LIL' SPROUTS

Hydroponics System

A Process Book by Anne Pascale

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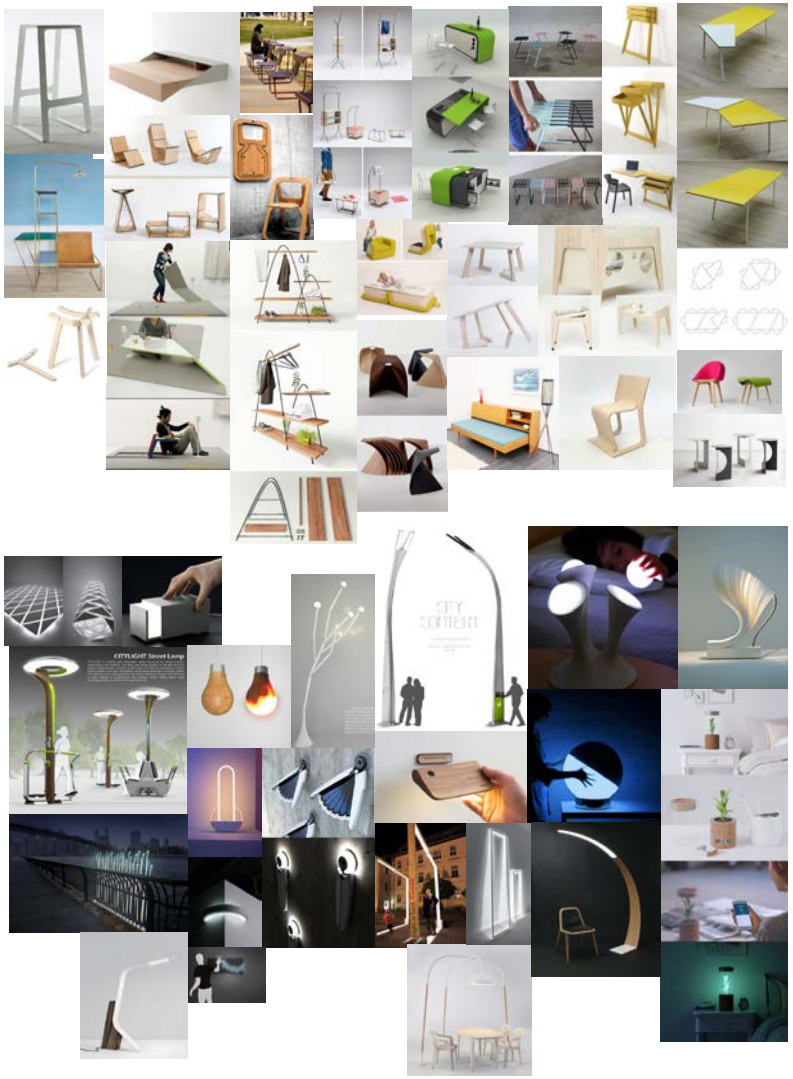
“Invent a product based on your interests.”

This broad description gave me the freedom to explore whatever most inspired me. I have always been drawn to botanical themes and I love caring for all things green (and, in turn, our planet). I began this design process by narrowing my focus to three very different categories, but I followed my instincts and decided to create something that would help others learn how to care for plants.

With this design solution, I can hopefully impart my botanical passions onto a younger generation, and the desire to improve and care for the planet will multiply...

INSPIRATION



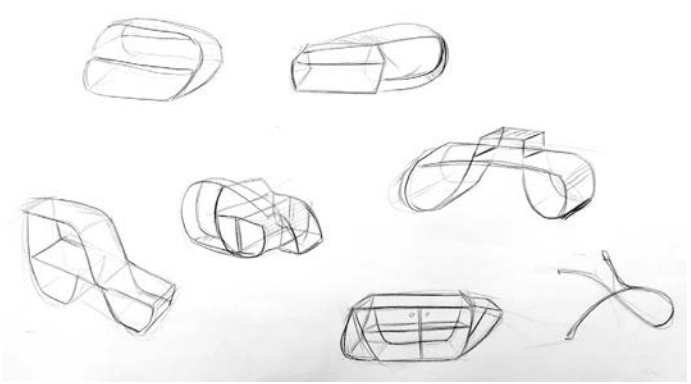
Indoor Gardening/Composting

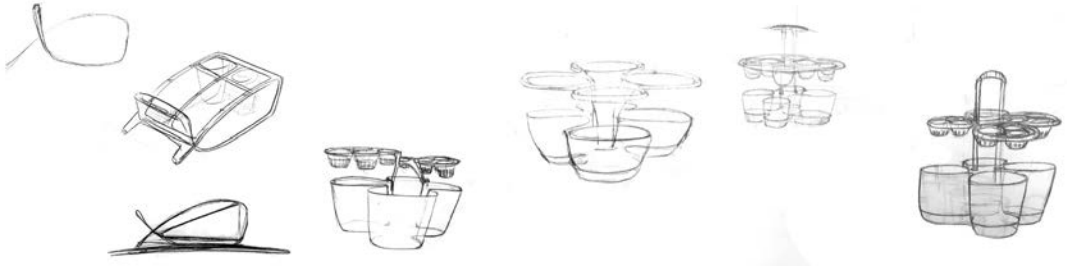
Many of the concepts I found inspirational were indoor composting units and minimal kitchen planting systems.

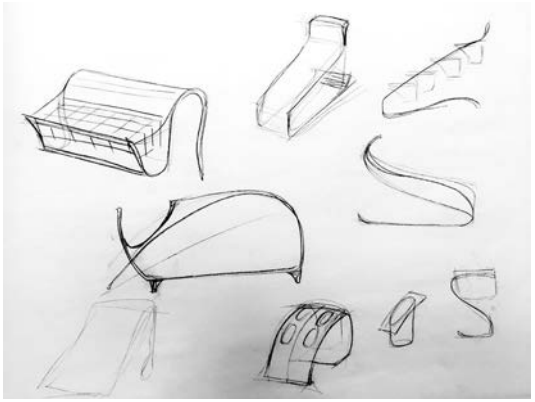
FORM STUDY

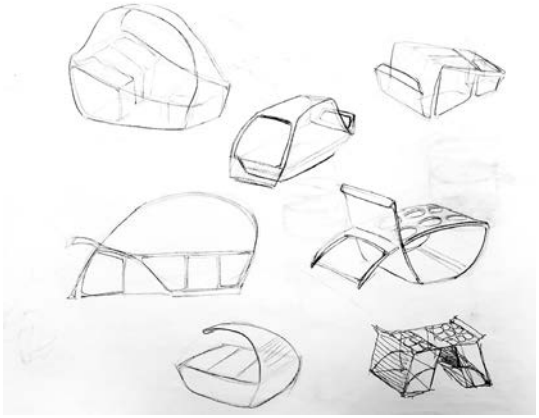
Next, I moved on to non-objective form studies. From there, I picked three that I found to be the most interesting and developed them further. These were supposed to become the inspiration for sketching and ideating. Making these sketch models helped me think about form in a more abstract way, before I focused on making function-related forms.

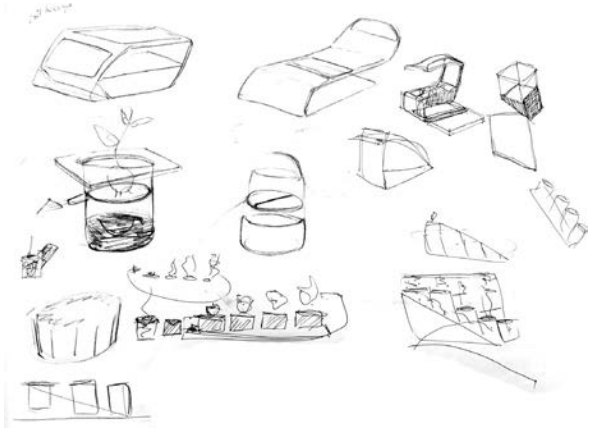
These sketches represent the ideation stage, where I started to consider my product's function and appearance.

