THE DPC REPORT

FOREWORD

by Ben Hanson,
Editor-in-Chief of The Interline

WHY A DISCONNECT BETWEEN FASHION'S DEMAND FOR DIGITAL ASSETS AND ITS ABILITY TO DELIVER THEM IS DRIVING RAPID UPTAKE OF DIGITAL PRODUCT CREATION.

To predict where 3D and digital product creation (DPC) workflows for fashion are going, you just need to follow the assets.

There are now use cases for digital representations of physical products everywhere you look.

Downstream, in print and online, a significant amount of static product photography is being replaced by either complete renders of stage and product, or a composite of a real environment with a rendered garment. And full-on immersive, real-time experiences are waiting in the wings to take that consumer engagement to the next level.

Within the halls of luxury houses, across the global offices of mass market multinationals, and in the flywheels spinning at the heart of fast fashion brands, a wide spectrum of creative and commercial decisions are being taken based on digital assets instead of physical samples and prototypes.

Upstream, brand-supplier relationships that have traditionally run on flat specifications and iterative physical sampling are seeing a fundamental overhaul with 3D assets at the centre of a more collaborative structure - and a shared burden of asset creation.

And that's just looking at things through a "digital for physical" lens - making use of digital tools and processes to streamline the production of physical products. As the massive rush towards the nebulously-defined Metaverse demonstrated, there's a huge, largely unaddressed, possibility space in "digital for digital" - using the same pipelines and workflows to create digital goods.

But the sheer scope of digital product creation - our umbrella term to collect every tool and process involved in the construction and use of digital assets - continues to be sold short when the topic is covered elsewhere, being labelled and delimited as "virtual sampling". Sample reduction is, of course, an area where replacing a costly, resource-hungry physical asset with a digital counterpart has delivered significant value for the companies that have adopted 3D in earnest. But to limit the potential to just sample replacement is to dismiss a complex, thriving, multi-faceted ecosystem of technologies, formats, and solutions that are driving the entire fashion industry towards a fundamentally different way of working.

Name a strategic objective in fashion, and digital product creation (DPC) will have a hand in realising it - and probably sooner than you might expect.

Sustainability. On-demand production. Customisation. Collaboration. Creative empowerment. Metaverse and digital fashion business models. Supply chain connectivity. Costing. Material consumption. DPC is already having a measurable impact in all of these areas, and the true scale of its impact will become evident when each of them is anchored in the same digital asset - fulfilling the vision of having a single 3D representation of a product that can stand in for its physical counterpart at every possible stage in its lifecycle.

I spoke in late summer at the 2022 3D Tech Fest about the need for fashion to decompartmentalise DPC. I haven't been able to find a better word for it since; for the industry to realise the full potential of digital-native working, the idea has to be taken out of the box it's been placed in, and allowed to run free.

As it happens, the editorial section of this report contains a perspective on the evolution of DPC from Janice Wang, of Alvanon, who are the organisers of the 3D Tech Fest. But hers is by no means the only angle the next 200+ pages have in store for you. We have:

- Exclusive thoughts from the DPC leader of a major multinational brand

- A personal story from a designer who knows first-hand the empowering potential of 3D tools

- A reminder of the importance of production accuracy, not just aesthetics, written by the CEO of Alvanon

- A reminder of just how much digital expertise exists in the supply chain, from the DPC lead at one of the world's largest manufacturers

- A roadmap to building the right infrastructure to support DPC, from the head of a 3D fashion agency

- A near-term vision for interoperability in digital assets, from an experienced digital pipeline engineer

- A case study on bringing the world of digital and physical materials closer together, from Cotton Incorporated

- A report from the frontlines of the real-time revolution, from one of our leading contributors

- An examination of the potential impact of digital fashion on the industry's obsession with over-production, written by the team behind the leading digital fashion platform

- My own perspective on the disruption of generative AI, and what it means for the future of DPC in fashion

- An honest appraisal of how far the terms "digital" and "sustainable" have become intertwined, and whether they need to be unpicked, from a key thinker in 3D fashion

- A breakdown of why cultural change will be as important as technology implementations for delivering the vision for DPC, from two retail industry influencers

- A strong case for the need for fashion to move from narrow, isolated applications of 3D to a more cohesive DPC ecosystem, from Mark Harrop

There was much more we wanted to include in this first edition but time and space limitations prevented us from doing so. There's an even larger story to tell, and we're committed to continuing to do that across The Interline itself, and in future editions of this report.

What we do have, I believe, is the most complete roster of DPC technology vendors and service providers ever assembled - and we've interviewed them all to gauge their thoughts on why DPC matters and where it's headed.

If you're looking to either buy into DPC for the first time, or to scale your ecosystem through new solutions, you'll find the technology section of this report unique and valuable.

Finally, we have our market analysis - a blended subjective and objective take on how far fashion has come towards realising the vision for DPC, how much farther it needs to go, and what steps our readers can take between now and the next DPC Report.

Like everything from The Interline, this publication was free to download. If you're reading this, it's now yours to read, yours to pass among your peers, and yours to use as a guide for informing the investment you make (of time and of money) in making the most effective entrance you can into a new era of digital working.

I'd also like to now hand you over to Kelly Helfman, President of Informa Markets Fashion, who has her own thoughts on why the future of our industry is being shaped by digital.

The Interline are currently working with Kelly and her teams to help bring fashion technology to life at SOURCING at MAGIC in Las Vegas, in February 2023, so if you find value in the editorial, vendor interviews, and analysis in this report, you're likely to get a lot from that talking to the team behind that event as well.

Thanks for reading. This is just the beginning.

4
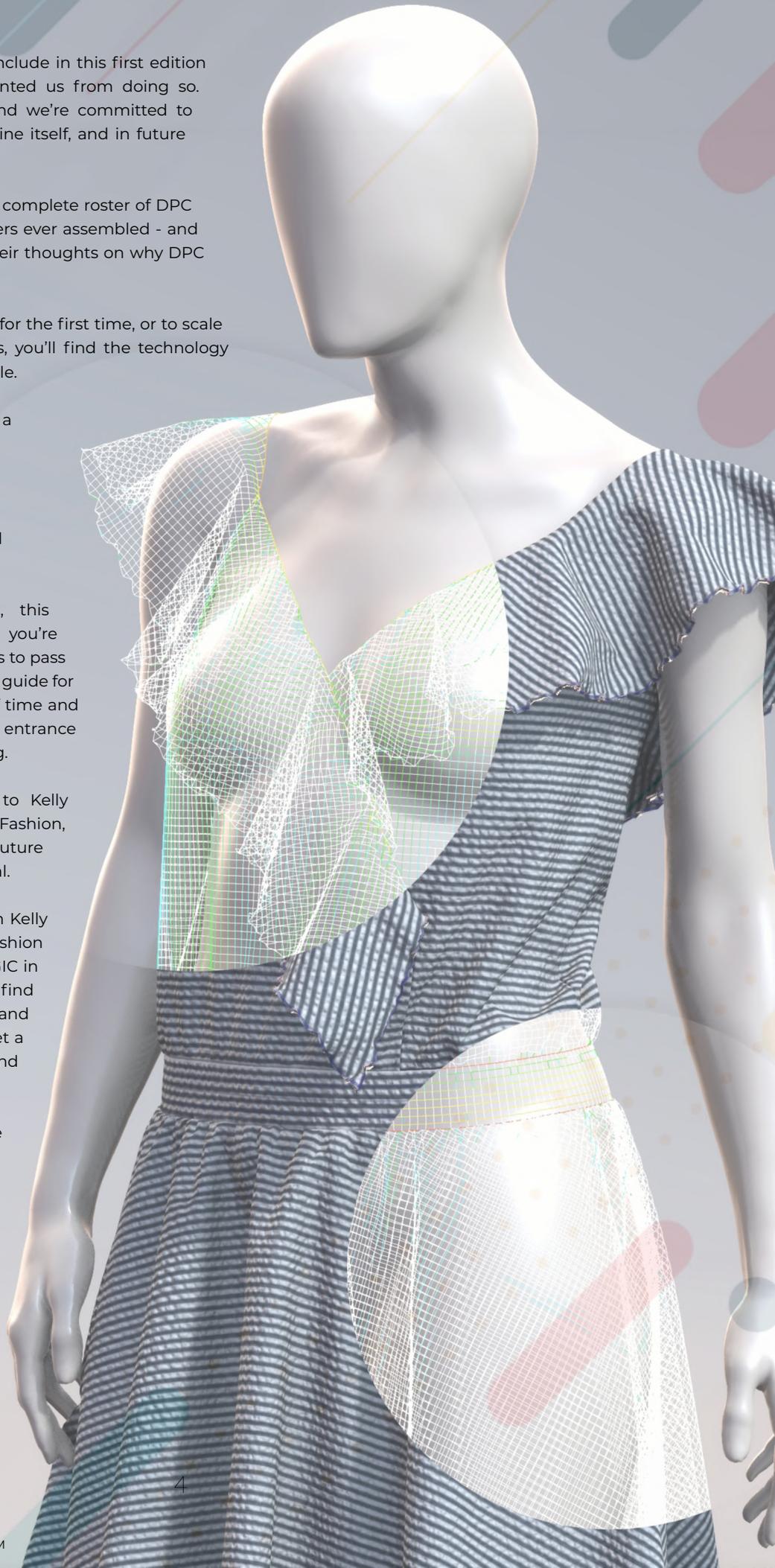
Kelly Helfman
President, Informa Markets Fashion

WHY THE FUTURE
OF FASHION IS DIGITAL

The world is becoming increasingly digital, there are new advancements in technology to make processes faster, more efficient, more cost effective and more sustainable. The fashion industry needs to evolve their approach to business to keep pace with these changes and consumer demands.

At Informa Markets Fashion, we believe that information sharing is more important than ever. Our customers and audience should be equipped with the right insights, education, and vision to start building towards a more digitally driven way of conducting business. Once supplied with the right resources, our customers have a real opportunity for change through improving efficiency, empowerment through creativity, and transformation of business structures in the B2B wholesale space.

Technology offers solutions to face the many challenges the industry is facing. Brands, manufacturers, suppliers, and retailers need to stay ahead of global challenges from sustainability regulations to the rise of inflation to supply chain disruption.

From start to finish, there is a quantifiable digital transformation taking place across the entire industry, from the initial spark of inspiration all the way through point of purchase, change will touch each part of the fashion ecosystem. Informa Markets Fashion is committed to supporting the industry by providing digital and in-person opportunities to learn, share, and connect to start the conversations that will propel the industry forward.

The Interline and Informa Markets Fashion will continue to collaborate to bring fashion technology to life in 2023.

SOURCING at MAGIC *The* INTERLINE

CONTENTS

THE FUTURE OF FASHION IS IMMERSIVE. HOW DO WE GET THERE?

FROM 3D TO IP, THE DIRECTOR OF DIGITAL PRODUCT CREATION FOR A MAJOR MULTINATIONAL BRAND SHARES HER PERSPECTIVE ON WHY FASHION SHOULD BE RETHINKING THE WAY IT APPROACHES DPC.

TRACEY MANCENIDO
DIRECTOR, DIGITAL PRODUCT CREATION, A MAJOR MULTINATIONAL BRAND

Tracey Mancenido is Director of Digital Product Creation for a major multinational brand. She's passionate about digital transformation, extending the life of digital assets, and digitizing the fashion industry one polygon at a time.

Fashion is the zeitgeist of our times. It has evolved from necessity and protection for the body to a form of individual self-expression and identity. Like fashion, our identities have also evolved. We have already started to create different versions of ourselves through social media using words, images and video. Prior to the internet we led mostly private lives. Now we have digital and social identities, and soon to be virtual identities. All three iterations of self: physical, social and virtual, will intersect with one another just as our choice of fashion for each will play an integral part of shaping that identity. How does the fashion industry prepare for this? How will it handle the intersection of physical, phygital and virtual, tying each experience into an immersive brand story? And how can we unlock an ecosystem that supports not only the transformation needed to make our industry take action against the damage we've created, but that also prepares us for this virtual future?

Over the past few years we have witnessed many brands enter digital fashion from the completely opposite part of the digital ecosystem through marketing, metaverse and web3 explorations. Couple that with a global pandemic that allowed technology to push forward years beyond what any of us could possibly imagine, and we have a fashion industry that has outwardly reshaped itself.

But while a lot of brands' forays into virtual environments are innovative and forward-thinking, the physical product creation processes haven't even started to undergo their digital transformations. Asset creation and activations are outsourced to incredibly talented studios that have little to no impact on the problems currently facing our industry as a whole. I believe in DPC (digital product creation) as a tool, a new medium, but also ultimately a lifeline in fostering true sustainability for product-producing brands, provided it becomes an engine for more complete transformation than just what is seen on the front-end.

DIGITAL TRANSFORMATION

Digital Transformation for an industry such as ours is a herculean task. Brands are scrambling to improve their ESG performance under more scrutiny than ever, and cost pressures are being felt everywhere.

Today, most brands approach digital design with, well, design first - and rightfully so. 3D design helps create better product and improves the quality of production. The misconception of 3D design's inability to maintain creativity or artisanal craft is a common one. These technology solutions are new tools that enhance existing practices of ideating, prototyping and producing physical product. It doesn't mean the physical product ceases to exist. On the contrary, a designer, a buyer and the consumer will ultimately see a better product with far less waste in the process.

Once the weight of adoption is lifted and creators are given the opportunity to rediscover their imagination with limitless enhanced expression via digital tools, then and only then will you begin to reap the downstream benefits from upstream transformation. And this isn't the only way to begin one's digital transformation.

In addition to the industry-wide and cultural mind-shift needed for this transformation, and depending on where you start, you must also acknowledge that digital touches every part of the product journey - from designers, technical designers, merchants, vendors and suppliers, marketing, B2B accounts, B2C, technology solutions, consumers and beyond. This translates to accuracy, more purposeful intent, speed, improved communication to reduced waste and more. Once you've crossed this hurdle of adoption, you will then unlock the numerous ways these same assets can be leveraged throughout the business. And there is no one-size-fits-all solution, or the right roadmap to achieve it either. Digital transformation is an accretion of change, support and technology enhancements from all parts of the organization inside and outside, top to bottom.

3D: FROM PRODUCT CREATION TO BUYING AND SELLING

For some brands, illustrations became sketches, sketches became CADs, and CADs are now digital assets. These digital assets can serve as an extension of brand IP, becoming digital IP in their own right. They are also often referred to as digital twins - a digital copy or record of a physical garment. They optimize the performance and execution of physical assets by empowering designers and other stakeholders to create better product. A library of digital twins can be likened to an archive of digital IP. Once created, these same assets can be leveraged in different ways, even unlocking a new class of asset ownership.

A 3D asset improves communication of intent and optimizes the execution of physical product. It is more accurate than any 2D representation and the process of creating and iterating is faster and far more efficient. The time saved eliminating any back and forth with physical prototypes is gained and real time changes can be applied. Created internally or through the support of vendors, these assets can be used for fit, product

execution and finalization. While there are some limitations with fitting digitally - namely the lack of soft body avatars, there are many reasons to begin the practice of fitting digitally leaning into the capabilities of the tools at hand. First and foremost, these are pattern-based assets dressed on avatars that reflect the body type of your average or ideal consumer. With physics-backed materials, you no longer need to visualize or wait for a prototype when you can see form, fit, function, intent, print scales, detail placements and proportion right away - giving you the ability to alter and create a myriad of different options without having to make a physical version until necessary.

Production calendars may shorten alone from internal digital efficiencies - designing, selling, producing and shipping product closer to season - enabling a shorter go-to-market calendar. It also opens up room for rapid product development to test and produce off-calendar styles and fast-track to market.
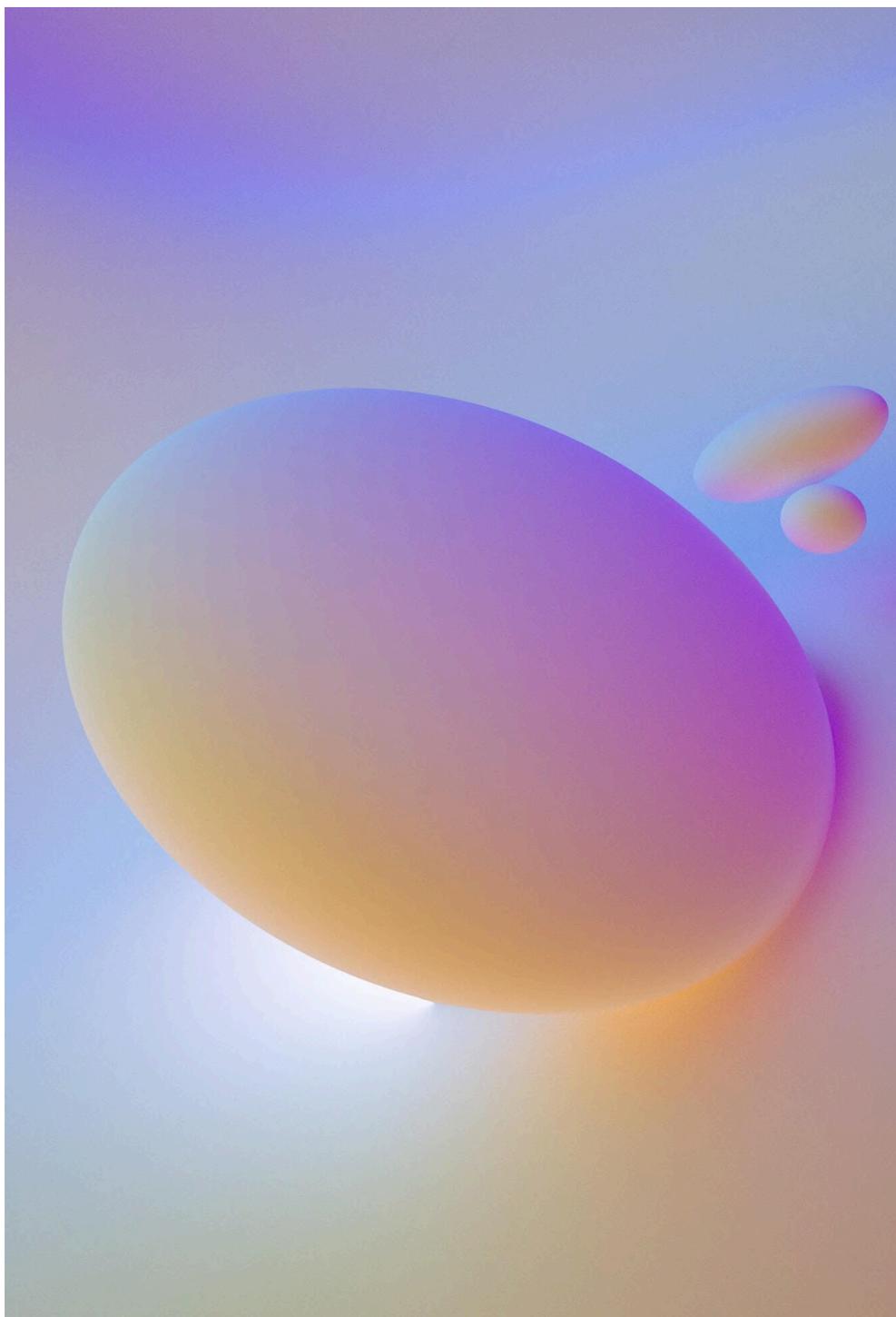
VALUE CHAIN DIGITIZATION: REDUCE WASTE, PERSONALIZE AND WORK TOWARDS ON-DEMAND MANUFACTURING

The more demand-driven we become as an industry, the better prepared we are to produce products consumers want, and products that can hold lasting value - leading to a reduction in fashion's current tendency to over-produce. Personalized products created in configurators yield higher conversion rates. Consumers are also willing to pay more and wait longer to receive customized product. There is also research that shows it improves customer retention to a significant level because of the emotional connection in co-creation.

The future of physical fashion consumption falls somewhere in the middle, no longer a top-down approach bombarded with product, too many choices and targeted marketing, but rather a meeting in the middle that brings real-time needs and desires from the consumers to life.

E-COMMERCE AND MARKETING: CONSUMER-FACING ASSETS

The possibilities with digital assets are not bound by physical restraints - i.e. waiting for a garment to be made, shipped, photographed, used in campaigns, arrive in-store or on your e-commerce site and then shipped to a consumer. The fluidity and agility of digital assets allow you to experiment in more engaging and meaningful ways to tell a product or brand story. With enhancing 3D tools to supplement your 3D pipeline, new use cases and workflows can be established for virtual photography, 3D viewers, virtual fit and AR capabilities - two perfect examples of phygital experiences, the latter through your mobile device. Consumers can experience and even interact with photo-real, high fidelity quality product before a product is even produced or comes close to hitting distribution centers - whether they're relying on in-house DPC talent or working in tandem with outside creative agencies.

V-COMMERCE: DIGITAL FASHION AND DIGITAL ASSET OWNERSHIP

Demand for digital fashion is planned to grow 50B by 2030, while the metaverse is expected to be worth 800B by 2024. Digital identities are becoming more relevant as we begin to spend more time outside of the real world. In that timeframe, digital will cease to remain digital and become virtual. Similar to the real world, we will consume products that become part of our identity. We will look for similar tools to help create our identities in the same way we collect physical product. These virtual worlds will take on a look, act and structure of human behavior through fashion. Our digital assets will become as important, if not more, than our physical assets as we embrace these digital identities. We will have avatars, and most likely many avatars.

In the recent Roblox x Parsons Metaverse Fashion Trends Report, half of Roblox users surveyed say they change their avatar's clothing at least every week. Additionally, "70% of Gen Z say their avatars dress at least somewhat like their IRL style, while equally as many users (70%) get physical style inspiration from dressing their avatars." There are many use cases and much value in digital ownership for brands - from storytelling, brand-building, loyalty rewards, engagement, new revenue streams, community-building and more. All brands will eventually need a presence in the metaverse in the same way they launched websites and began e-commerce. V-commerce is a new channel and meaningful way to engage with new and future audiences, especially those born digitally-native. Virtual fashion is going to play an equally important role, and one without the limitations of our physical environment and only that of our imaginations.

I do not believe, though, that we will be spending every waking hour in a digital environment. Phygital experiences will become ubiquitous. We will see AR applications for digital wearables become the norm as fully immersive hi-fidelity VR environments and technology continue to evolve. We will also begin to see more blended experiences in brick and mortar environments.

IGNITING YOUR 3D ECOSYSTEM: PREPARING YOUR FUTURE WITH THE FUTURE OF OTHERS

New pipelines can be created using digital twins by extending the use of your assets to increase consumer engagement. Imagine your archives being fully digitized at the same time and what value they intrinsically hold for internal efficient processes of inspiration and creation, as well as future ownership for consumers.

Preparing your teams, suppliers, vendors, and technology solution providers for this digital future will enable us to critically move our industry in the right direction. It will support brands to prepare for this digital future. New roles will arise within the industry, some of those closer to motion media. Interoperability will be crucial as technology and solution-providers evolve and work together for the new world of digital product creation and asset ownership.

The future of fashion is now, and the future of fashion will be immersive.

DIGITAL OPENS DOORS

HOW DIGITAL TOOLS OPENED UP NEW CREATIVE HORIZONS AND LAID DOWN A CAREER PATH FOR A DESIGNER WHO FOUND A WAY INTO FASHION THROUGH 3D.

JONEIEN LEAH JOHNSON
FREELANCE 3D
APPAREL DESIGNER

@joneienleah is a virtual clothing designer, with a focus in 3D virtual fashion sampling and connecting digital product creation to IRL manufacturing. Her signature style is creating original digital artwork textile designs.

Raya jumpsuit, original design print, custom designed avatar. Clothing simulated in Clo 3D, rendered in Daz Studio.

THE PAST:

I have known since I was 5 years old that I wanted to be a fashion designer. I started designing and making doll clothing from a very early age. Being a stylist for Barbie was a favourite pastime, and I loved costume history and cultural dress. Not your average hobbies for a girl growing up in the suburbs of Chicago, but I had a real focus on what my career would be and there was no hesitation when it was time to go to university.

Situated in the midwest in a small town called Ames, Iowa State University was not the obvious choice for fashion school. However with their emphasis on classic skills in

, industrial sewing techniques and draping on the stand, there was a good foundation in the traditional methods to build upon with their focus in technology. Hearing what some of my industry peers learned at university compared to my education, I realized how unique my program still is to this day. To put it into perspective, I graduated in 2004 and my education included digital illustration, Adobe Creative Suite to design textiles, digital pattern plotting and digital fabric printing. Today it remains one of the few schools that includes 3D apparel design in their curriculum. My education at ISU

Capsule collection, original design prints.
Clothing simulated and rendered in Style3D.

was the start of my passion for combining technology with the apparel development process.

My 17-year career in the apparel industry has been a winding one. I have designed for most product categories across large and small companies, and now across international lines. I am well versed in designing based on seasons, following the fashion calendar, and I know from that experience that even with the addition of PLM systems and Adobe Illustrator, the process is often still very analog. No matter which product category I was designing for, the process and timing was always the same, which for me created a type of burnout, but at the same time boredom. This wasn't because of the product necessarily, but because the process never changed over the years when it felt like there should be some kind of progress in the way we worked.

Why did I find our field so stagnant in practice? Why did fashion - an incredible industry that's always so focused on the future - seem to be perpetually living in the past?

Jayli Maxi dress, original design print.
Clothing simulated and rendered in Style3D.

About 5 years ago I discovered 3D apparel design, and suddenly it all clicked. I had heard of this technology but - even though I had a good base of 2D digital design to build on - I had convinced myself it was something reserved for CG artists and game designers. I didn't think I had the right background or skillset for something that looked so advanced. But then I discovered Marvelous Designer, and this would become a game-changing moment in my career and my creative journey. Through Youtube videos and some free trials I was able to teach myself this software and to take the leap into 3D clothing design. And to my surprise this advanced software required the use of all of my foundational skills of pattern making, sewing and fabric knowledge - bringing together traditional expertise and cutting-edge technology.

THE PRESENT:

Over the next few years I increased my skill level and experience in 3D by adopting Clo3D, Browzwear Vstitcher, Style3D, SEDDI and Daz Studio. Working in 3D has completely changed the way I design, because I can see in real-time how my creation is draping on the body. And using different avatars I can see how the clothing will look on different body types.

Most of all, my work life has drastically changed thanks directly to technology. Working from my small home office out of my apartment, there is now no limitation on space because I don't need to keep rolls of fabrics, cutting tables, dress forms or racks of samples on-hand. I can experiment with fabrics, prints and silhouettes - all digitally.

Ironically, this technology also empowers designers to hone in on their analog skills of patternmaking and sewing in a way where you feel empowered to try new shapes and designs you may not have with actual paper and fabric, for fear of wasting time, money and resources. Instead of taking away the need for these essential foundation skills, 3D technology encourages the refinement of classic flat pattern techniques to create clothing that fits the human body. In fact you now have game character designers who are learning pattern making, and apparel designers learning animation and texture map creation, and we have a crossover of industries we have not seen before.

Then the pandemic happened and it really changed not only my own career trajectory, but the course of the whole apparel industry and how we all work. I was furloughed from my job, and this gave me the courage to test the waters of freelancing in 3D clothing design - taking the combination of traditional and technological skills I'd learned, and applying them to the task of bringing brands' creative visions to life.

Naira jumpsuit, original design print.
Clothing simulated and rendered in Style3D.

The timing was incredible because pre-pandemic 3D was something very few apparel companies were seriously considering as a must-have tool. But now it was essential because access to samples and factories overseas was cut-off, yet development must continue.

Where traditional industry freelance work was hard to find before, opportunities came flooding in for 3D. With the adaptation of work-from-anywhere I can now use my skills to work for any company needing assistance in digitising their collections. Working together now just requires reliable internet and a powerful PC; location or timezone is no longer a factor. 3D has empowered independent designers to get recruited for their skills and experience and not be limited to where they live. For me personally it has opened the door for opportunities to work with companies I never would have had access to before.

 Today many companies have discovered the advantages of developing products in 3D and have continued to pursue digital design post-COVID. This goes beyond just creating nice images to use on ecommerce in lieu of photography when you are missing actual samples. It has instead become a tool to narrow decisions in buyers' meetings with something more realistic than a flat 2D sketch but without the cost and resources used on making many samples that will never make it to market. Better decision making pre-production is leading to better products in store and quicker response to what the consumer is actually looking for.

With talk of the metaverse, NFTs, VR technology, virtual try-on and Web3.0, the interest and desire to use 3D assets has just about surpassed what the readily available software and hardware can accommodate today. The industry has gone from dismissing what was perceived as a gaming industry tool to pushing the boundaries of the technology for use in the apparel industry.

It is not uncommon for a project today to consist of not only creating the product line in 3D and creating still rendered images, but also delivering a 360 turntable video, walking animations with elaborate scenery, custom avatar

Leah shirt and Exie wide leg pant, original design print. Clothing simulated and rendered in Style3D.

development, and exporting files to be used on websites as interactive objects to be viewed from every angle by the consumer. Together, all of these demands have underlined the reality that we cannot work in silos anymore - something that is fantastic to see the fashion industry realise. Artists from all over the world with high skill levels in specific areas of 3D must collaborate. We have a fantastic community where we can collaborate and learn from each other - and it is less about competition and more about building a network that better serves the future of fashion.

THE FUTURE:

As a designer working at the vanguard of digitisation, I believe the future is exciting for the fashion industry, and I'm confident huge changes are coming. With the adoption of 3D as an essential tool for the entire product development and marketing process, the possibilities will become endless as the technology, software and hardware become even more powerful and work seamlessly together. I see a future with universal file formats for use across all 3D programs that maintain the information of the product, fabric simulation data, textures and animation. Rendering will take seconds instead of hours, which will unleash the ability for almost anyone to create cinematic videos. Apparel manufacturing will be streamlined by connecting 3D and all the information contained in a file straight to the production floor for on-demand manufacturing. At-home body scanning and virtual try-on using smart mirrors, your own avatar or VR glasses will be the norm when shopping either online or in person. Made-to-measure garments for the average person will be common and standardised sizing will be reserved for basics like t-shirts and leisure wear.

This future is nearer than many people think, as there are multiple players in the fashion tech space developing and creating new tools as we speak.

The biggest takeaway today, though, is how much 3D technology is bringing the fashion industry together. Adopting new practices and going through new challenges has created beautiful collaboration across disciplines in a way we have not seen before. Sustainability has been supported through this technology by reducing waste before it becomes a problem that needs to be dealt with. There is a new energy in the fashion industry pushing the boundaries of technology and dreaming of a brand new retail landscape in a way not possible before. Digital product creation in 3D is here to stay for the apparel industry and opening new doors only dreamt in science fiction. It is an exciting new era in fashion 3.0 and the future is bright with 3D product development.

Jayli maxi dress, original design print, custom designed avatar in Daz Studio. Clothing simulated and rendered in Clo3D.

Image provided by Alvanon.

BUILD ONCE AND REUSE -
WHY PRODUCTION-READY 3D MATTERS

**DIGITAL ASSETS ARE NOW MORE BEAUTIFUL AND BELIEVABLE THAN EVER,
BUT HAS FASHION'S ADOPTION OF 3D PRIORITISED AESTHETICS OVER PRODUCIBILITY?**

JANICE WANG
CEO
ALVANON

Janice Wang is CEO of Alvanon. She is a board member of The Hong Kong Research Institute of Textiles and Apparel Limited, a member of the Advisory Board for The Mills Fabrica, and board director of the Hong Kong Chapter for the International Women's Forum.
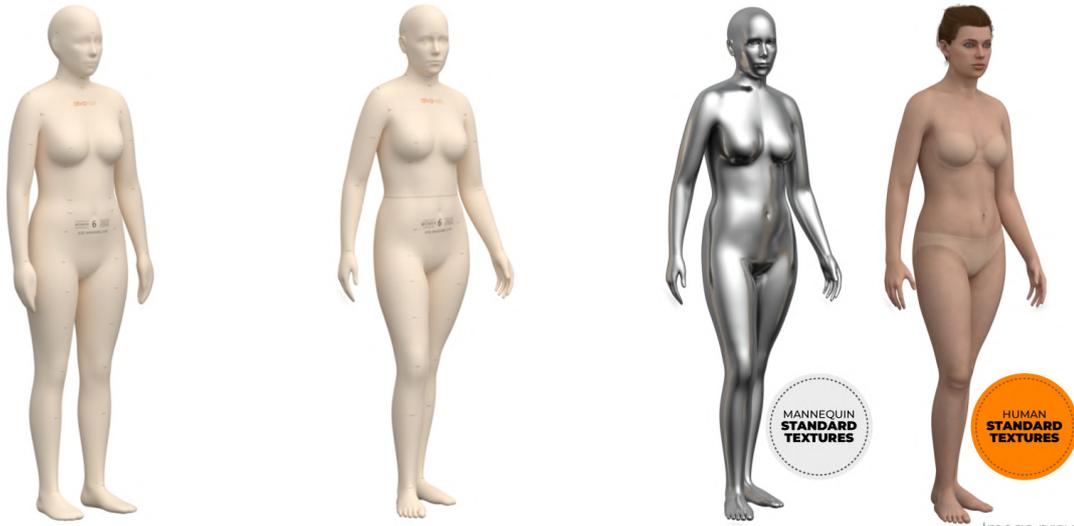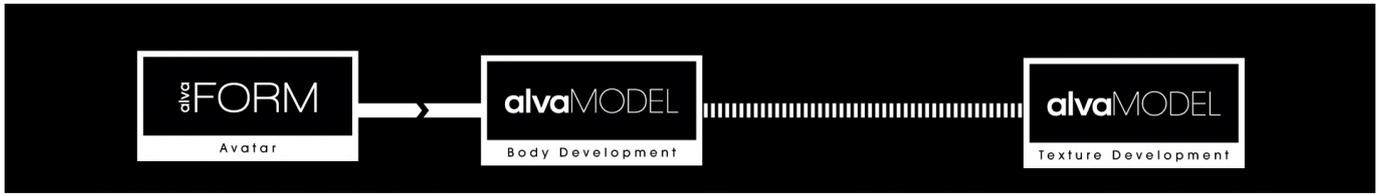
Image provided by Alvanon.

Alvanon turned 22 this year, and whilst rooting around in the archive files, I found two photos of our experiments circa 2001. When I compared these to what we are doing today, they were eerily similar to images we see today. Because in the past 22 years, the output of 3D for digital product creation, DPC, has not really changed.

But where we have made significant strides is efficiency in time and processes. In 2001, it took three days to render a simple T-shirt and skirt. Obviously this would not be useful for the massive amount of output we as an industry would require to make digital garments the norm. Today with the correct set of fundamental templates in place, you could make a digital garment in a matter of minutes.

Most apparel brands lack the fundamental libraries needed to create scale and speed. We have always advocated that brands should create and own their standards, and by this we mean they should have:

1. A full size set of bodies that match the demographic of the brand's consumer demographic

2. A block library - the fundamental pattern templates that can be manipulated into any garment

3. A digital materials library

4. Standardized operating procedure and assessment criteria for digital product creation
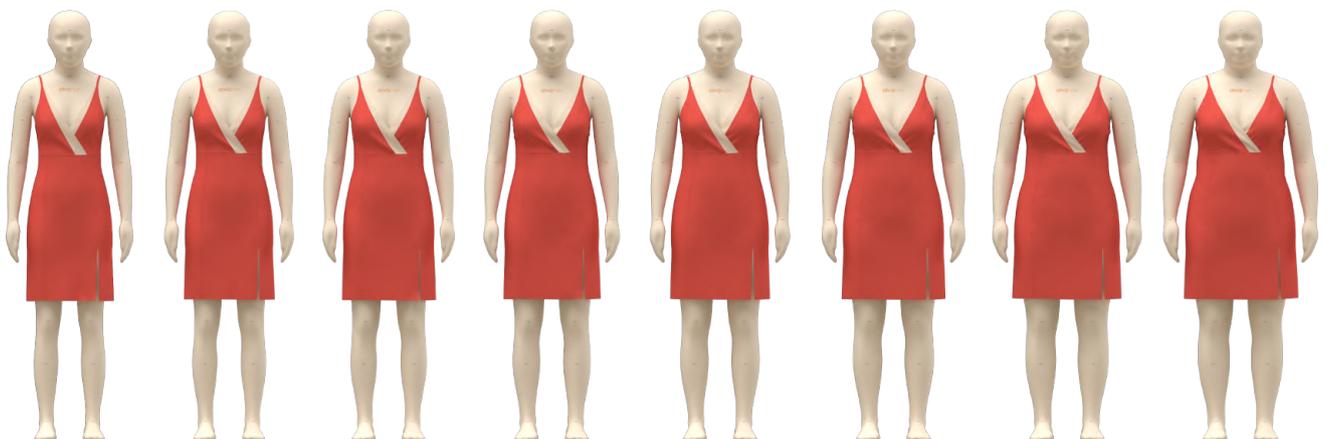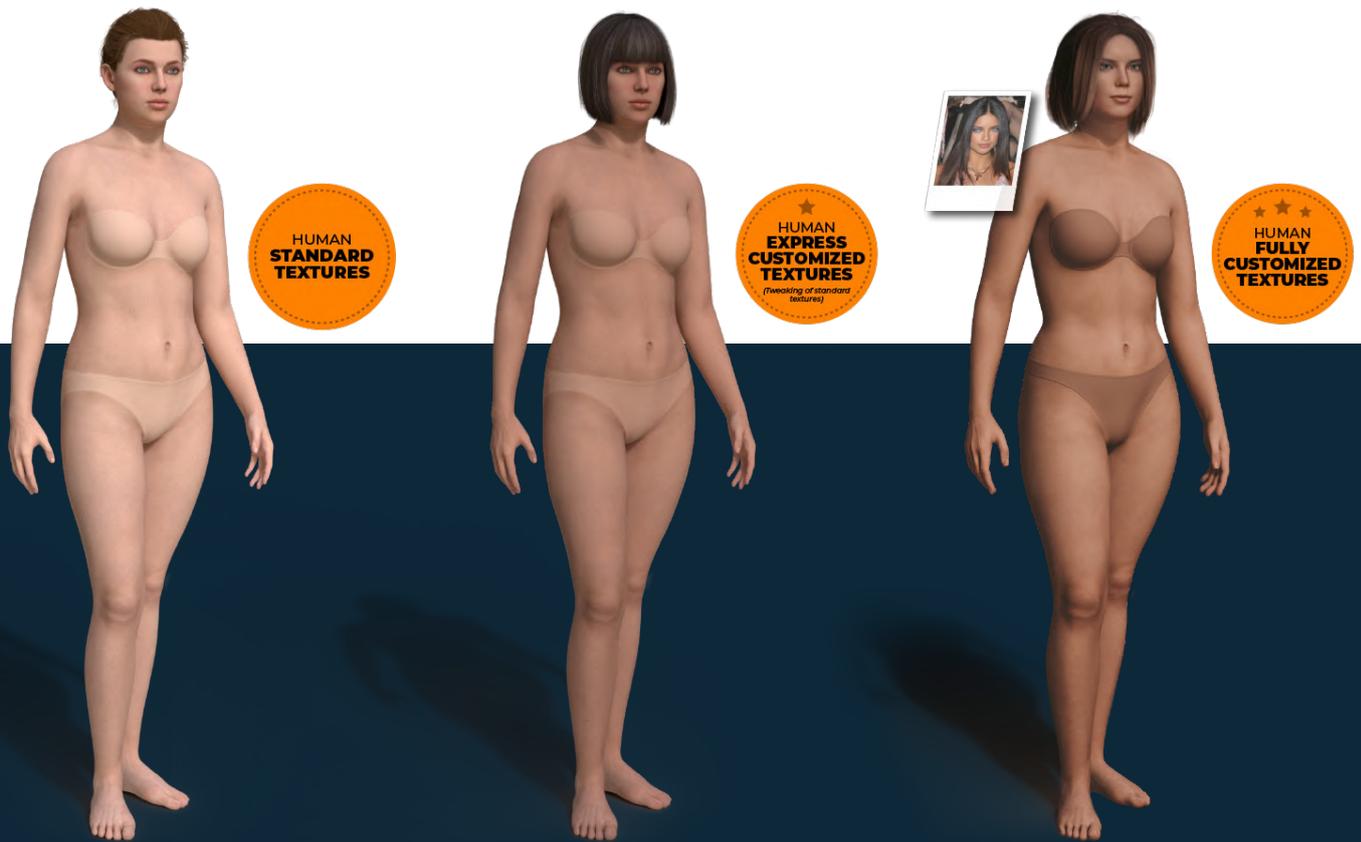

Image provided by Alvanon.

Image provided by Alvanon.

Alvanon's clients inherently believe in one thing - that a body standard is necessary and should be utilized throughout the supply chain. Our core tenet since inception is that the brand and the manufacturing partners had to have one common fit assessment and visualization tool, and this was the AlvaForm mannequin. The majority of our clients have made the first sample on the core size (Medium, US 6, UK 12) in order to be able to grade up and down so as to fill out a size range of product. This made sense in the past, when they mostly used fit models and was also how Alvanon started. We scanned the most popular fit models, while building up our own database of real people's bodies via scanning projects, and global body research initiatives.

Most brands have not really evolved from the traditional model of sampling and grading. To be specific, the only brand that made every size of body since 2003 was David's Bridal, as it made sense for them to be able to visualize bridal wear in each different size and shape from size 00 to 16.

