

# Prosthetics get the personal touch

April 10 2012, By Lee Romney

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We can rebuild him. We have the technology. We can make him better than he was. Better ... stronger ... faster. -Opening to "The Six Million Dollar Man"

As a boy, Scott Summit was entranced by that television show's premise. As an industrial designer, he has made it his business.

Summit makes legs.

Chrome-plated legs. Leather-coated legs. Legs, some laser-etched with tribal tattoos, that mirror the shape of an amputee's sound limb without pretending in the least to be human.

[Prosthetics](#) long have focused on function. But the same design sensibility that has come to influence practical items like smartphones is turning synthetic limbs into a platform for [self-expression](#). As Summit helps fulfill that desire, he is influencing what it means to live with a disability.

Designer limbs must "represent personality as well as physicality," Summit said recently from his work space on the upper floor of a light-dappled building near downtown San Francisco.

"The thought was, if it was beautifully sculpted and crafted, it would change ... the way the person actually perceives their own body and, hopefully, it would then change the way society sees amputees."

Modern prosthetic engineering - cutting-edge suspension hardware on titanium rods and carbon graphite sprinting legs - has done wonders for utility but little to reference the human form. And to some amputees, attempts to mimic the real thing - flesh-toned [silicone](#) limbs, complete with fake [veins](#) - just don't seem right.

Summit's company, Bespoke Innovations, takes off-the-shelf prosthetics with the latest advances and surrounds them in personalized "fairings," a term borrowed from the shapely casings that reduce drag on motorcycles.

His clients tend to be young and image-conscious - wounded [military personnel](#) and injured motorcyclists are prominent. To spread the word about the emerging design field, Summit is collaborating with celebrity amputees, among them Paralympic record-setter Aimee Mullins, who changed the conversation when she walked down a London fashion runway 14 years ago in designer legs carved from solid ash.

"What Scott's onto is taking something that was ... at best functional and elevating it to something that is coveted by people who have legs of flesh and bone," said Mullins, 36, who was born without fibulae and had both legs amputated in infancy. "A prosthetic limb doesn't represent the need to replace loss anymore. It can stand as a symbol that the wearer has the power to create whatever it is that they want to create in that space."

The model and actress declined to spill the design details of her collaboration with Summit but promised that the newest legs for her collection would be beautiful.

The earliest known prosthesis that facilitated movement is the bendable wood-and-leather "Cairo toe" discovered on a female mummy dating between 1069 and 664 B.C.

In the Middle Ages, prosthetics were made of armor. Pirate-style wood posts and hooks followed. In the early 19th century, wealthy amputees commissioned hand-carved limbs with metal adornment before assembly-line manufacturing took hold.

During the Civil War, amputations were performed on 60,000 or so soldiers, according to Katherine Ott, medicine and science curator at the Smithsonian Institution's National Museum of American History. Prosthetics for survivors were so crude that Confederate army veteran James Edward Hanger fashioned one himself from whittled barrel staves and soon was commissioned to produce more. (Hanger Prosthetics & Orthotics remains prominent.)

Alloys and plastics developed in later wars helped advance prosthetic devices. Then carbon fiber propelled function to new heights. Designed by [amputee](#) Van Phillips, the FlexFoot Cheetah leg was produced in 1996 - just in time for Mullins to race in the Atlanta Paralympics. (South African athlete Oscar Pistorius, also a double amputee, currently is petitioning to compete with them in the Olympics.)

Recent developments have included advanced motors, myoelectric signals that trigger muscle movement and even brain-activated devices. Aesthetics, however, were driven by "the medical model," Ott said. "It was 'reconstruct the function that was lost and don't worry about anything else.' "

Where aesthetics were emphasized, they focused on hyperrealism, which typically landed them in the realm of "the uncanny valley" - a term used to describe the disturbing response people can have to animated or robotic replicas.

Take the foam rubber feet Mullins remembers from her youth: color-coded "Caucasian," she said, they resembled "nuclear peach."

