

PROPOLIS: An immersive environment

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PROPOLIS

Creating and using an immersive 2D honey bee environment to educate children between the ages 3-10, about the importance of honey bees. This capstone project will showcase this researcher's skills in graphic design, spatial sound, architecture, exhibition design, and character illustration. Within this structure, individuals will be able to observe, determine, and make comparisons between a healthy colony and one that is fragile and dying.

SCHOLARLY ABSTRACT

"Honey bees have been on the decline. As of 2016, eight species of bees made it on the United States (U.S.) endangered species list. It reported that the decline of pollinators is due to industrial agriculture, parasites, pathogens, and climate change" (Contributors 2020). The loss of habitat and lack of nectar is due to monocultures and bee-killing pesticides. These are significant threats to honey bees and wild pollinators.

There is a need for good, clean food providing for a healthy existence for the honey bee. When bees have proper nutrients, the result is a healthy hive that gives mature bees a better chance to fight off diseases. To showcase the life of a honey bee, this researcher created an immersive environment that simulates a hive structure. The structure, along with the motion graphics and critical takeaway printed pieces, is to help children between the ages 3-10 understand the importance of honey bees. By comparing healthy and unhealthy bees in their natural habitat in an illustration format, the children could empathize with the honey bees. Hopefully, they will one day change the fate of these amazing creatures. The immersive environment will emulate a spatial audio, 2D character illustration, and animation projected onto a honeycomb structure. Custom seed packets and a brochure will accompany the immersive environment to allow the children to plant a bee-friendly garden and to learn more about the honey bees. This capstone project will showcase the researcher's skills in graphic design, spatial sound, architecture,

exhibition design, and character illustration. This structure will allow individuals to observe, determine, and make comparisons between a healthy colony and one that is fragile and dying.

GENERAL ABSTRACT

Propolis is an immersive environment that simulates a hive structure. The structure, along with the motion graphics and critical takeaway printed pieces, helps children between the ages 3-10 understand the importance of honey bees. This capstone project will showcase the researcher's skills in graphic design, spatial sound, architecture, exhibition design, and character illustration. This structure will allow individuals to observe, determine, and make comparisons between a healthy colony and one fragile and dying.

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DEDICATION

This thesis is dedicated to my husband Jason, and our lovely spirited daughter, Laurel Aurelia. They have endured the trials and tribulations of having a wife and mother who works, attends classes, does homework, and turned a dining room and kitchen into a carpenter shop as a designated site to build and construct an immersive environment. By these means, I will accomplish my educational goals and complete the project's thesis. I would be remiss not to include my "*North Star and Guiding Light*," Aurelia Alarid, as well as my family, who have supported me from afar. Thank you for being the voice of reason, the virtual hug, and the opportunity to pursue my MFA goals. Without my family mentioned above, this project would not be as successful as it is.

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CHAPTER I

Introduction

Blending a background in graphic design with new skills learned in the program

Working in graphic design has been a passion throughout a twenty-year career. The career has spanned from print design to UI/UX and motion graphics. The Virginia Tech Creative Technologies Program has opened up possibilities and new learning opportunities by becoming proficient with software programs like Maya, Mad Mapper, Substance Painter, and Zbrush. It allowed the opportunity to learn techniques like projection mapping, character modeling, construction, architecture, spatial sound, and laser cutting. By learning these new techniques and combining them with the fascination with honey bees, *Propolis* breathed its first gasp of air of life. Incorporating the new skills learned in the program supplemented by graphic design skills acquired through previous projects such as illustration, motion graphics, branding, and print design.



[Figure 1. Macro photo of a honey bee.]

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Bee, the endangered species

"Honey bees have been on the decline. As of 2016, eight species of bees were placed on the United States endangered species list" (Contributors 2020). The decline of the honey bee is due to multiple factors. To survive, honey bees and other pollinators require clean food for good health. When they have proper nutrition, their hives are healthy, and the adult bees are better able to fight off diseases. The immersive environment will incorporate a hive structure that shows a comparison of what a thriving, healthy hive and colony looks like, in contrast to a weak hive and colony that is struggling. This simulation included sound, multimedia motion graphics, 2D Modeling, and animation. The primary audience for this environment is children between the ages of 3-10. The main goal is to educate children about the necessity of protecting pollinators. By focusing on early education, this will help young children develop social and emotional skills.

Pollination is one of the essential processes in nature, and without it, many food resources that humanity depends on will not exist. "About 80% of plant pollination requires the help of other living, moving creatures such as insects, birds or bats, to transfer pollen from one plant to another" (Plant Pollination Process). Multiple species worldwide act as pollinators, and the focus of this thesis is to use the honey bee as the medium to show this researcher creative and technological skills.

The honey bee plays an enormous role in growing and producing vegetables and fruits, but they also produce beeswax and Propolis. Propolis is beneficial with multiple uses such as in medicine, cosmetics, practical applications, and as a natural sweetener. "If there were no bees, our food supply would be less varied and less available. While we might not go extinct, we would, however, certainly need to find safe alternatives to many of the mainstay foods currently enjoyed around the world, particularly those crops dependent on bees for pollination. The populous must figure out ways to stave off economic hardship and famine until new cultivation methods surface." (Dove, 2020).

There are multiple reasons why bees are on the decline. “Scientists point to pesticides as one of the main factors causing the die-off, in particular, a class of bee-killing insecticides known as neonicotinoids (or neonics). In the U.S. alone, more than 46 million pounds of these chemicals are used in our homes, gardens, and parks every year.” (Ban Bee-Killing Pesticides). In the past year, the European Union banned popular insecticides and neonicotinoids linked to the loss of bees. In the spring of 2019, the U.S. Environmental Protection Agency banned twelve product that contained neonicotinoids. Mace Vaughan, the co-director of the Pollinator Program, stated, "Everybody who owns a piece of property can add plants that provide nectar and pollen" (Farah, 2020). Some other examples of how to make your backyard and garden a refuge for pollinators are to plant native plants and flowers, use fewer pesticides around your home, and create solitary hives so that wild bees, insects and other pollinators can rest and hide. Taking small steps like these while urging government officials to ban harmful pesticides, can help the bees survive.



[Figure 2. Early learning audiences.]

Creating an immersive environment, key takeaways, and an online presence to help educate new learning audiences

This study explores the use of creative, technological, and artistic elements such as spatial sound, motion graphics, and project-mapping to depict healthy and unhealthy bee hives through an immersive environment. The intent is to use this platform as an educational tool to inform young children about the importance of bees. Art is a creative expression

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that is created by inspiration and consists of techniques that are influenced by beauty, humanity, ideas, creatures, or the environment. *Propolis* is an environment formed by using visual graphics to simulate a healthy hive versus one that is fragile. An immersive environment is an experience that a person can view while experiencing a mixture of motion graphics and spatial sound. By creating this environment, young children will gain knowledge about the importance of saving honey bees and other pollinators. There is evidence that introduction to disciplines of art, history, and science at a young age contributes to the development of a child's identity and builds a foundation for continued and increasingly more complex learning in school and everyday life. Due to the immediate endangerment of honey bees and other pollinators, the specific audience is critical to help advocate for change. By giving the child the narrative, motion graphics, seed packets, and a brochure, it allows the child to learn, empathize, and provides them with tools to take home and spread the word to their parents, siblings, and friends which are to be proactive and save the bees.

The structural layout is a plus sign (+), and it symbolizes the definite quantity. In Latin, it means "more." The plus sign is a symbol of positivity and represents how important the honey bee is to our environment. The life-sized structure will give the audience the ability to see how honey bees work in a hive. It demonstrates how important it is to have a healthy habitat. The structure was built based on the concepts of universal design. That is, it allows accessibility for all and complies with the American with Disabilities Act and allows children and adults an opportunity to sit, walk around and touch the structure. The participant will be able to enjoy a multisensory experience that enables children of all ages to be proactive and connect with nature. See *Appendix I: video of the path through the structure* <https://youtu.be/sHYzbKQe6QE>.

The immersive environment and the motion graphics created for this thesis will give a visual representation of what a healthy hive looks like with comparative visualization of how healthy and sick bees work in their colonies. Honey bees use the ultraviolet sight to find pollen as well. Within this structure, individuals will be able to observe, determine, and make comparisons of what a healthy hive looks like in contrast to a colony that lives in a weak hive. The environment will consist of sound, multimedia motion graphics, and

2D character modeling with animation. The eco-environment will educate the audience about why it is essential to protect the pollinators.

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Research Question

Can the decline of the honey bee be portrayed through an immersive environment, inclusive of the artistic elements of spatial sound, motion graphics and project mapping?

Delimitations of the Study

I am not an entomologist or a beekeeper. Therefore, some scientific protocols might have been missed. The creative horizons of this researcher might not have reached an intended standard. COVID-19 impacted this study because it had to be moved to the confines of a dining room to see the project to fruition.

DEFINITIONS OF TERMS

Bee-killing pesticides (Neonicotinoids)

"Neonicotinoids are a new class of insecticides chemically related to nicotine. The name means "new nicotine-like insecticides." Like nicotine, neonicotinoids act on certain kinds of receptors in the nerve synapses. They are much more toxic to invertebrates, like insects, than they are to mammals, birds, and other higher organisms" (What Is a Neonicotinoid, 2015).

Endangered

An endangered species is an animal, insect, or bird that is in danger of extinction from the Earth.

Honey Bees

Honey bees are domestic insects that live in hives and are pollinators. They are known for collecting nectar to make honey and propolis.

Immersive Environment

It is a structure that incorporates sound and visuals. It makes the audience feel that they are part of the experience.

Monocultures

Monoculture is the production of a single crop produced by farmers in each area.

Motion Graphics

Motion Graphics is a series of still photos, videos, or 2D illustrations that move frame-by-frame and creates footage synchronized to voiceovers and music.

Pollinators

A pollinator is a group of insects that collects pollen from one plant and travels to other plants, thus fertilizing it with the dust obtained from the first plant.

Projection mapping

Projection-Mapping showcases a video when projected on complex objects, locations, and shapes. Graphic artists use Projection-mapping with motion graphics or videos for art or commercial usage.

Spatial sound

Spatial sound is used in immersive environments and allows sound, such as music or voiceovers, to follow the audience to enhance the experience.

2D design

The 2D design is a flat illustration, graphic design, or painting that is a technique in computer-based graphics such as video games and motion graphics.

U.V. spectra

U.V. (Ultraviolet) Light refers to the region of the electromagnetic spectrum between visible light and X-rays, with a wavelength falling between 400 and 10 nanometers. This electromagnetic radiation is not visible to the human eye, because it has a shorter wavelength and higher frequency than the light our brain perceives as images" (U.V. Light).

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Varroa destructor mites

Varroa mites (*Varroa spp.*) are a ubiquitous parasite of honey bee (*Apis spp.*) colonies. Varroa mites (*Varroa destructor*) are now the most severe pest to western honey bee colonies, and one of the primary causes of honey bee decline" (Bee-Health 2019).

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THE SIGNIFICANCE OF THE STUDY



[Figure 3. Bees around a honeycomb.]

The subject matter: honey bee

The honey bee is an enchanted creature. Not only is it essential to save these amazing creatures from extinction, but through this process, to create a personal connection with the honey bee. The honey bee symbolizes power and a strong work ethic, both of which I incorporate in my daily life. However, it is good to stop and smell the flowers, which allows me to be creative in both my personal and professional work. Albert Einstein said, "If the bee disappeared off the face of the Earth, man would only have four years left to live." I have learned a lot from these insects and other pollinators, but through the research process, early learning and different audiences can learn about why it is so important to save the bees!