What we advocate for, given that we now have such better visualization tools, is that product should be seen on every size, and if not every size, then at least on the smallest and the largest size, as well as the one in the middle. Why do we nag so much about this? Because with the vast inclusive size ranges that are being sold in western countries, we need to actually change the patterns to accommodate these very different body shapes. Pictures speak a thousand words. Especially when it comes to how the armhole should grade, or how clothing should drape over the chest.

Increasingly our clients are buying into this thought process, because this can be looked at as an inventory problem. If you can see what the garment will look like, good merchants can decide whether certain silhouettes will do well in certain sizes, and then either tweak the assortment or tweak the garment itself. It makes no sense to make and attempt to sell certain types of dresses that are unflattering to a size 0 woman or a size 20 woman. I challenge anyone to look at something in a size 8 and be able to extrapolate that visual into different sizes if you are NOT that size. This is the reason for the ridiculous amount of marked down inventory on the sales racks shop floor today.

During our first 3D tech fest, we talked about building authentic or production ready digital garments that map one-to-one to the physical products being sold. The key reason why building authentic digital garments is a fundamental step, is that it allows you to utilize your digital garments in different stages of the product life cycle. The key to a successful digital product strategy is to build assets once, then leverage it many times. Therefore, it is critical that your digital product development is done with a production ready mindset from the beginning.

I cannot overstate the importance of a full size set, because if you have an authentic digital garment visualized in every size, you can later REUSE these assets to show your consumer how they would look in that size. Consumers want to see themselves in a similar approximation to the size that they are. In order to achieve this, you either have to photograph the actual clothing on women of varying sizes, or you create digital garments and fit them onto a size range of different avatars.

Digital avatars in the fashion world are there to showcase the clothing being sold. Therefore the bodies must be technically accurate. They are symmetrical, they hold the proportions we require for patternmaking, because clothing is symmetrical. We can add skins on avatars for use afterwards to highlight ethnicity, culture, style; create hair and makeup to make the rendered bodies and garments look great for merchandising purposes. But these avatars must be based on the technical fundamentals that adhere to the brand's agreed size and shape standards.

So much research, engineering and technology is embodied in Alvanon's work into creating a new army of diverse bodies that will empower the industry to become more sustainable. Getting sizing right has immediate ramifications on sell through, efficiency and inventory financing. Brands cannot wait anymore to go digital, because the sheer amount of waste being created is killing our planet. Brands, we implore you to look deep and hard into your fundamentals, figure out where you are on your digital journey, and spend money on training your people to truly use and deliver using 3D.

Image provided by Alvanon.

LEVERAGING DIGITAL PRODUCT CRAFTMANSHIP FOR FIRST-TIME-RIGHT PHYSICAL SAMPLING

A SIGNIFICANT RESERVOIR OF DIGITAL PRODUCT CREATION EXPERTISE AND CRAFTSMANSHIP EXISTS IN THE SUPPLY CHAIN. IT'S NOW TIME FOR FASHION TO TAP INTO IT, AS THE DIGITAL EVANGELIST AND GROUP DPC LEAD FOR MANUFACTURING GIANT MAS HOLDINGS (WHICH DEVELOPS 3,000 STYLES IN 3D EVERY YEAR, ACROSS INTIMATES, ACTIVE, AND SWIMWEAR) EXPLAINS.
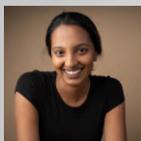
ANUPAMA FERNANDO

DIGITAL EVANGELIST & GROUP DPC LEAD, MAS HOLDINGS

Anupama specialises in change management, influencing and inspiring teams on what technology can do to make their lives better.

Figure provided by MAS Holdings.

A digital twin (DT) holds the power to change the way products are created made and sold. Digital twins that look and fit like their intended physical counterpart can bring about value creation that vastly exceeds a few cycles of sample replacement, or a few weeks of time saving. An accurate digital twin of a garment, shared between parties, can push the boundaries of traditional and sequential workflows and help us to fundamentally reimagine the future product creation and retail. Powered by that digital twin, collaboration across the value chain can have a powerful influence over production and sustainable consumption.

For brands, DTs open up endless possibilities - from commencing assortment reviews, B2B sales, simulating the full collection in a store, testing demand for new styles or even releasing the garment in virtual world. And the potential for a digital twin goes beyond a product development environment. A true to life digital twin could dramatically transform the End to End (E2E) process from creation to consumer, extending the life of a digital asset from development to consumer facing experiences. Challenging how products can be marketed and sold before being manufactured.

At a mature stage, DTs can move end to end from concept to photoshoot, empowering stakeholders to make as many creative and commercial choices as possible digitally. Taking decisions digitally means a faster development calendar that is now closer to the season. Products are far more relevant, which influences overall profitability through reduced mark downs, write offs and returns.

But the profitability potential of a digital asset doesn't only flow downstream. A digital sample with the right foundational capabilities can move as much as 50%-60% faster through its lifecycle than the physical sampling process.

This may not be an instant benefit - at times, the first round of DT might be slower than physical sampling considering the effort that needs to be front-loaded into material digitization & garment creation - but as the DT moves from concept to sales samples, the effort required to push the sample from one round or stage of sampling to the other is incremental.

And, crucially, a DT follows an additive process whereas a physical sample is built all over again at every sampling need. So as the need for digital sampling grows, the speed of the overall workflow picks up drastically.

But accessing those speed benefits requires both partners to establish the right foundation capabilities. A well-resourced Digital Product Creation team will include robust and interconnected systems, material and block libraries and skilled talent at a minimum. It is important that these baselines are met so that best practices can be set in motion to achieve accurate development of DTs.

Prioritising the accuracy of digital twins is, therefore, an investment for any organisation - but it is one that will pay off far beyond a visually accurate DT, and one that will have compounded benefits as the product moves through technical sampling rounds such as fitting, and so on.
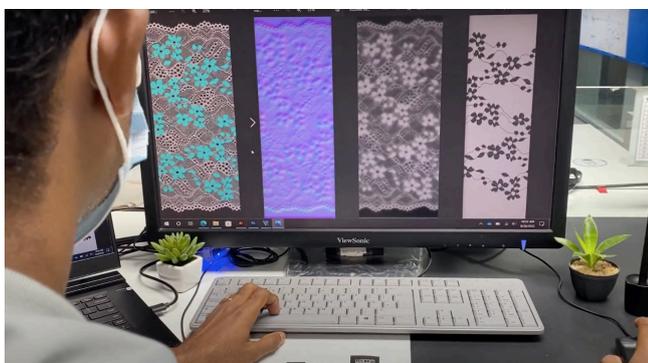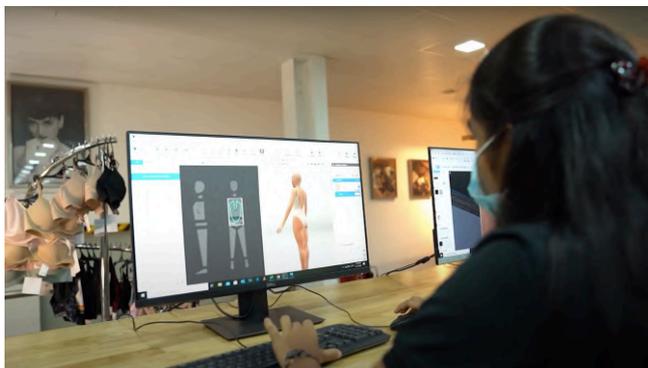
And if that priority is properly set, then the vision for first-time-right physical sampling can be reached - with the digital twin standing in for a physical asset at every stage until a physical sample is required.

Achieving this level of accuracy in DTs twins rely on the know how of people that build the digital twins. This know how will impact the ability to achieve a first time right physical sample. In a typical sampling stage, the first few rounds tend to be in digital and last in physical. When the DT is built with technical accuracy and vendor has the expertise to translate the digital garment to physical including all changes provided by the brand, a physical sample stands to be the final sample prior to moving forward to the next stage.

To build confidence in digital sampling, the fashion industry will therefore need to make use of expertise, digital craftsmanship, and best practices everywhere they exist in the value chain. In scenarios where 3D authoring tools may not yet be mature enough to replicate all the work associated with a physical sample, expertise in both physical and digital product development helps reduce the gap to a great extent.

Craftsmanship is at the heart of true to life digital twins, since these are not just aesthetic representations of a garment, but full digital counterparts - meaning that the digital asset will need to incorporate all the technical hallmarks of the physical product. Or, to put it another way, for fashion to make use of 3D and DPC tools as a way to truly revolutionise the creation of physical products, the industry will need to lean heavily on the skillsets and talent of the teams that develop those digital twins.

For example a creative 3D artist with access to good hardware and software can develop a life like digital product, however, the skill set for true to life DT requires a whole host of skills from knowledge on authoring tool, technical product expertise, material behaviour, fit technology, and a creative skill set. Achieving a first time right physical sample requires the digital sample to be built in an approach that consistently has the end goal in mind during the process, which is a technically accurate DT that can be translated to a physical product.

The path to an accurate translation from digital to physical is through the people that build and review digital garments.

Technical teams that develop physical product possess the required skill set for this translation. Bringing the same talent that work on the physical to digital workflow is how I believe craftsmanship is going to be successfully transferred

from the physical realm and into digital product creation. While creative design and experimentation remain vital stages of digital product creation, 3D technologists that come from a background of product development, and who understand how the digital product should be built for a first time right physical sample, will also be essential pieces of the puzzle.

Quality assurance processes, for example, play an equally important role in auditing digital twins as they do with physical samples - especially if those digital assets are being used to make critical creative and commercial decisions. This step ensures the DT is built according to the brand guidelines, setting and meeting as a virtual quality standard, and ensuring that the digital twin represents a technically accurate and manufacturable garment. Translating the best practices from physical review to the digital workflow ensures that the digital garment is reviewed with the same level of quality and due care as the physical sample.

In our experience, driving adoption of DPC at a whole-industry level will mean building trust in the digital samples. Trust is established when brands believe that the vendor partner has the right physical and digital skill set to translate from DT to a first time right physical product. To build this trust the vendor partner must appreciate what the digital twin can and cannot do, when to manipulate the garment to achieve visual accuracy, and when not to.

DTs built with the objective of standing in for physical samples at every possible juncture will ensure the end digital garment accurately represents the physical product. And with this foundation set, decision makers can surface issues early and re-evaluate technical feasibility on an ongoing basis. Absence of understanding the end use of the digital sample, by contrast, will result in over engineered product and heavily manipulated DT that achieves visual accuracy at the expense of technical feasibility.

Reaching maturity in DPC can be unlocked through continuous learning and collaboration across brands and tech partners, and through leveraging vendor's own expertise in product craftsmanship and best practices of the physical workflow. Success in Digital Product Creation, then, is not only attributable to acquiring the right technology, but also building the right balance of people process and technology.

And achieving sustainable value creation in DTs means having the right talent, the right scalable workflows, and the right approach to value chain collaboration, making use of the technical expertise that the right manufacturers have worked to establish.

BUILDING THE INFRASTRUCTURE FOR SUCCESSFUL DIGITAL PRODUCT CREATION

BEYOND THE TECHNOLOGY, CULTURAL CHANGE AND ORGANISATIONAL COMPOSITION COULD DICTATE HOW SUCCESSFULLY BRANDS ARE ABLE TO MIGRATE TO DIGITAL-NATIVE WORKING.

Digital Fashion Infrastructure - Created & Visualized by WORLD OF MESH

MARIE BASTIAN
CEO & FOUNDER
WORLD OF MESH

Marie Bastian is Founder and CEO of WORLD OF MESH, a 3D fashion service agency dedicated to helping fashion brands deliver environmentally sustainable 3D products faster to market through the power of emerging technologies.

THE FUTURE IS 3D

Fashion is highly creative and ever changing. We are captivated watching brands showcase collections at Fashion Week, patiently waiting for reproductions to arrive at stores. The current process starts with designers creating concepts, finishing products months later in time for go-to-market. But that snapshot is the old world: low tech. Picture the new world: high tech designers using three dimensional software to design styles, revising them on the fly, collapsing cycle time threefold. Industry leaders may feel hesitant and overwhelmed at the start of change, but calmness sets in as 3D technology benefits are realised. Leaders are discovering a more competitive, productive, sustainable and relevant work place where they are delivering products faster to customers.

KICKING OFF CHANGE

There is not a one-size-fits-all strategy that brands must implement to enter the digital revolution. Internal processes vary from company to company. But there are fundamental practices that organisations can take advantage of to ease into this transformation era.

To begin, a brand's leadership must be fully on board to ensure success and commitment to change. Starting slow by identifying a single new project– a pilot– minimises company disruption. New infrastructure, including people, technology requirements and budget is approved. Management designates a Digital Transformation Team (DTT) responsible for pilot project development and execution, and a Chief Digital Officer (CDO) responsible for daily operations of the new team.

DIGITAL TRANSFORMATION TEAM LAUNCHES DIGITAL PRODUCT CREATION

The Digital Transformation Team (DTT) kicks off Digital Product Creation (DPC), with their deliverables being digital assets. The DTT is composed of product development positions from across the company, including pattern makers, designers, technical developers, sourcing and production, IT specialists, engineers and project managers - all specialised in 3D. Adding a 3D expert from a digitally-generated industry that is further along its maturity curve than fashion, such as Visual Effects or Gaming, to the team is a competitive advantage. These industries are established and have amassed a great deal of knowledge from which other industries, like fashion, can learn. Overall, find talent with a growth mindset who are enthusiastic about 3D fashion creation and embrace the start-up mentality.

The DTT sets pilot program goals, milestones and metrics, and solves any roadblocks that arise. The DTT is also responsible for researching and defining how processes and technology work together. As the team drafts the project plan, they scrutinise the current product development environment, people and skill sets, and expectations currently in place. The team explores 3D technology capabilities and brainstorms how they want to utilise them to design fashion apparel. Management grants the team freedom to probe, make mistakes and pivot, enabling them to discover optimal processes.

Documenting process details, challenges and victories are all part of transforming the business. It ensures knowledge is captured for future brainstorming as refinement of the 3D ecosystem is inevitable.

CHIEF DIGITAL OFFICER (CDO) ENSURES CONTINUITY

Acting as a single point of contact between the Digital Transformation Team and management is the CDO. This role oversees daily pilot team operations and ensures management is apprised of project status. The CDO also assists with project escalations, transitions, decision making and obtaining quick approvals. The role prevents interference from other groups, and provides other support as needed.

GETTING STARTED IN DIGITAL PRODUCT CREATION (DPC)

A good strategy in selecting a pilot project is to identify a product group with low complexity and fewer style requirements. Selecting, for example, Sweat product group,

Dynamic Team Visualization - Created & Visualized by WORLD OF MESH

as a first project may be the path to success. Simplicity may reduce frustration when learning something new, encourage team building between the DTT and the product group, and instil confidence in the technology.

This DTT is constantly refining new processes and sharing them with the product development group. The two teams troubleshoot together and work through many new challenges to determine the most effective outcomes. It is agreed at the start of the pilot that change must not interfere with productivity, and all must work to ensure seasonal drops happen without a hitch. The close collaboration ensures the product group is well-positioned the next time around to develop digital assets on their own.

Once the digital assets are complete, the DTT hands them off to the next cross-functional group in the product cycle.

An example of how the process moves forward, Marketing is next to receive the digital assets. Although Marketing is less involved with the 3D design processes, they are responsible for adopting new 3D presentation software, allowing them to showcase the 3D assets. They also incorporate the 3D assets into go-to-market strategies. The easier each group has

handling the digital assets, the easier the entire process progresses.

SUCCESS AND NEXT STEPS

At the end of the pilot project, the Chief Digital Officer and Leadership review the project findings. The goal is to realise that digital transformation is a success, accounting for cost and time savings, creativity advancements and much more. Next steps are for the DTT to engage with other product groups and repeat the pilot process until all product groups are transformed.

In tandem, Leadership is evaluating how the new 3D technology and practices impact the broader business, including Finance, Business Development, Marketing, Quality Assurance, Manufacturing and so on. The rest of the business incorporates new workflows and 3D technology enhancements, and digital transformation is complete.

Depending on the size of the business, digital transformation can take a few years. Change is always ongoing once you introduce technology, but it is less disruptive as the complex evolutions are done.

A ROBUST NETWORK IS REQUIRED

Many fashion organisations may need to renovate their technology footprint in order for digital transformation to be successful. Implementing a solid networking infrastructure that includes a variety of devices, storage, security and software solutions, and being able to connect teams in multiple global locations is critical. Because 3D technology is relatively new to the fashion world, having a stellar Information Technology (IT) staff to help employees make hardware and software decisions is indispensable.

Successful digital transformation requires evaluating how each group is impacted by change. Some brands have multiple locations to consider. The network, whether it supports a single or multiple sites, must accommodate Broadband as 3D software is data intensive. A sluggish network prevents teams from file sharing and reduces productivity. Product development teams specifically require robust laptops and desktops in order for the 3D software to operate properly.

As network infrastructure is expensive, upgrading multiple sites all at once may not happen. An added benefit of doing a pilot project gives companies ample time to upgrade. Be sure as you engage in the transformation process you are aware of which teams and locations have upgraded their networks. Otherwise, mistakes may happen, product delays may arise and productivity may be compromised.

DIGITISING PRODUCT INFORMATION

Other considerations in your digital journey include setting up digital libraries to create virtual samples. For example, every detail that makes up a sweat article in the physical world, needs to be accounted for in the digital world. You must create a digital twin for each fabric layer of the style, for any trims like zipper pullers that exist, for the stitching around the neckline, for the product label and so on. Don't forget to include a representation of a tailor's dummy or a mannequin, known in the digital world as an avatar, used to showcase your digital garments in various stages throughout product development.

Customized 3D Assets - Created & Visualized by WORLD OF MESH

The digital files are organised and reside in software libraries on your network for other DTT members and cross-functional teams to access in the development process. For example, Development may add digital labels or a specific branded trim to the product file, and Manufacturing may access individual brand avatars for optimal fit outcome.

Leverage an onsite IT professional to help connect software solutions with network systems, to help coach on optimal 3D asset creation formats and more. Creating libraries is complicated, so create a playbook and document standards to ensure consistency across teams and locations.

THE NEW FASHION SHOWROOM IS AHEAD OF YOU

Start small and evolve your business at your own pace. Be sure you are building a team that is enthusiastic and skilled. Transformation takes time and requires individuals who are team builders, patient, curious and able to adapt to new circumstances.

Accept that once you enter the 3D revolution, the process will take longer than you expected. Share knowledge with other team members and colleagues who have used digital technology. And most importantly, celebrate the journey, acknowledge the creativity and all of your personal and professional growth. Digital is here to stay. Jump on board.
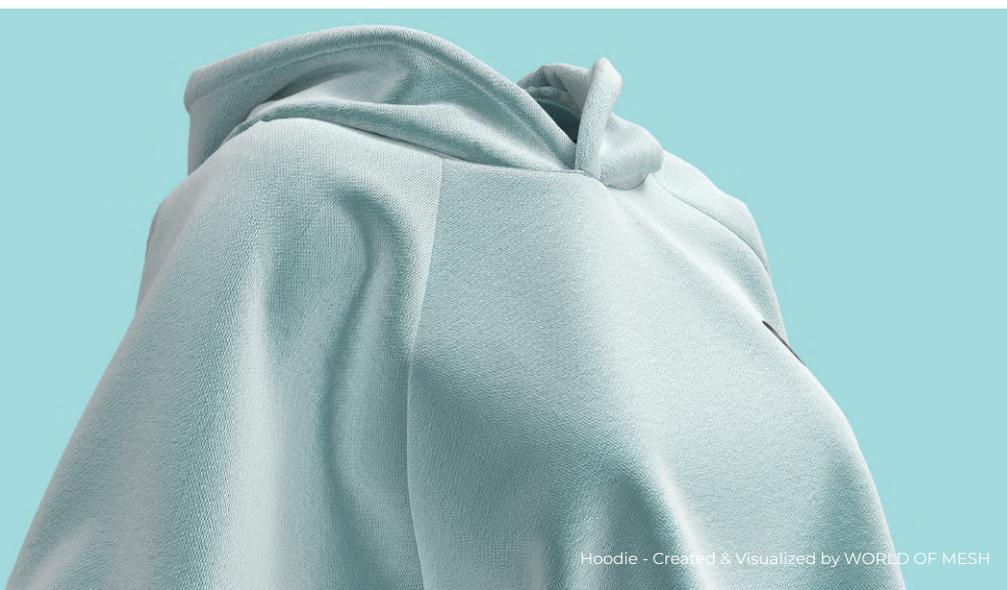
Hoodie - Created & Visualized by WORLD OF MESH

FINDING INTEROPERABILITY IN DIGITAL FASHION ASSETS

AS FASHION MIGRATES TO DIGITAL-NATIVE WORKING, THE DRIVE FOR STANDARDISATION IN DATA EXCHANGE AND MANAGEMENT IS BECOMING MORE PRONOUNCED. IS THE INDUSTRY READY TO RESPOND?

## TOM COWLAND
LEAD ENGINEER
FOUNDRY

Tom has worked in the Media and Entertainment industry for over 20 years. Focusing on computer graphics pipelines and software development for film, television, product design visualization and VR. He has worked for a variety of production companies and software vendors and is currently at Foundry.

A mature, scalable Digital Product Creation ecosystem should allow new and evolving technologies to be quickly and easily integrated, maximising the ability to leverage industry innovation to reduce cycle time and inform new designs.

Achieving this requires interoperability between upstream and downstream systems. There are open standards for data exchange, but few exist for the creation and consumption of digital assets. This hinders the development of cost-effective DPC workflows that comprise solutions from multiple vendors. Originating in the Media and Entertainment sector, the new OpenAssetIO standard defines common dialogues between content creation tools and data management systems. Facilitating more modular, scalable and efficient DPC workflows. In this article, Tom Cowland takes a look at the ideas behind this new open standard and

invites you to help shape the future of how fashion's tools can interact with the data we make.

Imagine a future, where scalable DPC workflows integrate seamlessly with upstream and downstream processes. Enabling rapid delivery of unique designs and providing detailed insight into the entire lifetime of a product. Where new tools and technologies can be easily incorporated into existing solutions without the need for custom development or wholesale change. Such a future, built from interoperable components, allows us to leverage cross-industry advances in 2D and 3D design and visualisation technologies, whilst maintaining familiar concepts and terminology. This future not only results in more effective product development, but more sustainable and environmentally friendly workflows - both
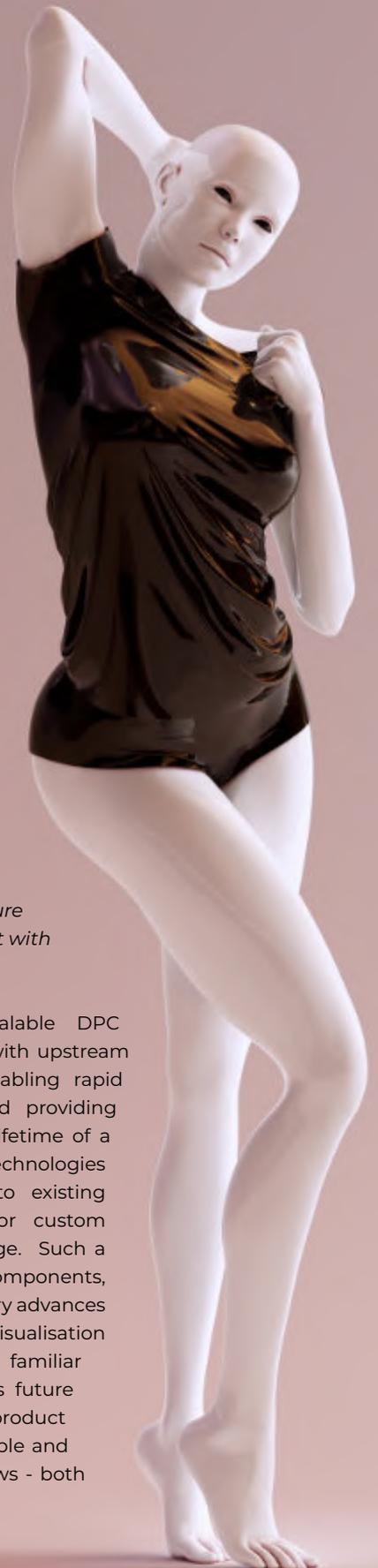
in the physical and digital space. Streamlined processes and iteration cycles, result in a significant reduction to the overall carbon footprint.

Today, DPC solutions require the tight integration of numerous components that aren't designed to work together. Physical scanners, 3D authoring and visualisation packages and traditional production CAD systems all must exchange data. Factor in e-commerce platforms and metaverse applications, and the sheer number of independent systems, each with their own data formats and APIs quickly becomes untenable. The integration effort required for any given tool severely offsets any specific value it may be able to bring to enhance product development efficiency.

Looking back over the last 20 years at the evolution of DPC within the broader computer graphics industry, efficiency and innovation blossomed when the approach began to evolve away from closed proprietary solutions in favour of interoperability. Creatives demanded the ability to combine tools from multiple vendors to create a coherent workflow far bigger than any view of the world that one single-source solution can support.

Notably, this flexibility has been achieved through significant investment by tool creators in open data formats. Specifically ones that can be easily integrated, and extended by any vendor without a complex licensing model. Adoption of these non-proprietary standards has resulted in out-the-box, collaborative, multi-tool workflows evolving at unheard-of rates. Users are empowered to connect distant ends of their workflow together, without the need for complex data conversion processes and custom software development.

An example of this change is Pixar's USD. It is an open source 3D scene description format. It was developed to handle the complexity of several thousand artists concurrently working on a single animated feature film. This project has been adopted and employed in a diverse variety of new business sectors. NVIDIA has used it as a foundation of Omniverse™ — including compelling design visualization solutions for Architecture and Automotive to name a few. Apple has built a streamlined 3D augmented reality framework based on USD - geared towards consumer e-commerce and entertainment. The underlying efforts in all these areas has led to native support of the USD format in a whole range of DCC tools, renderers and game engines. This allows data created by one of these tools to be read by others, without the extensive bespoke customization and data conversion processes previously required.

This is the first step towards interoperability. Open data formats are an essential prerequisite to truly scalable and flexible workflows. They facilitate a simpler exchange of work, but they don't help manage how this is done. Product creation ecosystems are frequently built around a PLM (or similar). These data management systems ensure users have the correct information available to them, and their individual outputs are properly tracked and propagated throughout the work process. New tools need to be connected into these PLM systems in order to function effectively.

The work to integrate new software into a managed workflow currently forms a significant barrier to adoption. The development effort required to connect the proprietary APIs of each tool to that of the PLM system becomes onerous. The result is frequently that either the tool is not adopted, or its use is somewhat manual, time-consuming and/or error prone.
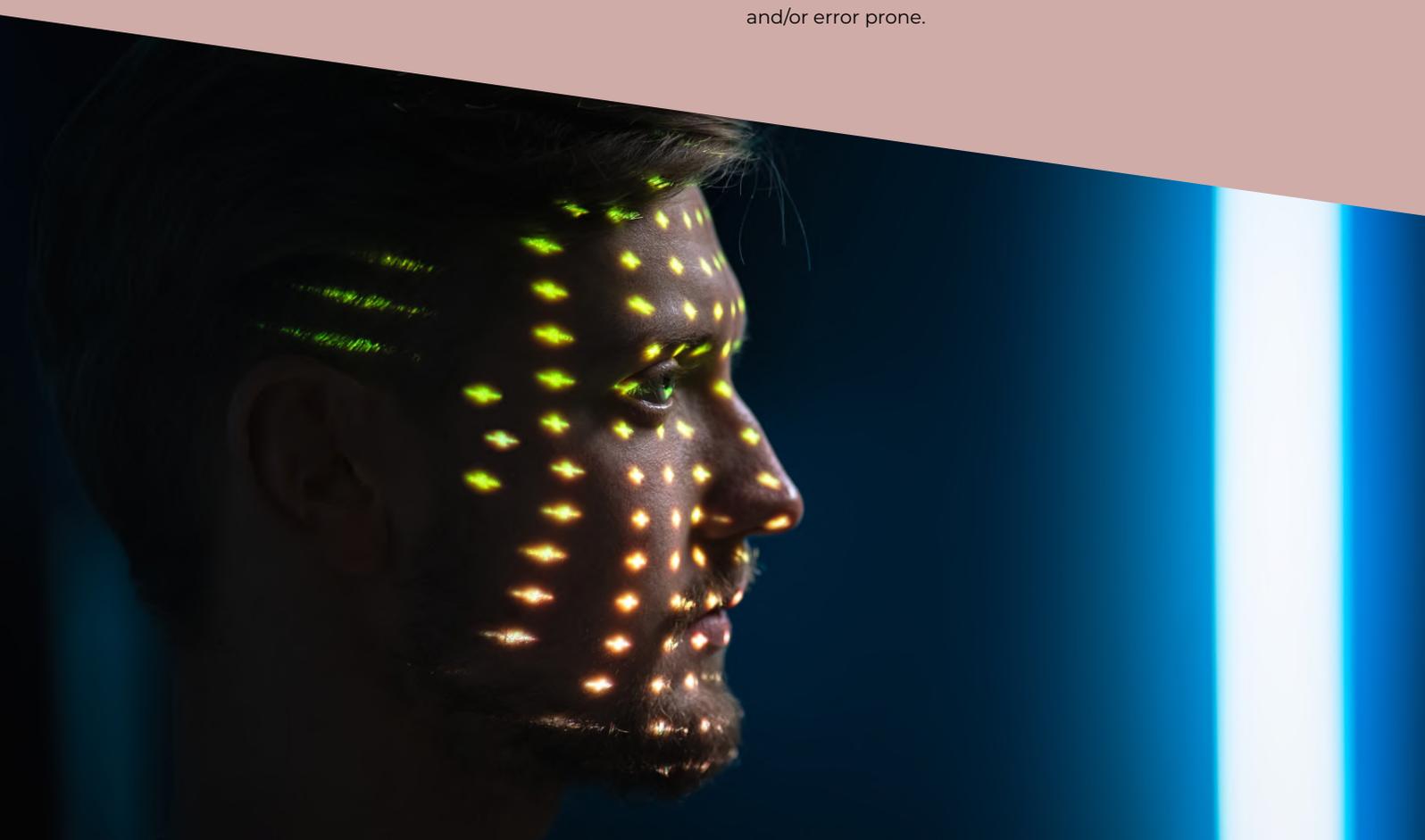
To take advantage of new and innovative technologies in our workflows, they need to be easy to integrate into existing workflows. We need a standard for how to connect specific-purpose applications and tools into an end-to-end managed environment, with minimal development effort.

This is not a new problem.

The Media and Entertainment sector has long faced this exact same problem - how to connect software from a variety of independent vendors. Significant local R&D expenditure on pipeline integration is not a sustainable model. A business's competitive edge can, and should come from something other than "better glue code". This year, under the stewardship of the Academy Software Foundation, the M&E community is working together on a new, open, standard for workflow integration - OpenAssetIO.

The goal is to remove the need for API-specific glue code to be written in order to integrate a tool within a managed workflow. Allowing for individual tools to be swapped-out as required whilst maintaining a coherent, well managed data flow.

Drawing on techniques validated over twenty years in production, the project defines a common interoperability standard to connect tools that consume or create digital assets, with the systems that manage them. OpenAssetIO enabled software can directly connect with similarly enabled PLM and data management systems to coordinate the publishing and loading of data. This isn't limited to files on disk. The API allows the management of conceptual information such as products, colorways and SKUs. It also allows user-facing interface elements to be delegated to the management systems to provide a seamless user-experience that is less prone to operator error.

The project does not define the nature of the data exchanged between the systems, but how to find the required data and where new data should be stored.

The project is currently working its way towards a "v1". This is being done as a genuine open source, community effort with a multi-organization steering group. The current focus is within the Media & Entertainment sector but, by design, it is industry agnostic. Visualisation and DPC pipelines in apparel, arch-viz, automotive, gaming and film all share technologies and face equivalent integration challenges.

By working together on interoperability, through open data formats and standardised dialogues between tools and systems, we can revolutionise DPC. There is a future where we can draw a through-line that follows a garment from cradle to grave - via material scanners, CAD tools, manufacturing hardware to storefront systems and post-sale experiences/socials - all powered by innovative, cutting edge technologies. We can then close the loop - truly integrated visibility of each development cycle empowers us to evolve and refine the design and delivery of the next.

If you are interested in helping build a better connected, more interoperable future for DPC tooling, come and join the conversation—and help forge a new way for us to build our workflows.

Find out more about the OpenAssetIO standard: https://github.com/OpenAssetIO/OpenAssetIO

SEARCHING FOR SOLUTIONS

UNITING THE TWO WORLDS OF DIGITAL AND PHYSICAL MATERIAL CREATION

KATHERINE ABSHER
MANAGER, FASHION & DIGITAL DESIGN, COTTON INCORPORATED

Katherine is the digital product creation specialist for Cotton Incorporated, a not-for-profit organization dedicated to the promotion of cotton through research and marketing.

The past few years have accelerated the use of technology across various industries, with fashion and textiles being no exception. 3D software and digital product creation (DPC) are increasingly becoming standard in the fashion industry, and as a result, digital materials matter more than ever. The fabrics that make up our garments have always been a critical component of the design, development, and sourcing cycle, but the disruption of COVID placed a sudden, sharp emphasis on fashion's ability to create using digital fabrics and to source physical materials reliably in a changed market.

Image provided by Cotton Incorporated.

Extending from design to product development, sampling and all the way downstream to ecommerce, digital product creation methods are transforming the fashion industry. As technology advances and the pressure to design and source materials quickly and responsibly increases, the demand for flexible digital materials that correspond to manufacturable fabrics is likely to grow. Considering the rapid transition towards large-scale digital product creation, the fashion industry faces new challenges in leveraging the capabilities of digital methods and materials while maintaining the connection to what is physically achievable. **Cotton Incorporated,** a not-for-profit organization dedicated to the research and promotion of cotton, is making the journey towards digital transformation alongside the industry and on track to provide solutions.

ADAPTING TO CHANGING INDUSTRY REQUIREMENTS

The case for digital product creation was strong even pre-pandemic– with the mounting pressures of sustainability commitments, keeping costs low, and rapid speed to market expectations that burden the industry. Digital processes and 3D design offer significant benefits to saving time and resources, reducing waste and increasing efficiency. But adapting to the new, digital normal and finding ways to thrive often presents companies with a host of new problems to solve. As many in the industry are finding, the challenges of digital transformation are difficult to solve and often require brands to hire new talent, upskill existing workers and purchase expensive equipment and software. Even once those steps have been taken, digitalizing materials remains a pain point for the industry. The need to scan physical fabrics, complete time-consuming physical testing and communicate with mills at every step makes transitioning to digital processes a tall order. Although material scanning and physical testing offer a key advantage in maintaining accountability to the physical fabric, these processes come with significant logistical barriers. From a fiber perspective, Cotton Incorporated is committed to finding solutions that enable creative agency afforded by DPC while maintaining the connection to physical, manufacturable fabrics.

In addition to the practical realities of digital processes, there are also important cultural and

creative challenges to successfully implementing DPC. Designers are key decision makers in the fashion industry, driving material selection and development. But rapid industry transformation is changing the way designers make those decisions. Digital and 3D design tools require different skills and ways of thinking, which can be challenging to accommodate in a fast-paced product cycle. As fewer samples are ordered for material selection and fewer prototypes are made for new styles, designers may not have as many opportunities to touch and feel fabrics during the

Texture   Physics   Data
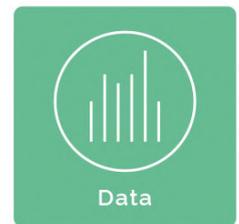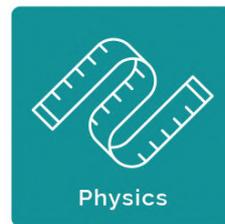
Digital Fabric

design process. Making the case for cotton, a fiber often prized for its softness, could become more of a challenge in a world becoming increasingly digital. The challenge and opportunity for Cotton Incorporated to solve then becomes how they can ensure cotton remains available, attractive to designers and differentiated from other fiber types in a digital environment.

At every stage of the value chain, Cotton Incorporated funds research, provides education and offers resources to the industry to help companies develop superior, innovative and profitable cotton products. As a fiber, cotton offers many benefits: it's breathable, durable and has a soft, comfortable handfeel that consumers love. Cotton is also a natural fiber which makes it an excellent choice for products in circular economies. Cotton Incorporated strives to persuade and support brands in their choice to use cotton in a market dominated by synthetic fibers, even as industry needs and practices are shifting in the digital age.

HOW COTTON INCORPORATED IS SHAPING THE FUTURE OF DPC

One of Cotton Incorporated's longstanding efforts has been to develop innovative, inspirational fabrics to show brands how they could be using cotton. They provide brands with all the information needed to manufacture those fabrics, which can then be taken into production. Each year, dozens of new fabrics are developed and released to the industry through the FABRICAST™ library, Cotton Incorporated's collection of cotton and cotton-rich fabrics. Today, Cotton Incorporated can offer hundreds of these inspirational fabrics through the FABRICAST™ library, which is available on CottonWorks™, the leading industry resource for developing outstanding cotton products.

In answer to the fashion industry's growing need for manufacturable digital materials, Cotton Incorporated began offering digital twins of their FABRICAST™ developments in 2020, enabling brands to experiment

cottonworks™

DIGITAL FABRIC

7308-1A
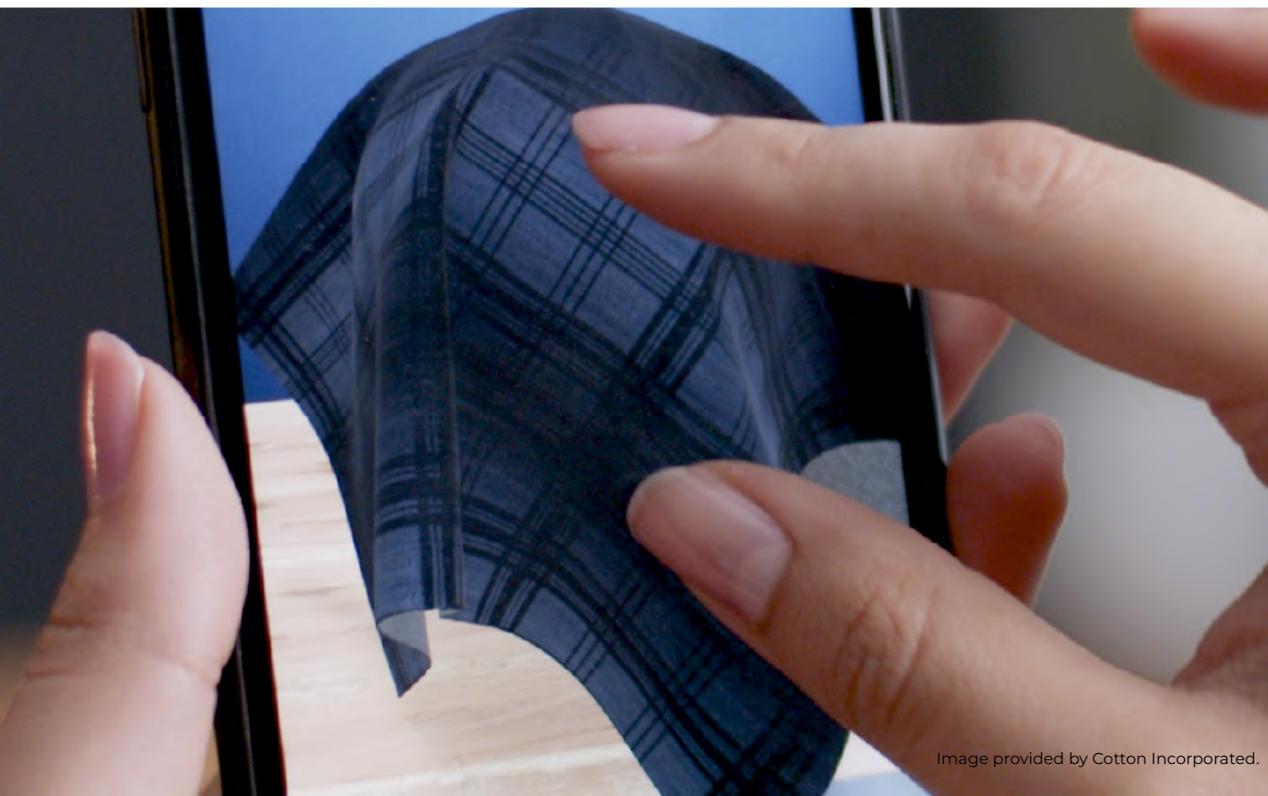
100% cotton, 3x1 twill

Image provided by Cotton Incorporated.

digitally with fabrics in addition to continuing to offer fabric swatches and manufacturing guides. The reasons behind this strategy are twofold. First, offering digital fabric files helps make cotton fabrics accessible to designers in the 3D tools that are increasingly becoming standard practice in product development. Meeting industry professionals wherever they are with information and resources has always been central to Cotton Incorporated's core mission. Secondly, material digitalization can be costly, putting it out of reach of many smaller brands, independent designers, and students. Cotton Incorporated offers free access to inspirational, flexible digital fabrics, supporting those industry members and emerging professionals who want to work digitally but may not be able to shoulder the burden of creating digital materials.

