

From Code to Clay: 3D Ceramic Printing at 3D Clay Summer School

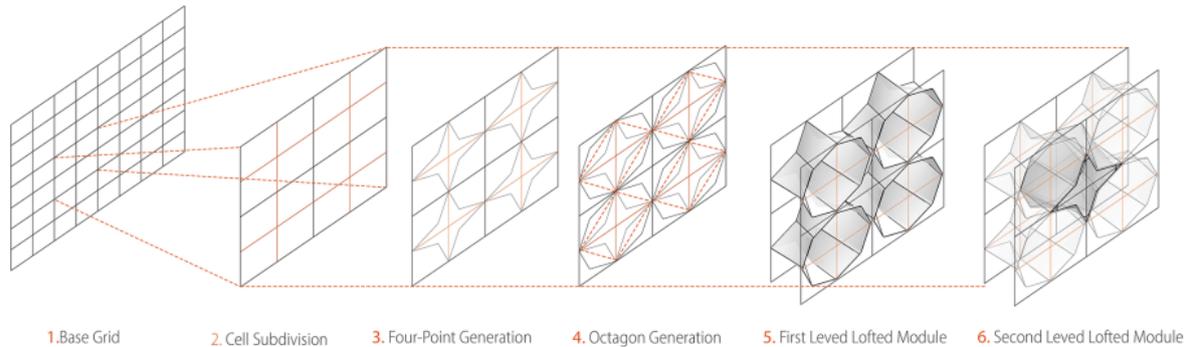
The 3D Clay Summer School is an experimental workshop dedicated to advancing computational ceramic design and 3D printing. This initiative brings together architects, designers, and researchers to explore innovative techniques for shaping clay using digital tools and robotic arms. Among the many remarkable projects developed during the program, *Datura Sculpture* stands out as a compelling case study of parametric design and 3D ceramic printing.



DATURA SCULPTURE: ORGANIC FORMS IN MOTION

The *Datura Sculpture* is an exploration of organic growth patterns, inspired by the sinuous geometry of the Datura plant. The design team employed Rhino and Grasshopper to generate a series of parametric variations, allowing them to refine the balance between structural stability and aesthetic fluidity.

The computational workflow enabled precise control over curvature, density, and the distribution of material, ensuring that the extruded ceramic elements maintained both their sculptural intent and their physical integrity during fabrication.



One key challenge faced in this project was adapting the extrusion process to the delicate overhangs and intricate details of the form. The team developed a Grasshopper script to analyze curvature thresholds and generate a toolpath optimized for continuous, stable extrusion. Adjusting parameters such as nozzle speed, layer height, and drying time prevented sagging and deformation.

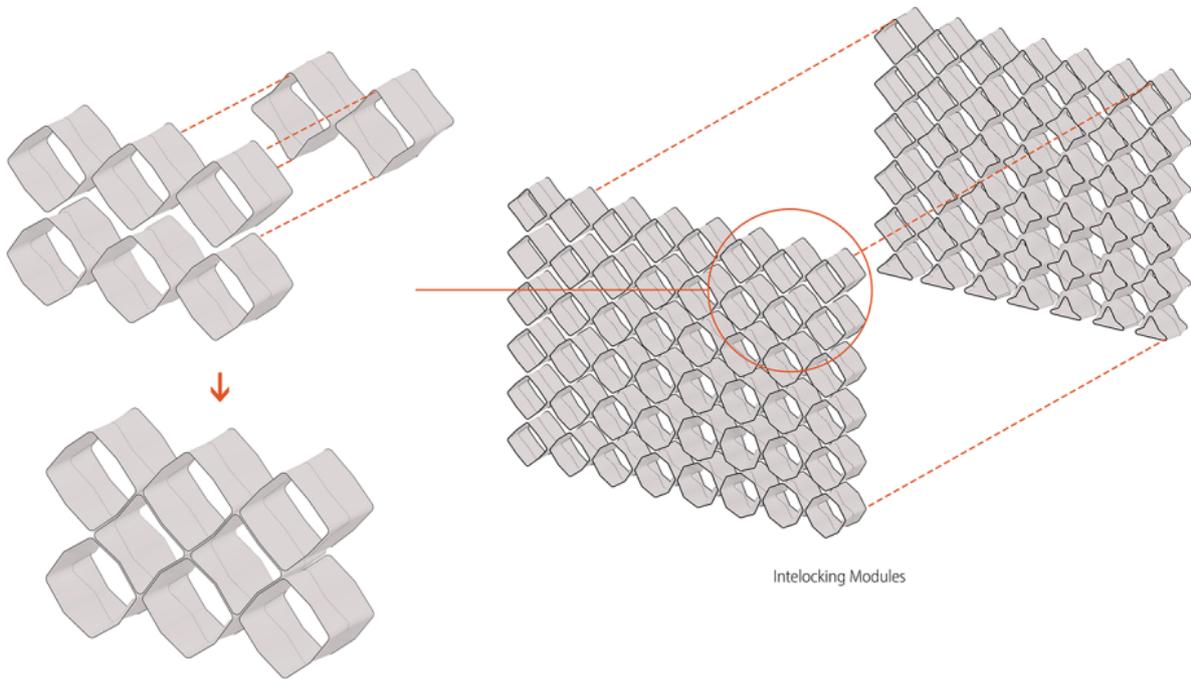
Extensive material testing played a crucial role in refining the fabrication process. Multiple clay compositions and moisture levels were experimented with to determine the optimal balance between workability and structural integrity. Test prints helped evaluate shrinkage rates and surface finishes, ensuring consistency across the final structure. Additional patterns were strategically deposited to reinforce geometries, preventing collapse while printing.