The focus on the honey bee is essential because they play a critical role in our ecosystem. As a hobby gardener, I saw firsthand how pollinators of all types help my garden and thought that if they disappear, one-third of our global food supply will not exist. The honey bee needed a voice, and I thought this would be a great platform to provide it with

one. I have gained a personal connection with the honey bee. As stated previously, the honey bee symbolizes power and a strong work ethic, both of which I strive to embody every day. They can also divide the labor needed to have a healthy and thriving hive.

On a personal note, the honey bee also reminds me of my daughter, Laurel, my little honey bee. The song "My little bumblebee," though not a sweet song, started the fascination of the honey bee and is a constant reminder of the free-spirited and loving child that I have. If this thesis could show her the dedication it takes to graduate with an M.F.A. while working full time and raising a beautiful child, anything is possible.



[Figure 4. Bees around a honeycomb and hive.]

Review of Research: beekeepers and entomologist

Bees are facing a life-threatening decline due to parasites and pathogens. There are multiple parasites, brood diseases, and pests that are responsible for destroying a beehive. The one threat that is the most dangerous is the parasitic mite *Varroa destructor*. "V. destructor attacks all life cycle stages of bees by sucking blood through punctures made in the host body wall. It uses its sharp mouthparts by weakening the insect and shortening its lifespan. It also acts as a virus vector in colonies and accelerates the harmful effects of other bee diseases such as acaraposis, which is caused by the tracheal mite *Acarapis*

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woodi" (Varroa Destructor). Until recently, when a varroa destructor invaded a colony, there was little that a beekeeper or scientists could do to protect it. However, some new studies and inventions - such as the Bayer Bee Care Varro gate have been introduced to the community. Hopefully, with these efforts, the Varroa destructor can become extinct, and healthy hives can thrive again for years to come.

Honey bees are social insects. There is a highly complex social order in the swarm where honey bees can communicate and create the complex structure of their colonies. They are also able to organize defenses, exercise environmental control, and divide the labor needed to have a healthy and thriving hive. "A honey bee colony typically consists of three kinds of adult bees: workers, drones, and a queen. Several thousand worker bees cooperate in nest building, food collection, and brood rearing. Each member has a specific task to perform, related to its adult age. But surviving and reproducing can take the combined efforts of the entire colony. Individual bees (workers, drones, and queens) cannot survive without the support of the colony" (The Colony and Its Organization).

Bees have been around longer than some civilizations and have always been a vital part of the ecosystem. "About 120 million years ago, the honey bee developed its morphologies specifically to collect pollen and nectar such as increased fuzziness, pollen baskets, longer tongues, and colonies to store supplies" (Horn 2008). Due to the evolution of the bee, early civilizations learned to gather honey. It became vital to everyday life. Due to European colonies expanding to other regions of the world, the honey bee and other goods, trades, and supplies were transported across the globe. Thus, the migration of honey bees populated the rest of the world. Beekeeping has evolved in many ways thanks to modern inventions in the 19th century. Today, there are many beekeepers worldwide, along with scientists and big corporations trying to save honey bees and other pollinators from extinction.

Dating back to the 1800s, there are over 100,000 beekeepers in the United States. In the state of Virginia, there are around 5,000 individual documented beekeepers. When talking to a couple of local Virginia beekeepers, they expressed many concerns about keeping their colonies alive. One of the beekeepers, Dan Chase, mentioned in a conversation that

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"the commonality among all the pests we fight now seems to be people. People brought Varroa mites from Asia to this country in the 80s - not intentionally - but the mites would not have spread to the U.S. without people.

People brought small hive beetles to this country from Africa in the 1990s. People are the ones who use pesticides – including herbicides, insecticides, and fungicides – all of which impact bees."

I reached out to Margaret Couvillon and Roger Schurch with the Department of Entomology, about the honey bee. In the beginning, I was very much a novice, and I admit that I didn't know the difference between a bumblebee and a honey bee. Margaret and Roger were great contacts and gave me insight into why the honey bee is so important to the ecosystem. They also introduced me to Parry Kietzman with the Appalachian Headwaters. I was grateful to have the opportunity to spend time in West Virginia and share in the experience of scientists and beekeepers working with beehives. In my wildest dreams, I would have never imagined that I would be holding a box full of queen bees or eat honey straight from a hive. At that moment, I knew that I wanted to create a motion graphics piece that showcased the honey bee in a day in the life manner with all the knowledge and understanding gained from this experience.

A family friend introduced me to Dr. Marla Spivak, Distinguished McKnight University Professor with the University of Minnesota. Marla and I talked through the fall of 2019 about the importance of the honey bee. Currently, she is working on developing methods to improve the survival rates of bees. She inspired me because she is a spokesperson for healthy habitats in pollinators. Marla revealed four significant reasons we are losing pollinators: monoculture, pesticides, parasites, and lack of habitat. She also gave simple tips on how we can improve not only our lives but the lives of the honey bee. Marla gave a T.E.D. Talk on how important it is to save the honey bee and what we as humans can do to protect the pollinators. If each of us does something small like plant flowers and keep them pesticide-free, we are allowing pollinators to live a healthy life.

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[Figure 5. Early learning audience.]

The audience: encouraging early learning - storytelling for children of 3-10

The scope of this project is about educating children as to the importance of the honey bee. There are three types of audiences when talking about the point of view: the actual audience, potential audience, and the target audience. The target audience for *Propolis* is children between the ages of 3-10. The intention is to have an early learning target audience to become inspired through the storytelling of a day in the life of a honey bee to be proactive and work to save the honey bee. When a child makes a personal and hands-on connection such as gardening or working with honey bees, the child

can become engaged and appreciate not only the message of saving the bees but the appreciation for continuous learning.

The narrative in *Propolis* takes the child on a journey through a day in the life of a honey bee by introducing the child to Happy Willow Woods, where animals of all shapes and sizes live in harmony. The child sees a healthy hive where they learn that there are three different types of honey bees, the queen, drones, and worker bees. The voyage takes the audience to see how honey bees spread pollen while collecting nectar to take back to the hive. In the hive, returning bees communicate with the other bees on where the flowers are located by doing a waggle dance. Honey bees make honey out of nectar, and because the bees are social creatures, they are unable to survive on their own.

The decline of the honey bee is due to climate change, monocultural industrial agriculture, infectious species, disease, and pesticides. During the presentation, the hive will encounter harsh circumstances. It will provide the new learning audience a way to see the weak habitat and the

factors destroying the species. The final two parts of the narrative will give the audience hope and suggestions on how to save pollinators like the honey bee so that healthy hives are around for generations to come.

A look into Children's Museums

According to the journal *Early Learning in Museums - A Review of Literature*, "Young children make personal connections to what they see in the museum, and they respond especially well when stories and their imaginations are part of the experience," (Munley, 2012). Children's Museums use tactile learning, which allows children to explore, play, and learn. By doing so, it enables children to open themselves up to imagine a better way to learn about subjects around them. The targeted 3-10-year-old audience will hopefully be inspired to be proactive and to take steps to save the honey bee. When a child makes a personal connection such as gardening or working with honey bees, the child can engage and appreciate not only the message of saving the bees but can also gain an appreciation for museums.



[Figure 6. Early learning audience at a children's museum.]

As a parent, I have had many opportunities to take my daughter to children's museums. I was in awe of her as she explored the exhibits and was able to partake in activities such as drawing, building, and pretending. Her experiences taught me that even in a museum setting, she was also learning. What an inspiration and an opportunity to create an educational and experiential exhibit. I wanted to learn about exhibitions in children's museums. I reached out to museum curators, educators, parents, and other children on their experiences with children's museums. I researched journals and studies online, and on

top of my own child's experience, I knew that this exhibit had to entice early learning.

Meggin Hicklin is the Exhibitions Program Manager at the Moss Arts Center; she and I discussed the world of exhibitions. She piqued my interest because I am a neophyte in setting up exhibits. I became cognizant on how one curates a show. It is a whole new world to me, and since Meggin worked on SWARM in the fall of 2018 that featured Talia Greene, I knew I needed to interview her. What I learned from Meggin is invaluable! She helped me understand what an exhibit is and how to curate the piece to the target audience. She mentioned that any exhibit must catch a person's attention and interest in three seconds. In other words, you must initially hit a homerun to hook your audience. If this does not happen you have lost a participant. Through our multiple conversations that consisted of sketches and note-taking. I learned your goal(s) and objectives must be clear. You want to engage the participant and have them interact with the exhibit. If you get interaction, you get people who will help spread your message, for example, by using social media. No pun intended; you want to create buzz about your work. You want to include a linear flow through the exhibit. You see this in my sketch of the plus design of the hive. How would I envision audiences walking through the exhibition? How effective is my immersive environment? Will it work? Must it be modified, or do I alter my direction. This was experienced as I prepared my project. First, I built components for a massive hive. It was too large. Logistical issues arose. COVID -19 became a pandemic. I was forced to change my project again. Ms Hicklin's words gave me the fortitude to handle yet another change. We discussed the narrative and takeaways. I learned takeaways give the exhibit longevity. What takeaways would be helpful and exciting for younger audiences? She also helped me figure out the educational component and how young children would engage with the structure and storyline. What materials are necessary? What framework should be used? How is the overall narrative defined and refined? I chose to refine the overall narrative and create different stations to highlight critical events. Should the exhibition be fabricated out of fabric, screens, or wood? Reiterating, the exhibit had to create interest, flow, and focus by using graphic design, spatial sound, and visual graphics. Meaning that if I wanted to showcase empathy for the honey bee, I had to create an exhibit that would make the audience feel for the fragile bee. As mentioned earlier in this section, she made me realize for the exhibition to educate the audience, clear and well-defined goals provide for a strong narrative, with the final step being an evaluation component to

measure the exhibition's success. Without Meggin Hicklin, I do not believe this project would have been as successful nor would my resiliency as an artist have surfaced.

I am very fortunate to work with Phyllis Newbill, who is the Outreach and Engagement Coordinator with ICAT and is the liaison with the Science Museum of Western Virginia. Through multiple conversations about my project, I learned that she is an excellent resource about early learning. After one conversation, when I went into detail about building an immersive environment for children to learn about honey bees, Phyllis thought it would be a good time to introduce me to Rachel Hopkins at the Science Museum of Western Virginia. Phyllis mentioned that the scope, the structure, and the narrative emphasized Science, Technology, Engineering, Art, and Mathematics (STEAM) and could be an opportunity for my project to have a longer life than just a thesis on a shelf.



[Figure 7. Structure built and displayed in the Science Museum of Western Virginia.]

bee is worth saving.

On November 6, 2019, I had the opportunity to visit the Science Museum of Western Virginia and meet with Rachel Hopkins, the Executive Director. This meeting allowed me to visit the museum and see the exhibits that were already part of the overall experience. She was very interested in the educational aspect and the subject matter, as it aligned with the mission of the museum. Furthermore, when completed, the project could have the opportunity to be exhibited at the museum. With that information, I knew that I needed to focus on the build of the structure. Since 36,000 students visit the museum annually, the structure must be stable, and the narrative needs to be educational and share a story of hope that the honey

Influence: artists and exhibitions

Inspiration comes from anywhere - nature, video, artist, illustrators, and other exhibits. There are different forms of illustration, photorealism, literal, character, information graphics, freehand and vector graphics, children illustrations, and graphic novel and comic illustrations. By relating to the early learning audience but also being faithful to the esthetic of the honey bee, the example for this motion graphics needed to be relatable to the subject and have a natural approach style for early learners to walk through the whole exhibition. The form of the piece is a combination of children's illustrations and vector graphics. Four artists inspired me through this process, and I wanted to create an immersive environment for early learning and focus on the inspiration for the narrative.

