** and **swapping/sharing raw ingredients/meals**, as assisting users in performing both of these tasks are key to reducing food waste. Additionally, if each person in a food co-op group takes on the tasks of shopping and cooking in a rotation, then much less time is spent on these tasks per person per week than if they were doing this just for themselves, freeing up time to do other activities but still getting the benefits of eating fresh foods with variety.

Written Scenarios

Scenario #1: *Planning Meals*

Erika is a young urban professional and loves the idea of eating fresh food with a close-knit group of people every day, as it would fulfill her social needs and her desire to eat a variety of foods without wasting ingredients. She decides to try out the app, making a profile listing her dietary restrictions and finding a food co-op group nearby. She is in charge of planning meals for her group this week. She checks the dietary restrictions of everyone in the group to get a ballpark of which cuisines to search for in the app. Seeing that someone is lactose intolerant, she decides not to search for French food and instead explores recipes for Chinese food, which she is interested in trying. After looking at the list of different Chinese foods, Erika wants to try out Mapo Tofu, and to minimize food waste, the app recommends other foods that utilize the same ingredients, particularly fresh produce. Erika selects a certain number of foods and puts them up for a vote so the group can reach a consensus of what to eat for the week. Once the group has come to a consensus, the app creates an ingredients list of what to buy, how much, and when, assigning particular individuals to shop on certain days given their availability. The list is flexible so members of the group can note the ingredients they already have. For fresh produce that might otherwise go bad later in the week, the app may suggest to get these items later when

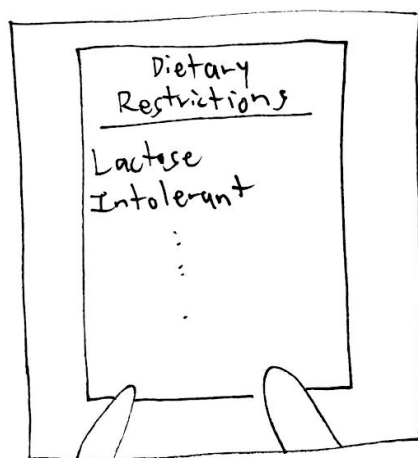
needed for a meal. In other instances, members of the group could also use a bottom-up approach where the app recommends meals based on ingredients they already have. In these ways, a lot of the cognitive load of planning meals for a group is taken care of automatically by the app.

Scenario #2: *Swapping/sharing meals or raw ingredients*

Richard is a young urban professional who likes to eat with his group of friends a couple of times a week for fun and otherwise mostly cooks by himself. He likes this arrangement as he can use up a lot of leftover ingredients he gets in bulk that would otherwise go to waste. He checks if his group is getting dinner this coming Friday and notes that his friend Lauren is hosting a meal then. Given Richard's habits, Lauren knows that he normally gets lots of extra eggs and so she decides to do breakfast for dinner with a deviled eggs recipe. Richard takes a look at the list of ingredients needed for the recipe and marks down that he can bring 24 eggs since he has a lot extra. Richard brings the eggs to Lauren's house and they make the deviled eggs together with the rest of their friends.

Storyboards of the Design

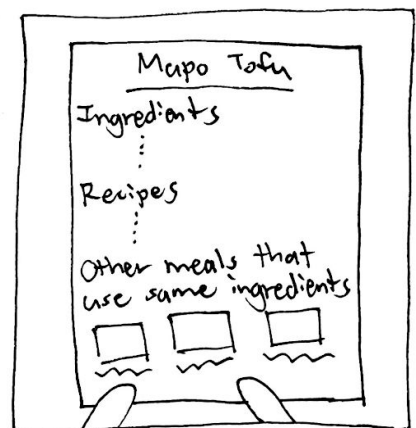
Storyboard #1: *Planning Meals*



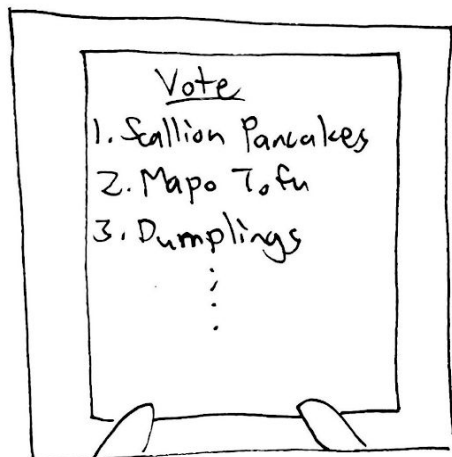
Erika is in charge of planning meals for her co-op group this week and quickly checks the dietary restrictions of her group to get a ballpark of which cuisines she should search in the app