The 3D printer's motion was meticulously calibrated to adapt dynamically to variations in extrusion pressure and drying times. Custom Grasshopper scripts were developed to fine-tune toolpath adjustments in real-time, reducing inconsistencies and maintaining even material distribution.

Nozzle size was another critical factor; the team experimented with different nozzle diameters to optimize material flow and layering precision. Multi-layered extrusion techniques were also explored to enhance structural resilience.

Module Arrangement

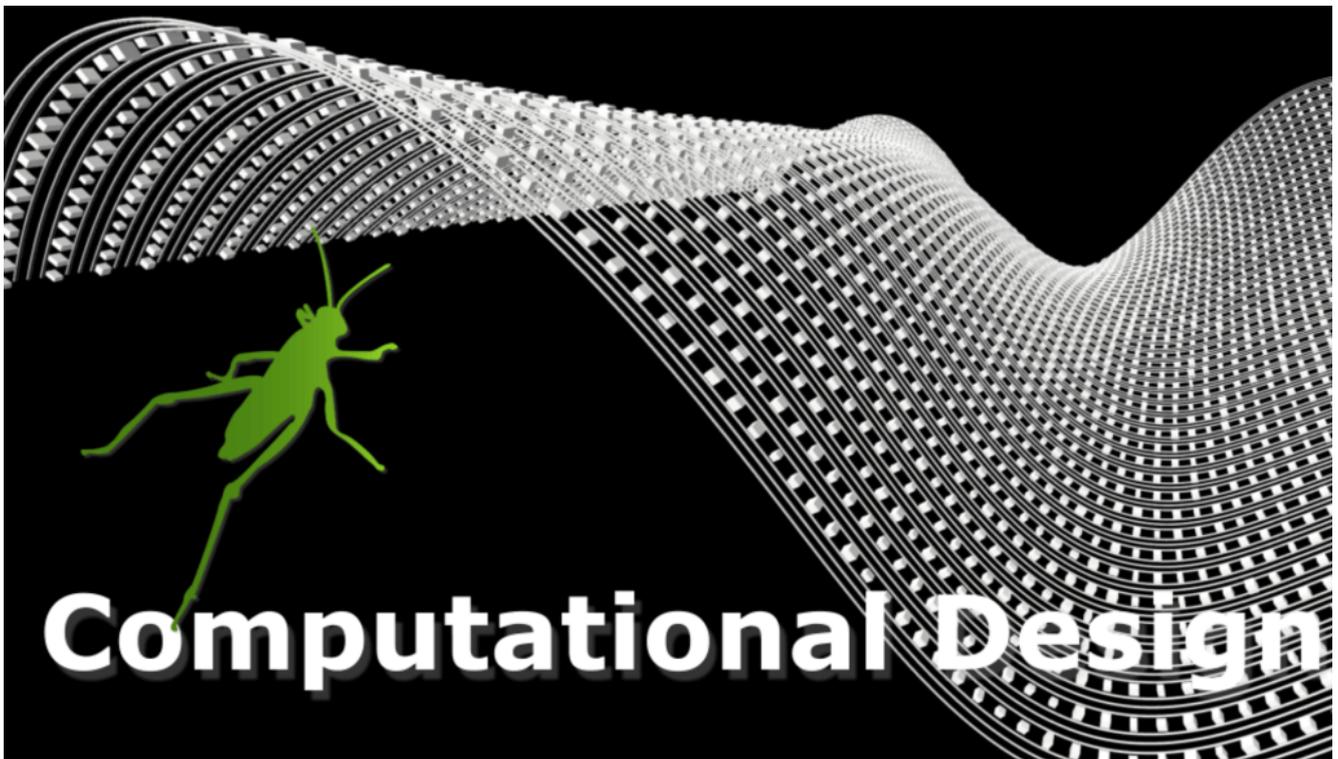


Post-processing was equally vital to the project's success. The team employed controlled drying environments to prevent warping and cracking, followed by a carefully monitored firing process that accounted for the sculpture's varying thicknesses.