The first artist, Talia Greene and her installation, *Cross-Pollination (II)*, was exhibited at The Moss Arts Center. The installation showcased bees in multiple patterns that floated peacefully around doorways and surfaces. The balance between nature and beauty gave this piece serenity and respect for these creatures. The second artist, Jessica Rath, focuses on multiple mediums to showcase the honey bee. She looks at the human intervention in a natural world using light, bronze, audio, and resin. Rath creates honeycomb sculptures that are life-sized and open up the conversation that honey bees are important. Not only that, but she also focuses on the flowers and plants that bees pollinate. The third artist, Matthew Willey, has a personal commitment to hand-painting 50,000 honey bees throughout Raleigh, NC. He wants his work to inspire communication and awareness about the importance of the honey bee. His paintings represent a metaphor to connect the planet, humans, animals, and pollinators. The last artist is Christopher Lee, who is inspired by cartoons from the 80s and 90s and has heavily influenced his art. Because his influences are based on early learning memories using flat design and an abundance of color, I was inspired to use similar graphics in the illustrations.

As a parent, in today's world, there are complicated subjects that are deciphered, parsed, analyzed, discussed ad infinitum from various broadcasts like the news reality shows, movies, YouTube, and cartoons. This list could continue as long as people with creative minds participate in these platforms, as previously mentioned. I believe that early childhood audiences cannot

comprehend complex, difficult topics like death, extinction, Varroa Mites, pesticides, and other harsh factors that kill the honey bees. "Images of monsters, nasty animals, or horrible faces can remain in preschoolers' minds for a long time. Regardless of what takes place in a story, or how likable characters can be, the image remains with the child. Preschoolers can be scared when a normal-looking character transforms into an evil one, particularly if they see the character changing. Scary images or scenes on the news can also upset preschoolers. For example, they might be worried by images that show war, violence, fire, or accidents" (Contributors, 2019). These scary images can occur daily, and they will emit tearful cries or laughs. My four-year-old reacts like this daily. The effect of scary or loveable images drove the sketching of the cartoon characters for this narrative. Any illustration showing an unhealthy or a decimated bee was deemed too graphic. Young children need to comprehend a story; therefore, 2D drawings became part of this researcher's artist toolbox. The objective was to have the audience drawn in to the story by focusing on the verbal and visual components of storytelling.

Additionally, this artist developed a style that is in concert with her skills. The artists inspired this researcher because of their knowledge and expertise. The artists mentioned above use color and structure to address the esthetics of the design.

Young children need to comprehend a story; therefore, 2D drawings became part of this researcher's artist's toolbox. The objective was to have the audience drawn in to the story by focusing on the verbal and visual components of storytelling. Additionally, this artist developed a style that is in concert with her skills. The artists were inspired by this researcher because of their knowledge and expertise. The artists mentioned above use color, structure to address the esthetics of the design.

Karkas (2012) stated, "Caricature enhances creativity. It helps the student to feel interested in various fields of art. In other words, where there is a language in the cartoon. The student who solves this language can develop a sense of self-confidence and gain a new perspective on life." Pictures tell stories, images of real bees and sometimes some audience members might feel uneasy; therefore, using Karkas' philosophy, cartoon-inspired images were created because the

are more considered more appealing to a young audience. Using bright colors and big shapes to develop the characters and backgrounds in this thesis allows children to follow directions and understand the subject matter. At the same time, cartoon images capture the various modes of learning, such as visual, auditory, haptic, or kinesthetic. Typically, children gravitate and learn by picture books and cartoons. Having four years observing the growth of my daughter, I noticed her drifting to a stylistic choice. It engages the younger child. Therefore, the illustrations in this project are more significant than average. With the use of bright colors and basic shapes, children can engage and gain an understanding of the importance of a creature like the honey bee.

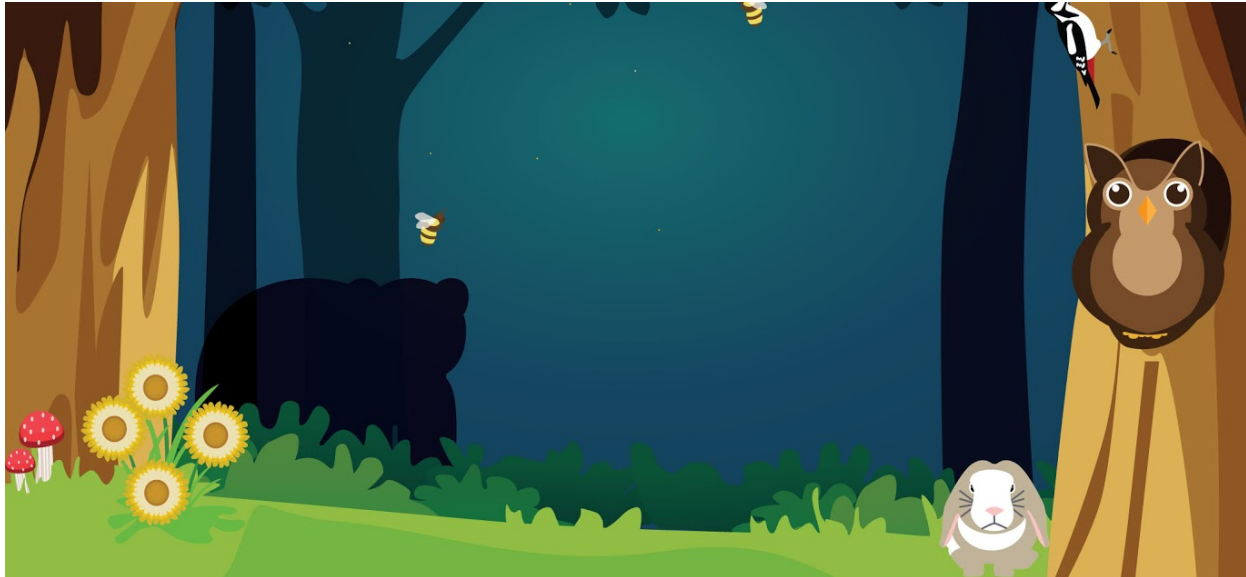
Along with the structure, motion graphics, and projection mapping, the audience will be able to take home a seed packet and a brochure telling the story of the Happy Willow Woods. By planting a bee-friendly habitat, we can become a voice for a creature that is about 1.54 inches long. See *Appendix 2: video of motion graphics* <https://youtu.be/29moh2XYebU>

Grants & Funding

Since the thesis project had an opportunity to be exhibited in a museum, there needed to be funding to help pay for the materials, equipment, printing costs, and hardware to create a stable and safe structure. The Student Initiated Research Grant (SIRG) through the School of Architecture is a grant opened up to all individuals throughout the university. I contacted Bob Schuber, the Associate Dean for Research, and applied for the grant, which was approved in February 2020. The amount received from the award totaled \$750 and was applied to the materials, hardware, and printing costs. Other equipment like projectors, speakers, and a computer to playback the projection also needed to be purchased.

I went outside-the-box and created two crowdfunding opportunities for friends, family, coworkers, people in my network, and strangers to contribute. Overall, I was able to raise \$1,390 by asking people to buy a honeycomb. The donors' names would be printed on a honeycomb and

be part of the structure. It was an excellent opportunity to learn about crowdfunding and to raise money for this project. The people who donated money to this project had their name laser embossed on the edges of the shadow boxes. The shadow boxes became individual modules, and when people walk around the structure, they will see the names of the donors throughout the exhibition.



[Figure 8. Happy Willow Woods.]

Creating a narrative

The narrative is about a day in the life of a honey bee. With keeping the early learning audience in mind, the description needed to represent the honey bee but also not to frighten the young audience about the decline of the bee. There is a delicate balance between informing younger children about the unfriendly details of the fall of the honey bee, and the positive message that they can make a difference. I spent a couple of weeks thinking about the narrative and the audience. I came up with three different tales: a children's story, an information-based story, and a combination of both. The description that I decided to go with was a combination of both. The narrative takes the viewer on a journey to Happy Willow Woods, where bees and forest animals live in perfect harmony. That is how Happy Willow Woods came to life.

Happy Willow Woods is a forest where honey bees live. The narrative takes the viewer into the hive to see how bees live, communicate, make honey, and work together to create a healthy

colony. The audience follows the honey bee to a field filled with bee-friendly flowers where they collect nectar and spread pollen. Once the honey bee collects the nectar, they go back to the hive. The narrative talks about the decline of the honey bee and explains why it is happening with pesticides and monocultures. Hope is not lost when the story goes into examples of how the audience can help save the bees by planting a bee-friendly garden or building a single hive.

One of the primary purposes of this structure is to educate children ages 3-10 about the importance of honey bees. The narrative will tell a story about a bee colony that lives in Happy Willow Woods and uses the four parts of the structure to tell the story. The first section will welcome the audience to the Happy Willow Woods and introduces the bees and their responsibilities to keep the hive healthy and happy. The second section will take the audience on an adventure to a field full of flowers where they can see the bees collect the nectar and transfer the pollen from one flower to the other and fly back to the hive to communicate where the nectar is with a waggle dance. The third section will showcase the decline of the honey bee by speaking to and showing the different elements that affect the healthy hive. Finally, the fourth section will take the audience back to Happy Willow Woods and talk about how we, as humans, can protect the bees for generations to come.

Spatial sound is a technique used to enhance an immersive environment. Music is used as a cue to go to the next scene or place and can flow around you in a 3D virtual space. Sound plays an essential part in the immersive environment. Combined with visual cues, the audio will help the audience walk through the exhibition and experience a day in the life of a honey bee.

The next step to complete the environment is to find music, record the voice over, and find special effects. I recorded the voiceover using a microphone attached to my iPhone. Saved the audio and used After Effects to modify the volume and edit the audio. The music needed to be upbeat, possibly rhythmic, and have a fun melody. Children love to express themselves in music from a very early age. Bensound.com offers royalty-free music and has a great mixture of music from kid-friendly to corporate, pop, and jazz. The soundtrack that best represented Happy Willow Woods is Sunny, and it features string instruments and has a cheerful, positive, and upbeat sound that children of all ages would enjoy. To incorporate music from nature, I wanted to include sound effects that are royalty-free and are on the website www.freesoundeffects.com.

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The combination of the voiceover, soundtrack, and sound effects allows the audience to see the day in the life of a honey bee.

Projection-Mapping

Since the beginning of this project, I knew I wanted to showcase the day in the life of a honey bee. The idea was always to create a motion graphics piece and showcase it within the Cube, but I didn't know how best to make it happen. *Shakespeare's garden* inspired me with the use of multiple projections, spatial sound, and motion graphics. I have been interested in projection mapping for some time and was impressed when I went to George R. R. Martin's Meow Wolf in Santa Fe, New Mexico. Meow Wolf creates immersive and interactive experiences by transporting audiences to a world of exploration, creativity, and imagination. Because of my experience, I knew I needed to learn more about projection mapping.

