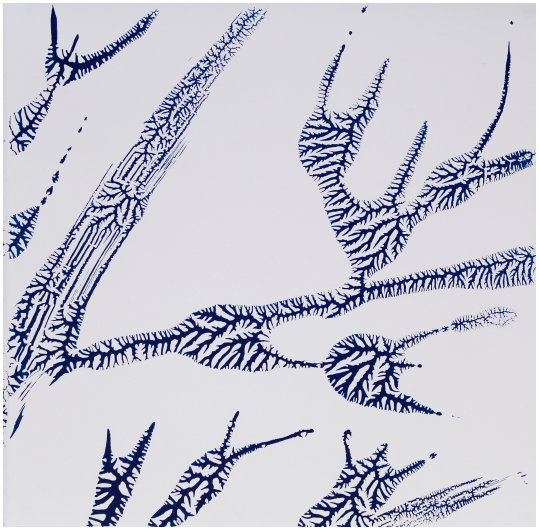
Dendritic Bloom

Olivia Allen-Wickler



Introduction

My thesis project entitled, *Dendritic Bloom* will discuss theories of nature's pattern formations and how those patterns take shape in art through the filter of human perception. Nature is completely unpredictable, yet it is seldom random. Humans have endeavored to find ways to predict the patterns of nature and sought a mathematical equation that explains it all. We have a unique adaptation for pattern perception in an ordered and simplified way. For centuries, artists have taken inspiration from nature by attempting to capture the chaotic beauty of a landscape or mimic the vivid colors in a fall leaf. Nature is a complex system and from it patterns are perceived. What is gained or lost when we order and simplify these patterns?

The Language of Nature

Patterns surround us in nature from the spiral shape of shells, the fur of animals, the branching of lighting, the rhythmic exchange from day to night, seasons of the year and countless more. Observers of nature have ventured to find contiguous sequences that create these patterns; to uncover the deeper pattern amongst patterns. Today, we have classified several main sequences of patterns that are commonly found in nature.

Numbers in Nature: A Mirror Maze is an exhibit by The Chicago Museum of Science and Industry[1] that explores Spirals, The Golden Ratio, Fractal Branching, and the Voronoi pattern, a few of the most common sequences of pattern which nature creates. The exhibit explains the Voronoi sequence as, "every point within a given region is closer to the 'seed' inside that region than it is to any other point outside that region.

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[1] "Numbers in Nature: A Mirror Maze." *Museum of Science and Industry, Chicago.* Access date: 10/15/17 https://www.msichicago.org/explore/whats-here/exhibits/numbers-in-nature/

Each point along a region's edge is equidistant from the two nearest seeds."(MSI, Chicago, *Numbers in Nature*) This pattern is commonly found in cracked mud (*Fig. 1)*, giraffe skin and foamy bubbles.

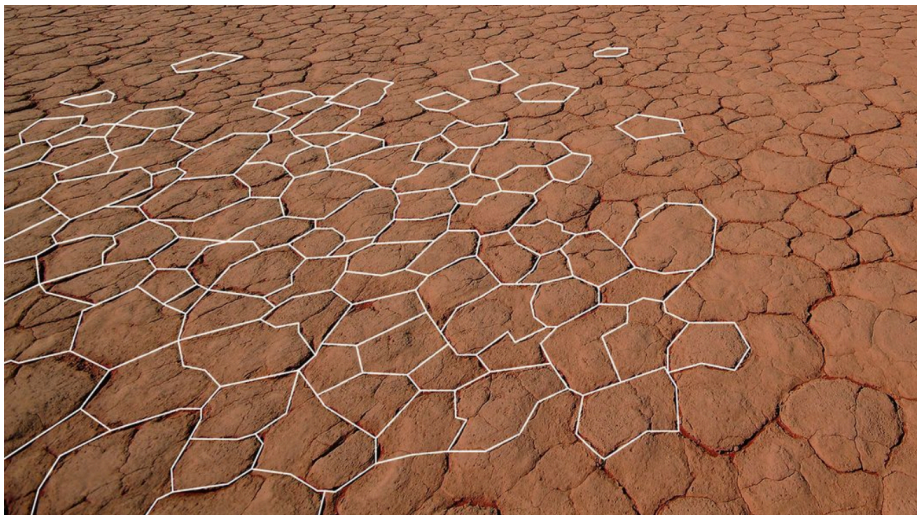

Figure 1: The Voronoi Pattern occurs naturally in cracked mud.

Spirals can also be found everywhere in nature and they are formed in the geometric proportion of the Golden Ratio also known as divine proportion. The Golden Ratio is demonstrated by, "dividing a line into two parts, one longer than the other, so that the whole line, compared to the longer part, is the same proportion as the longer part compared to the shorter" [2] This is shown in Figure 2 but can also be understood in the Golden Rectangle in Figure 3. In the Golden Rectangle[3], each square is proportionally decreasing as well as the length of the curve inside. This spiraling ratio forms the Fibonacci sequence[3], where every proportion in the sequence is found by

[2] Ibid.

[3] Christopher Williams, *Origins of Form.* (New York: Architectural Book Publishing Company, 1981)

adding the two before it: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34 and so on. This is found in pinecones (Figure 4), sunflowers, pineapples, hurricanes and more.

Figure 2: The blue line is broken down into the Golden Ratio through the red and green lines.

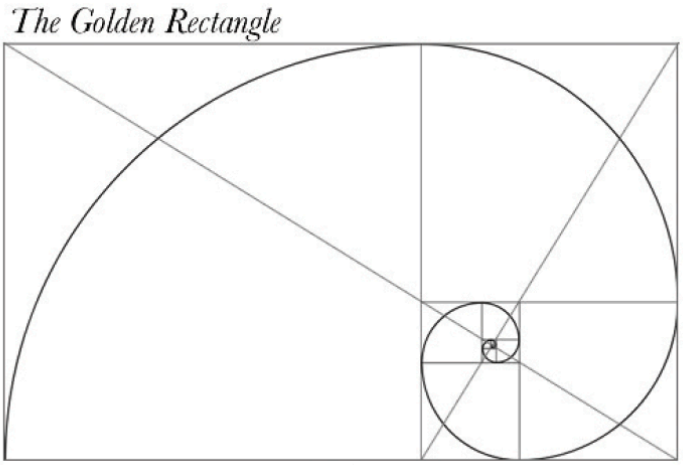

Figure 3: The Golden Rectangle is a perfect example of understanding a naturally occurring pattern through a humanly imposed grid.