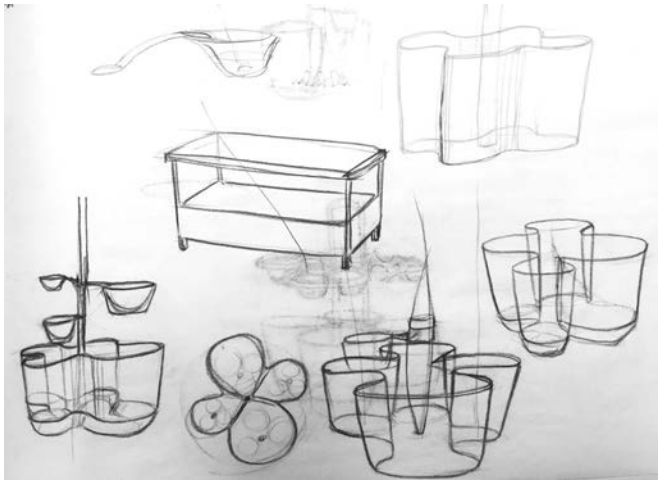


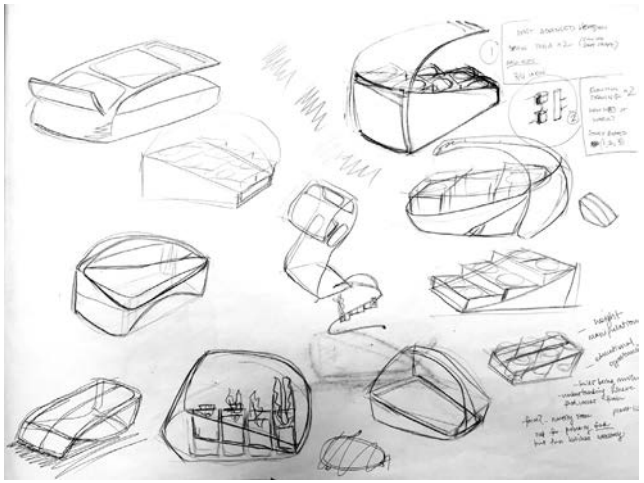


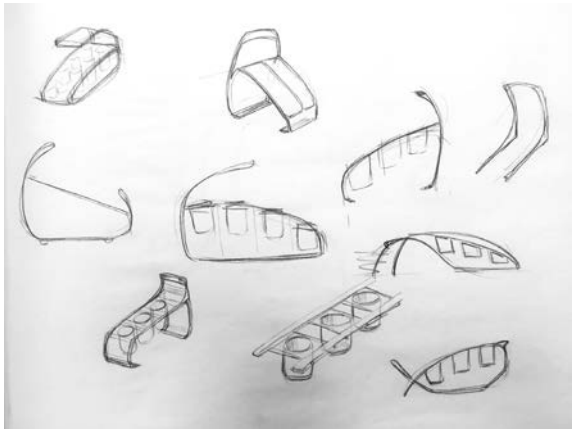


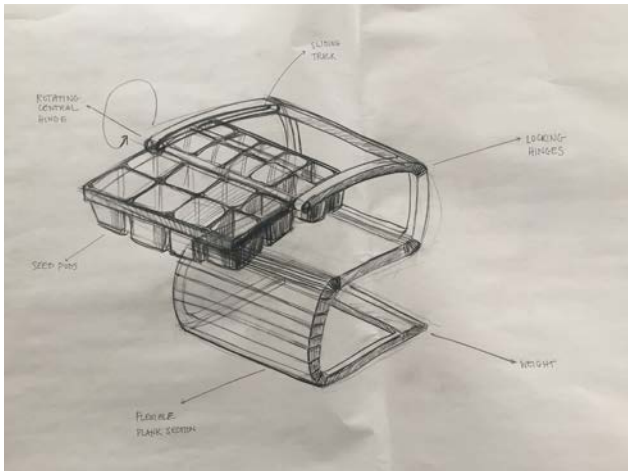


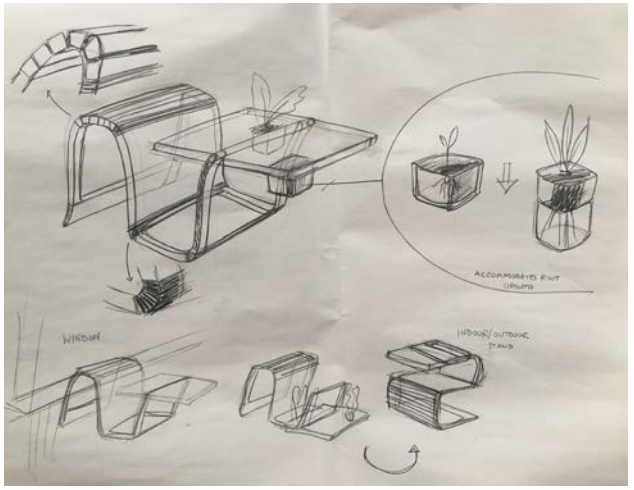












INITIAL CONCEPTS

My initial idea was to have an indoor system that would grow kitchen clippings. Water cups would sit along an angled track, and the plant would move down the line as it grew. (left)
The next version version is intended for use on a windowsill and features convertible capabilities so that the entire unit can be placed indoors. Each planting section has expandable planters. (right)
From here, I proceeded to do more research so that I could solidify my concept before moving further with the design.

CONCEPT RESEARCH

Research Plan:
What Does it Grow?
Leafy Greens, Lettuce, kale, chard, radish, peppers
What is the most interesting to watch while it grows?
What is easiest for kids to plant/ more likely to survive?
Container must be blacked out to prevent algae growth, but should it include ian nterior light to monitor? (like an oven light)

Materials?
- Sustainable
- Biodegradable
- Recycled Metals
- Recycled plastic bottles (PET)

User/Client?
Kids, elementary/middle school
Instill importance of sustainable farming methods at an early age
Make learning fun/incentivise monitoring the plants

Classroom:
What makes kids excited to learn?
What is boring about science class?
What parts of science class do kids like the most?
What are other hands-on teaching tools like?

Marketplace?
Largely online
-Urban Cultivator (indoor microgreens appliance)
-ROOT countertop grower
-AeroGarden (miracle grow)
-Free standing planter, Williams Sonoma
-IKEA counter planter
-TOYS: grow domes, basic hydroponics kit

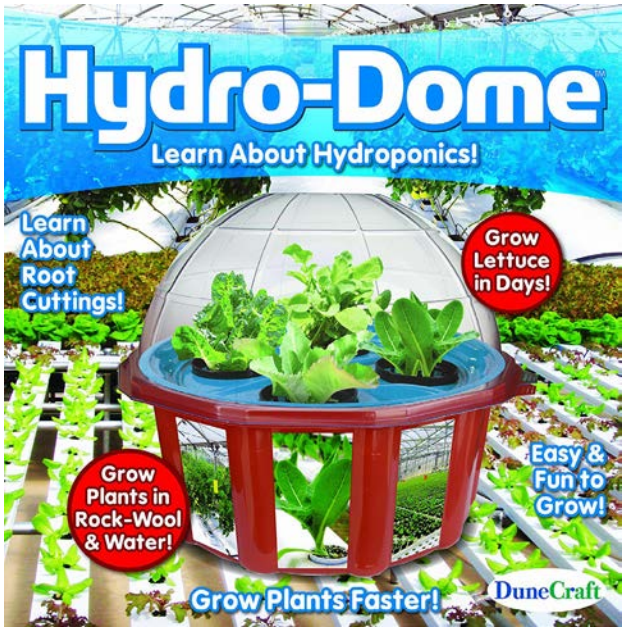
Hydroponics Info?
Nutrient Base (micro and macro) N K P CO2 O2
Oxygenated water, Ph Balance
Kratky Method does not require sophisticated equipment
Light: grow lamps to speed up process
(but use timer for natural light pattern)

Location of plants--some roots are stronger/faster growing than others
What are the perfect growing conditions?
Make it insulated/dark so O2 doesn't escape and to prevent algae growth

WHAT IS HYDROPONICS?

Hydroponics is a horticulture technique in which plants are grown in a nutrient-rich water instead of soil. his method allows for a greater yeild, and the plants grow much faster because of the user's ability to control the variables.

Users can grow virtually anything, but leafy vegetables are common because they require less attention. With the right nutrients, tomatoes, peppers, flowering plants, etc. can grow successfully.



Some current options on the market:

The Hydro-Dome uses Rock-wool and water to grow the plants quickly.

The Hydroponics Kit is a simple option that is clear, so the roots are visible.

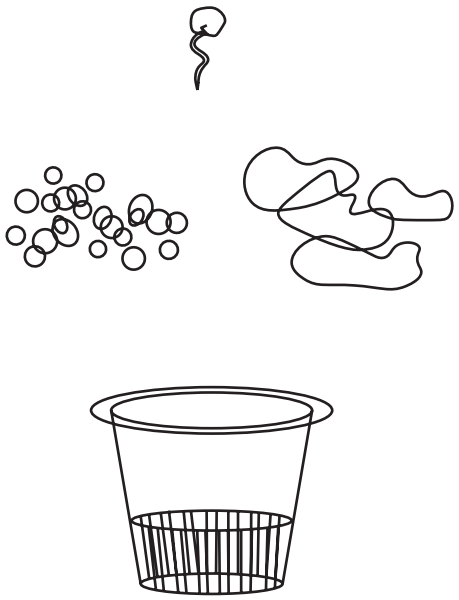
The Hydroponics Lab offers a way to grow plants at the same time using different growing mediums. Students can compare the growing rates between soil, water, sand, etc.


water
Soil
Sand

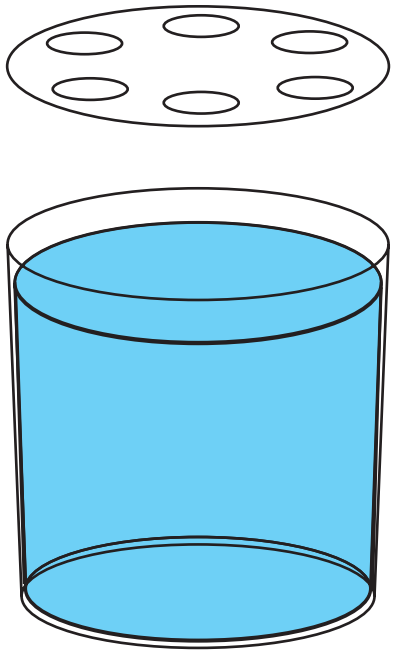
WHY and HOW?

This method intrigued me because it:

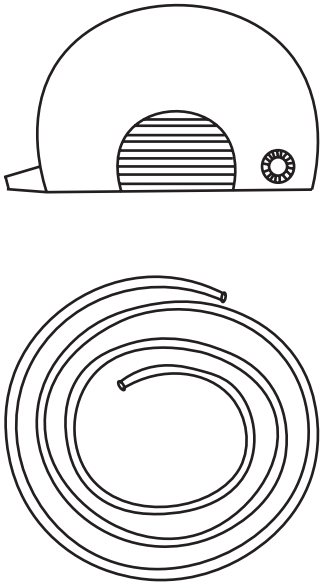
- is an interesting way to understand a plant's basic needs
- provides visibility of the plant's growth process
- can be done at a small scale
- is easy to monitor
- is low maintenance
- is kid friendly



-sprouted seedling
-growing material
(clay or rock)
-net cup



-large bucket
-water with nutrients
-lid with holes
(for net cups)



-air pump
-hose

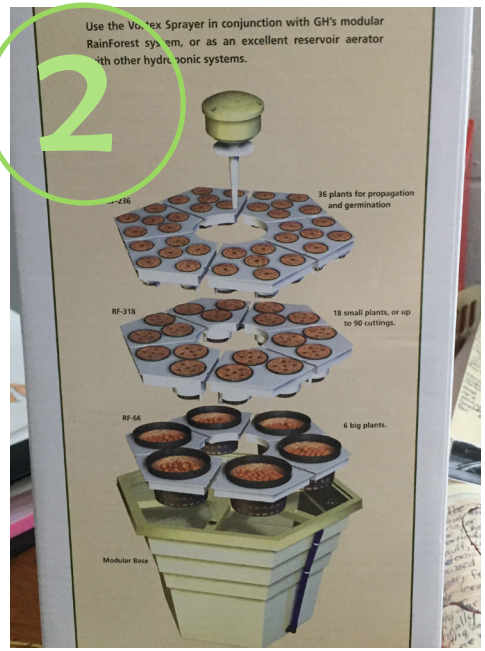
With these tools, the right PH level, and water soluable nutrients, plants can grow quite easily. Hydroponic farming is a grat success because it requires less space and less time. The method requires some practice, but with the right conditions users can grow food quickly and with minimal effort.

ON-SITE OBSERVATION

I visited the Charles Elllis Montessouri Academy in Savannah, GA, where students learn about many practical life skills, including gardening. At Charles Ellis, it is never too early to learn about the lifecycle of a plant, and children begin to learn about gardening at age five. They are taught about heirloom seeds and how to harvest the garden outside, but they have not had success with hydroponics. They have tried a few different methods, but both of the systems failed.

This is the garden at the local school.

Version 1:
This was a cumbersome tower made of many different parts. The large tub at the bottom held water that was circulated through the rest of the system through an air pump. The school found that it was better suited for outdoor environments because of its size.



Version 2:
This system was oddly shaped and did not come with a proper light. The school had to purchase a light fixture, which they placed precariously on top of the basin. It did come with water-soluble nutrients and seeds to grow different types of tea, but none of the suggested plants were native to the area.

To summarize my research findings, here are the main problems with current hydroponics growing systems:

1. Too bulky
The planters they purchased were often too large or oddly shaped to fit well in the classroom environment. They need something that can fit on top of a bookshelf or windowsill comfortably.

2. Not getting enough light
The other issue was that the classroom did not get enough light to properly grow anything, and most of the students' plants would die within a few weeks.

3. Plants were not native to the area
The plants they tried to grow were not native to the area anyway, so even if they had grown in the classroom there was no way to transplant them into the outdoor environment because of specific climate needs.

