

Varmárlaug

(DESIGN SEMINAR)

Course: After Gaudí

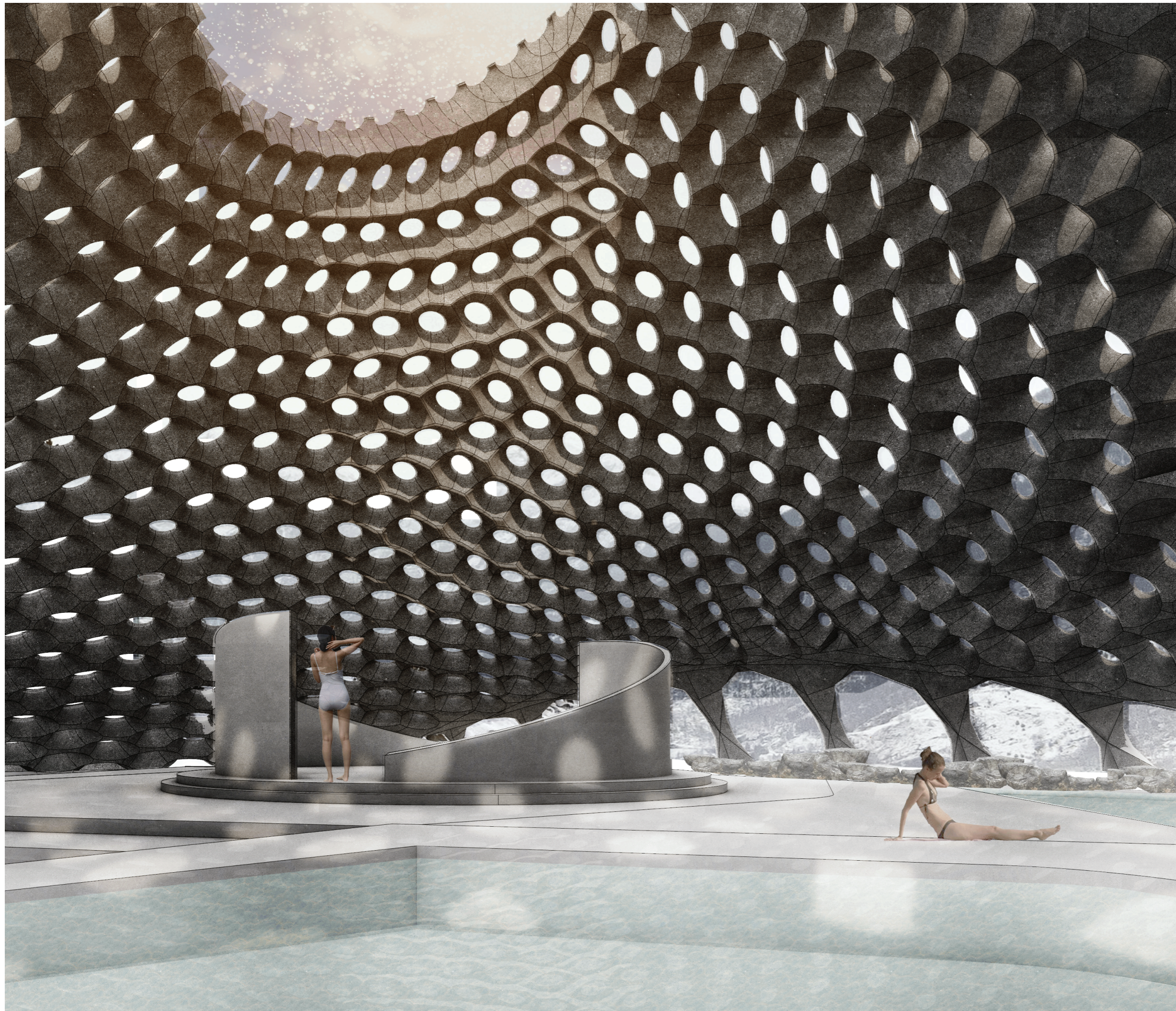
Guides: Mark Burry | Rodrigo Aguirre

Members: Yuvraj.S | Shrey.K | Natnaree.W |
Miti.S | Anish.H | Junaid.K

Contribution: Computational Modeling |
Robotic Stereotomy |
Fabrication | Grasshopper
Scripting | Presentation

Abstract:

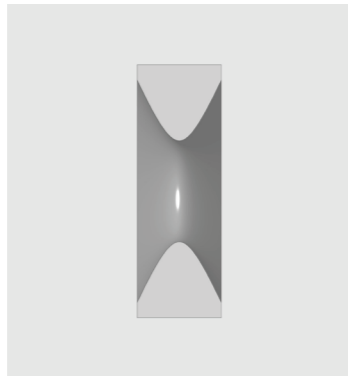
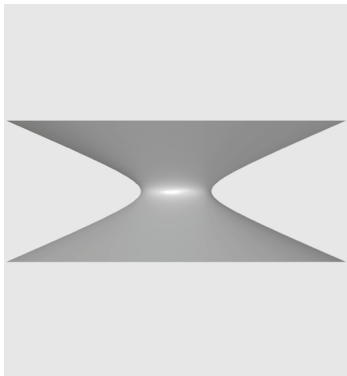
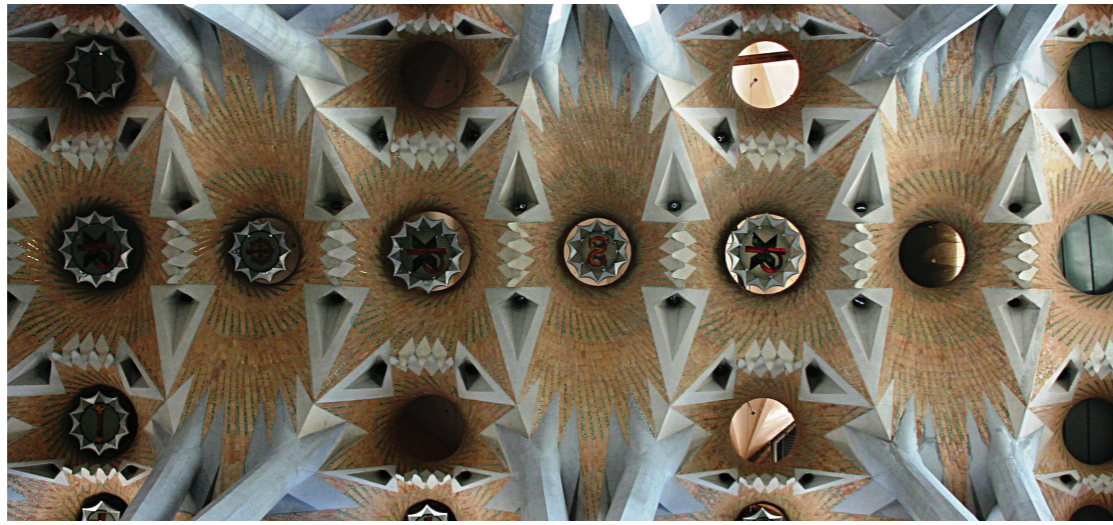
The project "Varmalaug," presented in our design seminar, explores the intricate relationship between climate analysis and form optimization, drawing inspiration from the teachings of Antoni Gaudí. Gaudí's unique approach to deriving organic forms, deeply rooted in the study of nature and geometry, serves as a guiding principle for this project. Varmalaug delves into the complexities of climate data to inform architectural design, ensuring structures that are not only aesthetically pleasing but also highly efficient and sustainable. By integrating Gaudí's principles with modern computational tools, Varmalaug aims to create innovative designs that harmonize with their environment, reflecting both functional excellence and artistic beauty.



For more info:



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UNDERSTANDING GAUDÍ:

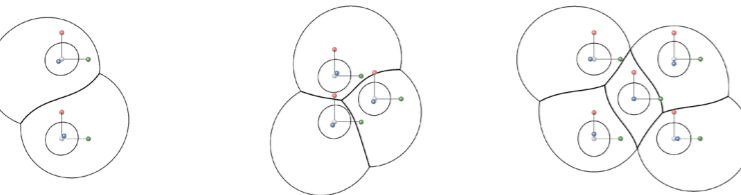
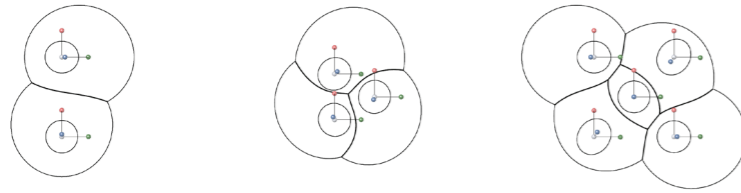
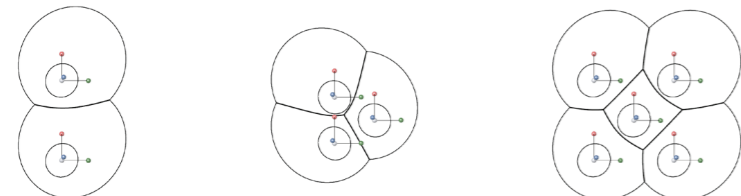
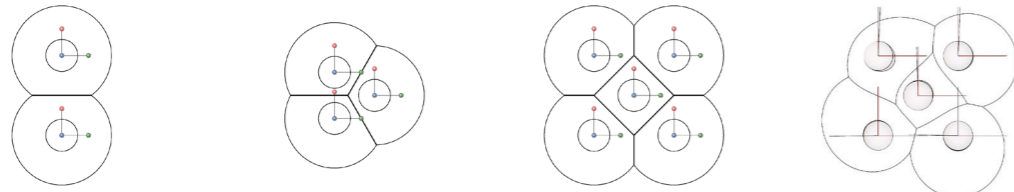
Antoni Gaudí revolutionized architecture by using natural geometries, particularly hyperboloids and doubly curved surfaces, to create flowing, organic structures. These forms provided both beauty and structural integrity, evident in masterpieces like the Sagrada Família.

HYPERBOLOIDS INTERACTION:

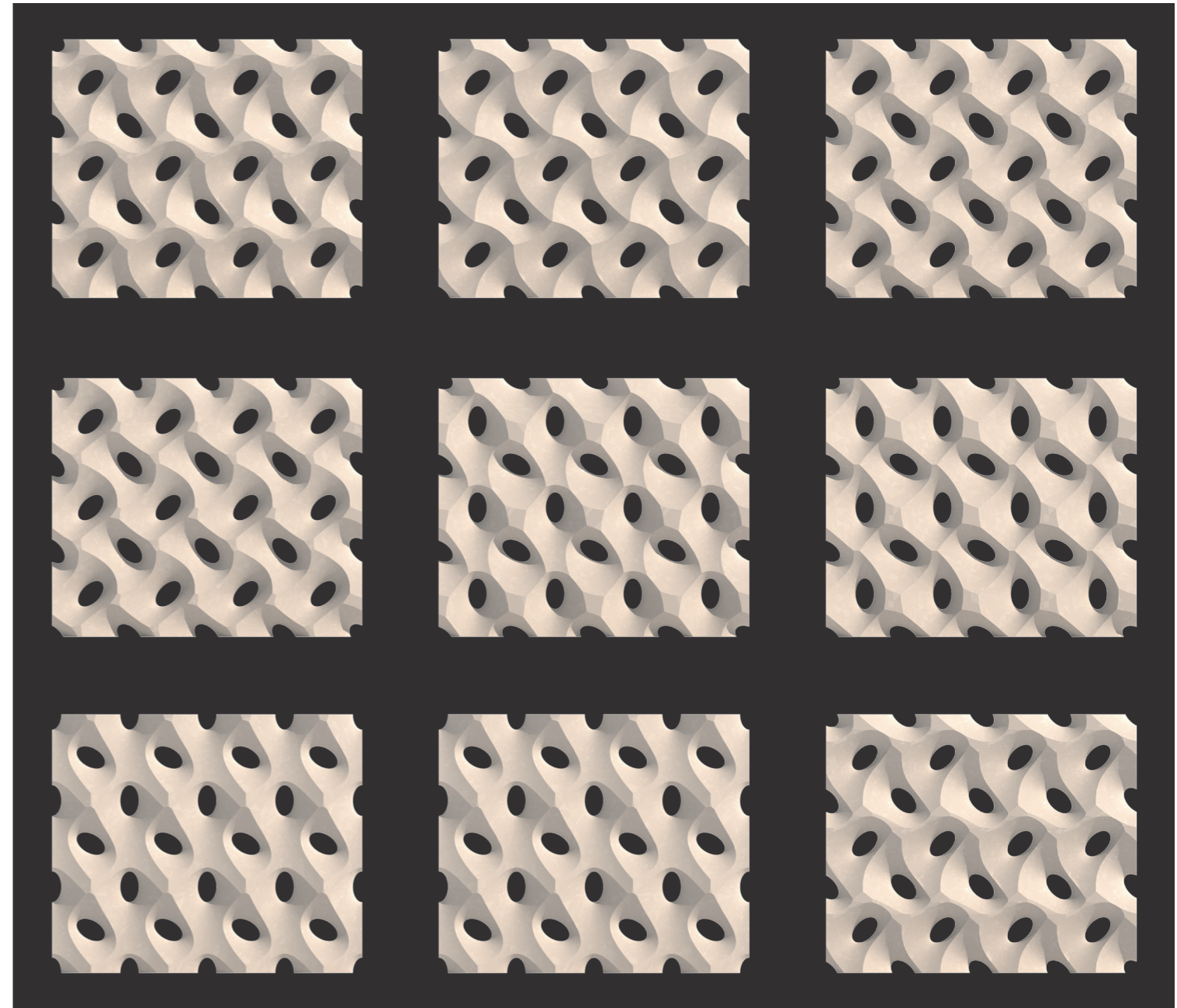
P Length: 0.60 units
Q Length: 0.60 units

Asymptote: 23.00°

Depth: 1.20 unit



PLASTER MODELS:



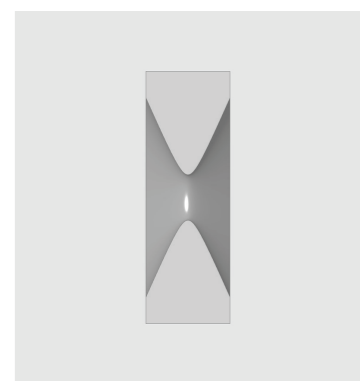
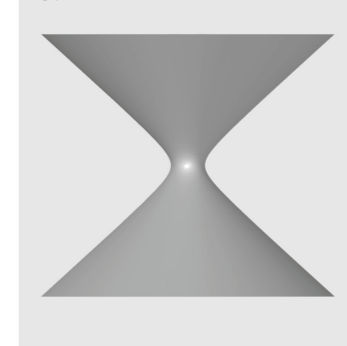
REMBRANDT ANALYSIS:

Intersecting hyperboloids create complex, stable geometries with unique openings that allow natural light to penetrate walls. These intersections form intricate patterns that diffuse light, casting dynamic shadows and illuminating spaces. This design leverages natural light for a visually captivating and energy-efficient architectural experience.

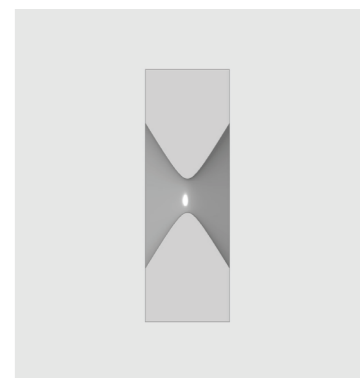
Hyperboloid A:
P Length: 0.13 units
Q Length: 0.27 units
Asymptote: 42.00°
Depth: 1.00 unit

Hyperboloid B:
P Length: 0.10 units
Q Length: 0.20 units
Asymptote: 50.00°
Depth: 1.00 unit

Hyperboloid A:





Hyperboloid B:

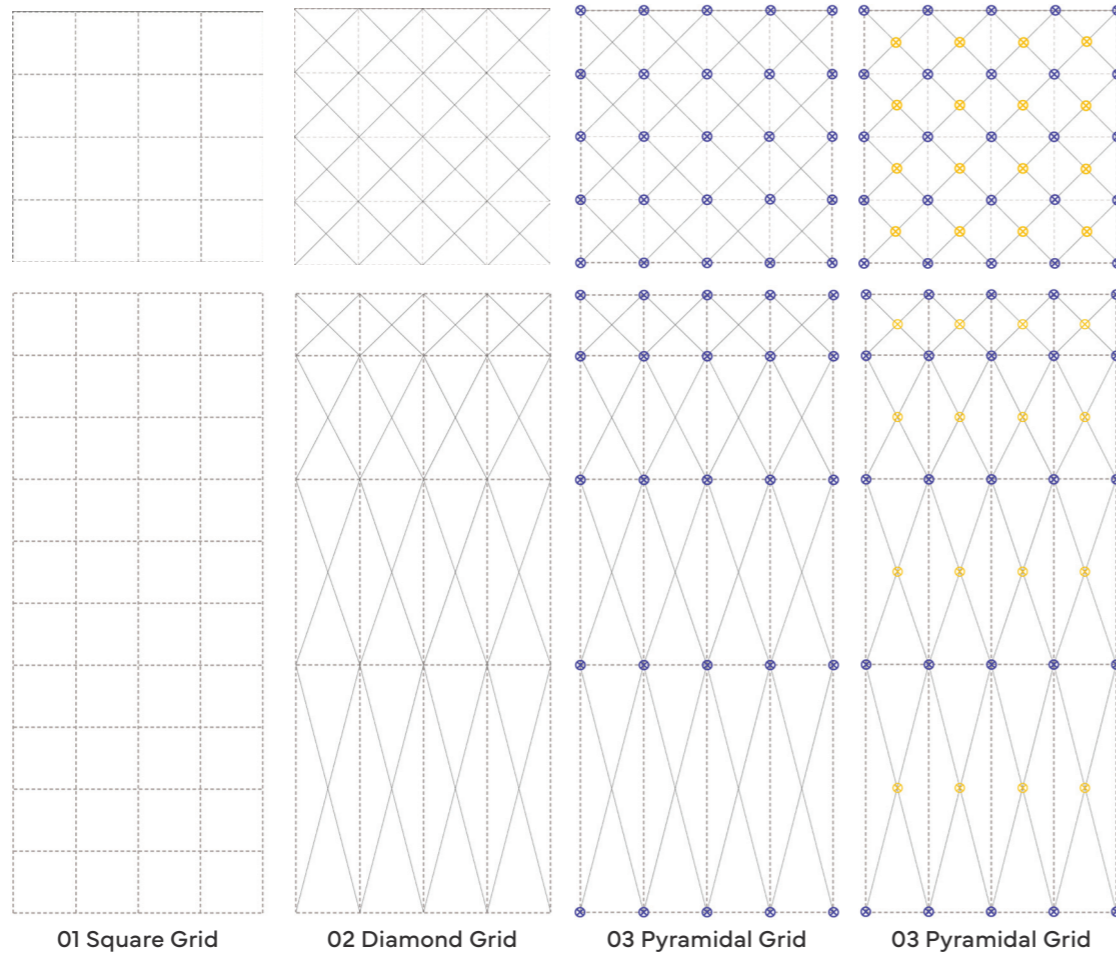


GRID

DEVELOPMENT:

Intersecting hyperboloids create complex, stable geometries with unique openings that allow natural light to penetrate walls.

-  **Point A:**
Point of Intersection
-  **Point B:**
Center of the Pyramid



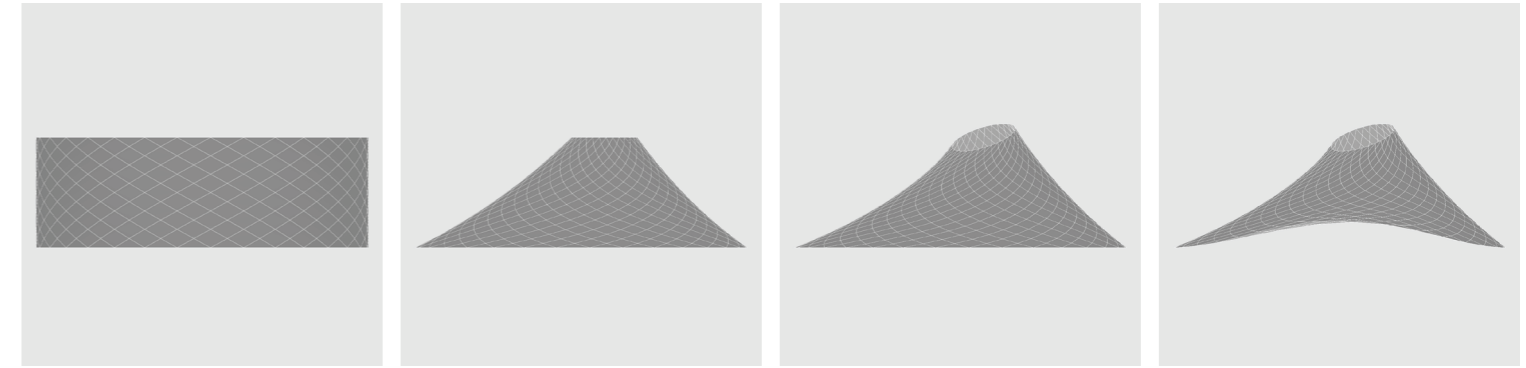
GRID

DEVELOPMENT:

Overlaying the grid on the surface for further environmental optimization and hyperboloid placement via grid control points.

GRID OVERLAY:

Overlaying the grid on the surface for further environmental optimization and hyperboloid placement via grid control points.