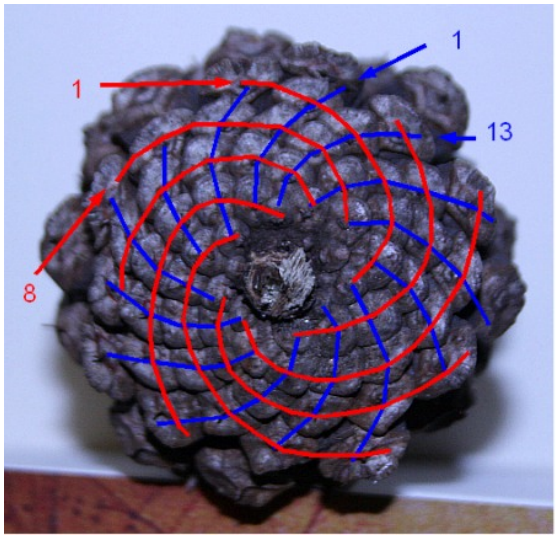

Figure 4: The Fibonacci Sequence helps trees on leaves and on other plants to grow optimally.

Fractals are another astonishing sequence of pattern found in nature. The unique aspect of fractal branching is that it is self-similar across different scales (Figure 5). Driven by recursion, fractals[4] become an image of chaos found at macro scales in tree branches (Figure 6) and river irrigation systems and at the micro scale of crystal formation in snowflakes. I have been particularly fascinated by the chaotic nature of

[4] Ibid.

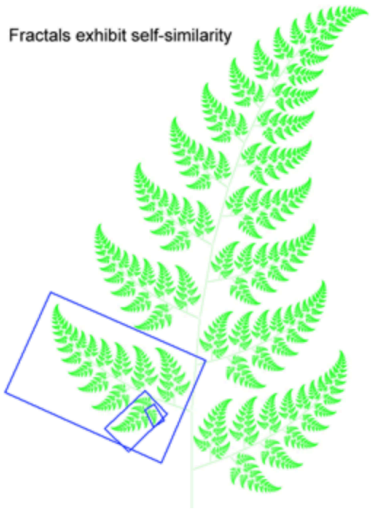

Figure 5: Ferns are self-similar at different scales.

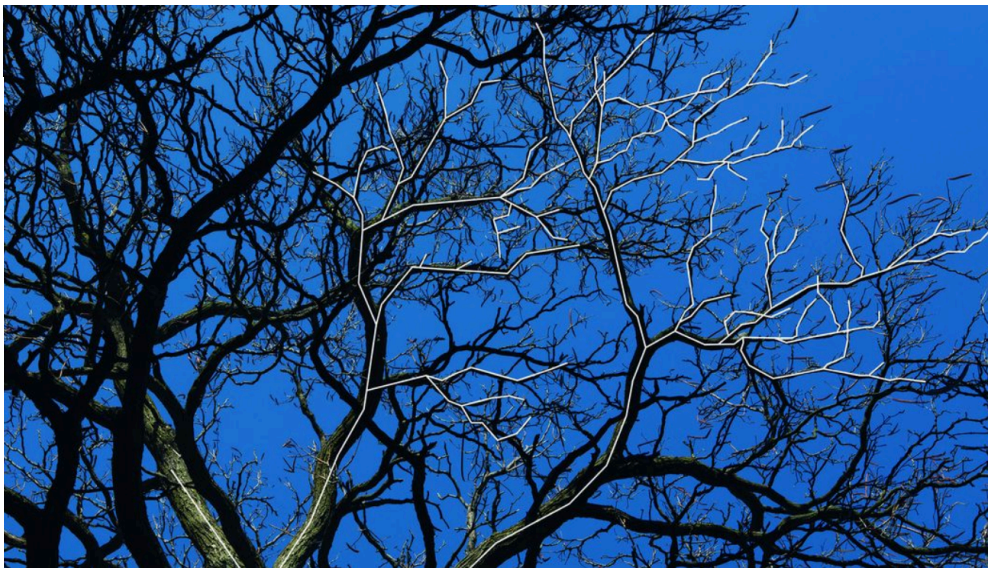

Figure 6: A tree's anatomy is a fractal system.

Fractal Branching also named Dendritic patterning and have chosen to focus on this pattern for my work *Dendritic Bloom*. Noticing the recursion of these patterns throughout nature helps us to understand their interconnectedness, yet it is still a reductive way of seeing pattern. We may never be able to fully understand the extent and nuances of nature's patterns but through observation and exploration we gain a sense of connection to the pattern.

Built for Pattern Recognition

Humans have long since tried to understand the seemingly chaotic way that nature takes shape and have harnessed nature's patterns to keep things ordered and flowing, like traffic systems and the fractals of urban planning. According to Root-Bernstein[5], "people are, in fact, pattern-recognizing and pattern-forming creatures.'(Bernstein, *What is the Pattern?*) The problem is that people no longer perceive themselves to be the same as nature. In order to comprehend the immensity of

[5] M. Root Bernstein and R. Root Bernstein, "What is the Pattern?" *Psychology Today,* Access date: 10/30/17 https://www.psychologytoday.com/us/blog/imagine/201103/what-s-the-pattern

the political, social, economical and environmental systems operating simultaneously, people need to perceive it in snapshots, figuratively cropping out what takes longer than a few moments to cognitively digest. This manner of focusing on parts rather than the whole can be misleading. When problem solving, it is important to understand the interconnectedness of every part of a system down to the miniscule. Attempting to capture the chaotic patterns of nature to understand their interconnectivity has broadened my perception to see systems as a whole rather than parts.

Particularly in visual arts, specific mechanisms for understanding pattern have been developed. Through the Gestalt principles of visual perception, artists and designers have utilized principles like proximity, similarity, continuity, and closure to evoke pattern recognition. In my work, *Dendritic Bloom* I have chosen to use the grid as a metaphorical 'net': a tool to catch the anarchic patterns of nature. This allows for inquiry as to whether the imposition of the grid, a manmade pattern, serves in pattern comprehension or affirms our limitations.