The above image is a grow light system that really worked for the classroom. Students were able to successfully start seedlings in the small trays, which could be placed anywhere in the classroom. These little seedlings were destined for the garden, grown in biodegradable cups. This method can easily be translated into a hydroponics version.

WHAT WORKS?...

The method of using grow lights yields much faster results. Also, because of the ability to control multiple variables, teachers can instruct through experimentation with PH levels, the effects of different nutrients, oxygen levels, etc.

...AND WHAT NEEDS TO CHANGE?

Add a grow light

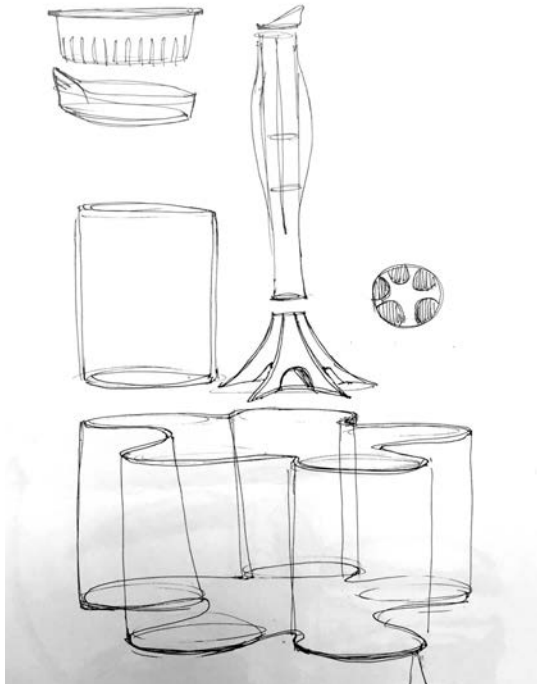
Make it an accessible size

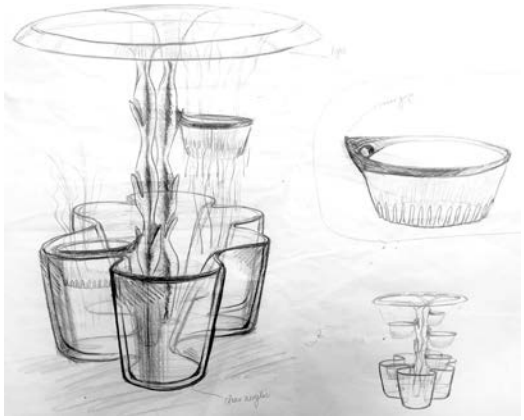
Grow native plants for an emphasis on the future

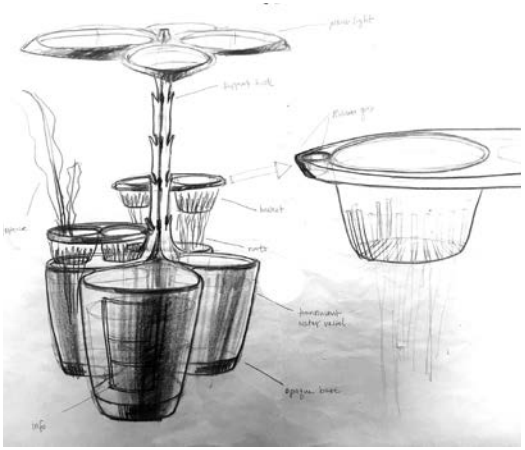
Make it a fun, nature-inspired design

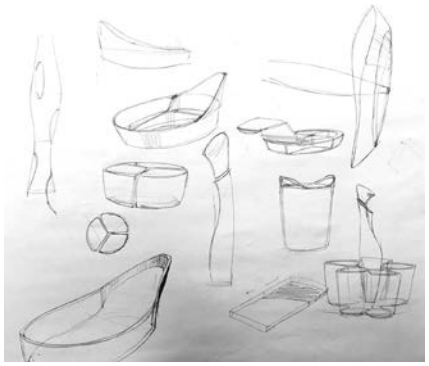
FINAL CONCEPT / SCALE MODEL

This is the final concept; it is a five-cavity system that has an array of individual, hydroponically grown plants in an organic cluster pattern. The central column is for support and includes a handle for mobility. Each cavity holds water and has its own lid and net cups to support a growing plant. The net cups can be moved up along the column as the roots extend further into the water.

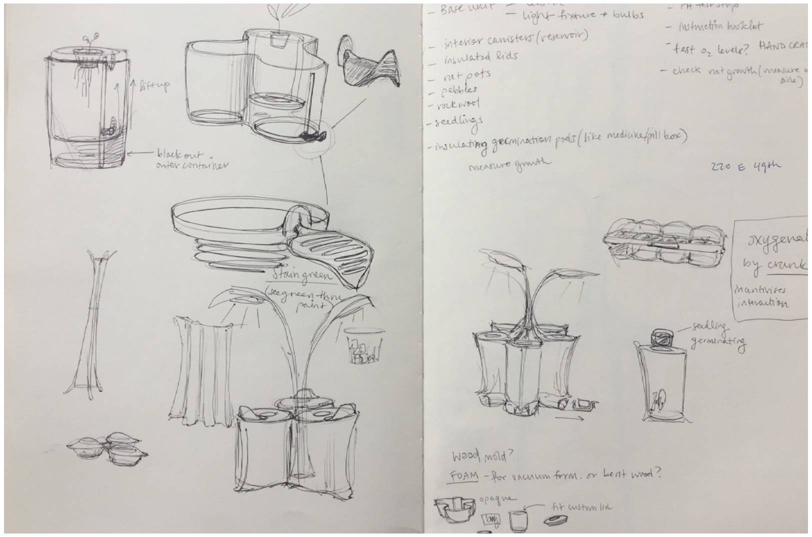


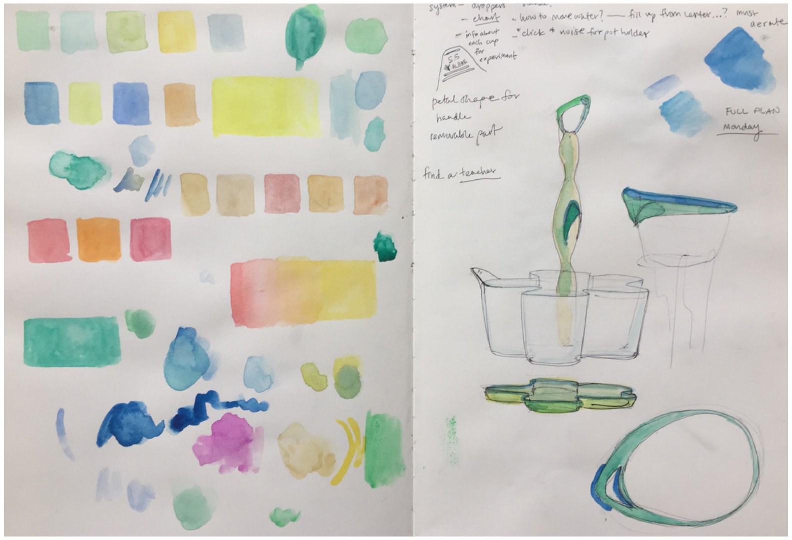


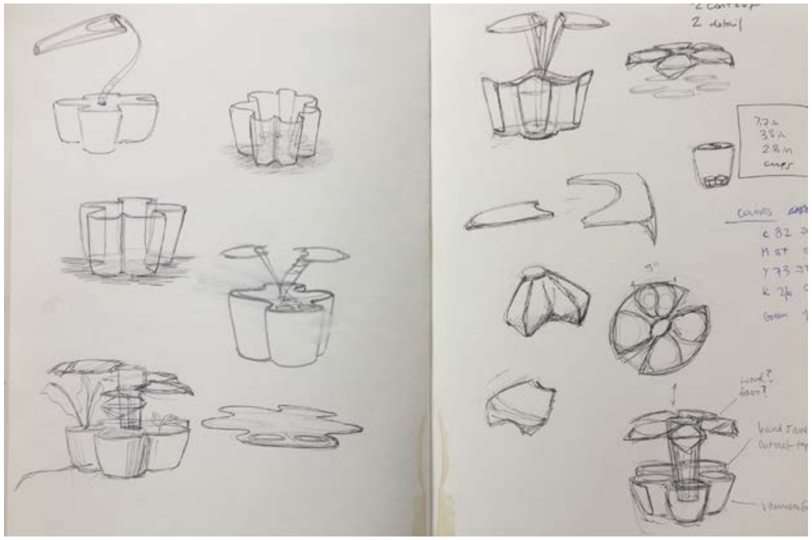


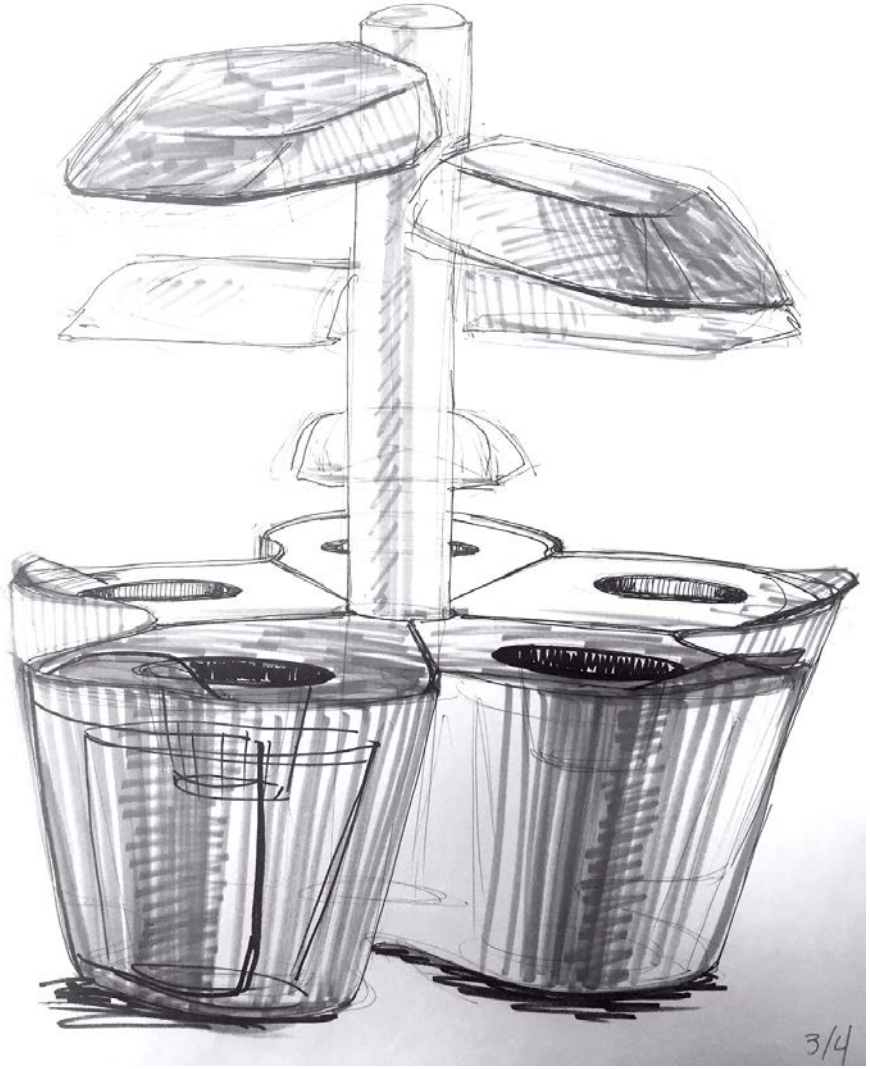


IDEATION


lift up
black out outer container
stain green
wood mold?
FOAM - for vacuum form. or bent wood?
oxygenate by crank
seedling germinating


petal shape for handle
removable part
find a teacher
FULL PLAN Monday


2 detail


3/4

Foam models for lamp shade (to be vacuum formed), and models for individual lids.

