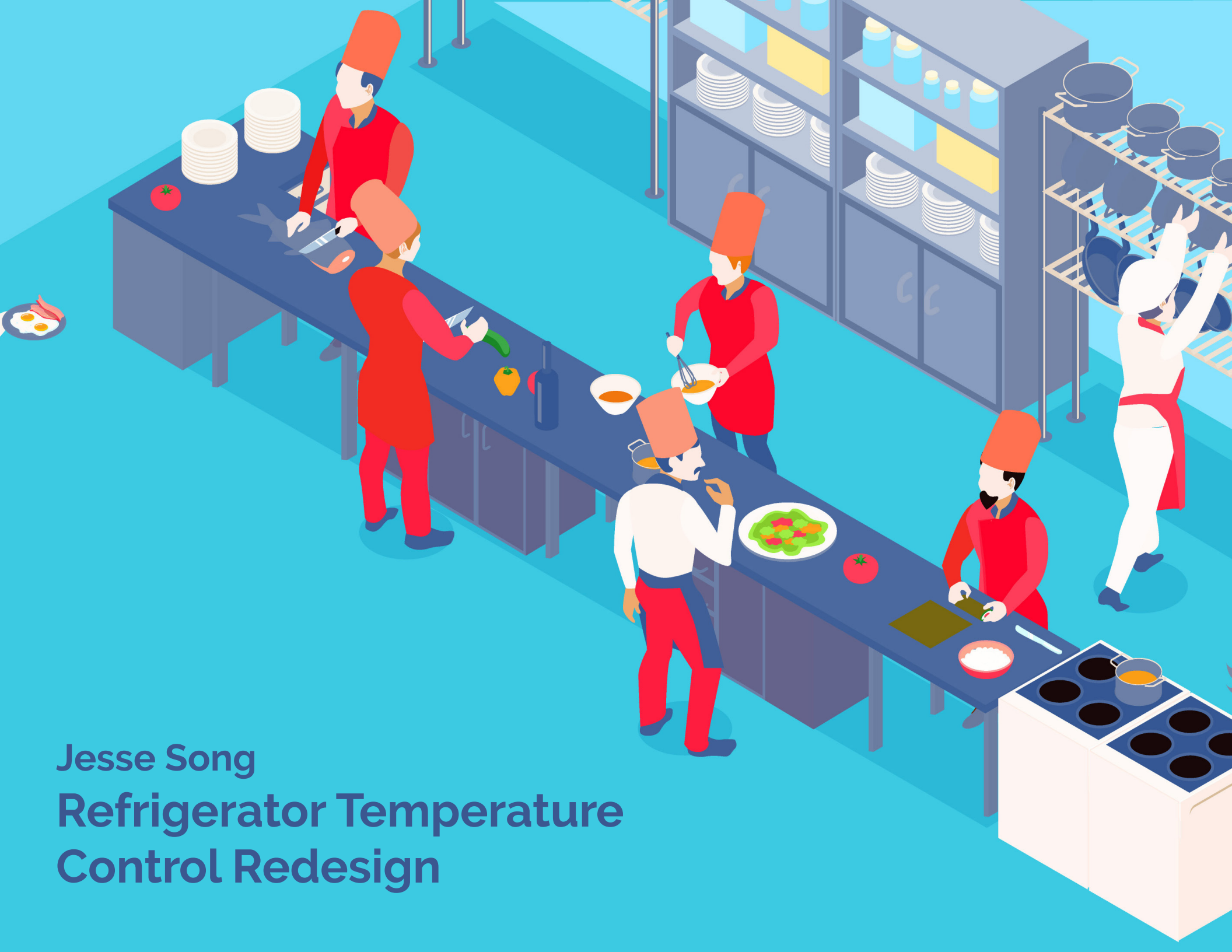


Jesse Song

Refrigerator Temperature Control Redesign

Prompt

The task at hand was to redesign a physical control by exploring unique methods that improve interaction through the use of design principles such as perceptual affordance, feedforward, and semantic/direct carriers of meaning just to name a few.

How Do I Start?

With such a broad category I needed a focus point. The first part of my process was to put my thoughts on paper through a brainstorming session.

My focus was to create a better way to represent how a refrigerator works to someone with no previous knowledge.

