Inspiration for Design

Ross Lovegrove Studio
June - July 2007
Cloe Shasha

Preface to Research
for aeroponic light

Cloe Shasha

In the fall of 2007, I began my gap year in Paris, France, where my family started their sabbatical year. After the summer, I was struck with unanticipated withdrawal from the intense pace of academia. So I began to structure my own learning time by reading non-fiction novels, science magazines, and newspapers.

Malcolm Gladwell's book "Blink" initiated my fascination with industrial design. In one chapter, he discusses subconscious human response to brand names and bottle form through the taste-testing of champagne and other drinks. The tests were well controlled to prove that the drink itself mattered a lot less than one would imagine. The presentation and packaging of food primes the human brain to judge the contents within the containers with a premature prediction of their quality and taste. Likewise, certifications can affect judgment. As many residents of health-crazed cities know, the label "organic" can alone convince many customers to pay twice the price for a restaurant's salmon special. Obviously, "organic" does not directly translate to "tastier", nor does it guarantee a more healthful option. As the fish farming industry globally expands (such as the number of salmon and sea bass farms in Chile), more fish are found to be contaminated with mercury and other toxic metals. The truth is that organically farmed fish does not imply that the mercury is eliminated from its flesh consumed by the public. In fact, most countries' relevant organic certification standards would allow salmon to be sold under the certified label as long as the food pellets fed to the fish were manufactured from the synthesized compression of rejected organic fish body parts. These body parts, such as livers, often store the toxins that the organisms attempt to filter and expel from their systems. Therefore, when the organic salmon eat these organic pellets, they are introducing higher concentrations of toxicity into their organisms than they would be if they were living in a natural environment. (For this reason, "wild" salmon is actually a better choice for long-term health.)

The general population is too often shielded from the truth when marketing and economic motivations compose the backbone of a product's public image. My interest in the power of presentation, packaging, and labelling is that it affects the choices that people make. I want to make carbon-neutral products and the most healthful options an immediately obvious choice. Often, environmentally friendly choices and the best quality foods are not more expensive than inferior alternatives.

However, in this era, even within the higher-educated population, the consumption of superior products with both economic and environmental benefits versus their older alternatives is too rare. Is knowledge so inaccessible to the public that incandescent bulbs are still thought to be "better" than the dual benefits of fluorescent bulbs? Not only is the effective cost to life span ratio of fluorescents much lower, but fluorescents are also four to six times more efficient than incandescent lights. This knowledge, however, does seem to travel. Perhaps, then, people are immoral and they cackle at their high carbon footprint contributions to global warming.

The above are doubtful conclusions. There are three reasons that I attribute to the well-informed population's refusal to consume superior products.

1. The laziness to make an effort to change or to research access to better options.

(Continued)

2. The human desire to preserve "traditions" that evoke personal nostalgia, when---in reality---the right fluorescent light bulb could easily replicate the warm yellow hues of a short-lived incandescent.
3. Bad presentation, packaging, or labels---in essence: bad design.

I brainstormed over reason three.

When it is well done, a design can effectively convey the truth about the contents or function of the object. This is in the power of industrial designers.

After reading "Blink", I began to research industrial designers. What are designers like? Do they care about the subconscious implications of their physical forms for functional objects? Who are the people who design biodegradable packaging? Do they truly care about the environment, or are they finding ways around regulations in order to project a virtuous image and increase profits?

My dream is to make environmentally friendly objects be the most aesthetically appealing, and to preserve or even lower the price of the products in comparison with the ugly alternatives comprising the same materials. This also translates to packaging the most healthful items in the most beautiful containers without augmenting the price.

Material reduction is an important factor as well. Our land is stuffed with more waste every day, and bulk accumulates and contributes to other negative effects on the environment. Biodegradable packaging, small surface area to volume ratios, and good design to promote consumption of these products should be a goal of all industrial designers.

While reading about industrial designers, I wondered, "who strongly believes in and---most importantly---acts upon this goal?"

Then, through the wonderful search engine of Google, I encountered articles and information about Ross Lovegrove. The TED (Technology, Entertainment, Design) website contains the video of Ross Lovegrove's speech, "The power and beauty of organic design."

It was immediately clear to me that the opportunity to see, experience, intern, or work at his studio would be ideal. Seven months later, after having returned from the Barefoot College in Tilonia, India, and from a plant biology laboratory in Santiago, Chile, I found out that I had only one degree of separation from Ross Lovegrove. I was therefore able to email him and eventually talk with him on the phone.

In the summer of 2007, Ross granted me the opportunity to intern at his studio. He assigned me to a project involving plants and light. The project drew on my entire year's experience. Though the direction changed over the six weeks, the basic theme did not: the conservation of energy. In India, I had built solar lamps and translated instructions for installing solar panels from English to French. In Chile, I had been working in a biology lab, doing genetic tests on the plant Arabidopsis Thaliana.

I was assigned to research any possible ways to produce light from plants for a lamp concept for the company Artemide. Ross sketched me an image of a plant growing that glows. On my first day, Pierre Jusselme wrote on a piece of paper to start me off: "hydroponics, photosynthesis, biopolymers, generating energy /electricity from plants".

The section titled "initial research" contains the summarized version of the research I did before the project took a different turn. After a week and a few days, I understood the relationship between the complexity of my goal and my time at the studio. I did not have enough time to truly be productive with that precise theme. While there is a lot of research being done about getting energy from natural sources, no established findings revealed promising material for the specific concept---although I have faith that Ross will collaborate with researchers and professionals to make it happen.

In the meantime, I began to brainstorm ways in which a lamp could incorporate plants and conserve energy at the same time. These thoughts, in collaboration with Ross's design ideas for the mechanics of the theory, evolved into this project.

An Introduction *to aeroponics*

Maintenance

1. An aeroponic system can be maintained with a timer.
2. Its nutrient solution must have a pH between 5 and 6 and must be changed every two weeks. The initial solution volume needs to be maintained. If some solution evaporates, add water without fertilizer.
3. Energy-efficient fluorescent or LED bulbs can be used for the system.
4. Air circulation is important for plant access to carbon dioxide, and for the prevention of contamination.

Source of Nutrients

1. Many companies sell nutrient solutions for aeroponic systems. Most of the nutrients for these solutions are created synthetically.

Benefits of Aeroponics

1. Esthetically, they display the full plants more beautifully than soil pots do---and -they especially would if they could grow in clear containers.
2. Compared with plants in soil, aeroponic systems save water, and the water is recycled within the system for two weeks.
3. Vegetables and fruits grown with this method mature faster and are often more nutritious than plants grown in soil.
4. They conserve space because the roots do not need to spread out.
5. Essentially any plant that can grow in soil can grow with aeroponics.
6. Contaminants are rare in aeroponics due to the sterile nutrient solution.

Carbon Footprint?

1. Aeroponic systems do not harm the environment.
2. Studies do not show negative environmental impacts resulting from extraction of nutrients for the creation of aeroponic nutrient solutions.

Mesh pots with propagation blocks, ready for seeds.

Detailed Diagram of Setup *for germination period*

1. Mix the proper amount of nutrient solution into the necessary quantity of water in order to pre-soak the propagation blocks.

2. Test the pH of the mixed solution, and adjust it to a pH between 5.5 and 6.

3. Soak the propagation blocks for several hours, and then remove them to let them drain excess water for 24 hours.

4. Select the same number of seeds as propagation blocks. In this case, that number is 12.

5. Place one seed deep into each propagation block (that has already been soaked and drained).

6. Place each seed-filled block into a mesh pot.

8. Leave your aeroponic system like this for 10 days during the germination period.

7. Place all filled mesh pots into a support tray, and place the tray over a container with a shallow quantity of pH balanced and 1/4 strength nutrient solution. The lamp and pump are not yet in use.