Matrix of the Grid

The grid is an ancient instrument that has appeared in many cultural and social manifestations. According to the definition of "grid" from the *Oxford English Dictionary*[6], the word derives from "gridiron," a lattice of parallel metal bars serving as structural frameworks. "The Cartesian map, developed by Rene Descartes, embodies the notion that humans can manipulate abstract mathematical laws in order to create new, concrete realities. Its importance coincided with the rise of modern science and the

[6] "English Oxford Living Dictionaries," *The Oxford English Dictionary*, Access Date: 01/10/18 https://en.oxforddictionaries.com/definition/grid

empirical study of natural laws." [7] ([Grid<> Matrix], *Grid,* p.12) This manner of mapping out uncharted space correlates to mankind's tendency to control, discipline and take possession of nature. In Alan Watts' book *How to be a Genuine Fake*[8]*,* he discusses the evolution of the net, from catching rabbits to catching the world through the lines of celestial and terrestrial latitude and longitude. "By itself, if the world goes something like this:

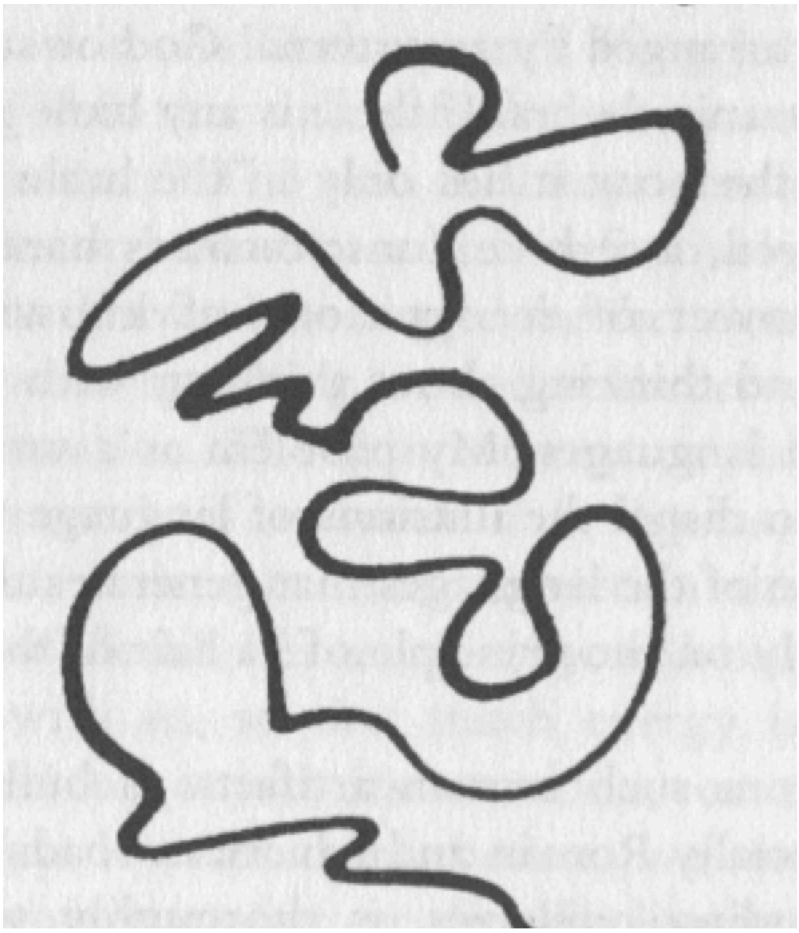

Figure 7: Alan Watts draws out the world as a wiggly line.

[7] Sabine Eckmann and Lutz Koepnick, *[Grid <> Matrix]* (Missouri: Mildred Lane Kemper Art Museum, 2006)
[8] Alan Watts, *The Book on the Taboo against knowing who you are.* (New York: Pantheon Books, 1966)

Now look at this wiggle through a net:

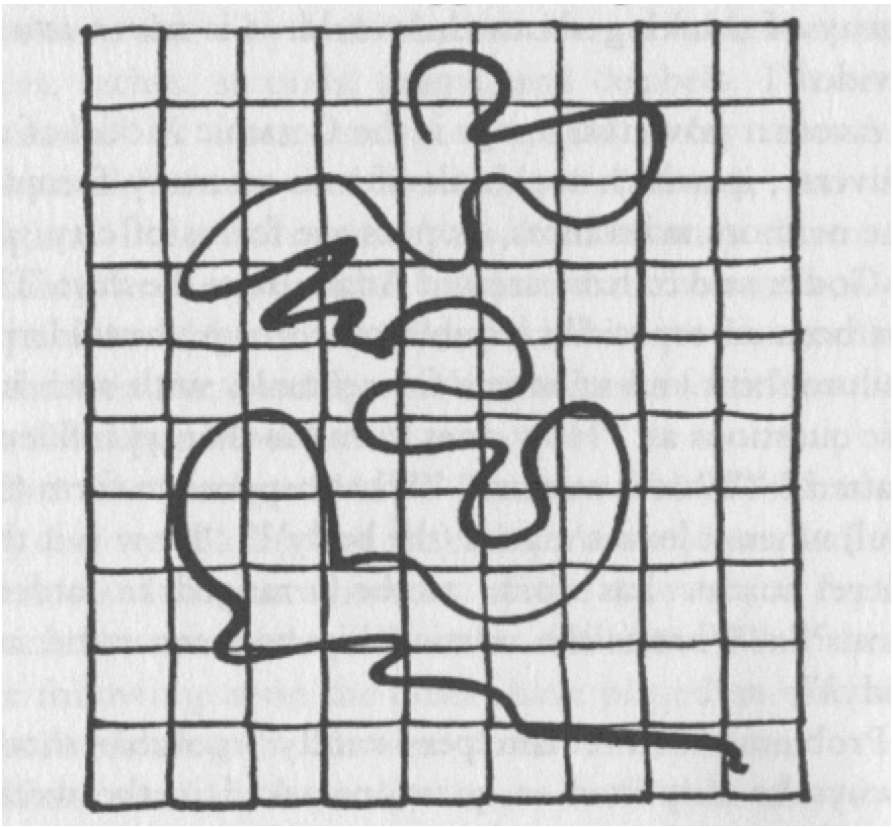

Figure 8: Order is imposed onto chaos when Alan Watts draws a grid over the line representing the world.