Currently, digital fabrics are available in two formats compatible with CLO3D and Browzwear and are available for download with a free CottonWorks™ account. Digital fabrics in the FABRICAST™ library are high quality, scan-based versions of their physical counterparts, which have been tested for physical properties using the proprietary testing kits from each 3D software, respectively. Cotton Incorporated is proud to offer the first fiber-specific library of digital fabrics in the industry. Today, over 300 fabrics are available digitally from the FABRICAST™ library on cottonworks.com.

Building on this effort, Cotton then began exploring collaborations to make cotton available in the 3D tools designers are increasingly using. In 2021, they launched a collection of minimally processed fabrics in collaboration with Browzwear. The collection of over 25 fabrics is available directly in VStitcher as a material library, with the aim of making fabric options processed in sustainable ways easily accessible to designers. More recently, Cotton Incorporated expanded their research efforts into alternative solutions to digital material creation. In collaboration with Adobe Substance, a leading toolset for 3D design and material authoring, the companies explored

different ways of creating and working with digital materials. This pilot project, presented earlier this year in a workshop with The Interline, investigated the application of the cutting-edge Adobe Substance tools to fabrics that could be manufacturable. These tools were created for digital industries, such as gaming and animation, but could also benefit the fashion industry as it moves into greater maturity with digital product creation and increased use of digital assets.

Image provided by Cotton Incorporated.

EXPLORING DIGITAL-FOR-DIGITAL TOOLS FOR DIGITAL-TO-PHYSICAL PURPOSES

Industries that rely heavily on digital assets such as gaming, animation and visual effects have faced similar challenges of scalability with the creation of realistic digital materials and have produced digital tools and workflows to help meet that demand. Unlike the fashion industry, which uses digital processes to produce products that are ultimately physical, the gaming and animating industries create materials and models that will only ever be digital. Consequently, the tools and processes used in these industries are designed for maximum creativity and flexibility. Among these processes is procedural creation, which enable designers to create materials and models that are almost infinitely editable, in a completely digital way. A simple way to describe procedural creation is like building a visual algorithm, which generates the appearance of a material using a network of individual characteristics.

Scalability, flexibility and efficiency are some of the key benefits to working procedurally because materials generated in this way can go beyond just a digital twin; they become digital tools which can represent many different versions of a material and allow designers to experiment with materials at a level that scanning processes cannot match. Although procedural generation comes with challenges and concerns of its own, the requirements for extending the uses of digital assets more fully into both the supply chain and consumer-facing applications will likely involve the fashion industry learning to adapt these kinds of digital-for-digital tools for digital-to-physical purposes. Even though solutions may be years from realization, Cotton Incorporated is nonetheless continuing to investigate the possibilities alongside their existing efforts in DPC.

FINDING SUCCESS IN THE NEW DIGITAL AND PHYSICAL ECOSYSTEM

Currently, the two areas of digital and physical product creation mainly exist as separate areas of expertise. Professionals immersed in DPC and 3D design often aren't as well versed in the realities of manufacturing and vice versa. In the new digital era, some merging of the two could become a requirement for success for many businesses. In the fashion industry, where digital methods are being used to facilitate the production of physical goods, solutions will inevitably require hybrid techniques merging the digital with the physical. From Cotton Incorporated's perspective, the possible reconciliation between digital tools and physical creations is three-pronged: bringing together digital and physical expertise, gaining knowledge about how digital and physical samples and products intersect and embracing the cultural shift of open-mindedness and curiosity towards both perspectives.

As the industry changes, it is important that businesses not only keep up, but stay ahead of expectations. To this end, Cotton Incorporated continues to develop innovative and inspirational fabrics to help brands imagine how they could be using cotton and supports the industry in finding success in the hybrid model of physical and digital ways of working. To learn more about Cotton Incorporated's efforts in DPC, visit us on CottonWorks™.
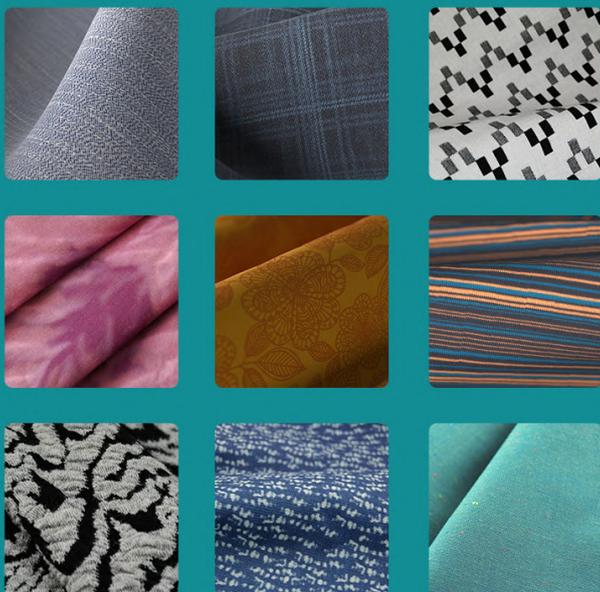
Image provided by Cotton Incorporated.

THE REAL-TIME REVOLUTION

FROM VIRTUAL TRY-ON TO FULLY IMMERSIVE EXPERIENCES, FASHION IS FAST MOVING BEYOND STATIC RENDERS. WHAT DOES THE FUTURE OF REAL-TIME RENDERING HAVE IN STORE?

Image provided by XTENDED iDENTiTY (Xi)

EMMA FELDNER-BUSZTIN
JOURNALIST, WRITER, TECHNOLOGIST

Emma Feldner-Busztin is a journalist and writer. She writes about how technology is shaping our world and how global trends and patterns will impact the fashion industry.

Initially, human-computer interaction was mainly via text commands. Then with the introduction of graphical user interfaces, we moved to the 2D experience that most of us have daily with our devices. The next step in this evolution is the use of 3D immersive technologies to deliver a change in our mode of interaction with technology. There are significant opportunities for the fashion value chain here: from designer-to-manufacturer collaboration to creative experimentation and the showcasing of concepts internally; to the consumer, by giving them better shopping experiences and driving more sales.

Unlike seeing a static render of a 3D garment in place of traditional product photography, this new mode of interaction will require more people than ever to access digital assets and environments in real-time. Whether they're creating, viewing, or customising those assets, people from across the value chain will find themselves shifting from a well-worn, comfortable way of interaction with technology, to new frontiers like augmented reality (AR) and virtual reality (VR). What do other industries have to teach fashion as it goes through this transition?

VR/AR/MR/XR - DECONSTRUCTING THE ALPHABET SOUP

In this context 'immersive' refers to a smorgasbord of technologies and experiences that take a person from

merely spectating, to being a part of the action. These include well-established experiences that are rendered in real-time, such as games, as well as new real-time technologies like VR/AR/MR/XR (which are sometimes called the 'alphabet soup'.)

First, to align on a few definitions. AR brings the physical and digital worlds together by superimposing digital elements onto the real world. This contrasts with VR, which is a fully immersive digital experience, complete with computer-generated imagery and audio. This usually requires using a head-mounted display (HMD) and haptic controllers. Mixed Reality (MR) experiences see users being able to interact with both physical and digital items and environments at the same time. Finally, extended reality (XR) is a catch-all term that covers all these different technologies. And all of these run in real-time.

'Real-time render' is another important concept worth defining. In computer graphics, 'rendering' is the creation of an image from a description of a scene or 3D model. Gaming development company Unity offers the following explanation: "images are calculated at a very high speed so that it looks like the scenes, which consist of multitudes of images, occur in real-time when players interact with your game. The main goal is to achieve the highest possible degree of photorealism at an acceptable minimum rendering speed which is usually 24 frames per second. That is the minimum a human eye needs in order to create the illusion of movement."

This is distinct from many of the use cases for 3D garments, footwear, and accessories, which are *created* in real-time (using one of the many popular 3D design and simulation tools) but which are then rendered out to flat images or pre-rendered video for use in eCommerce catalogues, social media and so on. A real-time experience is one where the end user is interacting with an environment and / or 3D objects that are being rendered

by a graphics (and often simulation) engine as that interaction takes place.

A videogame (i.e. something you "play") is the most familiar use-case for real-time rendering, but other industries have also pursued real-time experiences for a range of purposes. Architects walk clients through proposals put together in Unreal Engine, translated from CAD files. Car buyers customise their vehicle by swapping materials and alloys on a model being rendered in real-time. Filmmakers pre-visualise using virtual cameras. And all the XR experiences listed above require a greater or lesser degree of interaction with digital assets in the moment.

IMMERSIVE EXPERIENCES IN OTHER INDUSTRIES

So as fashion begins its foray into using immersive technologies, it does so on the heels of sectors that have significant experience immersing customers and creators into their products. The three mentioned above (automotive, architecture/construction, and entertainment) all make extensive use of real-time visualisation as well as AR and VR, and they have already proven the value of this shift in modes of interaction.

In the automotive space, immersive experiences have been known to boost sales, reduce the costs of research and development, and capture the customer's imagination by way of virtual test drives. Notable examples include Audi and Ford. Audi has included a VR entertainment system (called Holoride) in select vehicles, where passengers can blend what they see on the actual journey with AR elements via motion-synchronisation technology. Ford has an immersive virtual showroom, where, using AR, customers can tap on 3D hotspots to discover features, and virtually design and then view their ideal vehicle. Ford also uses VR to train technicians on how to service and maintain certain vehicles, without the need to access a physical model.

Architecture is another industry that has seen meaningful benefits by using immersive technologies. One such example is for the transformation of computer-aided design (CAD) models off the screen and into the real world. Models can be viewed from various angles, and as if on location. Virtual tours are also popular, as architects can quickly create guided tours that allow for tailored navigation. Global design and architecture firm Gensler cited VR as an integral part of building tech giant Nvidia's 750,000-square-foot California HQ. According to The Architect's Newspaper, Nvidia wanted to maximise quality of light in key workspaces. By using simulations in VR, it was learned that fewer skylights were needed to achieve the correct lighting effect designers were looking for.

These two industries overlap in that they can consist of various individual disciplines working together on the same project. This siloed way of working means that communication between parties can make processes complicated and time-consuming. Using immersive technologies improves communication and sharing of ideas, as all parties gain access to crucial information more quickly. Both industries also require a great deal of consideration from the consumer or client, and using immersive technology allows for the level of customisation needed in order to go ahead with the purchase or project.

However, it is the gaming space that might be the industry best known for harnessing the power of immersive technologies. Gaming has long been a favourite pastime for many, far before photorealistic real-time rendering was achieved. As of 2022, Vogue Business reports that the gaming industry has more than 2.7 billion gamers worldwide. Although the popularity of VR in gaming is arguably not yet at its peak, it is believed that its appeal will continue to grow as this type of play interests traditional gamers as well as more casual players who are curious about the experience. Immersive experiences are certainly different to the mobile, PC, or console ways of play - in terms of hardware and even in the emotional experience – as being immersed can feel like one has less control. However, on the other hand, it is an opportunity for players to enjoy a more personal and thereby fulfilling experience.
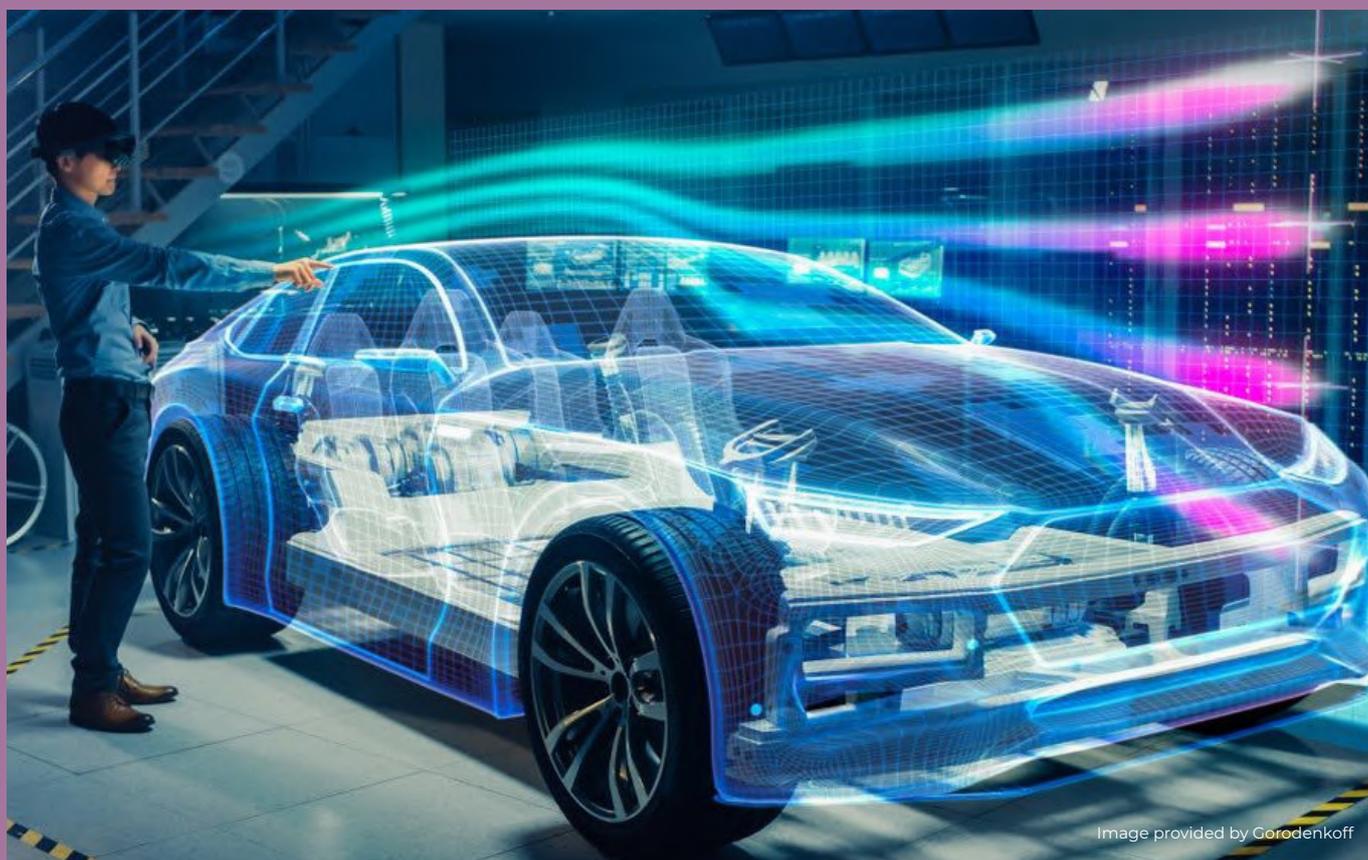

Image provided by Gorodenkoff

Speaking of hardware, another important contribution from gaming is the use of HMDs, colloquially known as headsets. High-end hardware for VR headsets such as the Oculus Quest Pro and the Valve Index currently retail for thousands. This price may be one of the barriers to entry, especially considering that the devices can be clunky and uncomfortable to wear. "I think that the most important aspect in the evolution of the hardware of AR and VR is that its usage needs to be smooth for the user," says Diana Perfilieva, founder and CEO of Diverge, a Metaverse fashion brand created to bring high-end fashion aesthetics into web3. "VR headsets are in their very early stage, and you can't use them for a long time as you feel dizzy. As for AR, I think when we switch to wearable devices like Google Glasses, the experience will make much more sense."

Upcoming competitors include Meta's Quest 3, Sony's PlayStation VR 2, and Apple's offering rumoured to be called Apple Glasses. The latter has been rumoured for years, and could be set to be released as soon as January 2023.

FASHION'S TAKE ON IMMERSIVE TECHNOLOGIES - SO FAR

There has already been considerable hype downstream when it comes to immersive experiences in the fashion space. Although slow to e-commerce and social media purchasing, select fashion brands and retailers are looking to stay ahead of the curve this time and are exploring virtual commerce or 'v-commerce' as it is coming to be known. This is perhaps where the most impactful commercial opportunity lies: creating unique shopping journeys, fostering a competitive edge, and increasing sales and brand loyalty.

The most common reasons cited for wanting to use technology such as AR and VR are to see what items look like on the consumer and to get a 360-degree visualisation of a product. AR and VR are thus becoming more of a utility than an amusement when shopping. Companies that have experimented in this area include Gucci, Zara, ASOS, American Apparel, Lacoste, and Timberland.

The 2021 Global Report for the 'Future of Shopping' by Snap Inc. surveyed 20,000 consumers across 12 global markets. Significantly, 56% of consumers who have used AR when shopping claim that it encouraged them to make a purchase, and 1 in 4 shoppers would prefer to buy luxury with AR, rather than visit a physical store. Additionally, 4 in 10 US consumers state that not being able to see and try out products is the most significant factor that put them off from shopping online. The global virtual fitting room market is projected to grow from $3.5 billion to $12.97 billion from 2021 to 2028. While stated interest does not always translate to action, these numbers, suggest a steady change in how consumers perceive AR and VR.

As of 2022, we have also seen various gaming collaborations with luxury brands, including Moschino x Sims, Louis Vuitton x League of Legends, and Gucci x Roblox – to name just a few. This topic has been covered extensively by The Interline here.

For designers, there is so much to consider when designing a new collection. Along with choosing the materials and creating the clothing, attention must be given to how to market the products in a way that does not lose the essence of the brand but reaches the most consumers possible. Additionally, the fashion industry has now evolved to require brands and manufacturers to consider digital product creation (DPC) and the new world of complexity and opportunity it creates - not to mention the asset creation burden that now falls on creative and commercial teams who have a moving target in real-time XR experiences as their final deliverables.

Among brands leveraging immersive technologies in-house and downstream are US-based Rebecca Minkoff, French luxury brand Balmain, and digital fashion house The Fabricant. Using VR, Rebecca Minkoff maps out the optimal layouts for its own stores as well at department stores, designed to see what will garner the most consumer sales. Alongside this, the brand creates products digitally before going into physical production. These experiments are also good for gathering data and making decisions driven by consumer behaviour for future seasons. Balmain has in the past used CLO (a 3D fashion design software program) to
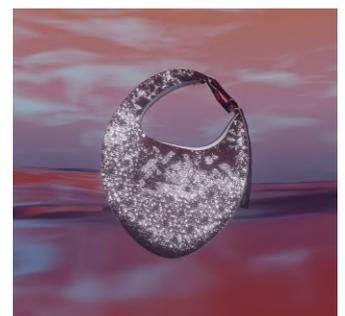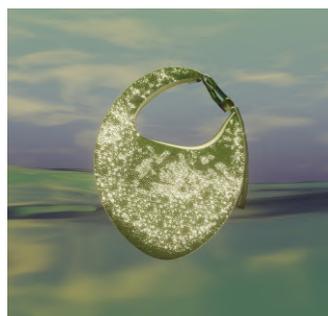
Images provided by Diverge.

streamline the design development process using photorealistic 3D images. Lastly, no stranger to technology, The Fabricant makes use of 'interactive look books' where customers can view products as 360-degree animations.

THE POTENTIAL OF IMMERSIVE EXPERIENCES IN FASHION

PERSONALISATION OF AVATARS

In new online universes that we could spend more and more of our lives in as time passes, the importance of personalised avatars wearing digital prodcuts may play a significant role. Ziqi and Yunjia Xing, founders of digital fashion brand XTENDED iDENTiTY (Xi), believe that self-expression and interoperability will be two key features when it comes to digital products and the use of avatars. "Designers have to think and design smartly," Ziqi Xing says. "People have very little attention nowadays, therefore it is essential to create in a way that will engage people." This creation extends beyond apparel and into how we look online. In their latest collection, the brand exhibits one of its pillars: to make everyone feel represented, helping minorities and the LGBTQ+ community

to find their place in the crypto world by using non-binary digital fashion as a bridge between true identity and web3. "It is important that digital designs and avatars are available on multiple platforms; to not limit them to runways but to ensure their utility in virtual meeting apps, games, and many more outlets," adds Yunjia Xing.

With the creation of photorealistic avatars using one's smartphone or tablet, it is likely we will easily be able to operate across digital platforms looking like ourselves or in a more fantastical way, should we choose. The questions around interoperability, however, are a bit more complicated because of the decentralised nature of web3.

CREATING DIGITAL SHOWROOMS

As digital products in fashion become more ubiquitous, so grows the need to adapt how they will be shown and interacted with by progressively wider audiences. Ordinarily, apparel might be shown in an atelier, a studio, or a store. Thanks to tech such as Microsoft HoloLens, it is possible to scan a room, capture the spatial information, as well as create high-quality 3D holograms. This allows designers to easily create a virtual space to showcase their clothing. With

the right software and the right avatar, this could enhance the 'try before you buy' shopping experience for consumers tenfold. In terms of environments to showcase items of clothing and accessories, the possibility to create somewhere entirely different from the inside of a room is also possible with AR and VR. Thus, alongside the practicality, the experience can be one that is unique and enlivening to whoever views it.

Before this, however, there are a few substantial challenges to be overcome. "There is a degree of education and training that must happen with the creatives that are making beautiful digital clothing. There needs to be an understanding of how designers use cutting-edge software, including its limitations" says Badrriya Henry. Henry is the founder and Managing Director of Fashion Foresight, a fashion consulting agency whose mission is to connect fashion and retail brands to the future by way of technology.

Since 2019, one of Henry's main focuses has been on VR. To this end, Semblance World was born: an online platform that mirrors the luxury lifestyle in Dubai. What started out as a project got the attention of Epic Games, who awarded Henry an Epic Mega Grant to expand her vision. "I think that is what we're lacking at the moment" she shares. "Fashion brands want to experiment but need the right space to do it in."

She goes on to explain that she has seen incredible digital garments that cannot be supported in a real-time immersive space because the polygon count is too high. In real-time environments, moving objects consist of polygons (e.g., triangles), where at each timestep a new position of each corner of the polygon must be calculated. Higher resolution means a higher number of polygons, which implies that thousands of computations must be performed. High polygon counts require high processing power, and if this is absent it can result in slow playback times or the image just not appearing altogether. Henry remains optimistic: "I think it's only you face these kind challenges when you're in the trenches, building." Building she is, as she recently announced that Semblance World is the host of an Africa Fashion Week Middle East (AFWME) showroom, the first of its kind.

As evidenced by the above, Game engines such as Epic's Unreal, Unity, and the creative toolbox provided by the Roblox Corporation have played a major role in fashion's biggest collaborations in creating spectacular environments. However, creating such environments takes an exceptional amount of skill that only bigger brands and retailers may have the resources for. There is an exception in Epic Games's Twinmotion platform: the easy-to-use, real-time 3D immersion software that can create high-quality images, and standard or 360-degree VR videos with limited experience, and with integration to existing CAD tools. With this software, it is possible for brands and retailers of all kinds to create virtual environments into which they can drop high-quality fashion-related assets to deliver real-time experiences.

FINAL THOUGHTS

As Diana Perfilieva puts it: "at this stage, we can only speculate how things will look like in the future, but I hope that immersive spaces respond to user (and customer) requests about things that are not available in the physical world. You should be able to manifest yourself in the most unexpected ways." The immersive fashion space holds vast opportunities for creativity and efficiency upstream and downstream, with the pace of change happening at a rapid rate.

Today, it seems that the focus is on the consumer, but there is much to be gained by designers who embrace immersive technologies to complement the creation of their products by building extraordinary environments to showcase them in. And while fashion has never been short of fantastical backdrops and meticulously-staged but passive lifestyle photoshoots, the trend line is now towards these being delivered in active, engaging, immersive real-time.

Images provided by Diverge.

THE ENVIRONMENTAL CASE FOR DIGITAL FASHION

OVERPRODUCTION OF PHYSICAL GOODS IS ONE OF THE KEY CONTRIBUTORS TO FASHION'S SLOW PROGRESS TOWARDS SUSTAINABILITY GOALS. CAN SHIFTING JUST A SMALL SHARE OF OUR PURCHASING POWER TO DIGITAL-ONLY PRODUCTS HELP STEM THE TIDE OF WASTE? THE TEAM BEHIND DRESSX SHARE THEIR FIRST-HAND EXPERIENCE.

OLGA CHERNYSHEVA
CHIEF SUSTAINABILITY OFFICER
DRESSX

Olga Chernsyheva is a Chief Sustainability Officer at DRESSX, the largest fashion store for digital-only collections from well-known brands and 3D designers. Olga is passionate about helping companies that create innovative solutions to restore our planet and supporting purpose-driven entrepreneurs. Before the COVID-19 outbreak, Olga spent 3 years in Central Africa, where she founded a non-profit organization to bring awareness to local communities about environmental issues and waste and plastic management.

DARIA SHAPOVALOVA
FOUNDER & CEO
DRESSX

*Prior to DRESSX, Daria established her TV-show on fashion, fashion week Mercedes-Benz Kiev Fashion Days and showroom More Dash. Called 'Kiev Fashion's Queen Bee' by Vogue UK, Daria is famous for putting Ukraine on the world's fashion map. Daria is featured in the famous **Forbes 30 Under 30 Europe** and **BOF 500 Most Influential People** lists. 15 years of experience in fashion.*

NATALIA MODENOVA
FOUNDER & COO
DRESSX

*Natalia Modenova is in the list of **Highsnobiety for TOP13 experts weigh in on Fashion NFT**, **50 disruptors of the USA by Newsweek**, **Top 50 people who shaped fashion in 2021 by Glossy**, and in **Threedium TOP50 Voices driving the conversation in AR, VR and 3D** and featured in Forbes USA, Financial Times, Vogue Business, WWD, Business of Fashion, Dazed and other media. Speaker at The Economist, Wall Street Journal, SALT, WWD, Vogue and other conferences as an expert on Metaverse, digital fashion and fashion tech.*

Coming from a 15 year background in the traditional fashion industry, we know that fashion needed a shift for a while now, signaling about it with all of its sustainability, diversity, and accessibility issues. Barclays Bank research has shown that 9% of customers in some developed countries only buy new clothes to make a picture for their social media. We genuinely share the beauty and excitement that physical fashion creates, but we believe that technology can become a solution to producing less, enhancing creativity and solving numerous problems traditional fashion has been facilitating over the years. Our big aim is to provide an endless digital closet to every person in the world for their digital presence with no boundaries to express themselves creatively. Same with the creators - 3D and fashion designers, we want to empower talents and provide them with a safe place to create and grow professionally. Metafashion provides a great opportunity for the industry to get to the next level and open new opportunities, create new markets and integrate in a digital creative economy.

With fashion cycles getting faster and the competition for lower prices increasing, brands and manufacturers require ways to work cleaner, more sustainably, and cost-efficiently. Digitalization of the fashion industry through virtual technologies like body scanning and 3D design tools, has long been considered to have a potential in optimizing the industry processes, minimizing waste, and providing sustainable instruments for fashion design and garment development.

In response to the growing demand and accelerated by the pandemic, fashion has recently made its way into full digitalization, introducing digital-only fashion - 3D visualization of the clothes which can be worn on the images and videos through various social media platforms, videogames and other online occasions. Digital fashion represents endless potential for democratizing the fashion industry, making it more affordable and available for people of diverse backgrounds, creating new revenue streams for fashion creatives and opening up the opportunities for creative self-expression.

While the concept might seem outlandish at first, gamers have been spending real money on digital fashion items for years. In 2018, Glu Mobile's 'Covet Fashion' game, which allows users to style models with digitally rendered designer clothing, generated $53.4 million. It is at this intersection between video games and digital socializing that digital fashion in its modern form will be most effective.

As people live and display more of their lives online coupled with growing concerns about sustainability, digital clothing has the potential to expand well beyond gaming. In lieu of physical events and runway shows, fashion collections made their way into the digital world. Gen Zs and young Millennials grew up in the digital era, blurring reality and fantasy, and developing key characteristics of a digital fashion customer. They evolve in a fluid digital world in which the boundaries between their physical and online lives have converged. When it comes to fashion, they not only need physical items to express themselves, but also digital clothes to dress up their virtual identities.

The possibilities digital fashion brings for creative expression are endless, making the digital fashion realm very appealing for both 3D, traditional fashion brands, design studios, and more creative outlets. Digital fashion is an opportunity to give a second life to clothes which are sometimes unsuited for being worn in our daily lives - young designers' graduate collections, some high-fashion or couture designs. While such items could be seen as too bright and expensive for our daily lives in the real world, we can look at the clothes in a completely different way in the digital space.

As with real-life garments, digital clothes vary in complexity. A physical ball gown made from silk with lots of ruffles, embroidery, lining, buttons, zips and trims will take more resources than a simple linen t-shirt. Similarly, an animated digital dress with detailed rendering and complex textures will use more digital space than a more basic shape. Designers are free to create and save as many digital versions of a garment as they wish, tweaking colors, trims, fabrics and other details as they go. Digital fashion allows designers to unleash their creativity in a real-life visualization of designs that could previously only be imagined through 2D sketches. It is clear that the world is going digital, and 3D virtualization plays a leading role in the process.

Traditional fashion brands tend to be reluctant in implementing the new approaches, but we proved that there are plenty of use cases and market opportunities, especially for the established fashion houses - from optimizing the influencer marketing campaigns to generating a revenue from the digital clothing. At DRESSX, we have worked with traditional fashion creatives since day one of our platform, launching designers whose outfits usually cost thousands of dollars for less than $50 in the digital format, or even for free in AR on the DRESSX app. We are very lucky to have more and more interest from the traditional fashion industry with popular brands reaching out to us aiming to expand and grow through the digital fashion realm. DRESSX worked on the purely digital influencer campaigns, digitizing the designer garments and promoting collections without any use of physical materials, unnecessary shipments, or damages for the environment. We also

created projects with Google, H&M, Balenciaga, Fendi, Buffalo London, Miss Sohee, created an AR fashion experience for the Paris Haute Couture designer Clara Daguin and engaged in many more initiatives successfully introducing traditional fashion brands to the digital world.

We believe that in the future every fashion brand - luxury, haute couture, streetwear etc - will own a digital fashion line, same as high-fashion luxury brands have perfumes or accessories. With its different from the physical items price point yet high precision, digital fashion will become a new way for customers to enter the high fashion world, discovering the new way to shop luxury, reducing their environmental footprint, receiving the same sense of belonging and excitement from wearing designer pieces in digital.

Image provided by DRESSX: Kodzayeva in EyeNastya.

Image provided by DRESSX: Nina Hawkins, wearing Alejandro Delgado

The production of digital garments has far less waste, energy and carbon footprint. No water or chemicals are used for the creation or usage of digital fashion, and the production of a digital garment, on average, leaves 97% less CO_2 footprint and no microplastic shedding or soil degradation, compared to the production of a physical garment. Digital fashion prevents the production of items that might only be worn once or twice, thus successfully decoupling financial growth from the extraction of raw materials. In digital garment production, the main goal is not the speed of production, but the quality. Still, the speed is much faster than the production of physical clothes, which means demand for fast fashion can be satisfied with digital-only fashion with no use of raw materials. Once the item is 3D rendered, it can be used endlessly. DRESSX research conducted in 2020 suggests that the current level of acceptance of digital garments fulfilling the need of physical clothing for content creation is 61%, meaning that respondents are ready to use the solution.

Due to the digitalization in the fashion industry, virtual design technology that can create photorealistic products to replace physical samples and a brand new digitized fashion system that refers to the replacement of production and consumption of physical garment with digital garments are coming up to reduce the environmental impacts. DRESSX did a collaboration to test this use case. This is the starting point where digital fashion becomes part of the business model. As it becomes a more important part of the supply chain, creating in 3D is going to be a future core that every brand needs to adopt.

The sustainability potential of digital fashion also cannot be stated enough. By substituting just 1% of physical clothing with digital garments, we will save 5 trillion liters of water and eliminate the annual carbon footprint of the fashion industry by 35 mln tons, which is equal to the total carbon emission of Denmark in 2017. All of this can be done by switching 1% of our wardrobes to digital! That's a contribution to our planet that everyone can handle, while still keeping fashion fun and enjoying the thrill of buying new clothes and creating amazing fashion content.

The digitally dressed marketing campaign was done to promote a new, innovative and sustainable way to conduct business for the fashion industry. By going digital we were able to save 346 698 liters of water, that is enough for 20 people to drink for 24 years. We also saved 2515 kg CO_2 eq, which accounts for 97.86% of CO_2 emissions produced by a similar campaign in the physical space and equals 29 years of using a smartphone for 10 hours a day.

Any fashion brand, no matter what part it plays, will benefit from the sustainability gains of transitioning to digital activities. Digital fashion not only creates an industry that's less wasteful and less environmentally impactful than ever before, it builds a future of fashion that's smarter, more resilient, and better placed to manage uncertainty.

The transformation of traditional fashion into its metaverse counterpart, which we call 'metafashion', happened and continues to happen very naturally, supporting the overall change in how we live and explore the world around us. Digital assets were in place in gaming for a while, but the game is actually changing as we become "the avatars of ourselves" in the multiple social media channels, messaging and streaming services. Digital fashion is designed to dress our digital selves. People from tech and gaming backgrounds get it fast and a mass audience is starting to actively follow - this is a common pattern when innovative products are launched. Wearables are the most natural extension of the metaverse and the most important pillar of the metaverse economy.

Creating a true metaverse will also unlock the full potential of digital fashion. The metaverse will allow users to digitally recreate their wardrobe, and wear personal items within new and existing social contexts and platforms. The main challenge in creating a true metaverse is universal cross-platform compatibility. Once this is achieved, on-chain digital fashion items collected on one platform, will be available to the collector on all platforms, allowing users to wear their wardrobe across the entire metaverse.

Thanks to NFTs, digital fashion now comes with provable ownership and scarcity. Digital fashion items registered on the blockchain are an investment. Each has provable ownership and rarity, and can therefore be attributed economic value. NFTs provide the next layer to the industry, maximizing its opportunities, solving some of its issues and opening up the new realms for self expression and creativity. We compare NFTs to high fashion or Haute Couture, because it provides a sense of belonging, scarcity effect and a luxury feel, which would not be otherwise achieved in the digital world. DRESSX is the first digital fashion company to provide dressing utility for the NFT assets both on photos and videos in AR, with more wearable use cases to be announced with the launch of DRESSX NFT marketplace nft.dressx.com - the ultimate destination for discovering, buying, re-selling and, most important, wearing NFTs.

Within this metaversal context, digital clothing will accrue economic and sentimental value as it accompanies us on our adventures, and users will be able to invest in fashion items designed and worn by their favorite creatives and cultural innovators. Transparent ownership gives digital fashion items the capacity to become heirlooms; documenting metaverse history and cultural milestones.

Image provided by DRESSX: PAX.
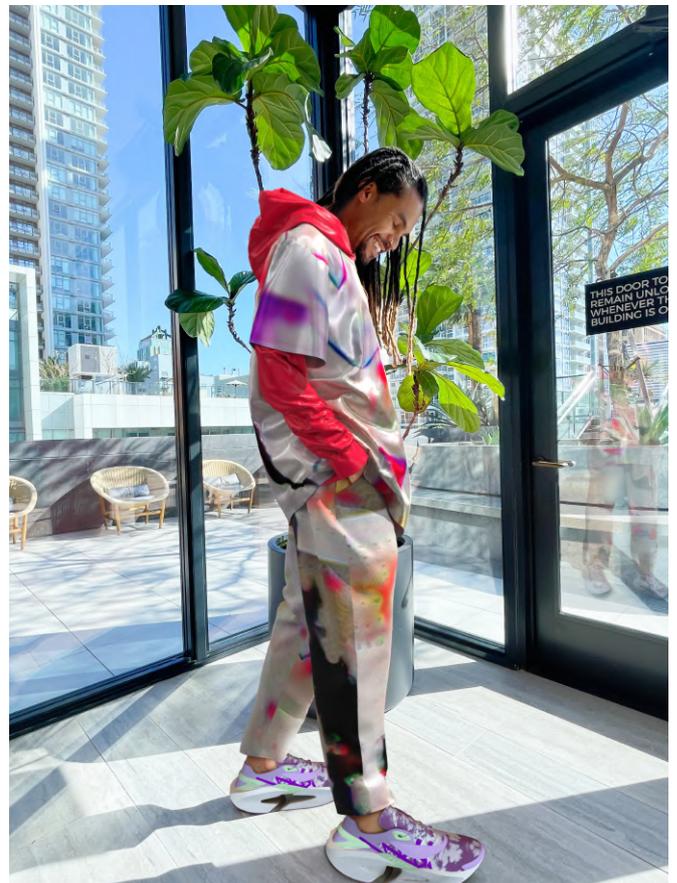
Image provided by DRESSX: PAX, in Yoona & ISDKV.

GENERATIVE AI IS HERE.
NOW WHERE IS IT GOING?

IN RECORD TIME, A TRANCHE OF TECHNOLOGY HAS MATURED ENOUGH TO CHALLENGE THE CORE PRINCIPLES OF COPYRIGHT AND THE ESSENCE OF HUMAN CREATIVITY AT THE SAME TIME. HOW DID GENERATIVE AI CREATE SO MUCH UPHEAVAL SO QUICKLY? AND IS IT GOING TO CHANGE ANYTHING FUNDAMENTAL ABOUT HOW DIGITAL WORKFLOWS OPERATE IN FASHION?

Made with Midjourney, DALL-E 2, and other AI tools

BEN HANSON
EDITOR-IN-CHIEF
THE INTERLINE

Ben Hanson is the Editor-in-Chief of The Interline - a technology publication for fashion professionals, written by industry experts, and read by brands, retailers, and supply chain businesses around the world. Day to day, he leads a growing, multinational team to address the most pressing challenges affecting the fashion industry's fast-moving digital transformation. From supply chain transparency to digital fashion, The Interline tackles major industry questions through a technology lens.

Every original pixel in the images accompanying these pages was made by AI. The products they depict don't exist, but the datasets used to train those AIs probably included real, IP-protected products in a way that's impossible to unpick.

Take the sneakers, for example. Do they incorporate elements that you recognise from one or more real brands? If so, that might be because the machine learning models that created them ingested key characteristics from existing footwear (i.e. real product photography or renders gleaned from web scraping) as part of their training.

The immediate reaction: how big of a problem is that, ethically and legally speaking, and should (or can) anything be done about it? The deeper question: what implications do accessible generative AI models have for an industry where creativity and originality are everything?

Before we get too far into that quagmire, though, what exactly is generative AI?

In its most barebones form, it's a specialised deep learning model that has been fed a large corpus of data, and then encouraged to create novel, acceptable results through a cycle of generation (raw output) and automated and manual discrimination (testing those raw outputs against a desired outcome, and eliminating the ones that don't pass muster).

When that training process is complete, you're hopefully left with a model you can prompt to produce something new in its narrow, specialised field, and you will receive a result that is believable or useful as an example of a deliverable in that field. The AI has generated something new, hence the label "generative".

In real-world applications, it's primarily an open text field you input a request into, and moments later you receive a result that makes you stop, think, and question how this all came so far, so *fast*. And this is a feeling a lot of people have had over the last twelve months or so, as generative AI made a major splash in the visual arts.

From the simple ("*a painting of a tree against a blue sky*") to the hyper-specific, ("*oak tree + [matte blue background] + [fine natural realistic textures, photorealistic, ambient occlusion, cinematic light, ray tracing, 4k, Octane, redshift, Colour Grading]*") plain text inputs are now being translated into incredible-looking images across a broad spectrum of artistic and photoreal styles by engines like DALL-E 2, Midjourney, and Stable Diffusion, in huge volumes every day. (The same approach is also being taken to text, voice, animation and more, but for the purposes of this article I'm focusing on static images.)

The odds are good that you've heard of at least one of these generative services, since they broke into the headlines numerous times in 2022 by winning art contests (undisclosed), or appearing at the heart of landmark copyright debates.

And if you haven't yet had the opportunity to experiment with using an AI service to generate images for yourself, the barrier to entry has never been lower. In addition to Midjourney and DALL-E exiting their invite-only phases and becoming open to the general public – for a fee, as cloud services – the Stable Diffusion model has been publicly released and packaged to run on consumer hardware.

If that still sounds like too much uncharted territory, Microsoft will happily put you on the waitlist for their turnkey Designer service (which has a generative component that runs on DALL-E 2), and popular creative platform Canva have already rolled out a similar service to their paying users (running on Stable Diffusion).

Suffice it to say that, despite only being truly released from it this year, this is not a genie that will be going back in the bottle. AI-generated visual content is here to stay, and it's something that fashion will need to reckon with sooner rather than later.

But several unanswered questions hang over the promise of anyone, anywhere being able to bring their creative fashion ideas to life by simply typing them. First, just how easy is it to get good results using AI? And second, who does the output actually belong to? Do they remain your creative ideas – or mine – if a generative model designed them with minimal human intervention, and used potentially copyrighted works from other creatives in the process?

The first question is comparatively simple to answer. Unless you get lucky, it is not especially easy to get amazing results from an AI – even with the release of "v4" of Midjourney. The images that appear in news stories about the threat posed by AI art are very carefully selected from top-rated community works; they do not show the many, many dead-ends that the prompter and the model hit along the way. And while rare images do pass detailed scrutiny as being "real", it's still a routine occurrence to find parts of the whole that do not fit: hands with too many fingers, architectural lines that lead to nowhere, or facial characteristics that fall into the uncanny valley.

