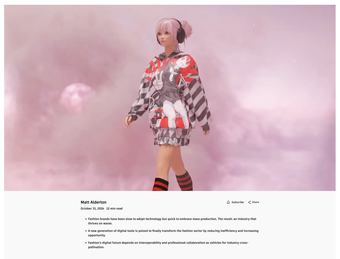
Fashioning the future: How digitalization can help the fashion industry reduce waste and increase opportunity

Learn how the digital transformation of the fashion industry is making it more efficient, sustainable, and profitable.



Physgital tech can let technology and its tribe designers turn digital designs into physical creations.
Image courtesy of Physgital

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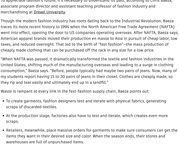
- Fashion brands have been slow to adopt technology but quick to embrace mass production. The result: an industry that thrives on waste.
- A new generation of digital tools is poised to finally transform the fashion sector by reducing inefficiency and increasing opportunity.
- Fashion's digital future depends on interoperability and professional collaboration as vehicles for industry-crossjustification.

Fashion has always been an analog business. It's easy to understand why. From the shimmer of a sequined gown, and the vibrancy of a neon T-shirt, to the buttery softness of a cashmere sweater, fashion is tangible, technical, and tactile. It is seen, sampled, shaped, and sewn.

Like many analog industries, however, fashion has remained on the sidelines longer than most. But the way things have always been done, in front of it, a vision for how things might be done better. And in between, an opportunity to use digital transformation as a bridge from past to future.



London based service Physgital helps independent designers turn digital designs into real-world creations. Image courtesy of Physgital

British fashion executive Louise Lamy is leading the charge across that bridge—in fact, she's one of the people it's crossing. In 2022, she set out to modernize the fashion industry by using digital tools to reduce waste and improve efficiency. Her London-based startup, Physgital Tech, leverages 3D design and digital prototyping to help major fashion brands turn digital designs into physical samples. Because technology is still largely new to the design industry, the low-hanging fruit at this stage of Lamy's business is 3D modeling. "3D visualization makes product development shorter," Lamy says. "You don't have to make a sample until you've perfected it and get the right one. You can see something much more clearly through the 3D mesh. It has more structure. You can get further in it to see how the fabric will drape before you actually sample it."

Sampling—the act of making and refining physical prototypes of garments before mass producing them—is just one area where there's room for digital tech in fashion. Digital transformation could help the fashion industry remake its entire supply chain through concept, design, manufacturing, production, sales, and marketing.

From wearable to wasteful

Many production facilities are overseas, making fashion's supply chain long and complex. Image courtesy of Shutterstock

To appreciate fashion's future, it's necessary to understand its past, according to Chris Bawza, associate program director and assistant teaching professor in industry and merchandising at Drexel University.

Though the modern fashion industry has roots dating back to the Industrial Revolution, Bawza traces its more recent history to 1994 when the North American Free Trade Agreement (NAFTA) went into effect. Before NAFTA, most American apparel was made in America. After NAFTA, most American apparel brands moved their production an ocean or more away in pursuit of cheap labor, low taxes, and reduced oversight. That led to birth of "fast fashion"—the mass production of cheaply made clothing that can be purchased off the rack in any size for a low price.

"When NAFTA was passed, it dramatically transformed the textile and fashion industries in the United States, shifting much of the manufacturing overseas and creating a large gap in supply chain consumption," Bawza says. "Before, people typically had maybe two pairs of jeans. Now, many of my students report having 25 to 50 pairs of jeans in their closet. Clothes are cheaply made, so they rip and tear easily and ultimately end up in a landfill."

Waste is rampant at every link in the fashion supply chain, Bawza points out:

- To create garments, fashion designers test and iterate with physical fabrics, generating scraps of discarded textiles.
- At the production stage, factories also have to test and iterate, which creates even more scraps.
- Retailers, meanwhile, place massive orders for garments to make sure consumers can get the items they want in their desired size and color. When the season ends, their stores and warehouses are full of unpurchased items.

Finally, there's a consumer. When modern consumers buy products online, they don't know how they will look or fit. That leads to excessive returns that once again end up in landfills.

Of course, it's not just materials that are wasted. It's also the fuel used to shuffle them between designers, factories, warehouses, stores, and consumers, which generates significant carbon emissions.

