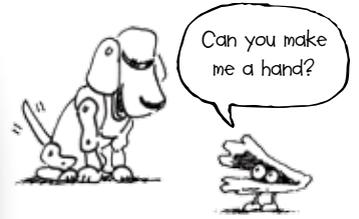


HELPING HANDS



It's possible thanks to helpful makers living all around the world. And the kids even get to choose the colors themselves.

By Elizabeth Preston

Need a hand? Print one out!

Faith Lennox is seven years old and is missing her left hand. She knows how to do lots of things without it, like ride a bike, braid her hair, and even surf. But to make her life a little easier, she has a new hand that looks like a robot's. It was created just for her on a 3-D printer.

Hundreds of kids like Faith are getting cool new 3-D printed hands.

Reaching Out

Faith got her new hand with the help of a group called e-NABLE. It's an online community that connects people who need artificial hands with designers and volunteers who have 3-D printers to make them.

The idea started back in 2011, when a South African carpenter named Richard Van As lost some of his fingers in an accident. He decided to build himself some new fingers.

The Flexihand, designed by Steve Wood, is one of many new artificial hands that can be printed out on a 3-D printer.



Ivan Owen invented these big fingers for a giant theater costume. Strings attached to the actor's hand make the fingers move. The idea works for small plastic hands too.

But how? He went on the Internet to look for ideas. And that's where he found Ivan Owen, a theater prop-maker who lived in Washington State. Owen had made some mechanical hands for theater costumes that looked effective and simple.

Owen was very excited to help Van As design some movable fingers. But he lived on the other side of the world. So the two men shared their ideas by email. Using 3-D printers, they could each print and test their designs at home, then compare notes.

After Van As's new fingers were finished, other people heard about the project. They asked whether the pair could build an entire

artificial, or prosthetic, hand. Owen and Van As began designing 3-D-printable hands for kids who needed them. They called their creation Robohand.

The project grew quickly. Many families around the world were eager to try a Robohand. But there was a problem. Most of these families



Faith Lennox has a helping hand printed out in her favorite colors.

Ten-year-old volunteer Torrae has helped make hands for kids in Mexico, South Africa, and Washington. There are many different designs to fit different needs.

didn't have 3-D printers, which are expensive. The solution? As it turns out, there are many other people who do have 3-D printers and are looking for interesting things to make with

them. Someone just had to get these two groups together.

This network of people became e-NABLE. Today, it has thousands of members all over the world.

