PRELUDE

Each year I enjoy initiating a project for the purpose of personal development. I often use it as a way to explore new mediums, materials or subject matter that I know nothing about. I allow myself to experiment, deviate and of course fail a few times for the sake of learning.

This year I decided to research the common honeybee and explore the possibility of finding a design solution to improve the current decline of bee populations.
I began at the top with the commercial bee industry and discovered a troubled honey industry plagued by thin profit margins forced to compromise their bees health for profits. As I worked my way down I discovered a growing population of passionate people with an appreciation for the environmental and social aspects of keeping bees. What I found most interesting is the social component of beekeeping and how word of mouth is the primary source of information. Just as it was in previous generations, the sharing of information, tools, and bees are incredibly important to sustainability and growth of the hobby.

Perhaps the most interesting aspect that I discovered is how many people have come to get their bees. Just as hives split in nature to grow their species, people seem to be following suit by making a habit of spitting their hive each year and giving it to an interested friend. With this in mind, I began to see that there is indeed a possible solution to improving bee populations at a grassroots level. By starting small project of giving away even just 10 hives could duplicate to well over 10,000 hives after 10 years. This was the foundation of my design exploration into urban hobby beekeeping.

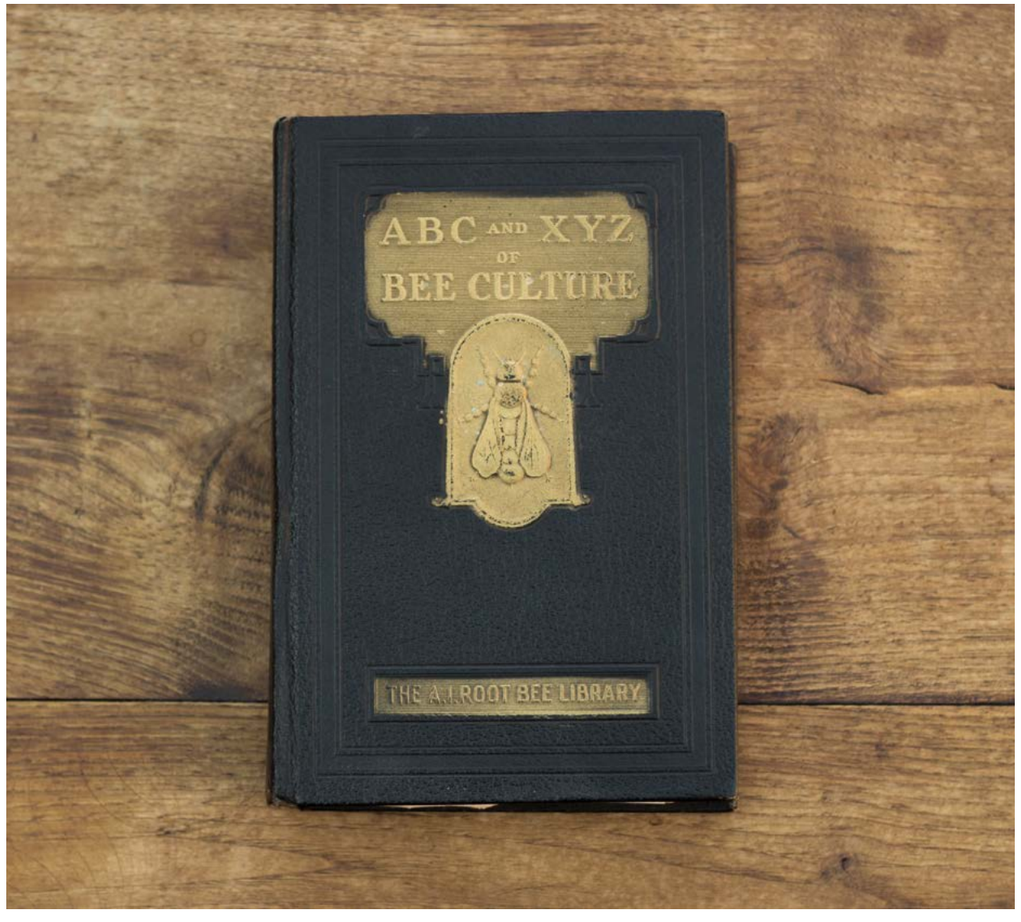
NATURE VS NURTURE

The plight of the common honeybee has been well documented over the last decade and is slowly resulting in a resurgence of interest in the hobby. This increased interest combined with the fact that the urban and suburban landscape offer significant advantages over rural areas, urban beekeeping has a lot of potentials to revive a struggling bee population.