Questions like these arose:

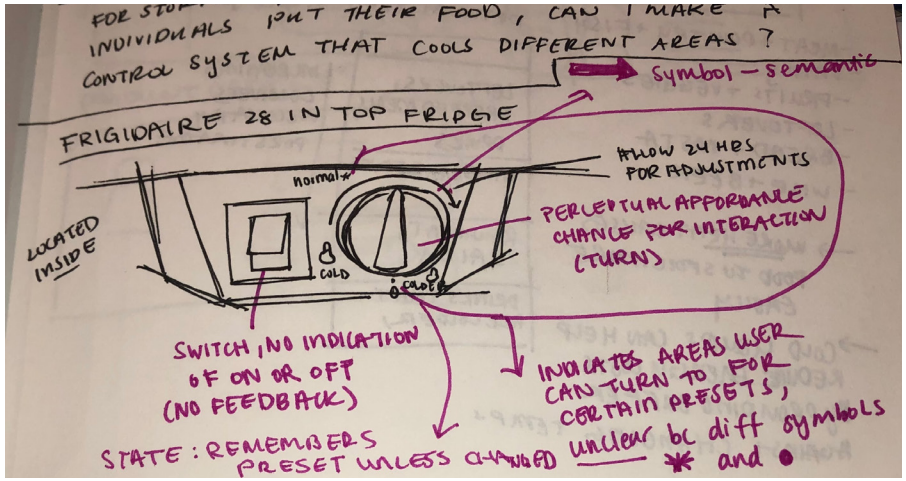
- How do you define coldness? Is it the actual temperature? Is it the feeling (how cold the person feels)? Or is it effect?
- What are the different types of things held in refrigerators?
- Do people have a working knowledge of what temeprature to keep certain foods at?

I started by answering my question about different types of items stored in a refrigerator.

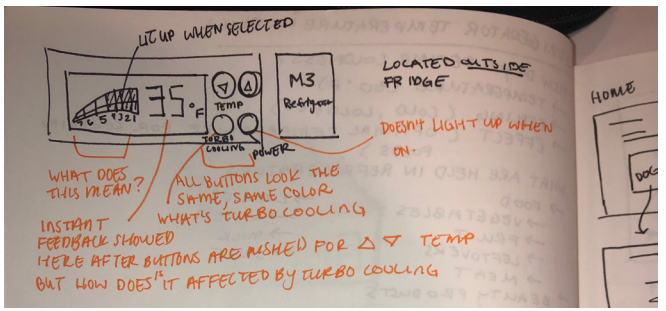
Finding A Focus Point

Looking at all these different categories and items, I wanted to see if different foods had different optimal temperatures for food storage to preserve the food for the longest time. But before beginning my design, I conducted some expemplar research to see what current refrigerator controls look like, in which ways they succeed and in which ways they fail.

Exemplar Research



Although minimal and sleek this model mainly lacks feedback. It's strengths include it's inclusion of perceptual affordance and state.

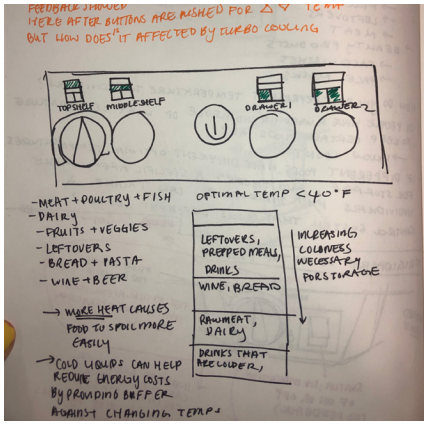


Instant feedback provided but feed lacks feedforward. What does the scale on the left side of the screen mean?

