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## Design process NOTES

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- Design is also a process that is used to systematically solve problems.

- What makes a good problem statement

- Concise
- Leaves room for multiple solutions
  - Does not imply the solution
- Solvable in the given time frame and available resources
- Answers the following questions
  - Who has the problem
  - What exactly is the problem
  - Where does the problem exist
  - When has it happened and for how long
  - How prevalent is the problem (statistically)
  - Is the problem valid (who said there is a problem?)

Angela Davis (8/25/14)

Johnny KISS

Engineering Structure	BIO	Hardware	Setpoint 2 Software
<p>Vibration testing</p> <p>Different compartments for compost open every few days</p> <p>14 little compartments → open 2 each time</p> <p>Worm compartment</p> <p>Small packed living habitat</p>	<p>→ Bioscope</p> <p>Vibration testing → padding to insulate</p> <p>CUBES OF COMPOST</p> <p>moisture system to release water - mist system</p> <p>VOLUME testing (Worm: Compost)</p> <p>bulap</p> <p>Gforce use a binary Spinning System Pre launch -center force</p> <p>Servos to control water - servo rubeband system</p> <p>1 atmosphere pressure tank</p> <p>Sponge system</p> <p>light to move them out</p> <p>Tube system in all directions</p>	<p>Vibration testing</p>	<p>Build in fail safe code</p> <p><del>Different compartments for compost open every few days</del></p> <p>Incremental testing</p>
<p>Angela Davis 18/29/14</p> <p>Johnny King</p>			

# Bio Brainstorming

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## Bedding:

- peat moss
- coconut fiber
- wood chips
- Soil (to be used with other bedding)

## Compost:

- fruits
- vegies
- egg shells
- tea bags
- Rinds
- grains
- leaves
- organic materials

## Moisture:

- Sponges
- Sprinkler into sponge

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## (9/2/14 Journal Entry)

- Today we worked on creating a poster for the CASIS headquarters room. Along with brainstorming ideas for materials and everything we might use for our experiment.

Angela Davis

9/2/14  
anyew  
heo to di Lal

## Bedding

- hand threaded news paper
- peat moss
- Coconut fiber
- Wood chips
- Soil
- Card board - Composted
- leaves mold/decay
- ~~Animals~~ manure
- 

## Compost

- ~~Apple peels~~
- ~~baked beans~~
- banana peels
- ~~brussels~~
- ~~cabbage~~
- ~~cake~~
- ~~celery~~
- ~~corn~~
- ~~corn bread~~
- ~~cheese~~
- ~~cream cheese~~
- ~~cream of wheat~~
- cucumber
- ~~denied~~ eggs
- egg shells
- tea bag
- farina
- Grapefruit peels
- Grits
- Lemon
- ~~lettuce~~
- malto-meal
- molasses
- oatmeal
- ~~oyster~~ peel
- orange peel
- pancakes
- pineapple rind
- pizza crust
- potatoes
- ~~potato salad~~
- Ralston
- Tea leaves
- tomatoes
- turnip leaves

# Bedding Experiment:

5

Question: What is the best bedding to use for red wiggler worms?

Prediction: Peat moss will be the best because it holds moisture well.

Experiment Beddings:

Peat moss, coconut fiber, corrugated cardboard, and leaves

Length: 5 day long, check every week day @ 1:30pm for 5 days

Observations:

- moisture
- compost
- Worm health

Materials:

Worms (5 per container), temperature, bedding, water

*Amelia Brown*

9/2/14  
Amelia Brown  
Zach Oberst



# Experiment Results

	Peat moss	Coconut fiber	Corrugated cardboard	Leaves
Moisture	Day 1: Fairly moist Day 2: Very moist Day 3: Fairly moist - need a little moisture Day 9: Very moist		Day 1: Very moist Day 2: pretty moist Day 6: Moist Day 9: healthy & Active	1: Very moist 4: not very moist 6: moist not very dry 9: no mold
Compost Used	Day 1: Medium Day 2: Normal Day 6: Normal Day 9: very moist		1: Same as PM 2: Normal 6: normal	1: Same as PM 4: Much more was eaten 6: Some more was eaten 9: no mold
Worm Health	1: Good - very active Day 2: Good health Day 6: <del>Saw one</del> <del>wasn't moving</del> Very active		1: About the same as day before 2: Fat, Healthy 3: active	1: About same as day before 2: very healthy 6: Very active 9: Low order
Other comments	Day 1: To dry Day 2: Egg? No mold Day 6: Mold starting to grow 9: healthy		1: cardboard still very damp 2: No mold 3: pretty damp - no mold	1: worms are very active 2: MOLD! 3: Lots of MOLD

## 9/3/14 Journal entry

7

- Today we researched more on ratias and came up with compost/bedding lists. A problem we ran into was which bedding was the best so we designed an experiment that we will run on thursday / friday.

## 9/5/14 Journal entry

- Today we created filled out a design matrix to help us record our ideas and rank them. We also set up an experiment to test which compost setup would be the best for our final experiment. We will be running our experiment for 7 days and checking it every day at 1:30 pm.

## 9/9/14 Journal Entry

- Today we analyzed our design matrix, along with checking in on our experiments and filling out our tables. The results from our tests concluded a lot of mdd and in one of them a bunch of smell.

## 9/24/14 Journal Entry

Today We

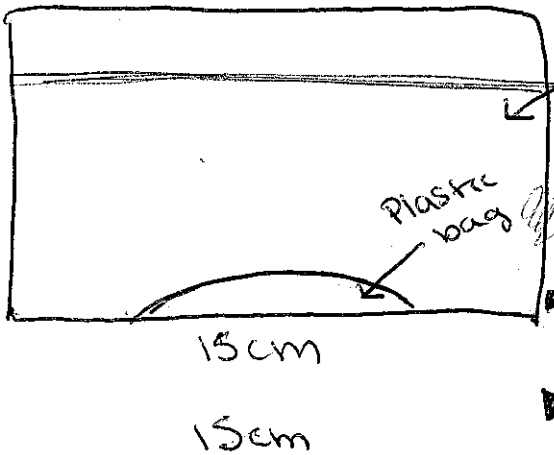
*Wrote the above*

9/3/14  
Journal entry  
11/1/14

# Brainstorming

## Compost Nest:

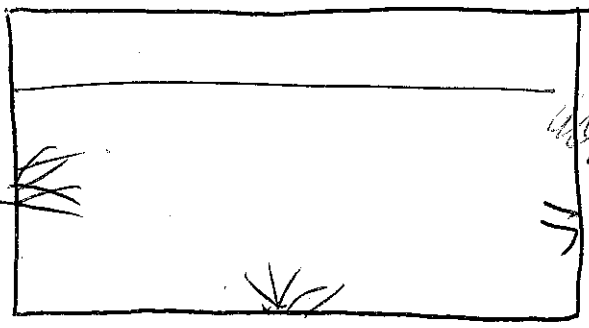
Soaked cardboard - easier to rip - moisture for worms