The net has 'cut' the big wiggle into little wiggles, all contained in squares of the same size. Order has been imposed on chaos. We can now say that the wiggle goes up so many squares to the left, to the right, up or down." [9] (The Book, *How to be a Genuine Fake,* p.59) Therefore, does imposing the grid onto space inform progress and understanding of the world around us and its natural laws, or does it undermine mankind's ability to learn from nature? This is a form of the question I am exploring in my work *Dendritic Bloom.*

Artists and The Grid

While trying to find answers to how deeply the grid informs pattern, I have looked to the ways artists have interpreted the grid first as a means to develop realistic

[9] Alan Watts, *The Book on the Taboo against knowing who you are.* (New York: Pantheon Books, 1966)

perspectives and later to the forefront as subject matter. Jennifer Bartlett is a painter that uses the grid as a way to compose landscapes. Similarly to Alan Watt's thinking, Bartlett's paintings can be analyzed through perceiving each square or dot at once. This allows her viewers to see landscapes broken down into singular colors and brushstrokes.

Figure 9: Jennifer Bartlett, *Atlantic Ocean,* 1984.

Figure 10: Jennifer Bartlett, *Four Houses,* 1998.

Terry Winters is a painter that explores the grid through the repetition of brushstroke. Each stroke is unique but ends up being an image of organized chaos. Jackson Pollock pushes this form of making further to break the boundaries of organized pattern. I have been particularly intrigued by Pollock's work because there is a hidden aesthetic geometry within it. According to Richard Taylor, a physicist who has studied Pollock's paintings, certain patterns within the paintings are repeated again and again at various levels of magnification such as fractals in nature. I have been working in a similar way, using the dendritic pattern in repetition to build a larger image, one that embodies the judgment of my human eye.

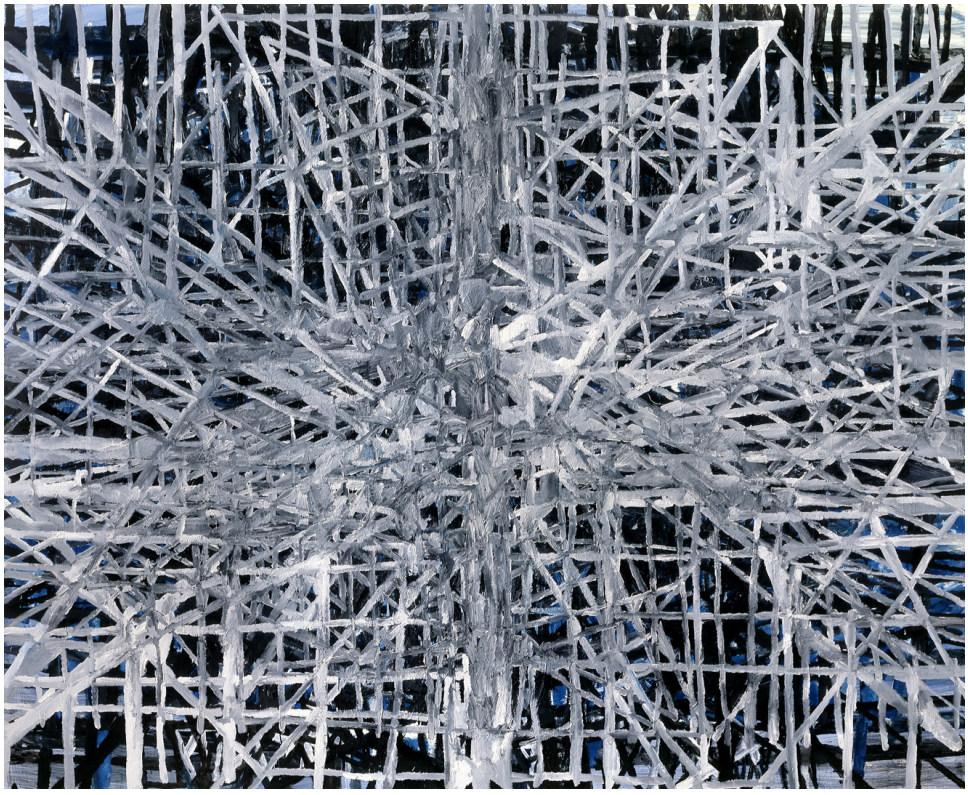

Figure 11: Terry Winters, *Branching Structures,* 1996.

Figure 12: Jackson Pollock, *Blue Poles,* 1952.

Methodology

I have come to identify myself as a printmaker, but not in the traditional sense. I look to printmaking as the process of exploring the world around me. I am not interested in representing the world about me as I see it initially. It is when I look deeper to notice the repetition of tree bark or intricate lines within a leaf held up to the sun. These are the details I try to be mindful of noticing and gather to be used as experience for making.

I am drawn to the technique of monotype in printmaking because I believe it allows me to become a collaborator with nature. A monotype is defined by its unique singularity, an image that has been made with ink on a polished plate such as metal or glass and then an impression is made from it once on paper. Similarly, nature has

systems of creating beautiful images and each one is different, like snowflakes. The collaboration with nature is when the quality of chance enters. Sending something drawn with my own hand through the printmaking press does not necessarily mean the image will come out exactly as I had intended. The atmosphere of the room may shift the paper or cause the ink to change consistency. The pressure of the press greatly determines how prominent the image is. In a more direct way, I collaborate by making impressions of natural objects.

My methods have been rooted in exploration of the textures and patterns occurring naturally around me. I started by collecting leaves varying in shape and size and created monotype impressions of them, using the lines and shapes as elements of design to create repetitive pattern. I'm intrigued by the connection between the repetitive nature of creating a print and the repetitive qualities of nature's patterns.