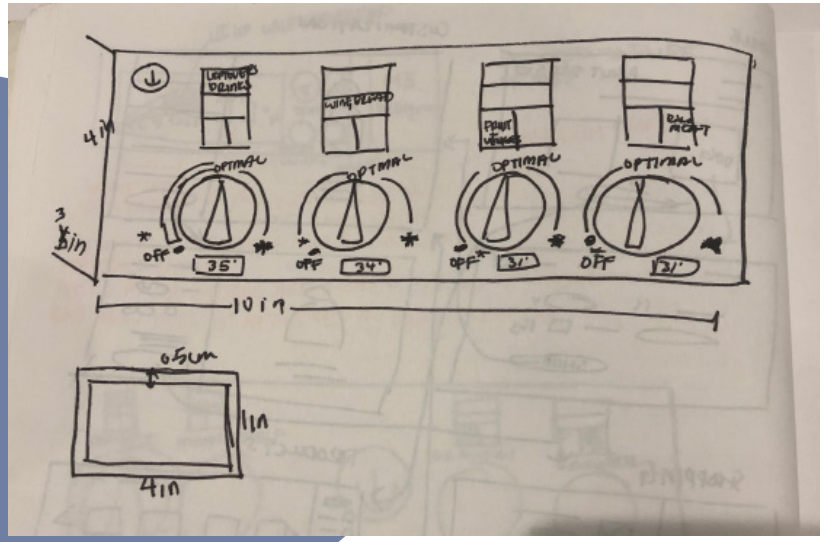
Iteration 1

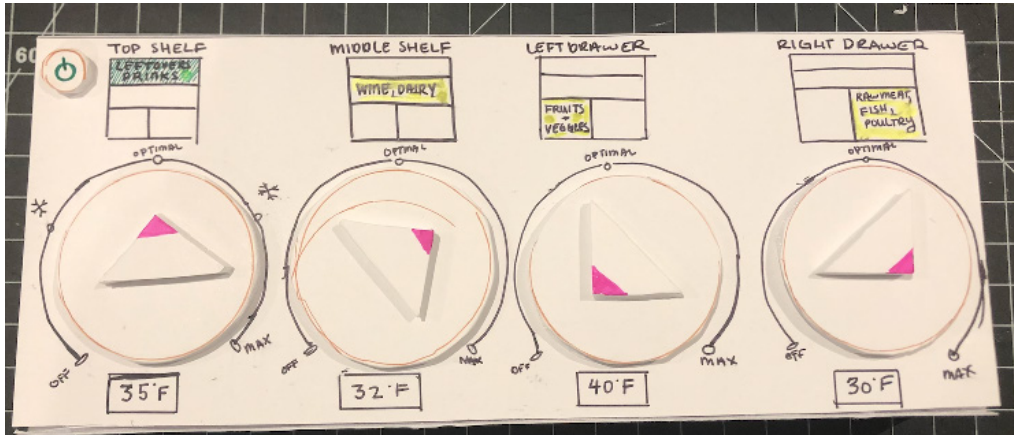
When creating my first iteration, I had two goals in mind.

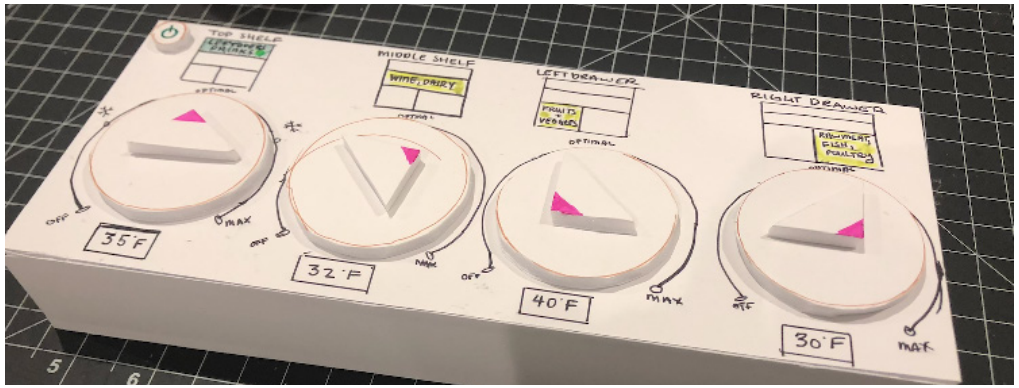
1. Create a refrigerator that can set different temperatures for areas of the refrigerator to keep food at their optimal temperature
2. Provide feedback, feedforward and perceptual affordances to the user



Brainstorming helped me organize how I wanted to create my 3D prototype. It helped me realize that the power button didn't need more emphasis, as the refrigerator is usually always turned on. Instead I turned my attention to the dial controls.







Feedback

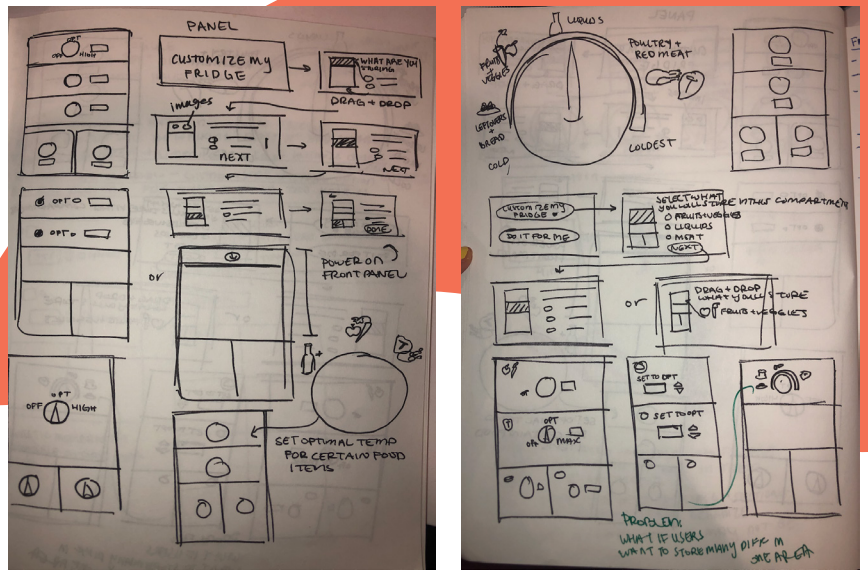
Some feedback I received included: taking advantage of physical mapping. For example, having the top shelf dial be located on the top part of the control panel. In addition, people store different food items in different parts of the refrigerator. Therefore, I needed to adjust my design to allow for customization. Finally, it was mentioned that other temperatures besides the "Optimal" option may not even be necessary because the other settings will not be used if optimal is presented to the user.