My goal for this project was to examine the positives and negatives of existing beehives and design a tool that makes the hobby easier or more accessible to a greater audience. I would need to consider the constraints of compact urban spaces and the importance of form factor to the urban audience as well as the nuances of bee behavior. I would need to explore both traditional and non-traditional approaches as well as place an emphasis on incorporating technology if it was appropriate and could improve the process.

I decided to approach the project from two points of view. The first or "Nature" placed priority on designing for the bees, while the "Nurture" placed emphasis on designing for the Keeper. By going in both directions I would be forced to approach the problem from a variety of different angles and hopefully find overlap and a solution to best suit the problem.

To outline the project, I defined a few core values that would guide my decision making process. Not only would it have to work well for both bees and people, it would also need to work with readily available equipment or materials. It would need to have minimal environmental impact and eventually be created solely from natural or recycled materials. Although not absolutely necessary, I placed an emphasis on scalability and the ability to make it myself.



RESEARCH

Before I began the design process, much time was spent reading and interviewing people about the intricacies of beekeeping. Working with other experienced beekeepers was the best source of information to get started with, while technical books and academic papers offered a wealth of knowledge as my questions got much more specific.

The best source of information that I got was from getting a bunch of hives and making a few mistakes. The process is way more intuitive and straight forward than any book can tell you. This is likely why the social component is such an important part of the process.

This stage of the process provided a lot of great insight into not only the technicalities of beekeeping, but also the culture around it. After seeing such a strong culture around the hobby I was reassured that a design based solution could potentially work. At this point i knew that this was my audience and that if I could design something good to suit their needs, then Id have a great start at tackling some of the bigger and more challenging goals.

USER ANALYSIS

Before I began designing I realized that it would be impossible to satisfy every single need of both the bee and the keeper. I split the project into two parts in hope that I'd find some overlap and solution to best suit the problem. The nature component is where I explore beehives from a natural or bee centric point of view while nurture focuses on the needs of the keeper.

LANDSCAPE ANALYSIS

One of the most important parts of the process was to examine existing equipment and see if there any needs yet to be satisfied. I found the equipment utilitarian and perfect for large scale production, but lack in user experience and form that would appeal to a wider demographic.

PROS

Durable

Functional

Modular

Readily Available

Standardized

Easy to Harvest

CONS

Require lawn space

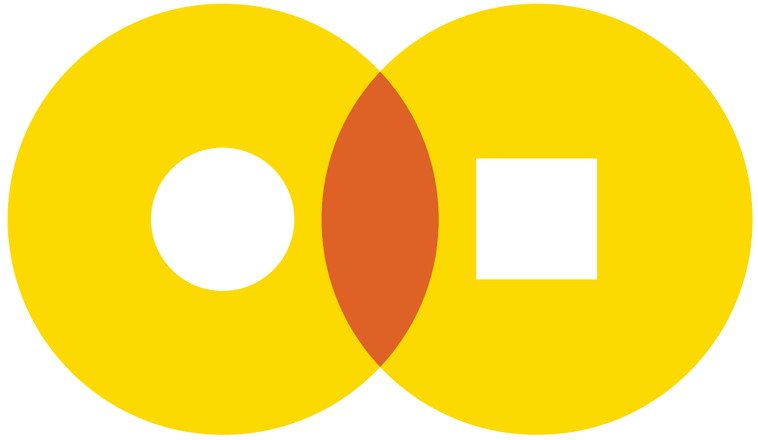
Often Unsightly

Poor user experience

No feedback

Tough on back

NEEDS



BEE CENTRIC

PROS

Natural hives require little human intervention. They are often significantly slower than other hives as they have to build the foundation from scratch, but this may be a positive for smaller spaces.