Compost & dirt

- Spray bottle if moisture goes below 75%

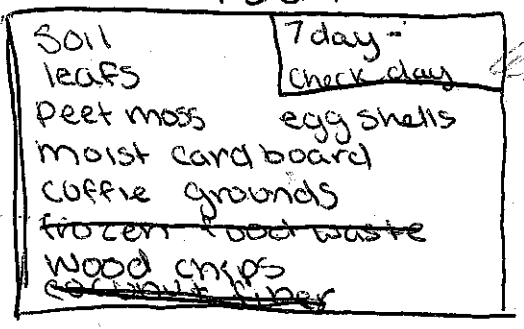
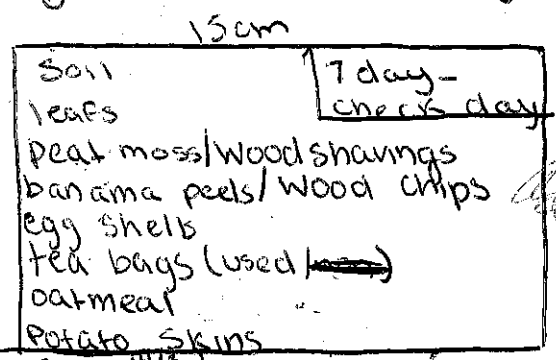
- Eat through cardboard instead of metal doors



engineering structure (arties team)

- mini IV bag  
- test within compost soil

- mini IV bag - clamp/servo
- two boxes (directional / experimental)
- pit in ground ... design idea for the box
- sponge on all four walls with direct water system into sponges



Amyle Davis 4/15  
2.5 hour

# Design Plan

10



## Ratios:

Soil to bedding - 2:1

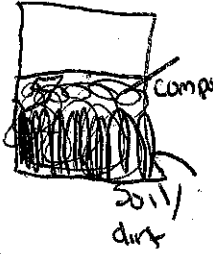
Soil/bedding to worms - 3:4

Worms to compost - 2x worms body weight

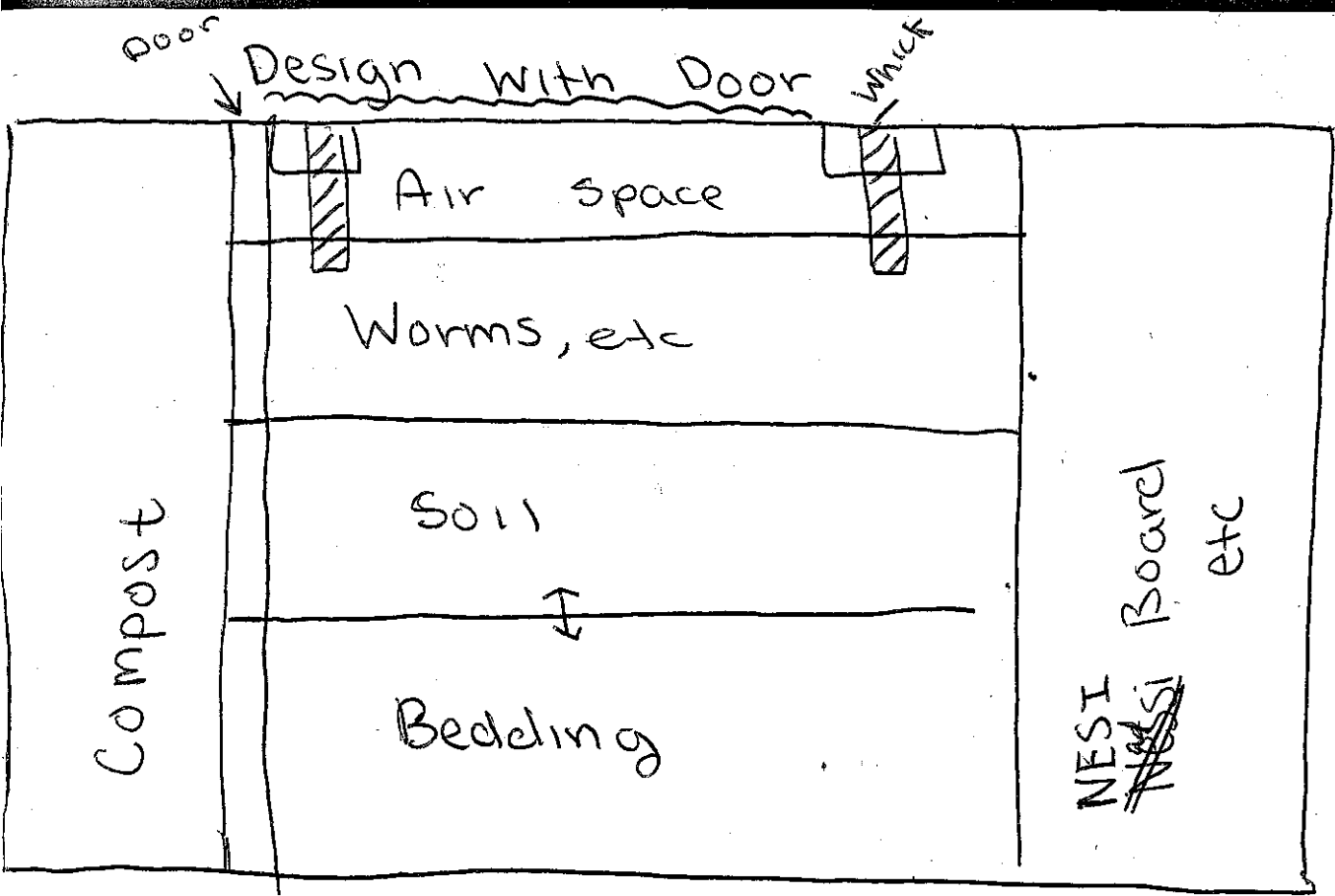
(consider compost) soil bedding to moisture - 3:2 - 3:1