PROTOTYPE 1

First official practice model for final design, after ten weeks of research and ideation.

PRODUCT DESCRIPTION

Lil' Sprouts is a hydroponic planting system for the indoor classroom environment. This endearing design makes it fun for kids to learn how to grow plants. As the plants grow taller, the adjustable grow lights extend vertically to make room. Students can experiment with PH levels, nutrients, and other variables to discover the best method for growing vegetables and herbs. After a plant outgrows its container, it can be transplanted to a home garden or alternate indoor planter. This system will hopefully inspire children to be interested in gardening and growing their own food.

IMPROVEMENTS...

-Scale down light fixtures

-Individual support columns for each light fixture

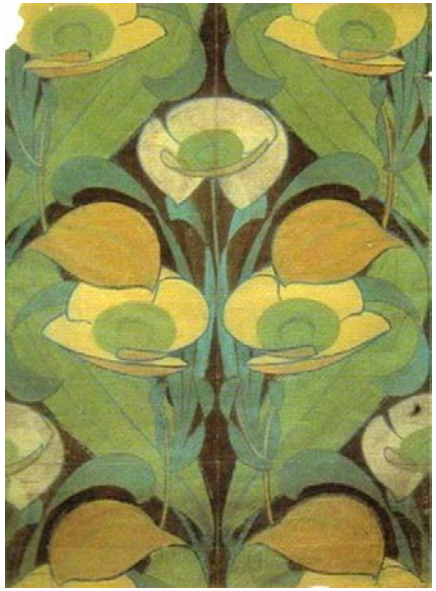
-Add texture to outside shell

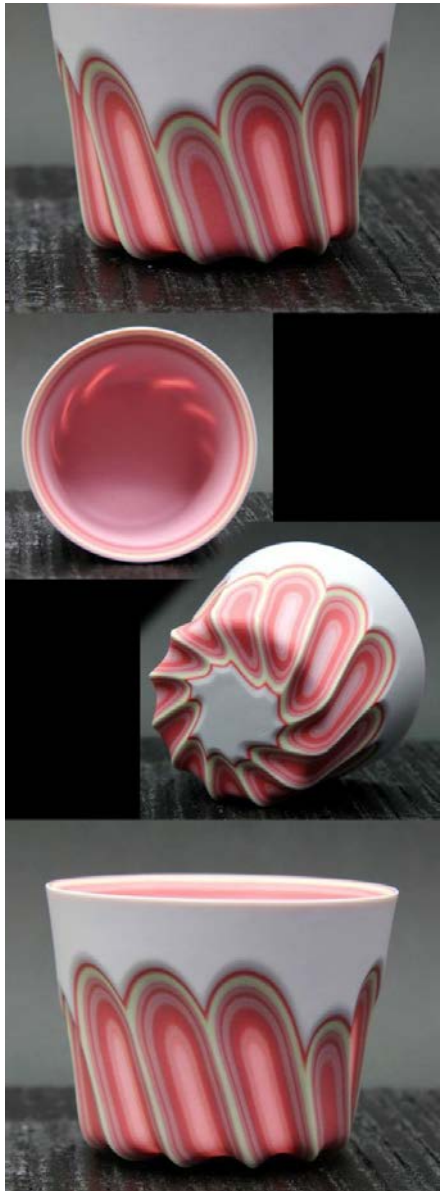
-Separate sections with interior webbing