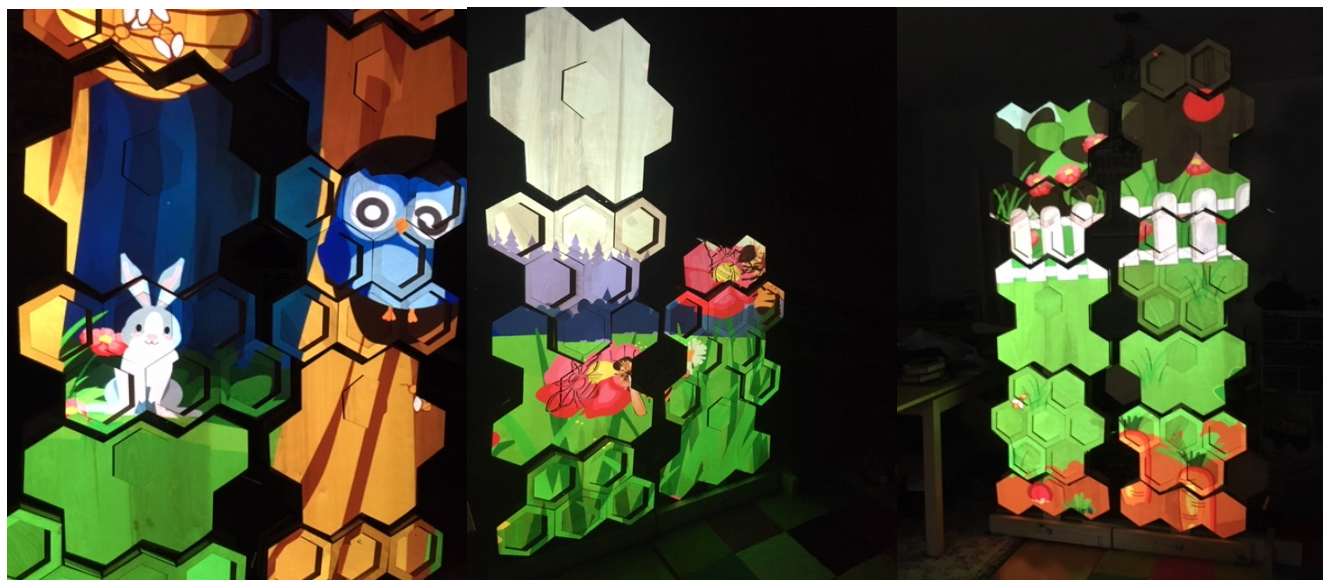
Throughout the process, the idea of using the cyclorama appealed to the project after taking a Wintermester class, which focused on motion capture, virtual reality, immersive projection, and spatial audio. However, with the idea of this project being an educational piece, the idea of creating a module structure seemed like a better direction to showcase the motion graphic piece.

I researched other museums and outside venues that used projection mapping and how successful they were with the narrative of the content that they showcased. The MORI Building Digital Art Museum, L'Atelier des Lumières, and the Olympic Winter Games in South Korea were my top favorite examples for projection mapping. In each instance, the artist/museums/curators/companies expanded the narrative over structural boundaries and incorporated color, sound, and shape to create optical illusions that extended space and time.

Projection mapping is a process that transforms objects into a display surface for video projection. Objects consist of multiple forms and can be as simple as a twin sheet or more complex, like a structure or a building. It helps to add an extra

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dimension to showcase video, motion graphics, and visual art.



[Figure 9. Projection mapping testing during COVID-19.]

Testing in COVID-19

During the spring semester of 2020, the unspeakable occurred. COVID-19 spread throughout the world, and testing opportunities in the CUBE were not available. In a rush, I had to pick up my fabrication and projector from the Moss Arts Center. To test the narrative, motion graphics, voiceover, and sound, I turned my dining room and kitchen into a studio space. The only audiences that physically viewed the structure and projection were my daughter and husband. The storytelling was a success with both of them, but I wish I could have been able to test it and show it in person through Innovation + ICAT Day.

This year because of COVID -19, the event took place online, and I was able to participate. The feedback I received was helpful; a teacher in Floyd loved the project and talked about how two of her students help their families who are beekeepers. The data and analytics of that day also showed that my page was the third-highest viewed. I would have loved to receive more feedback in person by children, adults, and educators. However, the data that I received proved that the concept was successful. Innovation + ICAT Day data, conversations with exhibitors, and other people were fruitful. I also received feedback from the Science Museum of Western Virginia. I

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structure is based on a honeycomb and will be used to project the motion graphic piece by telling the story of the bee colony in Happy Willow Woods. However, with the idea of this project being an educational piece, the idea of creating a modular structure seemed like a better direction to showcase the motion graphic piece. Through this process, the project has gone through multiple iterations. Creating the structure was something new, and various ideas and inspirations made their way to numerous inspirational boards. I wanted to create something that was architecturally interesting, and best represented the hive. The first idea was to create a dome out of cardboard. However, through testing and cutting out a honeycomb by laser cut and a saw, I realized that using wood would be easier to manage, and laser cutting would be cleaner.



[Figure 11. Six-sided structure.]

Since I had never used a laser machine to cut materials, I was grateful to BUILDLab for their support on the structure's construction. After multiple conversations, the dome would need some assistance from non-natural materials. I felt that I needed to modify the fabrication so that it would be easier to maintain, and the build would be tangible. The structure migrated to a six-wall structure that would look like a hive if viewed from a bird's eye perspective. This structure would consist of 1,000 shadowbox honeycombs. The audience would be able to walk through the construction and see the projection on all

sides of the fabrication. However, through testing, the structure was too big and not structurally sound as each panel was 8 feet tall and 8 feet wide. The entranceways need to be at least 32 inches in width to meet A.D.A. accessibility minimums, and that left the projected sides too small to show the projection.

The honeycomb took a lot of time to create. Each honeycomb was created by hand, and it was a

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new learning process for me since my carpentry skills are below the beginning level. The back of the honeycomb is a solid piece of plywood that was laser cut to a hexagonal shape. Six rectangles were laser cut in two different sizes and glued to the sides of the hexagon. Lastly, an outline of the hexagon was laser cut and glued to the top to create a shadow box. Screws and bolts were fixed on each side to create a module with other shadow boxes.

The fabrication needed a new direction. With a lack of time, the big laser machine out of use, the BUILDLab being closed for Spring Break, and the fact that this project needed to start testing, I chose a more straightforward approach. The layout would still consist of the honeycomb shadow boxes and flat-panel structures that were already laser cut.

The process of building the structure started with a paper model of a walk-through hive, tested out different cardboard and plywood materials, and migrated to laser cutting. The exhibition structure has evolved during the first two stages of sketches and construction. At the same time, the idea of the installation will still allow the audience to walk through and be able to emphasize with the honey bee.



[Figure 12. Plus-sign structure.]

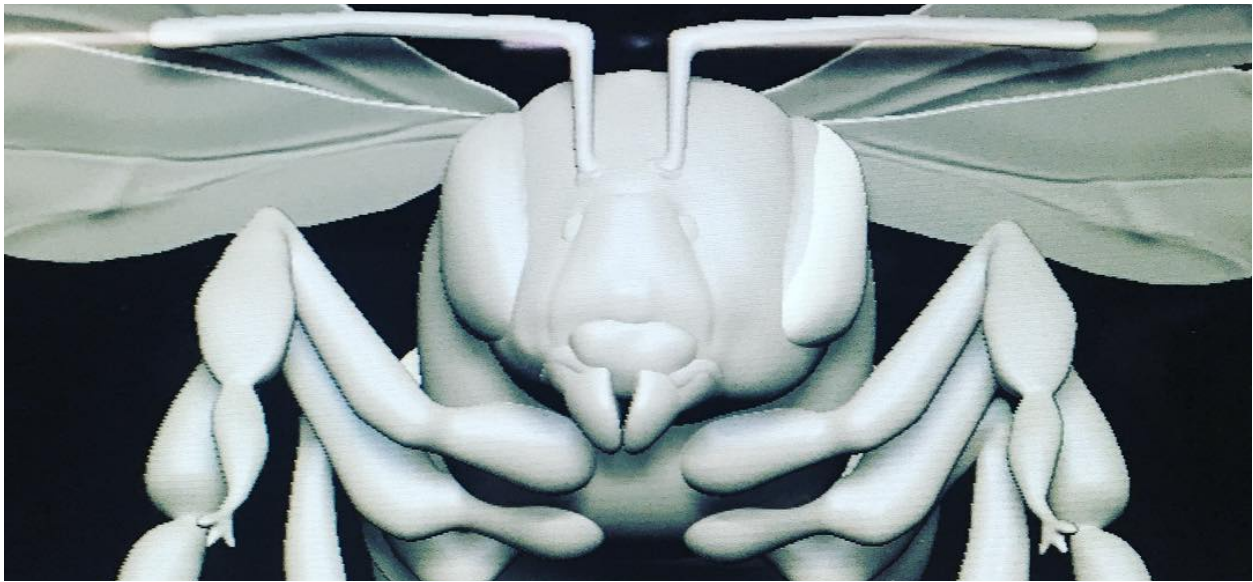
The final structural layout is a plus sign and consists of individual honeycombs that represent a life-sized hive. The structure will give the audience an ability to see how honey bees work in a colony as well as demonstrate how important it is to have a healthy habitat so they could survive for generations to come. The structure consists of individual modules and has a width of 8 feet and varies in height. *Appendix 4: pdf of the physical measurements.*

The plus-sign structure represents eight scenes in the day in the life of a honey bee. The first side

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introduces the Happy Willow Woods. With audio and visual cues, the person will walk to the panel representing a healthy hive. The audience member follows the path around to the next structure to see how bees collect nectar and spread pollen. The participant(s) will be able to see how bees communicate with other bees with audio and visual cues. The participant follows the audio signal to see a weak hive and determine how pesticides and monocultures are critical factors in the decline of the honey bee.

Finally, the audience member walks to the next structure to see how the earth would look without pollinators. At the end of the narrative and motion graphics, the audience will see that planting a bee-friendly garden will help all pollinators survive. As one can see, I want the audience to experience the simulation of honey bees in a natural environment.



[Figure 13. 3D Model of a worker honey bee.]

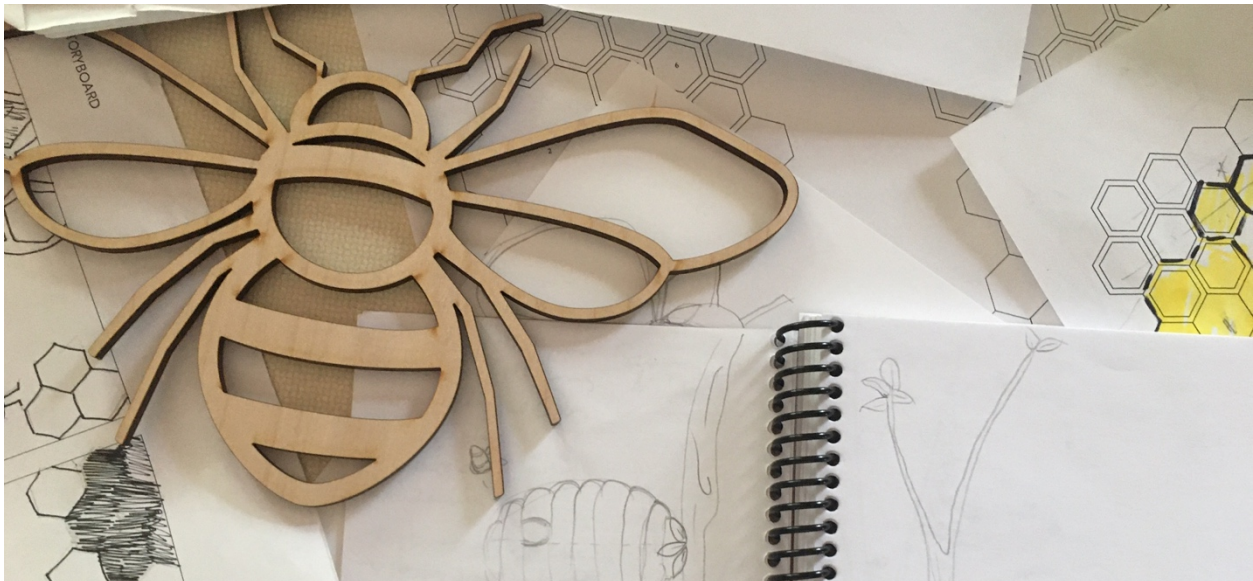
3D Modeling

As mentioned earlier, I wanted to use 3D Modeling in my thesis. I spent a year and a half in Zbrush and Maya classes learning everything that I could from Phat Nguyen, who was the professor in both classes. I modeled bees, hives, individual elements, and the environment. Since the beginning of this project, I wanted to use 3D Modeling and video from local beekeepers. I soon realized that the pieces created and lack of resources in character modeling and filming

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opportunities were less than sufficient. I had to rethink the motion graphics from 3D Modeling to 2D.

