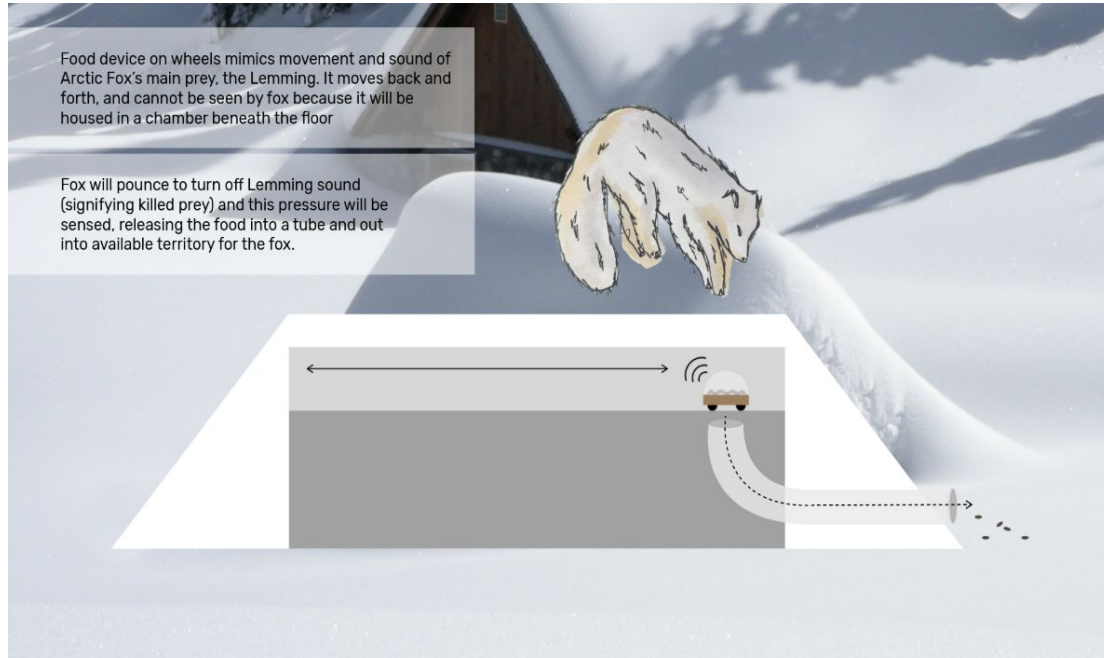




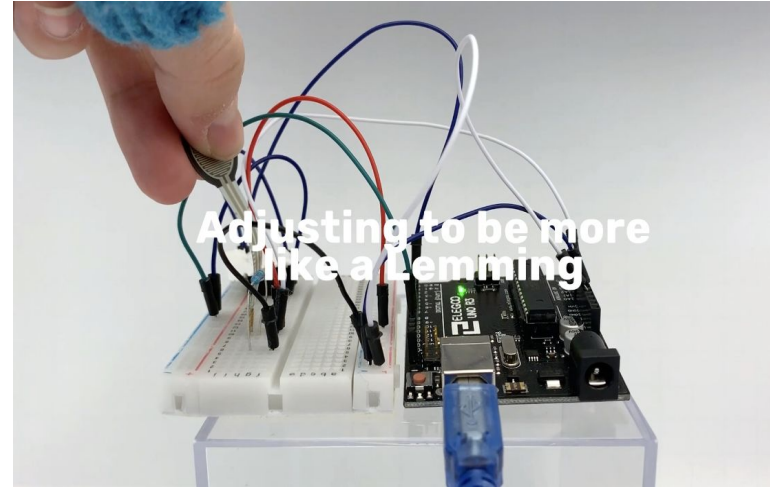
New England Cottontail (NEC)