Initial Spatial Mass

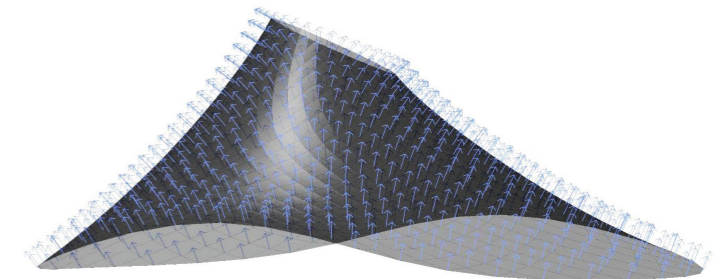
Optimize Wind Flow

Optimize Solar Radiation

Defining Access Points

REPROGRAMMING PERFORATION PLANES :

Optimizing hyperboloid planes involves strategically creating perforations based on wind direction, incident radiation, and the orientation of the planes. By carefully considering these factors, the design ensures that the structure receives ample sunlight for heating purposes while minimizing unwanted airflow from the outside to the inside. This approach not only enhances the thermal efficiency of the building but also contributes to a comfortable indoor environment by reducing drafts and maintaining a stable internal temperature.



FORM

DEVELOPMENT:

Developing the form from a flat surface to a doubly curved surface, through precise control points for better form optimization, ensuring a smooth surface without overlaps or errors.



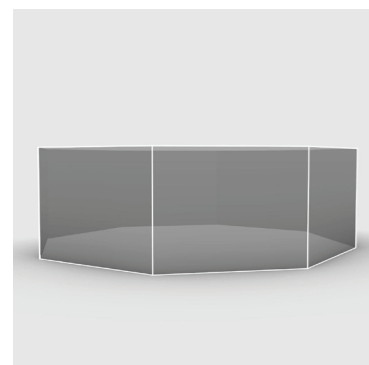
The form of Varmalaug is inspired by Iceland's landscape elements - the rugged mountains and volcanoes.



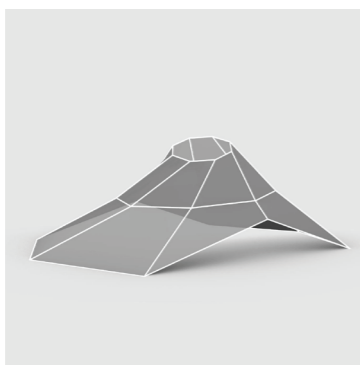
The form is design to make use of the natural hot springs and geothermal rivers.



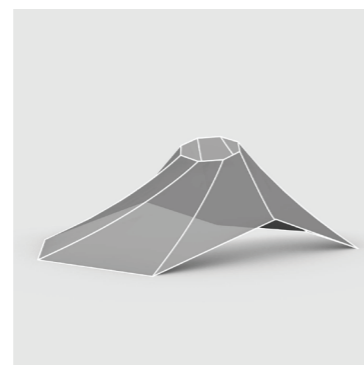
The form is optimized to give the most desirable view of the Aurora Borealis, also known as the Northern Lights.