Iteration 2

After receiving feedback from a critique, I pivoted my idea and decided to focus on restaurant owners as stakeholders because of the maximum benefit they could receive from this product. The FDA identified improper food holding time and temperature as a critical area that greatly increased the risk of foodborne disease at fast food restaurants (Source). The idea was to help restaurant owners organize and keep their food at regulated temperatures in order to prevent customers from getting foodborne illnesses. My refrigerator control was specifically designed for a commercial restaurant refrigerator and centered around the idea of food safety with a focus on storage at correct temperatures and prevention of cross contamination. With compartmentalized sections on the panel that reflect the interior or the refrigerator, the restaurant is able to choose the type of food item they are storing in that section.

Again, Iteration 2 Began With Brainstorming

To explore multiple ideas quickly, I first started by sketching out several different control designs. I played around with adding icons of food on the temperature dial to indicate the optimal temperature that certain foods should be kept at. I dabbled with using a display screen to allow users to drag and drop the food items they wanted in different sections of the refrigerator.

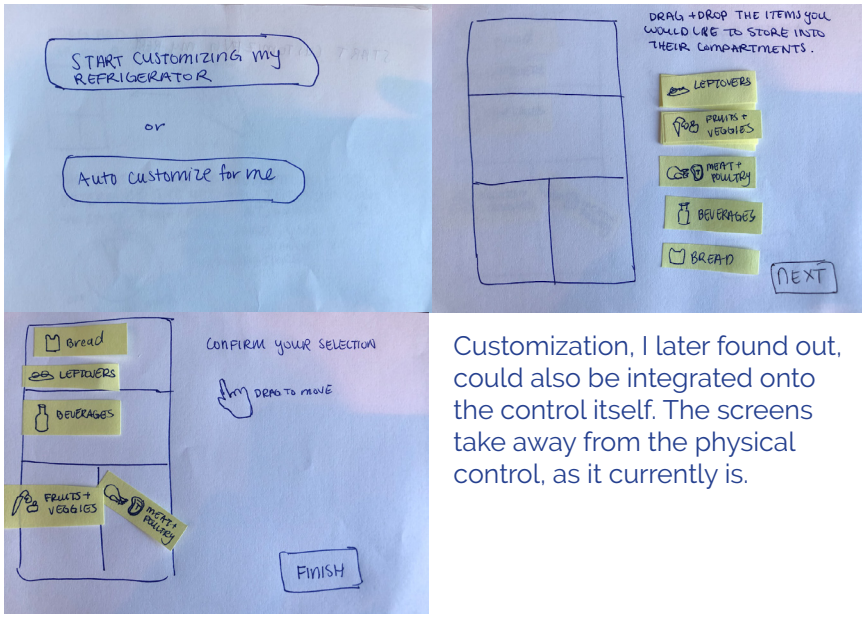


When beginning to prototype, my main goal was to

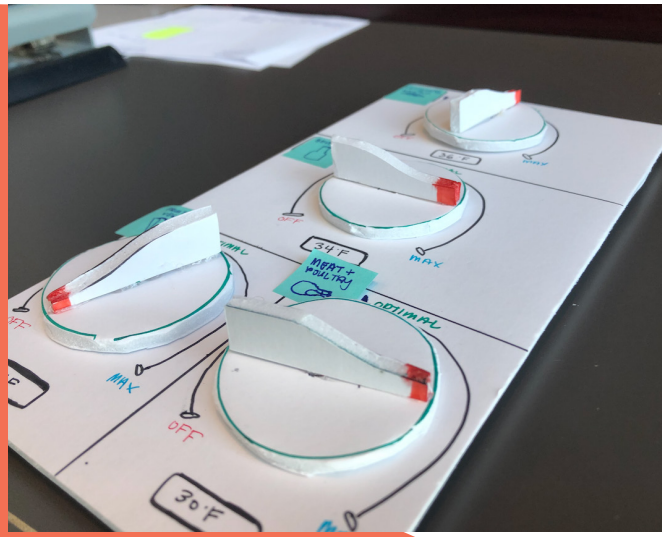
1. Create a control panel that would utilize physical mapping
2. Think about how to give the users more choice

For iteration 2, the user begins by going through a customization process. They are prompted by a screen. On that screen they can drag and drop the different food items they will store in that compartment. Next, those items will be reflected on the top left screen of the control panel. For example, on the top shelf the items stored are “Leftovers & Bread.” The control itself consists of a feedback screen displaying temperature as well as an improved dial that suggests interaction. The curved shape and height of the dial fits the grip of two fingers. The red tip of the dial provides feedforward about the type of output the user will receive when they turn it to a certain setting.