Mariah & Tinsley | Design in Safaris

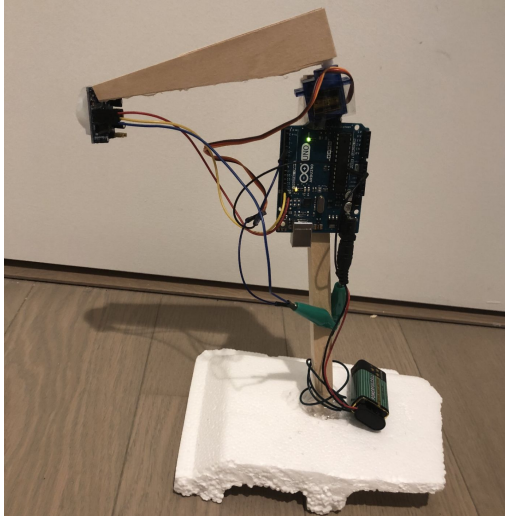
Mariah: Enrichment for Arctic Foxes



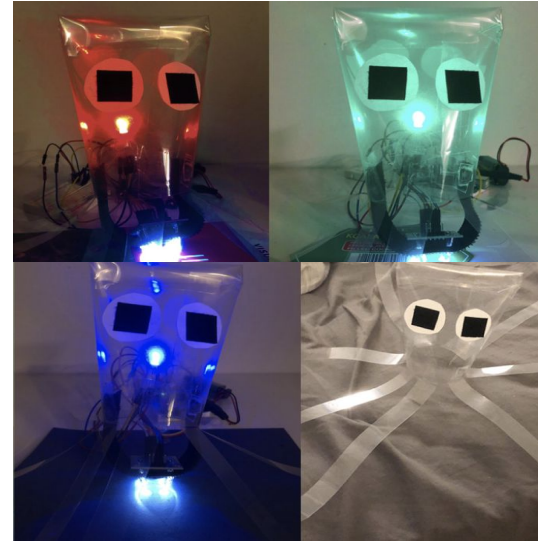
Mariah: Enrichment for Arctic Foxes



Tinsley: Previous work

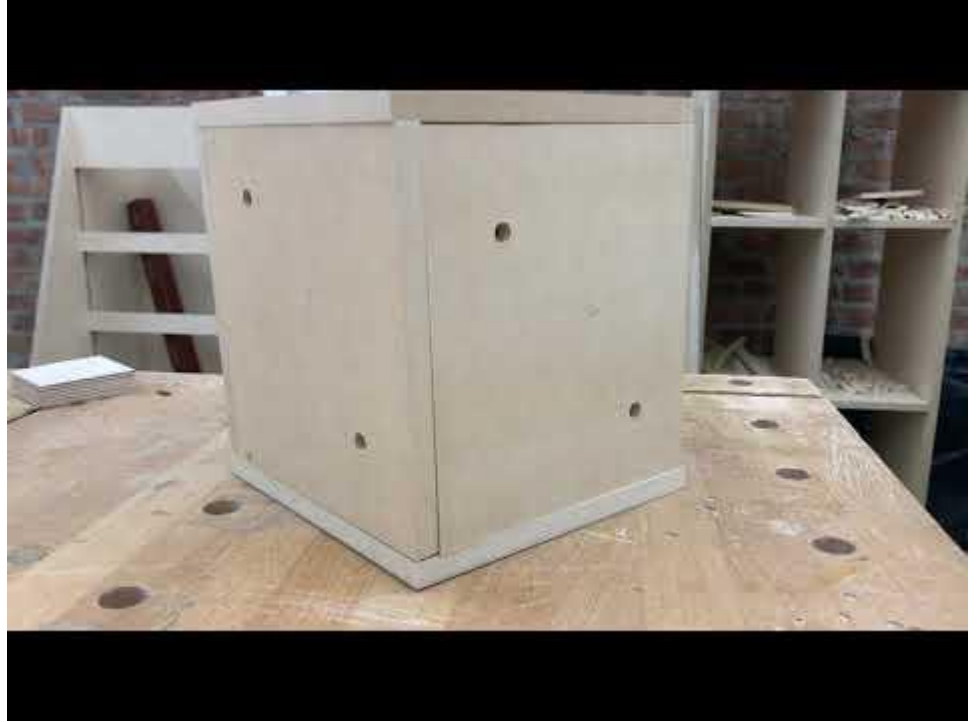


Polar Bear Enrichment



Octopuses Empathy Machine

Video



Background:

Captive Breeding Programs & Conservation

New England Cottontail Origins



The New England Cottontail was once abundant in the Northeastern United States. However, its population has dwindled since 1960 due to human development's impact on the Cottontail's environment along with infringement from the only other rabbit species seen in the region today, the Eastern Cottontail.