*Design Plan*

# Experiment Results

	Moisture	Compost	Warm health	Other comments	Picture
Experimental	Dayish <sup>Day 4</sup>	like <sup>Day 4</sup> Cardboard	Good worm health	-Oat meal = Bad	
	Day 5 Dry	NO OATMEAL! Tons of mold	Good health moving <sup>Day 6</sup>	-Worms stay bottom of compost <sup>Day 4</sup>	
	Day 6 Dry	Lots and <sup>Day 6</sup>	Very active and in the corners	Low smell - Keep near bottom or sides for more room	
	Day 9 very dry	Lots of mold		Lots of <sup>Day 6</sup> mold	
		So much mold when you turn it upside down it stays like that <sup>Day 9</sup>		So much mold - Black & White	
Directional	moisture <sup>Day 4</sup> was pretty low and the dirt was dry I had to moisten the experiment	Some <sup>Day 4</sup> of the compost was gone but most of the compost was still there and on top	I've seen <sup>Day 4</sup> 5/6 worms in our beaker and they were all moving & believe they are doing well	I think <sup>Day 4</sup> there is a lot of compost in the beaker that the worms haven't ate so I don't know why	
	Dry <sup>Day 6</sup> <sup>Day 9</sup>	Some compost gone <sup>Day 6</sup>	Good health <sup>Day 6</sup>	No mold yet <sup>Day 6</sup>	
	Dry - very dry	No mold - not much gone <sup>Day 9</sup>	I've seen none of the worms <sup>Day 9</sup>	no mold - no odor not a lot of compost was gone <sup>Day 9</sup>	

Apple Juice 9/8  
2002



Top and bottom parts of door pull middle section in.

Whick: for moisture release, water around Wick

Geetali Lal



## -Experiment Results-

14

### Bedding Experiment Results:

1	2	3	4	5
Horrible	Worse	OK	better	Perfect

Peat Moss - 3 because worms where coverge and the moisture was simalar to control.

Corrugated Cardboard - 4 Held moister well - worms where active

Cownot fiber -

Leaves - 5 Worms where very active because of the mold - moisture was really good

---

### Compost Experiment Results:

Experimental: 5: This is because it had great moisture all the time along with the worms being really active - They thrived off the mold surprizingly well probably because of the organisms surviving off the worms.

ad

## Qualitative

15

- Observations that use your senses to observe results (sight, smell touch)
- Description of what is observed at least one sentence

## Quantitative

- Observations are made with instruments such as rulers, balances, graduated cylinders, beakers, thermometers these results are measurable
- mass - use a balance and measure in grams
- length - use a ruler and measure in cent.
- temperature - thermometer in  $^{\circ}\text{C}$
- composition - balance - grams, graduated cylinder - volume in ml

ad



## Experiment procedure

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frozen blended compost -

purpose - to create an experiment to test whether or not worms enjoy frozen blended compost better than spread out room temp compost.

Materials: frozen Blended compost  
(banana peel, apple peel, oatmeal, tea bag, leaves, bark, egg shells)  
water

Experiment:

1.) put frozen cube in container with soil and peat moss measured to scale.

2.) put 7 worms into experiment container

3.) check every day at approximately 1:30 pm  
measure worms and compare to see different

4.) end <sup>(length & weight)</sup> after a week <sup>(volume)</sup> and take notes of it all.