Aeroponic Setup
for basil

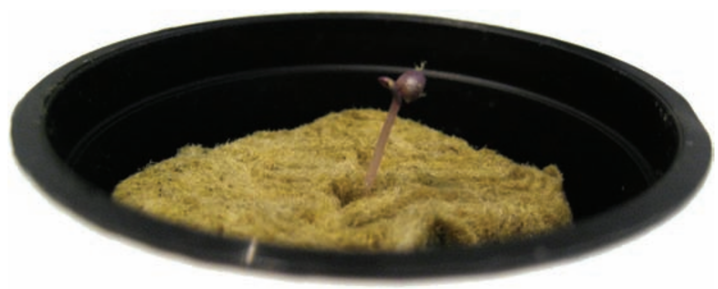
Basil Dark Opal seeds germinate in approximately ten days, and prefer darkness until their roots are visible. But before they can be planted, other steps must be completed.

1. Set up the pump and misting nozzles in the reservoir.
2. Fill the reservoir with water and nutrient solution, according to the water to nutrient ratio written on the nutrient bottle.
3. Adjust the pH of the solution by taking samples of the mixture and adding pH-altering compounds accordingly.
4. Pre-soak the propagation blocks in 25% strength nutrient solution, and then leave them out to drain excess water for 24 hours.
5. Distribute one Basil Dark Opal seed per propagation block.
6. Place propagation blocks in mesh pots.
7. Place mesh pots in the support tray.
8. Cover the whole system for approximately ten days, until the seeds germinate. Occasionally mist blocks with pH balanced 1/4 strength nutrient solution when dried out.

Basil

Cultivation
after germination

In the photograph above, taken on July 9th, 2007, a baby Basil Dark Opal shoot has germinated in the aeroponic unit. It was planted on June 27th, 2007.

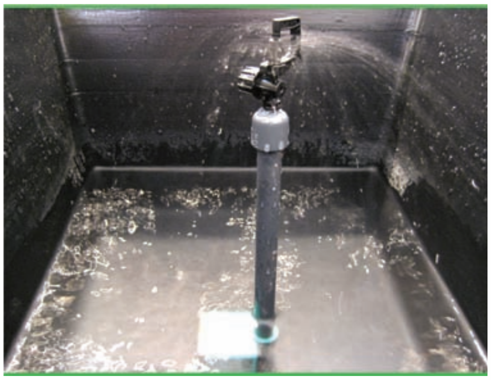


The head will become the purple basil leaves, and the pink shoot will split off and grow more leaves.

The germination period often takes ten to fifteen days with low light and a protective cover. Once the majority of the propagation blocks have a shoot at least as large as the one in the photograph, then:

1. Change the nutrient solution to 1/4 strength, with the correctly adjusted pH (between 5.5 and 6)
2. Activate the water pump to mist the propagation blocks in their mesh pots, and leave it on at all times.
3. Set up the timer so that the light is on for twelve to eighteen hours a day.
4. When plants begin to grow taller, change nutrient solution to 1/2 strength.

Detailed Diagram of setup after germination

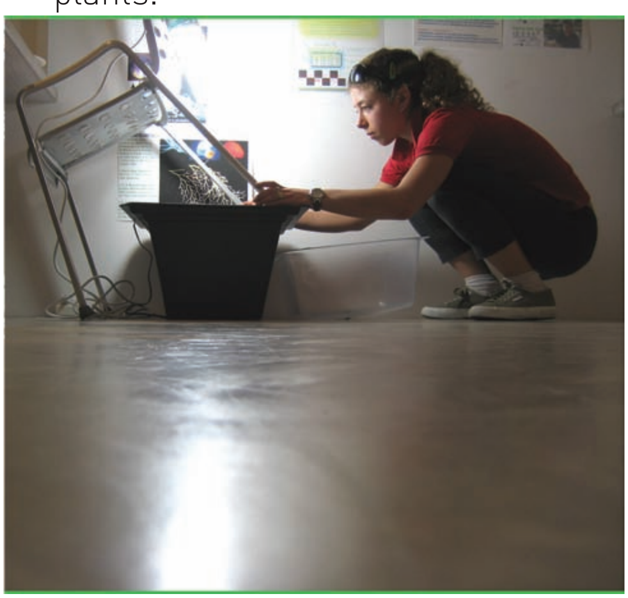


1. After having changed the nutrient solution with the appropriate concentration, set up the water pump. Simply plug it in and let it run at all times in order to spray the roots of the growing baby plants.

2. Plug the light timer into an outlet, and set the timer to the appropriate hours of light and darkness per day according to the plant's require-ments.

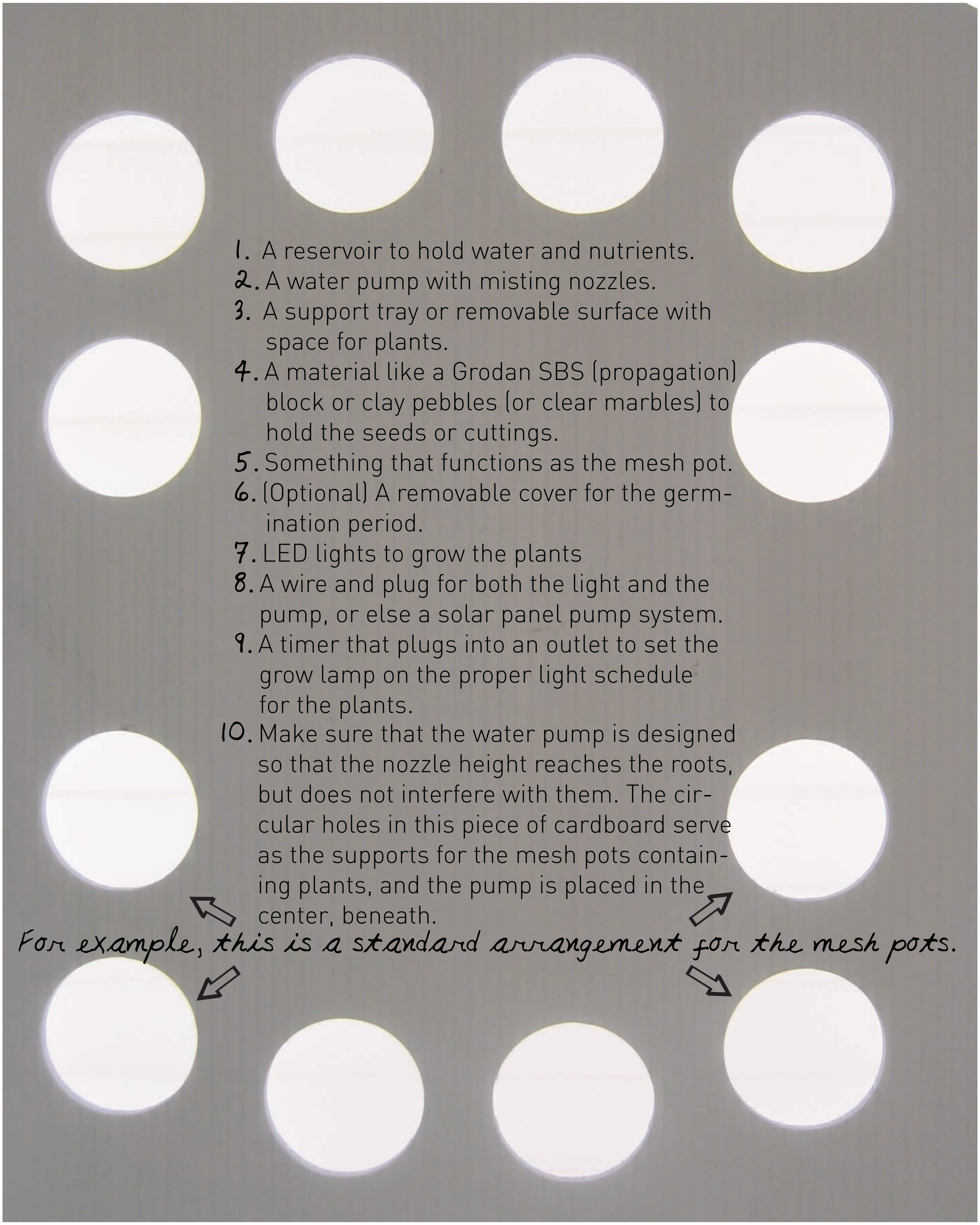
3. Plug the lamp into the timer. The light source (fluorescent versus LED) must be taken into account when setting the timer. In the case of this basil aeroponic system with fluor-escent light, newly germinat-ed plants require 12 hours of light per day.