Like art created using traditional tools, the final output often fails to tell the story of the failures that occurred along the way.

So can you expect to sign into Midjourney and start instantly generating brilliant, cohesive, internally-consistent designs for apparel, footwear, or accessories? You might, but the odds are against you. The likelihood is that you will need to put in work.

How much work? It will vary depending on your objective. If you're looking to create quick inspirations to then take into a traditional concept process, the right output could come fairly quickly. If, as we tried to do with these images, your aim is to create artificial product photography of a collection of non-existent products that are believable at-a-glance, you can expect to spent much longer. And the chances are that you will need to employ the services of several different AIs.

Our workflow for each of these images was the same. The products themselves were created by Midjourney, using the version 4 modifier and a granular set of inputs that were adjusted over hundreds of requests. Those square images were then exported and taken into DALL-E 2, where the canvas was broadened using AI-outpainting to extend the environments, again with tens or hundreds of generations per finished image. The final composition was then tidied up using more run-of-the-mill machine learning in a popular photo editing package to inpaint errors and fix visible seams and colour joins, before colour grading and lighting were tweaked by hand.
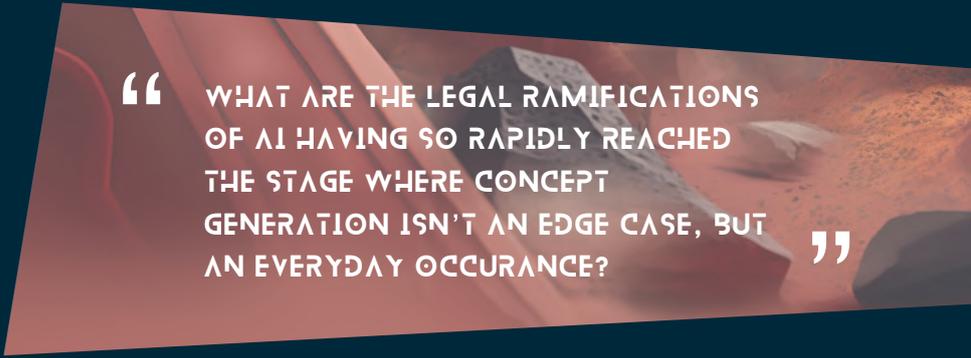
> " WHAT ARE THE LEGAL RAMIFICATIONS OF AI HAVING SO RAPIDLY REACHED THE STAGE WHERE CONCEPT GENERATION ISN'T AN EDGE CASE, BUT AN EVERYDAY OCCURANCE? "

I would not describe the final results as fully believable, but these specific images emerged as the best outputs from our experiment because they most closely resembled real products that look as though they could be manufactured and worn, and they came the closest to fitting a consistent aesthetic. And although it took a meandering road and multiple different solutions to get there, that's not so different to the circuitous route that a lot of 3D assets take to reach the end user, from geometry to texturing to staging and rendering. The fashion industry is already accustomed to using many different tools to get the job done.

But even though the amount of time and effort involved is sometimes quite a bit more than AI art's reputation would have you believe, the stark fact remains that it's eminently possible to ask one or more AIs to design and present footwear and apparel concepts for you, and to stage them in environments and settings it would be cost and time-prohibitive to achieve any other way. And provided you're comfortable committing the time to learn how best to wrangle those models to produce the desired output, you will eventually get results you can use for concepting, building mood boards, inspiring material choices, innovating on existing designs, and much more.

So what about the second question? What are the legal ramifications of AI having so rapidly reach the stage where this kind of concept generation is not just a feasible edge case, but an everyday occurrence?

To be clear: this is probably the most potent example of technology outpacing regulations and expectations to have occurred in my lifetime. I wrote a piece last autumn about the various ways that various types of bias (conscious and unconscious) become ingrained in artificial intelligence models. And although I was dissecting the broad swathe of ethical and philosophical problems that come from blithe adoption of AI, back then it hadn't even occurred to me that an AI could be quickly taught to clone a commercial artist's entire style. Now that's reality.

This is how fast things are moving.

Are brand design languages all that different from other creative fingerprints? Is it wild to consider that model could be trained, in very short order, to create genuinely believable new footwear or apparel in a particular brand's style? Not that long ago it would have been. Today? Definitely not. In fact it's likely to be only a matter of time.

And while any physical products that emerge from this kind of genesis will eventually be tamped down by traditional anti-counterfeiting and brand protection tools, we also (not coincidentally) happen to be entering an era where brands are working to sell virtual creations and to engage independent designers and creators to build communities around those assets. How long until AI design works its way into that ecosystem? And once it has, how quickly will it change things, and how hard will it be to excise? Based on what's taking place in the art community, the answers are fast and impossible, respectively.

These are hypothetical (if likely) examples, of course, but they raise a common concern: that nobody really knows who owns the output of AI art services, and that neither legislative bodies nor society at large have had the time to consider the possibilities before being confronted by them.

Tellingly, AI art services themselves are largely ducking the issue. Canva currently suggest that this is "an open question" with "no easy answer". And Midjourney – which pools every image created using its model into a community category for searching, remixing and re-use – has established an enterprise pricing bracket that gives corporates the chance to exclude their generated images from that pool, effectively giving those top-tier subscriptions a way to sidestep the issue by not having to reveal that their images were made by AI at all.

In the medium term, things are likely to become even more complex. The landmark copyright case I mentioned earlier is now being walked back and qualified, with the potential outcomes being that artists making use of generative AI in their works may have to disclose that fact, as well as needing to prove a "degree of human authorship" in order to exercise their right to claim ownership.

Quite where the line between majority-human work and majority-AI work will be drawn is difficult to predict, and could potentially stray into areas where machine learning has been accepted (such as retouching photos). Is human authorship implied by a long, iterative cycle of crafting of text prompts? Is AI authorship guaranteed if the first prompt is effective enough that a further set isn't required? If the person creating the prompts takes the results and uses more well-established machine learning tools, like inpainting, to improve the final image, does that threaten their claim to own the final output?

With all that uncertainty looming, it certainly seems as though the sensible approach for any brand would be to wait and see how the legal situation develops, but turning away from AI entirely also means shutting the door on some genuine behind-the-scenes use cases. A lot of creative time is spent on moods, concepts, and ideas, and AI excels at rapidly generating all of these things. And as dramatic as the power of ideating and experimenting in 3D can be (hence this publication) it still requires training, time, and knowledge to an extent that prompting an AI just doesn't. For quick visualisation of a fully-staged, entirely novel idea that can then be either taken up as inspiration for product design and development the same way a concept board would be, there is very little that can match the speed and unbridled generative scope of AI.

Practically speaking, brands are unlikely to want to continue to use off-the-shelf, general solutions like Midjourney for long, but the same principles and the same machine learning models could be trained on a much narrow set of brand-specific data to ensure that the results they generate are on-model more often than not.

Overall, then, how big of a deal do we think generative AI is going to be for fashion? Big enough that we let it design this inaugural report's front cover (although we went with a more abstract result, for obvious reasons) and big enough that I would not be at all surprised to see creative designers, merchandisers, and other job roles adding it into their workflows by the time we next produce one of these reports.

In the slightly longer term, there is also a strong chance that generative AI could become an integral COG in the overall DPC ecosystem, even if it doesn't generate useable digital assets itself. The same way that companies have trusted in

the optimisation algorithms that power automated nesting and improve their material yields, they could soon place the same degree of trust in generative AI as a way to kickstart the creative process and complement workflows that were previously manually-intensive.

It feels almost naive to talk about generative AI in this way, though. Platforms and solutions that make use of it are certainly going to land in brands' and retailers' digital product creation toolkits, but compartmentalising the whole spectrum of possibilities ignores the fact that we're currently living through a genuine tectonic shift in where the burden of effort and invention lies between person and machine.

In the past, I think a lot of the hand-wringing around whether AI is going to devalue human craft and creativity has been overblown. I don't feel that way about generative AI. And there remains an open question, for me, as to whether it's likely to turn creativity into a commodity in a destructive way, or put power in the hands of people who have ideas but not necessarily the manual skills to realise them.

Either way, though, the intelligent bet right here, right now, is to figure out how to incorporate generative AI into both your personal toolset and your brand's digital-native workflow before it finds its seat at the table some other way. Because if the latter happens, it's going to flip the table much faster than any of us are ready for.

DISCLAIMER: For the avoidance of doubt, The Interline makes no claim of ownership to the images contained in these pages. They were created using Midjourney and DALL-E2 from extensive prompting and re-working, and are subject to the same uncertainty that governs all AI-generated creative works at this point in time.

DOES DIGITAL TRULY EQUAL SUSTAINABLE?

WORKING IN 3D CAN SHORTEN THE DEVELOPMENT CYCLE OF PRODUCTS DRAMATICALLY. AND DIGITAL-ONLY FASHION COULD SIDESTEP THE INDUSTRY'S LEGACY OF OVERPRODUCTION. BUT DOES DIGITAL WORKING AUTOMATICALLY EQUATE TO SUSTAINABLE WORKING? AND IS DIGITAL-ONLY FASHION CREATING A FALSE PERCEPTION OF WHAT COMPREHENSIVE DPC SHOULD REALLY MEAN?

RAHUL VERMA
CO-FOUNDER
NOFORM

Image provided by NOFORM

Much has been said about 3D or digital fashion and how beneficial it could be for fashion's sustainability profile. This article, however, presents some counter-arguments and debates around why digital does not always equate to sustainability, and why digital products, digital fashion, and metaverse applications will not magically make the fashion industry's notorious practices sustainable by default.

First, there is no doubt that digital product creation is a catalyst in accelerating the process toward a sustainable fashion industry, but just the adoption of digital technologies alone will not solve the industry's mammoth problem with overproduction, waste, and questionable environmental and ethical practices. It remedies a segment of the value chain only, and the core benefits of digital product creation do not cover the full spectrum of sustainability.

By definition, sustainability and its values stand on three pillars: people, planet, and profit, or society, environment, and economy. They are interconnected, and one cannot sustain without the other. Each must prosper to make a system fully sustainable. The problem is that we often fall short of measuring sustainability against all three pillars. As a result, our insight is incomplete, barely scratches the surface, and portrays a false yet somewhat convincing image. We often fail to consider this very complex system's human and ethical aspects. To put this in perspective, technology could fully digitalise the inner workings of a

business, but that business could still remain unsustainable. For example, the physical product may be of low quality and made of toxic materials, the workers may still be underpaid and employed in poor working conditions, and the final product produced in wasteful quantities.

Digital product creation may have shortened the development calendar for brands, and with visible results, but did it bring a measurable change to other elements across the chain? The answer is no, so who is benefiting from these noble technologies?

In parallel, the digital-only narrative is currently being sold as a version of, if not a solution to sustainable fashion, since it has no tangible products and therefore must be sustainable by definition. While these are relevant conversations in the wake of Web3, it is still early to decide when and how digital fashion can be positively meaningful for all the stakeholders who make this 1.5 trillion U.S. dollar industry, especially when the majority of those stakeholders are heavily invested in the design, production, and consumption of physical goods. What if intangible fashion is actually diverting our attention and much-needed resources from more pressing issues IRL? The truth is: digital-only fashion does not come without its challenges. Case in point: high energy consumption and carbon footprints in NFT and blockchain activities. Therefore, such provocative narratives like 'Haute Couture Is Moving From Paris To The Metaverse' and 'Digital Fashion Is The

Future Of Fashion', are potentially creating a new void for, in a way, new pollution we don't fully understand the consequences of - at the same time as drawing attention away from the areas of the supply chain where it's sorely needed.

At the moment, though, digital-only, Snapchat filter-like clothing is what people think of when they hear about digital fashion. Not everyone has an understanding of the use of 3D technology for product design and development and the impact it has on the business, even though the same tools and processes are utilized in both cases. The lack of attention is easily attributable to social media, its enticing imagery, and the hype it has created. The glossy idea of digital fashion has quickly come to dominate the conversation.

This generalized definition of 'digital fashion,' along with the virality of social media has led Chief Strategy / Digital Officers of some brands to overlook the more foundational power of 3D technology, which otherwise could have been a core value proposition for the three pillars I began this article with.

3D IS AN INVESTMENT

3D modeling (for fashion) is tedious work. It requires years of practice and solid knowledge of patternmaking, draping, garment construction, and textiles, which is still a rare combination of skill sets to find. Digital craftsmanship is as unique as any other skill in the industry.

But due to a lack of practical knowledge, uninformed and therefore unrealistic expectations of 3D, from my experience, decision-makers often underestimate the required efforts. And the over-exposure of aesthetics-first digital fashion is perpetuating this misconception that digitising fashion will be a quick or easy process.

Another aspect is the software and hardware needed for digital product creation – these are state-of-the-art machines, and, needless to say, they do not come cheap. A high-performing computer system capable of real-time simulation and rendering can cost a fortune. And with consistent development in CG technology, you are expected to upgrade regularly, like any other personal gadget.

One of the biggest myths I have come across is that a digital product can be made relatively easily and quickly because intelligent computers and software do most of the work. And it is unlike any other skill in fashion, such as tailoring, where the value comes solely from the knowledge and experience of the tailor and not necessarily from the tools they may use. This is wildly untrue.

Until the programs are smart enough to automate and create digital products from measurements and other pre-defined data, the need for digital craftsmanship led by, in a way, digital tailors and digital patternmakers, who are real people with valuable skillsets, will persist.

THE DIGITAL PRODUCT TALENT POOL

The high development cost of digital products is evident. But so is the talent. As I mentioned in the previous section, digital craftsmanship is a unique, yet highly sought-after combination of skills. That means one thing - hiring and training are of paramount importance.

As the skills are hard to find (and sometimes afford), brands have started outsourcing 3D models in bulk from low-income countries and the place of manufacturing - for the same reasons physical garments are not feasible to produce locally and are rather outsourced. Often these are the same factories that manufacture physical clothes. So, if a brand or supplier has questionable practices, this also translates into digital product creation.

Outsourcing digital products (or any other digital service) is also more accessible as it comes with fewer nuances and regulations to adhere to. And one may only wonder if digital fashion is now following in the footsteps of fast fashion.

'DIGITAL' - ANOTHER WORD FOR FURTHER GREENWASHING?

As I have established, sustainability has to do with practices and values. Technology, in turn, has to do with tools. Therefore, technology is not sustainable by itself - it is how we use it. But we all know this is not how 'digital' is branded. While digital design and 3D simulation have been viable for longer, the fashion industry wasn't discussing 3D, digital or virtual as being intertwined in every aspect of the business until five years ago. Yet suddenly, DPC has become a conversation starter, an anchor, and even a sustainability measure. I, therefore, find it problematic when brands use the word 'sustainability' loosely and especially when they measure it against time and money saving only in digital product creation. I believe there should be clearer lines between sustainability practices and technology - the latter, as I said, is not sustainable on its own and does not improve the processes at the core.

Similarly, it isn't easy to believe that the metaverse is not just another commercial opportunity to create a new market and appeal to younger demographics. As exciting as the virtual world may be, it does not present itself as a solution to any existing issues the industry faces. Or to put it another way, turning our attention to a new world is not going to help address the problems in the world we have.

CAN THE FUTURE OF DPC PUT SUSTAINABILITY AT ITS CORE?

In partnership with software companies, brands have already started onboarding manufacturers of raw materials that go into physical products. This means digitizing and creating digital twins of not only fabrics but also interlinings, labels, zippers, and other trims. I think it is safe to say that in the future, all the components of a product will be conceived digitally first, much like how the product itself is developed today before bringing it to the market. And if we move forward in the value chain, brands can use digital products for e-commerce, virtual showrooms, AR-based digital fitting, and of course, they can be consumed as digital-only goods in the metaverse. In some cases, it is already taking place, but we are far from an industry-wide adoption.

By tracing its steps back and forth in the value chain, digital product creation would broaden its scope and purpose and position itself as an end-to-end solution - a way of creating, defining, and making extensive up and downstream use of a single digital asset. Much like us through social media, every material and product could, in the near future, will have a virtual identity. And in this light, one can also argue that we need to have a similar conversation focused on the ethics of and stricter legislation for digital product creation. We must treat digital products with the same integrity as physical ones, whether created as a digital twin of a physical product or for digital-only consumption.

For example, traceability can apply to both - physical and digital products, and the lifecycle of a digital twin and its physical counterpart may not be different or even separable. There could be ways to trace back to the origin of a digital product, much like what digital passports, QR codes, or RFID technology do for physical products. Digital products could also bear mandatory labels with information such as size, composition, care instructions, and place of origin.

The mindset that 3D or digital products can be made quickly and cheaply is often justified because, for many brands, 3D is a tool for in-between processes and for making small decisions only. It does not bear the same gravity as the final retail product does. If brands look at digital product creation as an end-to-end solution, it will maximize its value and justify a fair cost and time for development. Unlike physical products, which are sold once and entail only one transaction between the brand and the consumer, digital products can be leveraged at different stages in the value chain for more bang for your buck.

KEY TAKEAWAYS

The potential of 3D technology and digital products for fashion is now widely accepted. There is no doubt that more businesses will adopt digital product creation, and more consumers will purchase both physical and digital products in the future. But this new digital economy cannot be allowed to perpetuate fashion's existing practices and systems.

Digital is currently being heralded as the savior of the fashion industry and the path to sustainability. I am not claiming it is not true, but it will make a positive impact on the industry only if digitisation is done right, from the grassroots level up. As the world faces a looming recession and the existential threat from climate change, it cannot be another missed opportunity for the fashion industry to make meaningful advancements toward a world where sustainability, transparency, and social justice are not merely theoretical concepts.

TO SUCCEED IN DPC, DITCH THE BUSINESS CASE AND MAKE THE PERSONAL CASE

DIGITAL PRODUCT CREATION MEANS NEW OPPORTUNITIES, NEW EFFICIENCIES, AND HEIGHTENED PROFITABILITY AND CREATIVITY. BUT COULD THE MAJOR BENEFITS BE TO THE EVERYDAY LIVES OF THE PEOPLE USING IT?

LIZA AMLANI
PRINCIPAL & CO-FOUNDER
RETAIL STRATEGY GROUP

Liza Amlani is the go-to expert in retail merchandising, product creation, and accelerating speed to market. She is the Principal of Retail Strategy Group: a consulting practice helping brands and retailers dramatically improve profitability and increase organizational effectiveness. Liza brings a wealth of global insights to clients having lived in North America, Europe, and Africa. She has in-depth product creation experience from her 20+ years in retail. Her claim to fame is that she designed all the bags for FIFA World Cup 2002.

RAJ DHIMAN
CO-FOUNDER & RAINMAKER
RETAIL STRATEGY GROUP

Raj Dhiman PhD is the Chief Rainmaker and Co-Founder at Retail Strategy Group. He is an expert in tech sales having sold software for over seven years. He is a respected sales coach and has elevated the performance of hundreds of sales professionals. Before his selling career, Raj completed his doctoral research at the University of Toronto. His research produced three peer-reviewed articles which bear his name. Also, an accomplished speaker and former actor, he speaks to audiences about how brands can improve profitability.

Imagine our surprise.

Sitting on Zoom with product creation leaders of a leading brand. Asking them what is the most pressing issue they face right now as they look to change the way they create product and go to market.

Perhaps they will say supply chain issues or inflation. Maybe they have too many SKUs or can't keep pace with changes in customer behavior.

It was none of the above.

"The mental health of our teams."

We didn't anticipate that answer and it led to our own epiphany - brands changing the way they create product is not propelled with just a business case. It's propelled by people and what they personally stand to gain from that change.

In other words, there is a personal case for change to be made, not just a business one.

With digital product creation (DPC), success should, therefore, not be judged solely on how effectively the initiative was able to reduce samples or automation. It's about helping teams evolve and enabling people to do their best work.

Yet, current mindsets and behaviours of people are significant barriers to this degree of digital change. And companies acknowledge that scaling DPC is limited more by existing process, culture, and beliefs than by the limitations of technology. Moreover, as new technologies are introduced, research has shown that people have a natural tendency to resist.

As a result, digital transformation requires an understanding of current mindsets and behaviours, as well as a forward-looking view of more effective ones, and an understanding how they will benefit the people creating product.

Here are three common mantras that govern analogue product creation today:

1. Unacceptable Equality - Picture a basic, black t-shirt, and next to it, a complex technical jacket. Immediately, you notice these are not the same. The fit, feel and function are different. Also, their supply chains, testing requirements, and design process. Different. In contrast, these products are identical in the product creation calendar. Start/stop dates, the extent of physical sampling, and who is involved at key development moments. These are very much the same.

2. No Sample. No Sale - Some retail buyers have a baffling habit. They often refuse to attend vendor appointments if the collection is not physically sampled. Unless they touch and feel product, merchants do not trust their decision making. Buyers ascend in their careers, clinging to the need for physical samples. This explains why this mentality exists in major brands, at the highest levels.

3. Providers, Not Partners - In current organisational structures, functions like materials are in complete service to design. Moreover, design operates without limitations on development requests. Material teams are reactive to design requests and this has a domino effect across product creation. Further, material teams are not always part of key milestone moments.

These mantras have measurable negative impacts on the people at the heart of product creation:

- Teams work in a reactive manner, forcing deadlines to be pushed out.

- Unnecessary physical development wastes effort and resources.

- Priority areas that need attention do not receive it.

- Hindered speed to market.

- People burn out.

In this context, should we be surprised at the difficulties brands are encountering in scaling DPC? People have enough on their plates to begin with! And these are exactly the reasons why people will get on board with change. If DPC can address these personal and systemic issues, then there is an opportunity for success.

Once the old mantras and their impacts are identified, strategic and tactical changes are needed to bring in the new.

Based on our work, here is what we find effective.

To start, create deliberate inequality in the product assortment. Define the product mix under categories such as Seasonless/Core, Refreshed, and Newness. Then, build the calendar upon the theme of flexibility. Teams need the flexibility to adjust their approach depending on the product category. Then, determine the start/stop moments in the

calendar for each category. Finally, determine the extent of physical sampling needed; assign the rest of the sampling to digital methods.

For example, innovative products are found in the Newness category. As such, there will be fit and testing requirements. Physical samples are critical throughout the process. Thus, teams will need to start creating very early in the calendar. The Seasonless/Core category is the opposite; creation starts later in the calendar leveraging digital sampling.

Teams can then learn how to make approvals without physical samples, and do so with confidence. The decision-making process involves studying proven attributes of similar styles, prototypes, and swatches. Then, layer in sales data and customer insights to make an informed approval.

Next, for each category, determine the cadence and attendance of key alignment meetings. We call this "Product/Strategy Alignment." The key is to ensure that only the necessary teams are present for a meeting. For example, a meeting for a Seasonless/Core item doesn't need input from costing or sourcing.

The intention is to prevent the build-up of unnecessary "busy work." Also, this is where limitations on design are activated. Enforcing limitations is accomplished by establishing a pre-approved, digital library of materials. Then, design is only allowed to design into the library. This increases deadline adherence and cuts excess developments. With design limitations, material teams see their role evolves from provider to partner. They are now involved in key alignment meetings to offer input and drive creation.

The benefits of these changes for the business are simple and impactful. Accelerating speed to market and reducing development costs, for example. The more profound benefit, however, is found at the personal level with members of the team.

People work proactively instead of reactively, dramatically reducing stress. They carry out fewer tasks but get more things done. Teams work on cutting-edge innovative products and feel a stronger connection to the brand. These are the forces that will drive digital change as brands adopt and scale DPC. After all, people don't create product intending to deliver marginal results or be unhappy. They want to feel as if their work serves a higher purpose.

Even Ralph Lauren once said "I don't design clothes. I design dreams."

Today, perhaps, he'd do it digitally.

MOVING FROM 3D TO A NEW DIGITAL PRODUCT CREATION ECOSYSTEM

FOR FASHION TO TRULY SCALE ITS DIGITAL PRODUCT CREATION AMIBITIONS, THE INDUSTRY MUST SWITCH FROM THINKING ABOUT 3D AS SOMETHING TO BUY INTO, TO RECOGNISING THAT THE FULL POTENTIAL OF DPC REQUIRES A DEEPER COMMITMENT.

MARK HARROP
FOUNDER & CEO, WHICHPLM
BOARD ADVISOR, THE INTERLINE

As a technology advisor to the fashion industry, Mark has worked for more than four decades to help the world's best known retailers, brands and manufacturers achieve efficiency savings across their entire supply chain through informed technology investments.

As an industry that's been completely physical for centuries, moving fashion successfully into digital product creation (DPC) will not be a quick or easy task. It's not just a matter of a business deciding that it's going to design digitally, followed by demonstrations of 3D authoring systems and simulation environments, followed by selecting a vendor, and then deploying the 3D system and calling it a day. It's fair to say that this was the general approach over the last twenty years, when 3D was in its infancy, but today, as more and more brands begin to think more holistically about what it means to create products digitally, this is only a small part of a much bigger picture.

For one thing, the technology landscape is more complex. Buying into 3D is no longer a matter of connecting a couple of technologies – i.e. a material scanner and a 3D authoring tool). Things have matured considerably over the last twenty years and today the technology landscape is made up of a larger group of processes, solutions and even services that together make up a much-extended 3D ecosystem – hence the change in name from purely "3D" to the more all-encompassing "DPC," which is a re-prioritisation and re-scoping task that many brands are now beginning to reckon with.

*This feature originally appeared on The Interline in summer 2022.

That technology evolution has picked up a much higher pace in recent years, driven by bidirectional integrations between interrelated solutions, and catalysed even further by the pandemic. In place of just one or two isolated solutions, the typical DPC technology stack now takes in a raft of different products, environments, and tools that collectively support a much broader process scope: designing, developing, prototyping, and verifying numerous product types within virtual and collaborative environments.

The many use cases, opportunities, and the value created by a 'mature' DPC ecosystem operating across the value-chain can be significant, and they can vastly exceed the ROI potential of the narrower 3D strategies of the past. But the fact is that scaling and maturing to meet these new possibilities is not easy, and many businesses fail in their pursuit of what they thought was a simple switch over from working in 2D to working in 3D.

Today we have the pleasure to work with many of the world's leading fashion businesses on multiple projects, some of which include precisely this transition from 3D to DPC. It's important to realise, though, that the brands that are the furthest ahead in this area may be already well into their second decade of digital design. These are not companies that are new to 3D or digital product creation; they are the businesses that have invested heavily for years, and that continue to look over the technology horizon for new opportunities to expand. The difficulty comes when brands, retailers, and manufacturers (there is, after all, a great deal of 3D expertise in the supply chain today) who are new to 3D see the results that those early adopters have realised, and believe they can hit a similar target in a much shorter span of time.

Unfortunately there is no shortcut to scale, and scale is, frankly, the major challenge facing any fashion business wishing to embrace DPC in a comprehensive, enterprise-wide way.

We are often asked how businesses can scale DPC to support multiple use-cases both downstream toward e-commerce, and upstream to development and manufacturing. Extending the value of digital assets in both directions should, after all, be the ultimate objective – increasing the usage of digital assets in consumer-facing scenarios, targeting digital fashion business models, and matching digital twins to the physical counterparts that must eventually be produced.

The fact is that there is no easy answer to this question. In our experience, it's more a matter of knowing what it is that each individual business wants to achieve, by adopting and maturing DPC. Once they understand their objectives, they can then start to develop a plan on how to reach their journey's end. In our experience, the main goals of DPC (and one that is often missed by brands that see "3D" as a quick fix) is for companies to 'accept change' and to adapt their business strategy, solution modelling, and processes linked to new market realities. As I've mentioned, change and opportunity are everywhere, up and downstream, and a comprehensive digital product creation strategy can be the key to unlocking the right mindset to overcome challenges and seize new possibilities.

With that in mind, if your organisation is weighing up the jump to working in 3D, or looking to scale what was, pre-COVID, a small-scale or single-category pilot, it's important to be prepared for your DPC journey, rather than diving into the deep end and assuming that buying some licences to a 3D authoring tool and upskilling or hiring in 3D designers will get you there.

We have seen businesses – more than I care to mention – go down this road, only to find that the "3D project" is not able to deliver against perceived business expectations, or worse still it's quickly been classified as a failure by the management team. It's very rare in these scenarios that 3D technology itself is to blame; instead the issue is cultural, and it originates from a tendency to frame DPC as being an easy target to hit, when in fact that label captures a host of different targets that need to be hit at almost every stage of the value chain.

Our recommendation, then, is that businesses should start by focusing on the low hanging fruit (the easier wins of DPC) and build the capabilities to become more mature, and productive (set realistic expectations, project phasing and milestone deliverables) over a reasonable time. Implementing a DPC strategy, and building out the related ecosystem processes and solutions, is something that has to be done right to deliver the desired positive outcomes.
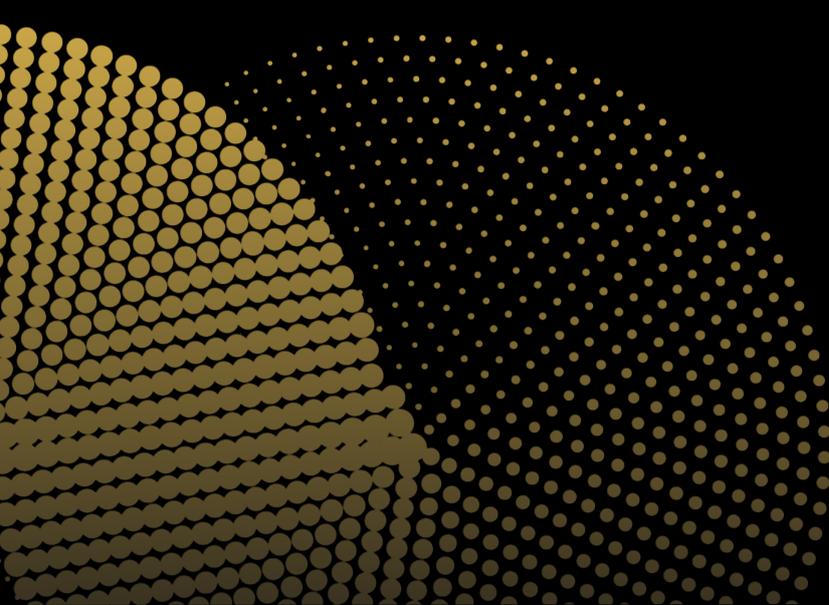
Often businesses try to implement DPC with a limited technology stack (scanner, 3D authoring tool) that is simply incapable of delivering the desired throughputs, efficiencies, qualities, and without thinking about the long-term goals, or aligning themselves with the primary strategy.

Today, we come across many businesses that are still stuck in what we call the experimental stage when it comes to DPC, rather than DPC becoming an efficient set of interoperable solutions, sharing data and processes that have been optimised and can operate seamlessly and efficiently within the DPC-ecosystem. Similarly, we also find that where 3D initiatives have been successful, their results have been focused in a single product category, a single division, or as part of an initial pilot – something that they then find difficult, if not possible, to scale to the volumes that the business requires so that they can create both the virtual and physical garments/footwear/accessories/hardware product collections, each with the targeted levels of output to support the physical collection workflows.

Only when businesses can get to these higher levels of virtual product output, will they be able to enable both a physical and virtual collection, that can be used in both the downstream (e-commerce and metaverse applications are the obvious use cases here), and within the upstream (virtual design, development, bill of materials, bill of labour, environmental impact measurement, and sustainability, to mention just a few of the supporting use-cases).

To put things into context, it can take a trained 3D design artist half a day to tackle the following tasks:

- test the physical materials

- scan them and put them into repeat

- manage the colour process

- select the block

- create the pattern styling details

- select the correct avatar that relates back to the block

- add the materials at the correct scale, along with the new design features (seam types, stitching details) including new colourways, trims (buttons, zippers, press studs), and components (embroideries, badges, motifs).

And this is just a short 'high-level example' of the 3D workflow process – there are additional stages I haven't mentioned, and much more that needs to happen in order for even the initial stages that effective 3D asset creation to be successful. Material scanning alone can take anywhere from 20 to 40 minutes on average (relative to the material's complexity, considering the differences in plains, prints, plaids). Then there's material physical testing that can take anywhere between 40 and 60 minutes per material type, using a semi-automated process. Design and development might take 30-60 minutes, assuming that we are working on a new style.

Then there's the rendering process, relative to the required use-case quality (internal sampling vs e-commerce virtual twin) desired to serve the specific use-case, this may take anywhere from 20-60 minutes on average.

The above list of processes is by no means exhaustive but rather the main activities involved in delivering a 3D product and does not include any administration inside or outside the solutions that make up today's DPC ecosystems. And those solutions are now more complex than ever, taking in:

- CAD systems (textiles, illustrations, knitting, weaving, embroideries, others)

- Body & Feet, materials, trims, components, packaging scanners

- Size surveys and recommendation datasets

- Avatar Design & Development (parametric digital replica of a human body, digital fit avatar to replicate a mannequin)

- Digital Material Platforms

- 3D authoring solutions (Apparel, Footwear, Hardgoods), several of which can only support a single product sector e.g. Apparel/Footwear/ Hardgoods/Packaging

- Digital Assets Management (libraries of digital assets, including renders stored in multiple sizes and formats)

- Computer Generated Images (Apparel, Footwear & Hardgoods) focused more on the downstream aesthetics, and product configurators

- Digital Colour Management

- Rendering Engines

- Virtual Try-on Engines

Taking account of the sheer breadth of that solution landscape, it should be no surprise that integration and interoperability is one of the key attributes of effective DPC, and this places a burden on both the supporting IT teams that are there to help the business users by enabling interoperability across what is today a complex DPC technology landscape, and on DPC vendors who are required to support Open APIs and file format standards. The role of artificial intelligence in driving DPC can also be crucial. With the use of AI, businesses can dramatically increase productivity in numerous ways that are too far outside the scope of this article.

As intimidating as that list of potential solutions can be, it's important to remember that each of these serves a different element of that comprehensive cultural change I mentioned before. The reason so many brands, retailers, and manufacturers are building out their DPC ecosystems is because they want to bring their products to life, digitally, to keep pace with an increasingly digital world.

Every solution category I listed above, and every step of the journey from initial concept design to virtual photography is aimed at the same common objective: moving from an idea on paper to practical reality, across design, development, sampling, refinement, production and showcasing.

Working backwards from that goal, start by defining what it is that the business wants to achieve by deploying DPC. Once you understand the high-level business objectives, you can then define your business use-cases, supporting the downstream e-commerce workflow with virtual twins, or products displayed on real-life fashion models. Perhaps the business wants to improve the way it designs, and develops samples, but instead of physical

sampling they want to deliver virtual samples, or that want to become more sustainable and understand the environmental impact a product will make even when it's in a virtual world.

Each of those goals will correspond to one or more technology possibilities, and each of them can be approach in its own time – provided you stick to the central objective of bringing products to life in a new way, and provided you recognise that achieving that aim will require a lot more than just buying a single, off-the-shelf 3D solution. While you can never guarantee success, defining the correct business needs, use cases, digital journey, and project phasing will greatly reduce the risk of product failure by taking a methodical and intentional approach to how you deploy DPC.

So far this article has focused on what it means to move from thinking about 3D to thinking about DPC at the individual brand level, but if we take these same conclusions and extrapolate them industry-wide, we can build a picture of what the key capabilities will be for fashion as a whole to genuinely mature and scale its approach to digital product creation:

- We need to be able to scan and collect body data at scale and share with our pattern/last makers.

- We need to convert body and foot datasets into digital Avatars and Lasts linked to specific needs.

- We need to scan and test materials at a greatly reduced time, to avoid these connected processes becoming the bottleneck of DPC.

- We need to improve technology methods to support smarter tiling of prints, plaids, repeats, scaling, colour accuracy.

- We need all solutions providers to create Open APIs, and standard file formats that together will enable true interoperability.

- We need to allow our business partners, mills, and factories to choose generic scanning and 3D authoring tools that interoperate with the brands and retailers own DPC-ecosystem.

- We need to train traditional designers and developers to become 3D-artists and 3D-engineers.

- We need to consider next-generation image file formats to help reduce and at the same time improve the Image fidelity.

- We need to embrace digital assets management systems (DAM) as part of the extended DPC-ecosystem.

- We should look to the use of SaaS models to support various processing, including material scanning, rendering, 3D studios, and bureau services.

- We need to support all parties within the DPC-ecosystem to become fully trained in all aspects of digital product creation to a level that provides professional certification and accreditation programs.

- We need to think beyond pure DPC and consider the opportunity to add new datasets to what is already a growing DPC-ecosystem, sustainability, and Co2 impact measurements.

- We need to onboard artificial intelligence and machine learning to help increase processing times.

At both the brand and industry level, it's time to leave the 3D testing laboratory and move into full production when it comes to digital product creation.
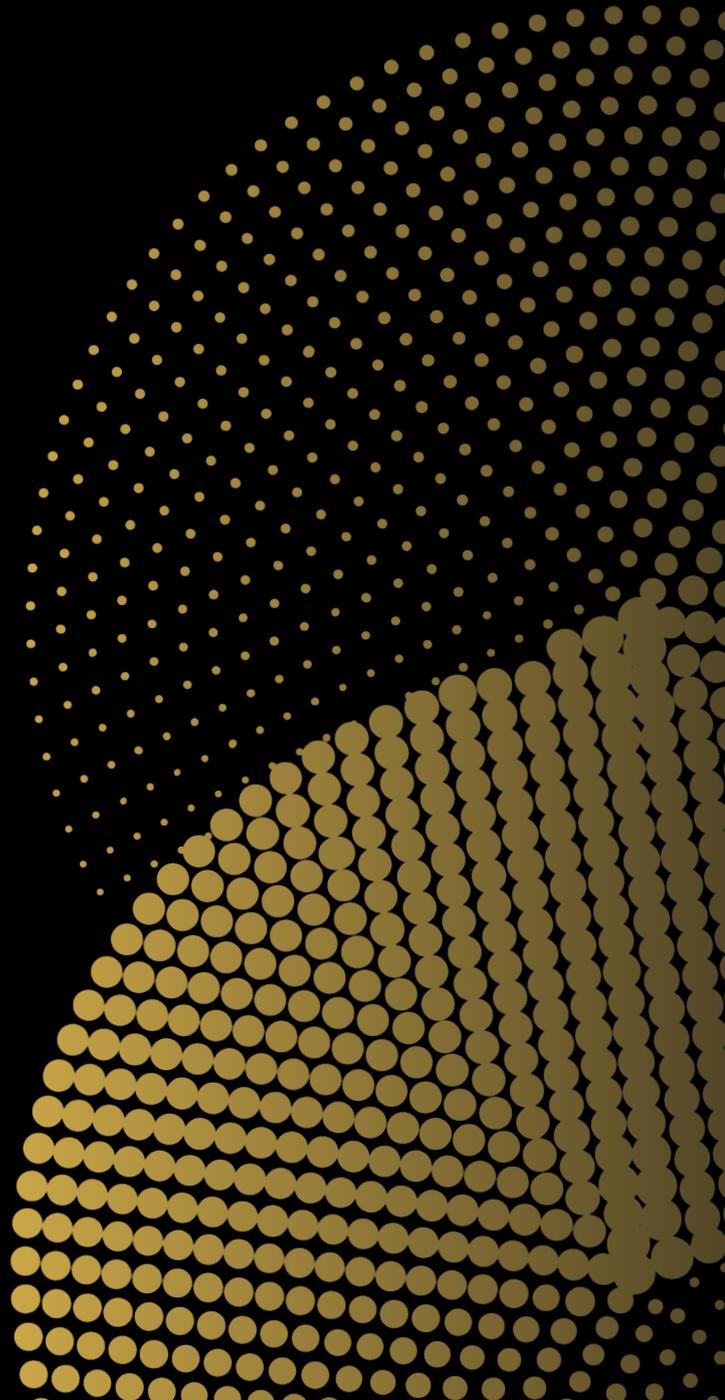
MEET THE KEY PLAYERS

FROM MATERIAL DIGITISATION AND 3D SIMULATION, TO DIGITAL PRINTING ON-DEMAND, PRODUCT CONFIGURATION, AND NEW EXPERIENCES IN SELLING ONLINE AND OFF, WE PROFILE THE COMPANIES THAT ARE WORKING TO BRING THE VISION FOR DPC TO LIFE.

No DPC strategy is likely to succeed with just a single technology solution. Even within the comparatively narrow segment of 3D creative design and simulation, there are different vendors who take contrasting (and sometimes complementary) approaches to the core task of linking 2D patterns to 3D visualisations, and each product segment has its own favourite, specialised tools.

In practice, this means that every process area that falls under the DPC umbrella is catered to by technology from several different angles. By extension, even a single-category brand is likely to need to make use of multiple solutions - and as the complexity of the business increases, so too does the stack of technologies that will be required to deliver its strategic objectives for digital product creation in-house, up, and downstream.

This makes choosing DPC technologies and partners a complex process. Not only do brands, retailers, and manufacturers have to make the right choice, they have to make it multiple times with a long-term view towards taking advantage of both the capabilities of individual solutions, and the compounded benefits of integration and interoperability.

To aid in that decision-making process, the next section of this report contains detailed information about 20 different technology vendors and service providers who are currently shaping the DPC landscape.