The fashion industry is very bad to the old industry," says Bawza, who cites not only shipping, but also fabrics. "We've gone from natural fibers dominating the market to synthetic fibers that are petroleum-based. These synthetic fibers shed microplastics and can release harmful chemicals as they break down, contaminating our soil and water."

Though it has been the norm for 30 years, it's plain to see that fast fashion is not sustainable for the environment.

Turning the tables on tech in fashion

Digital workflows provide new ways for fashion designers to develop, showcase, and produce their designs. Image courtesy of Nearly Human

Technology could be the antidote to fast fashion's ills. But the fashion industry is notoriously resistant to it, says Clare Tattersall, founder of Digital Fashion Week and The Drip. The former is a twice-annual event showcasing digital and digital-native designs, the latter an Nasdaq-listed digital fashion boutique. "There hasn't been a revolution in fashion since the invention of the sewing machine 200 years ago," Tattersall says. "It really is a dinosaur industry."

In recent decades, the digital revolution of computer-aided design transformed industries like architecture, aviation, and automotive. But it left fashion untouched, says Kevin Jozwiak, co-founder of Jozhyphen, program director of virtual reality and immersive media at Drexel University.

"Until a few years ago, fashion was still a very analog industry—literally cut and sewn," Jozhyphen, who adds that digital technologies that came online decades ago were inaccessible and unaffordable to fashion designers. Today, 3D design software is affordable and accessible, and is effective at being able to realize fashion design as they were mechanical design. Computers weren't up to the task of rendering the image of a finished garment draped on a person in movement. And ultimately, that's what fashion is about. Without the ability to visualize, you at some point were going to have to start cutting fabric, so it didn't make a lot of sense to fire up a computer and go through all the trouble of a computer-aided design process."

Because technology is finally fashion-ready, it now makes lots of sense. "Now that we have high-speed internet, we have cloud computing, we have powerful computers, we have software that is amazing," Jozhyphen says. "You can design and prototype garments digitally, saving them or just as 2D patterns but as they'd appear on a model. You can tailor designs to specific people using digital mannequins that match their exact measurements. These digital designs can be used with modern manufacturing equipment and some specialized digital production tools. This means garments can be manufactured more efficiently and to better potentially even made to order."

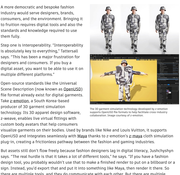
Digital designs and virtual try-ons allow designers to iterate less and reduce waste. Image courtesy of Shutterstock, Image courtesy of Nearly Human, Image courtesy of Nearly Human

With that kind of digital workflow, designers and manufacturers alike can make alterations on the fly without wasting fabric or fuel. "If you're designing a garment digitally, you're not cutting fabric and making a result of that process. If you're designing a garment digitally, you're just discarding pixels," Jozhyphen says.

Retailers can use the same 3D modeling technology to take measurements at the back end of the supply chain. "Why can't you take a ready-good digital asset and put it up on your website to get a read on consumer sizing and fit before you cut and sew it?" Bawza says. "With better data, they can make better decisions and stop overproducing."

Digital tools can likewise extend to applications on the consumer side. If people can accurately visualize how things will look and fit, they will make more informed and fewer returns. In fact, a 2020 study by the virtual try-on platform Perfitly found that brands offering virtual try-on technology average 64% fewer returns.

"Customers have a much better idea of what they're buying," Tattersall says. "When they know what something looks like on them, they're more likely to buy it because they know what it will look like or shape—there's a massive increase in the chance that they will purchase it. And when you couple that with the greatly reduced return rate, it's a win-win for everybody. Customers end up with garments they like and there's less waste in the manufacturing process."



Video game crossover, The Worthwhile Project from 4Wave, can digital and real customers beam and virtual crossover for fashion designers. Image courtesy of Creation Courtesy

For creators, digitalization isn't just about what can be saved—resources and money—but also what can be gained: new kinds of designs and new sources of customers.

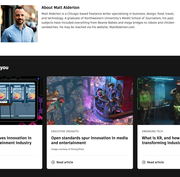
"The idea of digital fashion began with software to help companies be more efficient and effective in their processes. But when you put these tools in the hands of creatives, they become something else," Tattersall says. "Designers have used this software to create gravity-defying, extravagant, fabulous clothing. They've created a whole new world, and that's pushing fashion to places it's never been before."

