From Sculpted Forms to Functional Geometry: Fresco Design’s Helmet Exploration

Fresco Design’s internal helmet project illustrates a proven approach to taking products from design through manufacturing. The studio has applied this process across wearables, medical, robotics, automotive, and consumer products, with Rhino geometry supporting complex tooling for large-scale manufacturing while preserving the original design intent.

Early form exploration: a series of helmet sketches is taken into an AI-assisted tool, where line drawings are refined and turned into shaded, rendered visual directions before sculpting in Blender.

FROM FREEFORM SCULPTING TO EDITABLE SUBD GEOMETRY

The process began with iterative sketches and AI-assisted shading and rendering to explore visual directions. These concepts were then developed in Blender, where sculptural modeling allowed the team to experiment with the helmet’s silhouette, flowing surfaces, and transitions between volumes without committing too early to detailed geometric constraints.

The helmet developed as editable SubD geometry in Rhino after QuadRemesh, with the outer shell and inner components separated to control surface transitions, creases, and how the parts fit together.

Using Rhino's QuadRemesh, Fresco converted the dense sculpted geometry into cleaner, editable SubD surfaces. This provided greater control over surface transitions, creases, and the separation of individual components while maintaining the overall design language established during the sculpting stage.

Rather than rebuilding the design from scratch in a conventional CAD environment, the team used Rhino to continue developing the existing form. This transition was central to the workflow, making expressive geometry more manageable for detailed modeling and subsequent prototyping.

PARAMETRIC LATTICES & ERGONOMIC EXPLORATION

The helmet's development also involved exploring how its geometry could respond to the human head. Fresco evaluated SubD variations against digital head forms representing different head sizes, considering the relationship between the outer shell, internal space, and potential areas of contact.

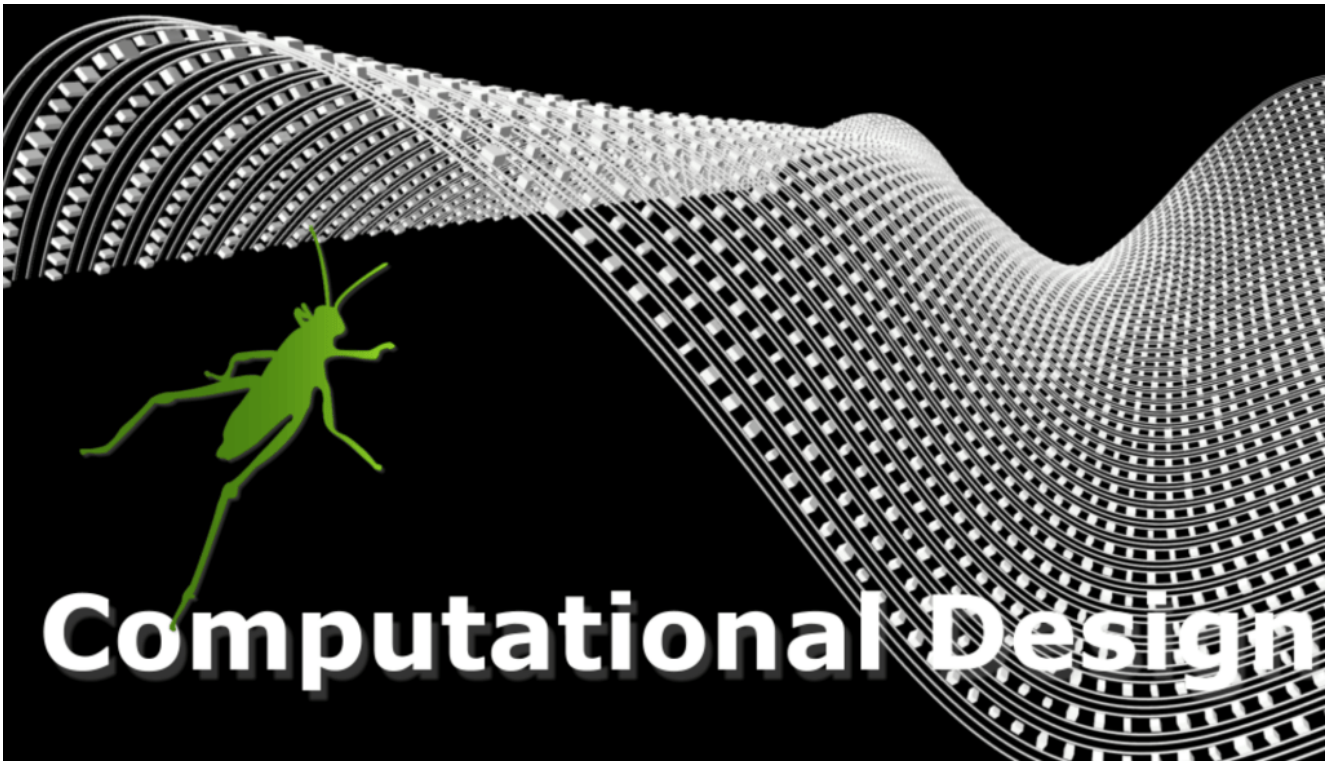


SubD helmet model tested on a digital head form to study fit and the relationship between shell, internal space, and contact areas, shown alongside a physical prototype being

worn.

For the interior cushioning, the team investigated conformal lattice structures as an alternative to conventional padding geometries.

Using custom Grasshopper scripts, Fresco developed lattice patterns that followed the helmet's internal surfaces. The team varied parameters such as cell density and strut thickness in relation to pressure-map data, allowing different regions of the padding to be explored with different geometric characteristics.



[See Also](#)

COMPUTATIONAL DESIGN WITH GRASSHOPPER

This approach linked ergonomic considerations directly to the generation of the internal geometry. Instead of treating the lattice as a uniform pattern applied after the shell was designed, Grasshopper made it possible to investigate how the structure could change across the helmet's interior.

The team also produced physical lattice samples, experimenting with different patterns, densities, and thicknesses to explore their tactile response and cushioning behavior. These studies informed the prototype’s development, although the available documentation does not establish quantified impact performance or safety certification.

A custom Grasshopper script generates a conformal lattice that follows the helmet’s internal surface, with parameters such as cell density and strut thickness adjusted in real time, followed by the printed lattice samples used to explore tactile response and cushioning behavior.

BRINGING THE GEOMETRY INTO THE PHYSICAL WORLD

The digital workflow continued through physical prototyping. Fresco produced resin-printed appearance-model components to evaluate the helmet’s form beyond the screen.

The team hand-finished, masked, and painted the printed parts, using contrasting satin and gloss surfaces to explore how color, material, and finish could reinforce the design’s geometry.

These physical models provided an opportunity to assess the visual and tactile qualities of the proposed design, while the separately printed lattice samples helped the team investigate the behavior of different internal cushioning configurations.



Resin-printed appearance models with hand-finished paint schemes in contrasting satin and gloss surfaces, displayed with a head form and the separately printed lattice cushioning samples.

The resulting prototype study demonstrates how digital modeling and physical experimentation can inform one another throughout product development.

By using Rhino to transform sculpted forms into editable SubD geometry and Grasshopper to explore variable internal structures, Fresco connected two distinct design challenges: maintaining the expressive character of the helmet's exterior and introducing geometric control into the development of its fit and cushioning.

The project ultimately illustrates how early formal exploration can be carried forward into increasingly detailed and physically tangible design decisions – without losing the qualities that made the original concept compelling.

CREDITS

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