Figure 13: Leaf Impression through monotype

Figure 14: Leaf Impression, *Kaleidoscope Pattern no. 1*

After printing with leaves, I played with transforming them into kaleidoscope patterns to enhance their geometry. I found that finding the hidden geometry of the world around me has been a continual theme in my work this year. During this time, I picked up a project I had started in India while studying abroad. I have been learning origami because I love the geometry of it and seeing the patterns of origami unfolded. I made a series of woodblocks that consisted of a balloon, a rabbit, and a frog unfolded, revealing the lines that construct it. The reveal of pattern connects the decisions of my final work *Dendritic Bloom* to all of my experimentations along the way.

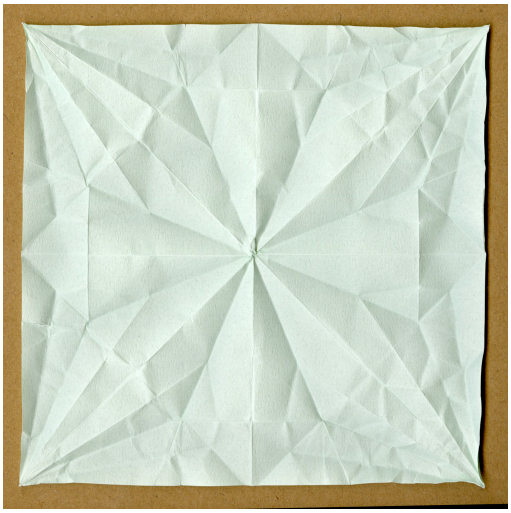

Figure 15: *Unfolded Frog*

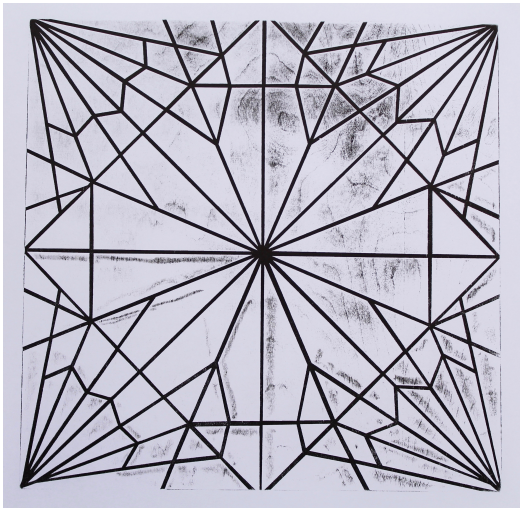

Figure 16: *Frog*

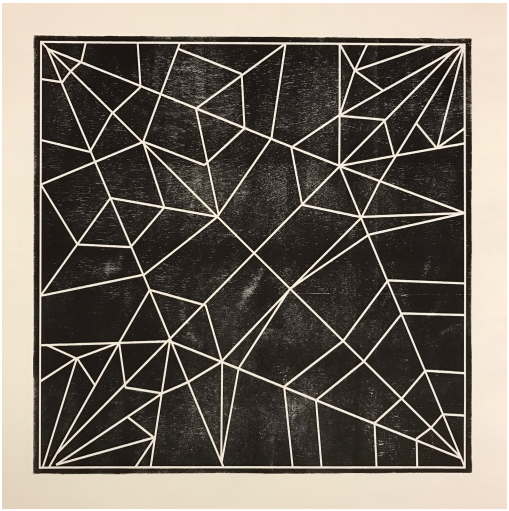

Figure 17: *Rabbit*

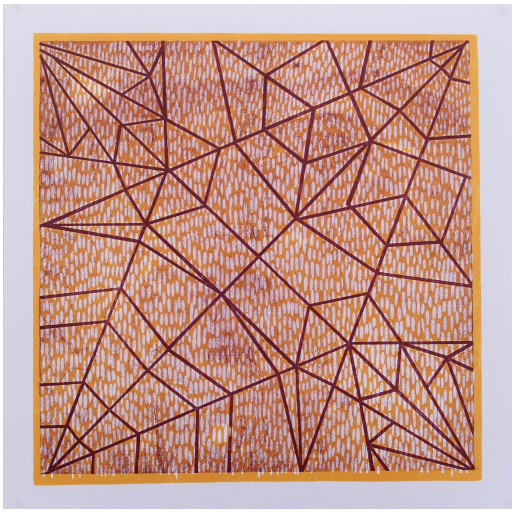

Figure 18: *Rabbit in the Rain*

As I continued to explore and play with the patterns of nature, I battled against the notion of traditional printmaking and struggled to find the validity in the way that I was depicting nature- not in the conventional way. I was less satisfied when my work was representational and more so when my work had a strong correlation to the patterns from nature. It was when I came upon the technique of dendritic painting that I had realized a way to not just represent nature, but work *with it*.

Creative Work

In *Dendritic Bloom,* I explored dendritic painting, a technique of monotype printing by squeezing acrylic paint between sheets of glass, pulling it apart, allowing the dendritic pattern to naturally form, and then making an impression of the pattern

simply by laying paper atop the wet paint. Through this technique, I was not constructing the imagery with my own hand, but allowing this natural phenomenon to occur. I began playing with which type of paper was best suited to pick up the paint pattern and how the paint could be drawn out in different ways. If I added the paint in dots or lines it would spread slightly and when I brushed the paint, it would not fully form fractals and start to look like tree bark. As I learned how to control the direction of the paint, I could harness the chaotic pattern to form according to my aesthetic intentions. With the individual prints, I began to build a larger image layer by layer.

Initially, I sketched a copious amount of the possible overall patterns and began a first draft of the final. I quickly understood that the negative space would be equally important to creating a balanced composition. I started with drawing out a square-by-square map that I would follow for each print, but it became clear that this approach was too constructed. It looked more natural if I had a basic idea in mind, and then built the image after making an abundance of prints. Since I was working with the grid as a visual component, each print is 12 by 12 inches. In the final piece, I chose to create the overall pattern on a stiffer fibrous paper, Rives BFK, in a dark blue color. There is a translucent overlay of printed pattern on rice paper in copper and blue that acts as if the pattern is permeating through the grid 'net.' I decided to elevate each print off of the wall to activate it slightly more, since the prints would be frameless and on a white wall. Each square print is backed by a thin wood board and mounted by a tension fit dowel.