Robots and Superheroes

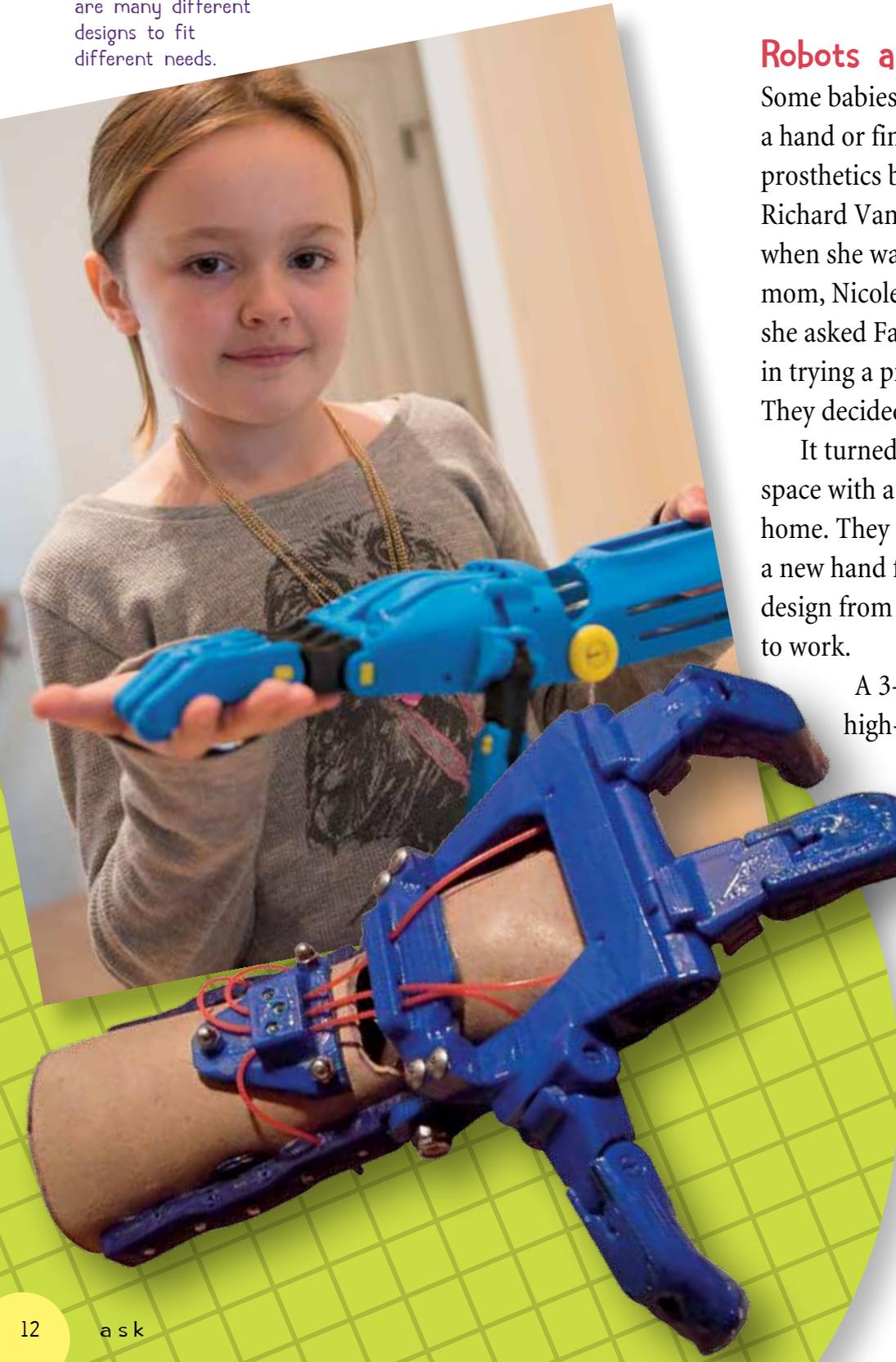
Some babies are simply born missing a hand or fingers. Other people need prosthetics because of accidents, like Richard Van As. Faith lost her hand when she was just a baby. When her mom, Nicole, learned about e-NABLE, she asked Faith if she was interested in trying a printed hand. Faith was! They decided to learn more.

It turned out there was a workspace with a 3-D printer near Faith's home. They were excited to help build a new hand for Faith. Starting with a design from e-NABLE's site, they got to work.

A 3-D printed hand looks high-tech, but it's actually pretty simple.

When the hand is attached to your arm, bending your wrist or elbow makes the fingers close and open. It doesn't use any electricity or motors.

Other kinds of prosthetic hands look



more like a natural hand, or use electricity to move on their own. But these artificial limbs can cost thousands of dollars.

That's a problem for kids, who are growing all the time. Their families may not be able to pay for expensive artificial hands that they will outgrow before their next birthdays.

That's one reason printed hands are so great for kids, says Jen Owen. She works for e-NABLE and is also Ivan Owen's wife. When a kid outgrows the hand, she says, it's no big deal. Replacement parts can be printed cheaply. Faith's family only paid about \$75 for the materials in her hand.



How Does a 3-D Printer Work?

