Mapping the Sand: Sea Snail Trail Projector

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Introduction

Sea snails create winding, seemingly random tracks through the sand at low tide, as a way of mapping their surroundings and finding food or potential mates. I find the overlapping between the tracks particularly intriguing, especially as the duration of time results in increasingly intertwined configurations. Using my own photographic documentation of snail trails, I etched the track pattern onto plexiglass and laser cut holes where these trails intersect. Each panel of plexiglass visualizes a different data set of trail connections, and is formatted on the dome structure as a way of utilizing sunlight to project these trails back onto the sand, as a "guide" for the snails. The shape of the geodesic dome allows light to refract and stay inside the dome longer than other types of greenhouses, taking advantage of solar gain in order to cast light onto the surface of the sand. When it is installed on the beach, the projection is only disrupted by the incoming tide, simulating the same experience of the physical snail tracks as they are washed away every few hours by the changing tides. I built this dome out of wood, plexiglass and plastic joints so that it is portable, weather resistant and easy to set up in different spaces. I will continue to explore the geodesic dome structure in my work, excited by the possibilities of its energy efficiency, decreased surface area, and ability to withstand different climates and temperatures, especially in a moment of increasing natural disasters and climate extremes.

Fig.1 Sea Snail Trail Projector installed in Nahant, MA

Process

I spent a few days walking on the beach as the tides went out, observing where sea snails were charting the sand and collecting data in the form of sketches and photographs. I was able to spot them by the trails they leave, and became increasingly curious about how they navigate their surroundings.

A. *Documentation and Data Visualization*

I took photographs of the trails from above, and identified the areas where the trails intersect. On the images, I marked this spot with a dot to identify where I wanted to make cut-through holes in the plexiglass.

Fig.2 The original documentation of the snail tracks in the sand

B. *Translation onto plexiglass*

I then imported the edited image into Adobe Illustrator and used the image trace function to create a rasterized trace of the tracks to etch into the acrylic. I created a second file of the image with a vector template of the intersection points, which was done following the etched design. Each panel displays its own data set, and took roughly 40 minutes to cut on the Epilogue laser cutter. The entire project required over 20 hours of laser cutting.

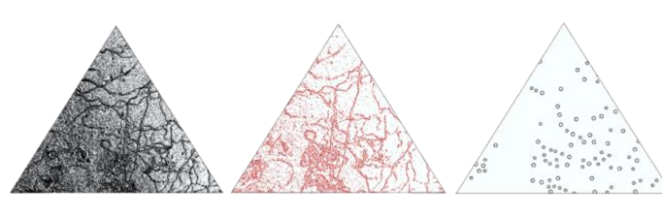

Fig.3 The edited source image (left), the rasterized data for the etching, and the circle intersections for the vector cut-through holes (right)

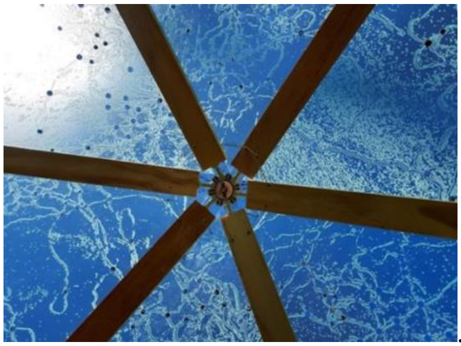

Fig.4 View from dome interior, peering through the plexiglass to the sky

C. *Physical Arrangement and Assembly*

Once the acrylic panels were cut, I began to assess how to attach the panels to the dome. I had already done the majority of calculations of the structure before cutting the plexiglass to understand what size I would need for all the panels, however I held off on figuring out the best way to secure them until I could understand the completed wood structure. Due to reasons of efficiency and ability to dismantle and reinstall easily, I opted for drilling holes through the wooden structure and securing each panel with wire. If I were to make this model again, I might choose to make slits inside the wood for a cleaner look.