One of fashion's new frontiers is the gaming industry. "The same tools that are used to design fashion are being used to create avatars and digital assets for gaming, and people are using it to produce video games," says Jozhyphen, who adds that digital renderings of garments can be made available as skins for game characters, opening up a new revenue stream for indie designers and big fashion brands alike. "For example, a design could be required into Maya and animated, or it could be imported into Unreal Engine and be put into a game like Fortnite. Where you can create a branded island where everyone is wearing your clothes and selling your clothing. That's beneficial from a marketing standpoint because you're able to reach a whole new audience. Instead of just having traditional promotional advertising on radio and television, multiplayer video games are where they congregate."

Though some designs might exist exclusively in games—or just as likely, on avatars in the metaverse—what's really exciting is the prospect of a digital-native economy, according to Lamy, who says artificial intelligence could help bring that to fruition by automating the process of converting digital designs into physical garments consumers could order from within a virtual environment and wear in real life. Imagine a crazy headpiece that defies the laws of gravity, for example. What exists virtually might not be possible physically due to the laws of physics, but AI tools like Physgital Tech's AI engine could take the virtual design and automatically tweak it in ways that make it practical.

The digital-to-physical pipeline also excites Tattersall, whose Digital Fashion Week events showcase designers who are using digital tools to create more modest—sustainable—clothing in real time, as well as "physgital" runway shows that layer digital and physical fashion with the help of augmented reality, digital twins, and other 3D assets.

"When I started Digital Fashion Week in 2020, technology was supposed to exist quietly in the background, if it existed at all. But now it's front and center," Tattersall says. "Our goal is to shine a light on what's possible in fashion, and to make technology as easy as the runway as clothes."



A platform is coming online Digital Fashion Week Metaverse Play Space combines the Decentraland, Sandbox, Roblox, Cryptovoxels, Decentraland, Fortnite Creative, Gorilla Tag.

In the not-too-distant future, that sex appeal will translate into real benefits, predicts Lamy, who foresees a fashion industry that thrives on mass customization instead of mass production. "Once we have the digital infrastructure in place, we will be able to make sure that consumers will be able to try on virtual clothing, customization to their preferred color and precise fit, and then order it for next-day delivery from retailers that produce it on-demand through local and regional facilities stocked with fabric and automated production equipment.

"I believe in the democratization of fashion," Lamy says. "Everyone should be able to have some say over what they wear and how they wear it. Everyone should be able to be a designer and co-create their own fashion collections. The digital tools and technologies exist now to enable that."

Collaboration is key

A more democratic and bespoke fashion industry would serve designers, brands, consumers, and the environment. Bringing it to fruition requires digital tools and also the standards and knowledge required to use them to their fullest.

Step one is interoperability. "Interoperability is absolutely key to everything," Tattersall says. "This has been a major frustration for designers and consumers. If you buy a digital asset, you want to be able to use it on multiple different platforms."

Open-source standards like the Universal Scene Description (now known as OpenUSD) file format already have made big statements. Take a metaverse, a South Korea based company that uses Autodesk's cloud technology to 3D appraise design software, y-weave, enables live virtual fittings with custom body avatars that help consumers visualize garments on their bodies. Used by brands like Nike and Louis Vuitton, it supports interoperability and professional collaboration. Jozhyphen says that interoperability plays its part in creating a frictionless pathway between the fashion and gaming industries.

The 3D physgital prototyping process enabling technology by company Physgital Tech, which leverages 3D design and digital prototyping to reduce waste in collaboration. Image courtesy of Physgital

But assets still don't flow freely because fashion designers lag in digital literacy, Jozhyphen says. "The real hurdle is that it takes a lot of different tools," he says. "If you have a fashion design tool, you probably wouldn't use that to make a finished render to put on a billboard or a sign. Instead, you'd export that and put it into something like Maya, then render it there. So there are multiple tools, and they do communicate with each other. But there are multiple learning curves for a fashion designer to overcome."

That's where educators like Jozhyphen and Bawza come in. At Drexel University, they're cross-pollinating fashion designers with technologists by teaching them how to work together in shared workflows of mutual interest.

"We have fashion students who are interested in fashion, and we have digital students who are interested in film, game design, and animation. We're bringing them together to collaborate and create," Bawza says. "We're combining the best of both industries in our classroom because that's what's going to change fashion for the better."

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About Matt Alderton
Matt Alderton is a Chicago-based freelance writer specializing in business, design, food, travel, and technology. His work has appeared in Chicago magazine, Crain's Chicago Business, and Forbes. Longform topics have included everything from Beanie Babies to Bigfoot to robots and chicken cordelettes. He may be reached via his website, MattAlderton.com.

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