Super personal

3D printers and scanners are no longer novelties, but what is all possible with these technologies is still truly astonishing. Even the designers are surprised by the results sometimes.

Pieter Smakman (25),
Industrial Design Engineering/
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3D hand scanner Curatio

Try not to use your hands for just a few minutes and you will realize that we need them for almost everything we do. A hand comprises muscles, tendons and 27 small bones that lend this part of the body its agility. Handy! In the development of a good 3D hand scanner this same complexity and flexibility form an almost impossible obstacle.

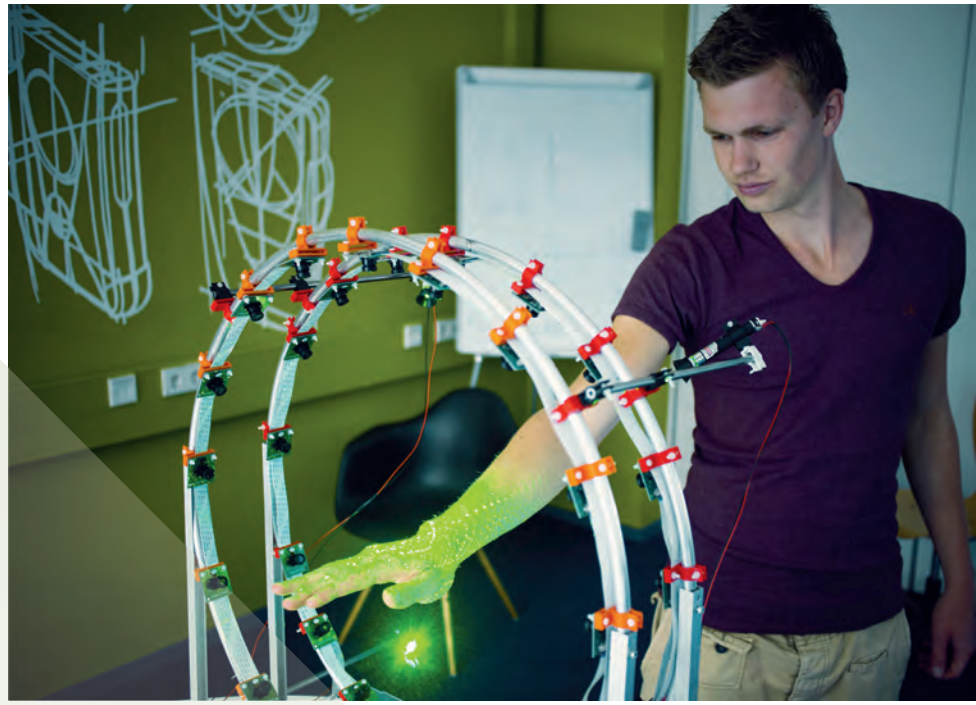
Extremely accurate

There is no doubt that the world is waiting for a good and affordable 3D hand scanner. Based on accurate three-dimensional images, scalpels and scissors can be fine-tuned to a surgeon's hand. As too can the racket for a tennis star and the steering wheel of a Formula 1 driver. And braces in the case of a wrist fracture can be made so that they fit like a glove. The possibilities are infinite. Industrial designer Pieter Smakman: "Good 3D scanners already exist, but they're really only suitable for stationary objects. They are not good enough for scanning the human body. If someone with their hand in the air has to stand on a rotating disc during a scan, the person can't help but move. So a scan like this isn't very accurate." How this could be achieved is some - thing that Pieter has researched step by step.

Mini computers

First of all, he investigated which optical tech- nology would be best for determining the shape, composition and structure from various positions. This appeared to be photogrammetry: the hand can be captured in a 3D image through projecting countless reference points onto the hand and calculating the distance between the points with special software.
The more perspectives, so the more photographs that are taken simultaneously of the hand, the more accurate the 3D image.
But how many images do I need to shoot and how am I going to do that?, Pieter asked himself. "Inspired by a person's hobby, who built a full- body 3D scanner, I opted to work with Raspberry Pi's. They are affordable printed circuit boards the size of a packet of cigarettes with the functionality of a fully-fledged computer."
To arrive at the correct number, Pieter construc - ted a viewing cabinet that contained an artificial arm. Of this, he took photographs from 48 different positions. This is how he tested the correct parameters: light intensity, projection of the reference points and camera positions.
"Then on the computer I discarded 1 photograph from each series, through which I discovered that 32 images were sufficient for producing a good 3D scan."

With a good 3D scan, scalpels and scissors can be made exactly to fit a surgeon's hand.



Eureka!

To test if he could instruct all the 32 raspberries simultaneously, Pieter got the mini computers to take a photograph of his stopwatch. And yes, the same hundredth of a second could be seen on all 32 photographs. Sending the images down the line to the main computer caused another not inconsiderable problem: the wireless network was overburdened. Pieter racked his brains for a full two weeks with this problem, changed the computer script and incorporated a send delay into each raspberry. And then... Eureka! "What I then felt... It's truly wonderful when it all works. Especially because no one has done this before."

Lidewij van Twillert (25),
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Mesh Lingerie: the custom fit parametric bra

If a bra is comfortable when you are dancing, it is always right. This was the basic premise for Lidewij van Twillert's graduation project: the custom fit parametric bra. "I've always been interested in fashion and wanted to develop a piece of clothing through the application of modern technology. Which item of clothing was the most important for me that it fitted well and was comfortable?, I asked myself. That has to be the bra."

If you employ 3D technology, you can achieve a better, more personal fit

Personal fit

The last major innovation in the world of bras was the preformed seamless cup. “I started my graduation project with an analysis and historical research. I learned from this that there have been innovative ideas from time to time, but that in the end nothing really came of them. Many fashion designers cling onto traditional methods. Above all, they have a different tool kit from the one that industrial designers have at their disposal. If you employ 3D technology, you have a lot more measurements to work from than when you just pick up a tape measure, and you can achieve a better, more personal fit.”

The first bra

Another student drew Lidewij’s attention to a theatre company that was putting on a variety-type show and were in need of costumes. “The lead role had to dance, sing and act in lingerie. A perfect model for my research! I made my first test bra for her.”
She had her work cut out for her, because Lidewij had made clothes in the past, but she had never made a bra, one of the trickier items. “I bought a book about drafting lingerie patterns and I completely immersed myself in it. It was very difficult, but after two intensive weeks my first bra was finished, complete with 3D prints. I surprised myself.”
Time for the next prototype. “For this, I first scanned my model’s breasts in 3D. I replaced the traditional underwiring, which is never comfortable, with supporting elements, shaped to follow the curves of her breasts. That printed section is made of nylon, but I wanted to do more material tests. On the one hand, you want flexibility and yet, on the other, robustness. This is what makes choosing materials so complicated.” Even the lace edging along the cup is printed and carefully tuned to the form of the breasts.

Perfect fit

Even though the wearers of the prototype were very satisfied, Lidewij made a number of alterations. “I wanted to show an even more beautiful bra.” So she made a new 3D file that was again produced by a professional 3D print company. “It’s really exciting when the new prints are delivered and a lot of fun to incorporate them in the fabric part of the bra. But the best moment of all is when I see my design on a model’s body.” Lidewij has certainly got a taste for this. At Delft University of Technology she has immersed herself in six months of material research and wearer comfort. In addition, she has started her own company: *Mesh Lingerie* (www.meshlingerie.nl), named after the file format of the to-be-printed components.

“I want to offer women a bra with a perfect fit guarantee; a bra that is comfortable in any situation.”