

Case Study: HeartBeatDress

3D Printed Sensoric HeartBeatDress
Translates Fashion and Technology
into Wearable Emotions



Describing herself as a combination between a fashion designer and an engineer, Anouk Wipprecht performs many of the usual steps in developing a project, from drafting to prototyping to perfecting the final product; however, the results are anything but typical. Imagine a garment surrounding its wearer in a puff of smoke to render them invisible, a dress capable of sensing and attacking any individual rude enough to interlope on personal space, or another that flashes in time with the human heartbeat—announcing a relaxed mood or an uptick in emotion.

Wipprecht's recent work not only measures the most important vital sign in the human body, but encapsulates the results within a delicate Swarovski crystal pendant. Doubling as a heart-monitoring sensor, the crystal lights up and flashes elegantly against the white backdrop of the 3D printed HeartBeatDress, built to remind us of an intact, protective spine, and vertebrae.

Pioneering Additive Manufacturing and Fashion Tech Trends

Wipprecht has long been a pioneer in fashion tech, a fan of unusual materials, and wholly unafraid to present designs that may disrupt traditional expectations. The wearers must also be brave enough to reveal their authentic selves, allowing fashion like the HeartBeatDress to expose them at their very core in revealing their mood or feelings. Fostering a connection between the internal and the external, Wipprecht's latest work comprises numerous 3D printed pieces and features



Many of these images were taken during the opening of the exhibition 'How You Wear It' at the MuseumLab of the Children's Museum Pittsburgh.

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the Swarovski crystal monitor with a conductive backing.

3D printing plays a central role in Wipprecht’s career and the HeartBeatDress, but science has been a source of continued inspiration for the Netherlands-born maker:

“I tend to take things from nature or biomimicry, looking at the behavior of humans or animals and putting that into my dresses,” said the 3D printing fashion tech designer.

Wipprecht has been having a lot of fun doing exactly that for over two decades. Interested in fashion design in her early teens, by the time Wipprecht was 17 she’d already grown tired of creating traditional clothing. Integrating electronics, she began to create designs that lit up and moved, controlled by electromechanical devices and a variety of special effects.

Designing 3D Printing and Robotics Around the Human Form

Wipprecht has been collaborating with Shapeways for nearly a decade to incorporate additive manufacturing into fashion tech. Her work is highly publicized due to its unique structure and inimitable style, culminating in an impressive portfolio of projects combining 3D printing and robotics that are centered around the science of the human body.

Well-known other [works](#) include:

- The Smoke Dress, part of an 8-piece collection for Volkswagen, is engineered with a custom microcontroller and sensors capable of cloaking the wearer in a cloud of smoke.
- The Spider Dress is meant to ward off those who might infringe on personal boundaries or otherwise do harm-threatening with spindly, arachnid-like arms. Due to its AI-enriched design, the Spider Dress is also imbued

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with wireless biometric sensors, providing the intuition to discern between and welcome those who are friendly.

- The Tentacle Dress serves as another example of a 3D printing collaboration with Shapeways, featuring tentacles that start to twitch upon facial recognition and even dance when motivated by a smile from another person.

“I do a lot of work using 3D prints and robotics, and then creating designs around the body that are sensory,” said Wipprecht, also mentioning that over the years she has put in countless hours constructing and assembling parts and pieces by hand.

Streamlining 3D Printed Product Development with Shapeways

Wipprecht is confident in working with the Shapeways team after so many years collaborating on 3D prints. Meeting tight deadlines is key to most of her projects, and that’s just one area where the designer mentions she has always been completely in sync with Shapeways. For an intense project like the HeartBeatDress with a project schedule of less than two months, customized, high-performance parts have to be manufactured and delivered within pressing cut-off times.

“Estimation on arrival for parts is really good,” said Wipprecht. “In ten years of partnering with Shapeways, there have never been any problems

or excuses.”

For the HeartBeatDress, Wipprecht chose [Nylon 11 \[PA11 \(SLS\)\]](#), using [Selective Laser Sintering](#) to 3D print select parts. Over the years, she has learned that durability is the most important quotient for her 3D printed dresses. This is especially true for 3D printed robotics that must be strong enough to stand up to the test of time, along with hours of wear. To perfect each part, Wipprecht relies heavily on [rapid prototyping](#) with Shapeways:

“3D printing really allows for rapid prototyping and I think that’s one of the biggest things for creators and makers—that you can try out a certain idea or design without having to jump right into a production line or a requirement for volume.”

Professing an affinity for SLS 3D printing, she appreciates the level of flexibility offered over other technologies.

