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ARTS & CULTURE

3D printed prosthetics are fashion statements for amputees

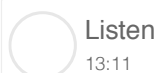
By [Angela Johnston](#) (/people/angela-johnston)



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A selection of different types of Bespoke fairing designs.

Angela Johnston



When Deborah Bevilacqua lost her leg in a motorcycle accident ten years ago, she had to get a prosthetic leg. It's been functional she says, but it's not pretty.

"It's a big black bulky thing with a big black bulky other thing attached to it, and a big grey metal bulbous ball...that's for rotation and shock, but looks kind of like the Epcot Center."

As we sit in her room in Alameda, Bevilacqua shows me how her new leg works. It's great for the triathlons and races Bevilacqua loves to compete in. But, she says it's not easy to wear a prosthetic and be fashionable.

"They're awful. These feet, these hideous ugly feet. It's the thing that makes me the most mad - it's just an out of the box foot, and as you can see it gets scuff marks that do not come off with the magic sponge eraser."



Deborah Bevilacqua poses with a fairing for a Bespoke photo shoot.
 Credit 3D Systems/Bespoke Innovations

Which is why, when a San Francisco startup called Bespoke was looking for amputees to test out their 3D printed prosthetic - Bevilacqua got excited about the project. It involved creating a fashionable, realistic covering that surrounds the metal pole of her a prosthetic leg called a fairing. She showed her design ideas to the head of the company.

"I sent him a bunch of surrealistic images and I'm sure he was like 'what is this stuff? How do you take Salvador Dali and Duchamps and turn it into a fairing?'"

After a long process of coming up with the perfect design, Bevilacqua walked away with a fairing that had her style written all over it. A black lace pattern on the front, and a shiny chrome back. It gave her leg it's natural shape again. She bought skirts and dresses for the first time in years. It looks really cool.

"I felt like a superhero, and it just looked robocop-ish. I just loved it and I immediately started wearing short skirts and going to the movies and just watching people's reaction to it, which was really fun."

Now, Bevilacqua has four different fairings, which she can change based on her mood, activity, or outfit. She says that after she started wearing fairings, she noticed some changes about herself as well.

"So I was just starting to build my confidence level back up because before that I would just cover up and pretend I wasn't an amputee and didn't want anyone to know. Then I just wanted to show my leg off because it was just so amazing looking, so i think its sort of therapy," Bevilacqua says.

A new kind of power

This feeling of empowerment is one of the reasons why Bespoke's founder Scott Summit started the company back in 2008. Summit



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Credit 3D Systems/Bespoke Innovations

gives me a tour of Bespoke, which is now a part of a larger 3D printing company called 3D systems located in converted apartment in San Francisco's SOMA neighborhood. They experiment with everything from 3D printed fabric, pottery, prosthetic fairings, and scoliosis braces like the one Summit designed for the a one-year-old girl.



3D printed fabric on display at Bespoke.
Credit Angela Johnston

"We scanned her and printed this and she wore it for her healing process, when she was done she was not only healed, she didn't want to give her brace back," he describes.

These braces and casts rest on top of shelves in the office and sometimes when you open the dishwasher in their kitchen you can find a couple of 3D printed arms and legs next to the coffee mugs. Washing them makes the plastic stronger, Summitt says.

A custom design

After an amputee decides they want a Bespoke fairing, they have to get scanned in person with a small scanner the size of a paperback. Chad Crittenden lost his leg to cancer in 2002. He came into the Bespoke offices a few years after to get fitted for his first fairing.

"So what we've done is we've taken a scan of my sound side leg, of my left leg in this case. The scan creates a computer assisted design file like you see on TV - 360 degrees and everything. We do the mirror image of that sound side leg, and create a fairing shape of the sound side leg," he says.



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Close-up of a pattern on a Bespoke fairing.

Credit Angela Johnston

Then the 3D scanned image is sent to a computer, where designers can add detail with any type of patterns and cut out. Designs that are influenced by everything from nature, historical fabrics, architecture, or things that are important to the amputee.

"I have a soccer pattern, I have the one that I'm wearing now which is kind of tattoo pattern, I have the very first one, it's just circular shapes, and then there's my

soccer fairing as well," he says.

Crittenden is now the Sales Manager at Bespoke and 3D Systems. Before we spoke he was in Boston scanning the legs of the Boston Marathon bombing victims. Crittenden has four different fairings. Because designs can be created by the clients, he's also always looking for inspiration for his next.

"I was recently in Lithuania and I was walking along the street and saw some amazing manhole covers and these teardrop patterns were just incredible."



Chad Crittenden's soccer fairing in action.

Credit Angela Johnston

The idea is to not make the fairing look exactly like a human leg, "Because you can't," Scott says. "That's flesh and blood, so instead we try to say that we're making something that's unapologetically man made, it's beautiful, it looks completely appropriate on the person, but it doesn't try to be that person."

From dust to fairing

Once a designer and an amputee agree upon the design, the final file is digitally sent to a large room of 3D printers. The printer is massive. Summit tells me it cost about \$800,000. It's about the size of a walk-in closet and has a tiny glass window to watch the transformation happening inside. Lasers move quickly back and forth and build a solid shape out of nylon dust. And from all of this dust - out comes an entire fairing, in one piece

But 3D printing isn't cheap, and neither are Bespoke fairings. It costs \$4000 for a basic leg, \$6000 for additional leathers or metals or designs. Summit's goal is to streamline and lower the cost of making a fairing so anyone can do it at anytime - so someone like Chad Crittenden can use just an iPad to make a new fairing whenever he wants to change his style.

Back in the 3D printing room, Chad Crittenden shows me how easy it is to put his on. It's when Crittenden takes his fairing off he notices the biggest change.

"I realized it looked cool, what I didn't realize that subconsciously or internally I was seeing this symmetry and the sort of reformation of my nonexistent limb, it was sort of restoring my leg and psychologically I think that as pretty important to get that back."



A leather fairing and prosthetic leg on display at 3D Systems-Bespoke.

Credit Angela Johnston

It gave him more of himself back, a renewed sense of confidence and self control.

“I’m out there to show this and I’m not trying to hide anything. That allows people to come up and ask about it, it starts a conversation and it really begins to bring down those barriers between those with disabilities and the mainstream,” says Crittenden.

Something that’s possible with this unique combination of medicine, technology and fashion.

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