

# PET FOOD DISPENSER

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# Problem Definition: Semi-automatic cat feeder

## Primary Functionality:

- Mechanical but human operated
- Stores dry cat food (securely)
- Made of found / improvised materials
- Dispenses measured portions of cat food

## Secondary Functionality:

- Easy to clean
- Lever free; Push in bowl
- One hand to use
- Adjustable sizes (not really needed)
- Readable amount full

## Thoughts:

- Would be useful to have
- The product has dynamic mechanisms which is interesting to me
- The project has room enough secondary functionality to grow as needed

Research of existing solutions

# Continuous Gravity Feeder

## Functionality

- As food is removed from the bottom, gravity pulls down more

## Pros

- Cheap (7bucks) & simple (two parts)

## Cons

- Cats cannot self regulate food

## Takeaways

- The hopper design is effective but not portion controlled



# Automatic Feeder - Daily

## Functionality

- Can be programmed by phone for scheduled feedings

## Pros

- Control of when and how much food to dispense
- Secure hopper that food for multiple days

## Cons

- Expensive
- Requires electricity

## Takeaways

- Not within the scope of my project (materials) but does solve the problem well



# Cereal Dispenser

## Functionality

- Dispenses measured portions of “hard granular” food

## Pros

- Functionally exactly what I want

## Cons

- Mechanism may be difficult to replicate with improvised materials and limited tools

## Takeaways

- Spot on example of a solution, worth prototyping



# Water Bowl Design (Secondary)

## Functionality

- Floating dish limits accessible water

## Pros

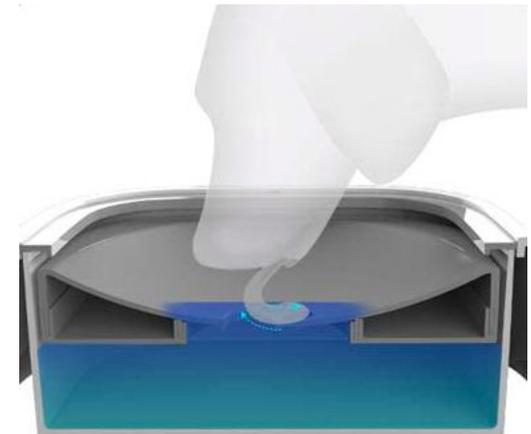
- Reduces spilling

## Cons

- Is it necessary or effective?

## Takeaways

- Not immediately relevant but I like the idea!



# Takeaway Summary

- Can't find the exact product I want on the market
  - Cereal dispenser was the closest thing I could find
- I like the minimal parts of the gravity feeder
- The high tech feeders are out of the scope for this project and not something I want in general
- The floating water bowl would be a nice second project
  - Good for 3D printing?

Designing

# Ideate and Design

## Primary Functionality

## Constraints

## Key Features

### Primary Functionality (what it does)

- #1 Mechanical but human operated
- #2 Stores dry cat food (securely)
- #3 Made of found/improvised materials
- #4 Dispenses measured portions of cat food

Notes

#1 will be addressed while solving #4  
#3 is more of a constraint

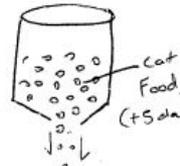
### Constraints

- \* Size: fits on a shelf
- \* Weight: must be able to support weight of cat food
- \* Units supported: at least 5 days of cat food
- \* Starting with Improv materials

### Key Features

#2 Hopper for Cat food

- \* holds cat food
- \* hole in bottom for food to come out
- \* refillable

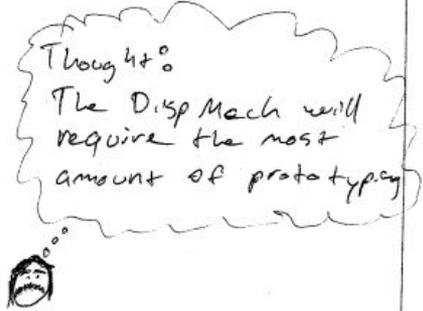
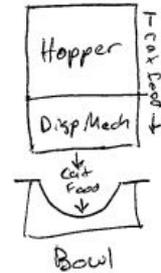