4. Suspend the light at least 6 inches (15.24 centimeters) away from the plants.



5. The final setup requires no maintenance for 2 weeks, until the nutrient solution needs to be changed again.

The Components *for the design*



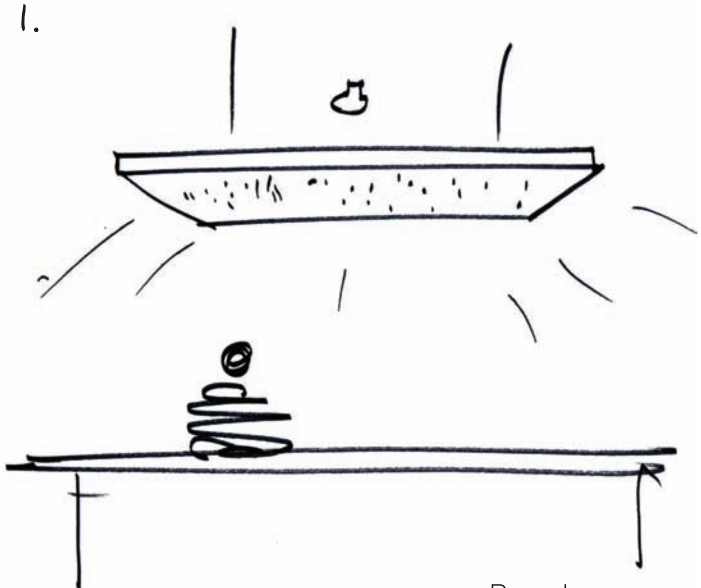
1. A reservoir to hold water and nutrients.
2. A water pump with misting nozzles.
3. A support tray or removable surface with space for plants.
4. A material like a Grodan SBS (propagation) block or clay pebbles (or clear marbles) to hold the seeds or cuttings.
5. Something that functions as the mesh pot.
6. (Optional) A removable cover for the germination period.
7. LED lights to grow the plants
8. A wire and plug for both the light and the pump, or else a solar panel pump system.
9. A timer that plugs into an outlet to set the grow lamp on the proper light schedule for the plants.
10. Make sure that the water pump is designed so that the nozzle height reaches the roots, but does not interfere with them. The circular holes in this piece of cardboard serve as the supports for the mesh pots containing plants, and the pump is placed in the center, beneath.

For example, this is a standard arrangement for the mesh pots.

The Evolution of Ideas *for environments*

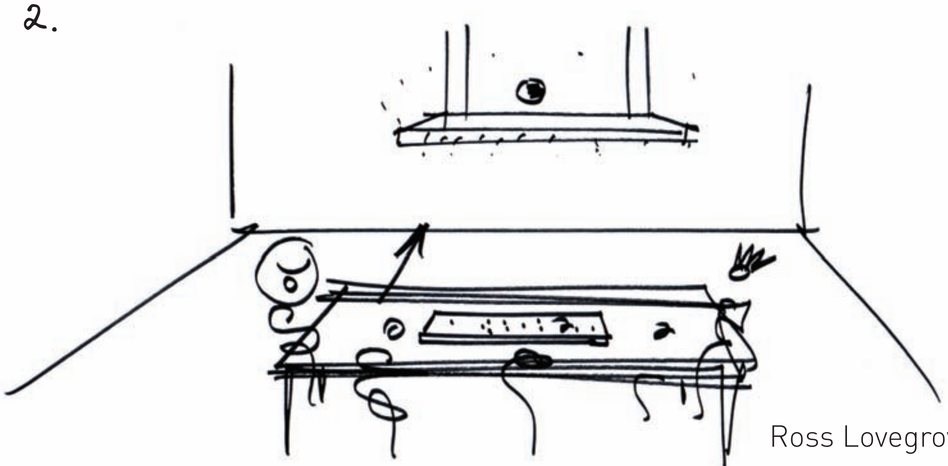
1. An aeroponic lamp system, hanging from the ceiling, over a dining room table, with a view of the roots.
2. An aeroponic lamp system that can lower down onto the table for dessert. Hosts and guests can indulge in fresh strawberries grown by the overhead lamp.
3. A silicone sack surrounding a longer, narrow aeroponic system, with a lamp at its base that provides light for the duplicate object below. These silicone aeroponic lamp systems would be installed on a wall in a row.
4. The silicone sack aeroponic lamp systems displayed in a living space in a row. Also present is the concept of "Natart" (Nature Art): a frame of live plants growing vertically on the back wall.

1.



Ross Lovegrove

2.



Ross Lovegrove

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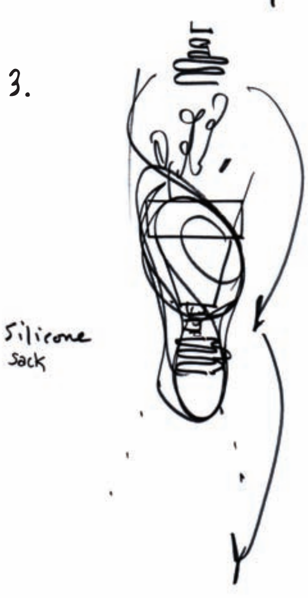

