Art of Nature—Chambered Nautilus

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The chambered nautilus, also called the pearly nautilus, is the best-known species of nautilus. Nautiluses are a living link to the ancient past. They have been around for 480 million years, swimming in deep-sea reefs even before the age of dinosaurs; for this reason, they are called "living fossils" (Combosch et al., 2017). Because of nautiluses' beautiful mother-of-pearl lining and creamy colored, red-striped exteriors, nautilus shells are sought out and collected by many enthusiasts. However, as the demand for perfectly shaped shells grows, shell collecting moves from beach scavenging to deep-sea fishing (Monterey Bay Aquarium, n.d.). These animals mature late and produce few offspring. Therefore, collecting shells has led to a significant decline in ammonite (and other mollusk) populations (Monterey Bay Aquarium, n.d.). In 2018, the National Marine Fisheries Service (NMFS) and National Oceanic and Atmospheric Administration (NOAA) listed the chambered nautilus as a threatened species under the Endangered Species Act (Endangered and Threatened Wildlife and Plants, 2018).

Artistically, Figure 1 shows that a Fibonacci spiral on the nautilus conforms to the shape of the Golden Ratio spiral, which can be found in most of living things, such as the shape of our galaxy, hurricanes, the arrangements of sunflower seeds in flowers, and in cauliflower heads, pinecones, and DNA (Norma, 2018). The Golden Ratio spiral suggests that our natural world is not as random or irregular as it seems, but instead can be explained in the logic of numbers and mathematical equations (Mascella et al., 2010). In addition, the pleasing visual experience brought by the Golden Ratio spiral has inspired artists, filmmakers, and designers throughout time in design and composition. For example, the *Fractal Geometry of Life* (Zhang & An, 2018) and *Fibonacci for Fashion Design* (Zhang & Yang, 2008), two design projects, used the Golden Ratio spiral as designers' inspiration to present their attempt at understanding the mathematical theory through wearable art designs and achieved successful results.

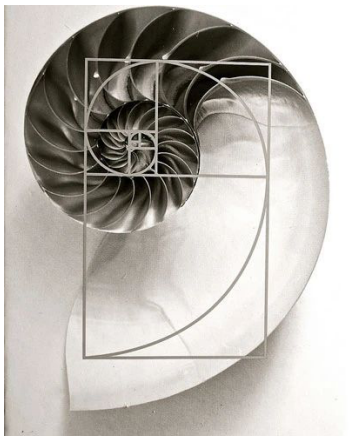

Figure 1. A Fibonacci spiral on the nautilus shell (Norma, 2018)

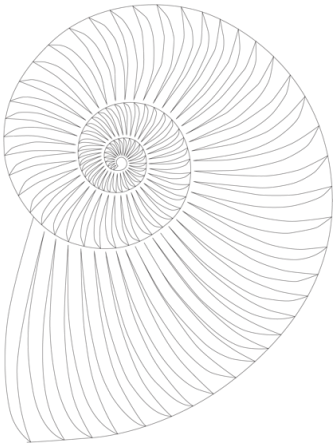

Figure 2. The vector drawing of a chambered nautilus

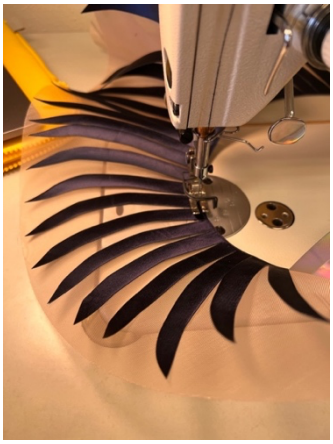

Figure 3. Sewing process

The goal of this design project was to use apparel design as an expressive language, in the form of a wearable art vision, to showcase the art of one of the world's oldest creatures, the chambered nautilus. Simultaneously, this design project calls for nautilus shell collectors to appreciate and celebrate the beauty of nautilus shells in other ways than collecting; it is also a call for audiences to avoid buying them at will. Maintaining species diversity is an important means to achieving sustainable development. Publicity and appeals in the form of clothing to raise public awareness of nautilus protection are as important as actual conservation actions. Therefore, the purpose of the design project was to: 1) use surface design to represent the beauty of the chambered nautilus, 2) to use computer-aided software to create a vector drawing of a chambered nautilus, and 3) to use a laser cutting machine to achieve precisely cut chamber shapes on the fabric.

The whole design process consisted of three steps: motif creation, experimental draping, and implementation. The first step of this project was to create vector drawings of nautilus shells with chambers in Adobe Illustrator for laser cutting and draping. The designer started by tracing the spiral curve of a nautilus shell picture in Adobe Illustrator and then experimented with different ways to distribute the growing chambered shapes along the spiral curve from the center to the end of the spiral. After comparing the Pattern Brush and Blend tools, the designer decided that the latter produced better results. Therefore, using the Blend tool, a line of chambered shapes that grow gradually along a straight path was created, and then, blended with the spiral curve, a growth chamber shape roughly distributed along the spiral curve was created. The designer then had to manually adjust the shape of each chambered drawing to achieve the final effect (see Figure 2).

The second step of this project was to create a satisfying silhouette through experimental draping tests. The vector drawing of the nautilus shell was duplicated on different scales and printed out on pattern paper. Then, the designer cut all shell shapes in muslin and draped them on a size eight women's dress form. A medium-sized (17 inches wide, 21 inches long) spiral shape printed on paper was selected to create the shoulder piece, and a large-sized (36 inches wide, 41 inches long) spiral shape was selected to create the skirt piece. A fitted base skirt was then draped to combine with the spiral drapes.

The third step was implementation. In order to better call attention to and promote the protection of marine animals and their environmental habitat, all the fabrics used were from the deadstock fabric donated to the university by alumni, but a few yards of heat transfer foil were purchased at the store. To achieve the ocean's visual effect, the designer selected a dark blue satin fabric and pressed the metallic effect foil on the wrong side of the dark blue satin fabric. Then, two pieces of medium-sized and two pieces of large sized of the chambered nautilus shape shown in the Figure 2 was laser cut and stitched on a light coral organdy fabric. These two pieces were stretched out and placed around the armholes as the shoulder pieces. The large-sized chambered nautilus pieces were also laser cut and stitched on the skirt of the outer shell. The cut-out parts out of the two medium sized chambered nautilus shapes were saved and used to create the motif and surface design on the bodice. All chambered nautilus shaped cut fabrics were stitched on the inner spiral curve of laser-cut organdy fabric first, manually rotated at each end edge in the same direction and stitched on the base of the organdy fabric (see Figure 3).

The whole design process was sustainable. Most of the fabric used in this design project was unwanted, deadstock fabric. The remaining parts leftover from the laser cutting were fully utilized, and the design process produced minimal waste. Moreover, the final design also successfully used the fabric as a resource to express the unique beauty of the nautilus to convey the concept of protecting marine life to the audience.

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