This new species was introduced by hunting organizations and is not native to the region, but due to its keener eyesight, it survives more **predator attacks** leaving the New England Cottontail more vulnerable. A serious **decrease in thicket habitat** has also led to this decline, giving less hiding places to the rabbit and forcing them to travel farther from their safe spaces in order to forage for food.



NEC: Captive Breeding Programs

Since 2010, there has been a grand effort by 6 states partnering to increase the New England Cottontail population through captive breeding programs primarily run out of:

Roger Williams Zoo (RI) + Queens Zoo (NY)
+ ME, NH, MA & CT

The rabbits were **listed on the endangered list** until 2015, when it was deemed that the 6-state effort to increase the population with captive breeding and release posed a positive outlook for the species. However, in 2017 in the Department of Inland Fisheries (Maine) release effort, most of the 18 NECs brought into the state died primarily **due to predation**.

Making Phase 1: **Predation**

1st Prototype (Anti-Predator Training Device)

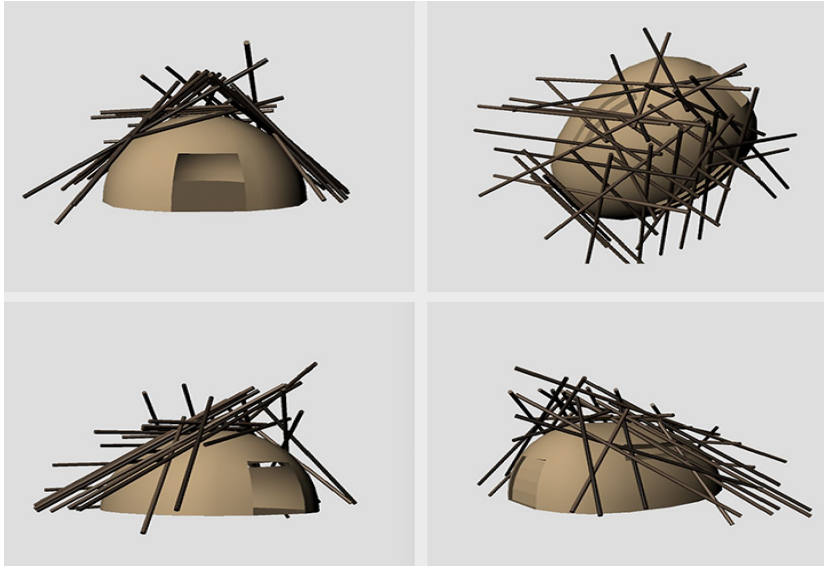


Our first prototype was an anti-predator training device that was designed to train the rabbits to dig when the device released the smell of predator.

Feedback:

- *The odor from predator is hard to be carried and released in a silo*
- *The device may stress the rabbit*

2nd Prototype (Hiding Device for the Wild)



Our 2nd prototype was an hiding device with a proximity-triggered door meant to be placed in the wild in areas farther from natural thickets.

Feedback:

- *Tech (door) may not be good if this is being placed in the wild (i.e. rain, cost, battery power)*
- *Think about cost if many need to be produced and placed in wild*

3rd Prototype (Hiding Device for the Wild)



Our 3rd prototype was an iteration on the hiding pen but with no tech and a plan for cost-effective materials.

Feedback:

- “Rabbits breed like they breed because they die like they die” - *Lou Perotti*
- Rabbits’ place in the ecosystem means they are meant to be prey
- They haven’t seen a big difference in survival rates of rabbits released directly into the wild vs. those transitioned in hardening pens.

Research Phase 2: **Pregnancy/Parenting**



Motive Transition: Poor 1st Pregnancy

Conversation with Lou Perrotti (breeding program manager, Roger Williams Zoo)

- Led us to **dismiss anti-predator motivation** as a necessary area to address

Shift → **1st pregnancy in female rabbits used for captive breeding goes wrong**

- In 1st pregnancy, mothers neglect or sometimes mutilate/consume their young
- This **doesn't happen in 2nd, 3rd pregnancies**
- Most babies die within first 3 days. After 4-5 days, they are usually OK.
- What is it about this 1st pregnancy that goes wrong?
- How can something be created to help test an improved parent-child experience which will in turn increase kit production and survivorship?