Ross Lovegrove

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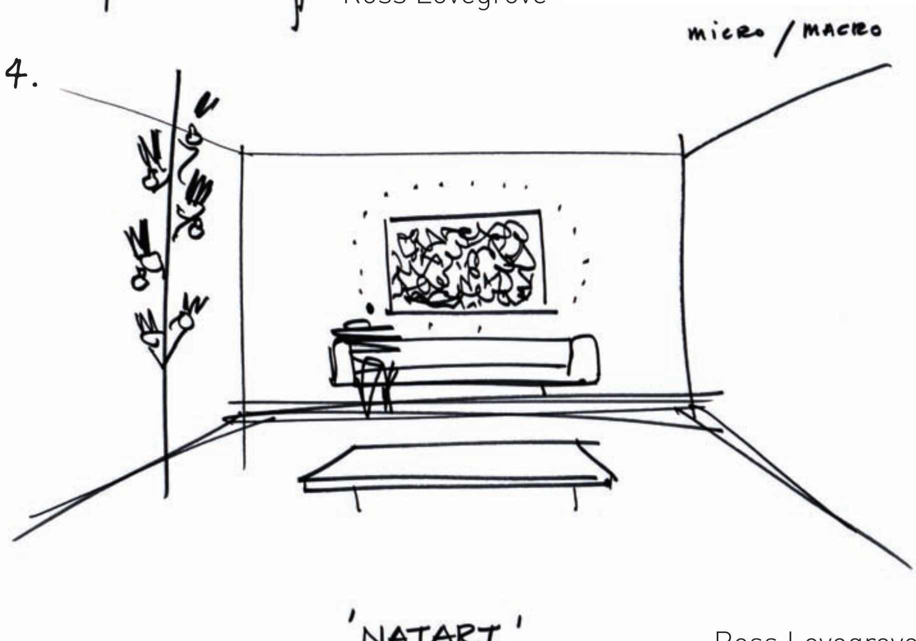
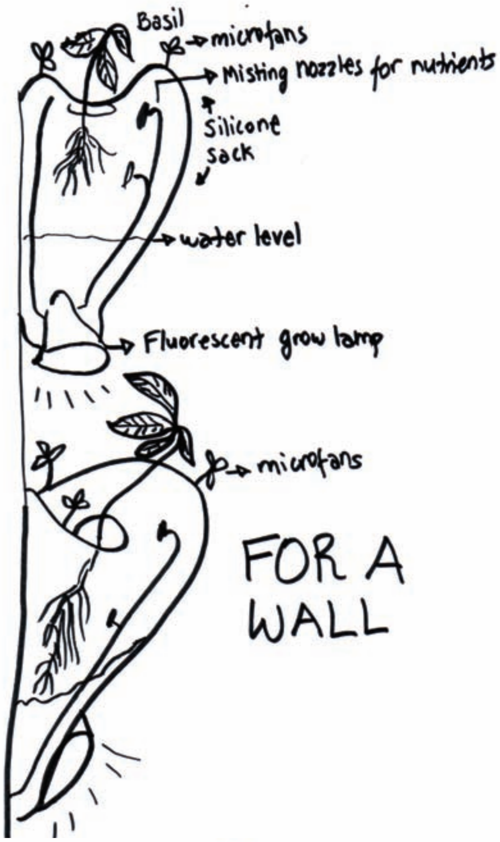
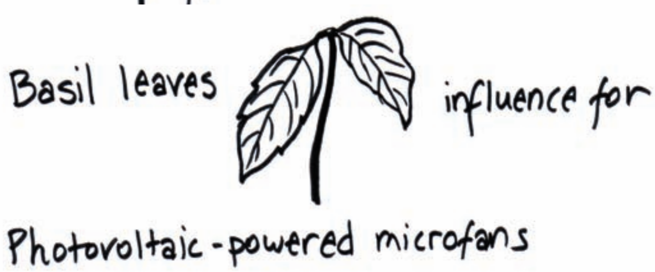


Ross Lovegrove

From Flower to Form *in silicone*

The Nepenthes flowers in a row on the wall.





One idea for the conservation of energy from the grow lights.

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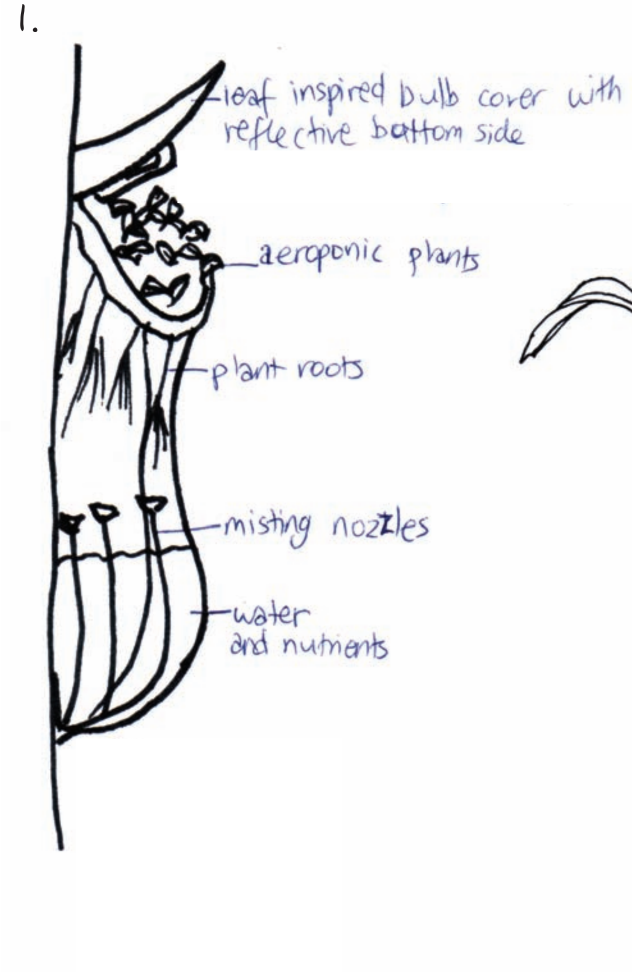
Now imagine them made of silicone shapes, with aeroponically grown basil leaves sprouting from the top surfaces.

The Structures and Logistics of aeroponic design

1.



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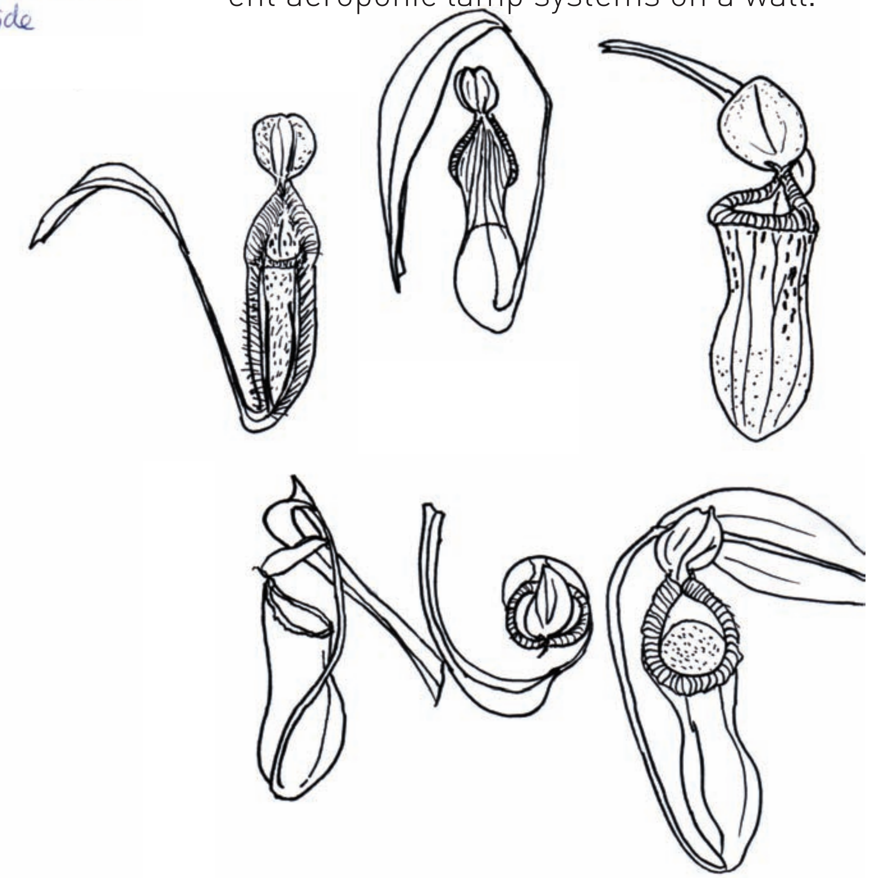
1. Using the influence of the Nepenthes flower form to design a row of interdependent aeroponic lamp systems on a wall.