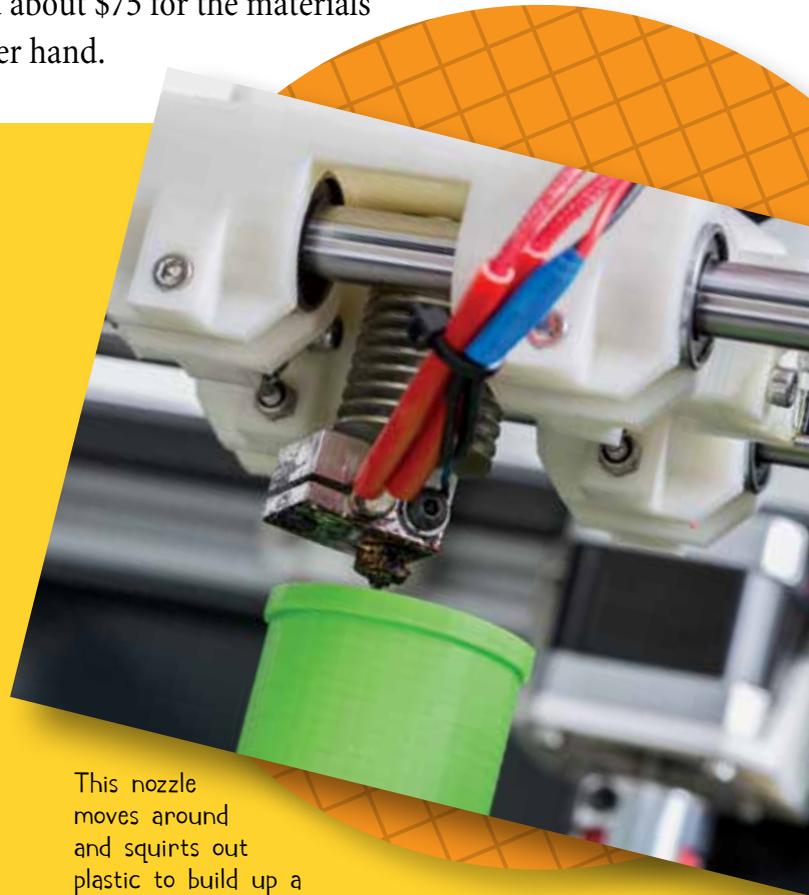
In an ordinary ink-jet printer, a tiny ink-squirting needle moves back and forth as paper slides under it. Your computer tells it just where to squirt ink on each line to build up a picture or text.

A 3-D printer works in a similar way—only instead of ink, it squirts plastic. And it moves up and down as well as side to side. So instead of a flat picture, it builds up a solid object, layer by layer.

Most 3-D printers print with plastic, which flows when it's hot but hardens when it's cool. The plastic starts out as a long thread on a spool. Inside the printer a hot tube melts the plastic thread into a liquid. Then it squirts the liquid plastic down onto a surface in a pattern controlled by a computer. The computer figures out where the plastic should go in each layer to build up an object.

The printer moves back and forth laying down one layer, then moves up a tiny bit and builds the next layer—a bit like forming a loaf of bread by stacking up slices. Each new layer sticks to the one below it, becoming one solid piece. As the plastic cools, it hardens.

Depending on how complicated the shape is, printing out a 3-D object can take anywhere from minutes to days. Faith's hand took about 24 hours to print, and a couple more hours to



This nozzle moves around and squirts out plastic to build up a solid shape.

assemble, bolting the parts together and adding the pull strings.

Just about any object that can be modeled in plastic can be printed on a 3-D printer. Inventors find them very useful for testing designs for everything from toys to airplane parts.

New kinds of 3-D printers can print with metal, computer circuits, and even food! So what shape would you like those noodles?

Aah. A perfect fit.



Printed plastic hands can't do everything, but they let kids pick up toys, eat apples, and play catch.

Plus, Jen Owen says, kids love the bright plastic designs. They can print their hands in their favorite colors or even make them look like superhero gloves.

Faith chose snazzy blue, purple, and pink for her hand. She's tried other prosthetics in the past. But since she helped make this one, she's more

excited about it. Learning to use an artificial hand can be frustrating. But now that she

has her handmade hand, Faith is eager to put it to work.

At school, Faith uses her new hand to hold her papers while she writes. Without it, she has to lean way over to hold her work steady. Other kids in Faith's class say they want a robot hand too.

Still, printed hands can't do everything. They aren't strong enough for handstands or swinging on the monkey bars. The plastic can melt in hot sun or break.

And although these helping hands let kids hold a water bottle or catch a ball, the fingers can only squeeze together all at once. They can't move one at a time—"Yet!" says Jen Owen.