- Should be easy. Main concern is secure & refillable

### Key Features Continued

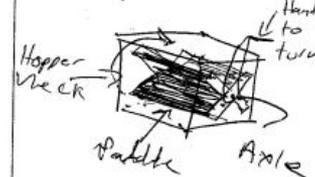
#4 Portion dispenser (Disp Mech)

- \* Measured units
- \* Keep cat food from pouring out
- \* Reliable

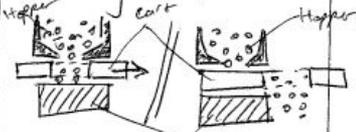


\* Rotating Dispenser

- ↳ like the cereal disp
- ↳ rotating the handle dispenses food



\* Sliding dispenser

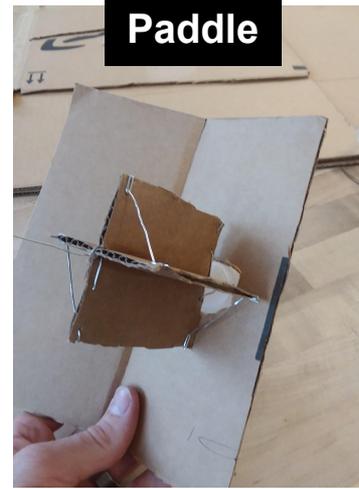


Cart fills from hopper  
↓  
base keeps food in cart  
↓  
cart slides off base  
↓  
food in cart leaves

# Prototyping

# Phase 1 Prototype Build

- I ended up using a bottle cap as an axel and it worked out really well. I learned that it is much easier to find a round object than to make one... now I'm hoarding round trash.
- I like how the folded handle turned out. It looks nice and is really strong because of the folded construction.
- I will not construct the base in the same way. The cardboard tabs were small and the paperclips didn't give enough support to the whole base.



# Phase 1 Prototype Test

## *What is the purpose of the prototype*

- To test the feasibility of the rotational dispenser approach

## *How did you test your prototype*

- User Testing:
  - I filled the prototype with cat food
  - Used a cup to measure amount dispensed
  - Using the handle to test ease of use

## *Results*

- As the video shows, the prototype was not able to dispense consistent portions of cat food. The lever was hard to rotate and the paddles got jammed up and leaked through the sides.



# Phase 1 Prototype Evaluation

## *What aspects of your design and/or build do you like?*

- My construction technique using folded cardboard and paper clips to bind pieces together
  - Ridged
  - Capable of being taken apart (opposed to using glue)

## *What aspects of your design and/or build do you not like?*

- The rotating dispenser seemed to have two main flaws:
  - It has to push food out of the way to rotate (difficult to rotate)
  - It requires tight tolerances to not leak

## *How are you going to improve your design?*

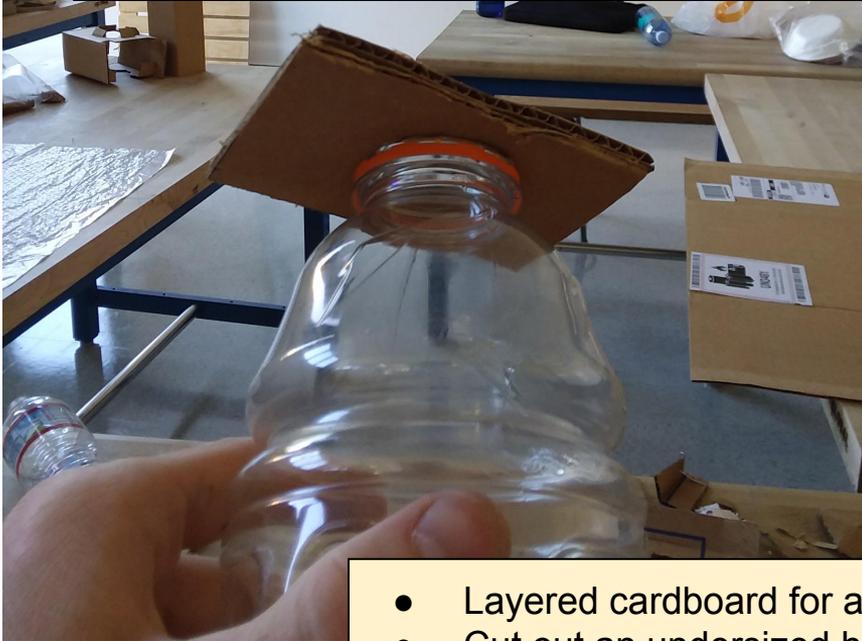
- If I made a second version of the rotating dispenser I would experiment with paddle sizes and geometry to reduce leaking and difficulty to rotate. A smaller paddle could be easier to rotate while adding more fins could reduce leaking. However, I think a sliding dispenser design avoids some of these critical issues.