COMPUTATIONAL DESIGN MEETS CERAMIC CRAFT

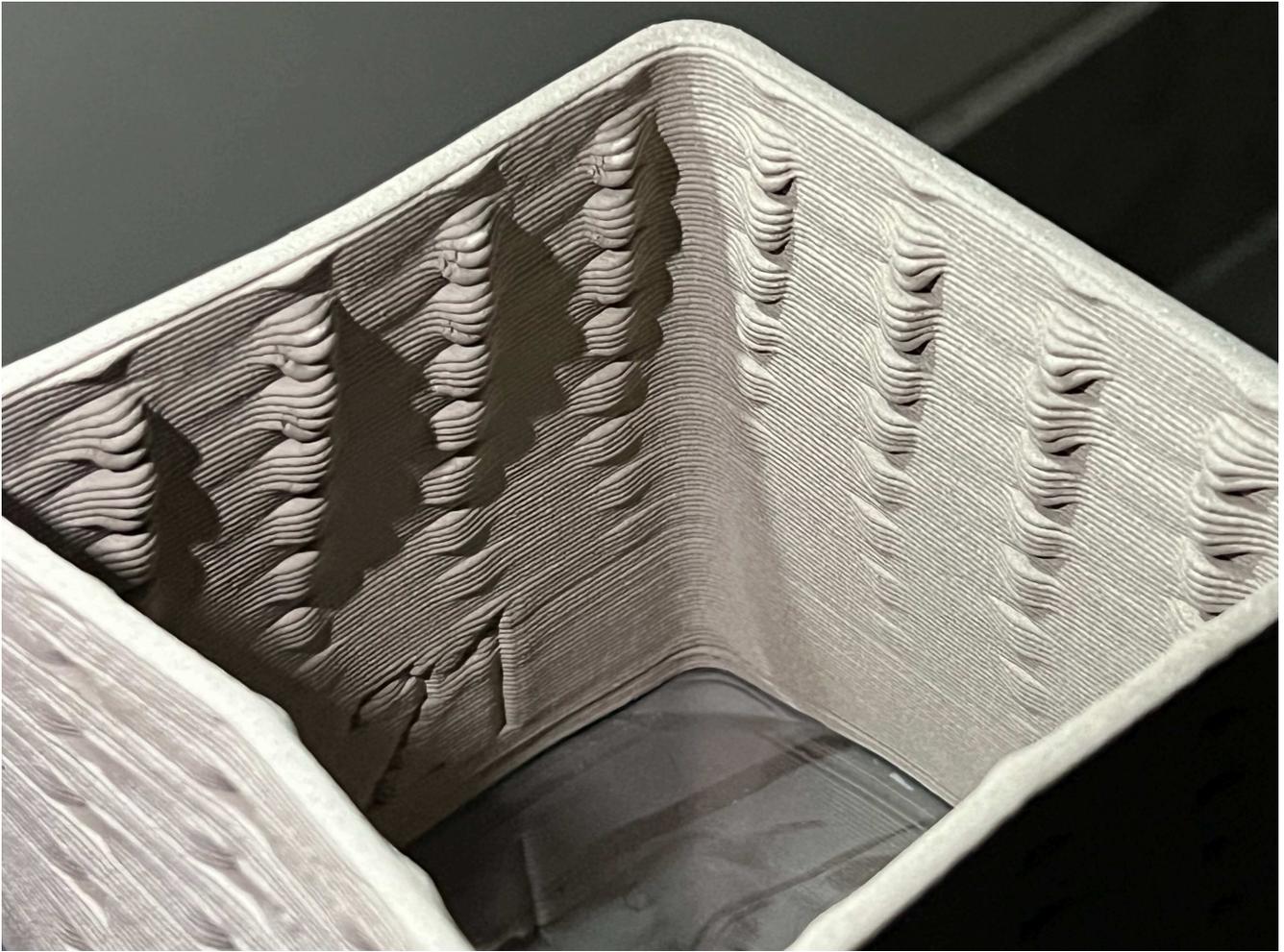
Datura Sculpture exemplifies the potential of computational design in ceramic fabrication, showcasing how digital tools can enhance traditional craftsmanship. The ability to script and simulate material behavior in Rhino and Grasshopper has transformed the way designers engage with ceramics, enabling more ambitious and structurally sound creations. The iterative process of design, testing, and refinement highlights the synergy between computational precision and material unpredictability.



[See Also](#)

[COMPUTATIONAL DESIGN WITH GRASSHOPPER](#)

The 3D Clay Summer School was a platform for innovation, fostering collaboration between designers and 3D printing specialists. As computational ceramic design advances, projects like these push the boundaries of what is possible in digital craftsmanship, bridging the gap between material tradition and technological evolution.



This summer school was held by the “Center of Excellence in Architectural Technology” in collaboration with the GeoMars group at the college of Fine-Arts at the University of Tehran in June 2024.

CREDITS

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