CONS

Although these hives tend to be very low maintenance, if things go wrong they often cause big problems for even the best of beekeepers. The irregularity of natural comb can also be difficult to harvest for honey. In the height of summer, a natural hive with a fixed size could require more maintenance.

KEEPER CENTRIC

PROS

Keeper centric hives are often modular and can often get quite big. In general the bigger the hive, the healthier they are so this is a significant positive, although in moderation with the size constraints. The tools are available, simple, and make harvesting honey much easier.

CONS

Human centric hives are often in the shape of boxes which have a few problems with condensation and humidity. Excess condensation provide a breeding ground for bacteria and viruses. Wet conditions often bring problems like mold.

EXPLORATION 1

EXPLORATION 2

NATURE

Bees are very intelligent, methodical, disciplined, and self aware creatures that exist for the survival of their colony. Everything they do has purpose and exists from millions of years of natural selection. If I was going to design a great hive, I needed to fully understand the nuances their behavior.

Before domestication, bees lived in hollowed out trees in wooded areas that provide them with favorable amounts of food and safety from predators. The wood is a perfect medium as it provides enough insulation for hot summers and cold winters. The height provides them with enough protection from hungry predators while its shape makes it easy for them to circulate air and maintain a healthy temperature. I used this as the foundation of my design explorations.

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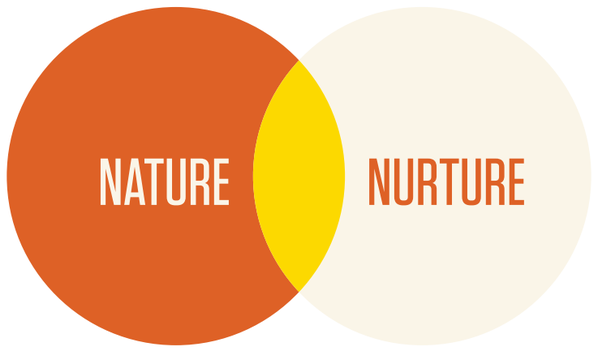
NURTURE

On the contrary, bees have taken to a wide variety of different types of homes outside of their natural habitat and shown that they are incredibly resilient and can flourish in a wide range of environments. There are many examples of bees inhibiting coolers, buoys, glass jars, neon signs and just about anything else that provide them with a bit of protection.

The reason that current beehives have been around 125 years is that they are simple, utilitarian, and proven. If I was going to make a good beehive that works well, I would need to take a conservative approach and respect the traits that make existing beehives ubiquitous. This was the foundation of my nurture design exploration.







NATURE
NURTURE

CONCEPT

One of the most satisfying parts of the having bees is showing it to other people. For those who have never seen a hive, opening it for the first time is quite magical to them and i wanted to enhance that. Theres a lot of connection between beehives and flowers so I went with a construction based off of how a flow bud opens and closes.

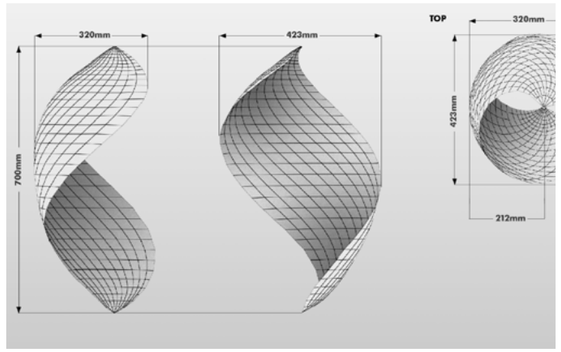
Safety is always a concern as well and bee equipment can be cumbersome so I built in a viewing window to allow people to feel as though they are interacting with the hive from a safe distance. It also benefits the hive as it would reduce the disruption caused by new beekeepers frequently going in to make sure everything is going well.