For each of them, we asked the questions that we believe matter the most when brands like yours are looking to discover, shortlist, and work with new partners. So each vendor contained in this section has been asked to provide:

- An overview of their solution
- A list of their headline customers
- An indication of their monthly active users
- A breakdown of their pricing model
- A laundry list of their technology partnerships and integrations

We also sat down with a senior executive from each company to better understand their ethos, their strategy, their roadmap, and how they believe digital product creation for fashion will evolve in the near future.

Every vendor has also provided a point of contact, so if you see a solution or service you think could enrich your DPC ecosystem, even more information is just a click away.

Please note that the information contained in the vendor profiles that follow this page remains the property of the vendors themselves. While we endeavour to check the data we are given, The Interline does not verify the authenticity of customer engagements, user figures, or technology partnerships, and the contents of any advertisements provided to us are solely created by the advertiser.

To find out more about a particular technology vendor or service provider, you can jump straight to their listing and executive interview using the links below. With so many different perspectives on the key challenges and opportunities of digital working and digital assets, though, we encourage you to investigate vendors you might not have heard of. You may be surprised by what they are capable of, and what synergies there are to be discovered in their partnerships.

ADOBE SUBSTANCE

BANDICOOT IMAGING

BROWZWEAR

CENTRIC SOFTWARE

CLO VIRTUAL FASHION

CLOTHING TECH

EMBODEE

EMERSYA

FRONTIER

KALYPSO

METAIL

MODERN MIRROR

OPTITEX

PRINTFUL

SO REAL

STITCH

STYLE3D

SWATCHBOOK

VIZOO

WHICHPLM ADVISORY

Adobe Substance 3D

Md Sa Ds Pt Sg

2003
SUBSTANCE FOUNDED

2019
ACQUIRED BY ADOBE

Adobe Substance 3D brings you an ecosystem of apps and content that empower creatives to design in 3D. The Substance 3D Collection provides designers an end-to-end creative solution for 3D from concept and ideation to material and texture creation and final renders. For fashion design workflows, Substance offers a powerful set of tools for creating 3D fabric and material libraries. Adobe Substance 3D Sampler allows users to create ready-to-use 3D materials from photographs. These materials can be applied directly to 3D models with Substance 3D Painter or exported to a variety of common 3D fashion design tools including CLO, Marvelous Designer, Browzwear, Lectra and more.

At Adobe MAX 2022, we expanded our capabilities within the Substance 3D Collection with the debut of the new 3D Capture tool that brings photogrammetry to Sampler, Substance materials in Photoshop and Illustrator, and a new 3D asset creation tool with the launch of Substance 3D Modeler. 3D Capture in Sampler makes photogrammetry easy by combining AI for masking and image prep with a powerful photogrammetry toolset. This makes it easier than ever to create high-quality 3D models from real-world objects that are ready to use within creative pipelines. Modern rendering technology in Photoshop and Illustrator allow for use of Substance materials that are highly adjustable, coming from the Substance 3D Assets library or created in Substance Designer or Sampler. For footwear designers looking to represent ideas in 3D, Modeler has a unique VR + Desktop user experience that allows you to generate concepts in 3D.

120000
TOTAL NUMBER OF ACTIVE MONTHLY USERS WORLDWIDE.

+80000
ADDITIONAL ACTIVE MONTHLY USERS WORLDWIDE FOR SUBSTANCE 3D ASSETS.

HEADLINE CUSTOMERS

HUGO BOSS	ACTIVISION	META
LOUIS VUITTON	ELECTRONIC ARTS	NVIDIA
MIZUNO	UBISOFT	ROBLOX

Adobe Substance 3D

Md **Sa** **Ds** **Pt** **Sg** ⬛

WWW.ADOBE.COM

PRICING MODEL:

Substance 3D Collection includes 5 apps and at least 50 3D assets per month.

Individuals: $49.99 / mo (USD)
Teams: $99.99 / mo (USD)

40+
TECHNOLOGY PARTNERSHIPS, INCLUDING:

ASSYST
BROWZWEAR
CLO VIRTUAL FASHION
LECTRA

MATERIAL EXCHANGE
SWATCHBOOK
VIZOO
X-RITE

AUTODESK 3DS MAX
AUTODESK MAYA
MODO
RHINOCEROS

BLENDER
CINEMA 4D
NVIDIA OMNIVERSE
UNITY
UNREAL ENGINE

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

The Adobe Substance 3D toolset allows designers to explore concepts quickly and virtually by providing powerful content and material creation tool and deep integrations with the most common tools in 3D fashion workflows. Substance makes it easy to create realistic, detailed visuals of all your design ideas, allowing you to showcase your work with real impact at any stage of the creative process. New tools allow for conceptual 3D creation in the new Substance 3D Modeler application and creation of 3D objects from real world products or samples using 3D Capture in Substance 3D Sampler.

Key to fashion workflows are the ability to create and manage libraries of hyper-realistic 3D Substance materials. These "smart" materials are fully procedural — that is, you need only set your chosen parameters for your material, and the software will generate a photorealistic material with as much uniformity or uniqueness as you require. When working with a leather material, for instance, you might define parameters that include its color, the direction and uniformity of its grain, to what degree it is rough or smooth, and the level of its wear and tear. Working with as many parameters as you need, you can produce an infinite matrix of materials. What's more, ready-to-use Substance materials are directly integrated into a number of key software tools used in the apparel industry. You can modify and use Substance materials directly within third-party applications, without switching back to your Substance 3D software. This is possible within modeling tools such as CLO, Marvelous Designer, Vstitcher by Browzwear, and Maya, as well as in the Unreal Engine game engine and the rendering engines V-Ray and Redshift.

CONTACT

69

Adobe Substance 3D

Md Sa Ds Pt Sg

Transform your apparel design process with Substance 3D.

The Adobe Substance 3D toolset grants you absolute control over characteristics such as the prints' color, gloss, thickness, metallicity, and more. In addition, you can visualize any modifications in real time, making changes as required on the fly.

3D model made with 3D Vidya, courtesy of **Assyst**

Adobe Substance 3D

Md Sa Ds Pt Sg ▣

IN CONVERSATION WITH

PIERRE
PMAHEUT

DIRECTOR, STRATEGIC
INITIATIVES AND PARTNERSHIPS,
3D & IMMERSIVE, ADOBE

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

I believe it's a combination of many things happening all at the same time.

The first is the democratisation of modelling tools - CLO and Browzwear in apparel, for example, or Gravity Sketch for footwear – that have solved a lot of the roadblocks that used to exist at the beginning of the pipeline. The ability to convincingly render scenes has been there for a long term, but before the wide adoption of those tools we were missing the 3D garments, sneakers, and accessories to populate them. Those assets really are the starting point for everything that comes afterwards, and the fashion industry has now been empowered to create those assets in much higher quality and higher volume because modelling tools like the ones I mentioned have reached a tipping point of usability, accessibility, and performance.

The second is the real-time technology wave that began in the game industry. Substance has been part of this wave, as a key force in texturing and digital materials that's now being used in many industries outside video games, but the growth of game engines such as Unreal and Unity into new sectors has made it more intuitive than ever to create real-time 3D experiences – either in virtual reality or on flat screens. Fashion being given the ability to make changes to products and environments in real-time has been really impactful.

The third and final thing is the general move towards digital twins and the Metaverse, which has created a sudden need for 3D assets in huge numbers, since brands who want to build a presence in those virtual worlds need to populate them with compelling 3D content and experiences.

All of these forces occurring together is, in my opinion, why progress towards digital product creation and digital-native working has happened so fast. Bringing them together is generating a huge amount of value for both creators (fashion designers, for example) and the final consumer. That final consumer gets an experience that's more immersive, and they can engage with phygital fashion, where the distance is being closed between the virtual twin and the physical object, leading to new blended experiences. And at the same time creators are better able to reach their potential because they have access to tools that allow them to bring their ideas to life in entirely new ways.

The Adobe Substance suite has seen extensive use in other industries where 3D-native working is perhaps more embedded than it is in fashion. What lessons can the fashion industry learn from those sectors? And, conversely, how much of what fashion needs to do in digital product creation is unique to our industry?

That's a very good question, and I would say that fashion has as much to learn from other industries as they have to learn from fashion.

Fashion, for example, has a strong culture built around colour: colour management, colour creativity, colour theory and so on. It's a fundamental part of how that industry operates, and it's also something that you see reflected in other industries such as visual effects, where colour calibration and grading are key parts of a final look. So there are crossover areas where one industry can benefit from the knowledge, experiences, and best practices that are built for another.

Take the gaming industry as another example. The entire culture there is built around real-time performance, and achieving results super-quickly, in-engine. That's something that the fashion industry is working towards right now, because there's such creative power and such a strong business case for designers, merchandisers, marketing teams and more being able to visualise their ideas as fast as possible. So I think there's considerable cross-pollination of tools and workflows that's already taking place between those industries, and there's a lot more still to come.

The challenge is in understanding where fashion needs to build its own workflows and processes – because there are certainly things that are specific to the fashion industries – and where it will be better served by grabbing portions of workflows from other industries. Because fashion does not always need to use solutions that were built specifically for fashion; the industry can make use of cross-industry tools and workflows where its aims align with the aims of other sectors.

Our new, accessible 3D modelling tool, Modeler, for example was not designed just for footwear, but we're excited to see how the footwear industry is already making use of it. And if you take Gravity Sketch as another example, that's a tool that was born in the automotive industry but that has since gone on to find a huge audience in footwear – to the extent that you could easily assume it was conceived as a footwear tool.

The Substance suite is very similar. Those tools began life in texturing characters and environments in game design, but when you look at how they're being used in in fashion today (we regularly hear fashion designers tell us that Substance has changed their working lives) you might imagine they were designed specifically *for* fashion.

That's what leads to the important realisation that, while every industry is different in its outputs and in its demands, many of them have objectives and processes in common. And that's why I believe that the most important innovations might originate in one industry, but their benefits will eventually be shared by the others.

One of the primary values of digital assets and digital materials is their ability to stand in for physical alternatives in a range of decision-making scenarios. How do you see DPC workflows enabling faster, more flexible routes to market?

Our primary focus recently has been towards building workflows and tools that allow people to move from the digital world to the physical world of vice versa, any time.

Image by Anthony Salvi.
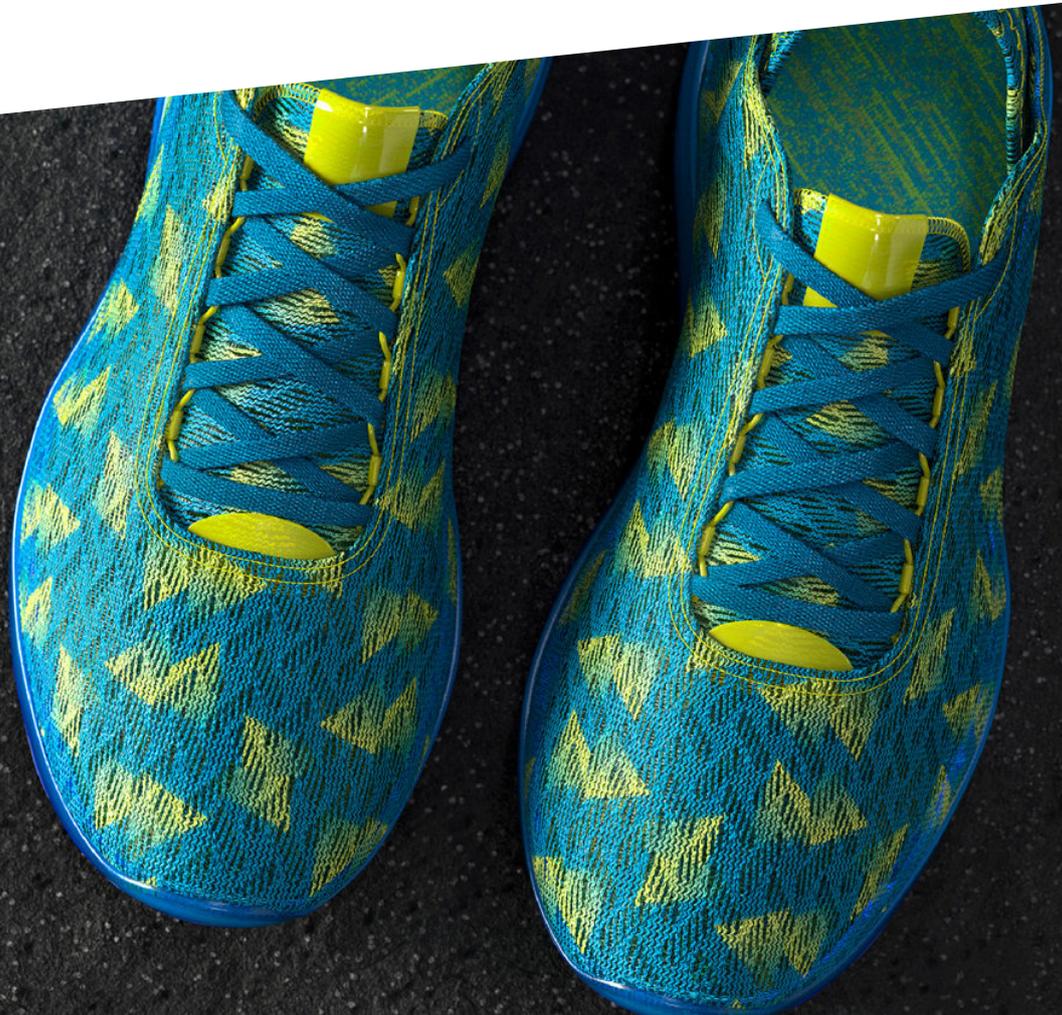
The starting point of that journey was building our image-to-material capability in Substance 3D Sampler, where you have a physical fabric in your hands that you want to apply to a garment created in, say, CLO, and you need to bring that real material into the digital world. We're making it as easy as possible to turn a reference photo, or a quick smartphone snapshot, into a high-quality 3D material. Now, we are also about to release a new capability in Sampler that allows users to capture a 3D model through photogrammetry, and to turn it into a digital model. So you have two options to digitise real-world assets in a user-friendly way, which is something we see as being the heart of 3D workflows in fashion and other industries.

We've also spent a lot of time working on taking that journey in the opposite direction with 3D printing. Together with Mimaki, Stratasys, and other partners, we're building streamlined ways to turn a digital object into a physical one, at any time. And that's something we have also worked towards with digital fabric printing and on-demand production, as we showcased with our partnership with Gerber to bring an artist's vision to life digitally and then physically.

The goal here is not to replace every physical asset or every physical workflow with a digital one. We believe the right approach is one that transcends digital and physical, and that allows the user to move back and forth between those two worlds, so that the physical can be augmented by the digital – and the other way around.

Procedural generation and the adaptability of parametric materials open up a huge possibility space in virtual materials, empowering material designers to create almost anything they can imagine. This is terrific in a digital-for-digital workflow (where the final output is a digital asset) but some questions remain around how materials that begin life virtually can then hook into physical production. What is your take on where the creative flexibility of virtual and the achievability of physical should meet?

The best way to create a digital material is the one that best serves what you're trying to achieve. A scan-based workflow is faster, but it also locks you into a particular track since you only have the ability to make a narrow set of changes once the initial digitisation has taken place. A procedural approach can, in the end, deliver an asset that has greater value because it's more flexible and because it opens up more creative possibilities, but it requires you to have a very clear view from the beginning of where you want to go, because all your parameters need to be defined the right way – which means spending time up front to gain back more time later.

The other component to procedural materials is that they can potentially help to drive manufacturing. This is something we're still in the early stages of, but it's possible for digital knitting machines, for example, to leverage the data from procedural digital materials. And from an authoring point of view, we can put guardrails in place to ensure that anything you can generate with a procedural material can indeed be manufactured using a proven process. We're only at the beginning of this journey right now, but we're working to build deep connections between digital working and digital manufacturing that we believe will bring the creative power of virtual and the mechanics of physical manufacturing closer together.

The Substance suite is very much geared around comprehensive 3D working, from modelling to staging. Beyond the solutions perspective, extracting that extended value from digital assets, upstream and downstream, is going to require a high level of standardisation and interoperability. How close do you believe the fashion industry is to achieving that standardisation?

A big part of the DPC revolution is going to be standardisation. From the outset we wanted to make sure that the core Substance SBSAR format was as widely supported as possible, and today it's accessible in solutions from CLO / Marvelous, Browzear, Lectra, and many, many more – bringing the power of parametric materials into the environments that fashion users already know.

The next step on that journey is embracing USD (Universal Scene Description), which is a framework for bringing together all the different elements of 3D graphics. The animation industry can provide a glimpse into the future here, because there has been a move away from having separate meshes, materials, and textures that are merged by the animation tool, towards having a single file that contains everything, using USD.

A useful way to think about this is that Photoshop or Illustrator have multiple layers in a single file. And this is what the move to USD promises to do for 3D assets – giving users the ability to consolidate information and to produce more variations, more easily.
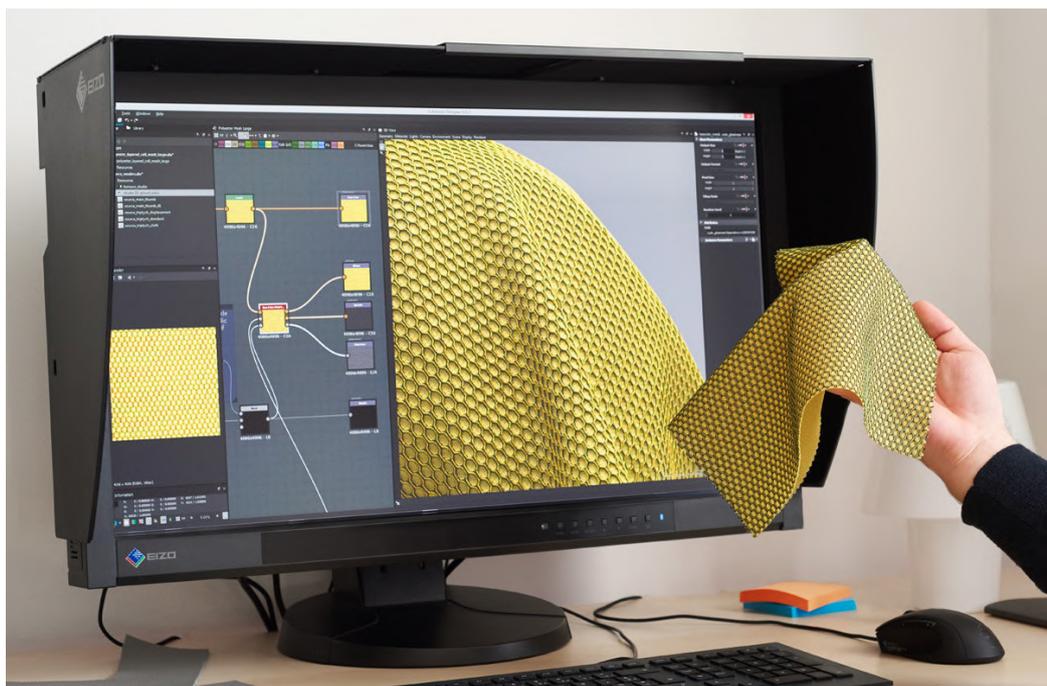
It's important to note, too, that we're definitely not alone in moving in this direction. We're part of a much wider consortium of companies – including NVIDIA – that is working towards democratising and standardised 3D even further.

Where do you see digital product creation - and digital assets - going from here? What does the near-future look like for fashion as a whole, and for Adobe specifically?

Creation tools have never been more accessible than they are today. A single person, with a consumer-grade laptop, with software that's affordable and easy to use, can go through a complete, end-to-end 3D workflow and arrive at either a super high quality static render or a real-time experience, starting from the initial sketch.

I this this is a unique point in history. The amount of power that's being placed in the hands of anyone who's interested in creativity is unprecedented. And that's the world that the next generation of fashion designers are entering – one where you can create and share in ways that would have been unimaginable before.

It's also even more exciting to think about that cross-pollination of tools and expertise I talked about earlier. The next great fashion designer might not even start their career in fashion! Perhaps they start as a game designer, or a movie director, before moving on to use the same toolsets and the same workflows to create art of a completely different type. In that context, silos are making less and less sense every day, because the world is becoming one big crowd of creators.

BANDICOOT
IMAGING SCIENCES

WWW.BANDICOOTIMAGING.COM

2019
YEAR FOUNDED

Bandicoot is offering a complete cloud-based solution for creating high-quality digital fabrics that are accurate and realistic when compared to the physical fabric. It's an easy, affordable, and scalable way to digitise your fabrics with just a regular camera.

We offer two approaches to fabric digitisation:

Shimmer Scan – a self-service method that enables anyone, anywhere to create high-quality digital fabrics with easily accessible equipment.

Serviced scanning – we take care of everything. Our customers simply send their fabrics to us, we digitize them, and share the digital fabrics in our web app – ready for use in a range of 3D workflows.

Bandicoot's patented technologies allow for fast, automatic generation of PBR textures and seamless tiling, turning a series of regular image files into a complete 3D-ready digital fabric for use in popular 3D design tools such as CLO3D, Browzwear, Adobe Substance, Optitex and more.

Easily digitise your own fabrics with equipment you already have, or purchase the complete onboarding package on Bandicoot's website, incl. camera kit and full support.

Offering one of the most user friendly, high-quality approaches to fabric digitisation, Bandicoot is now one of the fastest growing solutions for brands and designers to create digital fabrics, either in-house or at-source with fabric mills and garment makers directly.

20+
TOTAL NUMBER OF ACTIVE USERS WORLDWIDE, ACROSS THE FOLLOWING REGIONS:

20% North America

20% LATAM

30% EMEA

20% APAC

HEADLINE CUSTOMERS

AGI DENIM	**MATTEAU**
BRU TEXTILES	**PROSPERITY TEXTILE**
DEYAO TEXTILES	**RM WILLIAMS**
ESQUEL GROUP	**SAPPHIRE FIBRES**

BANDICOOT
IMAGING SCIENCES

WWW.BANDICOOTIMAGING.COM

PRICING MODEL:

Pay-per-scan.

Purchase scan credits directly on our website.

1 credit = 1 digital fabric
Buy more credits = get more discount

Simple. Predictable. Scalable.

5+

TECHNOLOGY PARTNERSHIPS, INCLUDING:

SWATCHBOOK, 2020

BROWZWEAR, 2021

VIRTUAL TOUCH, 2021

OPTITEX, 2022

Our PBR texture files are fully compatible with all popular 3D CADs, like CLO3D, Browzwear, Optitex, Adobe Substance, Maya, and 3Ds Max, and also popular game engines incl. Unreal Engine and Unity.

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

Digital garments are made of digital fabrics. You cannot create a high-quality product without high-quality materials. This principle applies to both digital and physical product creation.

Bandicoot's aim is to make it as easy as possible to create high-quality digital fabrics, and we see that as an ongoing role and responsibility.

We have big plans with the cutting edge technology that Bandicoot will be making available to the industry in the coming year. With a team of world-class scientists and deep industry knowledge, we see Bandicoot positioned perfectly for leading major technological advancement, fully centered around our customers' direct pain points.

Adopting a digital workflow is not just about doing the same things you have always done, but with digital tools. It's about achieving the same or better results, in ways the industry never even thought about. External perspective and a good understanding of where the industry is moving is critical for making this work. Bandicoot's role in the Digital Product Creation journey is to innovate and move the industry forward with surprising technologies and approaches, that just makes sense when you try them for the first time.

CONTACT
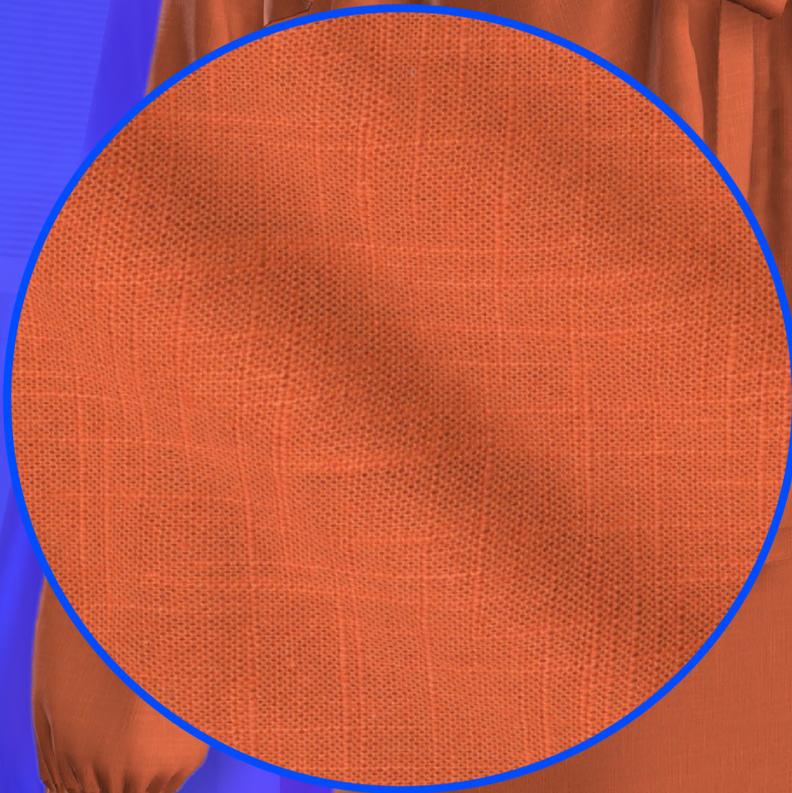
IN CONVERSATION WITH DAVE MONAGHAN

CEO, BANDICOOT IMAGING

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

There's a number of factors shifting the fashion industry towards DPC at the moment; a push towards becoming environmentally sustainable, restricted travel and reduced ability to meet face to face. All these factors have led to an increased awareness in the fashion industry that DPC can provide a viable solution to these issues. Add to that the realisation that there is a growing market for digital consumables. Brands are now having a close look at DPC and getting excited by the potential. They're starting to realise that not only is DPC going to save them time and money but it opens up whole new business models and avenues of creativity, allowing them to prototype and test novel ideas that otherwise would be expensive if they used traditional methods. The technology and platforms available to put a DPC workflow together are maturing to a

point where it's no longer an experimental foray into the unknown for brands to test the waters. Pathways are being established to follow. At Bandicoot, we spend a lot of time talking to our customers to ensure that once they have created their digital fabrics, it's clear to them what the next steps in the process are. We've also taken part in a number of case studies to help iron out these processes and get them mainstream. Each of these case studies reach a wide number of brands and helps with awareness.

How has the demand for digital fabrics changed as a result of the industry's adoption of digital workflows?

It's early days yet, but at Bandicoot we are seeing a steady increase in inquiries about digitising fabrics. These range from those that know exactly what they want and are ready to start, to people who have heard about the shift towards DPC and want to learn more. Whilst there is a growing demand for digital fabrics we are also seeing a need for an

like to think that we have hit a sweet spot in affordable hardware that can be bought off the shelf and used to deliver outstanding quality. We strive to deliver a simple, cost effective product that 'just works'.

improved understanding of what can be done with digital fabrics. One thing, though, that won't change is the demand for high quality. The brands demand a very high standard for their physical fabrics and that standard will need to be maintained (if not increased) for their digital counterparts.

How far is that demand being catered for by existing methods of material capture?

At present there are a number of available options for capturing the visual and physical aspects of materials. These products are aimed at different markets and demand different levels of user expertise. Some require a capital outlay, while others only require a single image; there is quite a variety of options for people to try. Different market segments will have different needs, different budgets, different constraints. But all of them are looking for high quality, true to life digital reproductions that look and behave like the real fabric - that isn't a point of compromise, and it's something Bandicoot doesn't compromise. Second to that are two other critical aspects to consider. The first is that any hardware needed is readily accessible to buy, easy to use, maintain and replace. The second is simple integration with the ecosystem. Digital fabrics on their own are of little use - they become useful when they seamlessly import into other products that showcase them, be it a website showing an interactive digital fabric swatch, a 3D design platform, or simply a beautifully rendered still used in a sales brochure.

And can those methods scale in a way that's cost effective?

We feel that to truly scale, you need a simple approach to digitising fabrics that can be employed at the textiles mills themselves, with minimal training/expertise needed. We

As digital-native workflows become increasingly embedded in fashion, what does it mean to create digital fabrics that are futureproof?

Digital fabrics are more than just a set of PBR texture files. A digital fabric that will meet customer needs now and in the future includes high quality visuals, material physics as well as the ability to store other technical data associated with the fabric. One of the big challenges associated with this is universal adoption of a standard format. U3M has made a great start towards this and as an open format can be adapted to meet changing needs. A mill, for instance, that wants to create digital fabrics that can be used by a variety of brands, all using different platforms, is faced with the need to create a variety of different formats. Material physics in particular is a challenge, but it is encouraging to see that there are ongoing efforts to address this by 3DRC. Finally, the digital fabrics need to be of use at all points along the workflow - from the mills using them to replace the need to physically ship fabric swatches, or at least reduce the amount shipped, to virtual sampling in 3D design for retail and eCommerce, to skins used in video games. No doubt there are uses we haven't even imagined yet! Settling on a common standard, robust and flexible enough to meet these needs is paramount .

Whether the capture is taking place at source, in the mills, or at brand HQ, it feels as though the goal should be to create materials to an archival quality standard. What does this look like in terms of resolution, DPI, material properties etc.?

This is an important point, and one that is difficult to predict given the early stage of DPC in fashion. On one hand we are keen for the format to evolve as Bandicoot and other

developers identify and incorporate new functionality into their platforms, on the other there is the risk that there may not be provisions made for backwards compatibility with older file formats, so data may become unusable. At present, 450 DPI is perfectly fine for tiled output with textures between 1K and 4K depending on the size of the patterned repeat, but we should expect that to increase in the future. Most fabrics can be well represented using the PBR standard channels of base colour, metal, roughness, normals and displacement, but we'd like to see more standards evolve around fabrics with unusual appearance, like velvet. And for all digital fabrics it is critical that the base colour is in a calibrated colour space such as sRGB so that when different digital fabrics are combined into a garment, the colours appear correctly against each other.
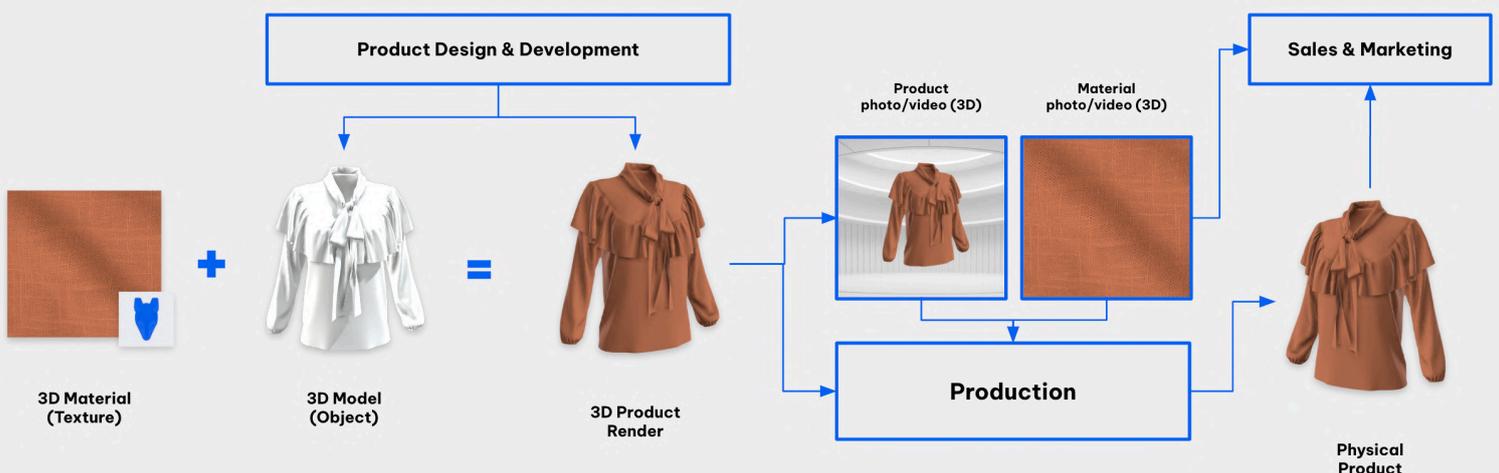
Digital material capture has traditionally been a hardware-first task, with software filling in the gaps. In Bandicoot's case, replacing the bespoke hardware with off-the-shelf digital cameras shifts the emphasis on to software. Can you explain how you believe software processing can remove the requirement for dedicated hardware, and whether this requires any compromise to those archival standards we just discussed?

That's exactly the reason Bandicoot has chosen this path. It's a similar story to digital cameras themselves. Camera phones, for instance, rely less on hardware and make use of powerful computer vision algorithms to produce beautiful images. At Bandicoot we've only just started to tap the true power of software to create high quality digital fabrics. At present we are using a pure algorithmic approach, relying on our in-house expertise in image processing to create our digital fabrics using only the

information captured from the photos. As we grow our database of fabrics we will start to improve the quality of the textures whilst remaining 100% faithful to the captured properties of the physical fabric. Being in the cloud allows us to go back and easily re-process as we improve our algorithms providing customers with 'upgrades' to their digital fabrics. The flexibility of using a handheld camera also means we are not limited in the size of scan we can take. We've scanned fabrics at B0 (1.1m x 0.65m). Recently, using our in-house developed stitching algorithms, we've scanned in patterned velvet fabrics 2m x 2m, which opens up a myriad of possibilities for the soft furnishing market. The cloud-based software approach also gives us the ability to easily and seamlessly integrate with any number of downstream systems. Regarding the archival aspects, the flexibility and agility offered by a software solution that is largely hardware agnostic should only help with this difficult problem.

The other component of a futureproof digital value chain is the question of where material capture should take place. We believe Bandicoot's use of standard formats means its outputs can easily integrate with digital material marketplaces and collaboration tools, but do you see more uptake of affordable digitisation taking place within the brand's walls, in the supply chain, or both?

We believe that the brands will largely be responsible for driving the shift to digital. Once they make the decision to move to DPC the onus will be on the mills to provide digital fabrics, so we see the bulk of fabric digitisation happening at the source. Leading fabric mills are already digitising their fabrics in-house at the manufacturing site using Bandicoot's 3D fabric scanning technology. By offering designers digital 3D fabrics straight from the mill,

BANDICOOT IMAGING SCIENCES

Product Design & Development

Product photo/video (3D)   Material photo/video (3D)   Sales & Marketing

3D Material (Texture)   +   3D Model (Object)   =   3D Product Render   Production   Physical Product

millions of dollars are saved in shipping every year. But what is really exciting is how we see our scanning technology evolving to the point where scanning is possible with any camera. This opens up a lot of potential for anyone in the supply chain to obtain samples that can be used and shared. We envisage a platform where once a physical fabric is captured, it's not only easy to start a 3D design but you can also locate its source and order the physical material.

And does the lower barrier to entry provide more flexibility in this respect?

Absolutely. As the technology evolves it will become easier for anyone to capture fabrics anywhere. If you're carrying the means to capture and share high-quality digital fabrics in your pocket then the possibilities are endless.
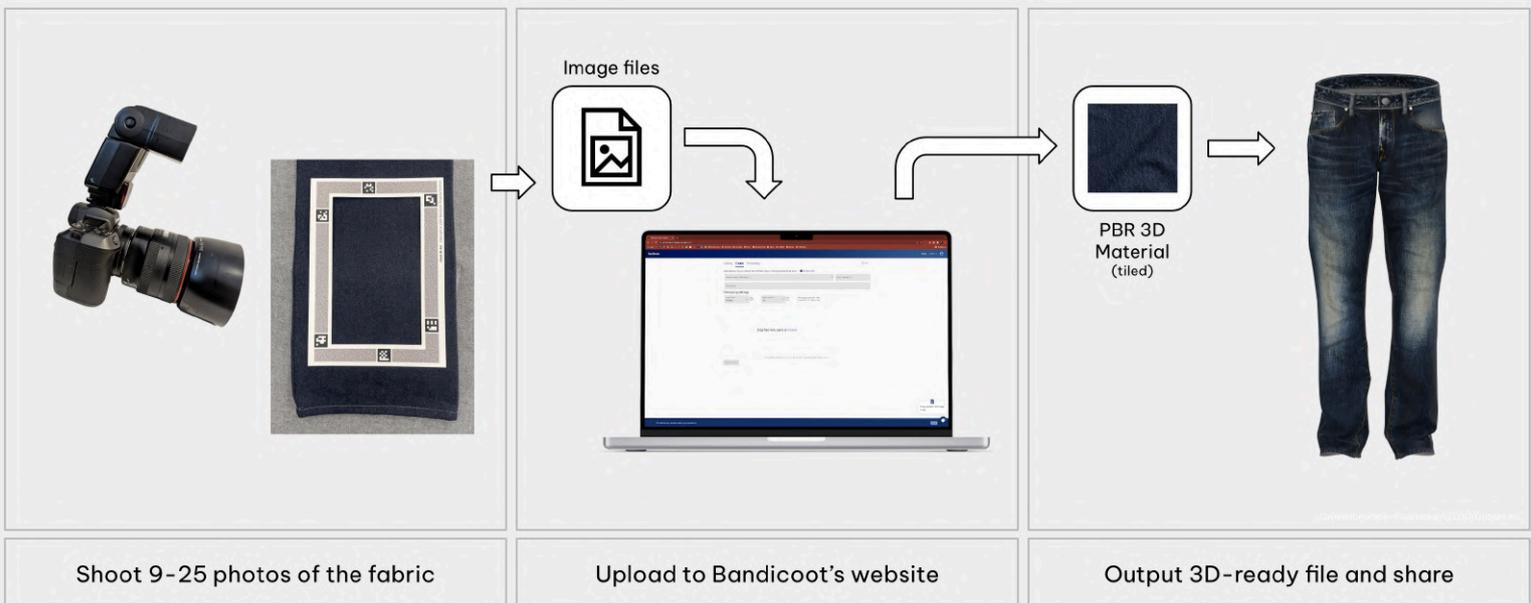
Where do you see digital product creation - and digital assets - going from here?

Over the next five to ten years we're going to see a shift in mindset as a result of the fashion industry adopting a digital transformation. This gives everyone creating the tools driving this shift a chance to test and refine the digital experience to improve their products and services. A big realisation for us was changing our thinking from 'how can we sell more digital fabrics?' to 'how can Bandicoot give anyone interested in fashion design a fantastic experience that increases their creativity?'. How can we make this so accessible that any budding 3D fashion designer can get a start? The music industry is a great example. Twenty years ago to make music you needed a studio and professionals, today because of the accessibility of easy to use, readily available products, anyone can do it at home. As fashion technology develops, fashion design will become more accessible to everyone. And that will lead to the next generation of exciting new designers.

What does the near-future look like for the industry and for your business?

There is a groundswell now that is exciting to be a part of and to be in at the start, working with an industry that is perfectly poised to take the next steps towards revolutionising its workflows and unlocking new ways to be creative. We see ourselves playing an expanding role in not only working alongside other technology companies shaping digital workflows but also communicating the opportunities to the fashion industry. For instance raising awareness at fashion schools, where the next generation of designers are learning. Bandicoot is working with several universities, and it's exciting to see how students push the boundaries and experiment with our technology, using it in ways we never thought of. Like all industries, fashion is being driven in new directions by an ever changing global economic outlook and brands will need to fundamentally change the way they operate to survive. As more and more brands begin to realise the potential of this new age in DPC, Bandicoot will be leading the way to ensure the digital ecosystem evolves to meet their needs. There's a big wave coming and Bandicoot will be there to ride it.

Shoot 9-25 photos of the fabric | Upload to Bandicoot's website | Output 3D-ready file and share

BROWZWEAR

1999
YEAR FOUNDED

Founded in 1999, Browzwear is a pioneer of 3D digital solutions for the fashion industry, driving seamless processes from concept to commerce.

At the heart of Browzwear's SaaS platform are true-to-life 3D visualizations that enable businesses large and small to streamline operations and reduce material waste throughout the product development lifecycle. For example, designers can create endless variations of styles and iterations of colorways without making a single physical item. Furthermore, Browzwear's fabric analyzer (FAB) translates textiles' unique properties into digital form, ensuring the draping and movement of digital garments is the same in 3D as it will be in real life.

These digital twins can also help the industry resolve its overproduction issues by giving companies the ability to sell before a single garment is produced, using hyper-realistic visuals to merchandise collections anywhere, no plane travel needed.

In short, Browzwear's solutions help the entire value chain operate more efficiently, significantly reducing time and material waste during product development, supporting data driven manufacturing strategies and eliminating production errors that result from misinterpretations. Together, all these factors are making the industry more sustainable, environmentally and economically.

OVER 650 ORGANIZATIONS AROUND THE WORLD ARE USING BROWZWEAR'S TECHNOLOGY TO DRIVE EFFICIENCIES AND REDUCE WASTE, INCLUDING:

ADIDAS	**PVH GROUP (PARENTS OF BRANDS INCLUDING CALVIN KLEIN & TOMMY HILFIGER)**	**TARGET**
COLUMBIA SPORTSWEAR		**VF CORPORATION**
LULULEMON		**WALMART**

BROWZWEAR

WWW.BROWZWEAR.COM

PRICING MODEL:

For enterprises, Browzwear's 3D clothing design software VStitcher costs between $8-$10k per seat, depending on the apparel organization's requirements. Browzwear's priority is to ensure customers have the right solution to fit their needs from start to finish, so the company works closely with customers, providing expert support and guidance throughout the onboarding process.