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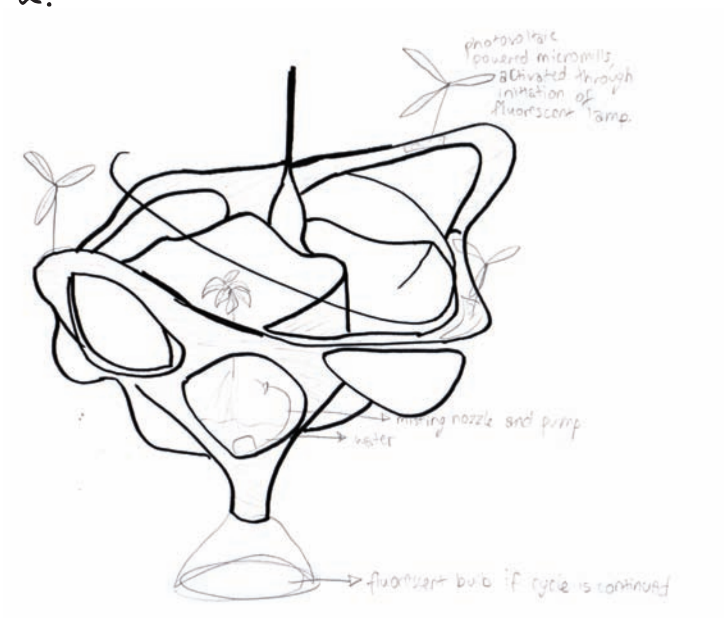
2.



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2. A possibility for a next generation: Using the Lovegrove planter design below, developed by Gernot Oberfell, to incorporate an aeroponic lamp system.

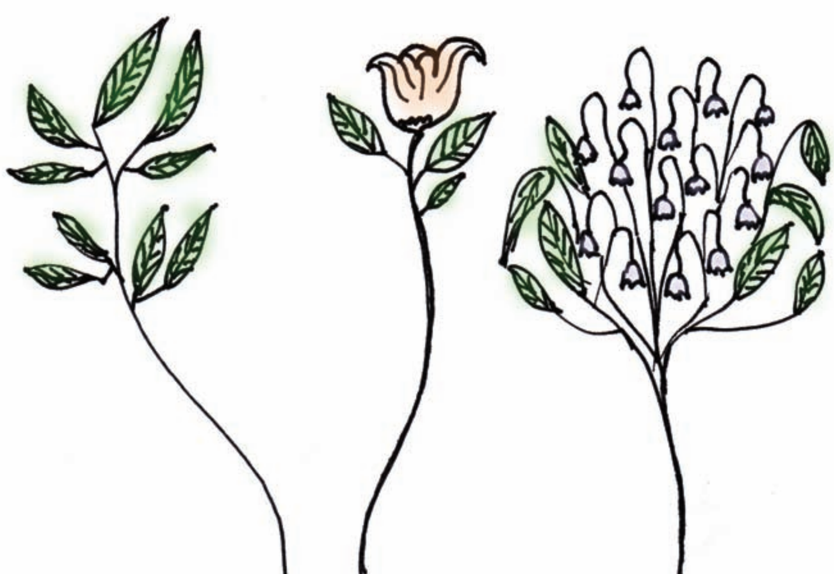
Light *for the plants*

1. LED lights, with at least 100 lumens per watt, are good grow lamps. They can be placed close to the plants because they produce little heat. Good ones use less than 2 watts of power, and have over 80 wavelengths. A balanced mix of 83% red and 17% blue LEDs offers a complete light spectrum for photosynthesizing organisms.

2. The organization and number of these lights can be designed according to the number of plants growing beneath each lamp. More plants require more light. The closer the distance between the light and the plant below, the less light needed. If a lamp is placed too close to the plants, then it will overheat them. The ideal height is at least 6 inches (15.24 centimeters) away from the plants.

3. LED grow lamps that have already been invented for plants have the following light to plant area ratio: A 6 by 56 centimeter bar with three small LED lights can cover an area of 31 by 62 centimeters of plants. Therefore, if only approximately 10 by 10 centimeters of plants are being grown per system, one small 2.54 by 7.62 centimeter LED light should be sufficient.

Just one of these LEDs is sufficient for a small area of plants.



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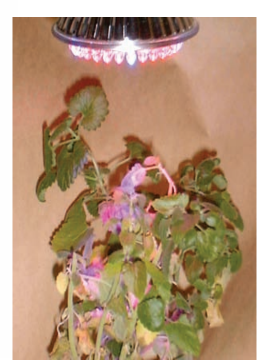


Supporting *the roots*

The propagation block can be redesigned or eliminated from the aeroponic system.

Options:

1. Redesign the form and color of the material.

2. Use an entirely different porous material.

   a. Marbles

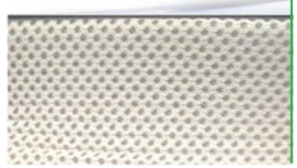
   b. Clay pebbles

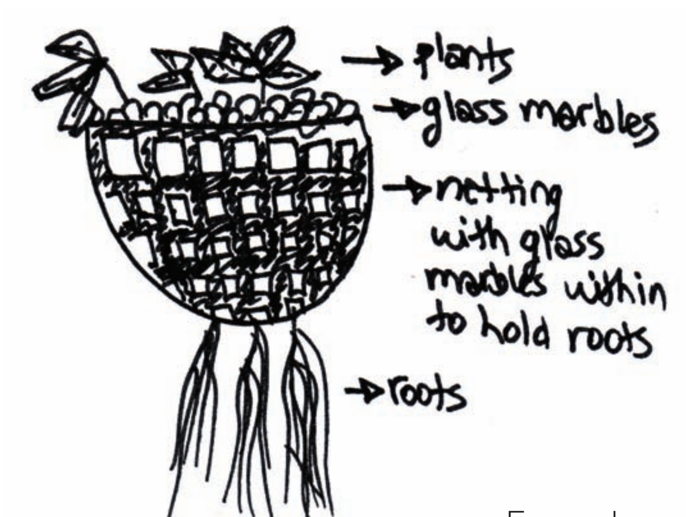
   c. Waterproof foam substance

   d. Mesh

The only requirement for a good root support system is a porous substance or a collection of small objects. The selected material must allow the seed to propagate and be capable of holding the shoot and root in place after germination. In general, germination is most successful in substances like foam and mesh, but already germinated shoots with roots can live well in marbles or clay pebbles.



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Example *a.*

Misting Nozzle setup

Below are two methods for an efficient and functional misting nozzle setup.