Even though I want to pursue this direction, I knew that I had to look at alternatives to tell the honey bee's story. *Appendix 5: This is an animation of one of my 3D bees that were rigged and set to motion* <https://youtu.be/Dz3SH5oWW9U>



[Figure 14. Creative process.]

Creative Process

There were a couple of mediums I could use to tell the story of the honey bee; I decided that I needed to use illustration. There are different forms of illustration, photorealism, literal, character, information graphics, freehand and vector graphics, children illustrations, and graphic novel and comic illustrations. I wanted to reach the young audience by creating scenes, characters, and objects in a friendly way but also being faithful to the esthetic of the honey bee. The form of the pieces that I created is a combination of children illustrations and vector graphics. By relating to the early learning audience but also being faithful to the esthetic of the honey bee, the figure for this motion graphics needed to be relatable to the subject and a natural approach style for early learners to walk through the whole exhibition.

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Creating a kit that included illustrations, color palettes, sketches, and visual inspirations were necessary to show the committee members that all the work is created by me and not borrowed from the internet. The sketches were inspired by photography, video, and resources from 3D Modeling. Each character, element, and background object were sketched and documented. Usually, a sketch begins with a purpose. It is created by using a pencil and is based on a quick study. It is used to help develop the idea for illustrations and motion graphics and defines the curves, elements, and structural features such as eyes and wings.



[Figure 15. Color palette - honey bee.]

An artist creates a color palette that is in concert with an illustration. A color palette is a collection of colors that best represents the objects. Color palettes for this project are compatible with all of the backgrounds, elements, objectives, and creatures. The color palette should help tell the story of a day-in-the-life of a honey bee. I wanted to be as realistic as possible; I wanted the color palette to represent nature. Therefore, I used inspiration from photography and videos to create the color palette used in motion graphics.

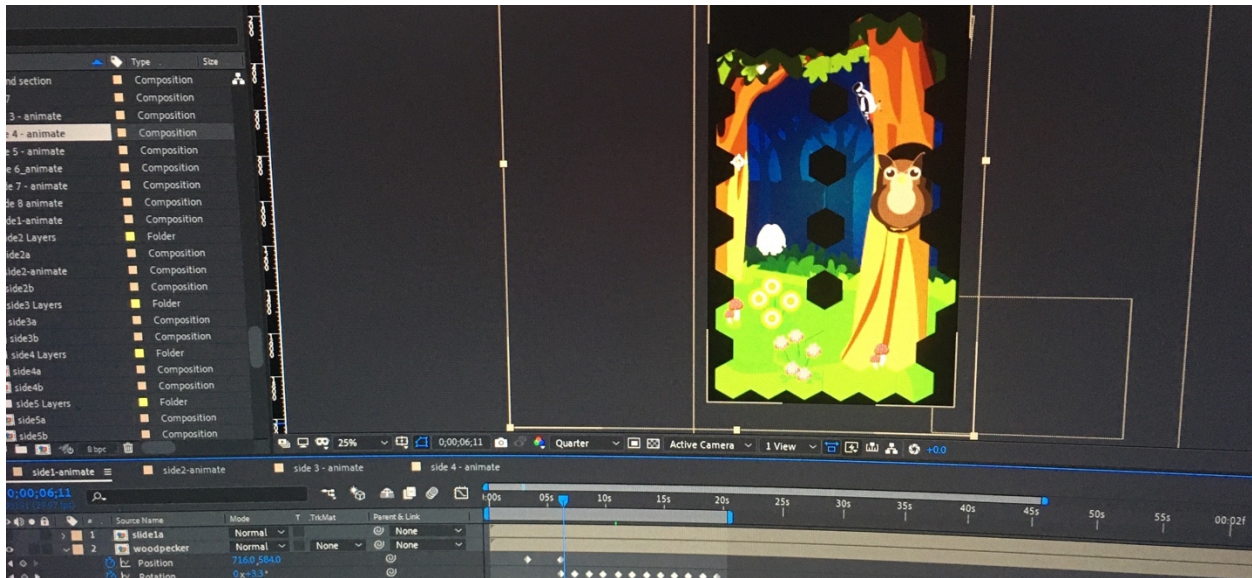
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[Figure 16. Illustration examples.]

An illustration is a visual representation of a concept, background, or element. A vector program like Adobe Illustrator produces a picture. Each sketch created is scanned and used to help build each illustration. Using the color palette, drawings, and photography, I created each image. The illustrations created are minimal in design but emphasize the early learning esthetic. A minimal figure uses less detail and leaves essential design elements. The illustrations are vibrant representations of the honey bee and built by combining simple shapes and essential geometric elements and incorporating the color palette. *Appendix 6: Walkthrough of how I would illustrate a character* <https://youtu.be/JuQSRFsU4c0>

Propolis is an immersive experience that will educate audiences about the importance of honey bees and why it is crucial to saving pollinators from extinction. The immersive environment will include multimedia motion graphics, 2D character modeling, sound, and animation. By combining the different mediums, the immersive experience will showcase the beautiful life of the honey bee while also showcasing what the Creative Technology program offers.



[Figure 17. Screen capture of a composition in After Effects.]

Motion graphics are combined with illustration, sound, and motion to create the illusion of movement in a video. The motion graphics for this project are built using After Effects and imported into MadMapper for the projection. The animation consists of over 70 compositions and multiple hours of voiceover animation, creating a consistent world so that audiences of all ages could enjoy the story of a day in the life of a honey bee. *See Appendix 7: Walkthrough of how to create motion graphics* <https://youtu.be/2GZ7T7NLTQA>

The audience will be able to take home a seed packet and a brochure about the Happy Willow Woods along with descriptions of the structure, motion graphics, and projection mapping. The intent is to inform the audience that by planting a bee-friendly habitat, we can become a voice for a creature that is about 1.54 inches long. *Appendix 8: close up of the video of motion graphics* <https://youtu.be/i6WBuK0IcjU>

This thesis includes motion graphics, physical structure, spatial sound, brochures, seed packets, and stickers. In marketing, it is ideal for creating a takeaway like a brochure for audiences to bring home so that they may share the experience with others. It gives another opportunity to open the conversation with others on how important honey bees are to the environment. The project is also about giving the audience a proactive opportunity to do something for the ecosystem and planting their bee-friendly garden by taking a seed packet home and creating a

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haven for these beautiful creatures. By using both marketing tactics, the projection on the structure and the motion graphic piece, the voice of the honey bee will be spread throughout the community and become the reason that it is allowed to live, pollinate and create honey for all to use.



[Figure 18. Promotional stickers with the URL and image of a honey bee.]

Stickers are promotional materials that are used by children of all ages, and everyone loves stickers. There are two different sizes of labels created for this project. The first is 2" and has a color illustration of a honey bee and the URL on the bottom www.honeybee-project.com. The second sticker is 1" and uses the same figure as the larger one but is in black and white and promotes the hashtag #savethebees.

The brochure is a great take away for older audiences to learn about the project and how important honey bees are to the ecosystem. The booklet is a tri-fold and uses the same illustrations and narrative as the motion graphics. The hope is that an early learning student will share this with their parents and friends. *Appendix 9: Brochure PDF.*

An essential takeaway for this project is to have seed packets. The seed packet allows the students to be proactive and be part of the solution by planting a bee-friendly garden. The seed packets use flowers that are native in the northeast of the United States. The hope is that one day,

this project will partner with The Plant Southwest VA Natives chapter to use local flower seeds. For both the brochure and the seed packet, I am waiting for some direction from personnel at the Science Museum of Western Virginia, regarding final design elements before I send this work to the printer. *Appendix 10: Seed packet PDF.*

Partnering with local chapters to spread the importance of the honey bee

Hopefully, there will be opportunities to enlighten early learners about the importance of pollinators, such as the honey bee. This researcher desires to partner with other non-profits such as The Plant Southwest VA Natives and the New River Valley Beekeepers Association to teach others about these fantastic creatures and to show people how easy it is to help pollinators survive in an overpopulated world. Partnering with local chapters to spread the importance of the honey bee has always been an option and one to pursue after this M.F.A. journey. As mentioned above, one approach is to partner with a local flower chapter or a seed cooperative to include their seeds in the packets. Another idea would be to partner with the New River Valley Beekeepers Association to learn more about the honey bee and use those findings to create similar motion graphics using 2D illustration or 3D Modeling.

Propolis is an immersive environment that tells a story about a day in the life of a honey bee, using motion graphics, illustration, spatial sound, and a narrative about Happy Willow Woods. A child can learn about the value of the honey bee. If there is an opportunity to show this work to early education professionals and partner with local teachers, then bringing this project to the classrooms could open up the conversation to communities throughout New River Valley and beyond. Finally, with a digital presence, this project can be seen anywhere in the world. It would be a goal to partner with any of the non-profits mentioned in my research to create multiple motion graphics for education purposes.

The Science Museum of Western Virginia

This researcher is disappointed at not being able to receive feedback from children, adults, and educators who would have viewed the exhibit. However, this researcher did receive an indication

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the project was on point and successful. At Innovation + ICAT Day held at Virginia Tech provided me with an opportunity to exhibit the project. The many conversations with exhibitors and other attendees were beneficial. The personnel from Innovation +ICAT Day informed this researcher that *Propolis* received the third-highest ranking among all exhibitors. The Science Museum of Western Virginia provided input. I can officially say that in some form, my thesis project will be housed in the museum and be part of the exhibition experience. I am currently working with Phyllis Newbill to see in what form this project will be part of the overall experience at the Science Museum of Western Virginia.

Synthesis and Results

Due to the COVID-19 lockdowns, this thesis required retooling to a motion graphic piece for YouTube. The constructed hive structure intended to showcase the motion graphics was shelved; however, this researcher will use it in future endeavors. The designed brochure and seed packets have not been printed and could not be handed out to an audience as critical takeaways. The conversation is continuing with a local museum to house the project upon completion. As of now, it is uncertain if this portion of the project will live outside this thesis. However, when the "New Normal" surfaces and the Fall semester is underway, the hope is to showcase this project in its original form at the Cube, located in Virginia Tech's Moss Arts Center.

With that said, the message remains the same; it is still important to save the honey bees and other pollinators from extinction. There are simple actions each one of us can do to make sure that honey bees are healthy. In essence, plant bee-friendly gardens, create solitary hives, become a beekeeper, stop using pesticides, talk to legislators and farmers, and keep the conversation going. If we all do at least one of the interventions, as mentioned above, we can help these insects survive. It would be phenomenal if all of us can be part of the solution!

