

Reimagining Prosthetics: A Parametric Foot Cover

Franziska Valerie Hagenauer, a student at [Controlmad Advanced Design Center](#) in Madrid, has developed a compelling project that reimagines prosthetic aesthetics through the lens of parametric design and digital fabrication. Her work challenges the traditional notion of concealment in assistive devices, opting instead to celebrate the underlying technology through an expressive, nature-inspired foot cover.

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**patent for design is pending*

LEARNING BY DOING AT CONTROLMAD

Controlmad is a certified Rhinoceros and [Rhino Fab Studio](#) training center specializing in architecture and design. The Madrid-based school offers a hands-on learning environment, emphasizing digital fabrication and parametric workflows using [Rhino](#) and [Grasshopper](#). Through its philosophy of “learning by doing,” students are encouraged to translate theoretical concepts into real-world applications, guided by expert instructors with industry and academic experience.

This educational model provided the perfect context for Hagenauer to explore complex geometry, material performance, and fabrication constraints while addressing real user needs. Her project illustrates how computational design can enable personalized solutions within medical product development.

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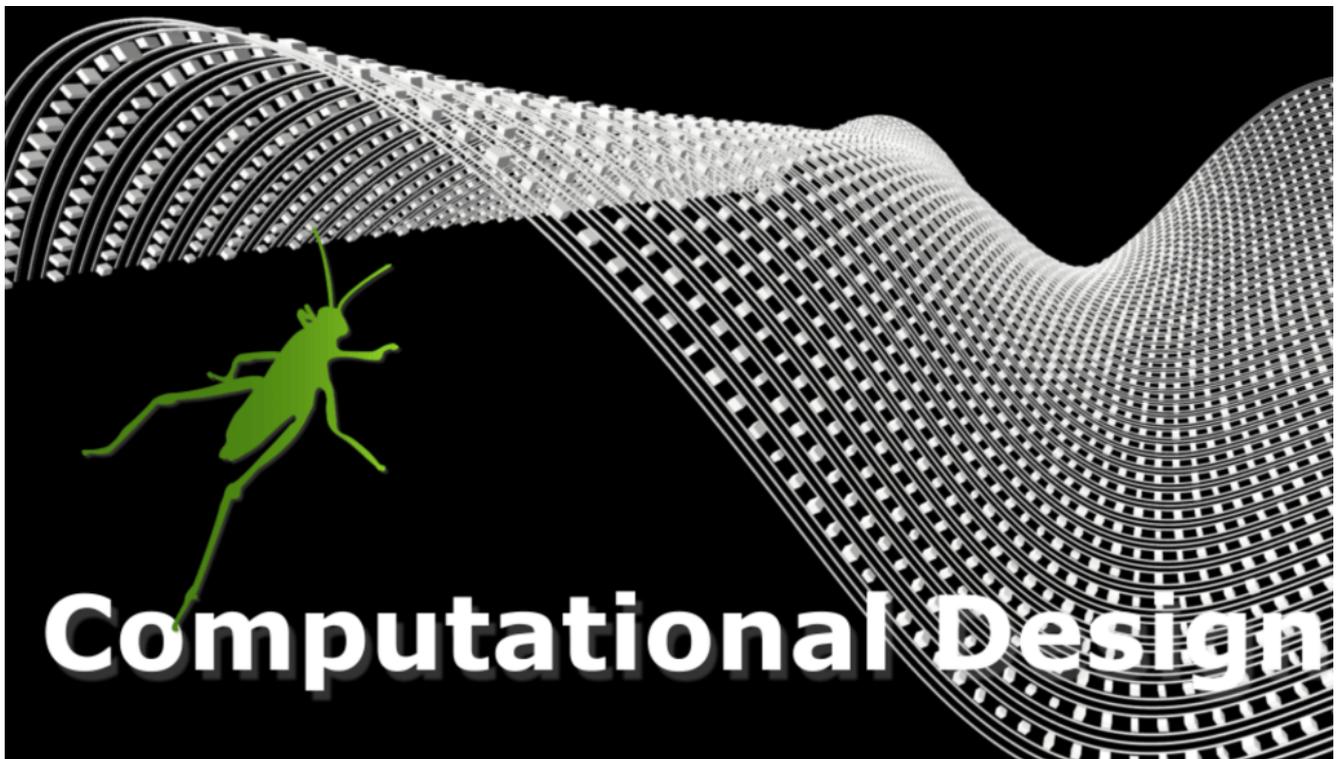


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DESIGNING WITH NATURE IN MIND

Inspired by flexible systems found in nature—such as the root structures of mangrove trees—Hagenauer began her design process with hand sketches and AI-assisted renderings to generate ideas for structures that enhance aesthetics while preserving movement capabilities. From this ideation phase, she developed a SubD model in Rhinoceros 8 shaped like a natural foot, allowing space for users to wear shoes, while strategically revealing the prosthetic's carbon spring and an opening mechanism for ease of use and adjustment.

During her pattern exploration phase, she experimented with various aesthetic strategies, including use of the Mesh+ plugin. For the final designs, she created intersecting circular patterns inspired by forms commonly found in nature. These patterns were applied to the SubD model in multiple ways. In a subsequent approach, the same pattern served as the base for generating an organic network that appears to have grown naturally on the foot model's surface.