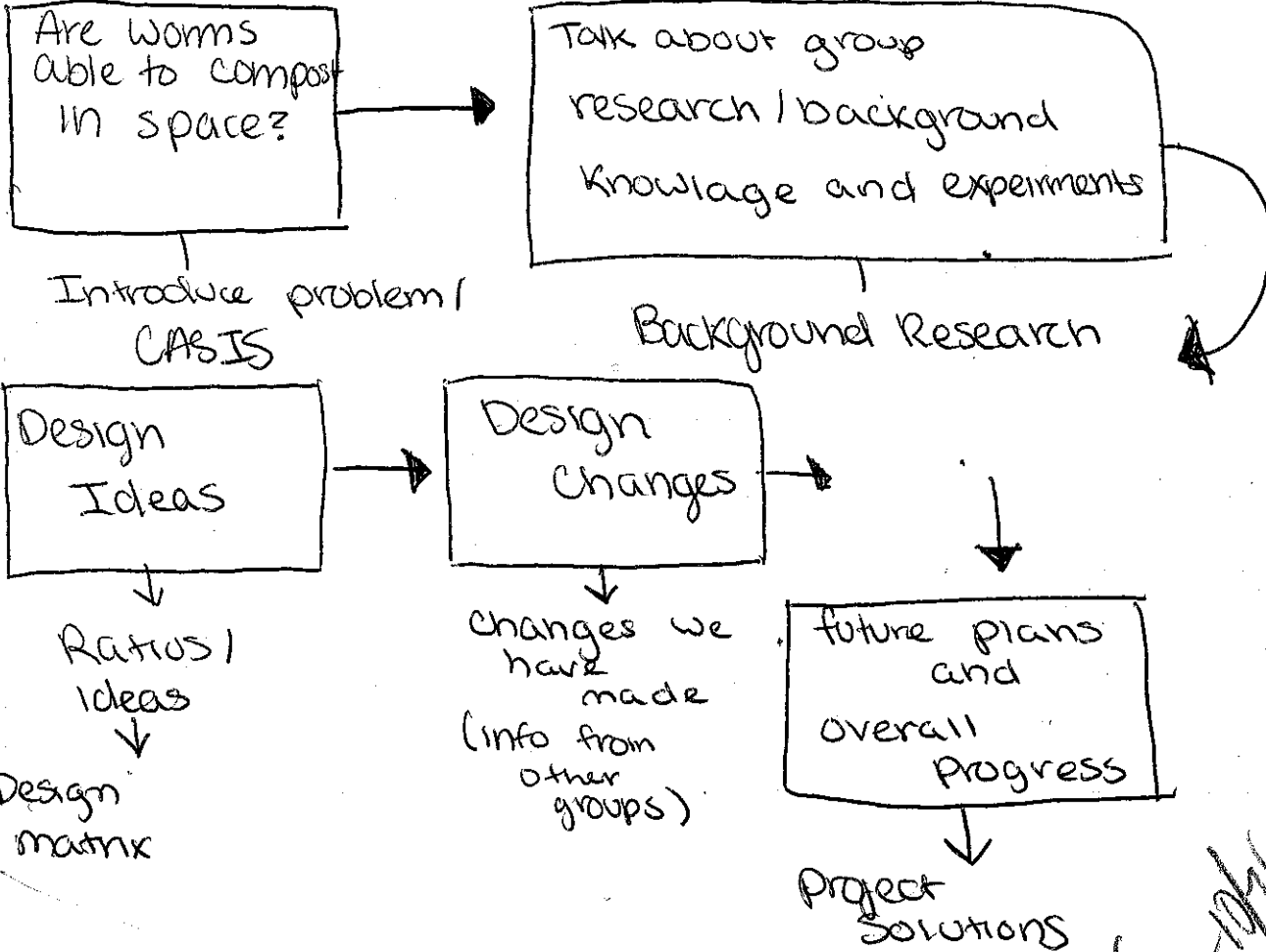
Complete

9/30

Amelia Davis

# Presentation Flow map (on imovie)

27



*Sanat 10/1/14*

# Experiment procedure

## Materials:

- leaves
- Compost
- Soil
- peat moss
- Coconut fiber

## Materials:

- leaves
- Compost
- Soil
- peat moss

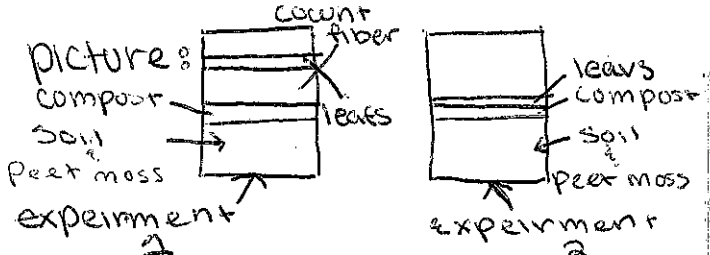
Based on our past data:

The leaves scored a 5 but the downside is that they mold a lot but the organisms growing off the leaves are nourishing the worms and help them. The

Compost is a must have based off our problem statement and our project. The soil is also a must have because we want something for the worms to thrive in.

We chose to have the peat moss because our results showed up really well when we mixed them together. Our coconut fiber we only had one test done so therefore we need to do one test with the coconut fiber and one without coconut fibers.

## procedure



The experiment will run over a course of 10 days in which we will check ~~every day~~ <sup>every other day</sup> and it will end next Friday (every other day).

Test results we need: final prototype compost and bedding we need to use in our prototype in November.

Which works better - yes coconut fiber or no coconut fiber

# final experiment

10/23/14

Starts	Experiment 1	Experiment 2
Moisture	[Faint handwritten notes]	[Faint handwritten notes]
Weight of Container	4399	<del>2679</del> 2679
Average Length	[Faint handwritten notes]	[Faint handwritten notes]
Weight	[Faint handwritten notes]	[Faint handwritten notes]
Temp.	[Faint handwritten notes]	[Faint handwritten notes]

Merge days  
318 2/25/14

Container 1

Worm 1: length: 83.21 mm  
weight: 0.1 g

Worm 2: length: 79.14 mm  
weight: 0.3 g

Worm 3: length: 27.78 mm ✓  
weight: 0.1 g

Worm 4: length: 44.27 mm ✓  
weight: 0.1 g

Worm 5: length: 37.91 mm ✓  
weight: ~~0.1~~ 0.01 g

Averages: length 50.462 mm

Average: 0.1 g weight

Container 2

Worm 1: length: 41.83 mm  
weight: 0.1 g

Worm 2: weight: 0.1 g  
length: 43.50 mm

Worm 3: length: 56.59 mm  
weight: 0.1 g

Worm 4: length: 58.66 mm ✓  
weight: 0.1 g

Worm 5: length: 60.17 mm ✓  
weight: 0.2 g

Average: 52.55 mm length

Average: 0.1 g weight

Container weights:

Container 1: 440 g

Container 2: 267 g

Final Experiment (~~day 2~~) 10/27/14 31

Steps	Experiment 1	Experiment 2
moisture	The moisture was also relatively good and showed that the worms were enjoying the bedding the worms were also healthy and some compost was gone - this is the second check where we haven't had to add more water!	The moisture was relatively good, we did not have to add any water - this is the second check in a row that we haven't had to put water into the experiment the worms seemed very moist and healthy.
Weight of container	428g - the compost has gone down - there is also some mold growing in our experiment but the worms seem to enjoy it and seem very very healthy	258g - some compost was gone making the container lighter making the worms heavier. I am happy with how the compost has been going down
Average length	98.21mm - Worm 1 93.53mm - Worm 2 57.31mm - Worm 3 64.75mm - Worm 4 32.23mm - Worm 5  Average length: 69.21mm	64.71mm - worm 1 48.04mm - worm 2 60.20mm - worm 3 94.80mm - worm 4 90.07mm - worm 5  Average length: 71.564mm
Average weight	<del>3.0g</del> 1.0g - Worm 1 2.0g - worm 2 3.5g - worm 3 4.2g - worm 4 8.0g - worm 5  Average weight: 0.254g	0.3g - worm 1 0.1g - worm 2 0.1g - worm 3 0.1g - worm 4 0.2g - worm 5  Average weight: 0.16g
Temp.	<del>Room</del> Room Temperature: the room is room temp Aetali Lal	Room temperature: the room is room temp

# Final Experiment

10/28/14

32

Stats

## Experiment 1

## Experiment 2

Moisture

The moisture was lightly damp today - a little less damp than yesterday, the worms are all still really moist and are healthy - the container needed to slightly be moisturated but not more than 1 spray with the spray bottle