-Add handles

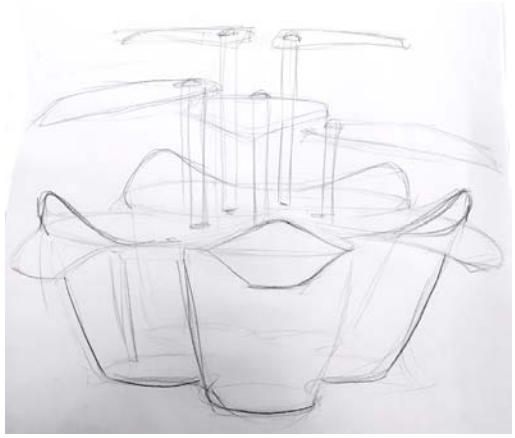
-Add see-through viewing section

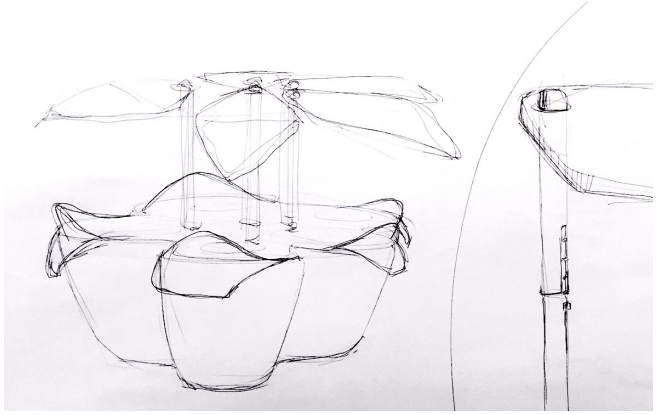
INSPIRATION

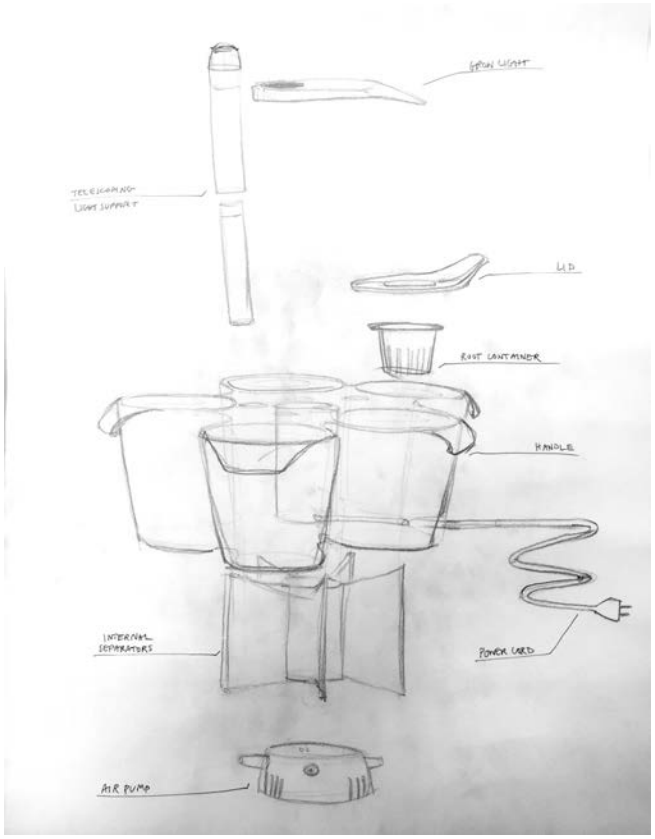


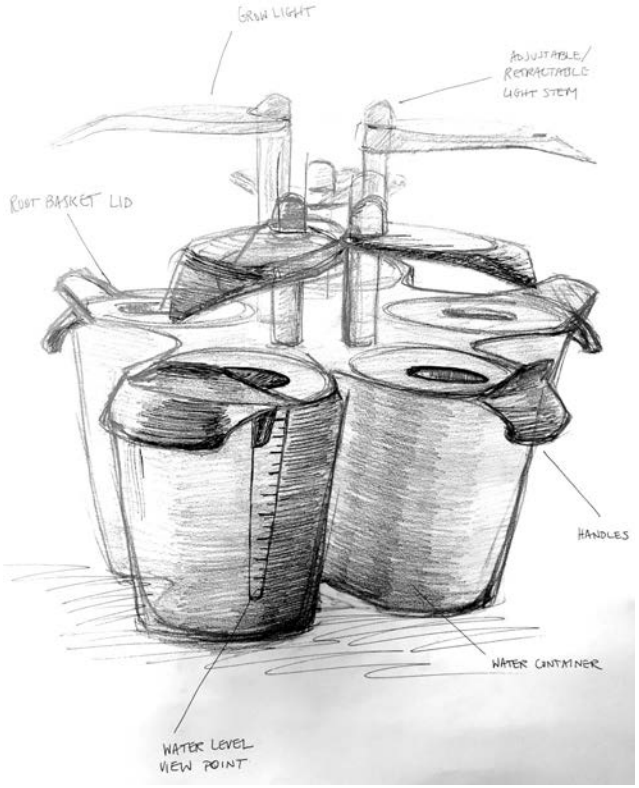


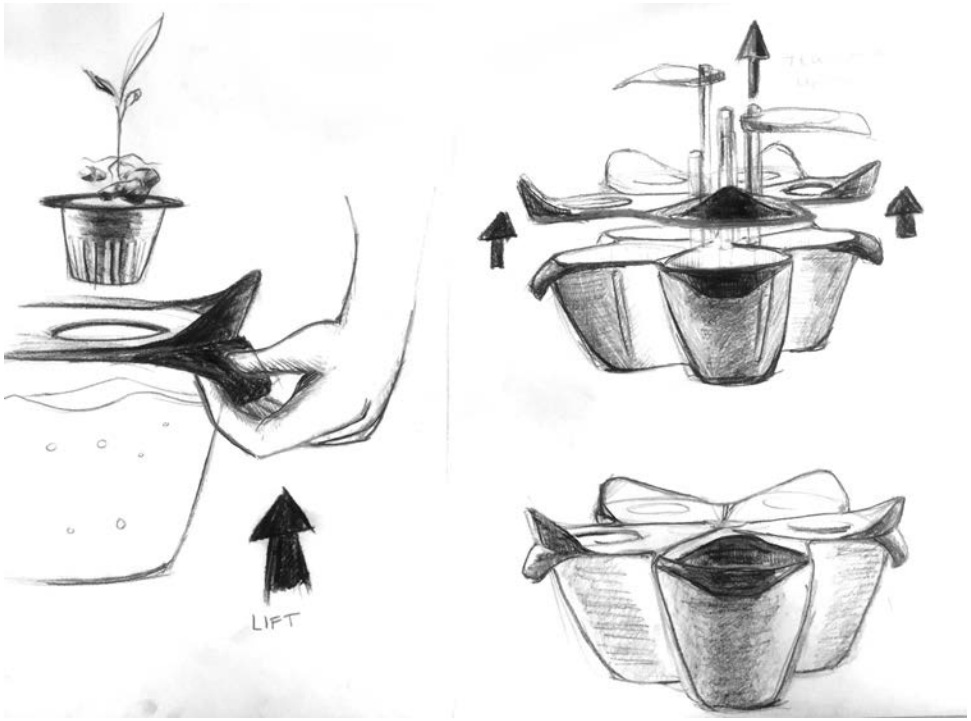
DRAWINGS



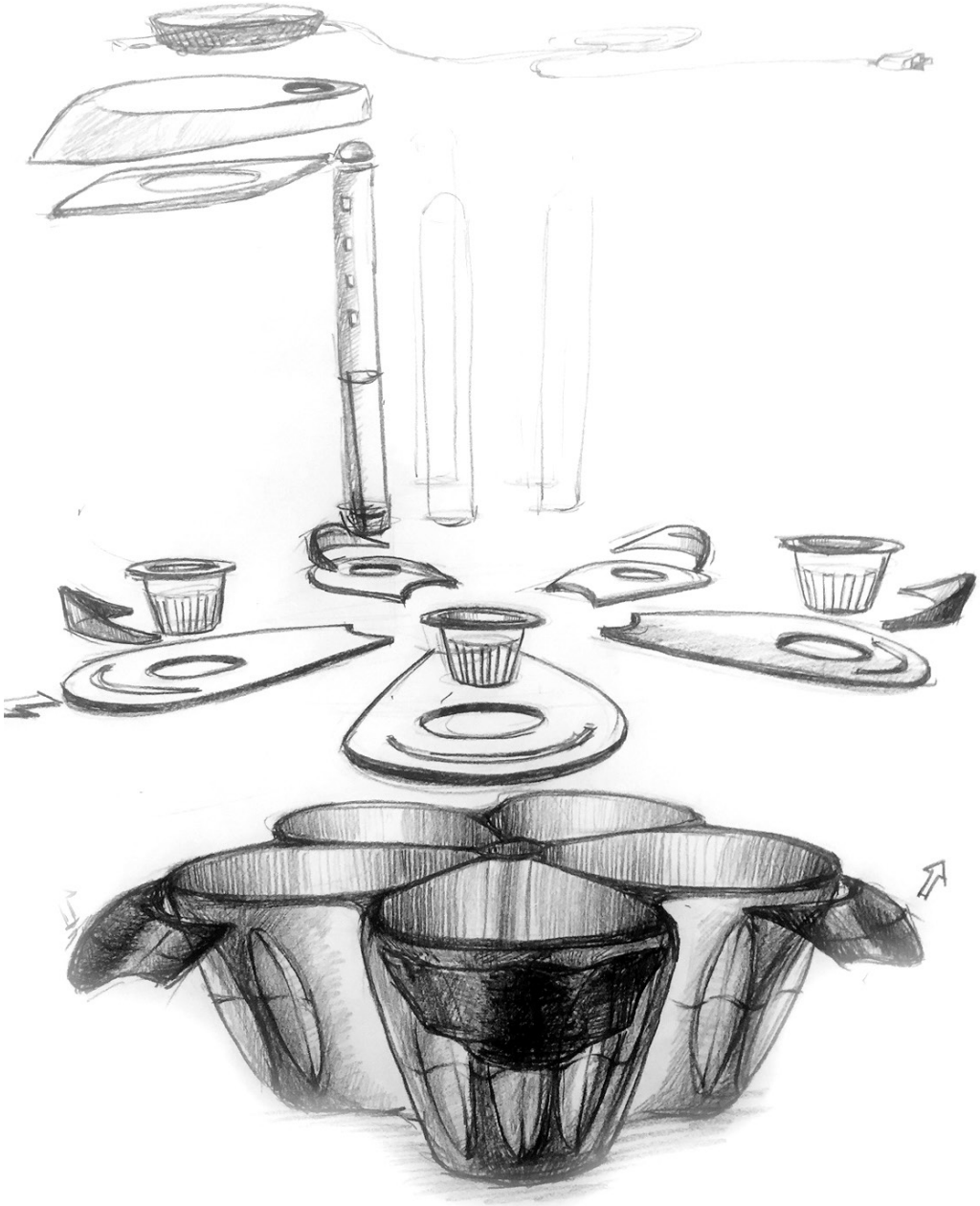


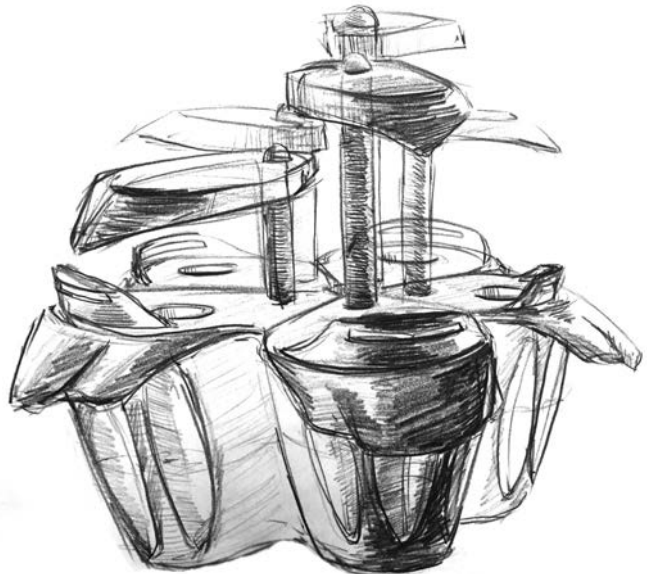

GROW LIGHT
TELESCOPING LIGHT SUPPORT
LID
ROOT CONTAINER
HANDLE
INTERNAL SEPARATORS
POWER CORD
AIR PUMP

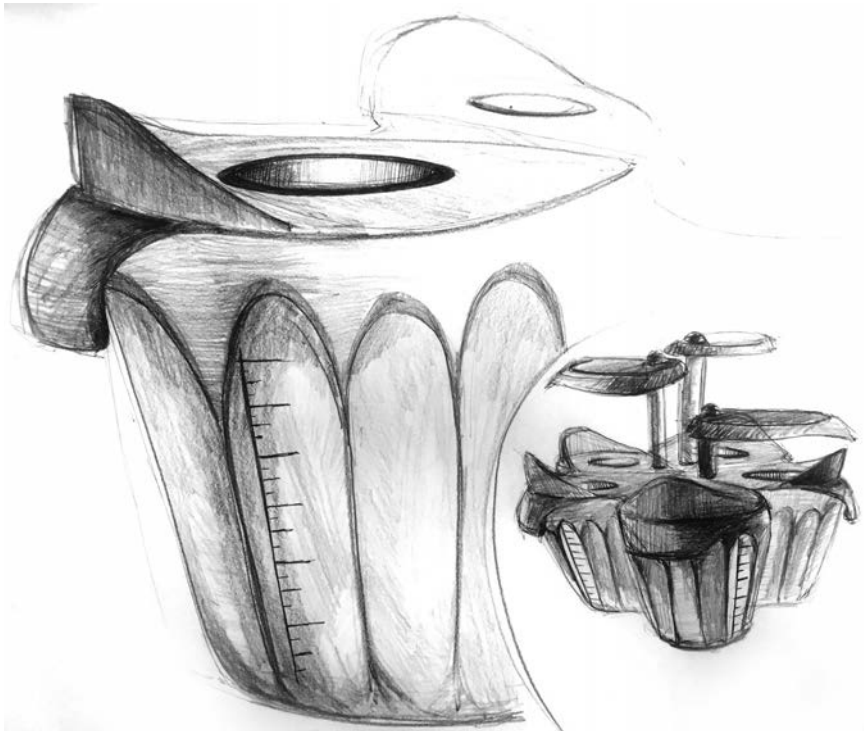

GROW LIGHT
ADJUSTABLE/ RETRACTABLE LIGHT STEM
ROOT BASKET LID
HANDLES
WATER CONTAINER