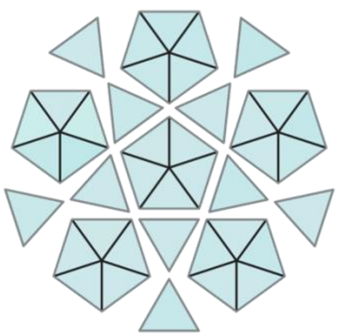

Fig.5 The panels consisted of 30 isosceles and 10 equilateral triangles

Challenges

When I had originally envisioned this dome, I imagined that it would be large enough to allow a few viewers to stand inside at a time. Upon calculating the material costs and hours required for laser cutting, I realized that I did not have the budget or timeline to create such a large scale piece. I created this piece as a MakerInResidence at the Brandeis MakerLab, in which I applied and was accepted into a microgrant program, making this my first laser cutting project. I was allotted a $500 budget, with which I used 40% for materials to construct the dome, and the rest for plexiglass. Initially, I imagined the panels would be opaque black, so that the cut through holes shine light in a dark space, creating the visual language of a constellation. Though I may continue to experiment with that idea in future projects, I decided that the trail marks were important to me in this design, and I wanted to see how the transparency created effects with sunlight. Perhaps the biggest challenges that I encountered were figuring out the dimensions of the structure and its parts, and understanding how to control the laser cutter's settings to etch and cut separate data for each sheet, as the design was so complex that Epilogue's older drivers were only able to send the machine vectors or rasters of this complexity separately.

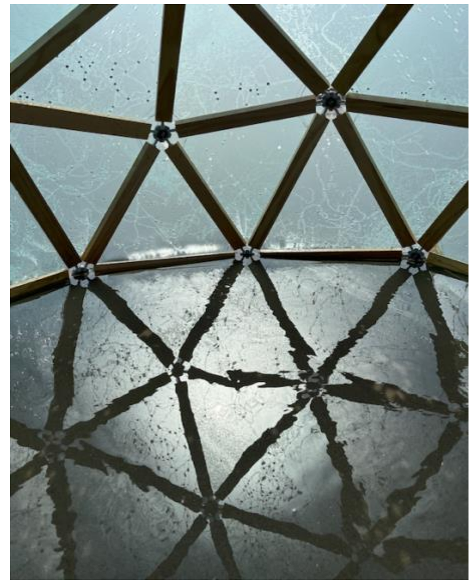

Fig.6 View of the reflected tracks from inside the dome

Outcomes

I embarked on this creation with the goal of replicating the sense of wonder I felt when encountering these snail markings, however the result was pleasantly different than what I had previously imagined it might be. The dome seemed to work best in the context of the snail track origins, and it was a really interesting experience to see how the sun, tides, ground and sky activated the data set. It is fascinating to observe the tide move in and out of the dome, disrupting the projections and creating new patterns. The cut through holes in the design did in fact create a constellation of light on the sand, but perhaps they were even more beneficial to the overall design in their ability to allow air to pass through the dome, so that it wouldn't blow away in a particularly windy landscape such as the beach. Being my first project operating the laser cutter, I am pleased with the result and excited for all the possibilities this technology allows for my future work.

References

[1] R. Sousa, J. Delgado, J. A. González, and M. F. and P. Henriques, *Marine Snails of the Genus Phorcus: Biology and Ecology of Sentinel Species for Human Impacts on the Rocky Shores*. IntechOpen, 2017. doi: 10.5772/intechopen.71614.

[2] E. Simons, "How a Common Sea Snail Explains the Universe," *Bay Nature*. https://baynature.org/article/at-a-snails-place/ (accessed Aug. 03, 2022).

[3] "hubs = geodesic domes made simple." https://buildwithhubs.co.uk/thekit.html (accessed Aug. 03, 2022).

[4] And a special thank you to Ian Roy from the Brandeis Maker Lab for the training and help with this project!