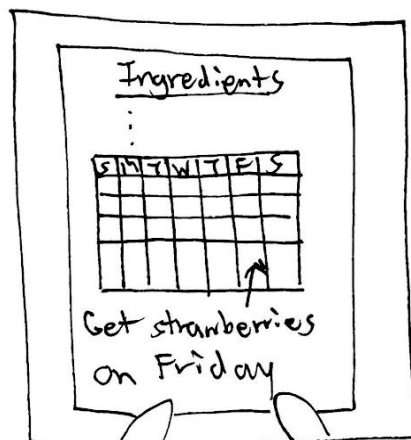
Seeing that someone is lactose intolerant, she decides not to search for French food and instead explores recipes for Chinese food, which she is interested in trying.



Erika wants to try out Mapo Tofu, and since she wants to minimize food waste, the app recommends other foods that utilize the same ingredients, particularly fresh produce

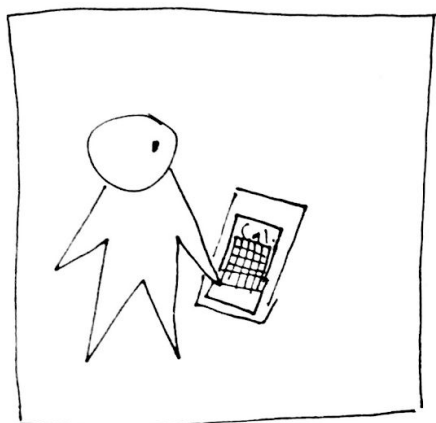


After selecting a certain number of foods, Erika puts them up for a vote so the group can reach a consensus



Once the group has come to a consensus, the app creates an ingredients list of what to buy and how much. For fresh produce that might otherwise go bad later in the week, the app may suggest to get these items later when needed for a meal

Storyboard #2: Swapping/sharing meals or raw ingredients



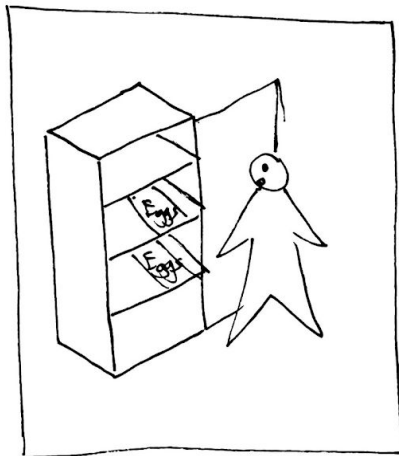
Richard eats with his food co-op group a couple of times a week and checks if they are getting dinner this Friday



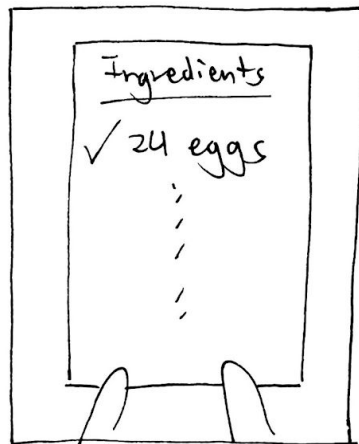
Richard notices that Lauren in his food co-op is hosting dinner on Friday, Perfect!



Richard looks at the list of ingredients Lauren needs to make deviled eggs



Richard notices he has lots of eggs in his refrigerator. So many, in fact, that they would be wasted if he tried to eat them by himself.



Richard marks that he will bring 24 eggs.



Richard brings 24 eggs to Lauren's house and they make deviled eggs together.