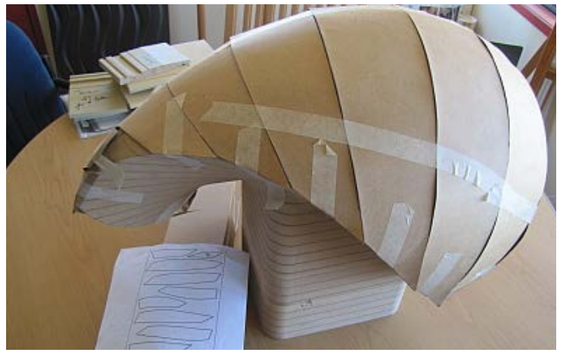
The shape being parabolic reduces the amount of energy required to heat the nucleus while improving ventilation. Since there are no cold corners for moisture to build up, it reduces the amount of bacteria that can grow inside. Current hives that sit on the ground wick moisture and cold making it more difficult to regulate so I went with a hanging structure that could attach to any wall or overhang minimizing lawn space.

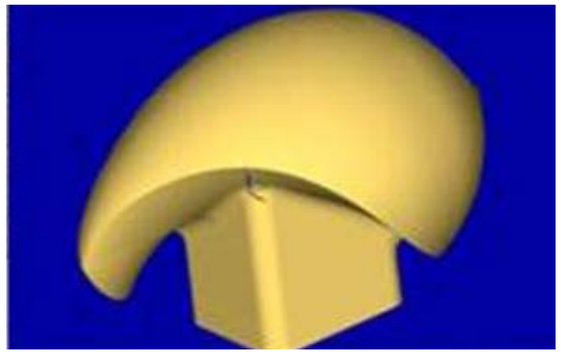
I also took into consideration the skill level of new beekeepers. The core is modular and doubles as a transport device while individual frames can easily be removed and transplanted into another hive. This makes the process of starting a beehive or splitting a hive easy and with minimal disruption.

PREVISUALIZATION

Previsualizing this part of the project proved to be incredibly difficult due in part that I had never worked with a lot of the materials I needed to work with. Many hours were spent on v watching tutorials on fiberglass, thermoforming and milling. It was also helpful in that I could also figure out how to build the structure that the bees build on. This took me a few tries until I got one that would work.





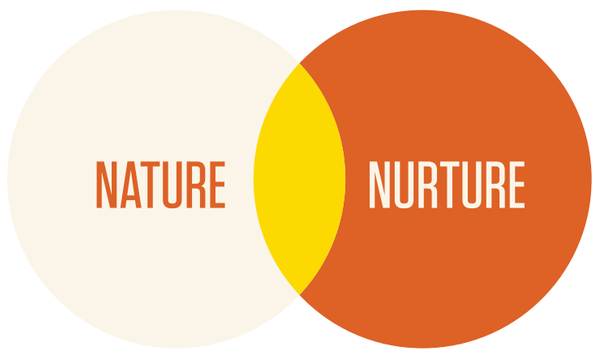


DIGITAL TO ANALOG

To begin the process. I started with an individual "pedal" and worked backwards through the various steps of the process until I was confident enough to actually go build it. I began with the parabolic shape and found a way to get three identical panels to interlock perfectly and form a sealed chamber. I knew I'd eventually need three separate moulds to make it work properly but for now my budget could afford one. I also wanted to explore the possibilities of different mediums. Wood was always the best case scenario but bioplastics provided an easy and affordable alternative that I knew would work. For sake of progress I decided to go with the cheapest, easiest, and most accessible medium that i could do all the manual labor for. Fiberglass provided to be a great fit as many boat builders offered off cuts at an affordable price and it could easily form compound curves. I knew nothing about it at the beginning but figured out the process as i went along. Looking back this was a bit of a mistake, albeit a necessary one. Fiberglass being incredibly durable and rigid didn't offer me the flexibility that I would have like. However it did give me a new set of ultra practical skills. Unfortunately I couldn't find a thermo-form oven big enough for the viewing window but for this part of the exercise I was more interested in function over form.

PROOF OF CONCEPT

After all the hard work, the bees had no problems acclimatizing to their new home and have had very few problems. It was only a matter of days before new comb was formed and brood was created. The internal construction and could do with a bit of work but as a whole I consider this to be a worthwhile exploration in natural beekeeping.


NATURE
NURTURE

CONCEPT

One of the main reasons current beehives are so good is that they that they are simple, utilitarian, and accessible. I knew that if I was going to make a good beehive that would last a lifetime, I would need to take a conservative approach and respect the traits that make existing beehives so ubiquitous.

