TECHNOLOGY

I PRINTED MY ROBOHAND

How 3-D printing changed Leon McCarthy's life—and is revolutionizing manufacturing

Leon McCarthy, 12, was born without fingers on his left hand, but the impairment doesn't slow him down—especially now. The seventh-grader from Marblehead, Massachusetts, recently got a **prosthetic** hand. He can open and close the robotic fingers just by raising or lowering his wrist. He can even hold a pencil and draw pictures. But the coolest thing about Leon's robotic hand is that he made it himself.

Leon built his prosthetic device with the help of a 3-D printer. These high-tech machines print three-dimensional objects using plastic, ceramic, metal or glass as "ink." Most heat thin plastic tubing and squeeze it out of a nozzle into layers as thin as a piece of paper. They then print hundreds of thousands of layers, one on top of another, until a complete object is formed. A small object, such as a cell phone case,

WORDS TO KNOW

- **prosthetic** *(adj)*: referring to a device used to replace or assist a missing or injured body part
- **prototype** *(n)*: a preliminary model

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Leon McCarthy and his dad used a 3-D printer to make his hand.

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takes about 30 minutes to print.

Leon got the idea for his prosthesis after seeing a video of a boy using a "robohand." Leon found the blueprint and printing instructions online. The parts took about 10 hours to print. "Then [my dad and I] had to build them into a hand," Leon tells *JS*. "We call it the Frankenstein hand because it has a really big bolt sticking out of the side," he says.

3-D printers have actually been around for commercial use since the 1980s. Companies first used them to create **prototypes** of new products. Doctors now use 3-D printers to create prostheses and replacement body parts, including ears and jawbones. Museums print 3-D replicas of statues and fossils. Scientists are experimenting with how to print food for astronauts.

Mini Factories

Home use of 3-D printers is skyrocketing in popularity thanks to lower prices and better technology. The mini factories cost from about $350 to $2,000. People use them to print everything from sneakers to missing Scrabble tiles—and they save money doing it, says Joshua Pearce, a professor at Michigan Technological University. He recently compared the cost of buying household goods with creating them with a 3-D printer. Printing 20 common items, including a spatula and garlic press, would cost $18. Buying those same items online would cost more than $300. "It simply costs people less money to make things for themselves," Pearce tells *JS*.

Users don't have to be computer whizzes to print objects either. "There are more than 125,000 free designs you can download from Thingiverse, one of many sites," Pearce says. Users can tweak the designs to fit their needs.

Those advantages are benefiting businesses as well. Companies can now print products on demand instead of spending money up front to manufacture and store extra inventory. Industrial 3-D printers lower costs, reduce waste, and speed up production. For example, General Electric now prints nozzles for its new jet engines. The company used to make each nozzle by welding 20 separate pieces together. 3-D printers produce the new nozzles as one complete piece. The printed nozzles are faster to make, five times as strong, and lighter than the old version.

Printing the Future

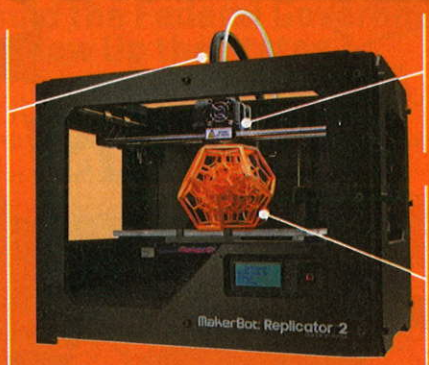
As more companies embrace the technology, experts predict that the face of manufacturing will change entirely. Factories once filled with workers may instead have a few technicians overseeing 3-D printers. Companies could manufacture more products in the United States instead of outsourcing work to China, India, and other developing nations where labor is cheaper.

The printers will also likely create controversy. Inventors recently printed a working handgun and a rifle. They then posted the blueprints online, spurring fears that the designs could fall into the wrong hands.

Leon and others, however, are focusing on the good the printers can do, such as potentially feeding people with 3-D-printed food. Leon plans to use his newfound knowledge to design even better prosthetic hands for other kids like him. "It feels good because I'm completing people," he says.

—Laura Anastasia

HOW 3-D PRINTING WORKS



1 PLASTIC FEED A spool of plastic filament—the printing material—unwinds and feeds into the top of the machine.

2 PRINTER HEAD The plastic is heated, and a thin thread is squeezed out through a nozzle.

3 FINAL PRODUCT An object is printed from the bottom up. The moving printer head lays down layers of melted plastic shaped as cross-sections of the object.

A 3-D Printer made THAT?




What would you like to print?

Left to right: a bike, a prosthetic foot for an injured duck, a shoe, and an electric guitar

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