Rough Draft

# Rough Draft Build - *Hopper*

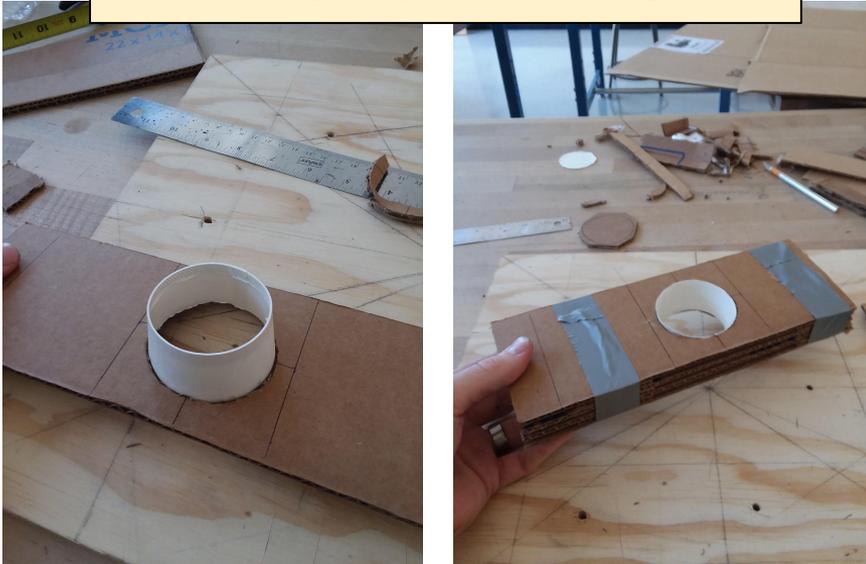
Used a gatorade bottle as a hopper and created a threaded connection out of cardboard



- Layered cardboard for added thickness
- Cut out an undersized hole based on the gatorade bottle
- Used the gatorade bottle to slightly open the hole in cardboard while threading the bottle into the cardboard