Speaking at the 1998 International Design Conference in Aspen, Colo., she called on artists to dive into the world of prosthetics so that form, function and aesthetics could unite.

That year, the late fashion designer Alexander McQueen created Mullins' ash legs, carved with grapevines and magnolias. Today, Mullins has more than a dozen pairs of legs that allow her to range in height from 5-feet-8 to 6-feet-1. A small cadre of designers worldwide now creates prosthetics as fashion statement.

Summit was in the Aspen audience the day Mullins spoke. After she showed off two sets of legs - one lifelike and the other utilitarian - he began to puzzle out an alternative, "something with the grace and fluid lines that came from the body," he said, "that is still visibly a product of a designer."

Technology helped. A process known as 3D digital printing allows one-of-a-kind designs that once would have been too costly or complex to carve by hand or create by injection mold to be produced with a few computer keystrokes.

Summit's goal was lofty - to create a fully functional personalized prosthesis that could be printed from lightweight, durable materials for Third World consumers, whose good legs would be scanned with a portable camera. By 2008, he developed one at a cost of \$4,000, a sharp drop from what would have totaled more than \$60,000 in machined parts. But the price was still too high.

Summit said he was down to \$1,000 in savings - drinking cheap beer at happy hour two-for-one specials - when he teamed up with Kenneth Trauner, an orthopedic surgeon and engineer. The pair founded Bespoke in 2009 and last year began to sell fairings.

The devices, which typically cost between \$4,000 and \$6,000 - make up a small slice of Bespoke's activity (Summit said he can't discuss what's coming next, as patents are pending). But they have made a mark in the design world.

First, designers have an intimate conversation with the customer about his or her sense of self. The fairing's shape is dictated by a digital scan of the mirrored limb. In the case of double-amputees, Bespoke has used stand-ins. The form is "laser sintered" in durable nylon and can suggest patterns of lace, herringbone and more. Further adornment comes with chrome plating, leather sheathing, fabric coatings and laser etching.

Their designs have matched customers' tattoos, complemented the stitching on a Chanel handbag and referenced the grill of one German amputee's beloved Volkswagen GTI.

The company began marketing the fairings last year, ramping up slowly with word-of-mouth referrals and outreach to veterans. Summit declined to release exact numbers but said the company is on track to produce hundreds annually by next year. Although private insurers have largely balked at covering the cost, Summit said, a growing number of Veterans Administration hospitals are making the fairings available.

When retired Army Sgt. Matthew Sullivan, whose foot was blown off by a land mine in Afghanistan, showed up a few months ago at the San Diego VA's prosthetics lab to get his device adjusted, he said, his jaw dropped.

Summit and Bespoke employee Chad Crittenden - who lost a leg to cancer and was among the first to receive a fairing - were there scanning soldiers for designer prosthetics. They squeezed Sullivan, a sports enthusiast who favors knee-length shorts, into their schedule.

"It was literally a case of right place, right time," Sullivan said.

Sullivan's fairing mirrors the powerful contours of his good leg. On the chrome-plated calf piece is a laser-etched logo of the San Diego Chargers. (A die-hard fan, Sullivan takes a garden gnome in a Chargers uniform with him to every game.) The black leather front of his prosthesis cover is embossed with a San Diego Padres logo.

When Sullivan sports shorts, people approach him to marvel. In the past, he said, his suction socket-and-post device was met with averted gazes.

Most notably, a piece of Sullivan's spirit has been integrated into what was once an alien form.

Customization, said Wayne Koniuk, a San Francisco prosthetist, can be key to psychological comfort. He long has offered clients color choice and the opportunity to laminate a favorite T-shirt onto the outside of a leg.

"It no longer reminds them of some horrific injury they had," he said. "They think, 'That thing is way cool.' "

The sophisticated technology of Summit's fairings takes it to the next level, Koniuk said. Indeed, the realistic form allows Sullivan to tighten his snowboard boot or wear pants without the gap that conventional prosthetics create.

"Kind of in a weird way," Sullivan said, "you feel like you've gotten a part of you back."

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