The moisture in this container <sup>ad</sup> also ~~was~~ <sup>was</sup> really fairly good and was in need of a little water - just the same amount of water that container 1 did. The worms have good moisture and seemed healthy

Weight of container

424g - The weight in the container has gone down a little bit, some compost is gone and the worms are gradually growing both in length and in width

251g - The weight has also gone down a bit, the worms also seem healthy but not ~~as~~ as fat as container 1. There is still some compost but both are running low

Average length

Worm 1: 40.26mm  
Worm 2: 51.52mm  
Worm 3: 67.73mm  
Worm 4: 93.54mm  
Worms: 98.81mm

Average length  
70.27mm

Worm 1: 65.41mm  
Worm 2: 66.97mm  
Worm 3: ~~59~~ 31mm  
Worm 4: 91.84mm  
Worms: 94.62mm

Average length:

Average weight

0.3g - worms 1  
0.1g - worms 2  
0.42g - worms 3  
0.2g - worms 4  
0.1g - worms 5

Average weight:

Worm 1: 0.3g  
Worm 2: 0.2g  
Worm 3: 0.1g  
Worm 4: 0.1g  
Worms: 0.1g

Average weight:

Temp.

The temperature of the room was room temp.

The temperature was room temp.

Seetal Lal

# Final Experiment (08/29/14)

	Container 1	Container 2
moisture	The moisture was pretty good- we added 3 spritz of water- the worms are healthy	The moisture was good- we added 3 spritz of water- the worms are healthy
Weight of Container	416g	248g
Average Length	75.15mm - Worm 1 65.68mm - Worm 2 45.10mm - Worm 3 41.31mm - Worm 4 99.11mm - Worm 5  <b>Average length:</b> <b>75.87mm</b>	Worm 1 - 70.29mm Worm 2 - 50.10mm Worm 3 - 66.71mm Worm 4 - 38.01mm Worm 5 - 91.91mm  <b>Average length:</b> <b>75.404mm</b>
Average Weight	Worm 1 - 0.3g Worm 2 - 0.1g Worm 3 - 0.1g Worm 4 - 0.1g Worms - 0.1g  <b>Average Weight:</b> <b>0.14g</b>	0.3g - Worm 1 0.1g - worm 2 0.1g - worm 3 0.1g - worm 4 0.1g - worms  <b>Average Weight:</b> <b>0.14g</b>
temp	The temperature was room temp.	The temperature was room temperature

Satuli Lal



## Structure Biology test 1

35

Materials: Gloves, soil, Worms, leaves, newspaper, compost  
nano box

---

Step One: Place needed amount of soil on the bottom of 3D printed box in semi pyramid shape

Step two: place 3D printed door on top of soil

Step three: Place 5 worms through door into soil

Step four: Close door ~~at~~ <sup>done</sup> ~~at~~ <sup>at</sup> start of procedure

Step five: Add compost and bedding to above compartment

Step six: Add the protective door and screw into place

Step seven: put 3D printed box into nano lab

Step eight: time and check after 30 min.

Step nine: evaluate and come up with improvements and record problems

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- Structure Improvements

Problem

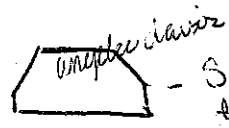
Solution

- ~ no reason to move
- ~ Door to small
- ~ Box to big For Nano
- ~ no holes for nano

- put an LED at the bottom
- ~ make 10% larger
- ~ Shrink sides and height by 5%
- ~ Add holes corresponding with 3D printed box



~ Not flat able to be pushed up



- Shrink tunnel push sides in - (closest to

~ Cant get good picture be blocked by contents such as bedding and compost

~ Soil and compost mixed together  
- may be okay

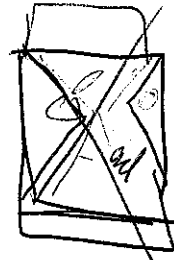
Angelle Davis

Angelle Davis  
~~Angelle Davis~~

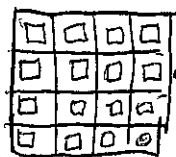
# Wings over the Rockies -

Safety constraints:

- Compost & smell
- Peat moss - ~~off~~ Gas
- Leds must be plastic (no glass)



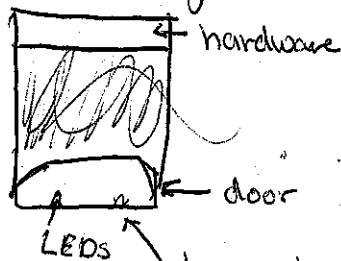
Structure designs:



A structure that would / will allow the worms to maneuver around while in zero G

Always having something to push off of

White LEDs to get worms out of door



LEDs have to be plastic covered or different (Silicone based) material (no glass!)

Tests needed retesting:

- Gortex with peat moss (mole smell?)
- Coconut Water (used ~~as~~ as a mold detector) test one compost with water one with coconut water

Control

Soil: ~~250~~ ml - 70g

$\frac{781}{-76}$   
9

Compost:

- 5g potato peel
- 1g leaves
- 9g banana
- 9g egg shell = 1 egg shell
- 7g oats
- 4g apple peels

---

104 grams

COCONUT WATER:

Soil: 250 ml - 70g

Compost:

- 5g potato peels
- 1g leaves
- 9g banana
- 9g egg shell = 1 egg shell
- 7g Oats
- 4g apple peels

---

104 grams

Angelle Davis

Angelle Davis  
 1/1/19

Compost - Coconut water

41

vs.  
Water  
procedure

Materials: Coconut water, gloves, soil, leaves, peat moss, wood shavings/wood chips, banana peels, egg shells, (tea bags (used)), oatmeal, potato skins, apple peels

Question: If we use coconut water instead of water in one of the containers of compost will it limit the amount of ~~total~~ mold created when we just use water?

Prediction: Coconut water will limit the amount of mold being created and growing in the compost.