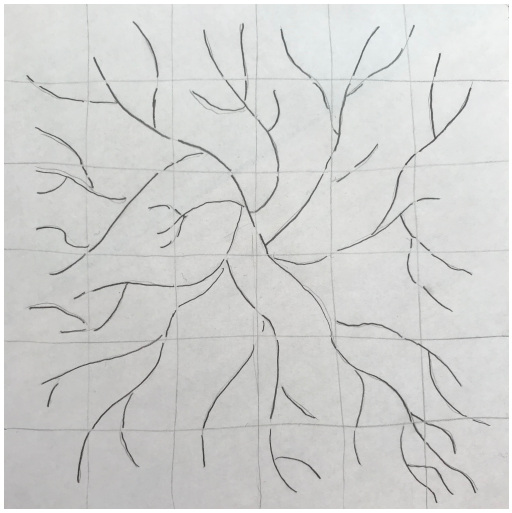

Figure 19: *Sketch no. 1*

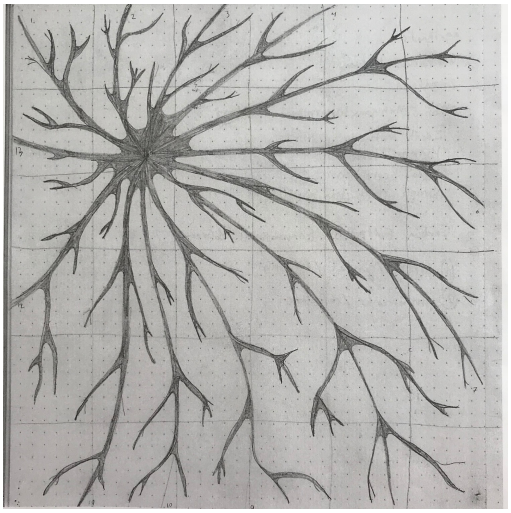

Figure 20: *Sketch no. 2*

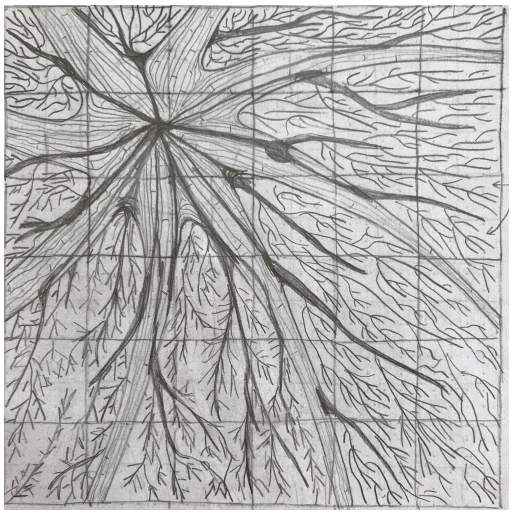

Figure 21: *Sketch no. 3*

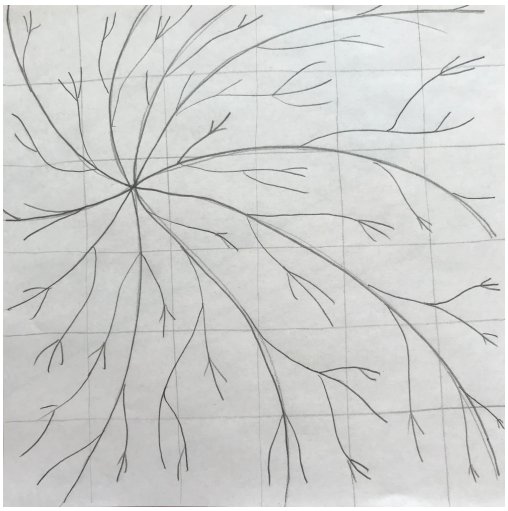

Figure 22: *Sketch no. 4*

Figure 23: Initially, I created a ‘map’ to follow how each square would be printed and aligned.

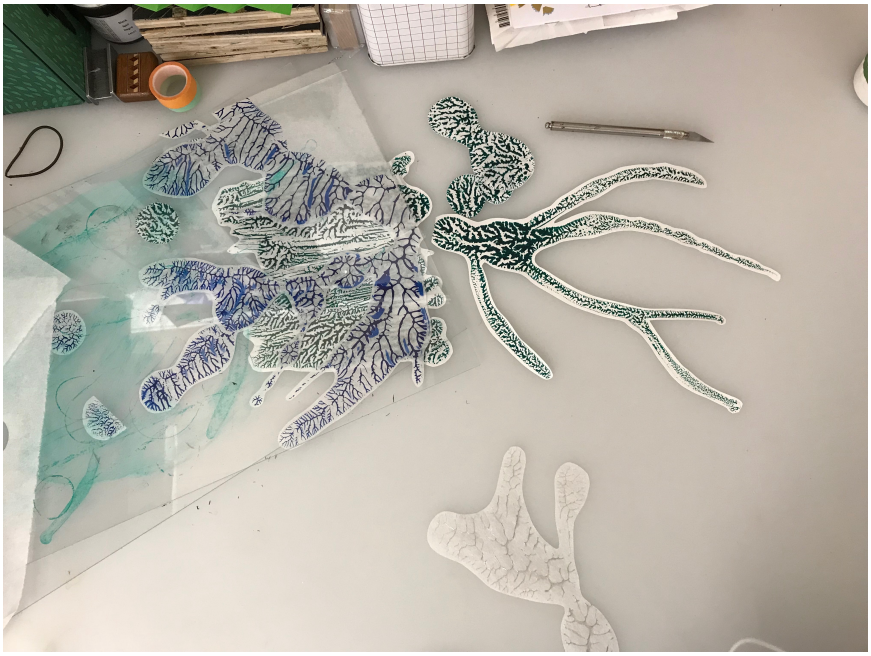

Figure 24: I later decided that printing numerous pieces and building the image was more successful than creating each square composition at once.

Figure 25: Detail of dendritic painting in dark blue color.

Figure 26: Detail of dendritic painting in copper color. The line strokes appear from brushing the paint before it is pressed between glass.