# Rough Draft Build - *Sliding Dispenser*

## Sliding Dispenser Carriage



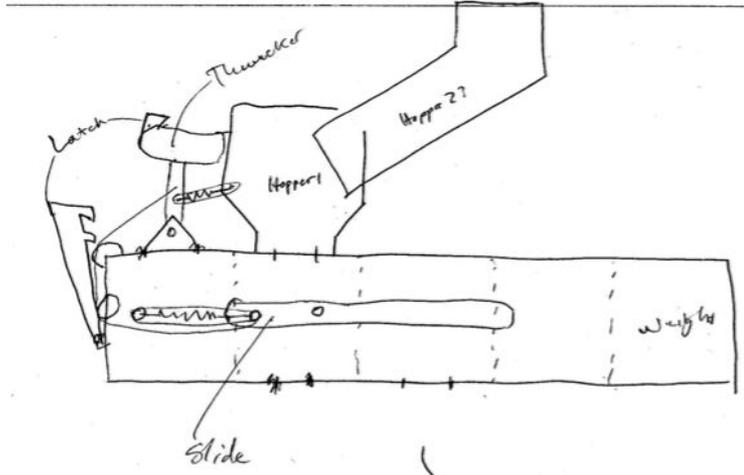
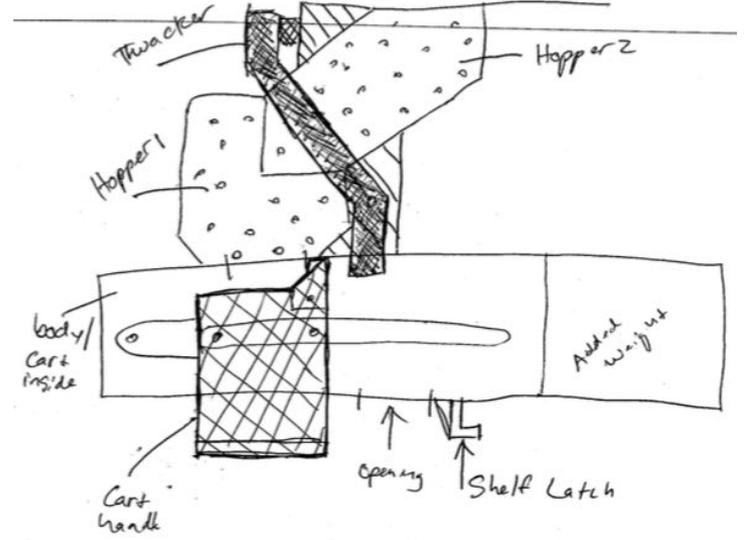
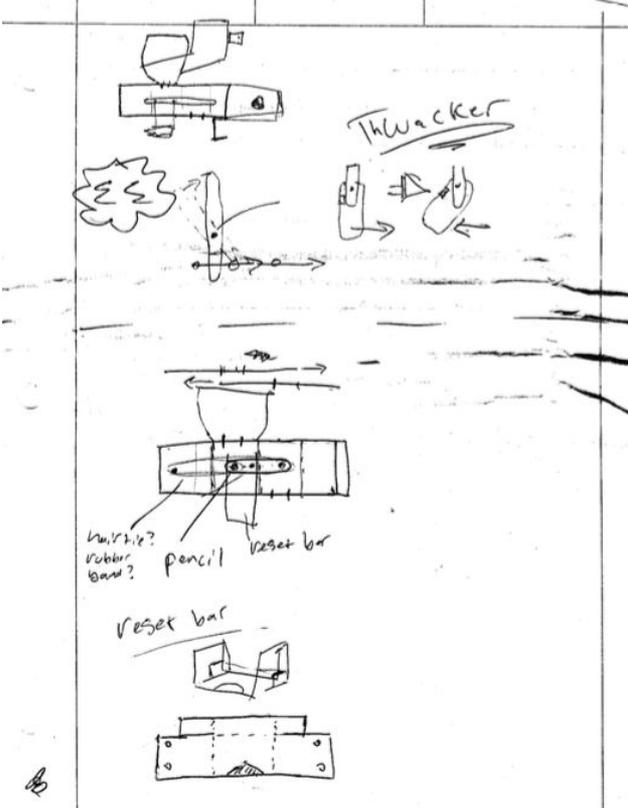
- Filled paper cup with one “portion” and cut to size
- Build the Carriage around the paper cup to allow it to slide back and forth

## Sliding Dispenser Base



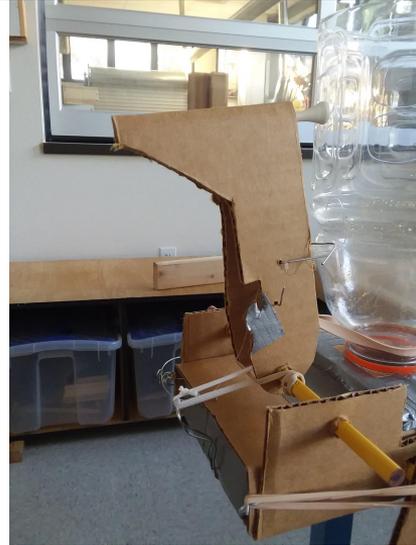
- The base sizing was measured off of the carriage
- Base was cut and scored with a ruler and exacto

# Design - Rough Draft + Hopper Thwacker



# Rough Draft Build - *Hopper Thwacker*

Thwacker is latched and released by the movement of the carriage



1. The arm has rubber bands that pull it towards the hopper
2. Sliding the carriage forward pulls the Thwacker arm back with fishing twine
3. When the carriage is released from it's forward position, rubber bands pull it back to its original position
4. Once the carriages original position, the latch is disengaged and the Thwacker arm is released

# Rough Draft Build

## *Something I learned was*

- Pencils are a useful and versatile improvisational material. They have great strength for their length and diameter. I used them as a rotating shaft and structural beams.

