

# Everything That's Fit to Print

Like a lot of kids her age, 10-year-old Anastasia Rivas has energy to burn, playing softball and cheerleading and wrestling with her little brother at home in North Bergen, NJ and unlike a lot of her peers, she likes to help out around the house -- carrying the groceries in after a supermarket trip, for instance. All those activities have become a lot easier, because Anastasia now has a left hand -- one made out of plastic, elastic cords and stainless steel hardware.

Anastasia was born with amniotic band syndrome, in which strands of amniotic membrane get attached to and tangled up with the fetus; the condition leads to congenital abnormalities. In Anastasia's case, her left arm ends in a tiny, partial palm and buttonlike buds of fingers. A standard prosthesis could run upward of \$60,000, and a fast-growing kid like her could outgrow it every six to eight months, creating astronomical expenses.

Anastasia's grandmother saw an article about a prosthesis that can be cheaply produced and repaired, called a Robohand. "We finally thought we could get a device that could allow Anastasia to use fingers to pick up and grab things." Anastasia's new hand ran just \$2,000, and it can be replaced at a fraction of that cost.

How is that possible? Because Anastasia's hand is created with a 3-D printer, which can build a three-dimensional object by laying down ultrathin layers of material, one at a time. Her hand is one of about 200 such prostheses that have been printed using a design perfected by Richard Van As, a South African carpenter who lost 4 fingers in a circular saw accident.

Ty Esham, a hand therapist in Decatur, Ga., who studied under Van As, is the crafter of Anastasia's Robohand, and she can cheaply produce most of its plastic components -- the digits, the block of knuckles, the wrist hinge -- with her desktop 3-D printer, the MakerBot Replicator 2.

Though the technology behind 3D printing has been around since the 1980s, only in the past couple of years has it become possible to re-create more commonly found objects of everyday life.

The technology has the potential to alter, even revolutionize, dozens of industries, from small batch manufacturing to aerospace engineering, from prosthetics to reconstructive surgery and beyond. Within a decade, surgeons might even use 3D printing to build organs for transplants.

"The kids at school think my Robohand is really cool," says Anastasia, who recently started fifth grade. "Now I can pick up my eyeglass case, and I can pick up a pencil, although that is still hard to do - I keep practicing."

Anastasia also wants to practice using the hand to play baseball and basketball and to ride her bike. As far as Anastasia's grandmother is concerned, the sky is the limit, and she's as bullish as anyone on the future of the technology.

"I will be counting on Ty as Anastasia grows, so that someday she will feel like she has two hands like everyone else." says her grandmother.

"Our relationship with these machines is going to be a lifelong relationship."

