

# Design tool transforms objects into intricate works of art

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Credit: Disney Research

Just as wrought-iron fences and ornaments connect straight and curved elements to form aesthetically pleasing 3-D shapes, a new computational design tool developed by Disney Research enables people to design 3-D objects whose surfaces are formed from interconnected circles, hearts and other shapes.

These ornamental objects, produced with a 3-D printer, look delicate, but the [design tool](#) helps users identify and strengthen weak areas so that the final product is structurally sound, said Bernhard Thomaszewski, research scientist at Disney Research.

Thomaszewski, along with Jonas Zehnder of Disney Research and Stelian Coros of Carnegie Mellon University, will present the tool July 24 at the ACM International Conference on Computer Graphics & Interactive Techniques (SIGGRAPH) in Anaheim, Calif.

"Artists have long created similar artifacts, including bone and wood carvings, wire wrappings, and intricate jewelry pieces," said Markus Gross, vice president at Disney Research. "But these have always required the steady hand of a skilled craftsman. This new tool, combined with digital fabrication, makes it possible for the general public to create things of beauty that also will withstand handling and shipping."

The tool enables a user to begin with a 3-D model and to draw or apply a shape of the user's choosing, such as a circle, flower or heart. As the user moves it into its desired place and adjusts its size, the shape automatically adjusts to the underlying geometry of the object. The user can mix and match shapes as desired, resizing each as necessary so that their outer edges touch to form a network of curves.

"Curve networks are routinely used for embellishing surfaces, but they typically do not carry or transmit any loads," Thomaszewski said. "In this case, however, the curve network itself becomes the structure of the object, leading to a very different and challenging design problem."

In addition to manually placing and sizing the shapes that make up these ornamental curve networks, higher level tools enable a user to place curves over the 3-D model and allow the tool to automatically expand them until they touch each other, forming a network. The tool also can identify areas of weakness in the design, enabling the user to strengthen the design by making changes in the way the curves connect to each other.

The researchers used the tool to [design](#) a number of ornaments - including bunnies, foxes and balls - that reflected a variety of aesthetic styles. The prototypes were fabricated with a flexible thermoplastic polymer using a selective laser sintering 3-D printer.

**More information:** "Designing Structurally-Sound Ornamental Curve Networks-Paper" [[PDF](#), 19.39 MB]

Provided by Disney Research

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