Research Transition: Stress in Rabbits

Conversation with Scott Silver (breeding program manager, Queens Zoo)

- 1st pregnancy **each year** goes wrong (around March-April), **temperature?** **Time of year?**
 - Not due to handling if it recurs multiple years
- Attempt to provide rabbits **larger spaces** during breeding (3ft x 8ft runs at Queens Zoo)
- **Nursing goes poorly**: Unclear if this is mother being triggered by her weak babies and therefore initiating negative behavior, or if mother initially neglects to nurse her babies which leads to their weakening and higher levels of stress for mother.



Two-pronged Research: Causes for Violent Parental Displays & Stress Reduction in Rabbits

Violent parental displays towards their young:

- **3 main causes:** 1. Stress/fear/disturbance, 2. malnutrition (lactational demands from young will intensify deficiency between mother), or 3. simply as a vice
- *Parental Injuries to Offspring: Infanticide (Study, Dr. Philip Evans)*

Commercially available music for rabbits shown to reduce stress (cortisol levels):

- When introduced to soundtrack for 6 months, fecal cortisol levels significantly decreased, suggesting a proven reduction of stress
- *Effects of Music Enrichment on Rabbits (Study, Debra L Hickman & Jessica L Peveler)*

Making Phase 2: **Music for Stress Relief**



Ideation

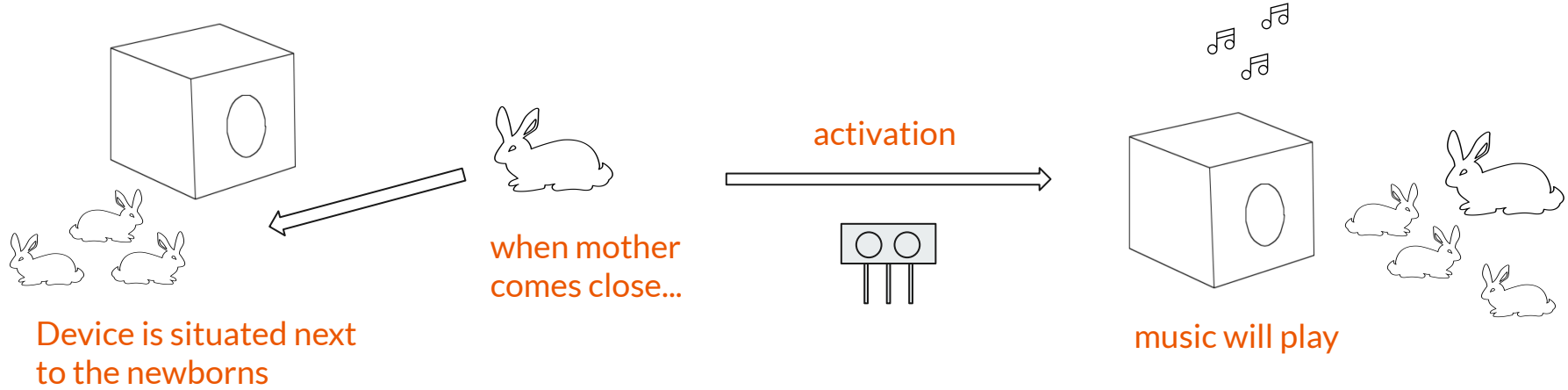
- **Use music to relieve stress** and agitation in mother (which could be caused by a number of things discussed earlier)
- Intervene at point in which **mother is close to her children** (proximity triggered)
- Create housing that will encompass audio player in a non-disruptive fashion