## *Something I like was*

- I really like how the sliding dispenser came out. It solved my primary functionality without the issues of leaking or being difficult to use that the rotating dispenser had.
- I also liked my threaded hopper connection. I'm surprised the hopper was able to be taken on and off without stripping the cardboard.

## *Something I will not do again*

- The Thwacker connection was very finicky because because of the limited length of the paperclip and the latch construction. The paperclip's length made it difficult for the hoop to both engage with the latch coming down and disengage when the carriage returned.

# Rough Draft Test

Sliding Dispenser User Test



Rough Draft User Test



# Rough Draft Test

## *The key features my Rough Draft addressed were*

- Secure and refillable hopper for cat food
- Reliable, consistent, and measured portion dispenser of cat food

## *To test my Rough Draft I did two different User Test*

- First I tested the Sliding Dispenser Mechanism. I filled the Hopper with cat food and slide the carriage back and forth to dispense the food.
- Once the Rough Draft was fully assembled I attached it to a board and clamped it to a table. Using a paper bowl I pushed Cart Handle back to dispense food.

## *Results*

- The sliding dispenser test went quite well. The sliding dispenser worked much better than the rotating dispenser. I did notice that if the hopper was not rossled, the food could get hung-up in the hopper. This is why I added the thwacker.
- Overall the rough draft worked. The carriage required a fair amount of force to return to it's initial position. This caused the Cart Handle and paper bowl to partially deform with use. Additionally, the bowl needed to be pulled away quick to get the Thwacker to disengage.

# Rough Draft Evaluation

## ***Aspects of my design that I like were:***

- I like the added Thwacker mechanism. It added a Rube-Goldberg-esc element to the design
- I like the new Dispensing mechanism. It was reliable and easy to use

## ***Aspects of my design and/or build I did not like:***

- The Thwacker was finicky and did not always engage and disengage
- The sliding cart has a noticeable amount of friction to move which requires more elastic bands to overcome
- The full Rough Draft needed to be hanging over an edge because of the geometry of the base

## ***For my final design I plan to improve:***

- Reduce the friction of the sliding Carriage
- Redesign the Thwacker to be more reliable
- Change the geometry so the whole product can sit on a shelf



Final Iteration

# Iteration 1 - Reduce the friction of the sliding Carriage

*I chose to focus on this area because*

- The carriage requires too much force to return; making it hard to operate

*My approach*

- Add a material with less friction onto the duct tape

*The results*

- Make first try was with aluminum foil but the foil easily tore and didn't slide great
- Next I used scotch tape and it worked really well; Easy to apply and low friction!