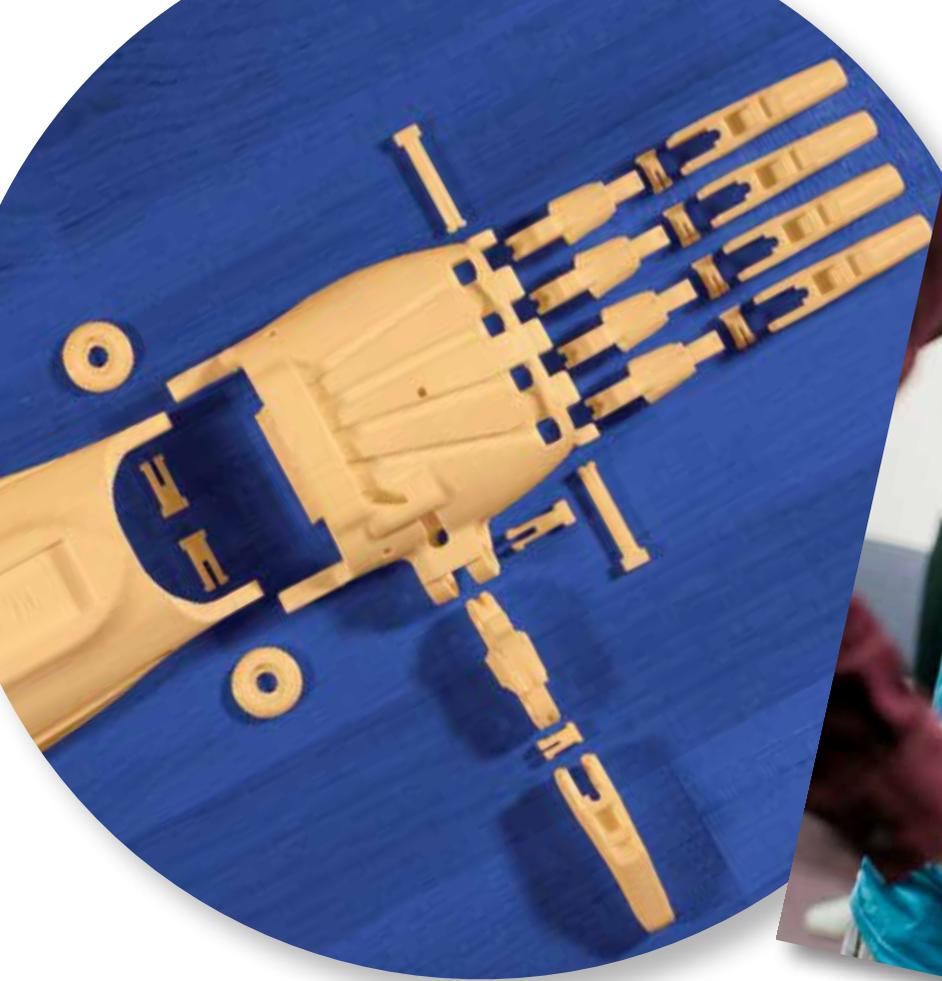
Hands around the World

Members of the e-NABLE community are working all the time to improve the hands and

invent new designs. The designs are shared as computer files that tell a 3-D

printer how to print the parts. Anyone who has a 3-D printer can use a





The printer just prints up the parts. Then a volunteer fits them together and adds the pull strings.

design shared by someone else online, even if that person is on the other side of the world.

Already, there are models especially for younger kids, for people who are missing fingers, and for people who need a whole lower arm. The group plans to develop more designs and wants to get more of its hands to hospitals and doctors.

E-NABLE has helped about 1,500 people in 40 countries get 3-D printed hands. Most of them are kids. The group estimates that people have built

another 1,500 hands—or more—using its designs unofficially.

As e-NABLE grows, Faith is growing too. Just three months after she got her blue, purple, and pink hand, it was pinching a little too tightly where it attaches to her arm.

So her family emailed the workspace and asked them to print a slightly bigger part. “That’s the really awesome thing about this,” says Faith’s mom. A brand-new limb is ready just as quickly as you can print it out. 🛩️

It’s important that the hand fits well. Each one is custom made for its owner.