I decided to go back to the traditional hives and preserve the all wood construction that makes them so functional and affordable. I also wanted to allow current beekeepers to use all their current equipment and make it backwards compatible. I maintained the modularity of traditional hives but designed it to hang off a wall or tree so it would fit almost anywhere and require minimal lawn space. The elevated workspace is much easier to work with and also reduces moisture and cold being wicked from the ground. I maintained a the looking window from the Natural hive to improve user interaction and safety for children and curious onlookers. By adding modular leaves to the top and bottom, the shell expands to fit even the largest hives. It also features a convenient and tidy top and bottom enclosed tool shelf for housing all the tools for general maintenance.

PREVISUALIZATION

Previsualization is likely the most important stage of the process for me. In addition to being a good place to test ideas, it also saves me quite a bit of money. Besides the beginning of a project, this is often the stage the requires the most research into materials and processes. During this stage for a project I simulate each step of the process with painstaking detail. I'll often build digital versions of actual tools, jigs, moulds, hardware and materials to annoying levels of detail so I have hopefully as few surprises as possible when the time comes to make it. Many hours spent in hardware stores with rulers and online catalogs with customer service were well worth it for my lack of budget. Fortunately for me I didn't end up with any unused tools ore materials.

DIGITAL TO ANALOG

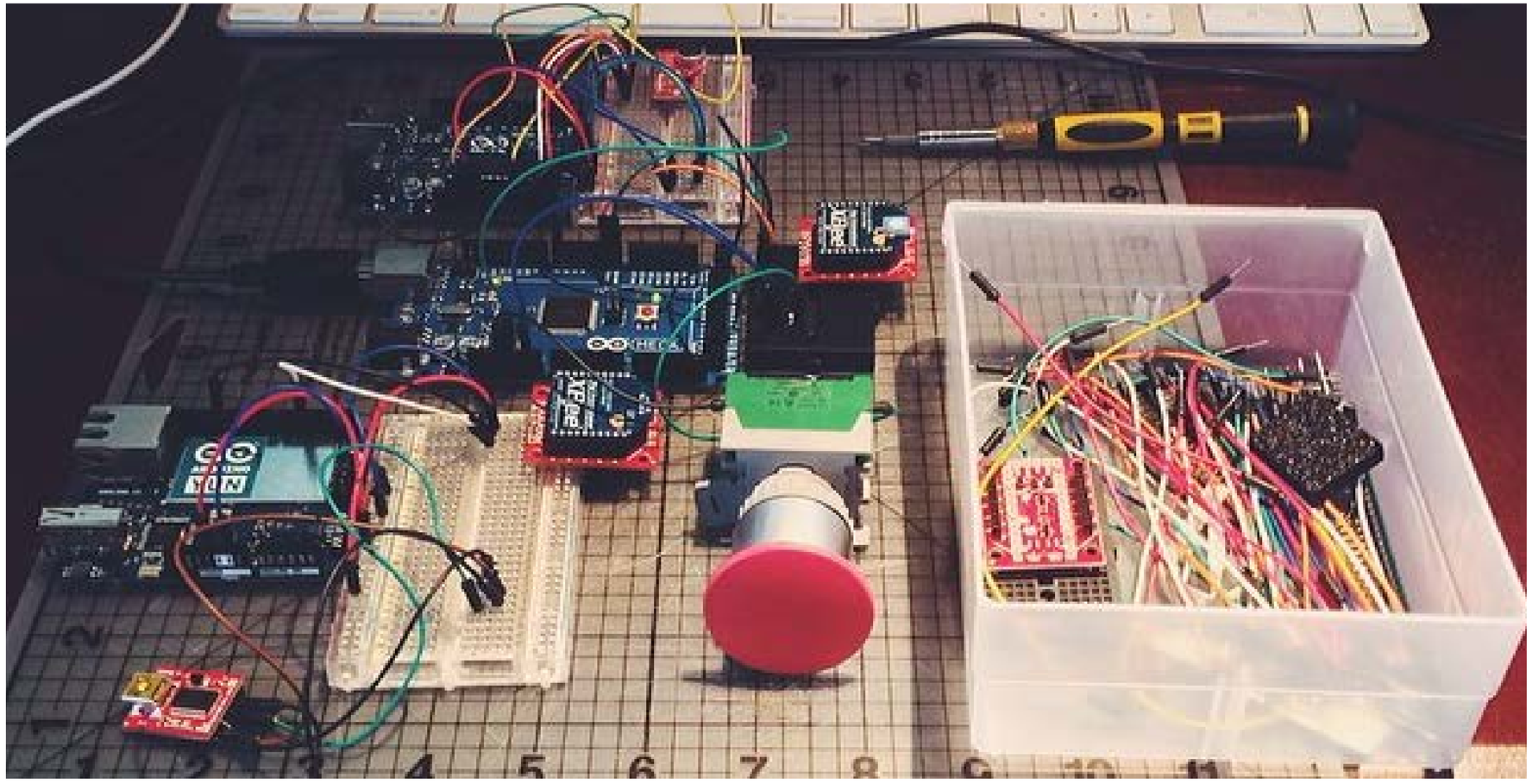
One of the key constraints was that I would be able to make it without expensive machines or materials that were out of my reach. My solution was to make due with the tools and materials that I had around me. I started with a full sheet of plywood and worked backwards until found a use for each piece. The process of making them is highly scalable, automatable, cost effective and with minimal waste.