Design students, freelancers, fashion enthusiasts and entrepreneurs looking to discover Browzwear's 3D apparel design software can apply for the company's Indie Program which enables them to start their digital apparel journey with a limited, sponsored VStitcher license and on-demand learning.

TECHNOLOGY PARTNERSHIPS:

Because the founders of Browzwear believe that digital transformation is an industry imperative, they developed the technology with cooperation, not competition, at its core. This led to one of the most innovative aspects of Browzwear's business model: its open platform approach that facilitates integration with other software solutions. This makes it easier for fashion brands, manufacturers and retailers to connect the technologies in their existing tech stack and seamlessly digitize their entire process.

Currently, the open platform program includes solutions for asset management, pattern design, costing, merchandising, showcasing, online shopping, workflow and more. In addition to an API, Browzwear provides support for testing and development as well as joint marketing initiatives. For brands and retailers, the program also includes advanced consulting and integration services to ensure their digital processes are implemented successfully.

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

Browzwear is leading the digital apparel revolution, providing pioneering solutions that carry businesses through the entire digital product creation journey and offer an unprecedented opportunity to reduce costs and speed time to market.

From apparel design to technical development and merchandising, Browzwear enables designers, developers, production and marketing to collaborate using true-to-life 3D visualizations that are so accurate to a physical garment's fit and movement that they are an eco-friendly and cost effective replacement for physical samples.

With Browzwear's streamlined workflows, businesses can also significantly reduce time and resources used throughout the process of review and revision so changes can be made and approvals secured faster with complete confidence.

Browzwear completes the digital journey by facilitating digital merchandising, enabling garments to be sold before a single one is produced. With capabilities for both aspirational, marketing showcasing and accurate e-commerce product display, Browzwear offers all the tools merchandisers need to convey the garment's story to the consumer.

CONTACT

DRIVE BUSINESS GROWTH WITH

THE POWER OF TRUE-TO-LIFE 3D

As the world's leading 3D apparel design solution, Browzwear has partnered with over 1,000 global brands to accelerate workflows from sketch to store.

Our tailored 3D apparel solutions allow brands, retailers, and manufacturers worldwide to develop, produce, and sell with remarkable efficiency. Sampling costs are cut, and production times are shortened. Speed to market is accelerated, and waste is minimized.

TALK TO OUR TEAM TODAY TO FIND OUT MORE

CONTACT US >
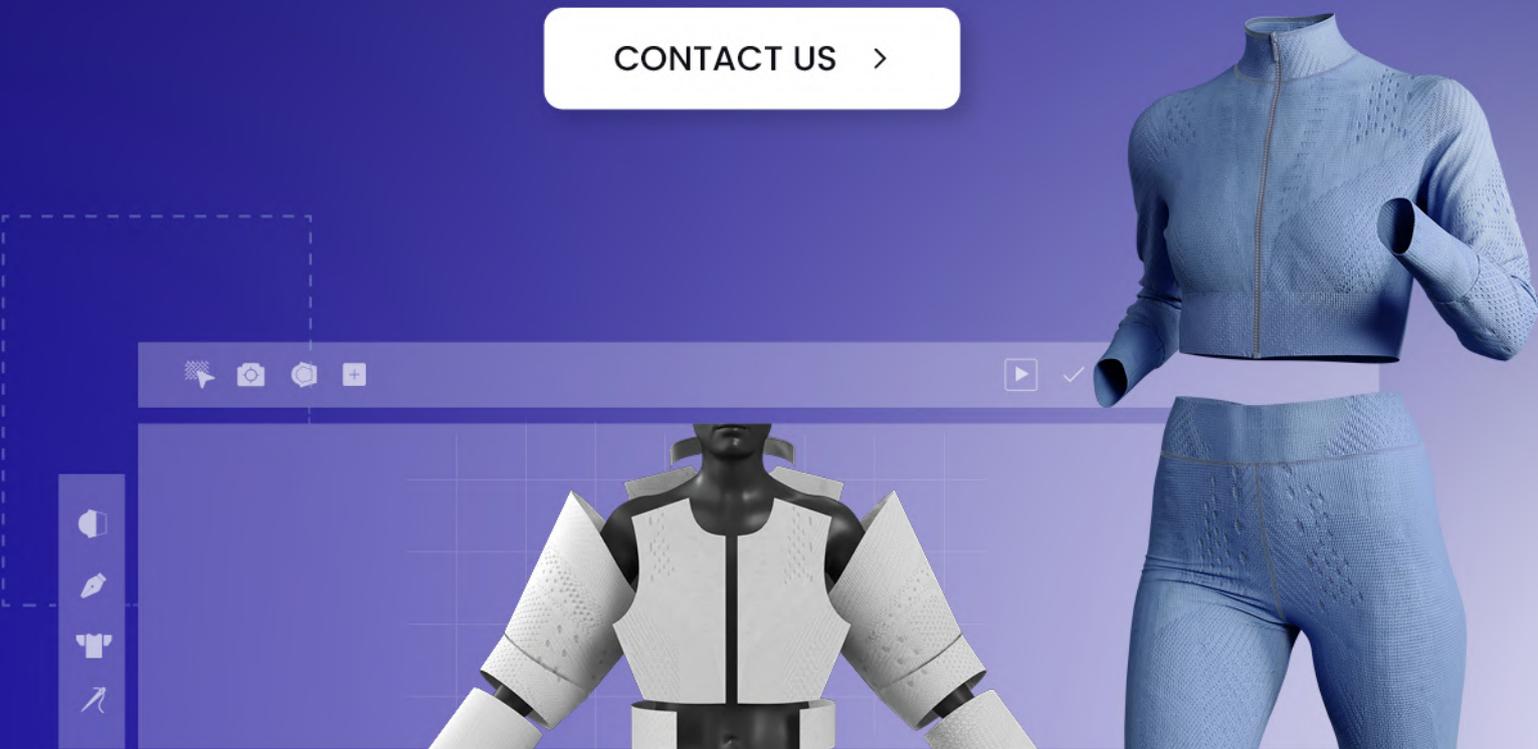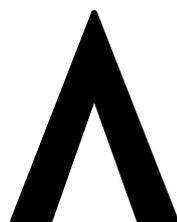
IN CONVERSATION WITH
AVIHAY FELD
CO-FOUNDER + CEO, BROWZWEAR

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

Despite its glamorous exterior, fashion is a challenging business. In fact, over half of clothing lines fold within the first four years in business. Why? Well, the profit margins are painfully small, while wastefulness - in time and material resources - is rampant. With the emergence of fast fashion, we entered an era in which quantity was king, and because it takes 6 to 12 months to get a product to market, speculation-based overproduction became the norm. By some estimates, only 16 percent of garments produced are sold at full price and more than half never sell at all, it's unsustainable economically and environmentally.

As for "why now," the COVID-19 crisis really accelerated the pace of technology adoption in the industry. It became abundantly clear that businesses that had already undergone their digital transformation had a level of resilience far above that as their tech laggard peers. The pandemic also demonstrated how far reaching the negative impact of inefficiencies can be across the entire supply chain.

Amid all this upheaval, apparel companies could no longer ignore the value of technology and the way adding 3D in their workflows could streamline processes, eliminate guesswork, reduce resource usage, speed time to market and ultimately put their businesses on a much more solid, and sustainable, foundation.

One of the primary values of having a true-to-life digital twin of a garment is the ability for actors all along the value chain to make creative and commercial decisions based solely on that digital asset. Can you provide some examples of where shifting those decisions from physical to digital can realise the most benefit?

We've seen numerous Browzwear customers realize incredible benefits by shifting away from physical samples and instead, using 3D throughout the design processes and beyond. Where there used to be seemingly endless back and forth over designs, multiple rounds of sample creation and then more back and forth on revisions, entire teams can now collaborate and make changes in real time. Want to see this style in a different colorway or with shorter sleeves? You can do that in seconds, which makes a remarkable difference in time to market.

Another benefit of true-to-life 3D is the way it streamlines communications. Fashion is an industry in which different parts of the value chain can be located all over the world. The ability to visualize in realistic detail instead of having to express things with words that are so often misinterpreted dramatically reduces errors during production.

When we look beyond product development and manufacturing toward merchandising, 3D can also help the industry out of the "hope to sell" mentality. Instead, they can sell and produce a collection based entirely on 3D visualizations - no need to guess what may or may not be in demand in the next year.

We have encountered quite a few brands who have stalled after realising the initial potential of

replacing physical samples with digital alternatives - making a narrow set of decisions based on a digital asset, but not being able to find those additional. For these businesses, there's now a difficult transition from "3D" to "DPC," placing greater trust in digital assets and digital-native workflows, and extending them to new areas. How do you recommend they navigate this shift?

Change is always difficult, and there is always going to be an inherent preference for "the old way of doing things." During a presentation at the Fashion Institute of Technology (FIT) in 2019, Emily Roosen, Senior Manager of 3D Transformation at PVH's STITCH accelerator said, "It's very scary...when we talk about digital transformation in fashion. We're under super tight deadlines. The calendar seems to be getting shorter every week, and we have to deliver the same amount of sales. Or even more, sometimes. So how within this crazy process are we going to implement a new tool?"

Reaping the full benefits of 3D as part of digital project creation requires you to dedicate time and put forward enough resources to really explore the utility from end to end. It's not just about training a few designers to use 3D. It's making it an essential part of the entire workflow.

One of the keys to building that enterprise-wide trust in 3D is having the confidence that, anywhere a 3D asset is used in place of a physical one, that 3D asset corresponds

BRAND

Jacket

S M L

Buy Now

as precisely as possible to the garment that will actually be produced - aesthetically and in its full spectrum of physical properties. How can a brand create that confidence, and build that accuracy into their digital assets from the outset?

This is a case in which seeing really is believing. The more stakeholders in the process witness just how "twin" the 3D visualization is to a finished garment, the more they will trust the process. Of course, not all solutions are created equally, so the reverse could happen if the solution you're working with doesn't have the same level of accuracy, with realistic fit and garment physics, that Browzwear offers.

The technology required to deliver on the vision for comprehensive digital product creation is more accessible and affordable than ever, but across talent, culture, and supply chain connectivity and collaboration, there is still large-scale investment that needs to be made to move from design-only 3D to comprehensive digital product creation. And that investment needs to be made at a time of peak uncertainty. What advice would you give to a brand that wants to scale its use of digital assets, but is struggling to justify the investment?

The first step is understanding where, in your typical processes, you have inefficiencies that 3D can address. Get that part of the implementation right, then move to the next priority. For example, some may benefit the most from streamlining design. Companies making a lot of denim garments could fall into this group because the finish of the fabric and minute details of design can be visualized instantly. For others, the biggest problem could be errors in manufacturing. At Browzwear, we try to identify these areas at the beginning of the implementation process to determine priorities so they can start seeing the value quickly.

From a competitive standpoint, this investment isn't a nice to have, it's an absolute must. If the past two years are any indication, the companies that transform are going to be the ones that prevail.

Where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

As the technology continues to evolve, it also holds great potential for consumer-facing uses such as virtual try-ons. This would address another large source of waste and resource consumption, product returns, which are as high as 30% for online purchases.

The burgeoning world of the metaverse is another place where 3D can be used in a host of new ways. For example, people are going to want the avatars that represent them to be dressed, and the more realistic the garments are, the more immersive and sticky the experience will be.

Companies can also leverage people's interest in their digital fashions to inform their physical collections. Browzwear actually experimented a bit with this over 15 years ago when we worked with a fashion brand that wanted to expose their fans to new designs before they went into production. We made 3D versions of the designs and invited the brand's core target of teens and tweens to play with the styles as part of an interactive, game-like digital experience. The brand was able to see what potential buyers really wanted, and that's what they produced. When the items hit the stores, there was a 100% match between popular in the virtual experience and in store. The value of that type of predictive intelligence is immeasurable.
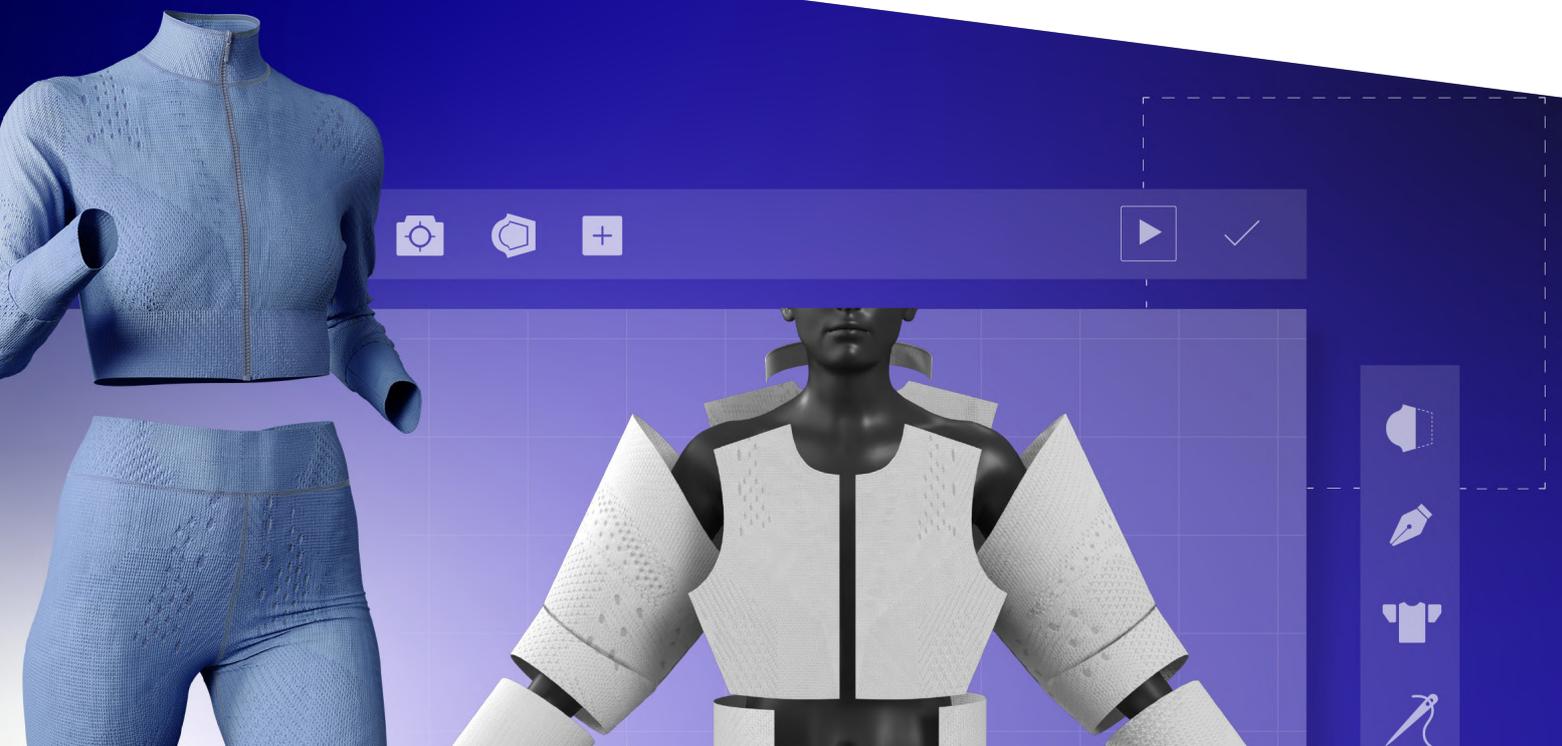
CentricSoftware

2006
YEAR FOUNDED

Centric Software drives digital transformation for retailers, brands and manufacturers across all categories of consumer goods—fashion, luxury, outdoor, cosmetics, food & beverage, consumer electronics—with an end-to-end innovative product concept-to-launch platform, featuring its flagship, market-leading, award-winning Product Lifecycle Management (PLM) solution, Centric PLM™. Headquartered in Silicon Valley, Centric Software solutions include:

• **Centric PLM** - streamline and accelerate product development from concept to retail or e-comm launch.

• **Centric Planning** - best-in-class data and visually-driven financial, merchandise and assortment planning as well as store and vendor forecasting for seamless and fast, pre and in-season execution.

• **Centric Visual Boards** - transform collaboration and decision-making for merchandising and buying teams, through intuitive digital boards.

• **Centric Pricing** - AI-powered tools for competitive assortment benchmarking, and price and product trend insights.

Centric Software proudly maintains a 99% customer retention rate and a 100% go-live rate. Awarded for excellence by Frost & Sullivan five times and a recipient of many other regional accolades, Centric is proud to provide the best solution, backed by the best team to service the best customers.

Centric Software, a subsidiary of Dassault Systèmes (Euronext Paris: #13065, DSY.PA), is a registered trademark of Centric Software, Inc. All other brands and product names may be trademarks of their respective owners.

HEADLINE CUSTOMERS

ALLBIRDS	CALLAWAY	FENIX	MACKAGE	SPYDER
ANTA	CALVIN KLEIN	GANT	MANGO	SWAROVSKI
ARITZIA	CROCS	GRUPO MALWEE	MIZUNO	TECHSTYLE
ASICS	DAINESE	GUESS	PANGAIA	THE GAP
ASOS	DIOR	HELLY HANSEN	PE NATION	TITLEIST
AUCHAN	ECCO	HOPESHOW	PENTLAND BRANDS	TOM TAILOR
BALENCIAGA	EILEEN FISHER	KENZO	PVH	TOMMY JOHN
BENETTON	ERNSTINGS FAMILY	LANDS' END	ROTHY'S	TRENT LIMITED
BIOWORLD	EVERLANE	LILLY PULITZER	S.OLIVER	UNDER ARMOUR
BIRKENSTOCK	FAST RETAILING	LOUIS VUITTON	SAINT LAURENT	VOLCOM
C&A	FILA	LULULEMON	SKECHERS	WACOAL

13

TECHNOLOGY PARTNERSHIPS, INCLUDING:

3D EXPERIENCE PLATFORM

ADOBE

ALVANON

BROWZWEAR

CLO3D

HIGG

OPTITEX

RHINO

SOLIDWORKS

SWATCHBOOK

TRUSTRACE

VISUAL RETAILING

VIZOO3D

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

Centric Software recognized the potential of DPC for soft and hard goods at an early stage and developed innovations that enable designing, developing and sourcing with PLM as the central hub for digital assets. PLM provides information, access and automation pipelines for digital asset creation and presentation & placement at retail. Many brands and retailers continue to use more than one 3D solution, so our strategy remains 3D software-agnostic. We continue to add connections with commonly-used 3D design platforms like Rhino 3D, Alvanon, CLO3D, Browzwear, Optitex and SOLIDWORKS.

Centric's market-driven integrations enable digital product designers to work in a familiar software environment while being seamlessly connected with PLM and Planning. Merchandisers, Retail Buyers and Wholesalers leverage DPC by interacting with 3D product renderings and providing feedback, as well as jumpstarting Merchandise Financial Planning and Assortment Planning.

We work very closely with customers who are pursuing exciting and innovative DPC strategies. Helly Hansen, for instance, began using 3D to get around Covid-related sampling challenges, and is now saving weeks of sampling time by creating 3D renderings with Centric PLM.

With Centric PLM at the center of a digital ecosystem, laying the foundation for the entire end-to-end digital process. We provide automations that allow brands, retailers and manufacturers to scale digital product creation workflows at an enterprise level. This enables them to achieve their digital strategies and goals, ranging from designing for the metaverse/NFTs to boosting product innovation, being more sustainable, reducing costs and a faster time-to-market.

CONTACT

IN CONVERSATION WITH

GRIF VON HOLST

PRINCIPAL PRODUCT MANAGER, CENTRIC SOFTWARE

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

Brands have been interested in Digital Product Creation (DPC) strategies and solutions for quite some time. For most, the initial approach to DPC was simply to choose a 3D design tool and begin designing in 3D. Even that was a huge shift for the retail industry, which has traditionally relied on physical samples. It's not just a shift in mindset— the technical landscape must also evolve to achieve the level of realism and omni-channel reach that is now expected.

Until now, many tools fell short of expectations. Today we have the perfect synergy of global business circumstances that shows 3D can help surmount critical challenges like sustainability, hybrid and remote working, as well as evolving customer expectations regarding product engagement and interactive experiences. This has accelerated the need for brands to expand DPC. In parallel, technology has evolved, offering product development teams amazing and ultra-realistic visuals with extended design capabilities that were not possible before. Such possibilities include 3D product configurators, virtual stores, magic mirrors, and other immersive digital experiences to reach customers in new ways.

By removing barriers-to-use and simultaneously making it practical for more cross functional teams to contribute to the creative and technical aspects of the go-to-market process, DPC delivers business benefits far beyond the traditional workflows.

There has always been a relationship between PLM and 3D, but now that the two solutions have become joint cornerstones of design and development, those connections are becoming even closer. How have you seen this need evolve over time? And how has Centric Software responded?

The evolution of each offering has been very exciting to watch! Product Lifecycle Management remains the foundation for managing product development. However, with the evolution of 3D Design, PLM must now manage product data differently. The data and files associated with digital products now include 3D-specific information (physics, textures, geometry, fit, etc.). This convergence of 3D design data with product development workflows provides unparalleled opportunity and flexibility to leverage these assets in a multitude of ways throughout the DPC ecosystem.

Centric PLM has responded by remaining 3D agnostic and tightly integrating with many different 3D solutions, giving our customers the flexibility to work within their 3D software of choice. We enable digital product creation with advanced workflows and automation, that brands, retailers, and manufacturers seek from an end-to-end digital ecosystem.

Beyond the core audience of 3D artists, there's a growing need for new personas and new in-house audiences to be able to interact with and benefit from digital assets. Can you provide some examples of where extending access to DPC workflows and assets is transforming the way brands operate?

This consideration is dependent on the end product usage. 3D artists can create an NFT or another digital asset which is never meant to exist in the real world. A 3D artist doesn't need to worry about the constraints of a tangible product that needs to fit a real human being and be bound to the laws of physics. They can create products that are only meant to exist in the metaverse or in Instagram feeds which avoids the traditional supply chain requirements.

For digital products that will have a real-world equivalent, extending 3D capabilities throughout the product development lifecycle and supply chain allows users who would traditionally be dependent on 3D designers, to now become autonomous.

By leveraging 3D web viewers and product configurators— merchants, product owners, or even store planners can visualize 3D products, create new color variations, or work through collection options themselves in real time.

With the introduction of automation pipelines, general system users can initiate on-demand rendering of high-resolution images from 3D models in varying camera angles or views for downstream systems or integrations. This automation workflow also helps to facilitate supplier-based design initiatives where brands can request suppliers to upload their own 3D design files into Centric PLM, and the 3D pipeline creates all the digital assets automatically based on the brand's 3D standards.

PLM platforms have long been held out as being "sources of truth" and, as a consequence, engines for decision-making across creative and commercial stages of the product lifecycle. Have we now reached the stage where enough of those decisions can be made based on digital assets that the way we think about where that truth resides is changing? And what impact is that having on the way PLM platforms are evolving?

It depends on the decision that is being made, and what that decision can inform or even influence throughout the ecosystem. PLM links all teams to a collaborative platform where they can access a wealth of up-to-date information. The amount of data kept in PLM is typically tremendous. When this data is combined with 3D assets and properly incorporated into the infrastructure, it can provide

unparalleled insight to make data-driven refinements regarding product strategy, planning, sourcing, pricing, and assorting, based on information gathered or decisions made throughout the supply chain and omni-channel sources.

It is important to note that PLM is evolving together with these digital ecosystems, since the definition of a "product" is changing due to enhanced 3D capabilities and requirements. PLM has the advantage in this evolution, as existing workflows provide a long-proven foundation for managing development processes. At Centric Software, we are augmenting these existing development workflows to incorporate 3D asset management, integrations, visualization, and interaction for all cross functional teams throughout the supply chain. To scale 3D asset creation, we are implementing 3D automation pipelines.

In order to provide insight to product assortments, pricing, and trend shifts, we are also incorporating Artificial Intelligence. From product strategy, merchandise planning, development, production, and through to customer interactions we are enabling a best-in-class, scalable, digital product creation ecosystem to support our customers' evolution from 2D to 3D development.

Where do you see digital product creation—and digital assets—going from here? What does the near-future look like for the industry and for your business?

Digital product creation has the potential to completely change how consumers interact with products. Some might argue that this is already well underway. However, I think we are still just discovering the potential of these experiences, and what can be learned from them to drive

business decisions to convert those engagements into customer growth. As technology evolves and digital assets become more realistic, multiple industries will be on the verge of revolutionary change, and that change will be a combination of many initiatives at once. From sustainability to on-demand production with personalized products, DPC has the potential to be a catalyst for many other initiatives gaining momentum.

> " **WITH THE EVOLUTION OF 3D DESIGN, PLM MUST NOW MANAGE PRODUCT DATA DIFFERENTLY.** "

Recently at Centric Software, we have made advancements that have moved beyond the near future and have created a long-term, scalable DPC solution for our customers. It has been tough for brands, as there are so many single point solutions which focus on just one area of the workflow or have some overlap with another technology they have already purchased. Putting all these technologies together in a way that can scale is a real challenge. Thankfully at Centric Software, we have been able to do this with our 3D partnerships to create a DPC pipeline where Centric PLM remains the hub for these digital assets and leverages our 3D technology partners to provide configurable, scalable, enterprise-automated DPC pipelines for the world's top brands, allowing them to evolve as quickly as their customers' habits.

2009
YEAR FOUNDED

Evolved from the word "clothing", CLO Virtual Fashion's mission is to empower everything related to garments - from design to styling, and beyond.

With more than 20 years of research and development in accurate garment simulation, we are leading the market by digitally merging, consolidating, and converging all components related to digital garments through our state-of-the-art 3D Cloth Simulation Algorithm.

Our product portfolio includes:

3D Fashion Design Software **CLO** (for apparel designers and fashion brands), **Marvelous Designer** (for artists at gaming and animation companies), and **Jinny** (for non-professionals to create 3D garments),

Virtual Collaboration and Creation Workspace **CLO-SET** (a communications and archiving platform for virtual garments),

Fashion Creatives Community Platform **Connect by CLO-SET** (a global community for fashion creators and open marketplace),

and integration plugins such as **CLO-Vise** (a plug-in system to integrate CLO with other PLM solutions).

CLO Virtual Fashion is a truly global company with offices in New York, Los Angeles, Munich, Madrid, Seoul, Shanghai, Hong Kong, Tokyo, Bangalore, São Paulo, and a brand-new office in Paris.

HEADLINE CUSTOMERS

Our full list of clients can be found here,
which includes:

ADIDAS	GROUPE DYNAMITE	LEVI'S
ARC'TERYX	HUGO BOSS	MANGO
EMILIO PUCCI	L.L. BEAN	SALOMON

CLO

CLO Virtual Fashion

WWW.CLOVIRTUALFASHION.COM

PRICING MODEL:

CLO offers Individual, Academic, and Enterprise licensing.

CLO-SET offers Basic, Advanced, and Enterprise pricing.

Learn more about our different plans and pricing.

30+
TECHNOLOGY PARTNERSHIPS, INCLUDING:

ADOBE SUBSTANCE

ALVANON

BAMBOO ROSE

CBX SOFTWARE

CENTRIC SOFTWARE

CHARGEURS PCC

DMIX

FIRST INSIGHT

INFOR

KALYPSO

LECTRA AND GERBER TECHNOLOGY

OKTA

PANTONE

PIXELPOOL

PTC

SAB

SIZESTREAM

SWATCHON

THE FOUNDRY

UNREAL ENGINE

VIZOO

WACOM

YKK

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

There are growing needs and necessities in the apparel industry to maximize the full value of each garment. We firmly believe that our technology and services can fulfill these needs by touching each and every step of the journey of a garment, from conceptualizing the design to the trying on and purchasing process.

We believe that the industry will benefit in countless ways through this new cycle. Efficient workflow, cost savings, better communications, higher accuracy and quality, and bridging content to other mediums such as movies and animations to name a few, while also achieving sustainability goals.
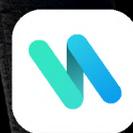
So to us, Digital Product Creation is merely the beginning. We are creating a new ecosystem in the industry by bridging the gap between real and virtual garments, and providing an unprecedented, enhanced user experience throughout the whole cycle.

CONTACT

CLO
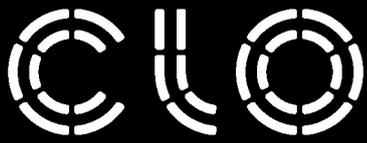
CHANGE
THE WORLD
WITH VIRTUAL
GARMENTS

YOUR GUIDE TO THE NEXT ERA
OF VIRTUAL FASHION

IN CONVERSATION WITH

SIMON KIM

CEO, CLO VIRTUAL FASHION

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

The turning point in the industry happened a few years ago, in 2017-2018. We were at the height of the retail apocalypse when the industry's leading brands finally got together and admitted that it was "3D or die". This was when changes really started to happen, little by little, within digital product creation.

Any innovation ("creative destruction") once rooted, will still take a good 5-10 years to be fully adopted by the industry as there are many phases of testing and resistance to go through before finally being embraced by the users and decision makers. Add 5 years from the industry turning point in 2017-2018, and you get to where we are today.

Although COVID was certainly an accelerator to many digital-based processes, I don't think that it was the primary reason for 3D design and DPC reaching critical mass. Even without COVID, the innovation would have permeated the industry by now because the benefits of 3D design and DPC are far too great to ignore, and the tech would have continued to improve to meet the industry's needs.

There are two different aspects to the explosion of interest in 3D and digital product creation for fashion. The first is the expansion and extension of 3D-enabled processes and capabilities within organisations that have already realised value from digital-native design, and are now looking to build on it. But perhaps the more interesting is the huge untapped market of brands, retailers, and manufacturers who haven't yet started on their 3D journeys - creatives who might only have recently been exposed to the potential of tools that can run at, or near, the speed of imagination. How are you seeing these two different markets evolve?

Naturally, there's heightened interest in 3D and digital product creation in the fashion industry right now, as early adopters are currently reaping diverse benefits and latecomers are seeing it firsthand.

Early adopters of CLO are now enjoying supply chain advantages with an enhanced communication flow, putting an end to the era of "handovers" (handing over tech packs and blindly waiting for samples) and ushering in a new era of collaboration (real-time revisions and decision-making). As early adopters continue to grow and evolve, they are now focusing on how best to utilize digital design to the fullest, experimenting with new arenas such as virtual showrooms and virtual e-commerce fitting rooms, as well as using their hyper-realistic digital designs in marketing and the metaverse.

Latecomers are not at a disadvantage though; these days, with the continuous improvement of our technology and platforms, it is easier than ever to learn, collaborate, and experience an upgraded holistic workflow right away, compared to earlier days when it was not as fast or easy to see holistic changes.

However, it's not just about being early to 3D and DPC–brands and manufacturers need to find the software and platform that's right for them, and sometimes it takes time to trial. In our recent CLO User Summit in Munich, we met with a number of clients whom we had conversations with years ago that ended up choosing a different service, but now decided to restart with CLO as they did not see the results they expected from other platforms.

Everyone has their own journey but the ending will be the same–everyone will eventually adopt 3D, leading to improved collaboration workflows and digital designs becoming a new revenue stream and channel to engage with consumers in fresh and exciting ways.

When CLO and The Interline collaborated in 2020, we wrote about how fashion brands and designers were preparing to translate their short-term focus on using 3D to sidestep sampling challenges, to using digital assets as fuel for enterprise-wide change. It feels as though the industry has made some strides there since, bringing more stakeholders - merchandising, marketing, manufacturing, and more - into the DPC workflow, and making decisions across those different disciplines to refine each product before it enters production. Are you seeing more CLO users now taking these next steps to extract more value from the work they've put into 3D asset creation?
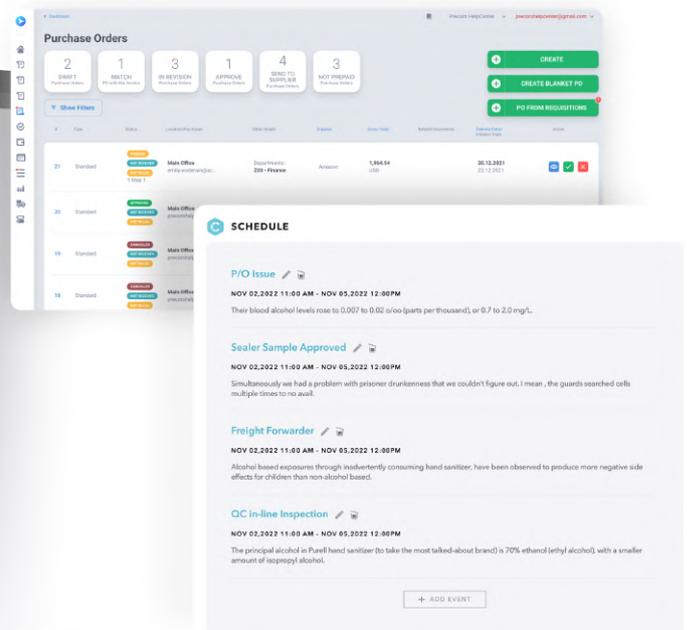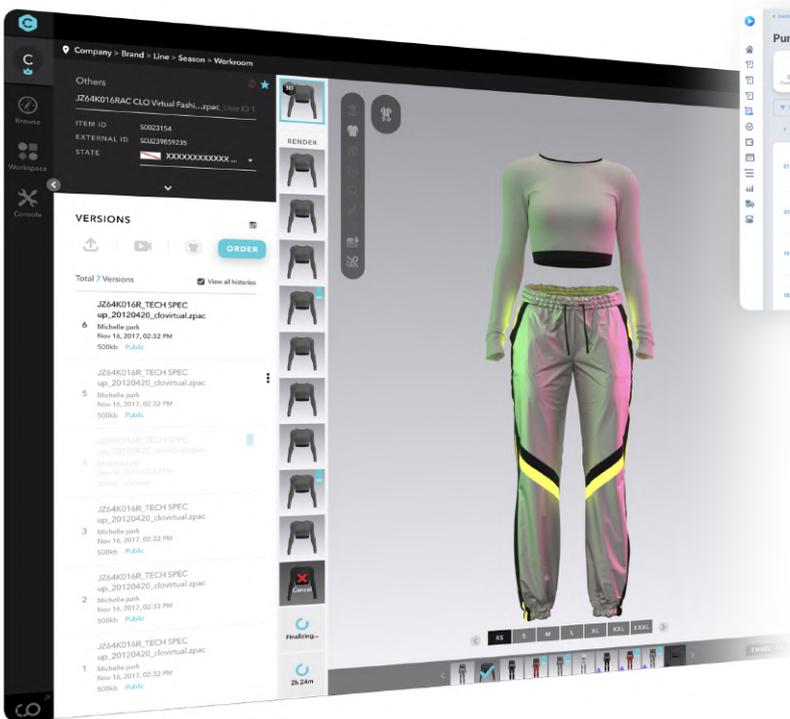
Yes, definitely.
From the very beginning, we have tried to emphasize that 3D is not just a tool, it's a new language to help all stakeholders and participants in the product creation process communicate and understand each other better.

In the beginning, many industry players saw 3D as a tool that was only used to cut costs during the sampling process. We know this far too well, as many prospects have asked for comparative studies on physical sampling time and digital sampling time–while this is a proven benefit, it's not the only reason for adoption. Using a 3D design process allows for faster and better communication, higher quality output (reduced errors), greater control over patterns and designs, minimized waste and material costs, higher efficiency, improved collaboration between designers and manufacturers, and more, all of which contribute to an immeasurable improvement to the process and final output.

Technological advancements and continued innovations to expand the usage of 3D and benefit more audiences, such as the CLO-SET platform, have resulted in more and more stakeholders becoming involved in 3D and DPC. CLO-SET not only allows all stakeholders to review designs in 3D (with advanced version controls and real-time collaboration to make adjustments and finalize collections), but also creates further efficiency through features like automated 3D web tech packs (why do tech packs have to be generated in excel or illustrator?), assortment planning, virtual showrooms, and much more.

All of these expansions have led different stakeholders to experience improvements to their own workflows and consequently maximizes the value of each and every 3D design created. We are excited and humbled to see such rapid growth in the industry and how the endorsement of 3D accelerates when it is used by all stakeholders.

As DPC becomes more deeply embedded into the way fashion operates, the industry's demand for digital-native talent is set to increase significantly. What roles do you believe brands should be hiring for, and how is CLO contributing to the ecosystem of education and grassroots creativity?

We do not think brands will need to hire new roles, as 3D empowers all current designers, patternmakers, tech designers, fabric specialists, and merchandisers in their own unique ways. Being young or digitally-native is not a requirement–rather, it is a question of how committed brands are to embedding 3D design in their processes and how devoted users are to learning new technologies. Anyone can learn, adopt, and enjoy working in 3D if they are given the right training, time, and capacity–this has been true for our customers throughout the last decade.

We partner with brands and train their existing staff to empower their roles and ultimately establish a common language between teams sharing the same 3D assets and tools. Successful adoption often requires a holistic understanding of the benefits 3D can bring to each role, rather than limiting it to a designated 3D design team. Many times, users will immediately see new benefits unlocked from embracing CLO first-hand, often resulting in a grassroots movement to adopt the technology and sparking an interest across many different departments in the organization.

Regarding emerging talent, CLO closely collaborates with hundreds of academic partners to make 3D design software more accessible to instructors and students, and to develop curriculums that reflect current industry demands and ensure that students are prepared to enter this new era in fashion.

3D design education is also expanding organically; with our individual licenses being used by many students to actively learn 3D design on their own, we are seeing an increase in cases where students ask their schools to teach CLO in their courses. Additionally, many of our CLO-partnered schools will recommend CLO curriculums to other institutions. It is inspiring to see knowledge and experience shared in this way.

Just like how we once had dedicated courses to teach IT/computers when it was first invented, only to disappear once computers became embedded in all aspects and curriculums, 3D will travel along a similar journey. One day, it will be rooted as a foundational technology in all aspects of the apparel ecosystem; until then, we still have a lot of work to do to make our software even easier to learn and use.
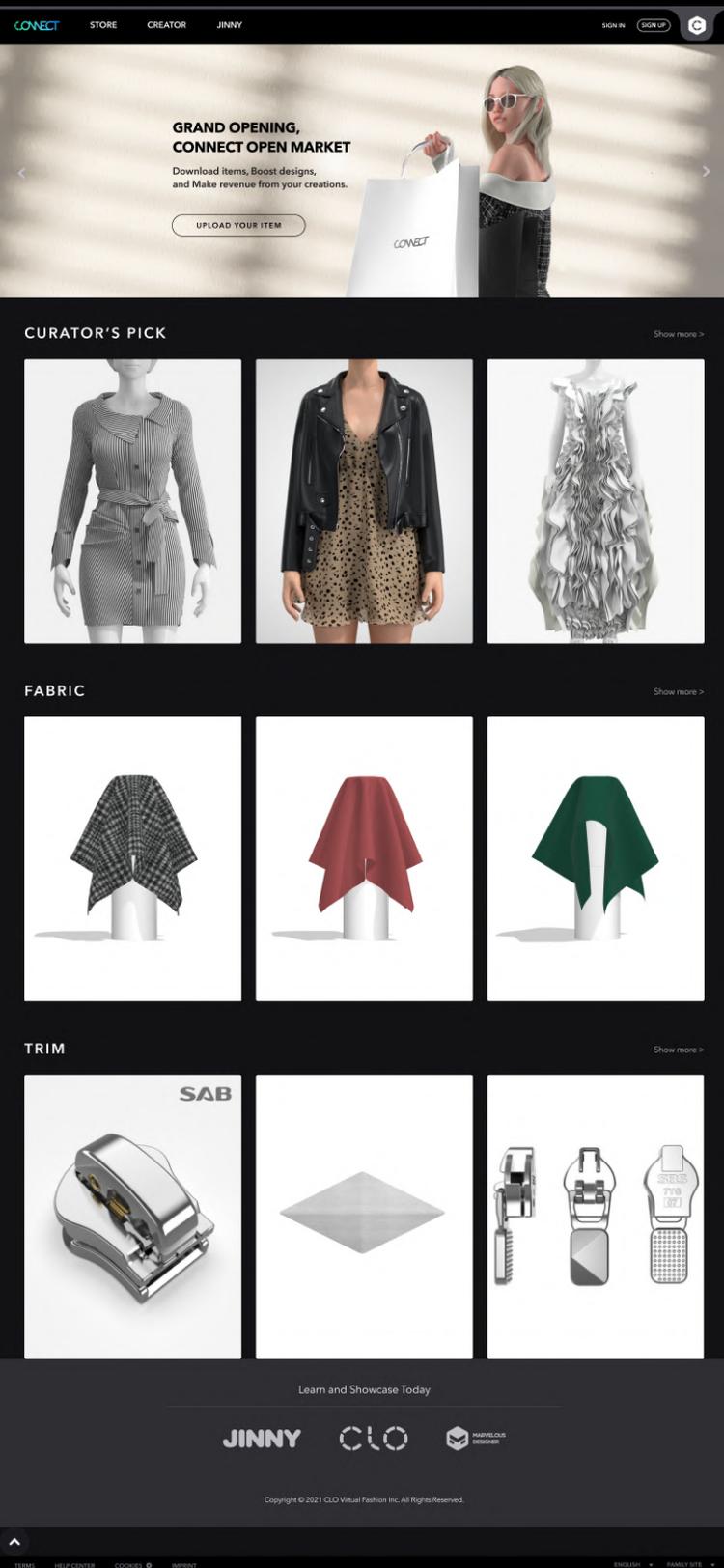
To help realise the visions we've spoken about, it will be vital for any 3D design tool to become part of the broader DPC technology ecosystem - through APIs and through file formats. Can you explain your perspective on integration, standardisation, and how fashion can start to make sense of the complex picture of managing its digital assets - from fabrics and patterns, to staging virtual photography and powering real-time experiences for buyers?

