

## Simulating the Genius Water Bottle Cage

When Aram Goganian was an avid 14-year-old bike racer, he became impatient with a company that he felt was taking too long to produce a new time trial bike. “I told them it’s not that complicated,” Goganian recalls. “That they should hurry up and do it. The company owner said, ‘If it’s that simple, you should do it.’” So he did. Twenty-two years later, he is still designing unique bikes and accessories at his company Predator Cycling.

With a goal of having a complete line of cycling-related products that they can 3D-print in-house and sell directly to consumers, Goganian used Discovery’s topology optimization functionality to design a revolutionary new bottle cage. While a device that attaches to the frame of a bike to hold a water bottle doesn’t seem like it should require much in the way of engineering innovation, it does if you work for Predator Cycling. Goganian wanted it to be the most efficient, durable and easy-to-use bottle cage on the market.

“Bottles are ejected from cages all the time, especially when you are mountain biking over rough terrain,” Goganian says. “This can be dangerous and inconvenient, and it slows you down.” The entry angle is one important parameter. How does the bottle enter the cage? At what angle?

“Traditionally you couldn’t go in on the side,” he explains. “You had to come in straight from the top. We designed ours with a mouth that looks like a shark mouth opening. The idea was that you could come in from almost a 45-degree angle and insert the bottle. You can come in from the top almost straight down and access it. It makes it easy. The material properties of the cage make it super flexible. You can actually bend and twist it and it will just grab the bottle.”

Goganian came up with the idea for the Genius water bottle cage about 3 years ago, but he wasn’t able to build it until he had the topology optimization feature of Discovery, which starts with a standard design and analyzes where material can be removed without reducing performance.

You can watch an animation of the Genius bottle cage topology automation using Discovery on the Predator Cycling website, showing how topology optimization automatically removes material from the design to go from the starting shape to the nearly final shape.

“I absolutely love topology optimization,” he says. “It’s my favorite thing ever. We had this idea for a bottle cage that would be the perfect thing to 3D print, but we could never figure out how to do it until we found Discovery.”

[VIDEO> Getting Started with Topology Optimisation](#)