Concept 1

Needs 2 power inputs:
1. Light
2. Motor

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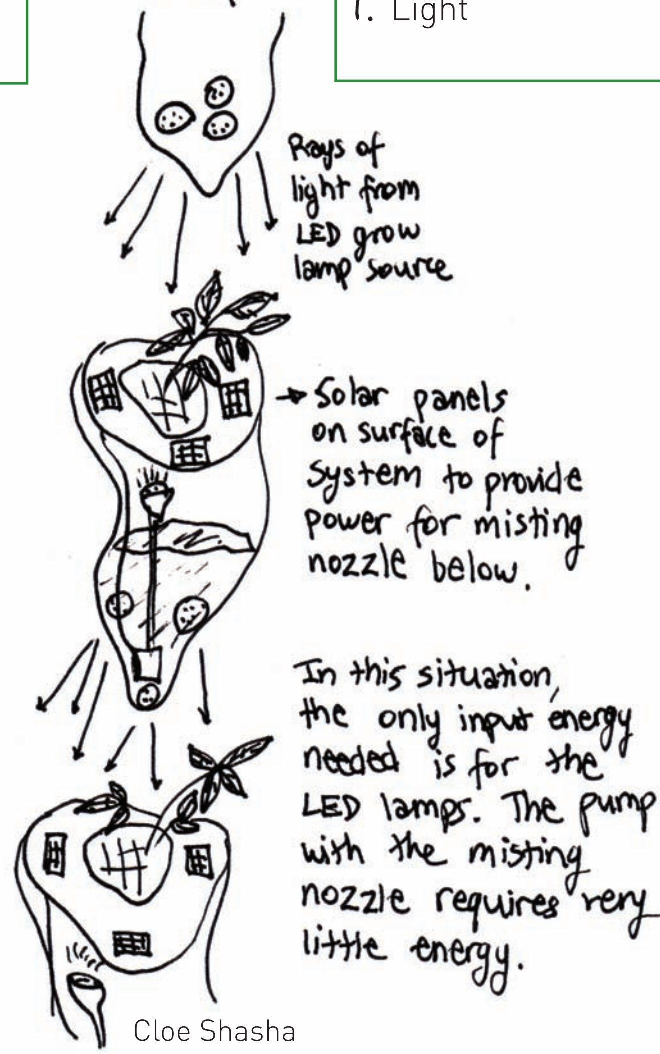
Concept 2

Needs 1 power input:
1. Light



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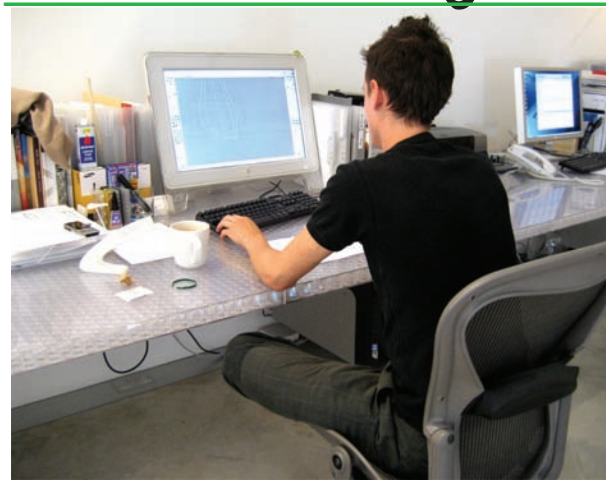
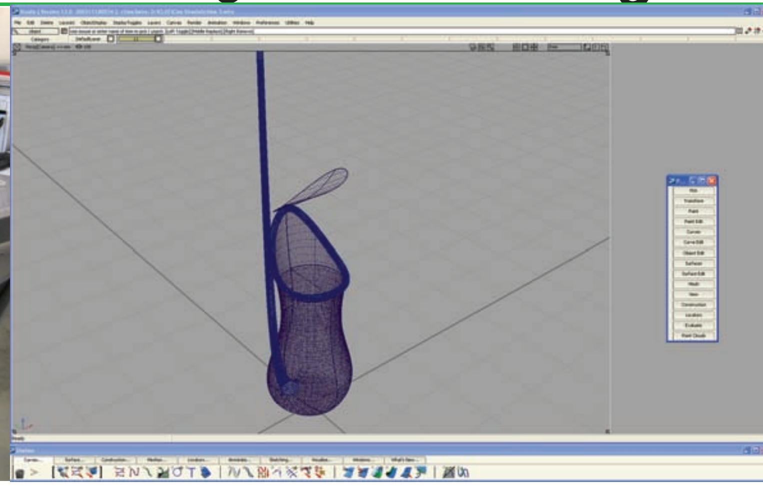
Physics:

1. The kind of motor needed to propel the rotating misting nozzle is a simple one. The mechanics behind this setup are cheap.
2. The design will provide an energy advantage if the pumps do not transport water too far in vertical directions. Local water circulation is more efficient.
3. Separate water systems and pumps in each unit provide the benefit of a modularity advantage, since levels can be added and removed at will.

Using Alias for *the rough draft design*





Matthew Longbottom used the design and diagram sketches of the rough draft Nepenthes flower form, and created this three-dimensional form on the program Alias. The images below show different angles of the silicone aeroponic shape. (Lovegrove Studio, July 2007.)

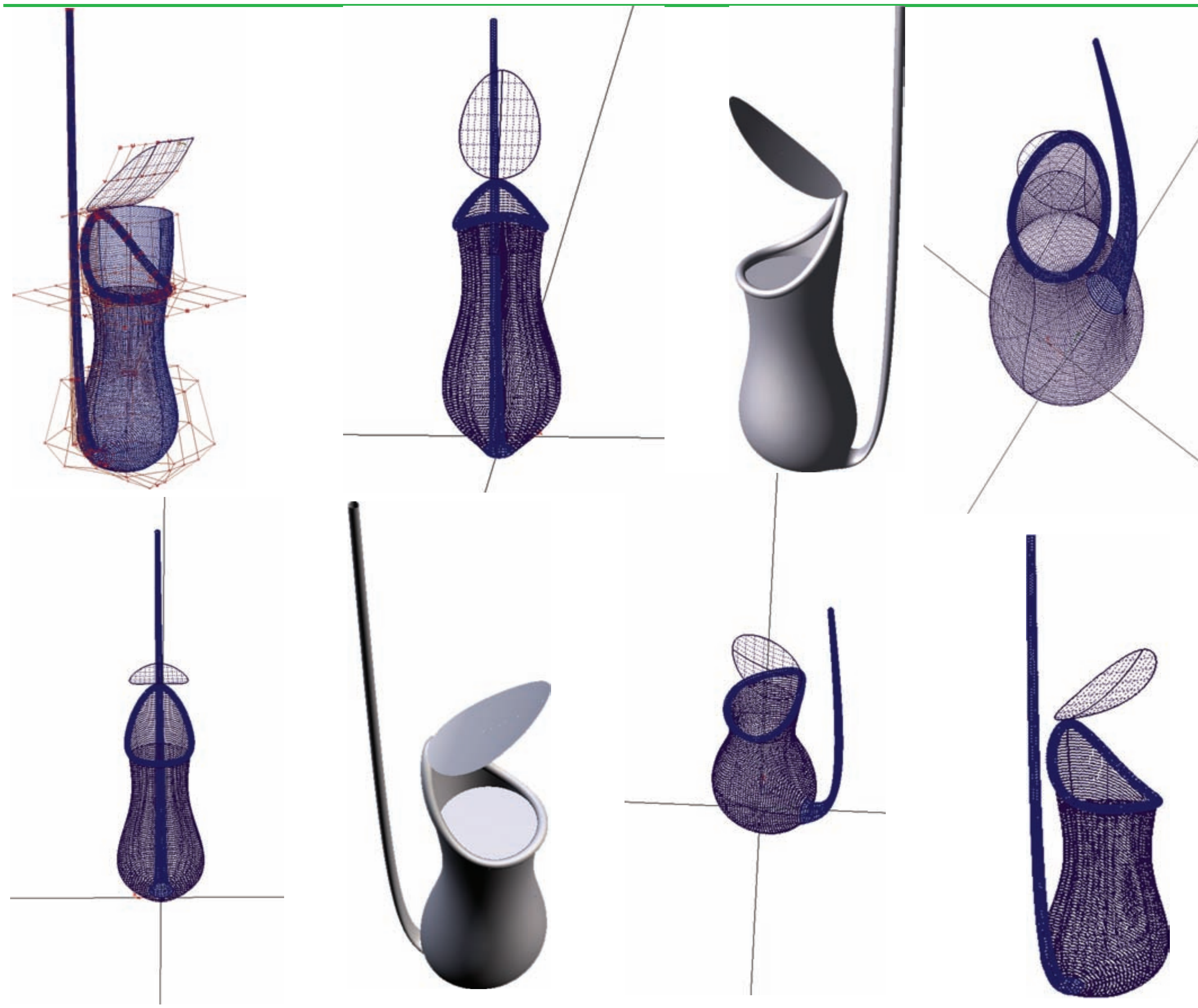
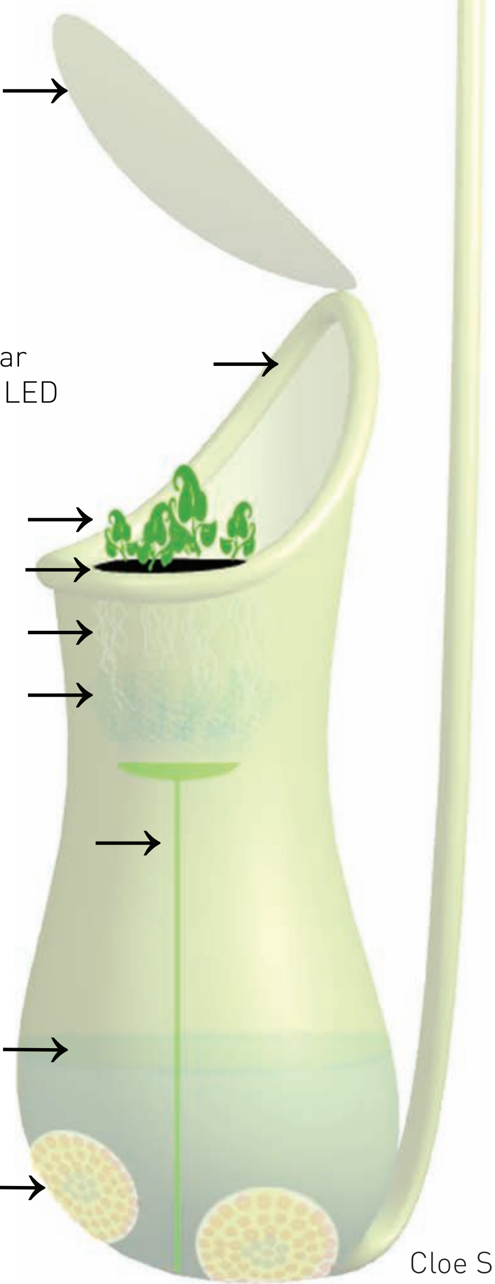