We've been actively improving our Open API and continuously developing plugins based on our users' needs, such as CLO-Vise (integrating CLO/CLO-SET and PLM solutions). We also collaborate with many different partners such as Adobe, YKK, Chargeurs (Interlining), and major PLMs.

CLO's core philosophy is to be user-focused; our roadmap highly depends on our users, but it's important to keep in mind that the best way to serve users' needs is not always exactly what they're asking for. Sometimes, the industry is so attached to traditional workflows that we miss the possibility of a better solution.

A good example of this is tech pack integration–many users asked for an automatically generated, excel-based tech pack for their 3D designs, but when we presented the 3D web tech pack feature which completely eliminated the use of excel, our users found this more efficient and effective. Even though we also developed an excel-based tech pack generator, that feature will likely be made redundant in the next few years.

In terms of standardization, we are well aware of and have been in discussions around fabric file format standardization and interoperability. There is a stereotypical thinking that standardization will solve a lot of problems, but it can also bring rise to newer, larger issues. For instance, software simulation engines are all black boxes, so even if there is a magical way to convert a fabric file from one software to another, the physical properties of the fabric may seem similar but are never exactly the same. This means that fabrics will drape differently in each software, causing inaccurate designs and leading to more confusion. So we have to be prudent and discuss the boundaries of what technology can do and what is practical so that we do not end up with an additional competing standard.

Nonetheless, we will continue to develop new integrations to meet our users' practical needs and improve the workflows of all stakeholders.

Where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

We are excited for the future.

We were excited when we started the company in 2009, and now we are even more so as we witness changes powered by new technologies that make us dream further.
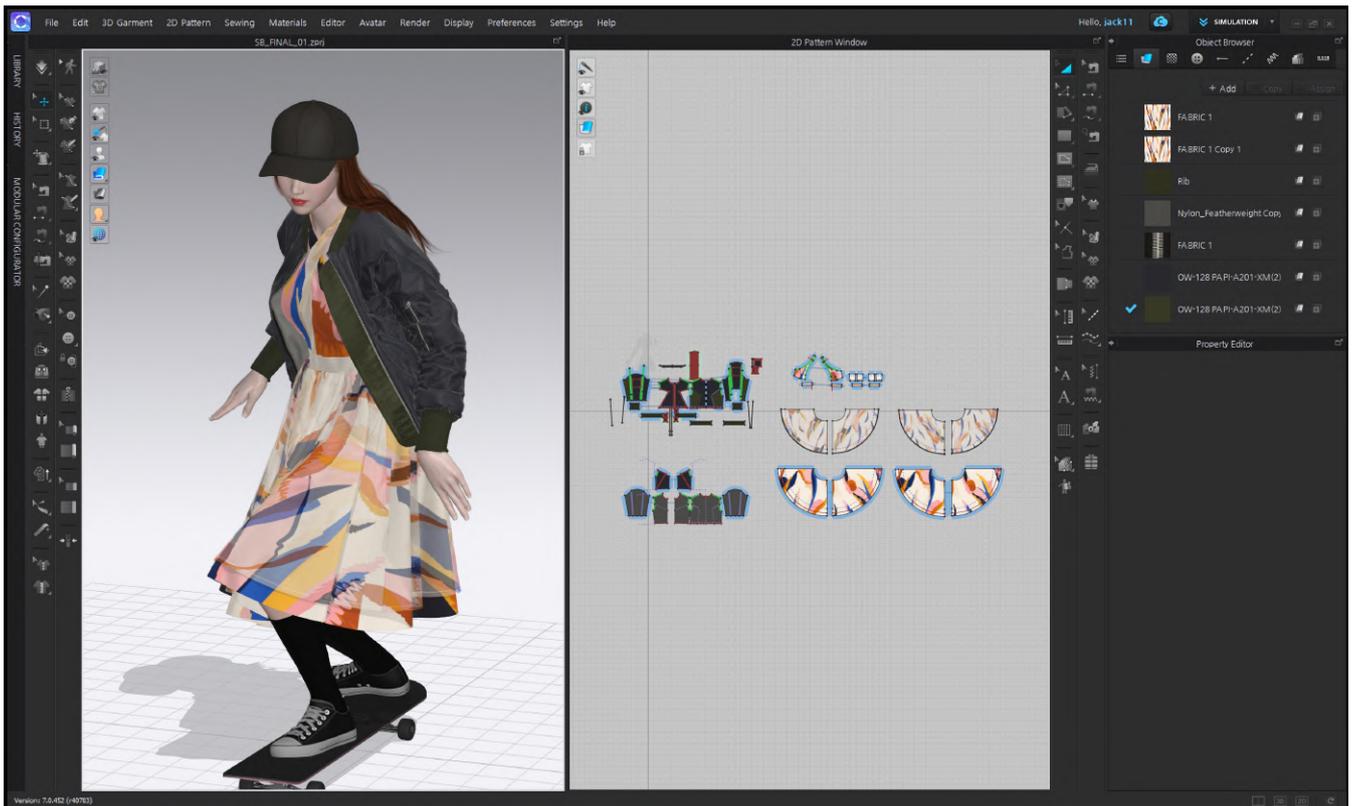
We believe that in the not-so-distant future, we will see...

... the adoption of virtual e-commerce fittings that not only reduce return rates but also allows brands to understand and engage their customers better. ***CLO has already launched beta virtual fitting services and testing with several brands.*

... all brands adopt virtual showrooms for practical purposes, such as wholesale and VMD operations. ***In partnership with Pixelpool, we already have brands who are fully equipped in this area.*

... all fabrics and trims digitized. ***CLO launched Connect by CLO-SET Marketplace in August 2022 where designers can get all the ingredients needed for their creative designs.*

... brands extending their design presence into digital worlds–animated movies, games, and the metaverse. ***CLO has recently launched the Metaverse Converting Service to provide an easier way to convert 3D assets into different metaverses.*

... all digital designs protected and verified by blockchain. ***CLO has a dedicated Web3 team and is preparing to launch related services soon.*

... the rise of new data analytics that connect fabrics, trims, patterns, and garments to body shapes.

... more brands adopting "Responsive Design" powered by 3D, where consumers can purchase designs before they are manufactured.

... and one day, a future where we no longer have size charts, just your size and my size, where garments will fit your one-of-a-kind body rather than forcing you to fit into averaged-out ever-changing size charts.

The list goes on and we are confident that our technology will power the future that we envision. Most of all, we are so excited to build this future together with our user community.

Clothing Tech was founded to tackle 2 enormous problems facing the fashion industry:

1) Garment design, design validation, and engineering take too long. In most cases 9-12 months.

2) The extremely high return rate of clothing.

Our solution, the Garment Digital Twin, was designed to address both problems. How?

1) True 3D CAD for garment design. Current "3D" garment design systems in the market are really 2D pattern creation systems that allow for 3D visualization Edits are done in 2D and visualized in 3D.

2) Our Digital Twin is created, designed, and modified in 3D. The 2D pattern is the output.

We propose a fully 3D Design system for garment design.

We believe the goals for the adoption of 3D Design are:

- Faster time to market

- Reduced overall costs for clothing design

- Native support for Garment Digital Twins that could be used in e-store visualizations and virtual fitting rooms.

- Automated support for regional grading differences.

- Cost estimates built in from the earliest stages of design.

Our Garment Digital Twin is much more than a virtual Sample. It is the complete definition of the garment. That means users can:

- Eliminate Tech Packs

- Generate Images for Marketing

- Enable Virtual Fitting Rooms

- Automatically load a DXF file and convert it into a fully sewn 3D garment

- Every Garment Digital Twin becomes a block that can be further edited in 3D for derivative styles.

HEADLINE CUSTOMERS

"We have been working with almost a dozen enterprise brand and retailer partners who helped in the development of our GDT technology."

![ClothingTech logo] ClothingTech
a **Hexagon** joint venture

WWW.CLOTHINGTECH.COM

PRICING MODEL:

Our pricing model is Value Based Pricing. We have a very low monthly subscription cost. You only pay when you use the GDT to create a new style.

2
ACTIVE TECHNOLOGY INTEGRATIONS:

ALVANON, 2022

CENTRIC PLM, 2022

9
INTEGRATIONS IN DEVELOPMENT:

ADOBE SUBSTANCE

BAMBOO ROSE

DESL

FLEX PLM

INFOR

KEYSHOT

NGC

POINTCARRE

YKK

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

The DPC process today is time consuming and must involve someone in the process who has pattern experience. The default 3D user today is usually a technical designer who knows enough about patterns and garment construction to navigate the current 3D solutions. It doesn't end there. In most cases, you will need 2 people involved, the tech designer and the designer, to make corrections and decisions during the design process. There are also workflows that involve 3 people, bringing in a pattern maker as well. Aside from the inefficient use of manpower and low productivity, these 2 or 3 people are in different time zones and cannot collaborate in real-time.

The GDT takes the pattern-making out of the equation. Any team member will simply upload a block pattern and our technology will automatically stitch the pattern and place the pieces. After that, ALL DESIGN EDITS are done in 3D with our unique set of tools. The user does not need to interact with the pattern to make changes, we do the pattern making for you. This opens the door for Designers to use 3D for the first time.

What normally takes days, even weeks, depending on garment complexity, will now take minutes using our GDT solution.

We see our solution speeding up the up-front garment creation process. Once a design is approved, we can envision working with other 3D solutions for things like advanced rendering, configuration, etc.

CONTACT

ClothingTech
a Hexagon joint venture

IN CONVERSATION WITH
WILLIAM WILCOX
CEO, CLOTHING TECH

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

The pandemic was certainly a big catalyst for those companies who have been "on the fence" about adopting 3D technology. For other companies who had already purchased a 3D technology but were not really using it, the pandemic forced them to refocus on their 3D implementation strategy. Remote became the norm and digital collaboration a must. Sharing 3D across the supply chain; design and development, at the factory level, and even in areas of e-commerce, merchandising, and marketing was also accelerated.

Fashion differs from other industries in that the primary use cases of 3D working have been weighted towards visualisation, whereas some other sectors use their digital twins to fully define their products - from materials to operations. Your philosophy is that the digital twin of a garment should be exactly that: a complete package containing full technical specifications, physical properties, and aesthetics. That represents a shift in thinking, so can you unpack it a little for our readers, and explain why you think the industry is ready for it?

For many reasons, the fashion industry is trying to become more efficient. This means lower costs, more sustainable, less waste, etc. The traditional approach to product definition in the industry is one of the main obstacles to improving efficiency. Most garments are defined by creating a tech pack and a pattern. In addition, virtual samples are now used to visualize and validate the garment design. This approach to product definition suffers from three main problems.

1. Ambiguity: The tech pack is a human-readable document. It is typical for there to be a period of back and forth between the technical designer and the supply chain to make sure that both sides fully Understand the requirements.

2. Synchronization: If a detail is changed on a tech pack, it does not update the pattern or the virtual sample. If the virtual sample is modified the tech pack is not updated etc. It is very easy for there to be multiple sources of truth.

3. Missing information: Even with all the information in the tech pack, the pattern, and the virtual sample, the information cannot be used to tell a robot or an automatic factory how to produce the product. The information is not complete and much of the information is not digital. It requires a garment expert to interpret it.
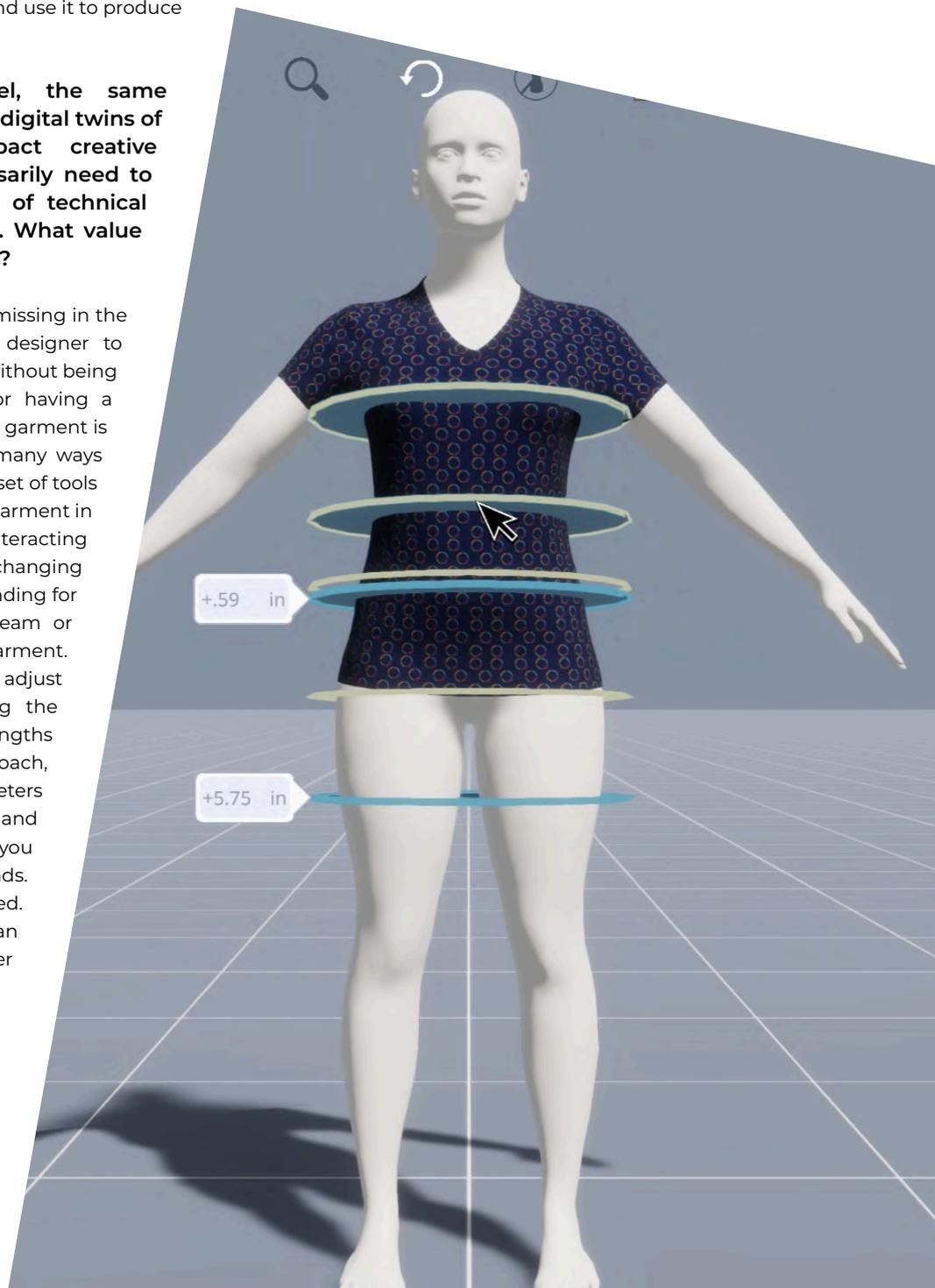
Our approach to Garment Digital Twins is to combine all the information in the tech pack, the pattern, and the virtual sample into one digital document. If the garment is modified in any way, the tech pack, the pattern, and the virtual sample are all updated automatically. The product is completely defined so there is no ambiguity or missing information. A robot or other automation devices in a factory can read this information and use it to produce the garment.

Beyond the technical level, the same approach to creating genuine digital twins of garments could also impact creative designers who do not necessarily need to interact with the mechanics of technical development and production. What value do you see being created here?

One of the things that have been missing in the industry are simple tools for a designer to interact and modify the garment without being a 3D expert, a pattern maker, or having a detailed understanding of how the garment is to be produced. Our product in many ways changes this. We provide a simple set of tools that allow designers to adjust the garment in 3D without ever looking at or interacting with the 2D pattern. This includes changing finishes like swapping the neck binding for a collar or adding pleats to a seam or adding a pocket or a vent to the garment. We have created simple tools to adjust the garment shape by adjusting the waist dimension or the bust or lengths etc. Using a parametric CAD approach, we convert the garment parameters into pattern making instructions and then resew the garment in 3D so you can see the changes in seconds. Seams can be added or moved. Garment openings, like the neck, can be reshaped using a simple Bezier curve tool.

The word "parametric" is often used, but not always correctly. What does it mean to you, and what implications does it have for digital product creation?

Parametric CAD means adjusting the shape of the product by its parameters. For garments these are the points of measure. For most adjustments to the pattern in current 3D CAD software, you need to be a pattern maker. Adjusting the waist of a dress means adjusting each pattern piece that makes up the waist. This means lots of clicking by a trained expert. With a parametric approach, the user types in the new waist "parameter" and the adjustments to each pattern piece is made automatically and when sewn together the new garment have the desired waist measurement. This simplicity removes many of the barriers of brands adopting 3D CAD into their processes.

Moving on from the ways that brands and their suppliers can interact with digital assets, they also have a long lifespan downstream. How do you see digital twins influencing and responding to consumer expectations and shopper behaviour?

> **THE TRADITIONAL APPROACH TO PRODUCT DEFINITION IN THE INDUSTRY IS ONE OF THE MAIN OBSTACLES IMPROVING EFFICIENCY. OUR APPROACH IS TO COMBINE ALL THE INFORMATION IN THE TECH PACK, THE PATTERN, AND THE VIRTUAL SAMPLE INTO ONE DIGITAL DOCUMENT.**

Currently, digital assets are created primarily to replace or reduce the number of physical samples. As we include 3D into earlier stages of design and costing, not only are these processes more efficient but you get a 3D asset for free. The assets can be used to engage the customers to get feedback. They can be used to create images for marketing, and they can be used as part of a virtual fitting room where customers can try on clothing to evaluate fit and style with the goal of reducing returns and increasing engagement.

Where do you see digital product creation - and digital assets - going from here? What does the near future look like for the industry and for your business?

We see a greater focus on standards in the industry. Compared to other industries there are very few standards in the garment industry. You cannot take a digital asset from one 3D CAD system and use it in another. There are no standards for digital fabrics, no standards for tech packs, no standards for avatar measurements, etc.

At Clothing Tech we are focused on automation, simplification, and integration.

Automating the conversion of patterns and tech packs into 3D digital twins. Automating the connection between the design and the factory processes that are producing the garment.

Simplifying the user experience for users when they are creating a new garment style from an existing style.

Integrating additional tools such as PLM and high-resolution photo realistic rendering solutions.

![Embodee logo]
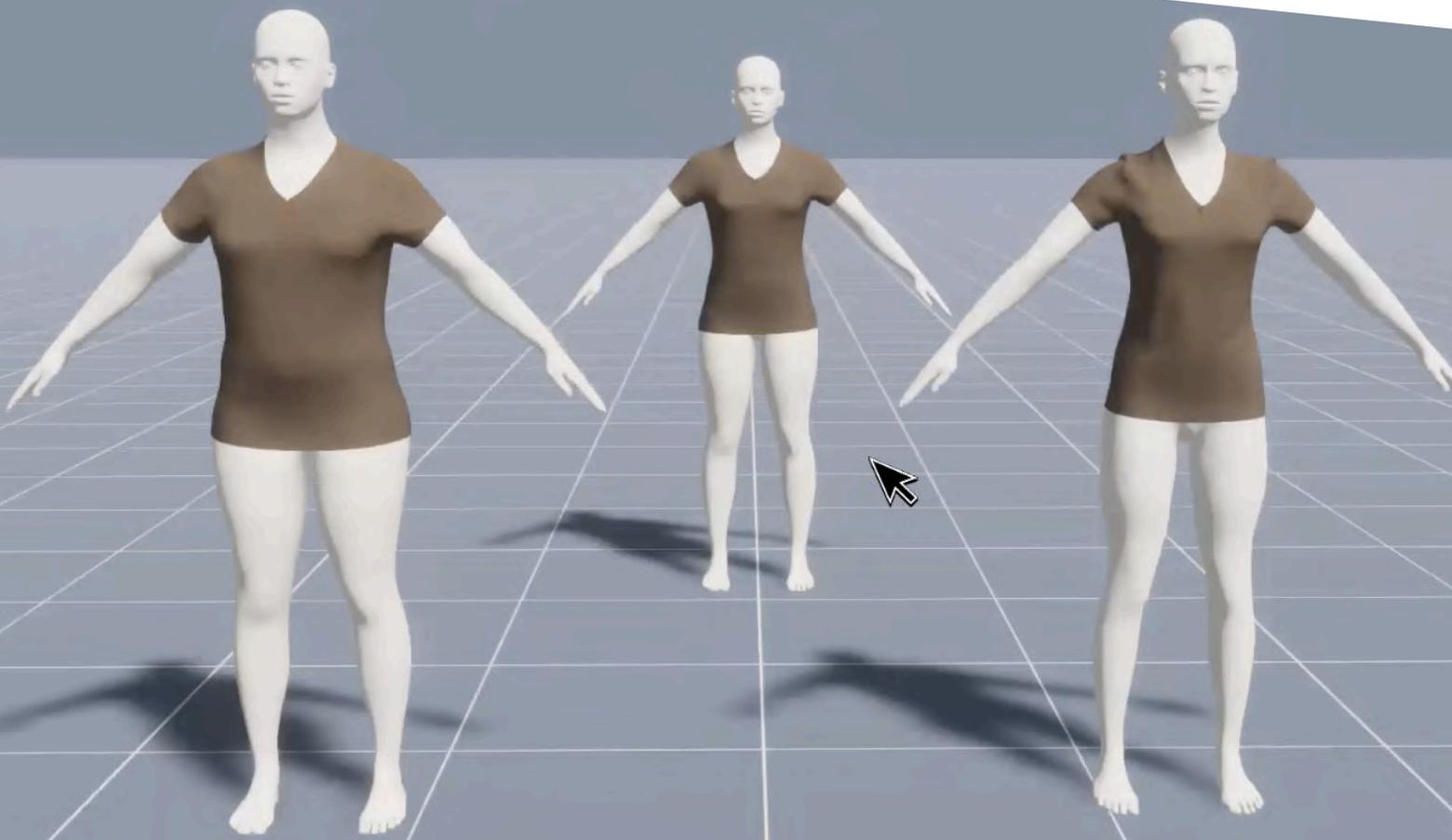
WWW.EMBODEE.COM

2008
YEAR FOUNDED

Embodee provides the global Apparel Supply chain with digital solutions that increase efficiency and make our future more sustainable. The company's software has been in use for over 10 years by apparel leaders including Nike and Adidas, and brings critical capabilities to the industry's emerging digital creation pipelines.

Orchids by Embodee, the company's collaborative platform, improves engagement between supply and demand by coupling existing 3D data with rich capabilities to boost the productivity of interactions between designers, manufacturers and brands across the industry's ~$1 trillion supply chain.

Digitally created products are easy to share & publish even before they are made. Silos between departments and companies are removed and relevant employees are brought closer together, giving them real-time visibility to let them make direct contributions. Decision making across distance and time becomes faster, easier, and less error prone.

Proven benefits include fewer - or no - physical samples needed for customer acceptance. Ease of use, low adoption hurdles and rich capabilities including support for all major languages enable the next step in the global industry's drive to go digital.

Orchids lets organizations get more done, in less time, for example:

Ideate: Create and share digital canvas spaces.

Collect inspirations, sketches, photos, and any related files to showcase, share, and take input on ideas for your new collections.

Publish: Upload 3D products into Orchids to have them come alive online.

3D models developed by technical designers become accessible to anyone. Optimize them with the click of a button to publish them anywhere - B2B Sales, E-Commerce, Online Ads, Social Media, the Metaverse - or use the creation tools to design a cornucopia of design variants.

Create: Easily, Collaboratively, and Rapidly, Online.

The entire team anywhere can view, comment, and help evolve - all products in 3D - without specialized 3D expertise. Apparel Designers, Print Designers, Product Managers, Merchandisers, and Sales get new products to the customer faster and better. Buyers can interact in the same manner helping make decisions and speed product to market - without reliance on physical samples.

Embodee is headquartered in San Juan, with employees across the US and in Europe.

ORCHIDS BY EMBODEE IS USED WORLDWIDE , WITH THE FOLLOWING APPROXIMATE GLOBAL DISTRIBUTION:

20% North America

15% EMEA

15% LATAM

50% APAC

WWW.EMBODEE.COM

PRICING MODEL:

Subscriptions to Orchids are priced based on usage. All plans have unlimited users. Usage is priced based on gigabytes plus number of users upgraded to PRO. Learn more about Orchids pricing here.

2+

DEEP TECHNOLOGY INTEGRATIONS:

SWATCHBOOK, 2020

BROWZWEAR, 2021

LEADING PLM SOLUTIONS (VIA WEBHOOKS/API)

10+

WORKS WITH:

ACCUMARK 3D	
BLENDER	
BROWZWEAR	
CLO3D	RHINO
MAYA	ROMANS CAD
MODARIS	OPTITEX
MODO	and many more.

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

We remove the industry's bottleneck of relying only on the 3D technical designer to get new Products done. Instead, we enable teammates to collaborate effortlessly and help get new product variants done together - in 3D, online.

We make existing 3D solutions more cost-effective by opening up the digital product creation process to stakeholders regardless of their particular expertise, or location in the world.

We make teamwork more visual, enabling online brainstorming, annotation, and providing on-product feedback with suggested changes and comments.

We unlock latent potential for organizational efficiency by reducing the back and forth, enabling faster decision-making and faster time to market.

We greatly reduce maker's & buyer's dependency on physical samples. We help make the supply chain process more sustainable.

We make it easy to publish your 3D products online and have buyers engage with your products - anytime, anywhere.

CONTACT

∆NDRÉ WOLPER

FOUNDER + CEO, EMBODEE

Digital product creation in fashion seems to have recently reached critical mass. There are more brands and retailers than ever either kicking off DPC / 3D strategies or trying to scale up the ones they already have. Why now?

Process change is hard for any organization. Most people agree that the pandemic provided a big boost to positive process change. Before the pandemic, most firms up and down the apparel supply chain had digitalization strategies in place, but overall the supply chain's progress was very uneven, as the transition requires resources and evolution in skill base. Technical advancements rarely proceed smoothly because the change affects not only process, but also requires behavioral adaptation. We are nearing a tipping point - which we won't recognize until it has happened to us - but my conversation with other CEOs in the DPC space usually provide confirmation that the industry's move to 3D centered DPC is really underway now.

There's also a generational factor that impacts the uptake of 3D-based DPC. For example, 20-30 years ago, architects still worked with pencil and paper, not because CAD wasn't around, but because that generation of Architects was used to their ways, and often reluctant to make the change mid-career. Today, you'd be hard pressed to find a drafting table at an Architecture firm.

Other industries have made the change to 3D-based virtualization already, but in apparel, the relatively low cost of the "prototype" - compared to, say, an automotive part or a piece of machine tooling - gave apparel companies the luxury to just get another sample made. But that old way of doing things has run its course because there are bigger cost drivers than just the cost of a product sample.

The pandemic's impact was very hard on the apparel supply chain. Not only because workers needed to be protected, but also because consumer demand for clothing dropped precipitously, rendering vast inventories in the

pipeline unsellable. Working fully digital became an overnight necessity. However, unlike in other industries, working with 3D is key because the supply chain's decision making processes are so visual - and traditionally dependent on having a physical product for every iteration. Suppliers and brands that had already made progress were in a better position to pivot, but we see that virtually everyone in the supply chain increased their efforts toward the utilization of 3D as a result of the pandemic.

Even without the pandemic, competition in the apparel supply chain is brutal. Conception to finished delivery is very slow due to a very high need for coordination within - and among - the globally distributed supply chain members. And production processes are unfortunately still very harmful to the environment. Shipping times are long and inventory is seldom fully consumed, leading to legendary write-offs and huge, recurring waste. Time, resource, and efficiency pressures are so high in the supply chain that those who learn to leverage the latest technologies will pull ahead. So we can expect that what has already happened in other industries will happen for apparel, too – making state-of-the art DPC the backbone of the supply chain. It is not a question of if - just when. Suppliers and brands realize that they need to be a leader, or at least a fast follower - or else they run a large risk of obsolescence. So the realization among many is that it is better to get serious about fully digital workflows and risk some up-front investment rather than risk the whole business!

Why do you think it's so important to break down some of the barriers that stand between non-technical, creative and commercial teams and the benefits of 3D digital product creation? Across

merchandising and marketing management, there's a strong argument for taking DPC away from that small pool of experts who currently hold the keys to it and extending the benefits everywhere. Why do you think that is, and why is that so important?

There's a big need in the supply chain, and within individual businesses within that chain, to get the less-technical and commercial teams more connected to the product development teams. All the various skills - business and product - need to converge for great products to emerge efficiently. And, as with everything, product development itself has sub-specialties, and stages. Timely, up-to-date information flow and improved transparency - including for visual information - enables the traditionally serial processes to become more efficient; with everyone having easy access to up-to-date information, teams can coalesce, produce, and then disband rapidly to move on to the next task.

Because apparel is highly visual, 3D holds the key. It isn't always possible to get all business and technical players around a physical table to see physical samples. And while 3D in apparel has really matured in recent years, it has still been confined to those specialists who have the right software on their PCs. 3D requires considerable skill and specialized software to create a quality that enables decision making; that has traditionally kept 3D off the desks of the people that need to contribute to guide the outcomes. Solving this is something we've been very focused on.

Today, and for the foreseeable future, 3D technical specialists are scarce - as their skillset is unique and quite divergent
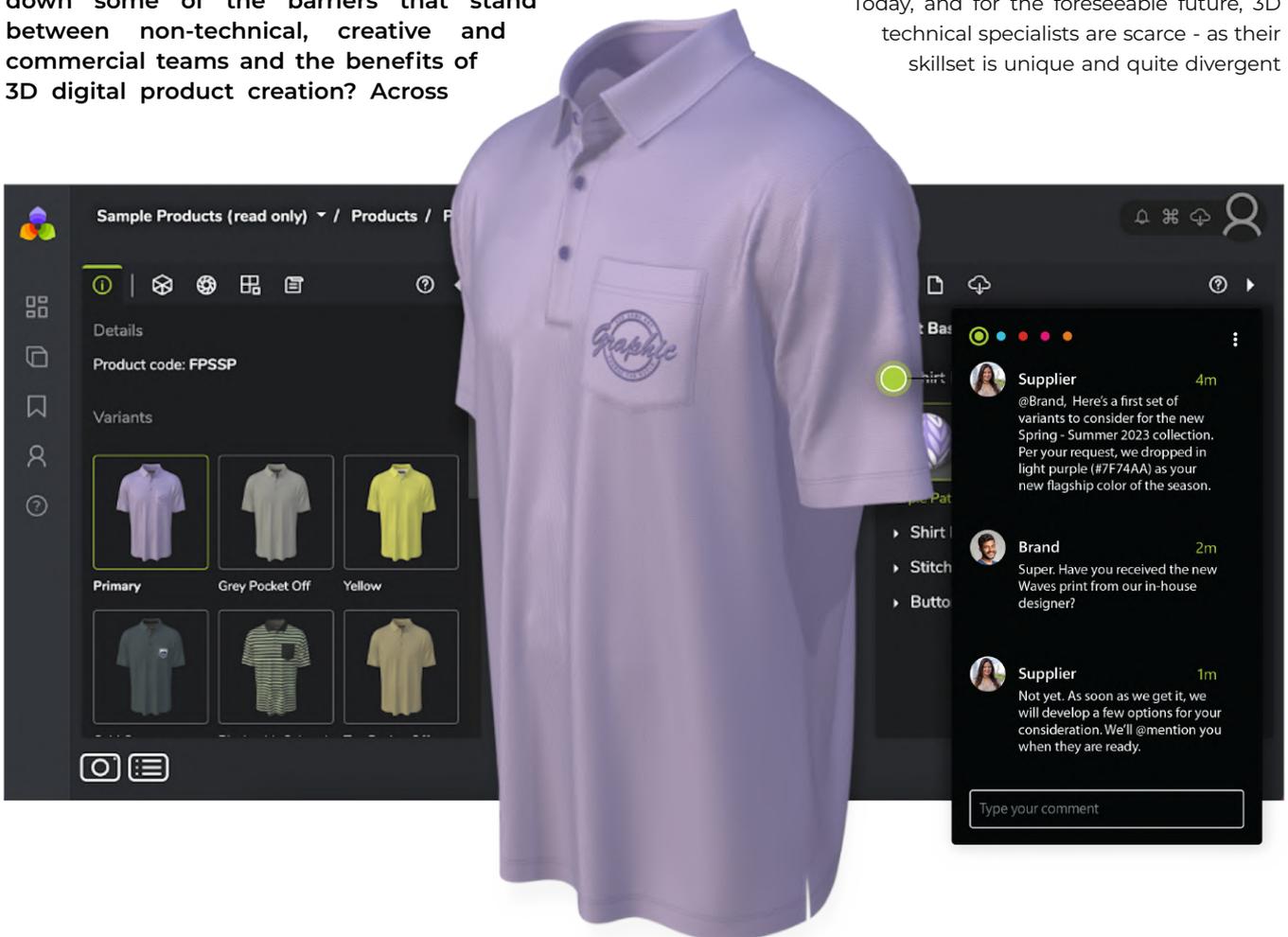
from the classic skill sets within apparel businesses. Businesses have the classic designers focused on materials, silhouettes, and feeling; 2D technical people focused on pattern making and also color, embellishments, prints, and graphics. Those folks think of 3D as difficult to use - and they are right, it has been difficult to use. But we are changing that. We are now able to let the designer and the 2D players converge with the 3D specialists. We enable them to open up their silos and join into an online space designed for DPC. Being online is especially powerful because of how international and distributed our industry is.

The time is ripe for a platform to unite companies and their team members across the DPC chain. Various tools exist (Illustrator and Photoshop for 2D, 3D-enabled pattern making software and silhouette simulators etc.) but each of them works in a physical place, without the means to interact, share, communicate around the emerging product. Video conferencing helps but timezone and product data access problems still remain. A common platform - with cost-effective access for all who need to be a part of the process - whether for 8 minutes a week or 8 hours a day. Everybody needs to be able to see the current design in its latest iteration, engage in the conversation, help make decisions and provide input. This applies not only to the aforementioned players, but also to merchandising and sales - not technical trades, but just as critical to market success. This is, to answer your question, the reason why it is so important.

How is the link between brand and manufacturer being redefined in digital native workflows? When you start to give more people access to 3D and you start to open up things like product variations and configurations, you start to open up these kinds of possibilities. How does that change the way that the brand interacts with their manufacturer? How do you maintain the confidence that with all the tweaks and configurations you're making, the product is producible?

Brands and manufacturers are very co-dependent in their relationship. Brands hold the key to the market; manufacturers to the supply. Some brands have pushed ahead aggressively in their adoption of 3D, but the majority are still finding their way. Some brands do not yet trust 3D as being a proxy of sufficient quality to lower the requirements for samples. The manufacturing leaders want to replace samples with 3D, but, in the end, the brands are the buyers and their workers often don't have the ability - or power - to make decisions that affect the proven (archaic) process. The individual professionals are bound up in that process. The pandemic brought this issue to a boil, for some. It led to proven cases where leading brands and suppliers realized that 3D, combined

with an online platform like Orchids3D.com, enables much more rapid review and approval workflows. And this is very powerful for both parties. It saves lots of time, saves money, is less error prone, and makes 3D easier to use, with low-to-no training requirements for the majority of participants. And, equally important, it's good for the planet!

So the way brands and suppliers interact is in the midst of change. Leading companies are already recognizing this and acting on it. Our platform (Orchids by Embodee) enables these improvements to scale - between a supplier and a brand - and from there across the value chain. The proof points for this exist and are very convincing. The missing ingredient is awareness and education. Once a brand sees the power of being presented and communicated within 3D via a web platform such as Orchids, they want to see it done that way for them by their other suppliers. It is already happening, and will catch on because the productivity and efficiency benefits are large and proven. Once awareness of this builds to a critical mass the tipping point will occur.

> " THE TIME IS RIPE FOR A PLATFORM TO UNITE COMPANIES AND THEIR TEAM MEMBERS ACROSS THE DPC CHAIN. "

What makes the Orchids platform different from other approaches to product configuration? There's a much bigger possibility space and maybe some extra complexity that opens up when configuration becomes more tightly integrated into: consumer engagement, value chain collaboration, the buying relationship you've mentioned. What sets Orchids apart from what other people may have experienced around product configuration so far?

Let's think about that question in two parts.

Firstly, 3D for standard (i.e. In-line products.) Using 3D product models at points of sale makes buying decisions easier for the consumer, because the product in question can be looked at more closely, and more interactively. Once the majority of products are generated in quality 3D during DPC, this use case will become commonplace, because the digital asset becomes available at zero incremental cost.
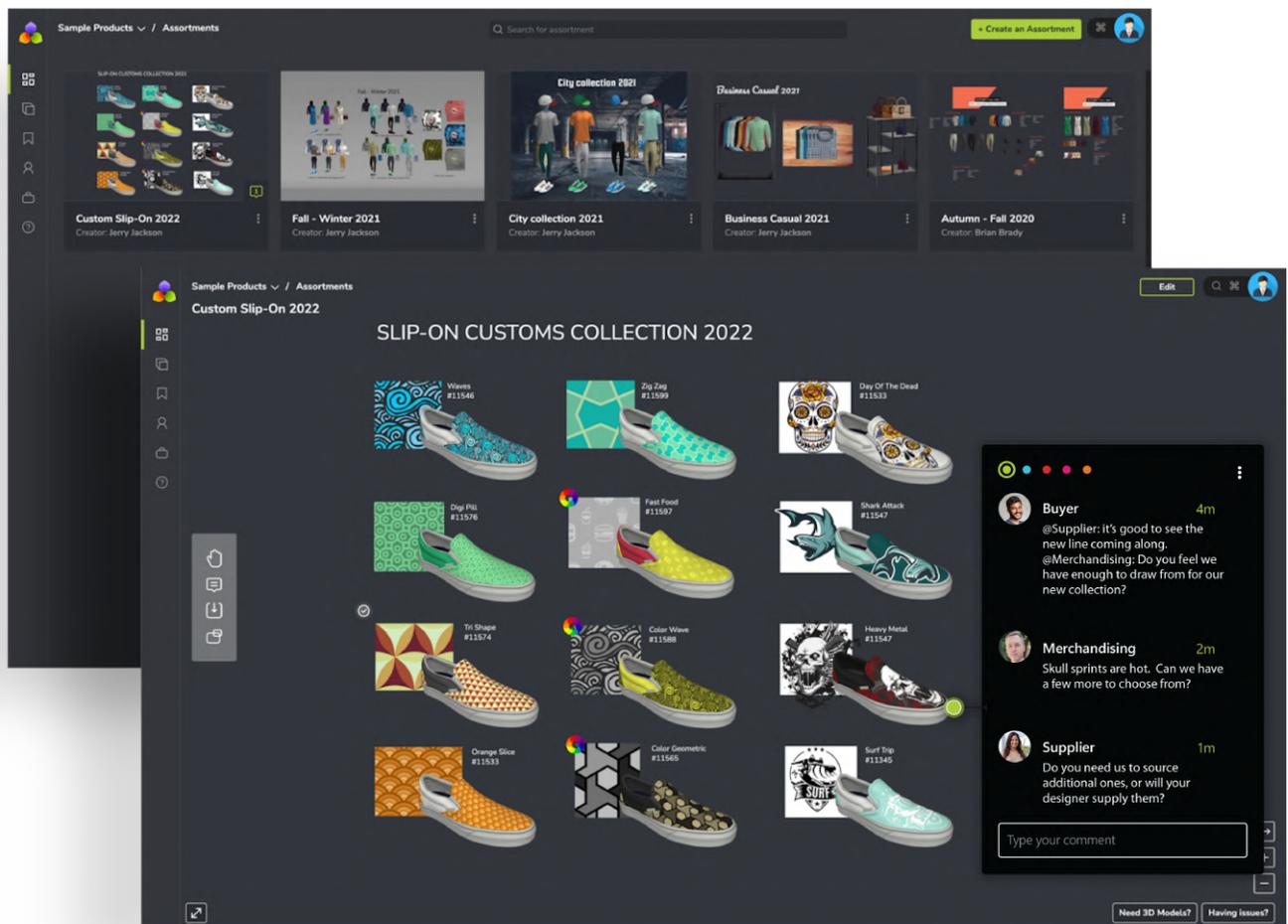
Secondly, there is a long-standing niche of buyer facing configurators for on-demand, i.e. custom made products. Today, this is a small fraction of the whole apparel market, but often a high value one because on-demand production doesn't have inventory issues. Selling custom also creates deeper brand engagement with buyers, which brands with a strategic outlook like to build.