Summary, Findings, Conclusions, Discussion, and Recommendations for Further Study

To create an immersive environment for young audiences, the materials in this thesis had to

showcase the honey bee's importance without scaring the audience. The process of learning about early learning, exhibition design, and creating a piece that will be a voice for the honey bee has been exciting, and I cannot wait to see where this will go in the future. The materials and structure need to be educational and provide a chance to change the course of these essential insects from endangered to being around for generations to come. The immersive environment and narrative have been a learning experience, not only within the classes and programs within Creative Technologies but in multiple departments throughout Virginia Tech and the field. I relate this project to the Little Engine That Could. There have been plenty of roadblocks, and I have been resilient and created a project that I feel represents the Creative Technologies program. This project is part of ICAT + Innovation Day, on social media, YouTube, and through the-honeybeeproject.com.

In conclusion, *Propolis* is an immersive experience that tells the story of a day in the life of a honey bee. The environment uses a narrative created for early learning audiences about how honey bees live, collect nectar, spread pollen, and communicate with other bees. The story explains why bees are on the decline and give suggestions on how we can all do our part by planting a garden, building a single beehive, and not using pesticides. If one child learns from this project and makes a difference, this project will be successful.

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"What Is a Neonicotinoid?" *Insects in the City*, December 29, 2015, citybugs.tamu.edu/factsheets/ipm/what-is-a-neonicotinoid/.

PROPOLIS: An immersive environment

APPENDIX

Appendix 1: video of the path through the structure <https://youtu.be/sHYzbKQe6QE>.

Appendix 2: video of motion graphics <https://youtu.be/29moh2XYebU>

Appendix 3: video capturing the projection on the structure with a child's reaction
https://youtu.be/Q16B2_EqxyY

Appendix 4: pdf of the physical measurements.

Appendix 5: This is an animation of one of my 3D bees that were rigged and set to motion
<https://youtu.be/Dz3SH5oWW9U>

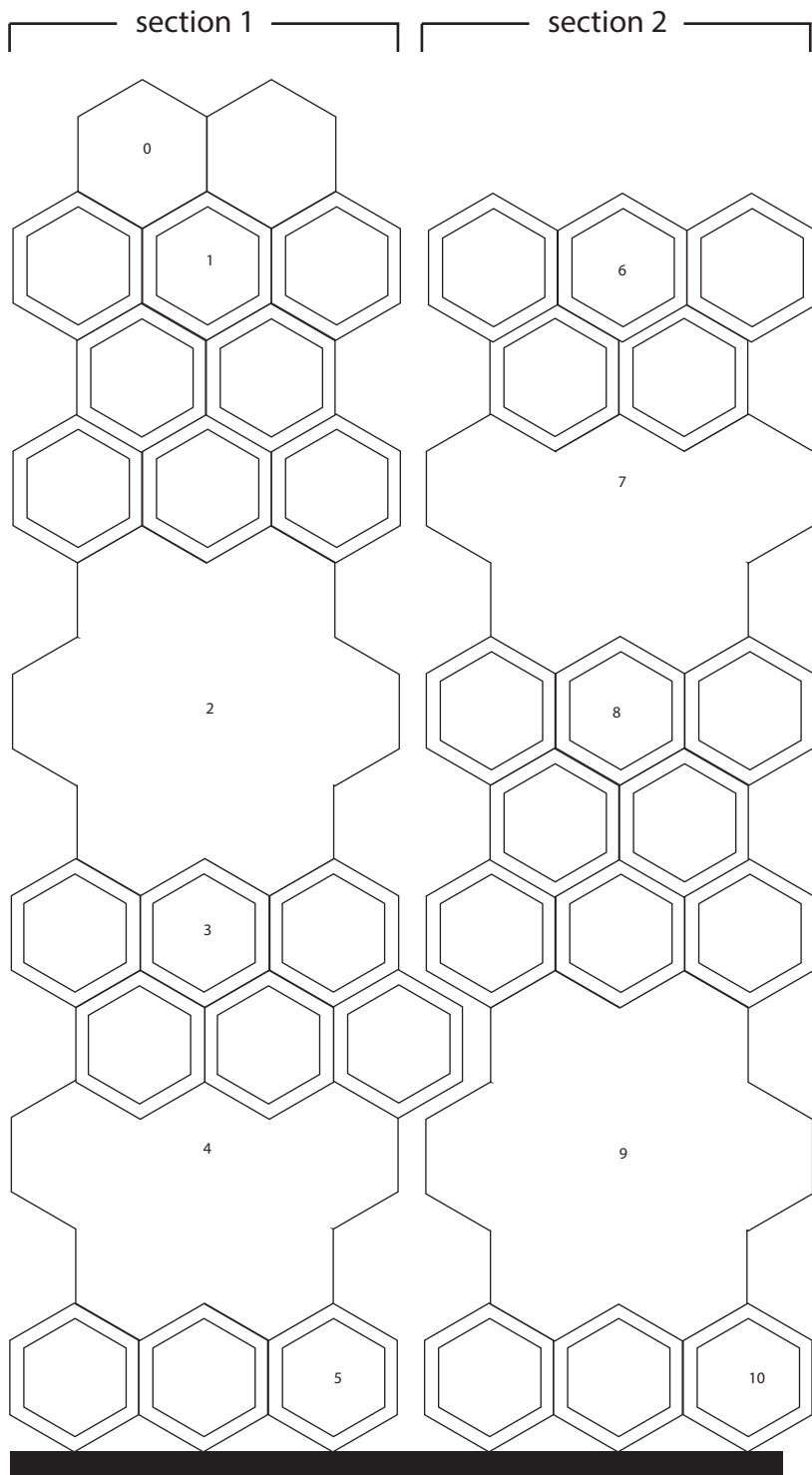
Appendix 6: Walkthrough of how I would illustrate a character <https://youtu.be/JuQSRFsU4c0>

Appendix 7: Walkthrough of how to create motion graphics <https://youtu.be/2GZ7T7NLTQA>

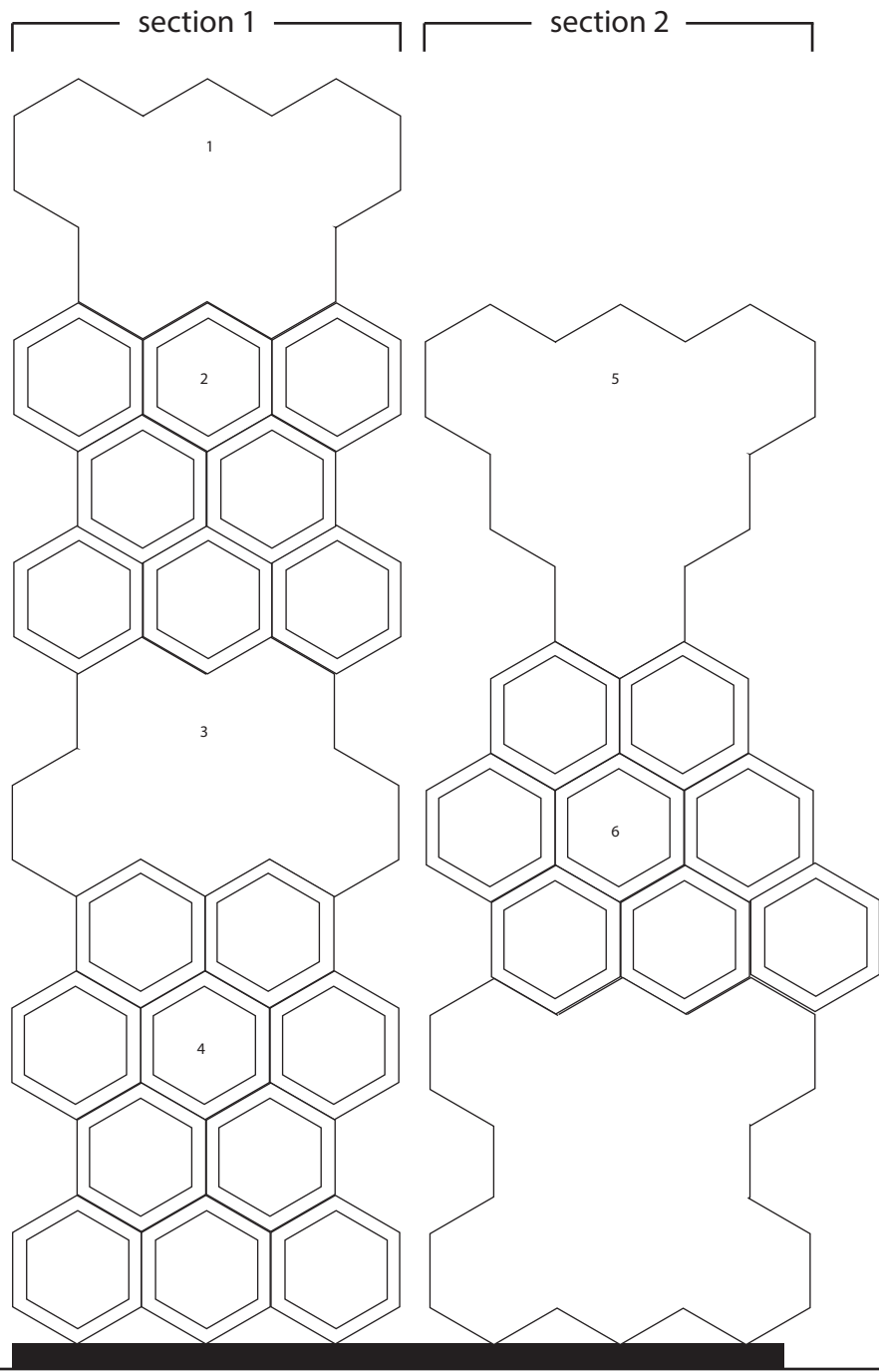
Appendix 8: close up of the video of motion graphics <https://youtu.be/i6WBUK0IcjU>

Appendix 9: Brochure PDF.

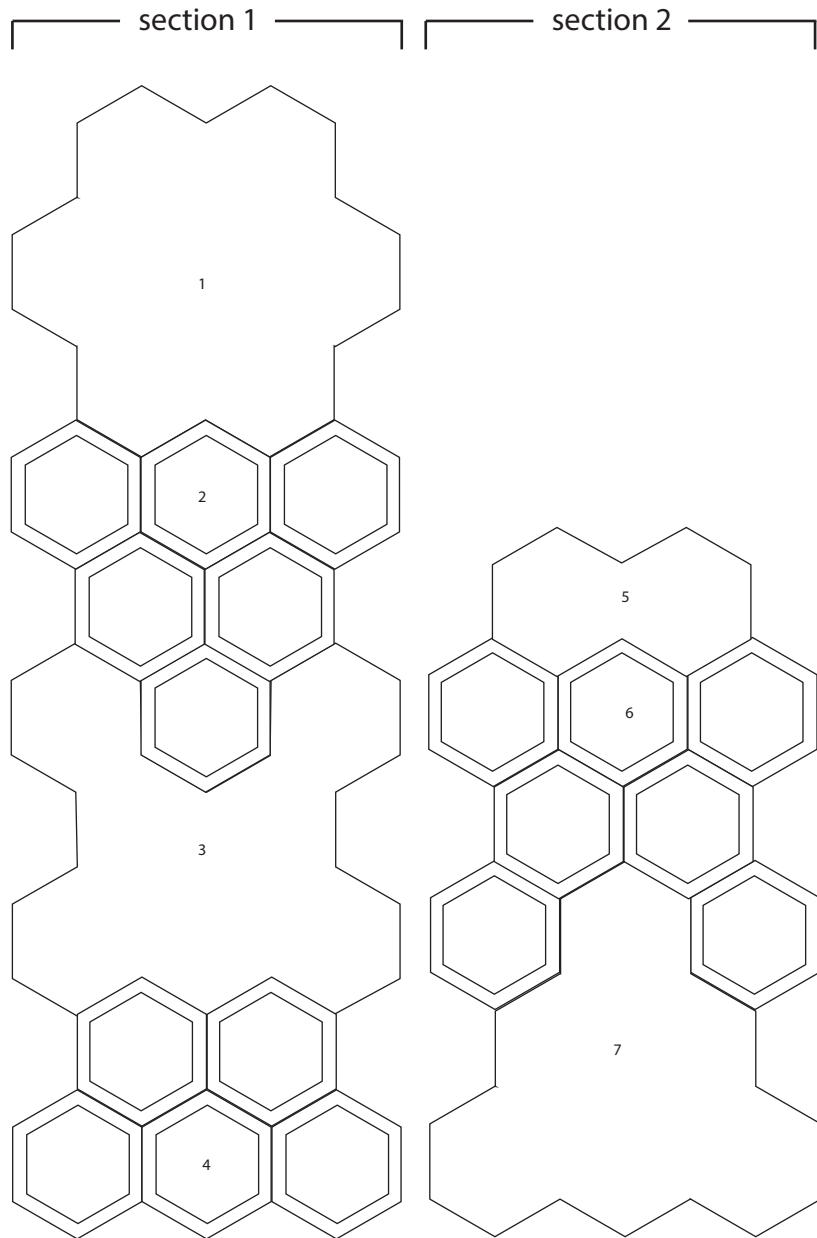
Appendix 10: Seed packet PDF.