Length of experiment: We will run the experiment for 6 days - starting on Monday (11-17-14)

*Amelia class*

Amelia class

Amelia

COCONUT Water

Observations	Weight of Worms	Results length mm	Weight of compost	mold
<p>COCONUT WATER</p> <p>What I noticed was that the soil was moist but the worms were not. I think the problem is the same as with humans you have to have at least some water</p>	<p>Day 1:</p> <p>Worm 1 - 1g</p> <p>Worm 2 - 1g</p> <p>Worm 3 - 1g</p> <p>Worm 4 - 1g</p> <p>Worm 5 - 1g</p> <p>Worm 6 - 1g</p> <p>Worm 7 - 1g</p>	<p>Day 1:</p> <p>Worm 1: 34.51mm</p> <p>Worm 2: 51.67mm</p> <p>Worm 3: 38.38mm</p> <p>Worm 4: 31.86mm</p> <p>Worm 5: 44.91mm</p> <p>Worm 6: 37.55mm</p> <p>Worm 7: 43.81mm</p>	<p>134g</p> <p>The compost weighed 134g we put all of our material in our compost. I feel like the compost weighed more in this container because of the coconut water.</p> <p>ad</p>	<p>SO FAR I <del>has</del> NO mold has appeared. The container was moist - a little more moist than the water container.</p>
<p>CONTROL</p> <p>What I noticed was that the worms were moist but the soil was just a little bit over dry. <del>It was better</del> The worms in this container the worms were very slow but VERY fat.</p>	<p>Day 1:</p> <p>Worm 1 - 2g</p> <p>Worm 2 - 2g</p> <p>Worm 3 - 1g</p> <p>Worm 4 - 2g</p> <p>Worm 5 - 2g</p> <p>Worm 6 - 2g</p> <p>Worm 7 - 1g</p>	<p>Day 1:</p> <p>Worm 1 - 47.92mm</p> <p>Worm 2 - 69.99mm</p> <p>Worm 3 - 57.75mm</p> <p>Worm 4 - 42.23mm</p> <p>Worm 5 - 58.39mm</p> <p>Worm 6 - 67.72mm</p> <p>Worm 7 - 54.82mm</p>	<p>133g</p> <p>on day 1 the compost weighed 133g we put all of our material in the compost. I think this container with the water is lighter because the coconut water is weighing it down</p> <p>end</p>	<p>SO far no mold has accumulated and the moisture is low. I think this is a common problem with the water - The lack of moisture</p>

Complex class

*[Handwritten signature]*

## Coconut Water Results

Observations	Weight of Worm	Length of Worm	Weight of Compost	Mold
<p>Coconut Water</p> <p>The worms were all clumped together but they were active and fairly moist - the soil was definitely a little bit more moist than the control</p> <p style="text-align: right;"><i>ad</i></p>	<p>Day 2:</p> <p>Worm 1 - 1g</p> <p>Worm 2 - 1g</p> <p>Worm 3 - 1g</p> <p>Worm 4 - 1g</p> <p>Worm 5 - 1g</p> <p>Worm 6 - 1g</p> <p>Worm 7 - 1g</p>	<p>Day 2:</p> <p>Worm 1 - 51.78mm</p> <p>Worm 2 - 34.61mm</p> <p>Worm 3 - 38.72mm</p> <p>Worm 4 - 45.01mm</p> <p>Worm 5 - 32.00mm</p> <p>Worm 6 - 43.89mm</p> <p>Worm 7 - 37.56mm</p>	<p>132 -</p> <p>The compost lost 2g of compost since we first measured it, does look like the container lost a little bit of compost</p> <p style="text-align: right;"><i>ad</i></p>	<p>I was observing the container and there has been a little bit of mold growth but not a major amount (white)</p> <p style="text-align: right;"><i>ad</i></p>
<p>Control</p> <p>The worms are healthy and moist and for the most part active. The soil was a little dry but not much drier than the coconut water. There is a little mold accumulating.</p>	<p>Day 2:</p> <p>Worm 1 - 1g</p> <p>Worm 2 - 2g</p> <p>Worm 3 - 2g</p> <p>Worm 4 - 2g</p> <p>Worm 5 - 2g</p> <p>Worm 6 - 1g</p> <p>Worm 7 - 2g</p>	<p>Day 2:</p> <p>Worm 1 - 70.81mm</p> <p>Worm 2 - 57.85mm</p> <p>Worm 3 - 47.98mm</p> <p>Worm 4 - 59.01mm</p> <p>Worm 5 - 42.26mm</p> <p>Worm 6 - 55.10mm</p> <p>Worm 7 - 67.92mm</p>	<p>130 -</p> <p>The compost lost 3g of compost since I last checked it looks like some compost has been eliminated</p> <p style="text-align: right;"><i>ad</i></p>	<p>While I was observing the worms I noticed a thin outer layer shield of mold starting to develop, more mold is in this container than the coconut water</p>

Angie class

miles

MIKE: - micro-biologist -  
flown Agar with bacteria

Agar - Good & moisture

- play with %
- cold slow to cold not enough agar - less stability
- may be fine without holes
- soft agar - (gel) if needing burrowing

mold (compost) - coconut water - Good electrolytes  
(figure out)

- Spices that can prevent ~~the~~ mold
- reduce microbacteria - add bacteria later
- heat compost
- alter compost (maybe in a cocoy)
- identify type of mold
- ink free paper - News
- may be worms we are creating it
- sterilize compost - least nature touched
- heat things up

mold prep:

- Present to CASIS what we are using

- soft Agar
- do worms even like coconut water

### Ph level of Coconut Water

Other: Agar vs Soil - w/ or w/out coconut water

Good job testing

less complicated - better ←  
- worms out of our hands



COCONUT WATER

COCONUT Water Results

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Observations	Weight of Worm	length of Worm	Weight of Compost	Mold
<p>What I saw was that so much mold has accumulated and the worms have grown a little bit, I'm surprised because instead of eliminating the mold it only made it worse.</p>	<p>Day 3- Worm1- 2g Worm2- 1g Worm3- 1g Worm4- 1g Worm5- 1g Worm6- 1g Worm7- 1g</p>	<p>Day 3- Worm1- 34.65mm Worm2- 38.81mm Worm3- 51.79mm Worm4- 45.05mm Worm5- 43.95mm Worm6- 37.59 Worm7- 32.05mm</p>	<p>128g- The compost in the container with the coconut water weighed 128g and some compost had been eaten but judged by the weight I don't think much has.</p>	<p><del>no more mold has accumulated in the</del> Much more mold has accumulated in this container. The whole outer layer has mold.</p>

CONTROL

<p>What I saw was the mold had not gotten worse since yesterday. I also noticed that the worms were very active. There seems to be more mold than usual.</p>	<p>Day 3- Worm1- 1g Worm2- 2g Worm3- 2g Worm4- 2g Worm5- 2g Worm6- 2g Worm7- 2g</p>	<p>Day 3- Worm1- 57.91mm Worm2- 48.00mm Worm3- 70.85mm Worm4- 42.26mm Worm5- 55.15mm Worm6- 67.94mm Worm7- 59.07mm</p>	<p><del>114g-</del> The compost that we weighed for the last time today weighed a total of 114g and some more compost has been eaten.</p>	<p>No more mold has accumulated in the control container since yesterday. The worms seem to enjoy the little amounts of mold in the container.</p>
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Control class  
M... ..