WATER LEVEL VIEW POINT

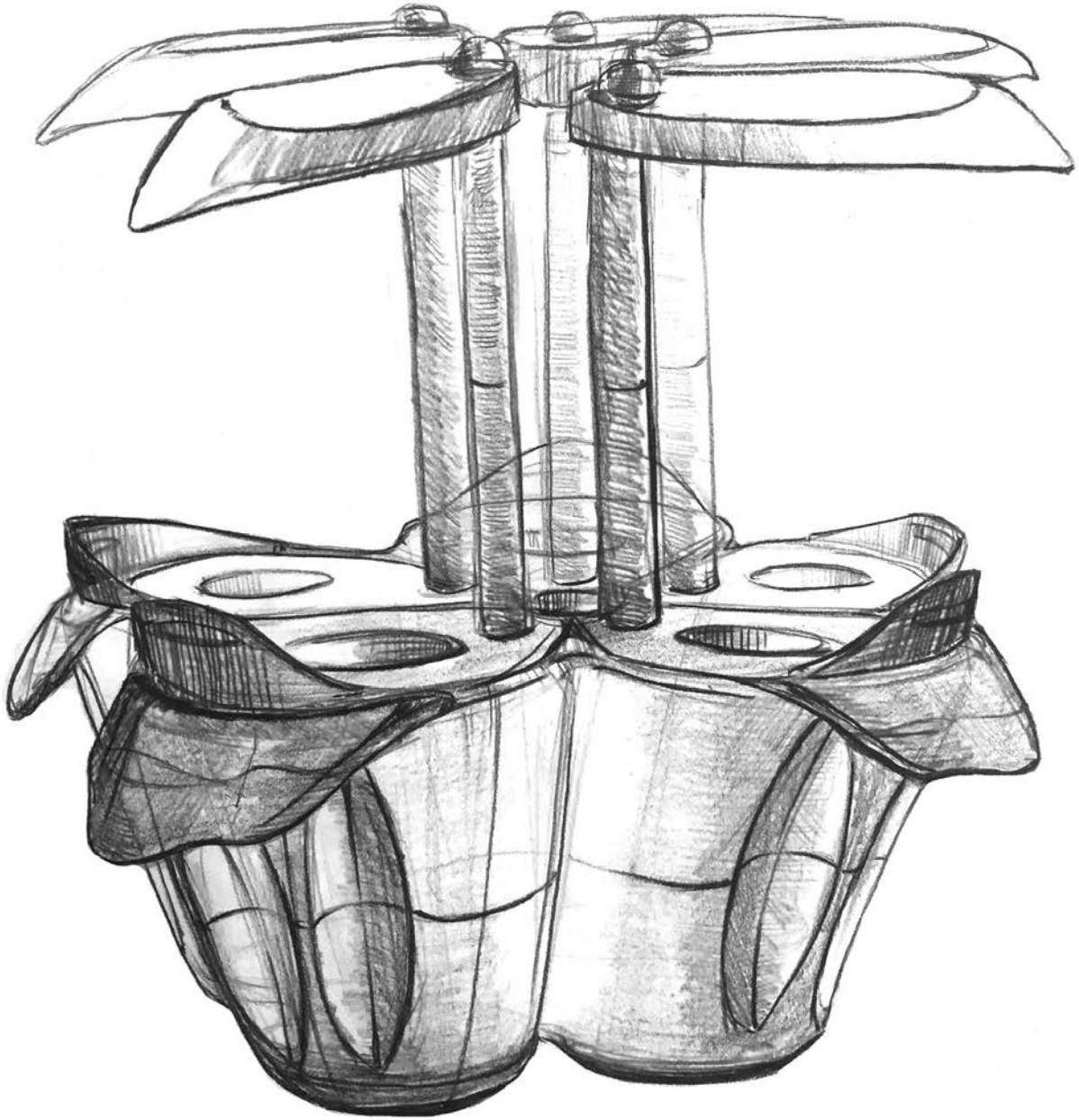

LIFT

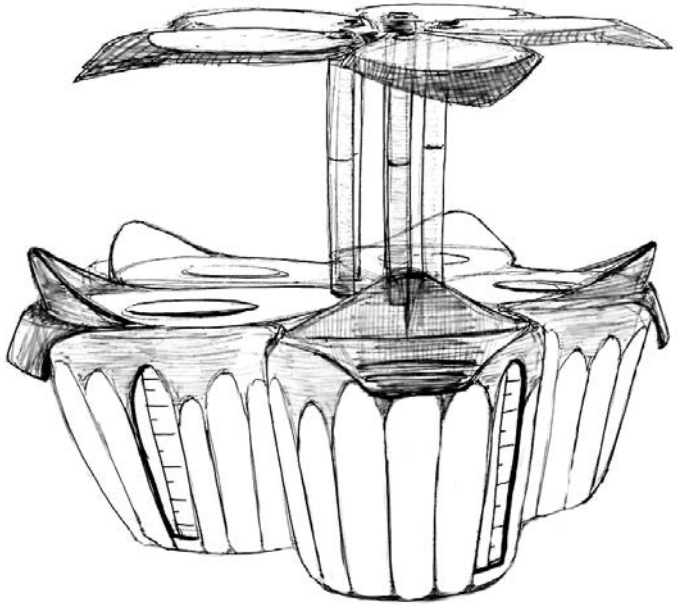
Drawings in charcoal/pastel 40x60”



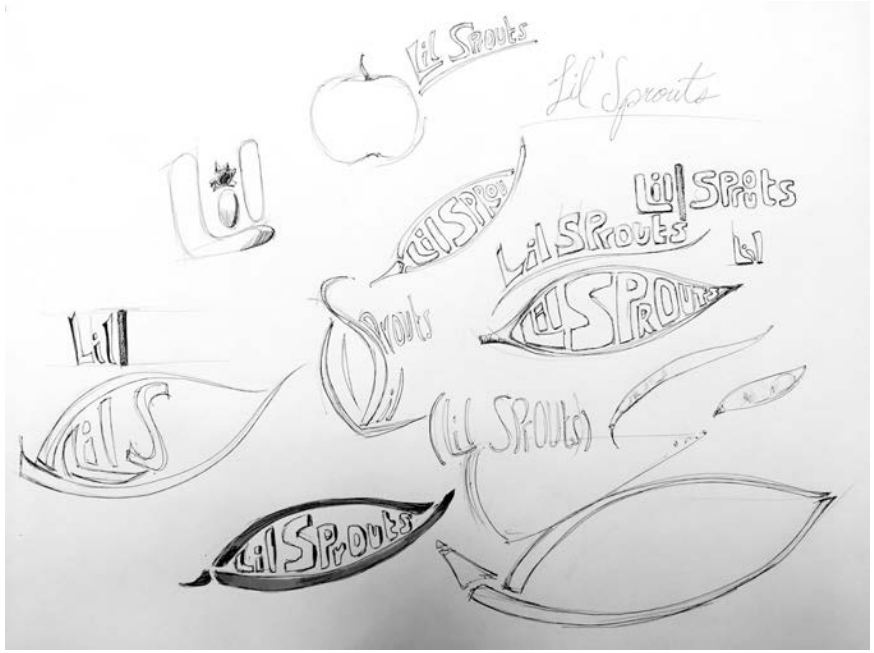








LOGO DESIGN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Lil' Sprouts
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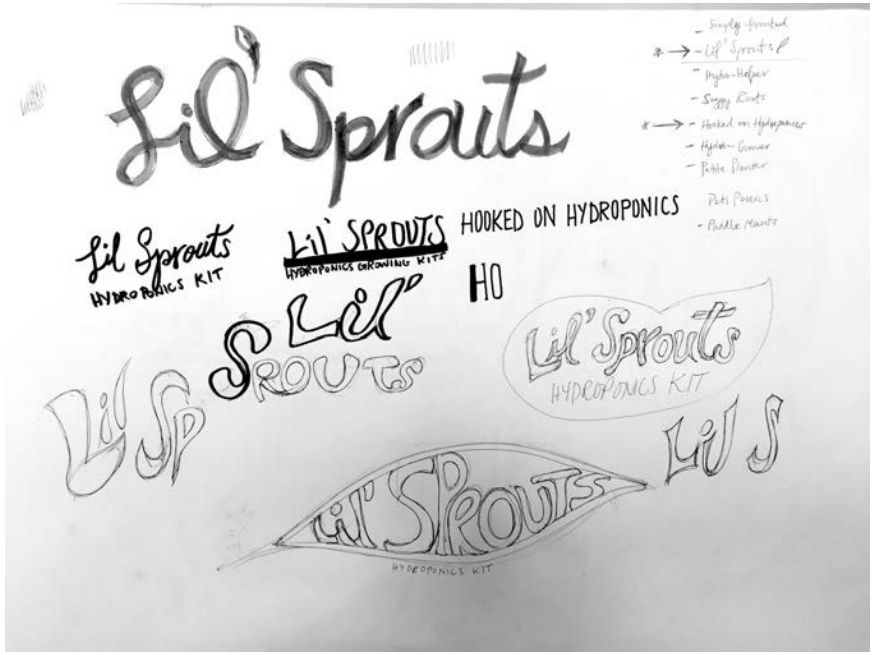
Lil Sprouts


Lil' Sprouts
Lil Sprouts
HYDROPONICS KIT
Lil' SPROUTS
HYDROPONICS GROWING KIT
HOOKED ON HYDROPONICS
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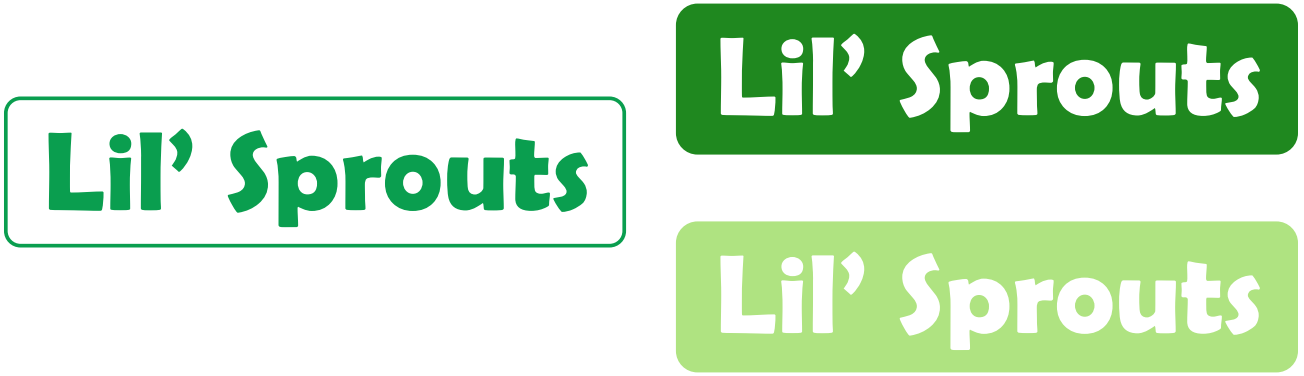
HYDROPONICS KIT