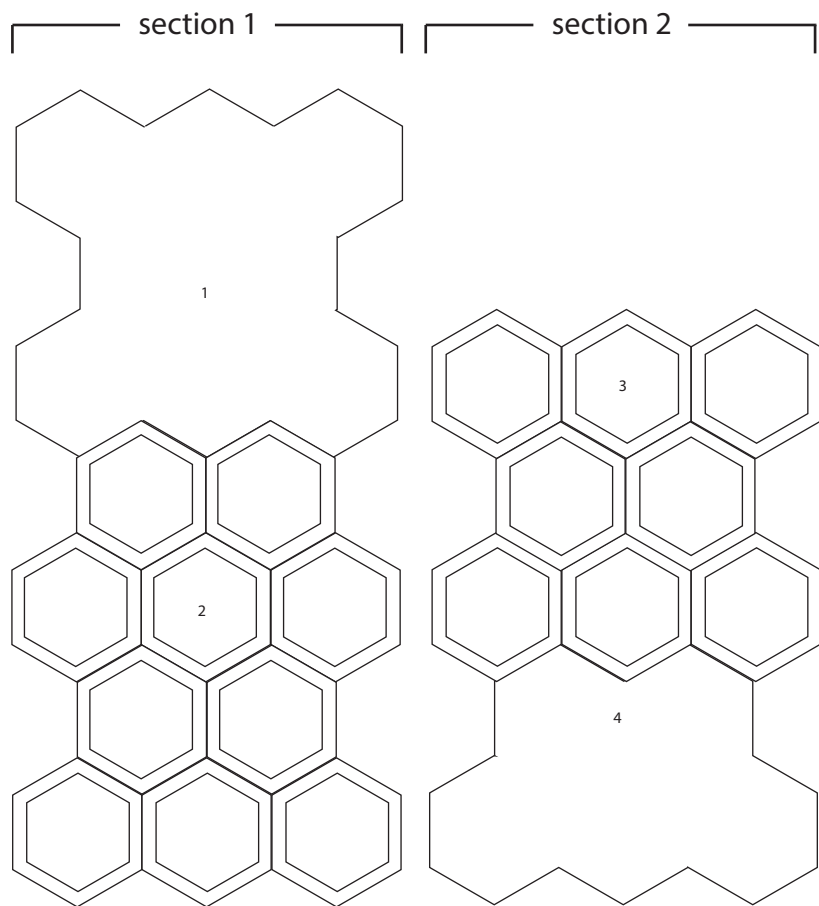
honeycomb: 8.5" height x 7.3125" width
section 1 wall: 84" height x 24" width | section 2 wall: 75.5" height x 24" width



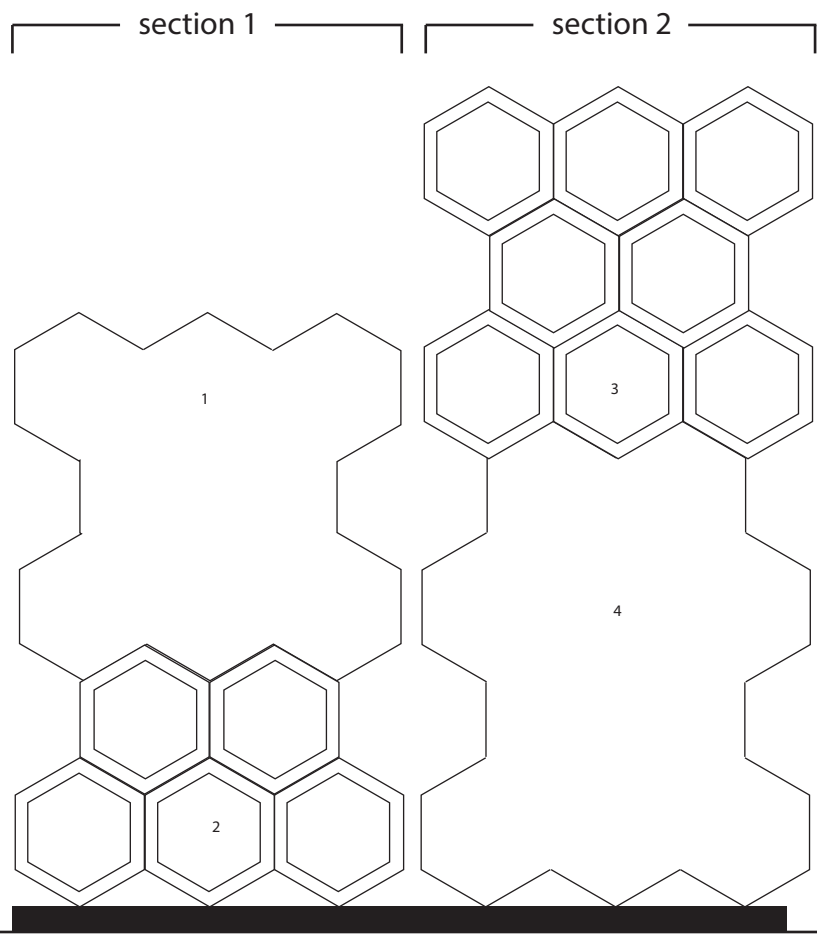
honeycomb: 8.5" height x 7.3125" width
 section 1 wall: 75.5" height x 24" width | section 2 wall: 58.5" height x 24" width



honeycomb: 8.5" height x 7.3125" width
 section 1 wall: 67" height x 24" width | section 2 wall: 51" height x 24" width

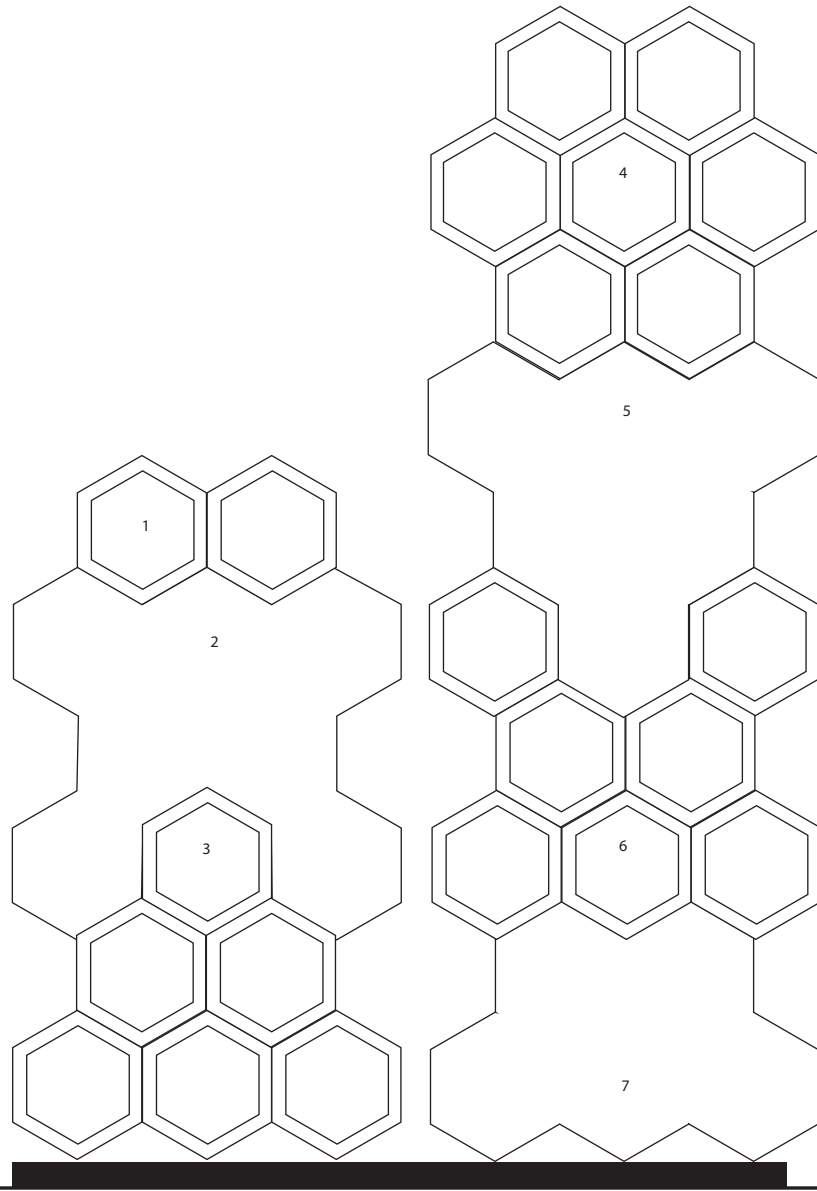


honeycomb: 8.5" height x 7.3125" width
 section 1 wall: 59.5" height x 24" width | section 2 wall: 42.5" height x 24" width