Device in the Zoo



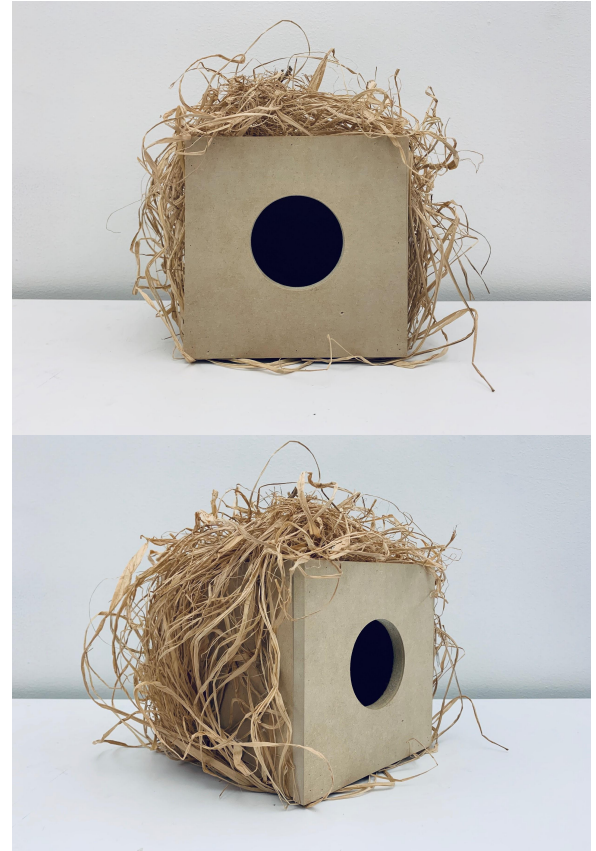
- Our device will be placed **beside the newborns** for the first 3 days after the mother gives birth (the greatest risk time).
- When the mother wanders near the newborns, the ultrasonic sensor inside the device will sense this presence and trigger soothing music to be played.

Interaction Flow



Form Factor

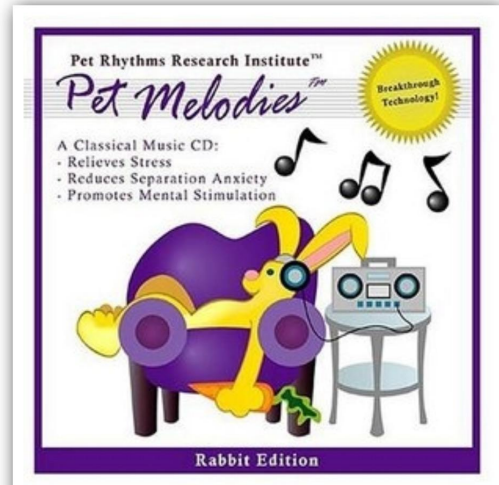
- Holes on each side for music to get through
- Wrapped with hay to better simulate natural habitat (to not add additional stress with foreign object)
- Used MDF wood to better mimic the color of thicket environment, also cost effective (\$4/2ft. square)



Music Playlist (Commercially

Pet Melodies: Rabbit Edition

by Pet Rhythms Research Institute



Tracks

1.	Track 1	4:29	⋮
2.	Track 2	10:36	⋮
3.	Track 3	5:19	⋮
4.	Track 4	6:31	⋮
5.	Track 5	5:51	⋮
6.	Track 6	9:01	⋮
7.	Track 7	5:25	⋮
8.	Track 8	2:25	⋮
9.	Track 9	5:19	⋮

Animal-centric Design

For the doe to be taking care of its newborns, it has to be in an **extremely comfortable and familiar environment**. It also need to have abundant supply of food and water. To make the mother rabbit stress free, we designed the device based on various researches pointing to a correlation with animals listening to music and reduced stress levels. With this animal-centric design we hope to reduce the rate of which a doe would cannibalize its babies.

Device should be **non-disruptive in appearance**



Feedback & **Next Steps**



Feedback from Zookeeper (Scott, Queens Zoo)

"Love the idea that you're looking for a novel way to approach the pregnancy issue"

- Him and Lou have been trying to solve the issue for 5 years
- He can't prove this wouldn't work, but can't prove it would work
- In order to advance to a testing stage, he feels the zoo should collect fecal samples from the first pregnancy to see if there's an increased stress level
- First pregnancy for the year is already taking place, so this would likely not be able to be tested until the following spring



Next Steps/Future Iteration

- Preload the music to the Arduino (not piezo buzzer, but commercial tracks)
- Zoo: Would need to collect fecal samples to test if the stress level is higher during the first pregnancy
- **Next week:** Visit Queens Zoo (Scott will show us breeding area)

Thank You!
Questions?