Diagram
for models 1 and 2

Model 1:
Light from unit above powers individual pump and misting nozzle through solar panel mechanism.

Model 2:
One pump attached to a power outlet controls all misting nozzles simultaneously.



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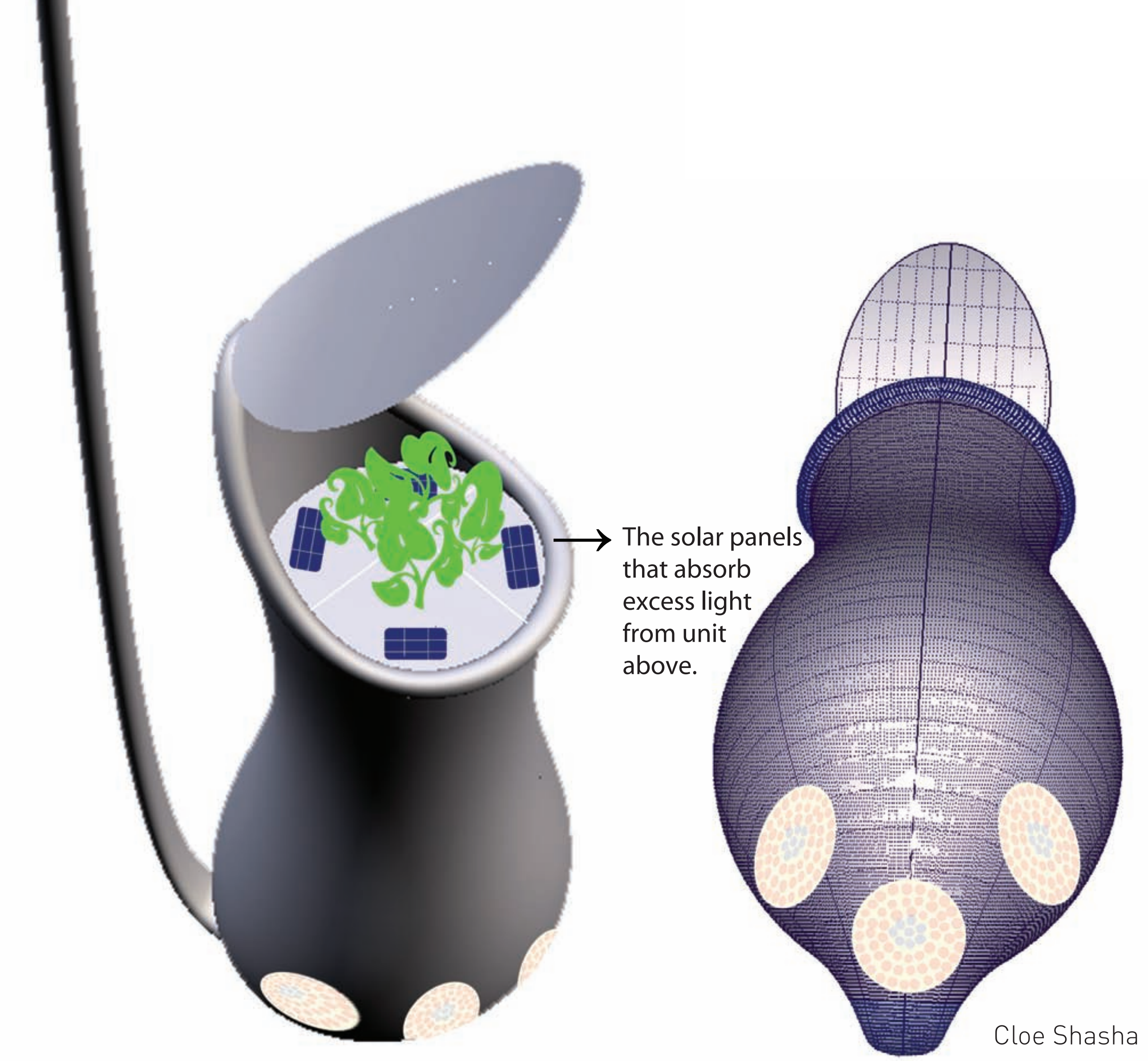
Views
of model 1

1. Inspiration from the Nepenthes flower form.
2. An installation for a kitchen or living space.
3. A design with easy access to the nutrient solution and plants. Assume the plants will be cultivated for food use.
4. A translucent silicone sack enveloping the aeroponic system.
5. The base of each form holds the LED lamps that provide light for the growth of the next lamp's plants. Through the solar panel design, the excess light from the unit above is transformed into energy to power each individual pump and misting nozzle.
6. A row of these forms to install on a wall as lamps and plants.



