

The Dragonfly

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Statement

The story of Dragonfly, born underwater, continues on the water as it completes its metamorphosis. While generally protecting their larvae by flying over water, what happens in this life cycle between death and birth is just a reflection of a water surface While the mirrors show more like the water surface with reflection than it actually is, the Dragonfly piece recalls the beauty of the Voronoi surface and color transitions on its wings.

Design Overview

First, the artworks of different artists and mathematicians were examined throughout the design process. As a result, the points that all group members were curious about were focused on. It has started to focus on keywords such as perception, perspective, duality and pattern. The "mirror", an element of the exhibition, was an issue studied from the very beginning of the process. In the group, it was not a matter of what the mirror reflects horizontally or vertically, but what it will add to our design with a different setup. Thus, the mirror became a part of our design and was reconstructed.

When reconstructing a familiar image, Dragonfly, we encourage viewers to reflect on the contradiction between what we actually see and how our brain processes it.

Mathematical Idea

The mathematical infrastructure of the artwork is based on the pattern found on the dragonfly's wing. In the 19th century, this pattern was named after mathematicians Gustav Lejeune Dirichlet and Georges Voronoi conducted research on quadratic forms and wrote the "Voronoi Diagram" algorithm. Voronoi diagram is a mathematical technique that allows to the division of the multidimensional space field into subspace fields. These regions, which make up the Voronoi cells, which are subspace areas, create regions for these points by considering the distances of the points in the given point set. Together, these regions take the form of cellular patterns. The Voronoi diagram is seen in many creatures (forms and structures of plants and animals) in nature.

The structure formed by the Voronoi diagram on the wing of the dragonfly provides the most effective and lightweight opening of the wing with the least amount of material. This mathematical expression in the artwork gives different perspectives in three dimensions by placing the mirrors at different angles. Because the Voronoi diagram can be defined not only in two dimensions but also in three dimensions. Since Voronoi cells have polyhedral geometry, they can be seen in three dimensions when projected onto any surface or geometry in three-dimensional space.

Milestones during the course-2021

Stage 01 / January – February

Among the images we were curious about in art, mathematics, and common areas, the keywords that we liked and agreed with the most were formed. Keywords such as *surrealism, optical devices, creating a perception, duality, perspective, pattern, actual-fictional, lightshadows, reflective spheres-lines* drew a frame for the next step.





Stage 02 / February – March

In the second stage, 3 different concepts were created over the keywords determined; Helicoid, 3D Anamorphic, and Mirror (s). For the next step, it was decided that the Mirror (s) concept should be combined with other ideas, with the main idea being the main one. In summary, it was decided that a design proposal covering the *mirror, perspective, and perception* issues would be presented in the next step.



Concept 1: Helicoid



Concept 2: 3D Anamorphic



Stage 03 / March - April

While exploring reflection, we met with the beauty of Dragonfly, which we will be inspired by nature. It has many sources of inspiration for artwork, where reflection and perception will be the main subject. Many points such as the shape of the dragonfly's body that we liken to a spiral surface, the habitat he lives in, the pattern on his wings

Our design consists of two stages. Skeleton and skin. It was decided that it would consist of metal wire and iridescent (acrylic) plexiglass. On the other hand, Mirror (s), which suggested using mirrors with different angles and numbers in the previous stage, was added to the idea. That's why artwork has always been edited with a mirror to be used as an exhibition element.





As a result, different prototype trials were carried out, focusing on Dragonfly's wings and the Voronoi pattern there. It was decided to create two wing abstractions between two mirrors that cut each other at 90 degrees. These wings were thought to be a design consisting of different colored plexiglass. When final prototypes were made, plexiglass was ordered and budget for the project was clarified: the cost of plexiglass was around 170€, the platform around 360€ and other needed materials (glue, plastic, tapes) costs around 30€ extra to sum up the expenses to around 560€ for the artwork. The art piece itself is built during the 18th week.



Implementation / April – May

A new prototype was created with wings scaled according to the dimensions of the two mirrors that will symbolize the dragonfly's habitat. Recommendations on how these prototypes will be positioned on the mirror have been developed. Since it will increase the variety of reflected surfaces, the wing was created as a curved surface. As a result of these experiments, when the wing was bent, it was not done by bending a single surface, but by combining each Voronoi cell with different angles to provide a curvilinear surface.







Design Development and Outcomes











abstraction of the dragonfly wing with Voronoi cell



bending points symbolizing the movement of the wing



bending direction



balancing the thickness of the material with the bent wing



symmetry of the wings to create an endless cycle of reflection on the mirror



















Team Info



Sanni Lares – (SCI)

Sanni is a fourth-year student in Aalto University, and she has a bachelor's degree in Information Networks (2020). Her focus is on user, data, and design, in her master's degree studies at Aalto.



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Ekin Ünlü received her Bachelor of Architecture degree from Eskisehir Osmangazi University in Turkey (2018). After graduating, she worked with the PET-MAT team at Czech Technical University for a few months during 2018-2019. She worked on recycled materials, digital fabrication and design. She continues her education and research in the Master Program in the Department of Architectural Design of Istanbul Technical University.