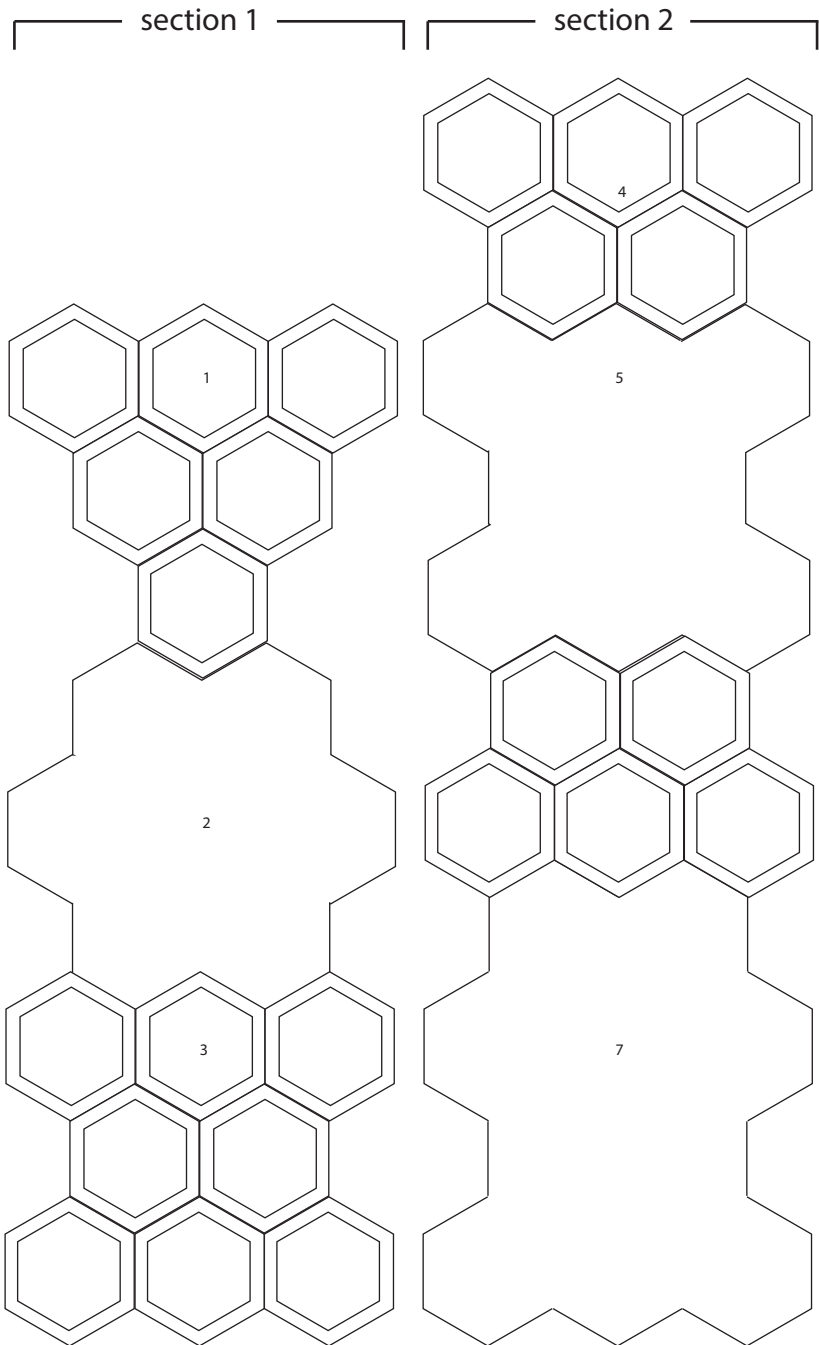


honeycomb: 8.5" height x 7.3125" width
 section 1 wall: 59.5" height x 24" width | section 2 wall: 42.5" height x 24" width

section 1 section 2

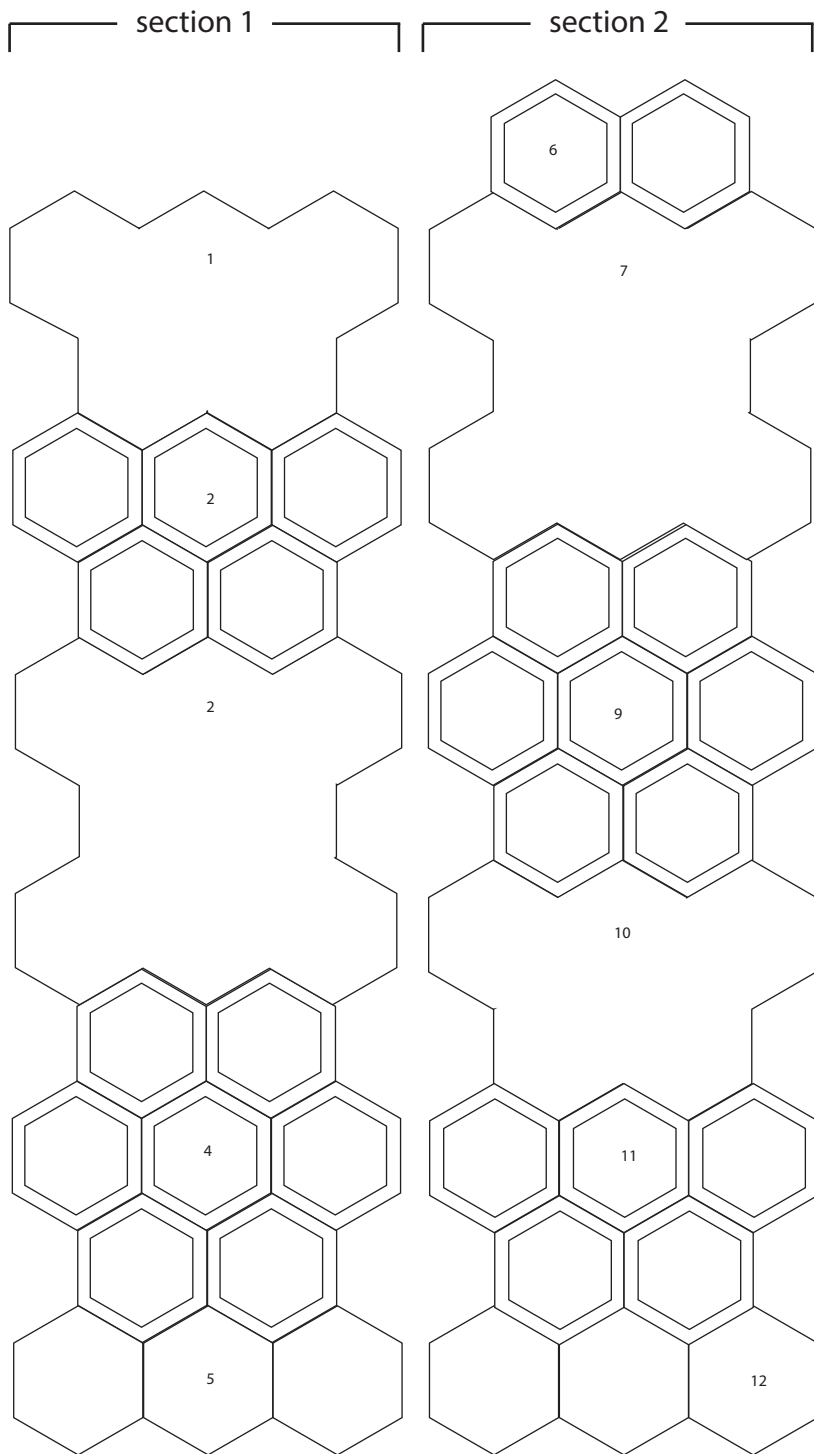


honeycomb: 8.5" height x 7.3125" width
section 1 wall: 51" height x 24" width | section 2 wall: 67" height x 24" width




section 1 wall: 58.5" height x 24" width | section 2 wall: 75.5" height x 24" width






honeycomb: 8.5" height x 7.3125" width
 section 1 wall: 75.5" height x 24" width | section 2 wall: 84" height x 24" width

A detailed illustration of a honeycomb structure. The honeycomb is composed of hexagonal cells, some of which are filled with golden honey. Several bees of various sizes and colors (black, white, and yellow) are shown interacting with the honeycomb. Some bees are flying around, while others are on the surface, some appearing to be working on the cells. The background is a light blue sky.

A honey bee **colony** consists of **three** kinds of **adult bees: workers, drones,** and a **queen**. Each member has an **essential role** in keeping the **hive healthy**, and **individual bees** cannot survive without the **support** of the **colony**.

A whimsical illustration of a forest scene. A large, brown tree trunk is on the left. A yellow, beehive-shaped structure hangs from a branch. Several bees are flying around the beehive and in the air. In the foreground, there are green bushes, yellow daisies, and red mushrooms. A white rabbit is sitting on the grass. A woodpecker is on the tree trunk, and an owl is perched on a branch on the right. The background is a dark blue sky with stars.

Propolis is an MFA thesis project that is an **immersive exhibit** that **educates children** for early learning about the importance of saving the **honey bees**. **Learn more** about saving the **honey bees** and other **wild pollinators** by going to honeybee-project.com.

PROPOLIS

An immersive environment

A **worker bee's** job is to **spread pollen** and **collect nectar**. Honey bees see the world in **ultraviolet** and are **attracted** to flowers that are **big, bright, colorful,** and **sweet-smelling**.

When **bees** find **nectar**, they **communicate** with the other bees in the colony by doing a **waggle dance**. This tells all the other bees where the flowers are. If the flowers are found to the **left of the sun**, the honey bee **waggles to the left**. If the flowers are found to the **right of the sun**, the honey bee **waggles to the right**.

The **decline** of the **honey bee** is due to **industrial agriculture, parasites/pathogens,** and **climate change**. The **loss of habitat** and **lack of nectar** due to **monocultures** that lack plant diversity and **bee-killing pesticides** are threats for honey bees and wild pollinators. If the **honey bees** do not have a **healthy habitat** to **collect nectar** and **spread pollen**, our **food supply** would be **less varied** and **less available**.

Honey bees might be **small** but are very **special** and **important** to **humankind**, and it is up to **you** to keep honey bees **healthy, happy,** and **alive**. Start by **planting a bee-friendly garden** for honey bees or build a **solitary hive** for other **pollinators**. If we take **small steps** like these, **honey bees** and other **pollinators** will be around for **generations** to come.



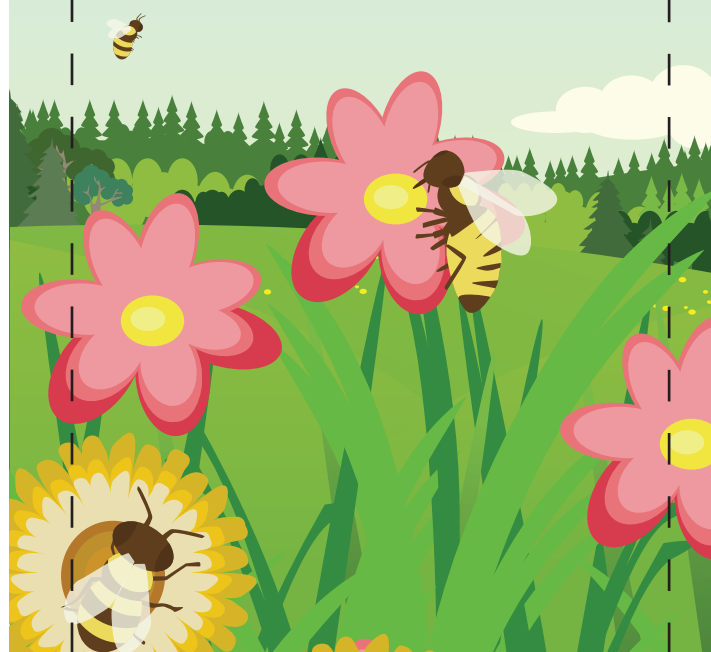
PROPOLIS

Northeast Wildflower Seed Mix



PROPOLIS

Northeast Wildflower Seed Mix



PROPOLIS
Northeast Wildflower Seed Mix

Propolis is an MFA thesis project that is an immersive environment that will educate early learners about the importance of the honeybee. The flowers in this packet will help you plant a bee-friendly garden at home. Watch your garden grow and keep honey bees and other pollinators around for generations to come. For more information about the project, go to honeybee-project.com.

Planting Guidelines

1. Plant after danger of frost has passed in spring or 6 weeks before heavy frost for fall planting. Plant in mostly sunny areas.
2. Rake area that will be planted an remove any debris.
3. Spread seed on surface of soil or lightly rake in seed.
4. Keep moist, not letting the seed dry out between waterings.
5. For more instructions, go to: outsidepride.com/resources

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