# PLA + Worms experiment

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Materials: PLA BOX that holds about 3 worms, soil, compost (experimental), gloves

procedure:

Step one: print small 3-D printed box or use box we are sending up.

Step two: fill the container being used with 250ml of soil or 70g of ~~soil~~

Step three: fill the container of 250ml of soil with 104g of compost

- 5g potato peels
- 1g leaves
- 9g banana peels
- 9g egg shell = 1 egg
- 7g oats
- 4g apple peels

total = 104g

Weigh all worms together and take the average of ~~50~~ worms ~~weighed~~ and measure each worm

Step four: add 17 worms to the container

Step five: DO this exact procedure in the control container

Step six: moisten each container until completely moist ~~then~~

Step seven: check up on and update each day or every other day

- master until moist - check each day

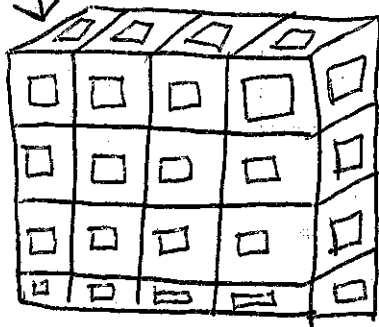
Angelle Davis

Angelle Davis 12/12  
Miles

# Structure experiment:

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Design:



(Sketch up file)

Purpose:

The purpose of this experiment is to give the worms to always have something to push off of or to touch



Worms in large groups enjoy tangling together and wrapping themselves around things

Therefore the purpose of this experiment is to test if the worms would rather have a playground structure or just be "floating" around when in microgravity.

final question - How will be able to test how well the structure would work on earth?

Solution: get access to a drop tower in which we can test the worms reaction to zero gravity and how the structure would work.

PLA Container

**Worms health**

On day 1 we chose to put in 17 small worms we chose this because in the coconut water test we used large worms. The worms that we chose were in good health and were very active.

**Total Weight**

Total Weight: 7g  
Average: 0.411g

The worms were all relatively small

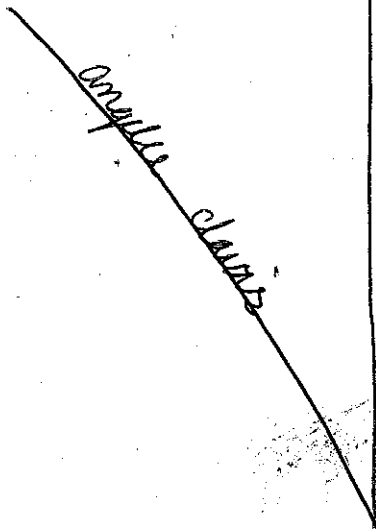
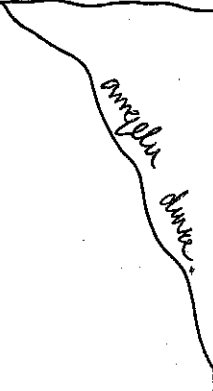
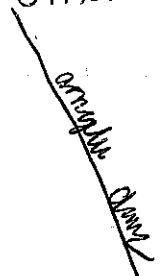
**Total Length**

Average Length: 26.38mm

The worms were small

**Additional information**

Note - pla container. The water did leak out of the sides of the container.



Control Container

In the control container on day one we also chose to use 17 small worms for the same reason. The worms were all also in very good conditions and were very healthy.

**Total Weight**

Total Weight: 6g  
Average: 0.35g

most of the worms were small

**Average Length**

Average Length: 52.23mm

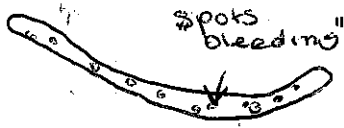
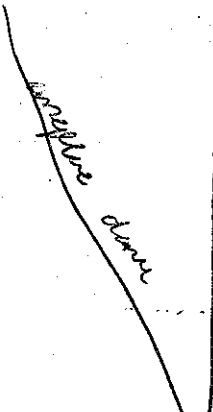
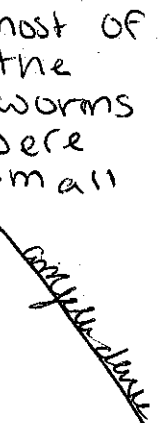
The worms were all small