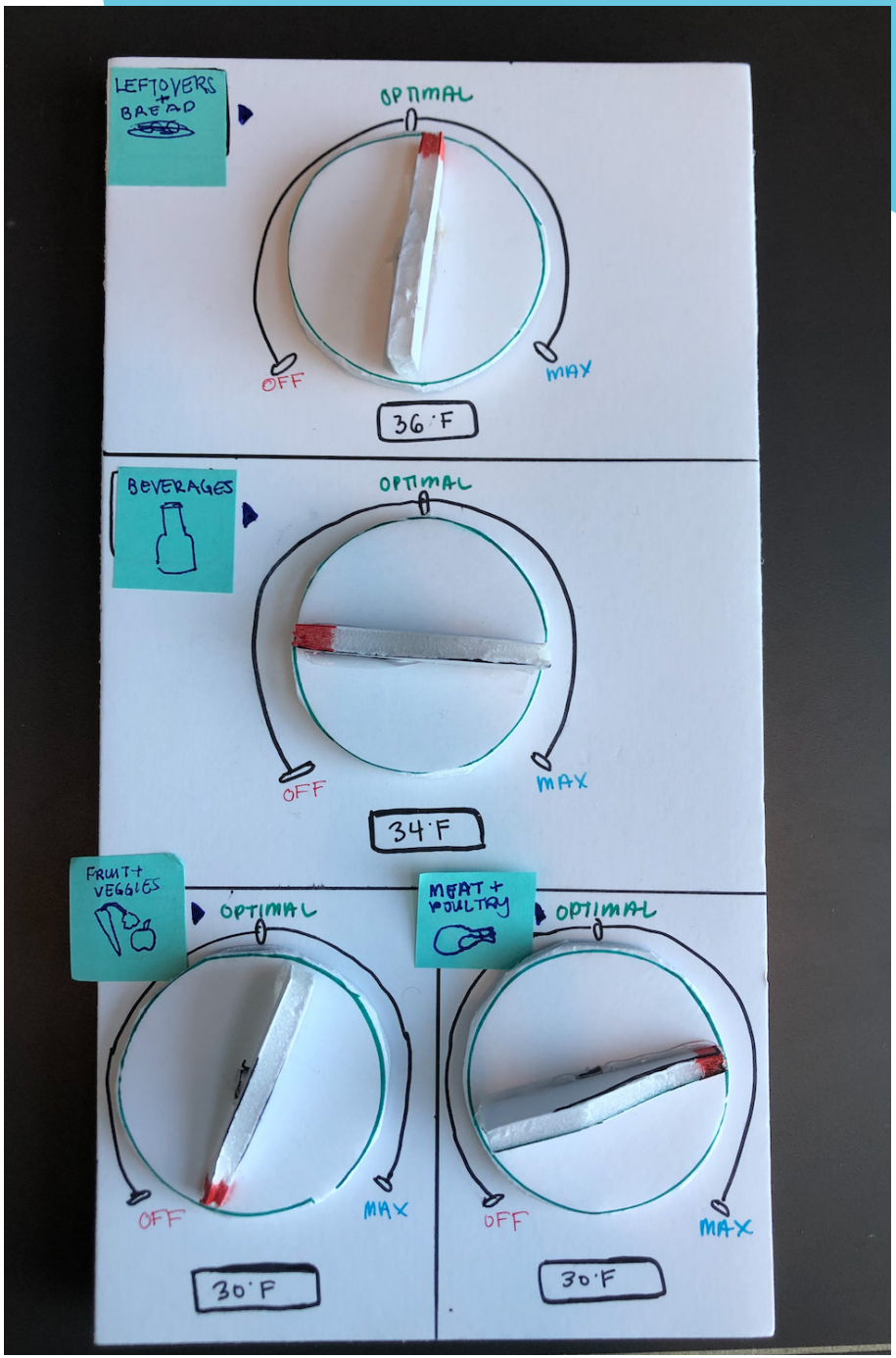
Despite these improvements, once I completed the model, **I realized that I wanted to remove the drag and drop screens and focus on the phsyical controls themselves.** I kept this in mind when creating my final iteration.



Customization, I later found out, could also be integrated onto the control itself. The screens take away from the physical control, as it currently is.



Perceptual affordance with the dial shape, feedback provided by the temperature screens, use of blue and red to mean cold and hot as a semantic carrier of meaning.