Initial Spatial Mass



Ruled Surface

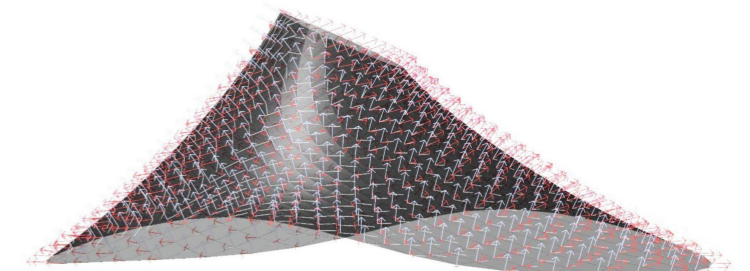


Ruled Surface Continuous

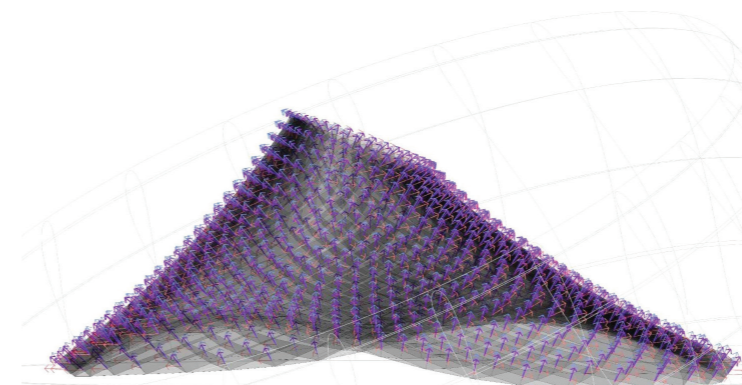


Interpolated Curve Continuous

Identifying Existing Plane Normals

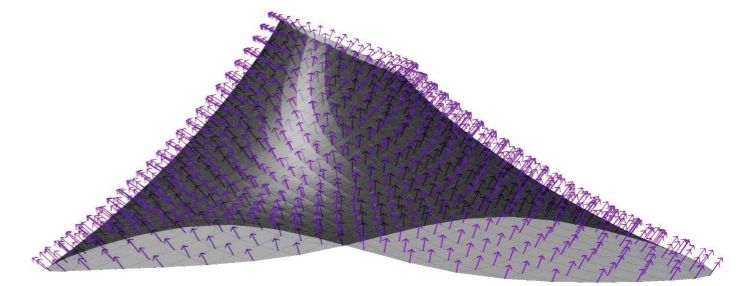


Orienting XY Axis to Wind Direction

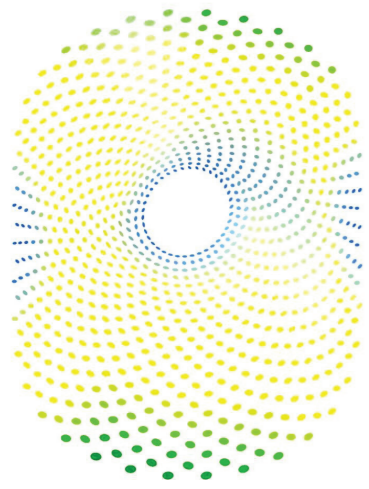


Solar Manipulation

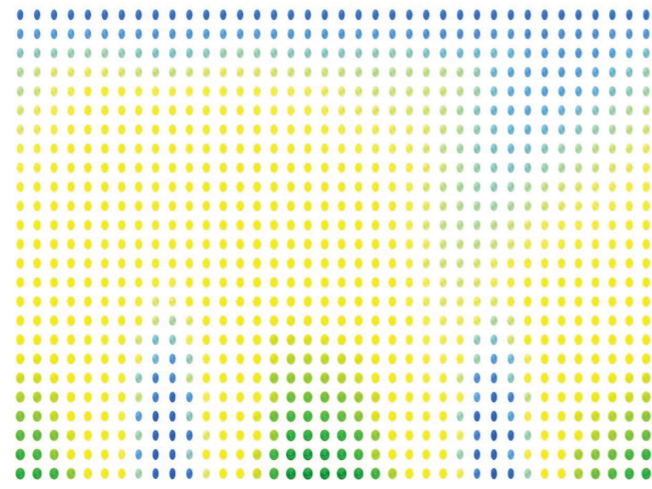
Orienting Highest Incident Radiation



Approximating Shift in Planes

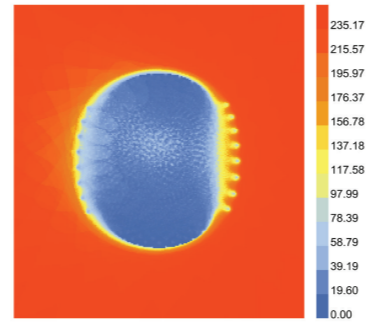


PREVIEW:

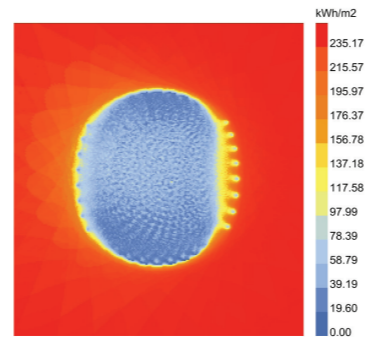


Reprogrammed Hyperboloid Catalogue :