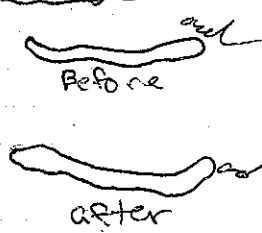
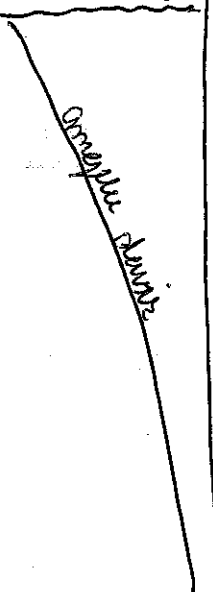
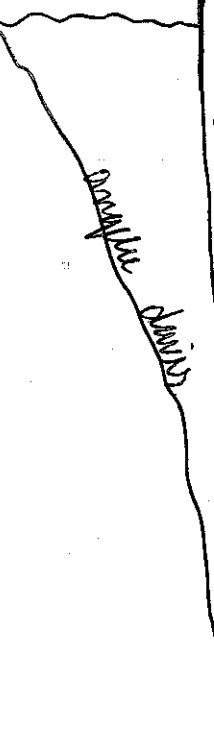
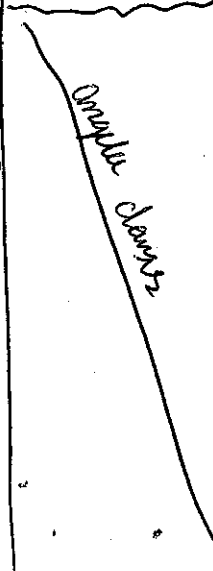
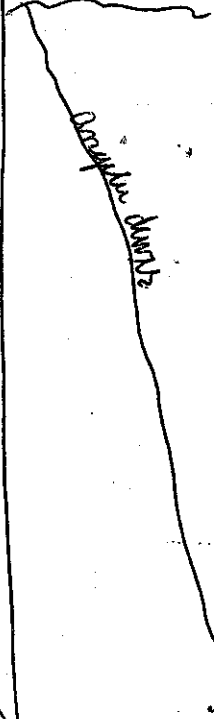
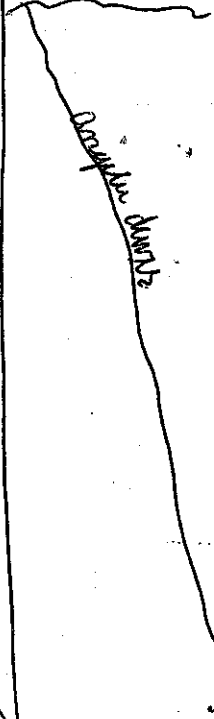
**Note - worm -**

Two - four of the worms were "bleeding" yellow fluid spots bleeding

**Cause:**

When worms get startled they squirt yellow fluid.



	Worms health	Total Weight	Total length	Additional Information <span style="float: right;">50</span>
PLA container	<p>The Worms health in this container was amazing. They were all moving and were all alive! The worms all seemed a little larger.</p> 	<p>Total: 8g Average: 0.4705g</p>  <p style="text-align: center;"><i>Amplitude charts</i></p>	<p>Total: 26.48mm</p>  <p style="text-align: center;"><i>Amplitude charts</i></p>	<p>The amount of mold in this PLA container was a lot... It was a top layer that covered the entire face of the soil and compost.</p> <p>- That may be a problem.</p>
Control container	<p>The worms in this container were like we always see in other experiments. They were healthy and only one had died.</p>  <p style="text-align: center;"><i>Amplitude charts</i></p>	<p>Total: 7g Average: 4.117</p>  <p style="text-align: center;"><i>Amplitude charts</i></p>	<p>Average: 52.65mm</p>  <p style="text-align: center;"><i>Amplitude charts</i></p>	<p>There was also a fair amount of mounding in this container. It was in the compost as well...</p> <p>- a? - How can we contain the amount of mold going into the experiment?</p>

## Soil / light procedure

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materials: Soil, container / structure, 11 Worms

Purpose: To see if ~~worms~~ <sup>worms</sup> add more soil  
If we steadily decrease the amount of soil being put into the door will the worms come through the door

Steps:

- 1.) fill under the door  $\frac{3}{4}$  full with soil,
- 2.) Add 11 worms
- 3.) Test for 5 minutes with lights on
- 4.) reset experiment and take data
- 5.) Test for 10 minutes with lights on
- 6.) reset experiment and take data
- 7.) Test for 15 minutes with lights on
- 8.) Take data and end experiment
- 9.) if unsuccessful reset with soil  $\frac{1}{2}$  full and repeat steps 1-7

Amylee Davis

Amylee Davis 11/7/15

Oliver P. B. B.

Time	Did Worms come out	how many out of 11 came out
5 minutes	no	0/11
10 minutes	no	0/11

mylar dew 1/17/15

Olivia Bohl

Long term  
Soil test

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materials: Soil, container/structure, 11 worms

purpose: If we keep 11 worms in the structure for 6 periods aprox: 7 hours Will they travel up through the door.

Step 1: fill Under the door to the top with Soil

Step 2: Place 11 worms into the soil

Step 3: start the LED and servo and place structure in container

Step 4.) leave structure running for 6 periods also leave a camera running to see what time they came out.

Step 5.) Check the structure at 6<sup>th</sup> periods and take data

Step 6.) end experiment.

*Amphelis clavis*

*Amphelis clavis*

Olivia Bohl



# Long term soil test:

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- Period 2 - 2/11 Worms came through
- Period 3 - 1/11 Worms came through
- Period 4/1unch - 2/11 Worms came through
- Period 5 - 0/11 Worms came through
- Period 6 - (last time) 0/11 Worms came through

## Observations:

At the end of the experiment there was no worms and when I opened the container the worms were in the top corner away from the lights but away from the door.

Period	# of worms
2	2
3	1
4	2
5	0
6	0

## Improvements:

To make this experiment better and more accurate we could put the lid on the top of the container so the worms have a hard time to crawl to the compost different.

Improvements to the door: I think to make it easier for the worms to come out we should make the door larger and more accessible for the worms to crawl through.

~~Anya de la~~

Olivia Bohl

## Soil/door test

60

Purpose: We want to test our structure and door and see if we ~~send~~ place 11 worms in our structure for approximately 2 hours will the worms come through the door.

materials: 11 worms, structure, soil, experimental compost

### Steps:

- 1: fill under the door 100% full and place 11 worms in that soil - then put the door on
- 2: fill above the door with  $\frac{1}{2}$  soil and  $\frac{1}{2}$  experimental compost
- 3: put container in box and start experiment
- 4: place lid on top of the container
- 5: run for 2 hours
- 6: end experiment and take data

*Amphipus davis*

Amphipus davis 1/14/15  
Amphipus davis 1/14/15

Long term soil results  
with lid on

1:00 - 0 out of 11 came out

1:15 - 0 out of 11 came out

1:30 - 0 out of 11 came out

1:45 - 0 out of 11 came out

2:00 - 0 out of 11 came out

Time	# of Worms
1:00	0/11
1:15	0/11
1:30	0/11
1:45	0/11
2:00	0/11

*Asperula densa*

*Asperula densa* 1/15/15  
Missy Skull 1/15/15