[See Also](#)

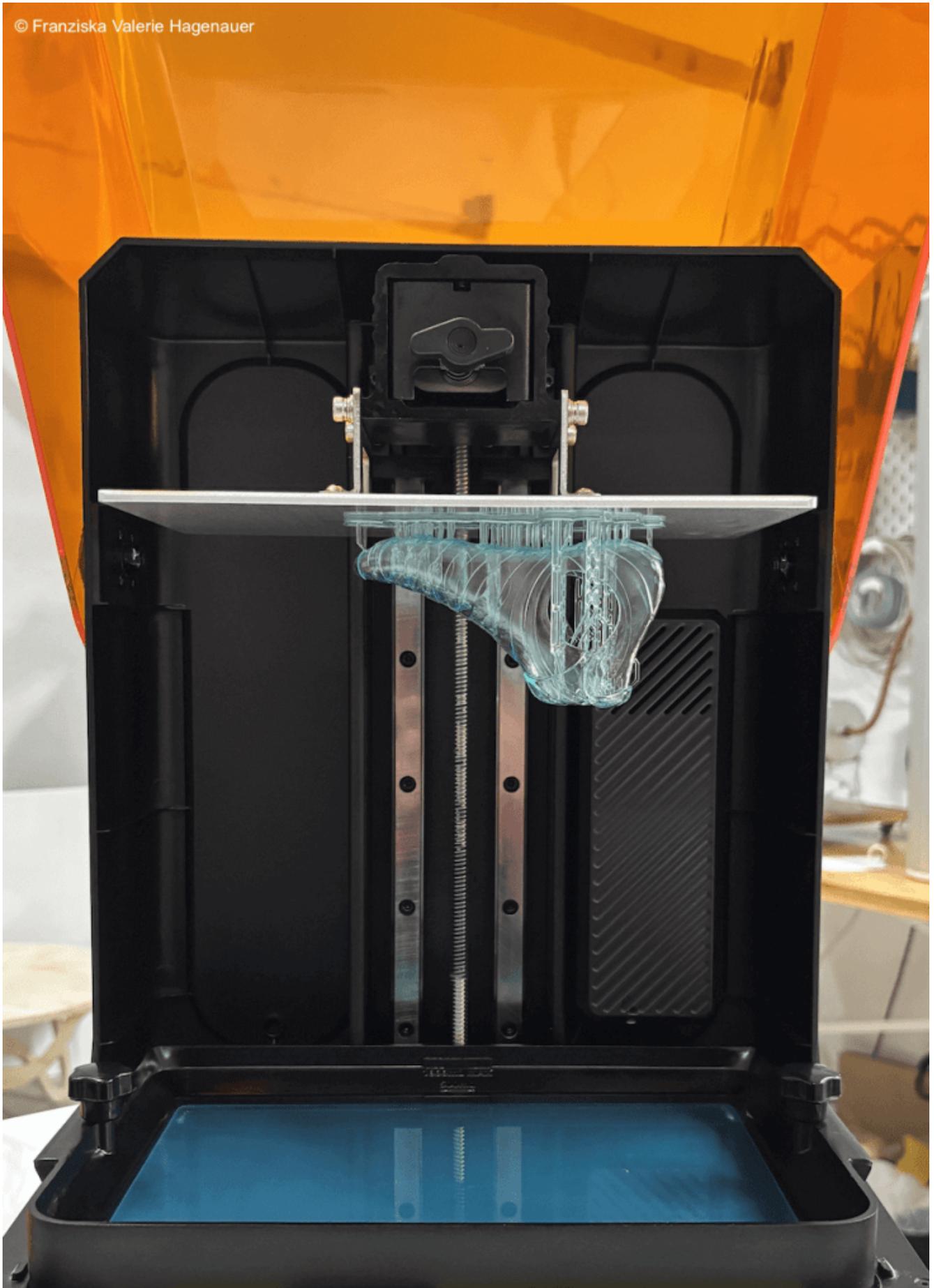
[COMPUTATIONAL DESIGN WITH GRASSHOPPER](#)

FABRICATION & MATERIAL EXPLORATION

The project's tactile realization involved extensive experimentation with additive manufacturing techniques. FDM printing was used with shiny PETG and flexible TPU filament on a [Bambu P1S printer](#), while SLA printing with aquamarine translucent resin (via Creality K1max) offered an elegant, high-resolution finish. While TPU delivered the required flexibility, –especially in areas like the heel mechanism, –SLA printing achieved the visual clarity that enhanced the design's expressive potential.

Fine-tuning the curing process was essential to preserve the resin's translucency and color. A thin resin coat applied post-print helped prevent yellowing and maintain the desired optical properties.





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CHALLENGES & FUTURE STEPS

Hagenauer faced challenges in translating complex geometry into printable models. Surface intersections and sharp transitions required careful optimization. SLA printing offered cleaner results but was limited by printer size. The next steps may involve the use of larger printers and flexible resin, as well as creating molds and using silicone as the final material. Hagenauer is also open to collaborations to help bring this product to market.

IMPACT BEYOND AESTHETICS

What distinguishes this project is its shift in narrative—from camouflage to celebration. By making the prosthetic's mechanics visible and aesthetically engaging, Hagenauer's foot cover becomes an extension of personal identity rather than a means of concealment. This empowers users to embrace their assistive technology with pride.

Positive feedback and interest from a prosthetist suggest the concept's viability in real-world applications. Hagenauer's project is a testament to how digital tools—combined with a thoughtful design philosophy—can redefine the boundaries of prosthetic design.

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You can find more of Hagenauer's work [here](#).

CREDITS

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