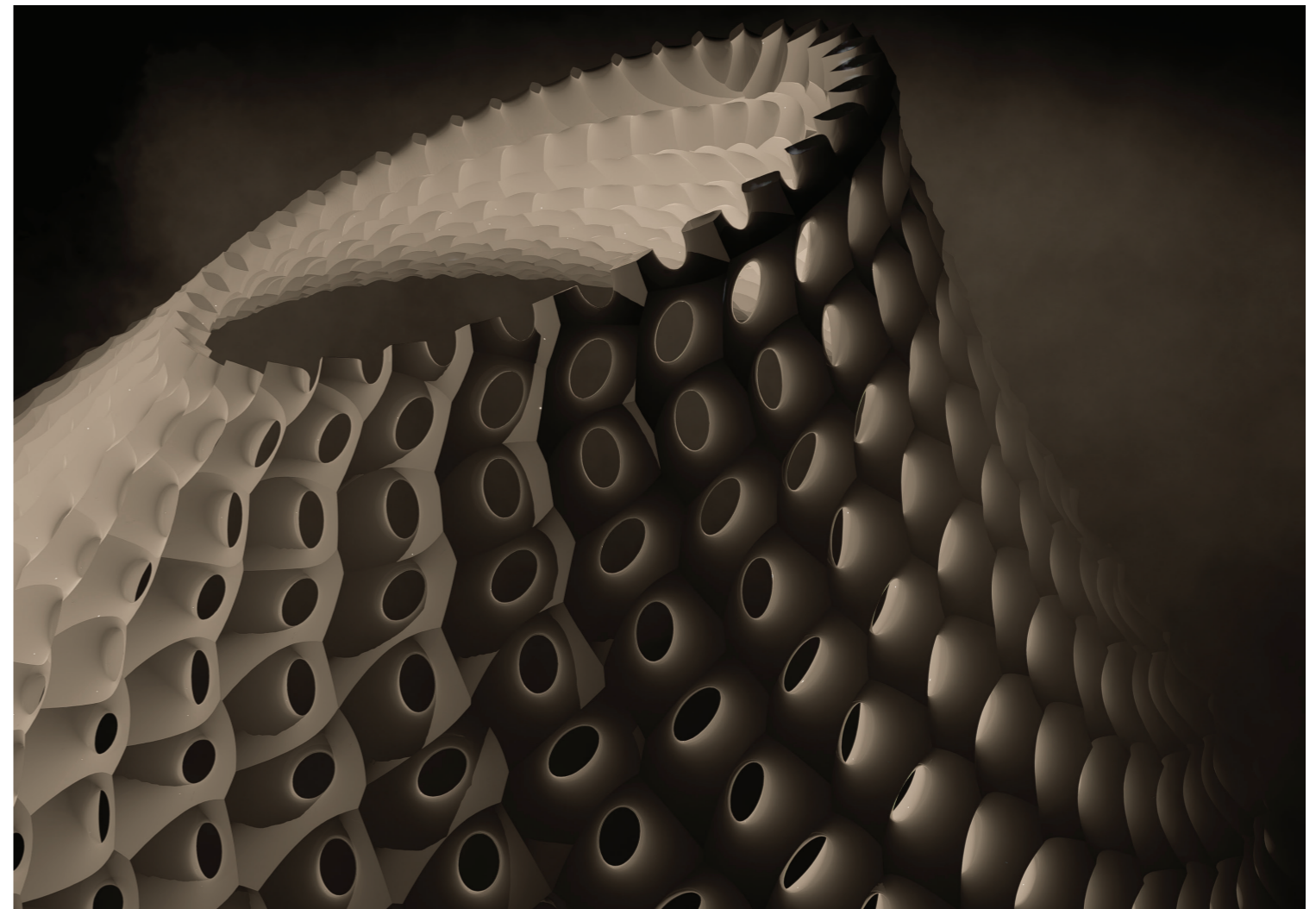
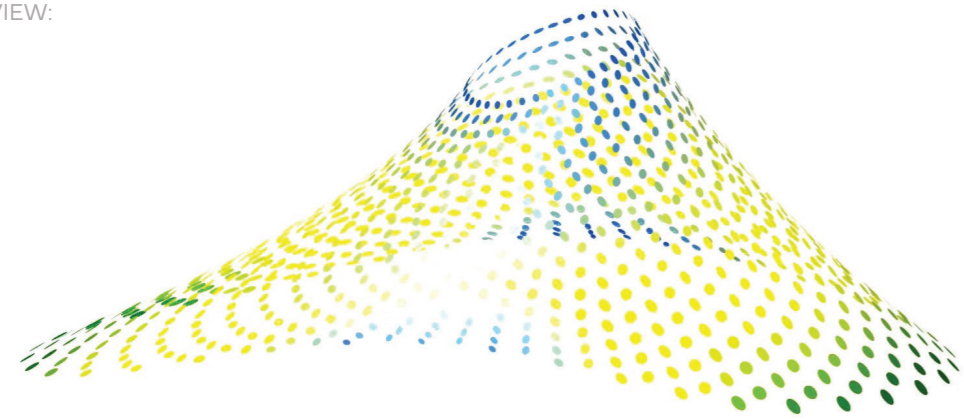
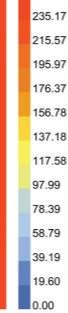
RADIATION ANALYSIS



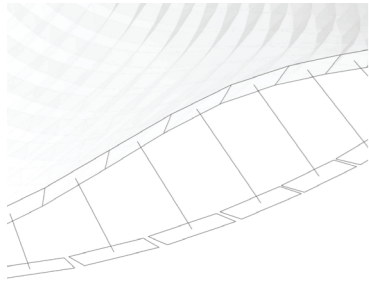
BEFORE OPTIMIZATION



AFTER OPTIMIZATION



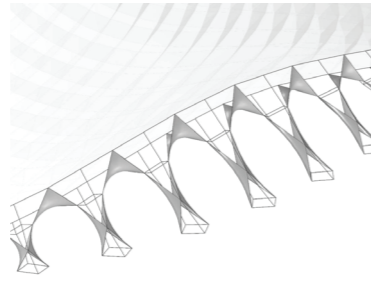
Column Ideation:



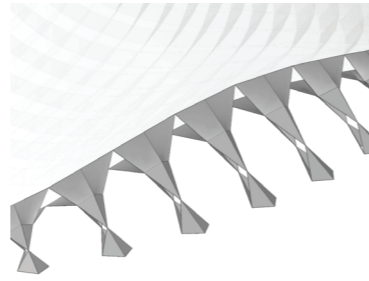
Setting the Extrusion Path



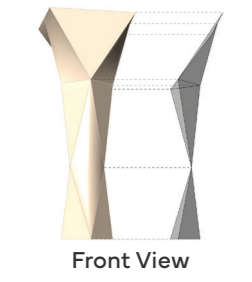
Creating Control Points



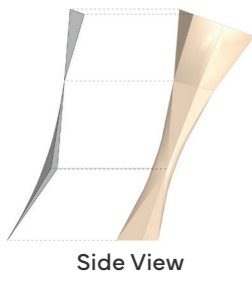
Doubly Curved Surface



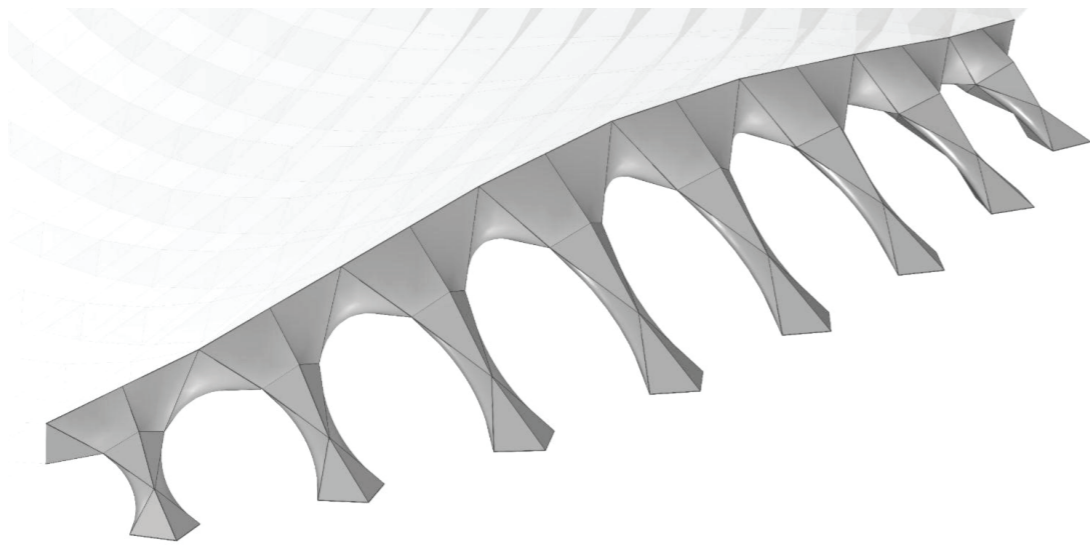
Ruled Surface



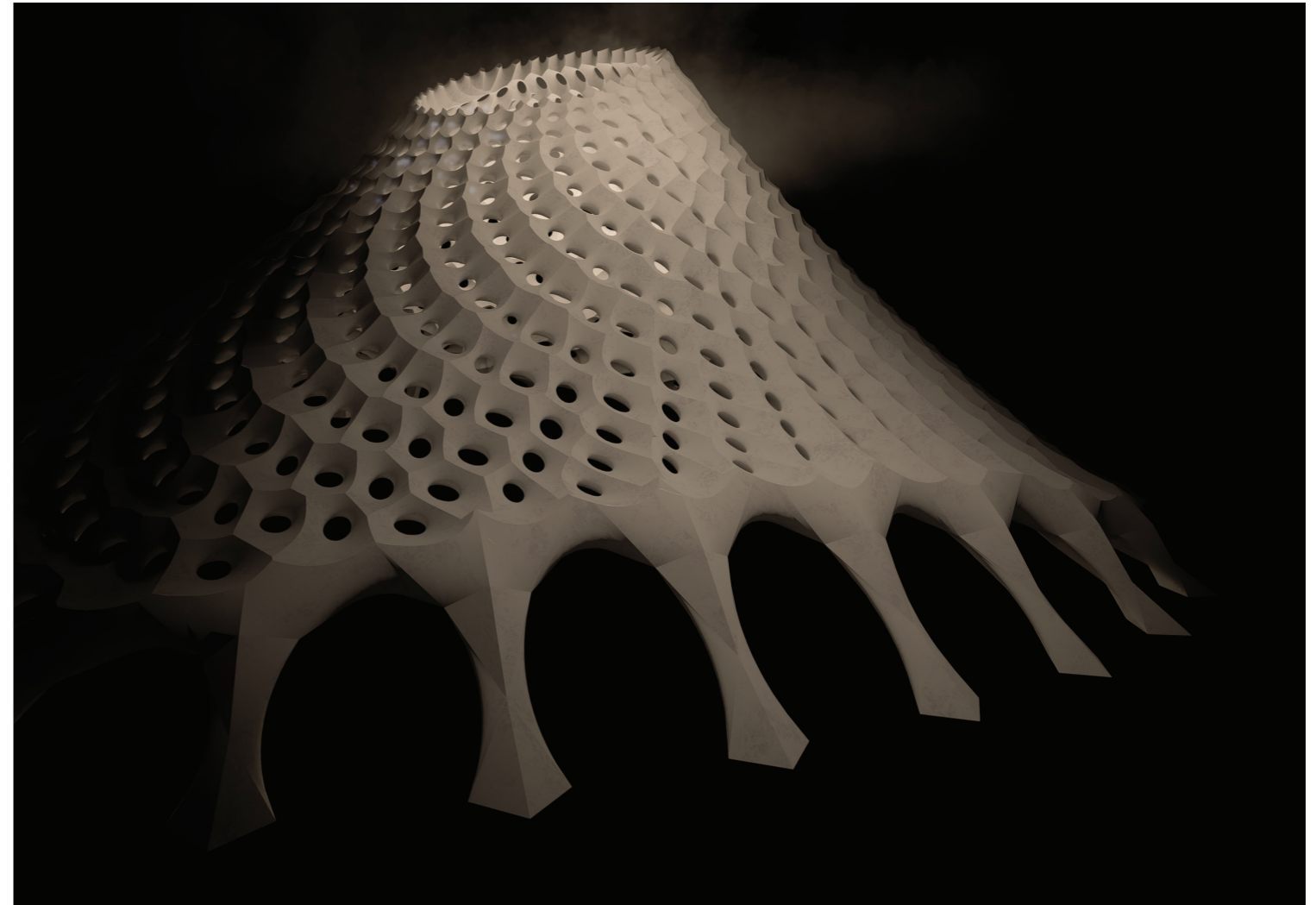
Front View



Side View



Merged Surfaces (Final output)



ROBOTIC STEREOTOMY:

Optimizing hyperboloid planes involves strategically creating perforations based on wind direction, incident radiation, and the orientation of the planes. By carefully considering these factors, the design ensures that the structure receives ample sunlight for heating purposes while minimizing unwanted airflow from the outside to the inside. This approach not only enhances the thermal efficiency of the building but also contributes to a comfortable indoor environment by reducing drafts and maintaining a stable internal temperature.

Voussoir