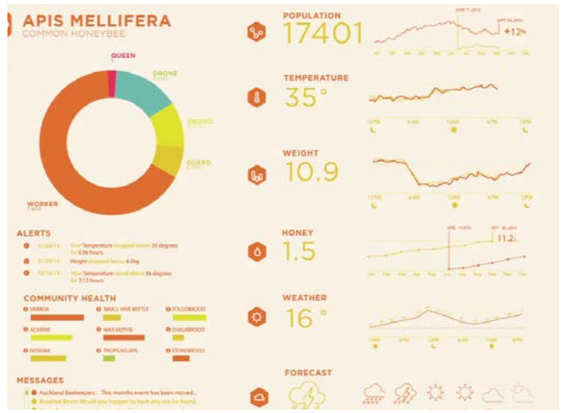
Not having much hardware and relying on traditional joinery proved to be incredibly economical. I was able to make it out of off the shelf tools and materials for approximately $100. Considering economies of scale will drop the material and fabrication price significantly, this design could be more accessible to a wider audience without compromising quality. The shell is incredibly durable and will have no problem lasting several years.

AUGMENTATION

There are ample opportunities to make digital tools to enhance the technical and social aspects of beekeeping. Interconnected hives would make troubleshooting and forecasting much easier and potentially provide a catalyst for social interaction. Since beekeeping is inherently communal, a social tool would feel natrual and improve the user experience.

Even smaller features like maintenance reminders or notes provide a valuable service to even the most advanced beekeepers. In addition to providing a valuable service to hive owners, data could potentially be of value to the academic community.





PROOF OF CONCEPT

This tool has currently been prototyped as an arduino based system that sends data through an Xbee shield or wifi. It sends real-time data to a google spreadsheet and stores a small sample each day and benchmarks them against previous readings and other hives in the same area. Its also useful to keep track of any viruses of adversity in a particular region. In theory all the data would be open source and accessible to everyone.

CONCLUSION

Looking back at the design process, I feel as though there is in fact a strong design based solution to the steady decline of bee populations. The recent resurgence of interest in beekeeping along with new tools to make beekeeping easier could potentially improve bee populations over time.

Although both approaches to beekeeping yield positives and negative, the Nurture hive provides the best solution for the task at hand. Since bees are quite adaptable and have evolved to live in just about any condition. The difference in quality of life between the hives are negligible and outweighed by the fact ease of use and scalability of the modular hive. General maintenance and harvesting is much easier as the tools and processes are ubiquitous and have been available for hundreds of years. Both functionally and aesthetically, it is likely that this hive would flourish for the current and future target audience.

Technology provides a unique potential for users being able to interact with their hive. Not only could it provide an easy way for collecting and the sharing information, it could also provide a conduit for socializing and community building.

Beekeeping is social by necessity and would benefit greatly from a tool that helps make beekeeping easier or more accessible. Providing this service would benefit a large number of people and could potentially speed the process of redistributing bee populations. This was indeed a worthwhile exploration and I look forward to continuing it to the next stage.

THANK YOU.