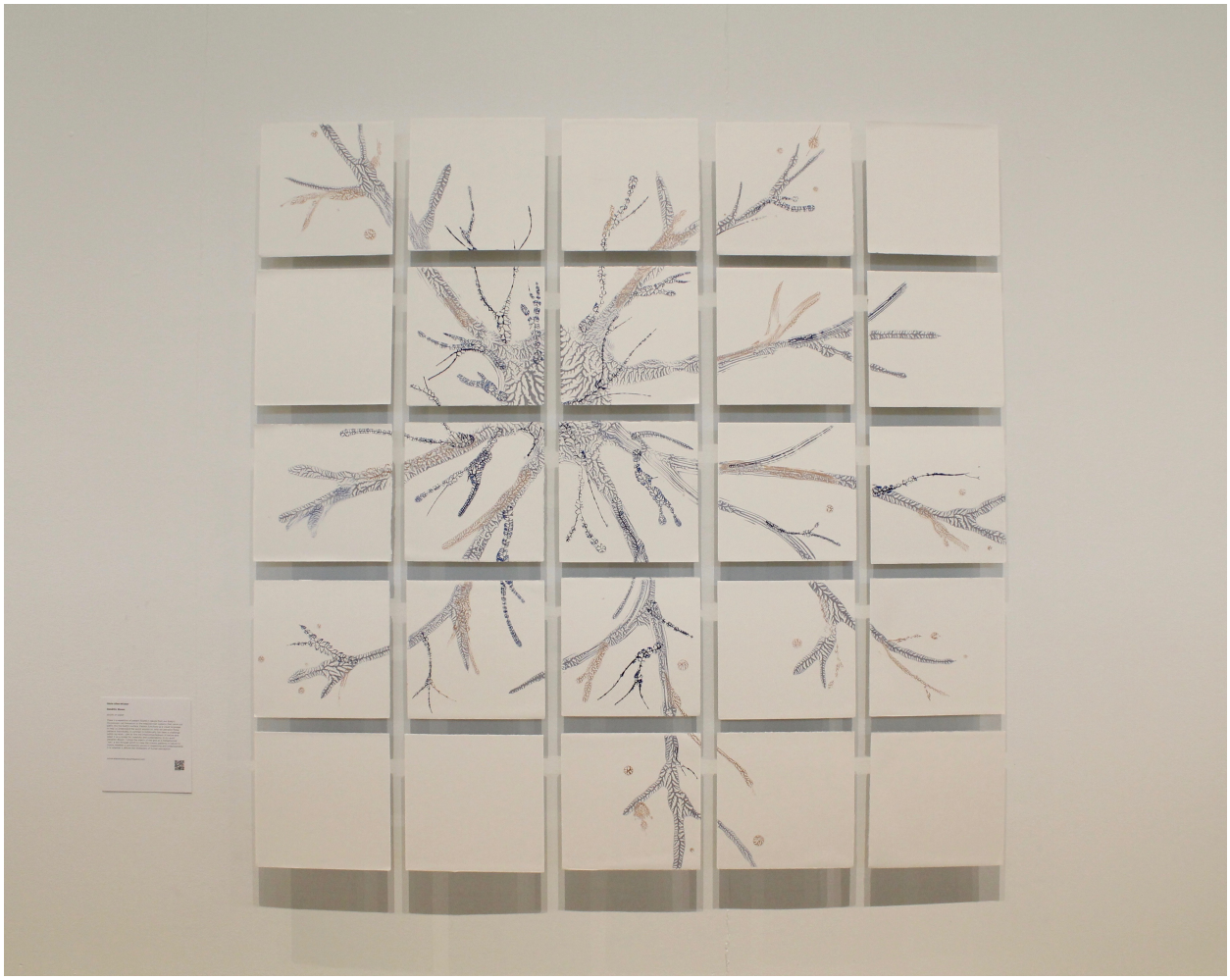

Figure 27: Olivia Allen-Wickler, *Dendritic Bloom,* 2018.