Lil' Sprouts
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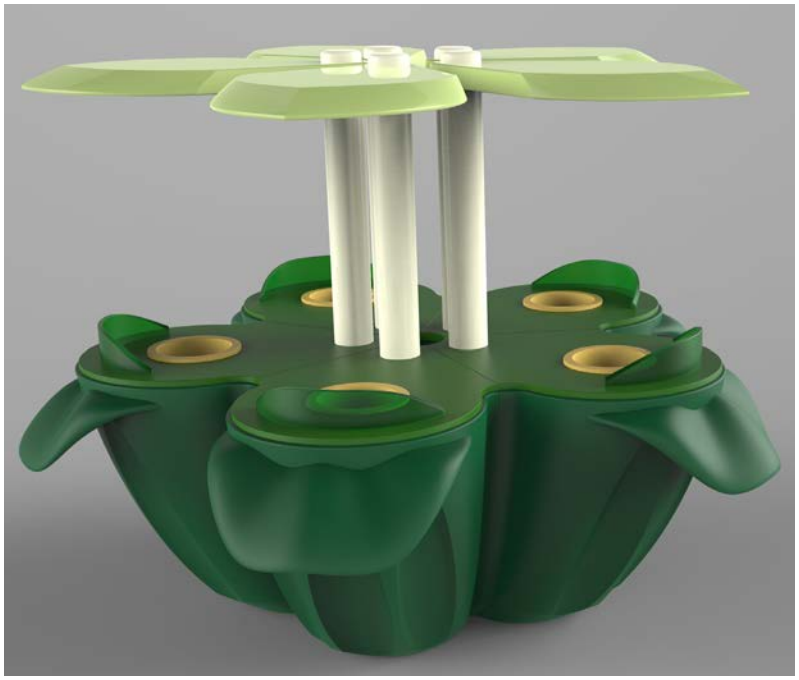
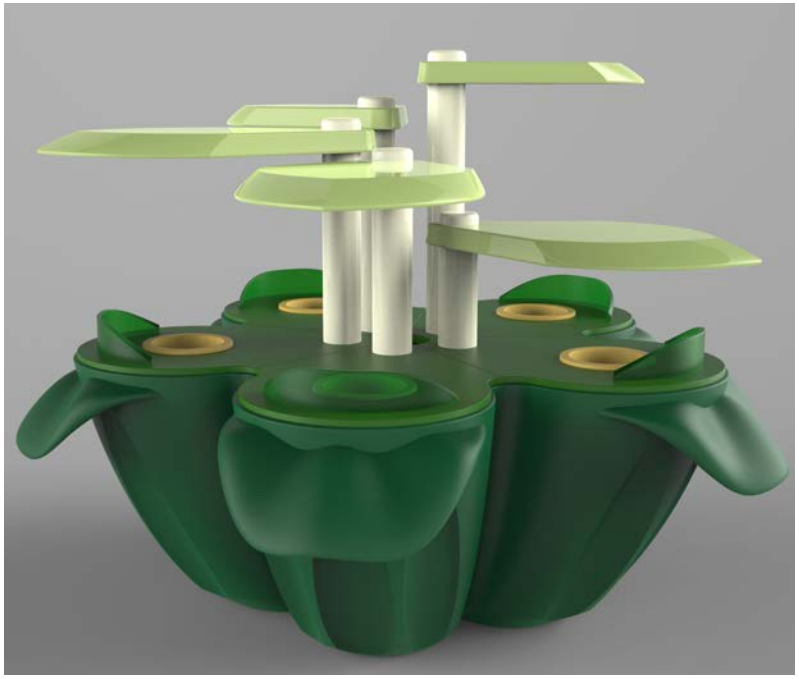
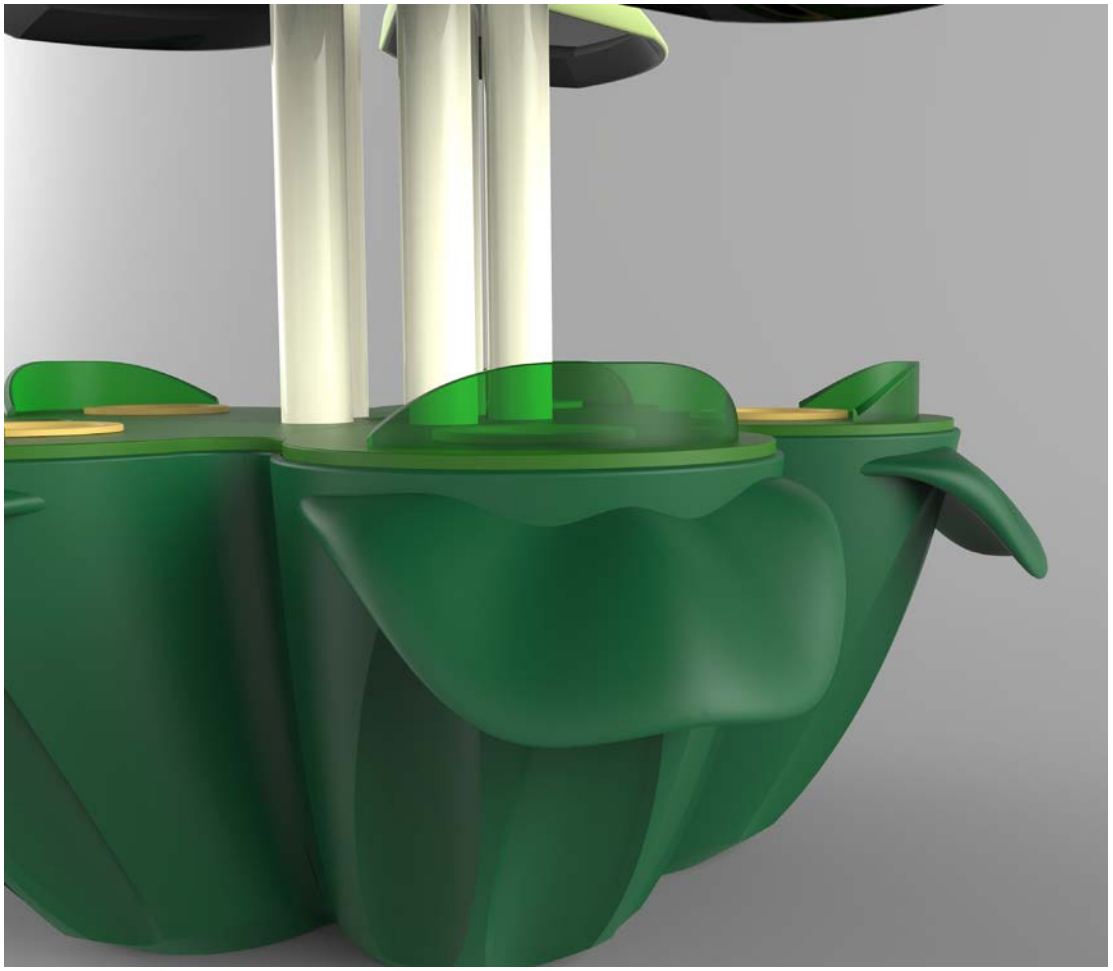
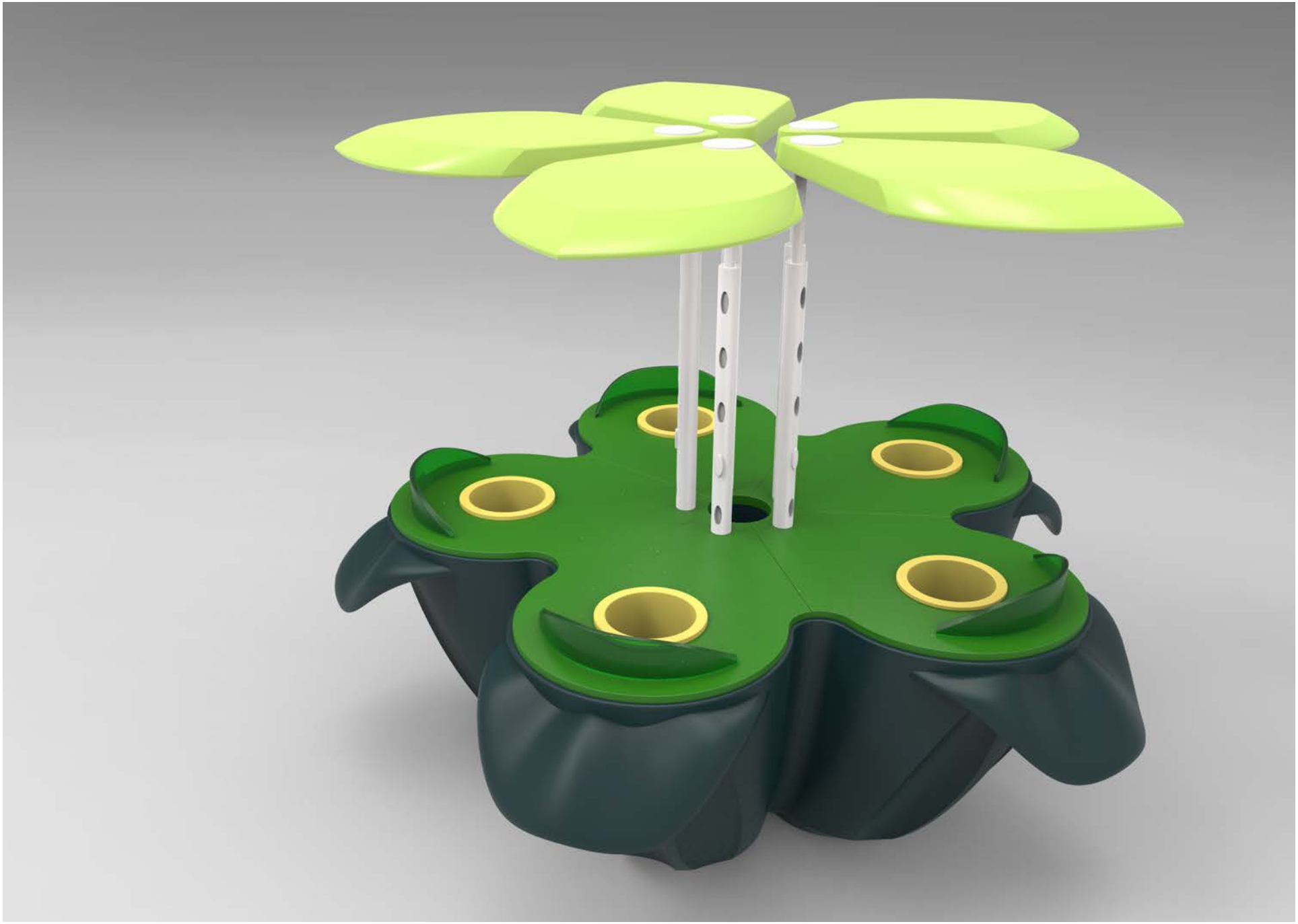
Lil' Sprouts