Feedback

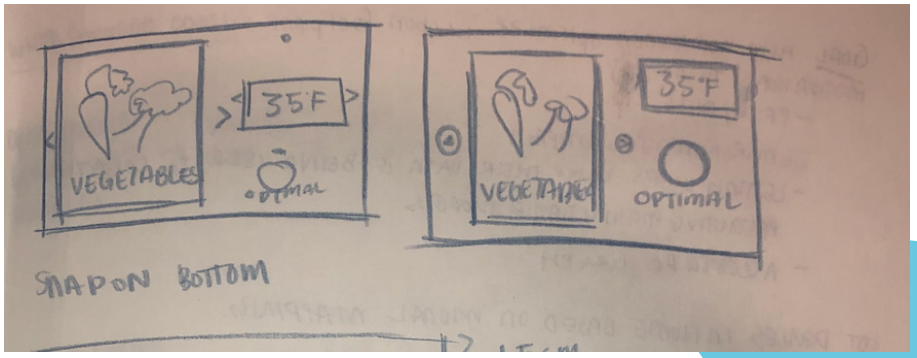
Most of the feedback I received from my second iteration was thinking about the environment of the control. For example, talking to a classmate who once worked at a restaurant, I learned a lot about how a kitchen functions. For example, cooks and prep chefs are constantly walking around the kitchen, opening and closing the refrigerator many times. Thus, I needed to recreate my control to incorporate smaller, flatter shapes so that when an employee bumps into the control, the temperature setting does not change.

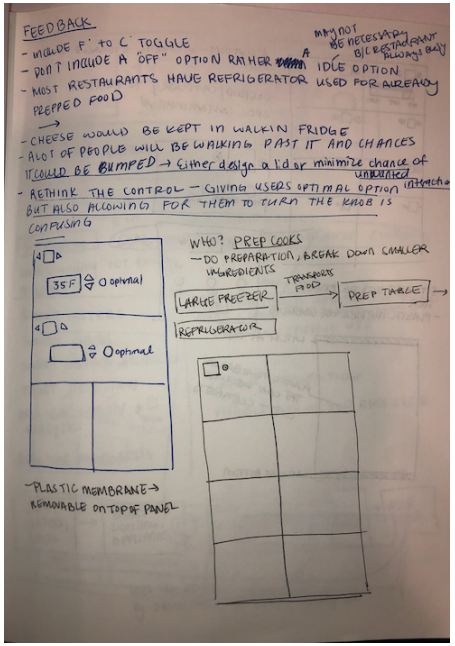
Iteration 3

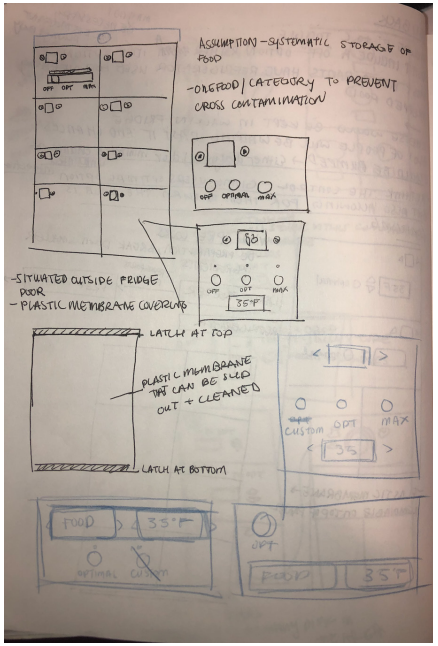
My main goals for iteration 3 included:

1. Designing with the environment in mind
2. Taking a step back from digital control and including all interactions on a physical control panel

Final Brainstorm







In my final brainstorming session, I played around with different types of controls: buttons, sliders, dials, to find out which control would be the best for a constantly moving restaurant setting. I ultimately decided on creating flat buttons. I also changed the sections on my model to be more representative of a commerical refrigerator. In my previous 2 iterations, the control panel had a top shelf, middle shelf and two drawers. However, a commerical fridge has 8 different sections for more storage options