# Iteration 2 - Redesign the Thwacker to be more reliable

## *I chose to focus on this area because*

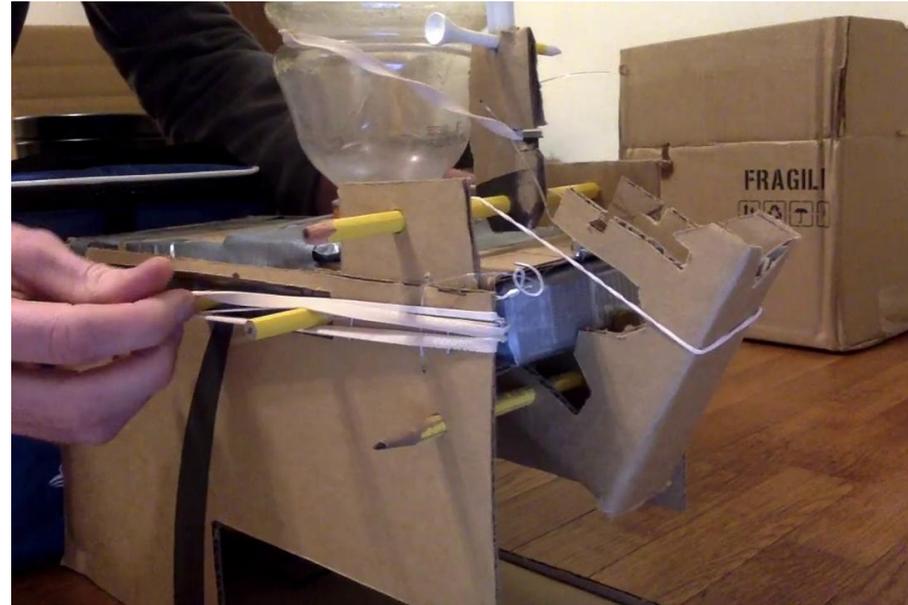
- The rough draft design didn't latch everytime
- I really like reliability

## *My approach*

- Hook mechanism was made out of folded cardboard
- Latch was changed from a paperclip to a golf tee; Increased diameter and rigidity helped the latch slide into place and push back the hook mechanism

## *The results*

- The Thwacker works every time!



# Iteration 3 - Change the geometry to sit on a shelf

*I chose to focus on this area because*

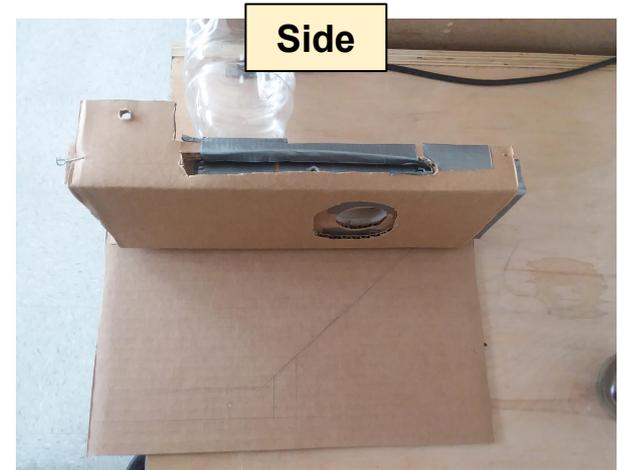
- Keeping this project clamped onto a table is not a realist way to use it

*My approach*

- Space up the dispenser and place a ramp under the opening
- Using two sheets of cardboard for walls and attach:
  - A ramp for the food to slide down
  - A base for the bowl to sit on and increase rigidity

*The results*

- The project can now sit on a shelf and is rigid
- Looks great too!



## Iteration 3 - How I determined ramp angle



# Project Functionalities

# Primary Functionalities

## ***Mechanical and human operated***

- Yes, to operate the device, just push back the lever and release!

## ***Stores dry cat food (securely)***

- Yes, the hopper securely screws onto the base

## ***Made of found / improvised materials***

- Yes, only used supplied materials plus objects found in the trash at home

## ***Dispenses measured portions of cat food***

- Yes, the device dispenses about a ¼ cup each time



# Secondary Functionalities

## ***Easy to clean***

- Yes, the Kibbletron 5000 can be disassembled and reassembled in under 5mins

## ***Lever free; Push in bowl***

- No, I prototyped a lever free system early on and it did not work well enough to keep it
- With more time this could be possible

## ***One hand to use***

- Yes, one hand to push the carriage back while the bowl sits on the base

## ***Readable amount full***

- Yes, the hooper is a clear gatorade bottle



Concluding Thought

# Project Reflection

## *Aspects of my project that I like*

- Thwacker mechanism is very Rube-Goldbergian
- Operates reliably
- Can be disassembled
- Actually works!

## *Aspects of my project that were difficult*

- The Thwacker mechanism took a long time to design and required multiple attempts to get right

## *What I would do differently next time*

- Incorporate a lever free design where the bowl is just pushed in
- Not let any duct tape be visible