FINAL CAD MODEL

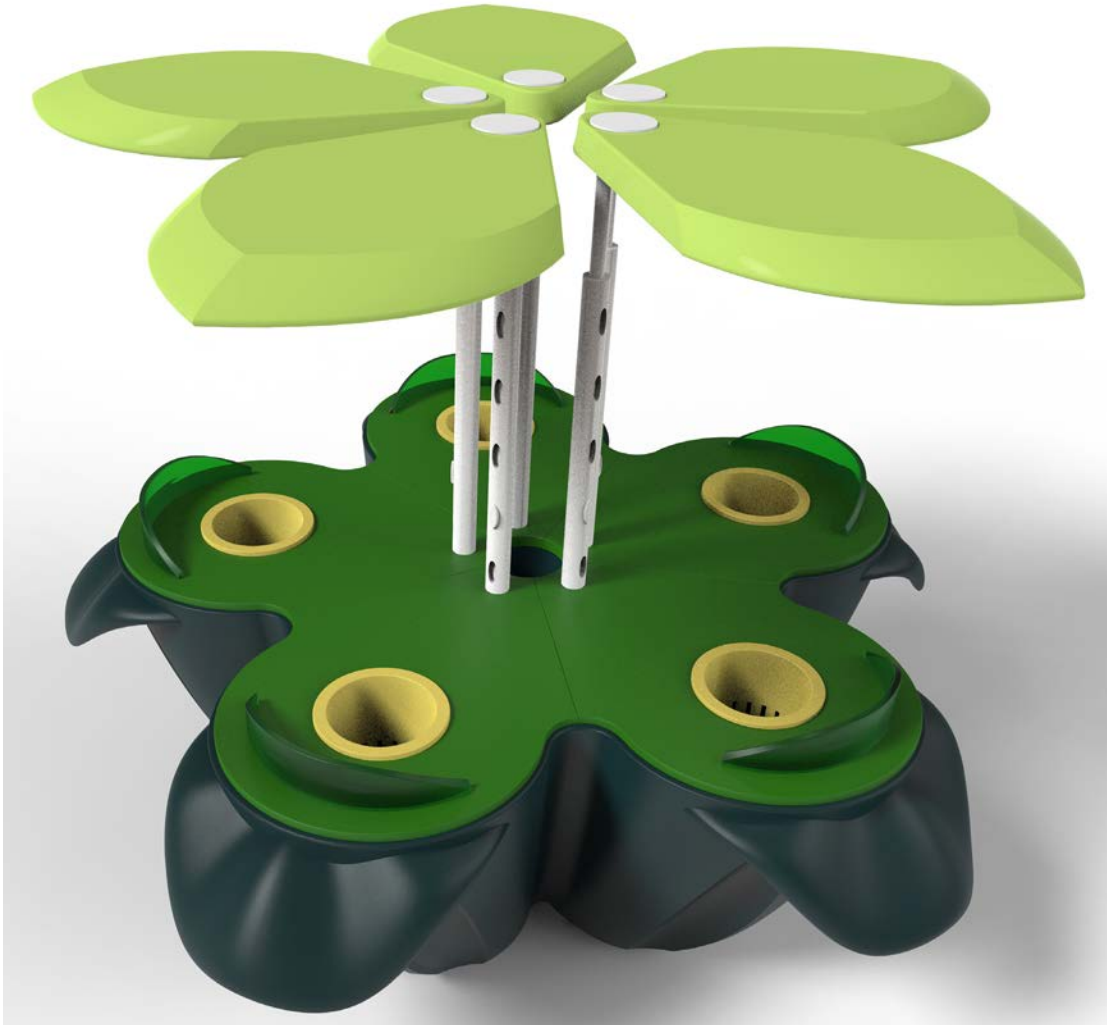


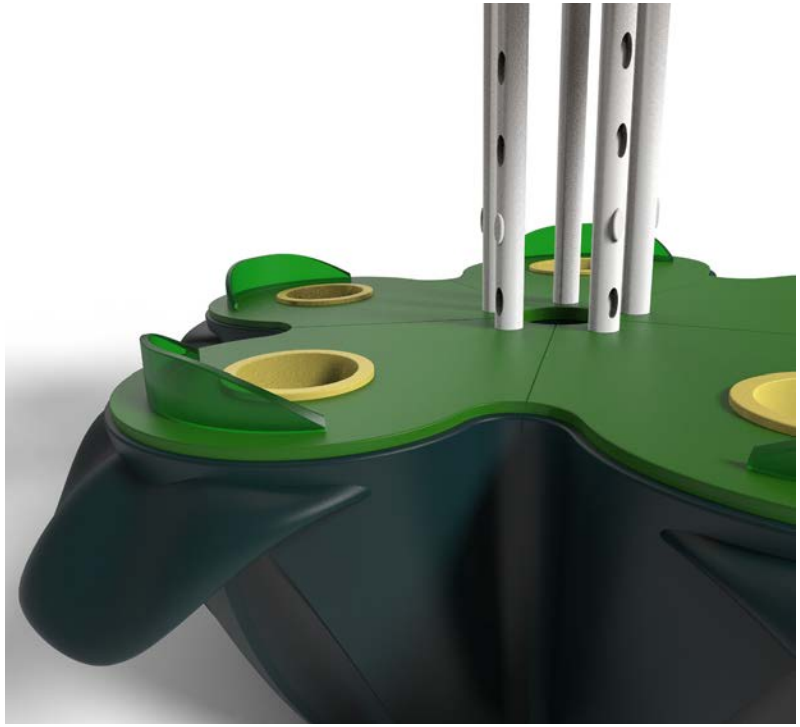


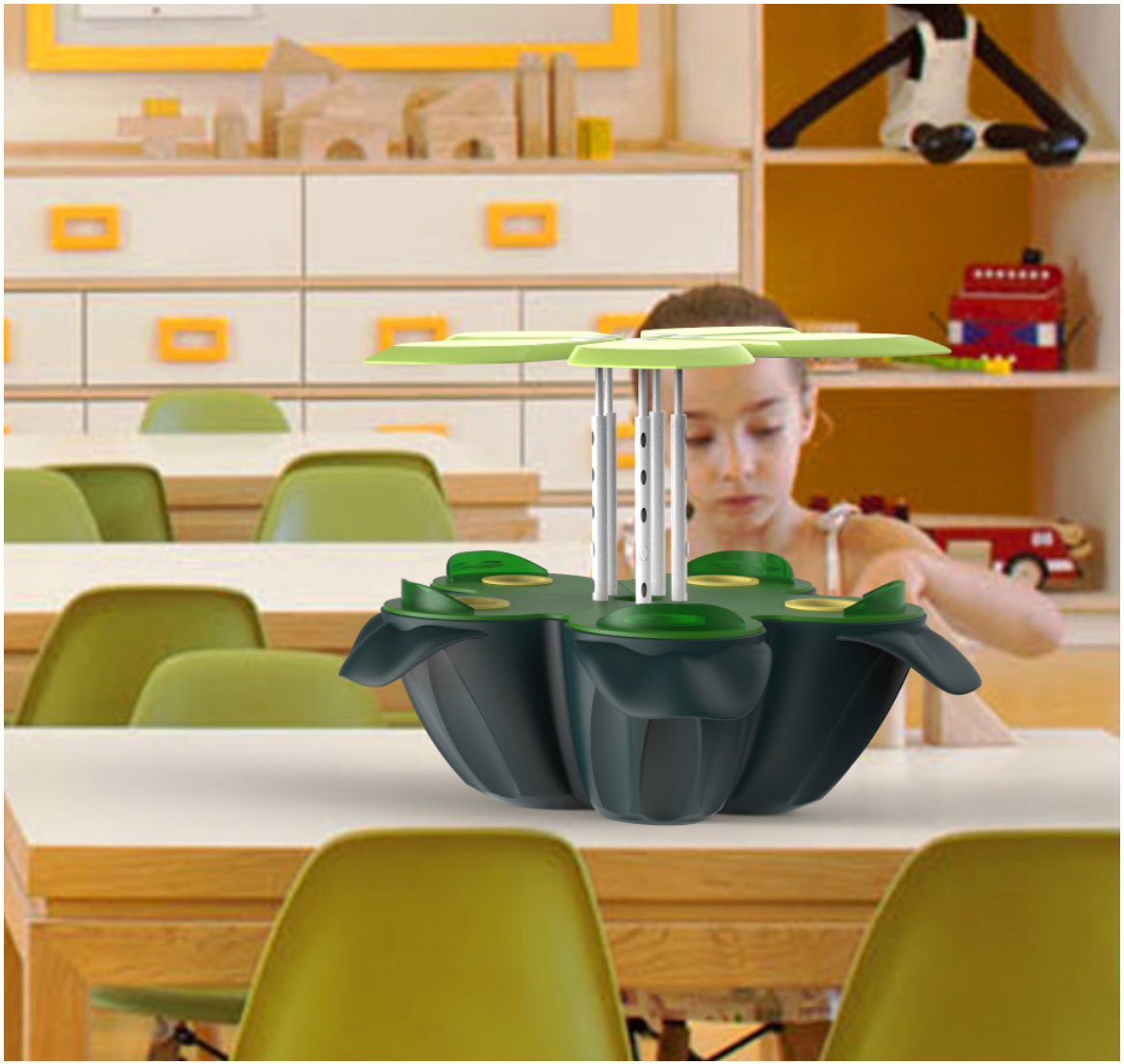





adjustable telescoping lights
net cups to hold plants
holds water
removable lids (and view roots)



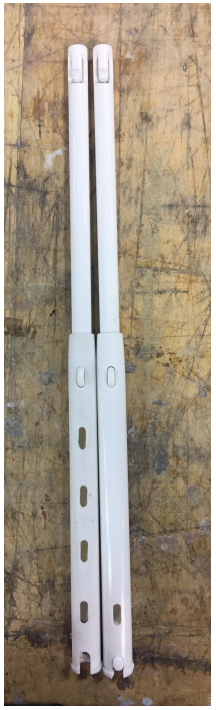




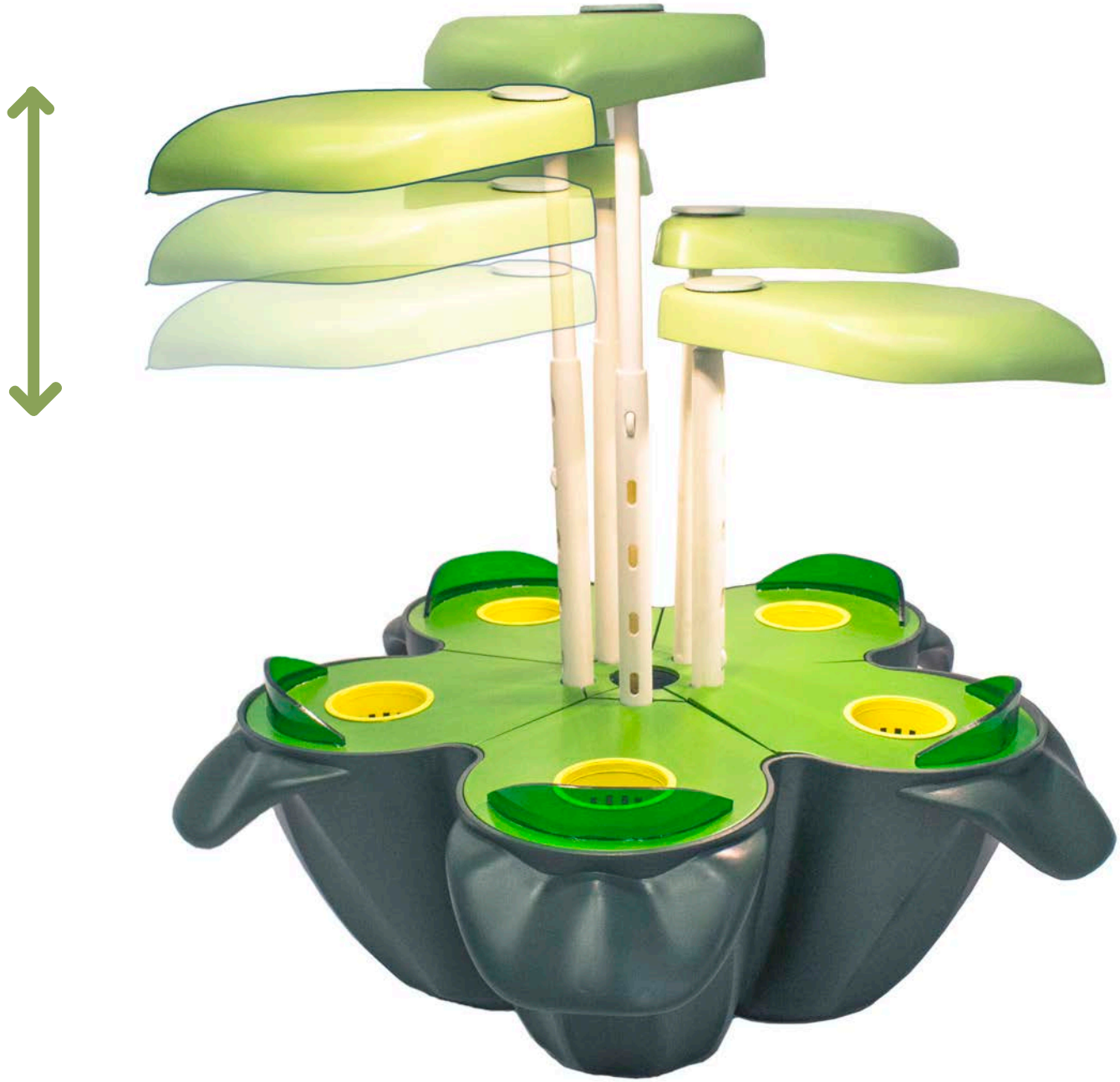
FINAL PROTOTYPE

Instead of vacuum forming the base, I had each cavity individually 3D printed. To smooth the ridged 3D print texture, I rubbed the surface with acetone to slightly melt the plastic.

To the right are the vacuum formed light fixtures, lids that I had laser cut, and telescoping support poles.




Titebond
ULTIMATE



Lil' Sprouts