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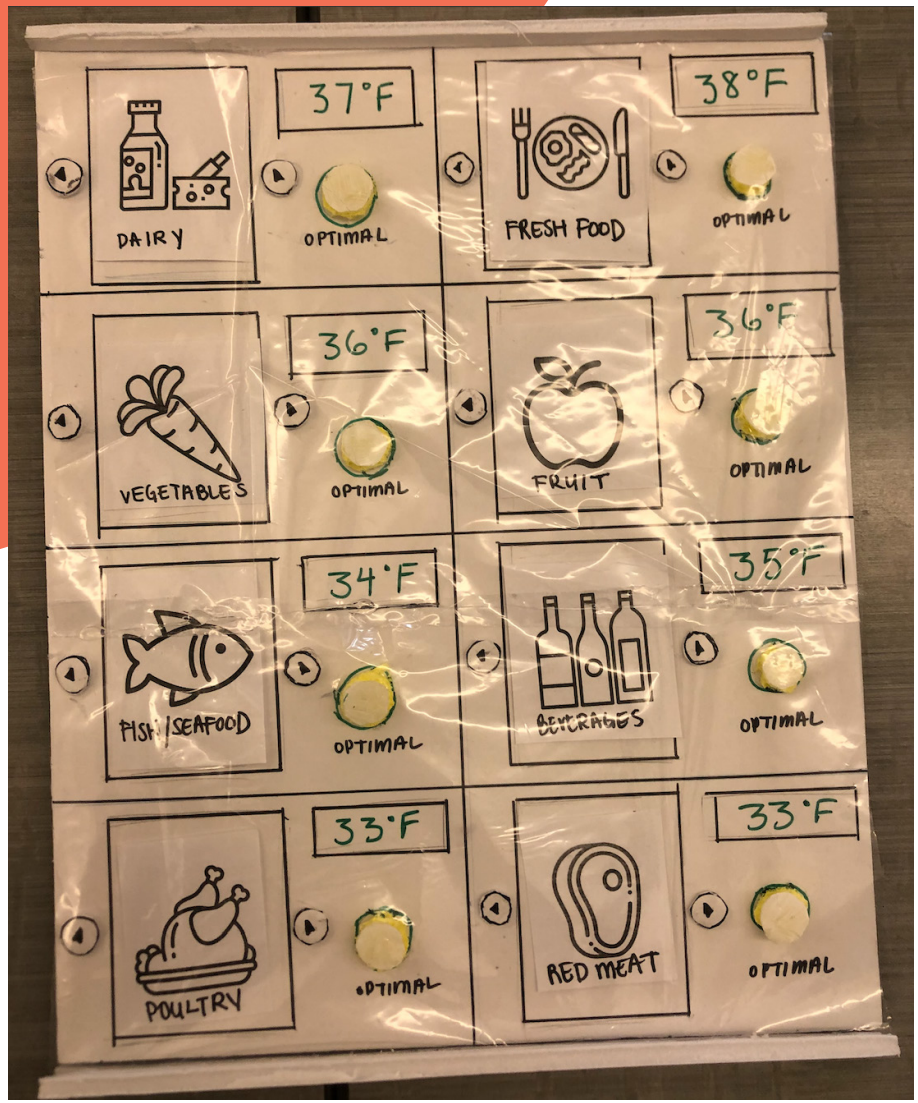
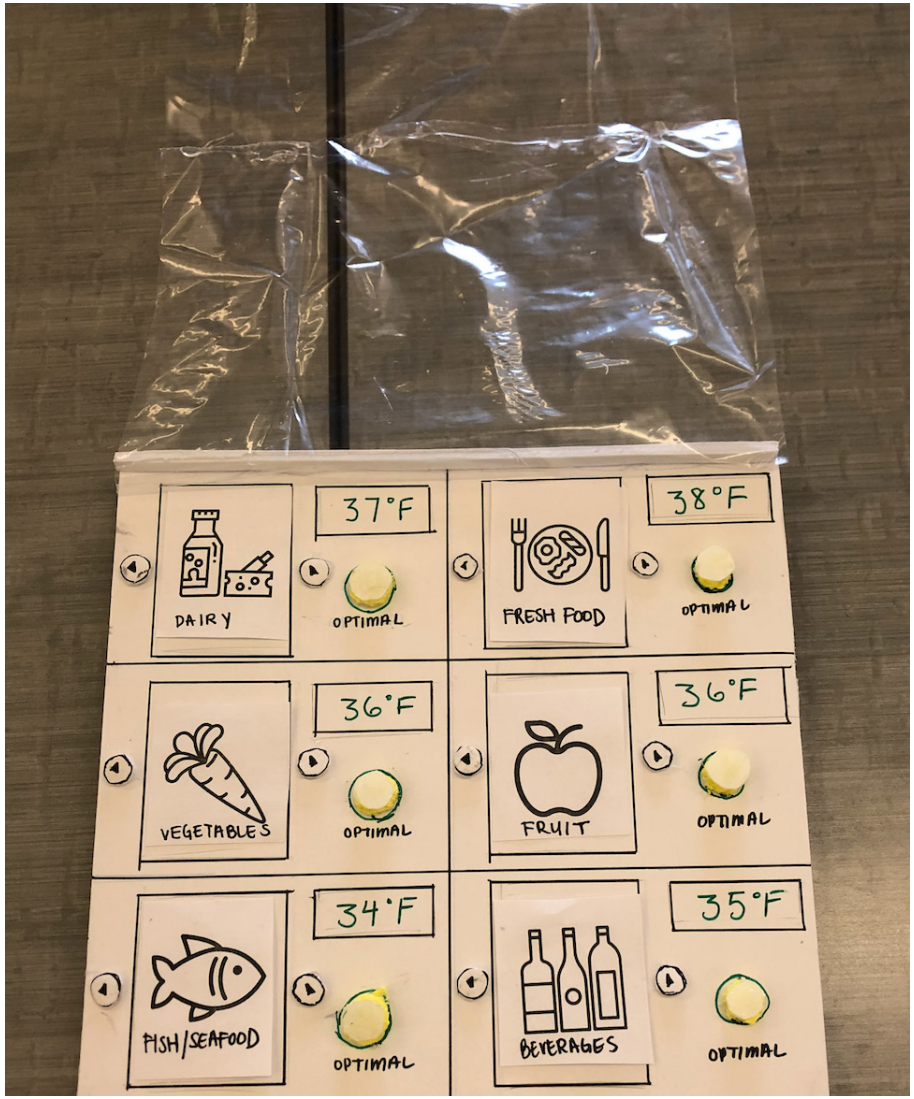
Final Iteration