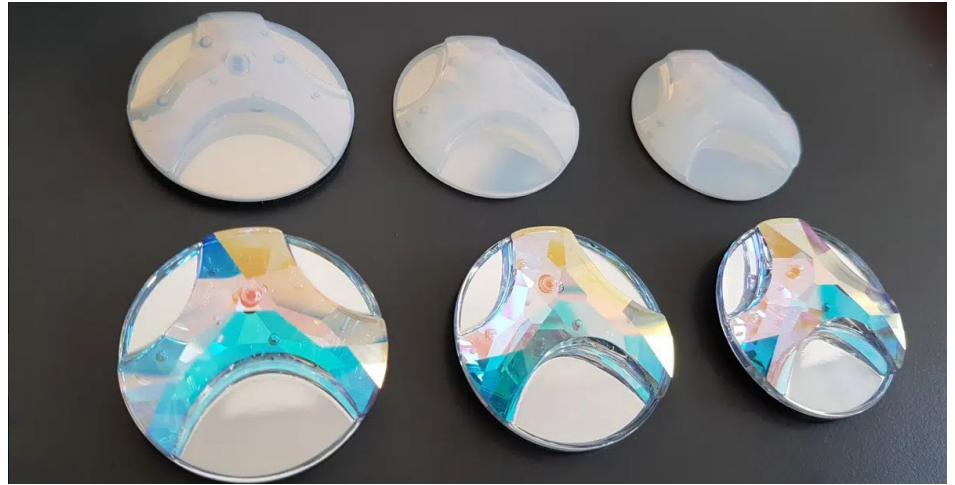
“SLS really gives a lot of freedom for designers and architects because you can do so much without having to calculate for supports,” said Wipprecht. “It also gives the best results, and is the most lightweight.”

Wipprecht places a strong focus on structural integrity in all her work, and 3D printing materials must be able to stand up to her expectations—especially for some of her work that eventually goes to live in a museum—potentially for decades.

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[Nylon 11 \[PA11 \(SLS\)\]](#) is a winning combination with SLS technology for the fashion tech icon's designs due to the resulting durability, flexibility, and impact resistance with high elongation at break. The material is derived from natural and sustainable origins, and is environmentally friendly and biocompatible too. Nylon 11 [PA11 (SLS)] is highly elastic, and easy to recycle as well.

For the HeartBeatDress, Anouk also incorporated the use of the BIOPAC MP40 system, meant to record data from the human body, as well as the PACIS pak, a wearable wireless device for biosensing.

Swarovski Collaborated in Support of Innovative Fashion Design

Sometimes Wipprecht begins a project spurred on by her own ideas, and other times a company approaches her with a new concept. The HeartBeatDress was a triumvirate of a collaboration, with everyone involved pushing new limits in design and production. Italian architect Niccolò Casas—a veteran in partnering with

Wipprecht for numerous projects, including the Smoke Dress—contributed to this project too.

“Because we've worked together for so many years, we quickly understand what works and what does not,” said Wipprecht. This translates to issues like refining interlocking parts and making sure the dresses move correctly.

And although partnering with Swarovski had been in the works for years, it was not until recently that all the stars aligned for the parties involved, culminating in the HeartBeatDress.

“I had been in contact with Swarovski but we just never quite knew how to organize everything until they came back to me a few years later and said they were ready to begin working with designers who are more experimental. That's how we connected again and began working together on the HeartBeatDress with crystals and touch sensors,” said Wipprecht.

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“I was interested in using the heart rate and we began making sketches of the necklace, along with bringing the structure of the human rib cage into the design.”

Ultimately, the design evolved so that the crystal sensor necklace could be sewn into the four-piece dress or worn as a standalone accessory. Swarovski engineers placed a specialized film over the crystals so they could be transformed into touch sensors, and ten units were created for the project.

3D Printed Dresses Require Strategy for Form and Function

In designing the HeartBeatDress, special attention was required for placement of the 3D printed parts. Wipprecht points out that it's very difficult to 3D print an entire dress. Over time fragile parts would crack or break.

“I use a lot of fabric or leather for other parts of the body,” said Wipprecht.

“At one point in my career, I started to make more pieces from the waist up, and then I got really bored with that. From the aesthetic point of view, it's kind of cool to show off more 3D printed parts but you also have to consider comfort and mobility.”

“There is also the option of showing off parts like electronics such as servo motors, or hiding them,” said Wipprecht. “You take those things into consideration, along with coding, robotics, and everything that needs to be placed on the body.”

One of the HeartBeatDress designs already resides at the Children's Museum in Pittsburgh. Because there is not a human wearing the dress, a remote heartbeat interface is set up for visitors. Once they place their hands on the interface, they can see their own heartbeat from the sensor.

Wipprecht points out that it is particularly inspiring to see kids expressing such wonder at the exhibit, and being able to participate with the electronic interface. She



hears from a lot of younger designers, especially women, and hopes to continue encouraging them to delve not only into fashion, but science and engineering too. There are also plans to offer the HeartBeatDress as an open-source design, allowing others to make their own customizations.

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Anouk Wipprecht’s career has already been prolific, spanning over 60 projects featuring fashion, technology, electronics, and arresting designs. An international sensation within the 3D printing industry, Wipprecht hails from the Netherlands but spends a lot of time in the US now too. No matter where in the world the fashion tech designer may be, she is one to follow.

About Shapeways

Shapeways makes world-class 3D printing more accessible to everyone through automation, innovation and digitization. Our purpose-built software, wide selection of materials and technologies, and global supply chain lower manufacturing barriers and speed delivery of quality products.

Shapeways’ digital manufacturing services have empowered more than one million customers worldwide to produce more than 20 million parts using 10 different technologies and 90 different materials and finishes. Headquartered in New York City, Shapeways has ISO 9001-compliant manufacturing facilities in Long Island City, N.Y., and Eindhoven, the Netherlands.

Contact us at www.shapeways.com to learn more.