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Pump Design for *model 2*

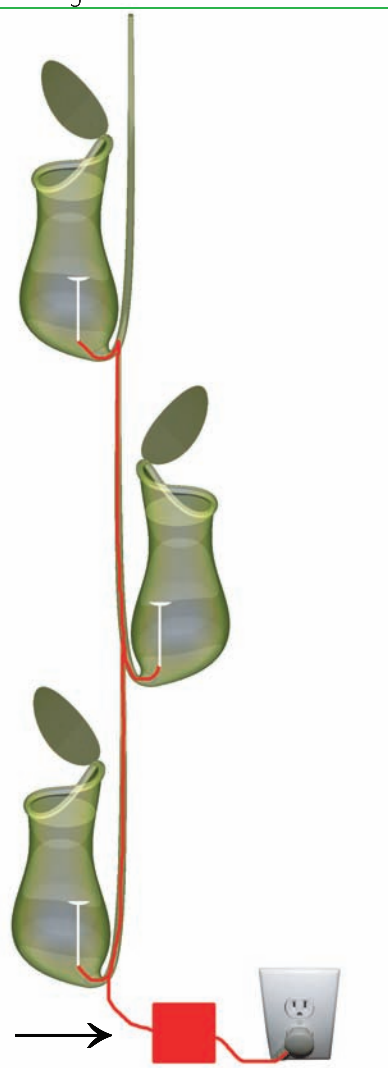
Think *MODULAR*. Below is a patent for a pump:

Title: Modular submersible pump
Link to this page: http://www.freepatentsonline.com/20020182055.html
United States Patent 20020182055
Kind Code: A1

Abstract:
The present invention provides a modular submersible pump comprising a motor section, bearing section and a pump section. The motor section includes a motor frame and a motor shaft. The bearing section has a bearing frame removably connected to the motor frame of the motor section. A removable cartridge is disposed within the bearing frame and has a shaft extension connected to the motor shaft. The cartridge includes at least one bearing and at least one seal in communication with the shaft extension. The pump section has a pump case removably connected to the bearing frame and having an impeller disposed therein. The impeller is connected to the shaft extension of the removable cartridge.

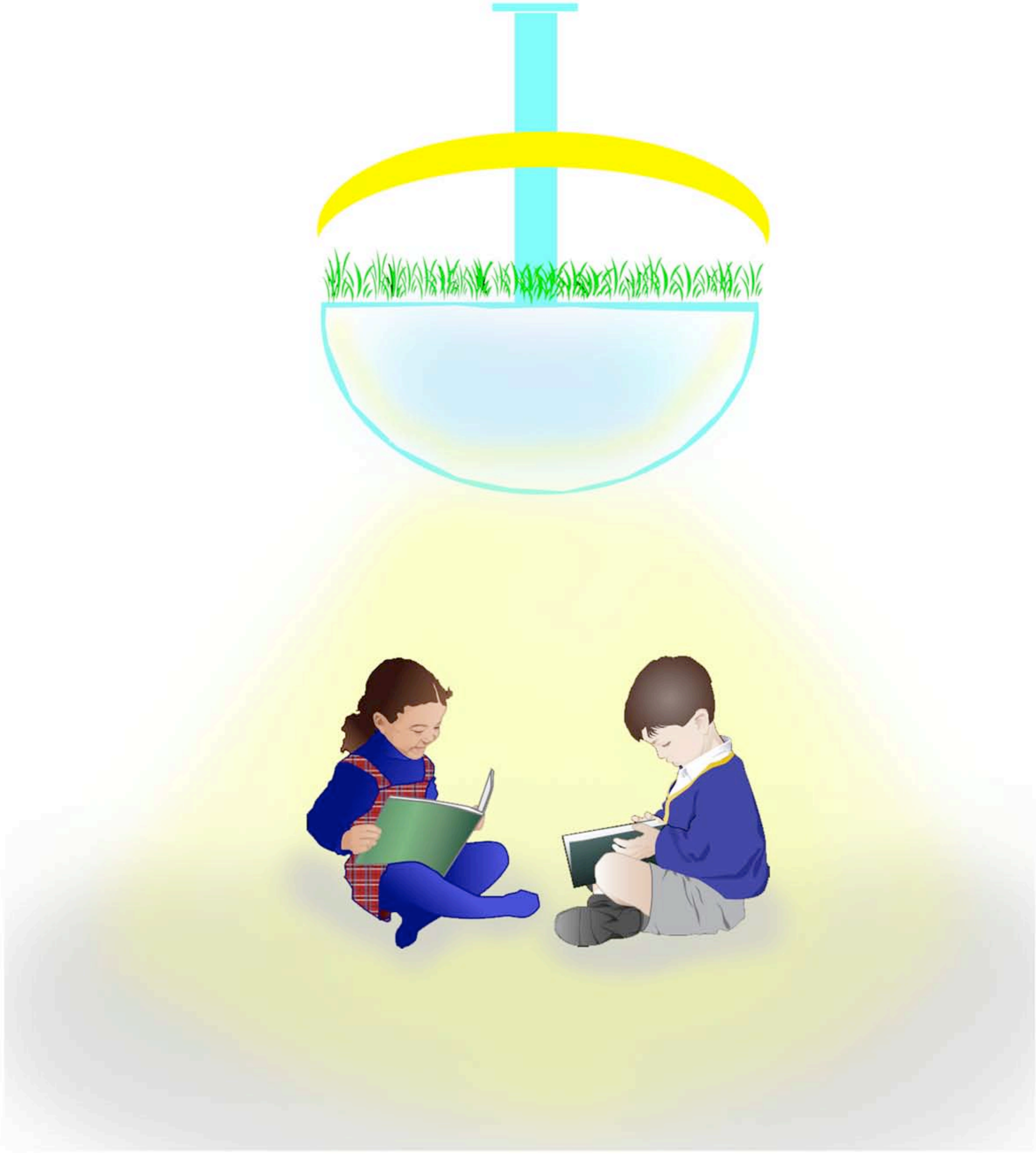
Applying the system to Model 2:

Concept:
One motor with only one outlet needed in order to power misting nozzles in many separate water containers.



Wire from pump that attaches all units, powering the misting nozzles.

The Row of Plants on the Wall *provides illumination*



the hydrolight solution

your indoor hydroponic vegetable garden

is

your home lighting

Reference
and acknowledgments

Sketches:
Ross Lovegrove
Cloe Shasha

Alias Model:
Matthew Longbottom

Adobe Photoshop Diagrams and Images,
Photographs in Lovegrove Studio,
Alias Renderings,
Research,
Text:
Cloe Shasha

New Lovegrove Plant Pot Design (white form on cover):
Ross Lovegrove
Gernot Oberfell

Photographs of Basil:
http://www.fotosearch.com/

Photographs of LED lights:
www.gro-tek.com

Photographs of Porous Material Samples:
www.alibaba.com

Images of Children Reading:
The Peirce Clipart Collection:
http://clipart.peirceinternet.com/educ.html

My warmest thanks to everyone in the studio for an unforgettable six weeks.

This project would not have been possible without several people.

Matthew Longbottom, who so kindly complied with my request on a whim to work with me and create a three-dimensional Alias model of the design. He also asked his mother to ship some of his beautiful Nepenthes flowers from a fish tank in his bedroom to Lovegrove Studio, so that we could play with them while working with a conceptual design.

Pierre Jusselme, who spent quality time advising me over the processes for my work, and giving me direction even when he had his own pressing responsibilities and time-commitments.

Ross Lovegrove, who gave me the opportunity to intern at his studio, and incorporated me into a wonderfully passionate and dedicated work environment. He gave me the benefit of the doubt without ever having met me, and gave me the chance to incorporate a fascinating field of research into a project for industrial design.