Figure 28: Detail Shot, *Dendritic Bloom.*

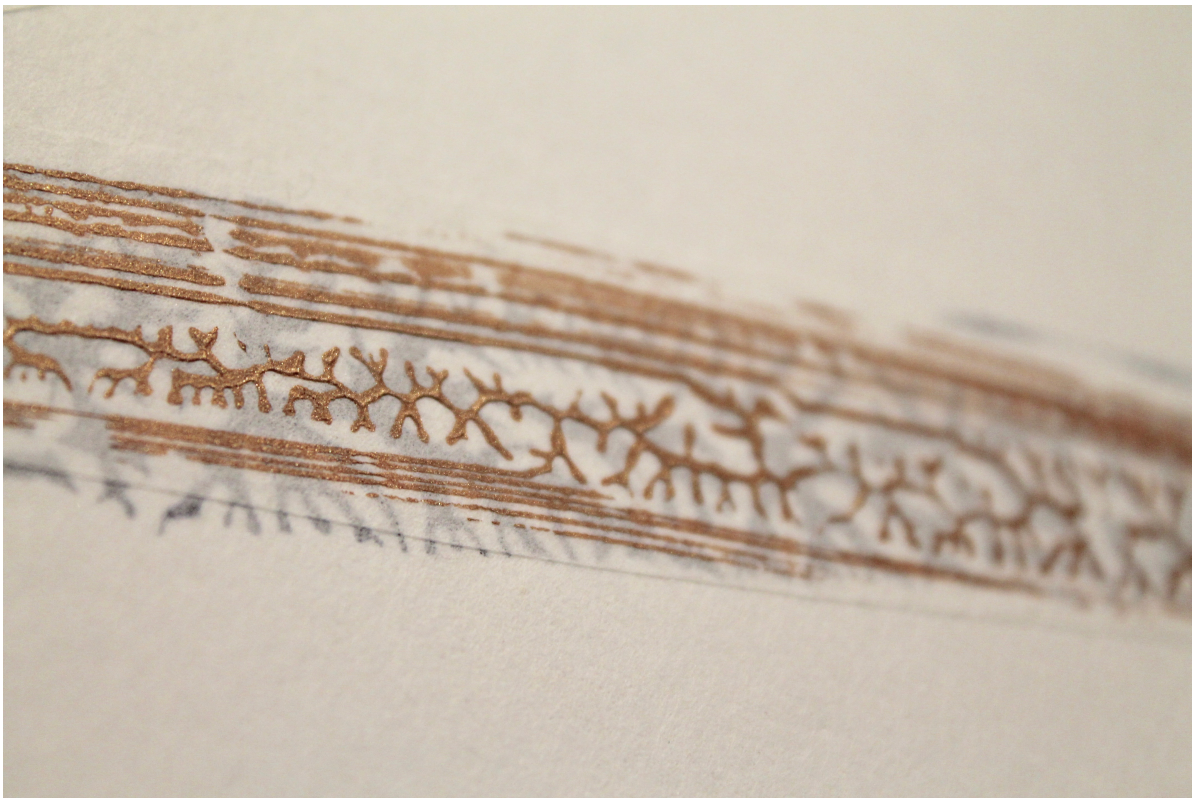

Figure 29: Detail Shot, *Dendritic Bloom.*

After the installation, I had more time to reflect on the work and the reactions I received. In my artist statement, I spoke about finding the interconnectedness of nature to perceive it as a model for creativity and sustainability. I asked whether the matrix of the grid successfully serves in organizing and understanding nature's patterns or whether it affirms the limitations of human perception. I have now come to understand this question through a different lens: what is gained or lost when we simplify and order nature's patterns? On one hand, we reduce these patterns into simple motifs, romanticizing our connection to nature through wallpaper designs and building interiors and the need to conserve nature feels lost. On the other hand, a sense of connection is gained when the viewer recognizes a pattern from nature that is also within us. This is distinctly the case for dendritic patterns found in our billions of neurons and circulatory system, which is the same pattern for tree anatomy and the Earth's river systems. I see friends and strangers view *Dendritic Bloom* and make the connection that these patterns are something we all share in common and that we *are* nature.

Conclusion

Throughout this year I have been learning extensively about the patterns found in nature and have been inspired to continue learning through exploration and making. I now see sustainability as not just something to be passionate about but as a necessity. I believe that producing work that explores the patterns of nature will reinforce our connection to it. The first step into living more sustainably is to regain our connection with the planet.

Through working with dendritic patterns, I have reached the very tip of the iceberg. If paint morphs into dendritic patterns under the pressure of glass, where else

are dendritic patterns found? Uncovering more of these patterns in the world around me will open up new discoveries and new bodies of work. I will be continuing these explorations by testing different materials besides glass, choosing different color palettes or mediums, and using a wider range of papers. I am fascinated by the idea of combining my work in origami and dendritic printing. After completing my Integrative Project, I feel fulfilled by the new possibilities it has opened. The year allowed me to work through what drives me and what does not. The biggest challenge and reward has been finding validity in my experimental approach and moving past conventionalism in my field.

Bibliography

Eckmann, Sabine and Koepnick, Lutz. *[Grid <> Matrix]*. Missouri: Mildred Lane Kemper Art Museum, 2006.

"English Oxford Living Dictionaries," *The Oxford English Dictionary*, Access Date: 01/10/18 https://en.oxforddictionaries.com/definition/grid

"Gestalt Principles." *Interaction Design Foundation.* Access date: 01/15/18. https://www.interaction-design.org/literature/topics/gestalt-principles

"Numbers in Nature: A Mirror Maze." *Museum of Science and Industry, Chicago.* Access date: 10/15/17 https://www.msichicago.org/explore/whats-here/exhibits/numbers-in-nature/

Quellette, Jennifer. "Pollock's Fractals." *Discover Magazine,* (November, 2001).

Račič, Maruša. "Nature's Patterns and Graphic Design." *Versita,* (2013): 5-32.

Root Bernstein M. and Root Bernstein R., "What is the Pattern?" *Psychology Today,* Access date: 10/30/17 https://www.psychologytoday.com/us/blog/imagine/201103/what-s-the-pattern

Watts, Alan. *The Book on the Taboo against knowing who you are.* New York: Pantheon Books, 1966.

Williams, Christopher. *Origins of Form.* New York: Architectural Book Publishing Company, 1981.

Image List

Figure 1: "Numbers in Nature: A Mirror Maze." *Museum of Science and Industry, Chicago.* Access date: 10/15/17 https://www.msichicago.org/explore/whats-here/exhibits/numbers-in-nature/

Figure 2: Račič, Maruša. "Nature's Patterns and Graphic Design." *Versita,* (2013): p. 22

Figure 3: Kepler's Discovery. *The Golden Rectangle.* Access date: 02/12/18. http://www.keplersdiscovery.com/

Figure 4: Hu, Jennifer. "Why does the Fibonacci sequence repeat in nature?" *Quora.* Access date: 02/12/18. https://www.quora.com/Why-does-the-Fibonacci-sequence-repeat-in-nature

Figure 5: "Fractals exhibit self-similarity" *The Rockefeller University.* Access date: 02/15/18. https://phe.rockefeller.edu/barcode/blog/2007/05/26/dna-barcodes-suggest-fractal-nature-of-genome/

Figure 6: "Numbers in Nature: A Mirror Maze." *Museum of Science and Industry, Chicago.* Access date: 10/15/17 https://www.msichicago.org/explore/whats-here/exhibits/numbers-in-nature/

Figure 7: Watts, Alan. *The Book on the Taboo against knowing who you are.* New York: Pantheon Books, 1966, p. 58.

Figure 8: Watts, Alan. *The Book on the Taboo against knowing who you are.* New York: Pantheon Books, 1966, p. 59.

Figure 9: Bartlett, Jennifer. *Atlantic Ocean.* Painting. 1984. http://artfakture.com/uncategorized/jennifer-bartlett-history-of-the-universe-at-the-parrish-art-museum/

Figure 10: Bartlett, Jennifer. *Four Houses.* Painting. 1998. http://2or3lines.blogspot.com/2013/07/mayo-blue-sky-2012.html

Figure 11: Winters, Terry. *Branching Structures.* Painting. 1996. https://www.thebroad.org/art/terry-winters

Figure 12: Pollock, Jackson. *Blue Poles.* Painting. 1952. https://www.jackson-pollock.org/blue-poles.jsp

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Figure 19: Allen-Wickler, Olivia. *Sketch no. 1.* Drawing. 2018.

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Figure 27: Allen-Wickler, Olivia. *Dendritic Bloom.* Print works. 2018.

Figure 28: Allen-Wickler, Olivia. Detail Shot, *Dendritic Bloom.* Print works. 2018.

Figure 28: Allen-Wickler, Olivia. Ibid.