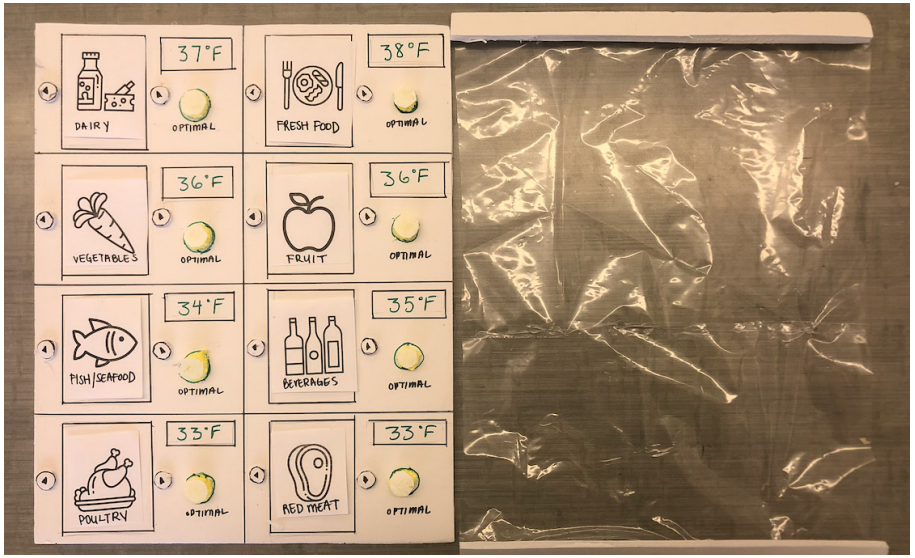
I decided to allow for user selection directly on the panel. Using the left and right arrow keys, the user is able to select the type of food they want to store in that specific section. Even though the users can only choose one food item to fit into each section, that design choice was intentional. Forcing users to only choose one item rather than a mix of items prevents cross contamination between different food groups. For restaurants, storing chicken and vegetables in the same compartment can a main driver behind customer satisfaction and health.



Keeping the environment of the control in mind, I decided to switch from dials to flatter controls like buttons. The intention was to create flat, concaved buttons in the rounded shape of a finger tip to suggest interaction. However, due to limitations of material, the best solution was to create a flat plastic covering on the top of sponges to simulate the interaction of pushing down on a button.

Another addition to the final iteration is the plastic membrane that is able to snap into place over the control. At a restaurant, prep chefs and workers are constantly touching and interacting with the control. From setting the optimal temperature to changing the food items, the surface of the control is going to get dirty on a daily basis. Introducing the plastic membrane that can be easily removed and washed eases the busy kitchen routine.

An additional change was entirely removing different temperature options. Feedback helped inform this choice. One person mentioned that she would never use the other temperature settings if “Optimal” is already presented to her. If I had more time to iterate this control, I would try to find a unique way to highlight “Optimal” as the most important button, but also allow the users to adjust the temperature. One final feature I removed was the “off” option. Realistically, it is infeasible to only turn off certain sections of the refrigerator, as each section’s temperature can affect the others.



Takeaways

This project really challenged me to think outside the box and create a control that hasn’t been explored before. Understanding design principles such as perceptual affordance, state, feedforward and feedback helped inform my design and reminded me to constantly guide the user without using any form of written communication. In the future, I would like to apply what I learned with physical controls when designing digital controls.