Why? Because the custom product buyer gets the exact product they want, identifies with it more deeply (because they helped create it), and relishes in owning a 'one-of-a-kind'. Meanwhile, the seller does not need to carry finished goods inventory. In the eighties, Michael Dell revolutionized the PC market this way, by only carrying raw goods inventory. Apparel requires better visualization than PCs do to make the same economic model work, but 3D DPC enables that, as a side-effect, for free. A growing share of on-demand apparel in the industry will not only enable custom products. In combination with smaller, near market production batches, it will also enable retail to keep less products in DCs, and to react more nimbly to changes in demand (due to trends etc). Taken together, the move to digital also enables a more sustainable apparel supply chain (less inventory built and wasted). Buyer-facing configuration is something that will come very easily to all brands once they implement the right DPC platforms and strategies.

I am very confident in this statement because on-demand custom product enablement is something we've been doing for over a decade. Some of the world's leading apparel companies are our customers. During this time, we have continuously reinvested in building the transformative platform that is now available at Orchids3D.com. The technology we originally built for custom product enablement has evolved to supplement existing inline product creation development cycles.

You can think of Orchids being a lot like Google's Workspace (formerly G Suite). It augments a company's existing 3D process to make it more powerful, and pay bigger dividends. There are no more files being sent around, and no more issues trying to find the latest version of something. You've got one live version, accessible to everyone in the process - anybody, anywhere, on any device - with no training. From your desk or from your armchair.

That is a revolution, because it makes everything faster, better, and cheaper - and it finally allows digitalization to happen at scale as it brings a greater share of the human resource element to bear on the problem. This is our central mission: to enable 3D to scale within the apparel industry so that it can become more sustainable.

114

When you're trying to get into all of the potential benefits of increasing the whole possibility space to 3D digital product creation, it's going to be essential for brands and their partners to be able to collectively manage and access digital assets. What do you see as the key capabilities when it comes to a Digital Asset Management System?

Basic DAMs (Digital Asset Management Systems) have been around for quite a while. Traditionally, they are a repository for digital assets, and enable easy retrieval. By itself, a DAM typically won't display 3D data for you, nor allow you to work on the product. Many companies use them - usually as the repository for the data that's kept in support of classic business processes.

The problem with standalone DAMs, cloud-based or file-based, is that when you store your critical business process data (files) in a DAM, you're not able to see - or collaborate - around the data directly. This is especially true when we're talking about apparel, because it is about renders, aesthetics, shapes, colors, materials, and so on. You have to be able to see the elements and you can't. You want to make an edit and you can't. That's because 3D is relatively immature, and standalone DAMs do not allow viewing or collaboration, nor do they have built-in apps that allow you to edit your (3D) data.

However, in the more recent past, while 3D support in browsers has become quite powerful, they do need 3D files to be optimized in order to take them in. Unfortunately, typical desktop DPC software does not produce browser-friendly files. So, you've got to get the 3D models optimized to run well in the browser. If a web platform does that, browsers are at a level of maturity to provide a fast, interactive, and fast-loading experience - so the user experience can be very good. Heck, Google Earth and Google Maps - both web applications - now allow browsing of the whole globe in 3D! That's because the size of 3D models and their associated data can be made manageable in ways that allow them to be loaded into browsers, and to render them - provided they've been developed well, and provided they can be exported in a good way.

If you look at our Orchids platform, most people are blown away by the depth of the service's capability. Orchids is not your typical web page experience - it is deep, and more akin to a powerful desktop application. But it is also very easy to use - a web page based, "what you see is what you get", drag and drop experience - all via the internet. Anyone can instantly become a part of it. So it is massively different from file-based, single user desktop based applications. Because the web platform is not only universally accessible by all who need access - but it also very naturally a communication medium. Any given user can immerse in the product and can simultaneously communicate with others on the same version in a visual way. And invite others to come see, look, comment, and generally participate.

This is a breakthrough and it's made possible by fundamental developments that are more broadly the progress of the internet - we just leverage them in smart ways, combine them with our experience from over a decade of work, and make a revolution in DPC - and beyond - possible.

Where do you see digital product creation, and the need for digital / 3D assets, going from here? What does the near future look like for fashion and for Embodee as a whole?

We see a fairly linear progression of adoption, until the tipping point is reached. The pandemic was a forcing function, and there will be more. Those who put in their homework now will be in a better position and be resilient when that happens. Our work aims to help prepare for this future, and for companies to improve their DPC processes - bringing a lower cost, friendlier, more inclusive, more productive, and more sustainable process for all. It will also help accelerate the adoption of existing 3D tools from well known vendors, making 3D data more mature and more accessible.

Taken together, this is increasing the speed of the DPC flywheel, until we go beyond the point of critical mass, and into a better future for all.

orchids
by embodee

Scaling 3D for Fashion Online:
From Creation to Publishing

emersya

2012
YEAR FOUNDED

For the past 10 years, Emersya has been pioneering Interactive 3D and Augmented Reality for digital product experiences.

Our all-in-one online platform empowers brands, manufacturers & retailers to leverage their digital assets from product ideation to commercialization, thus creating value all the way along their products' lifecycle.

Emersya develops an easy-to-use, browser-based solution to create, share, review and validate product collections in Interactive 3D and AR. Designers can load their product models in our real-time 3D viewer and create different variants by applying colors, materials and graphics directly onto the different product parts.

The Interactive 3D designs can be instantly shared with global multi-disciplinary teams for them to review, make comments, and discuss the adjustments to be made, all in real-time and through a user-friendly interface.

Using Emersya's Collaborative Design solution helps make product design workflows more efficient and sustainable by reducing the need for physical samples. It also helps streamline the workflow of transversal teams and accelerates time to market as the platform can automatically generate production data and digital sales & marketing resources.

Using the same digital twins created by the design team, the marketing team can generate photo-realistic renders for any product variant (from any angle) and create web-based Interactive 3D & AR product experiences for sell-in and B2C sales, online and in-store. Emersya's technology can also be used to offer product customization with 3D and AR visualization, that reduces the number of off-the-shelf items produced, as well as the number of returns.

1200+
TOTAL NUMBER OF ACTIVE USERS WORLDWIDE, ACROSS THE FOLLOWING REGIONS:

650+ North America

450+ EMEA

100+ APAC

HEADLINE CUSTOMERS

AVERY DENNISON	FARYLROBIN
BILLABONG	MARMOT
DAINESE	SALOMON
DECATHLON	TARGET

emersya

PRICING MODEL:

· Annual subscription to the platform.

· Modular plans available based on user needs.

20
TECHNOLOGY INTEGRATIONS, INCLUDING:

ADOBE COMMERCE

ADOBE SUBSTANCE & CREATIVE SUITE

AMAZON

BLENDER

BROWZWEAR

CLO

CMS PLATFORMS

GERBER

iCAD 3D+

KHRONOS 3D COMMERCE

OPTITEX

RHINO

SHIMA SEIKI

SHOEMASTER

VIZOO U3M MATERIALS

XRITE AXF MATERIALS

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

Today, one of the greatest obstacles to the development of DPC processes is the lack of adoption of new tools and the resistance to change. This is closely followed by the lack of technical expertise to use 3D design software and the justification for the required investment. Emersya aims to tackle these challenges by offering a solution that is online, agnostic, easy-to-use and in real-time 3D. This makes DPC more accessible to non-technical designers, as they can easily bring their vision to life by creating photo-realistic product variants in real-time 3D.

Our Collaborative Design solution makes it possible for global multi-disciplinary teams to be involved in the design review process by allowing everyone to visualize, interact with and provide feedback on the 3D designs, through an online, user-friendly interface.

Emersya helps justify the required investment by empowering brands to leverage the same digital assets used for design to automate the generation of production, marketing and sales materials. Our interoperable platform enables transversal teams to upload, create, manage and collaborate around digital assets for:

· Product variant ideation + design

· Line reviews + iterations

· Automating generation of production materials

· Assortment planning

· B2B sell in

· Automated virtual photo-shooting

· Interactive 3D product experiences

· Augmented Reality & virtual try-on

· Digital ads, NFTs + Metaverse

Emersya continues to work closely with our clients and partners to develop digital solutions that bridge the gaps in their current value chains, to collectively build interconnected and collaborative DPC workflows.

CONTACT

Leverage digital assets from product creation to sales

MANAGE 3D ASSETS

Publish & optimize 3D models, materials & colors from any software

CREATE VARIANTS

Easily apply colors, materials & graphics in real-time 3D

SHARE & REVIEW

Collaborate online with global stakeholders

GENERATE TECH PACKS

Push directly to your PLM with BOMs

AUTOMATE PHOTO-SHOOTING

Generate photo-realistic images in one click, at scale

EMBED 3D & AR EXPERIENCES

for B2B sell-in, eCommerce & made-to-order

emersya

3D & AR Product Experience Platform

IN CONVERSATION WITH

AURÉLIEN VAYSSET

CO-FOUNDER + CEO, EMERSYA

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

There are 3 main factors that explain the increased implementation of digital solutions in product creation over the last couple of years.

Firstly, the outbreak of the global pandemic in early 2020, which left all actors in the fashion supply chain facing unprecedented levels of disruption due to lockdowns and factory and store closures. Digital solutions became a lifeline for brands, retailers and manufacturers to be able to weather the storm. The upside is that, this disruption actually accelerated the fashion industry's digital transformation as these actors became aware of how far technology has come and just how much they can do digitally, without creating physical samples. For those who had already started their digital transformation, the pandemic provided the opportunity to test digital solutions on a larger scale and further explore the possibilities created by designing products in 3D. This had led to more open discussions between brands and their supply chain partners with technology providers, in order to share their challenges and work together on building more inter-connected solutions and processes.

Secondly, there has been a significant shift in consumer behaviour, also influenced by the effects of the pandemic. Between 2019 and 2020, eCommerce sales increased by 77%, which represents a growth acceleration by 4 to 6 years! Recent studies have shown that the younger generations value the unique experiences that digital shopping can offer and there is a more general trend showing that all generations of consumers are looking for more personalized omni-channel experiences (over 80% say they research products online before purchasing in a store). The increase in online sales and the growing opportunities to engage with consumers in new ways across digital channels, justifies more investment in creating digital assets and implementing technologies to improve the digital shopping experience. Furthermore, the promise of the Metaverse and the potential to sell digital only products provide further opportunities for brands that are creating products digitally.

Lastly, in recent years the fashion industry has been shown to have a significantly negative impact on the environment through pollution, resource use, waste production and accounting for up to 10% of global CO2 emissions. More and more consumers are looking to buy eco-responsible clothing, pushing brands to adopt more sustainable product creation processes. Traditional workflows that rely on producing and shipping physical product samples use a lot of natural resources and produce a lot of CO2 and waste. Through the pandemic, brands have discovered first-hand how replacing physical samples with digital ones can, not only make product creation more sustainable, but also more cost-effective and efficient.

For brands looking to scale their digital product creation strategies, there is a mindset shift to be made - one that moves from framing 3D assets as tools for a single purpose, to seeing them as the key to digital-native ways of working that extend from initial idea to consumer engagement. Is technology now ready to support that vision?

This is something we see all the time. We often start working with a specific product team, a marketing or eCommerce team that want to create 3D assets for specific isolated use cases, often downstream such as Interactive 3D product presentation, Augmented Reality experiences, virtual photography, etc. A pilot project for a specific use case is often enough for them to realize how realistic 3D models of their products can be and to start exploring all the different ways they could use those 3D models. However, the use of 3D assets is often first explored either upstream for product creation or downstream for sales &

merchandising. Companies are still struggling to create a connected workflow that enables them to leverage the same digital assets for both of these activities. One of the main goals of Emersya is to empower brands using 3D from the early stages of product development, to leverage the same 3D assets all the way along the value chain.

Is technology ready? Yes, absolutely! Today, it is possible to use 3D technology and digital assets to: design new products; run simulations and digital fit tests; experiment with colors, materials and finishes; carry out online design reviews; generate production resources; automate the flow and management of data; plan assortments; generate photo-realistic images; present products to retailers and provide engaging consumer product experiences across all retail channels ...The real question is how can you knit all the different technologies available together into one continuous thread, to create an end-to-end digital workflow? There are many challenges, for example, the requirements for the digital assets used for product creation are not the same as those used for creating web-based product experiences for consumers. It is necessary to be able to convert, adapt and optimize the assets in order to be able to leverage them to create value all the way along the product lifecycle. Technology providers are working together to standardize file formats and develop integrations that will enable brands to move their assets seamlessly between the different solutions they use for each stage of the value chain, adding data as they go. We are working closely with brands and technology partners to improve the interoperability of our solutions, in order to bridge the gaps and create an inter-connected eco-system.

Implicit in extending the utility of 3D assets is the idea of extending the culture around them, to become more collaborative and to support decision-making everywhere from creative design to range building and assortment planning. How do you recommend that brands approach that process evolution?

The challenge many brands are facing now is how to go from working in silos to implementing strategic change across all business functions. The key to digital transformation at an enterprise level is to define a clear vision, ensure everyone understands why the company wants to move in this direction and how it is going to help them in their part of the business. This helps people to better align with the objectives and become part of the vision and the journey to get there. Although the vision must be supported by executive leadership, in order to receive company-wide validation and resources, we have seen how a top-down approach does not often work well. It is more effective to create multi-disciplinary, transversal teams that will act as digital ambassadors within their respective business areas, to help change mind-sets and embrace the use of digital assets at scale. Through training and workshops, the ambassadors can help get all other team members on the same page, work together to overcome obstacles and experience the benefits of DPC tools for themselves. The strategic role of the digital transformation team is to be able to set short term objectives leading to quick wins for each business area, that will also contribute to the long term goal at the enterprise level.

Secondly, when choosing which digital solutions to use, it is important to choose ones that enable all stake-holders to participate effectively and collaborate efficiently. For example, it is often difficult for creative designers to adopt digital solutions if they have no technical training and find it hard to change the way they are used to working. It is essential to provide a way for these designers to get involved in the preparation of the 3D assets in order not to lose their creative approach in the digital design process. The right choice of tools could not only empower them to fully translate their vision into 3D but also provide them with more time and freedom for creativity, by automating the administrative tasks. As a technology provider, we
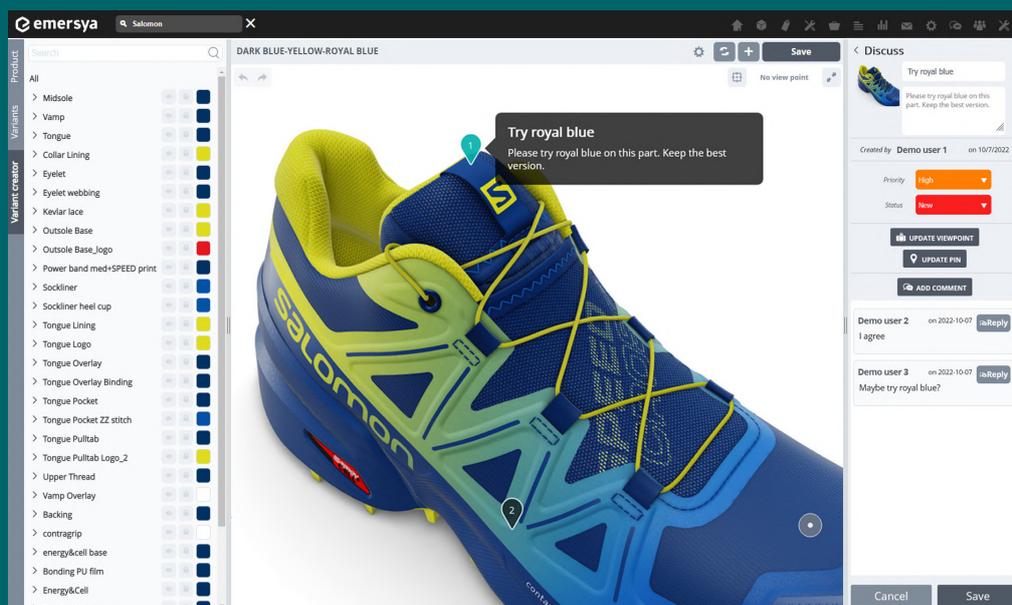
have a responsibility to make our solutions as easy to use as possible, in order to facilitate the digital transition for non-technical teams. Our goal is not only to facilitate the access to digital tools, but to allow multi-disciplinary teams to use digital assets to make better, more collaborative decisions earlier in the process, to get to the best final product more efficiently and sustainably.

The fashion industry has an outsized share of top direct to consumer brands, and a significant consumer appetite for buying online that appears to have mostly carried over from the pandemic era intact. What opportunities does this create for interactive, immersive shopping?

Aside from convenience, recent studies have shown that today's consumers are looking for two main things from online shopping. Firstly, they are looking for a unique, personalized and engaging shopping experience that goes beyond what they used to get in a physical store. Secondly, they are looking to gather all of the information they need, quickly and easily, to make the most informed decision before making a purchase. Interactive 3D and Augmented Reality technology open up a whole new dimension of possibilities to feed this new consumer appetite... With Interactive 3D, brands can engage consumers in an immersive experience that empowers them to actively explore a product from every angle, inside & out, in great detail. Each shopper is free to interact with a product in their own way, discover all the key selling points through dynamic annotations and seamlessly preview all colorways in a product range. Real-time 3D animations can be used to create unique

storytelling experiences and, for more technical products, exploded views can provide further insight into the material layers and components. With Augmented Reality and Virtual Try-On, brands can offer an even more personalized shopping experience by enabling customers to visualize products in their own physical surroundings or on themselves. AR technology has been shown to be both a practical and engaging tool for customers that helps brands to build loyalty and reduce the number of returns.

And what capabilities do you believe DTC brands and retailers need to build to seize those opportunities?

To be able to offer these kind of online shopping experiences, brands and retailers first need to create high-quality 3D models and digital materials for their products. This can be done in-house or through external partners. They then need a solution that will allow them to organize & optimize these assets, to create and manage the interactive experiences and to deliver these experiences across their retail network, securely and at scale. This is where Emersya comes in!

For DTC brands in particular, the ability to create the foundational assets as part of the product creation process gives them a significant advantage, as they are able to create the online shopping experiences before the physical products are made, thus speeding up time to market. Being able to test, market and even sell products ahead of production, means a brand can more accurately manage their production to match demand. However, as I mentioned before, the digital assets created for product development are not always directly usable for online product experiences. For example, 3D models for product creation are usually very large files that need to be optimized before they

can be rendered online in real-time or loaded in Augmented Reality. The brands that will be able to extract most value from their digital assets, are those that are able to create workflows with interconnected solutions, to make their assets evolve for different uses. At Emersya we develop solutions to empower our clients to optimize and adapt their existing assets and streamline their digital product creation to online product experience workflows.

Showcasing finished products in 3D also opens the doors to allowing consumers to interact with, buy, and customise products - and even to drive on-demand production of personalised products. How significant do you believe this method of engagement is today, and how likely is it to grow in the near future as relationships between brands and consumers evolve?

In the last 10 years, we have witnessed a growing interest in product personalization from both brands and consumers. From a brand's perspective, offering customized products increases their value, drives engagement and loyalty, while reducing returns. From a customer perspective, product customization empowers them to co-create a personal product that incorporates their preferences and reflects their personality. However, in order for consumers to want to buy custom products, the customization experience has to be easy, enjoyable and above all, visual! Today, 3D technology makes it possible to provide shoppers with a photo-realistic, interactive preview of their product, as they customize it. The true-to-life quality of the 3D visualization is essential for gaining consumer trust and giving them the confidence to buy a product based on its digital twin. They can even try the product on virtually and share the image with friends to ask their opinion before purchase. After purchase, the interactive 3D preview of their customized product and/or image of them wearing it is ready for them to share on social
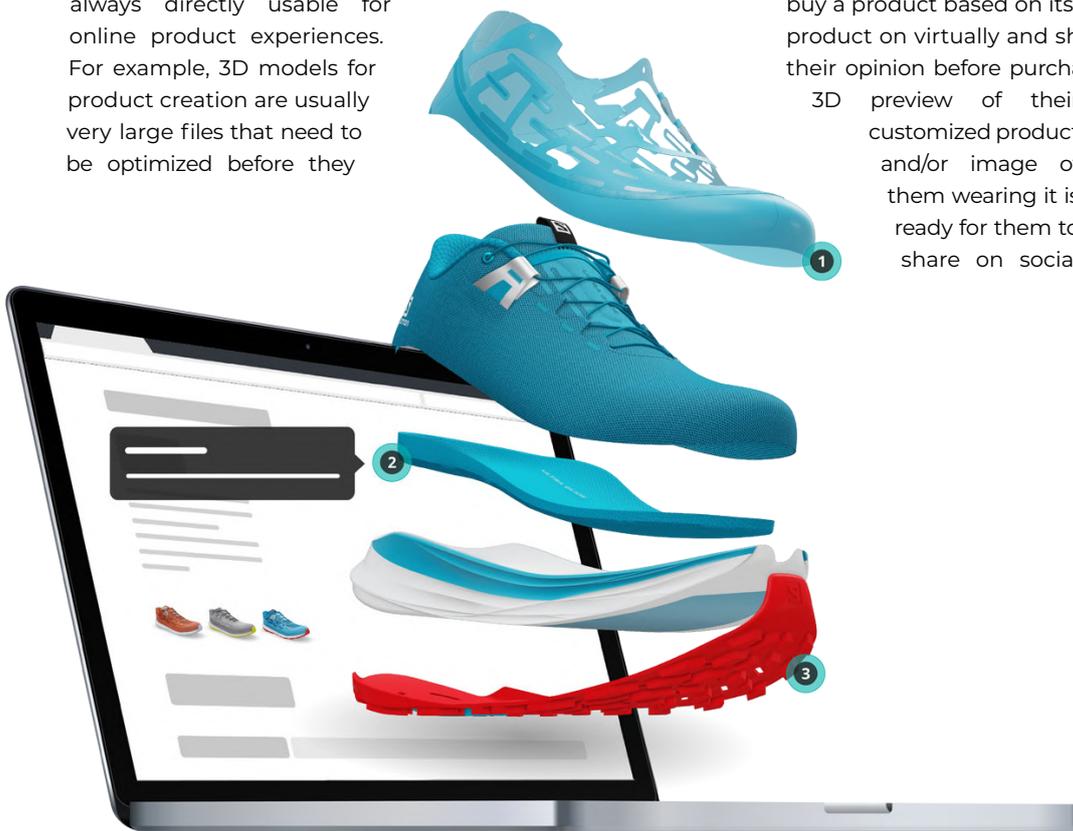
media, increasing the level of potential engagement exponentially.

The implications of this go beyond consumer-brand engagement. As shoppers are looking for customized products, are willing to pay more for them and are confident buying online based on a virtual product preview, this opens up the possibility for brands to move towards pre-sales and an on-demand production model. Moving from mass production to mass customization would enable brands to only produce what they have sold. While challenging from a production perspective, the model comes with major advantages such as eliminating the production of unsold stock (on average 30% of all collections), minimising returns, optimizing the use of resources and reducing environmental impact. Lastly, the growing interest in consumers owning the digital version of their products for use in the metaverse, or even "digital-only" collections, provide brands with further opportunities to generate revenue from 3D product customization, with no production model required!

Where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

With an ever increasing number of brands, retailers and manufacturers looking to create digital assets and implement DPC processes we believe the next big focus

for technology providers should be on improving accessibility and interoperability, reducing bottlenecks and facilitating the scale-up. On the user side (brands, retailers etc.), we believe that as the benefits of having digital assets continue to grow and become more widely recognized, more emphasis will be put on turning short term change and isolated developments into future-proof transformation across all business functions. Our goal as part of this ecosystem is to continue to develop digital solutions that are simple, yet complete, to promote wider participation in DPC and collaboration around digital assets. Emersya aims not only to provide an agnostic platform for transversal teams, but also to deepen our compatibility with other software providers, to further streamline the data flow and empower our users to create even more value with their digital assets.

Emersya has been a pioneer in developing the use of real-time 3D visualization for both downstream engaging product experiences and upstream collaborative product design. The more we explore these areas and the links between them, the more possibilities we find with potential for future development. We have always and will continue to work closely with our clients to identify their specific needs and challenges, in order to develop best solutions, for the different stages of the product lifecycle. We share the same goals with our clients: to increase the efficiency of their design teams by streamlining and optimizing workflows; to reduce their environment impact; and to offer the best online product experiences.
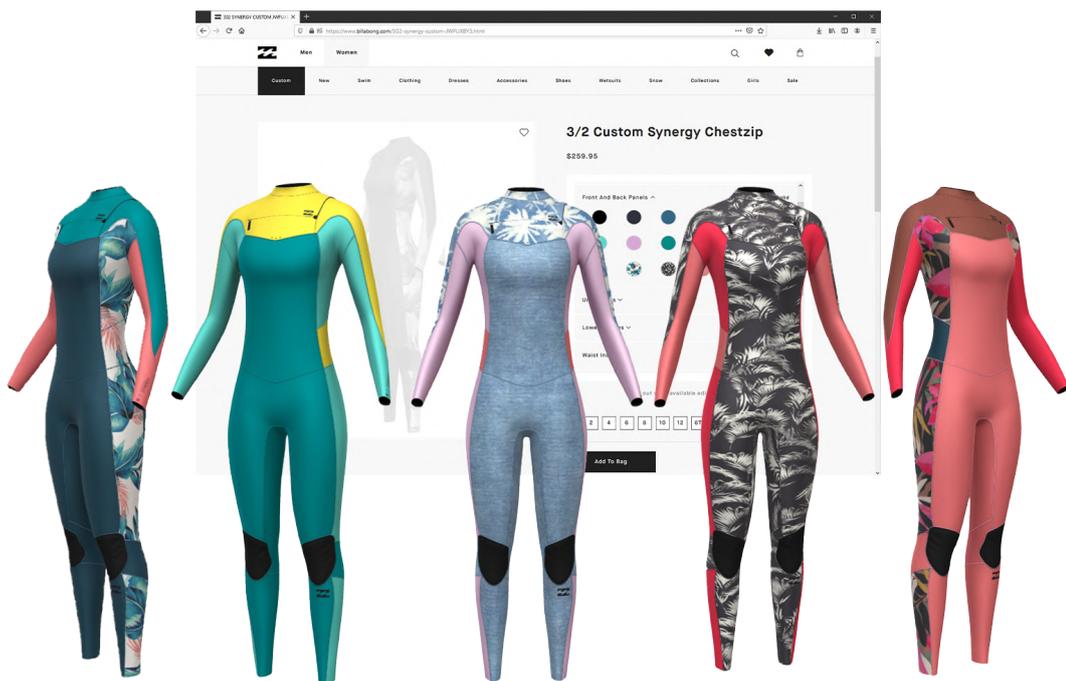
Frontier

WWW.FRONTIER.COOL

2020
YEAR FOUNDED

Frontier.cool's TextileCloud™ platform facilitates the rapid, scalable digitization of textile fabrics using a standard home or office scanner.

As a result, material digitization tasks can now be carried out within minutes and scaled without limitations.

In addition, we offer the most comprehensive material development collaboration SaaS and APIs to enable seamless integration and interoperation with applications such as PLM, ERP, and 3D design software.

TextileCloud™ is the world's first material digitization solution to offer internationally verified environmental impact data estimations.

Thanks to our technology, we can now deliver material-level impact estimation measurements such as Co2 emissions, water consumption, and even land use — instantly, at scale, and in a trustworthy manner.

2000+
TOTAL NUMBER OF APPROXIMATE ACTIVE USERS WORLDWIDE.

HEADLINE CUSTOMERS

We are currently working with 50+ mills and 10 of the world's leading multibillion-dollar global fashion, sportswear, apparel, and athleisure brands including but not limited to:

EVEREST TEXTILE CO., LTD

NIEN HSING TEXTILE CO., LTD

GRANDETEX DEVELOPMENT CO., LTD

TEX-RAY INTERNATIONAL CORP.

HONMYUE ENTERPRISE CO., LTD

J&B INTERNATIONAL HI-TECH TEXTILE & GARMENT SUPPLY CO., LTD

Frontier

WWW.FRONTIER.COOL

PRICING MODEL:

The Frontier.cool business model is subscription-based and is built on a combination of SaaS and consultative services.

The four components of our pricing model are as follows:

1. User licences

2. Storage fees (digital storage ranging from 50pcs - unlimited)

3. Premium features (U3M file, Eco-Impactor™, Design Hub™, supply chain management.)

4. APIs (business management platforms such as PLM, ERP, and digital textile tech solutions.)

3

TECHNOLOGY PARTNERSHIPS, INCLUDING:

MADE2FLOW (2022)

VIRTUALITY.FASHION (2021)

SO REAL DIGITAL TWINS AG (2021)

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

By offering a scalable solution that enables 3D and 4D material digitization tasks to be carried out and scaled while saving time and money and improving efficiency, Frontier.cool and the TextileCloud™ platform is revolutionizing the fashion and textile industries by bridging the communication and collaboration gaps between brands and their suppliers.

Improving collaboration and communication are the most significant problems the fashion and textile sectors are currently experiencing. However, integration is difficult in the textile business since it is distinct, lacks industrial clusters, and has siloed and scattered information.

We help to speed up the traditional and infamously slow supply chain process while assisting the industry in achieving its environmental impact and sustainability goals.

Traditionally, brands send sample requests to their suppliers, and the suppliers physically send fabric swatches to the brands. Frontier.cool and the TextileCloud™ platform gets to work at the very beginning — the sourcing stage.

Frontier.cool reduces and often eliminates manual processes while providing a supplier-to-brand information exchange.

At the core of Frontier.cool's TextileCloud™ platform is our proprietary AI and machine learning technology, which helps remove the friction and complexity associated with fabric digitization.

CONTACT

Frontier

TextileCloud™
Create Your Digital Library With Ease

- Rapid material digitization

- Global collaboration platform

- CO_2 and ESG impact measurement
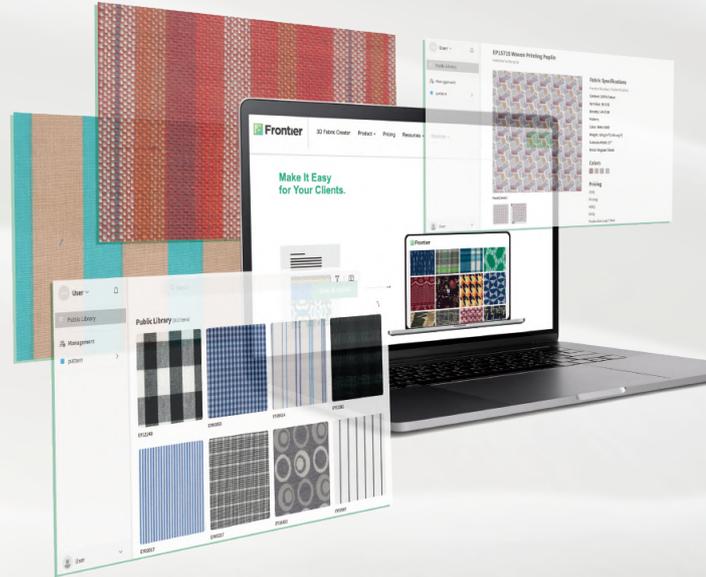
No External
Kit or Outsourcing Required!

Fast   **Efficient**   **Low-Cost**

Take your material swatch or hanger

Scan using a regular office flatbed scanner

Image and text recognition via AI-powered technology

Downloadable 3D file — ready in minutes!

Material Metadata
AI-generated maps (layers) which bring the design to life as they represent the character of the fabric.

Physical Properties
Stretch, bend, thickness, etc.

Environmental Impact Measurement

CO2 emissions   Land use   Water consumption

![Frontier logo]

IN CONVERSATION
WITH

Victor Chao

CEO, FRONTIER

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

There are a few factors to consider when understanding why there has been such an increase in DPC.

According to the US department of commerce, in 2020, 46% of all apparel sales were made online, accounting for around US110 billion. Ecommerce growth from 2018 to 2019 was 4%, and from 2019 to 2020 was 16%. There has been a massive shift in channels, and this is only the beginning.

This shift has increased the need for digital product creation to cater to a more diverse and dynamic marketplace to keep up with and meet the fast-paced demands of this new world.

Digital product creation also enables a more extensive scope of sizing to meet real-world demands. Demographics give us an average height and an average bust, for example, but clothes made according to statistics don't give us a comfortable, personal, or accurate size. A decent piece of clothing should fit the individual consumer's body shape.

We also have the issue of sustainability. Again, substituting traditional fabric samples with digital equivalents is the smartest answer to helping reduce our environmental impact, eliminating waste, and contributing to a more sustainable and eco-friendly future.

Finally, the technology stack ecosystem is more connected, and the world is more connected now. Even if we cannot solve all problems in one place, we now have the option to connect globally. SaaS solutions are now easier to implement and manage, there are many options available now, and the majority of them are easy to integrate into existing workflows.

According to a report by McKinsey & Company, in 2021, fashion companies invested between 1.6 and 1.8 percent of their revenues in technology. By 2030, that figure is expected to rise to between 3.0 and 3.5 percent.

More than 60 percent of fashion executives believe creating integrated digital processes throughout their organizations will be among their top five areas for digitization as they look to 2025.

Over 50 percent of fashion decision-makers say traceability will be a top-five enabler of lowering emissions in their supply chains. However, many brands still find it almost impossible to talk effectively with their suppliers. They need an efficient way to communicate, and this is where Frontier.cool and the TextileCloud™ platform comes into play.

Brands are increasing their focus on traceability through their supply chains, helping them address demands from regulators, investors, and customers for greater transparency. As they aim to cut emissions and meet their environmental, social, and governance (ESG) targets, brands would benefit from the environmental impact indicators that we can provide.

Do you believe that the scalability of material digitisation has held DPC strategies back, or are brands and their suppliers only now identifying that capturing fabrics at high speed, in high volume, is going to become a pinch point? How are you proposing to use AI to alleviate that pinch?

The notoriously cumbersome and slow-paced fashion supply chain has faced real challenges when learning to adapt to, embrace, and adopt a digital workflow. Since the brands are demanding digitization at scale, the supply chain must keep up, or it will lose out.

Brands and suppliers must cooperate to reach the ultimate shared goal of digitalization, and eventually, the shared value through productivity will increase. All players must be aligned — the brands are pushing for this, but the entire industry needs to upgrade as one unit for digital fashion to succeed.

We can look at this in three parts.

We have the traditional process where brands send their sample requests to their suppliers, and physical samples need to be shipped back to the brands via conventional methods such as FedEx or DHL, for example.

We also have the common digital process, where there is an element of digitization — typically a third-party scanning center or hub — but the shipping component remains.

Frontier.cool's proprietary AI and machine learning technology aims to reduce or even eliminate manual processes and the shipping of physical fabrics while providing a supplier-to-brand information exchange with all suppliers using a more interoperable solution.

Frontier.cool's TextileCloud™ platform enables anyone to digitize fabric materials using a regular flatbed scanner by themselves, regardless of who they are or where they are located.

Our cutting-edge technology then transforms that 2D fabric image into a 4D-ready digital twin, which includes the fabric spec, AI-generated metadata (or maps) to ensure the digital material looks realistic, the physical properties which enable the digital material to move as naturally as it would in the real world, and a 4th level of commercial data — we are now 4D-ready!

It's worth noting that the TextileCloud™ platform also has a built-in 3D viewer, which can be used to see a quick 3D preview of the digital material. It's also great for the mills that don't have any 3D design tools on site.

All of the above-mentioned data can be downloaded as a U3M file within 3-5 minutes. This file can then be plugged straight into future applications, including 3D design software, PLM systems, or ERP, for example.

Since the scanning can be performed by the user on-site, there is no need to outsource to a third-party scanning hub, which subsequently saves time, and resources and eliminates any training.

Beyond capturing core visual and physical properties, Frontier.cool is also committing to enriching materials with layers of commercial and - recently - sustainability data. Can you explain how this is intended to support digital product creation as an engine for more comprehensive digital transformation?

The commercial data, or 4th level of data, that we are able to supply is extremely powerful. This data includes, but is not limited to:

- Lead Time
- Costs
- Construction Details
- Country of Origin
- Certifications
- Remaining Stock
- Production Capabilities
- Environmental Impact Estimations

This extra layer of data is beneficial for management, traceability, and tracking, particularly the environmental impact estimation data.

As we know, the fashion and textile industries are under the microscope – sustainability and transparency are critical. Unfortunately, brands are struggling to meet their sustainability goals due to the lack of readily available, scientifically-backed data from across the supply chain.

For greater transparency, brands must increase their focus on traceability through their supply chains, helping them to address the demands of regulators, investors, and consumers.
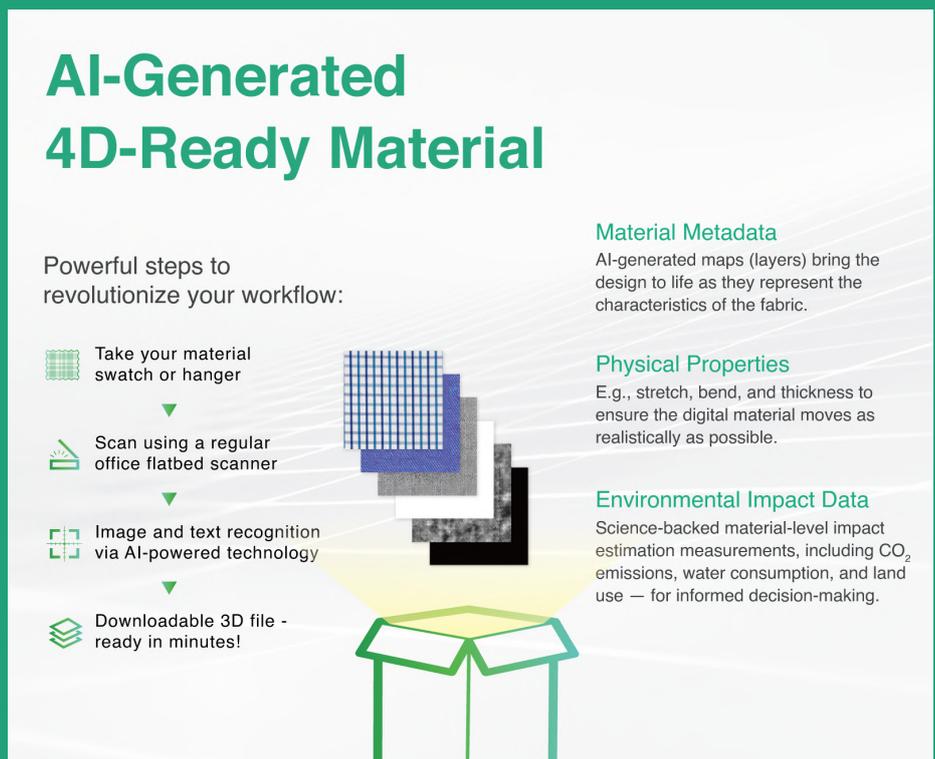
We are the world's first material digitization solution to offer internationally verified environmental impact data estimations via our Eco-Impactor™ module.

Thanks to our technology and our unique partnership with Made2Flow, we can now deliver material-level impact measurements such as Co2 emissions, water consumption, and even land use — instantly, at scale, and in a trustworthy manner.

Every piece of fabric scanned and uploaded to the TextileCloud™ platform will display the estimated impact that it has had on the environment. This information is essential for Informed decision-making and getting things right at the very beginning.

Moreover, we can even offer personalized environmental impact estimation calculations through facility-level data gathering (T2) and sub-supplier (T3) data gathering. Frontier.cool also works tirelessly with partners and research organizations to increase carbon disclosure accuracy, discover carbon inefficiencies, and uncover further development opportunities.

The environmental impact estimation data obtained via Eco-Impactor™ is verified by Quantis and follows the Life Cycle Assessment (LCA) software methodology in accordance with ISO14064 and ISO14040.

AI-Generated 4D-Ready Material

Powerful steps to revolutionize your workflow:

- Take your material swatch or hanger
  ▼
- Scan using a regular office flatbed scanner
  ▼
- Image and text recognition via AI-powered technology
  ▼
- Downloadable 3D file - ready in minutes!

Material Metadata
AI-generated maps (layers) bring the design to life as they represent the characteristics of the fabric.

Physical Properties
E.g., stretch, bend, and thickness to ensure the digital material moves as realistically as possible.

Environmental Impact Data
Science-backed material-level impact estimation measurements, including CO_2 emissions, water consumption, and land use — for informed decision-making.

Having access to this kind of critical data is crucial. It's safe to say that most brands, designers, and suppliers aren't aware of the data needed to perform such calculations accurately. Inset decarbonization is now a reality — instead of offsetting, where we cause damage, then try to "make up for it" by planting a tree on the other side of the world — it is no longer an afterthought.

One of the key considerations when it comes to extending DPC throughout the value chain is onboarding users, bringing in expertise from brands and suppliers, and allowing them to collaborate and to share the task of creating and making use of digital materials. How does the use of AI and cloud tools help in lowering that barrier of entry, creating opportunities for knowledge sharing, and distributing the burden of digitisation?

The global pandemic has somewhat forced a new way of working upon the fashion industry — remote working, Zoom meetings, and online collaboration are now the new normal. As a result, innovation has increased, and new skills and technologies are being developed rapidly.

At the core of Frontier.cool's TextileCloud™ platform is our AI and machine learning technology, which helps eliminate the friction and complexity of fabric digitization. In addition, our platform can interoperate and integrate easily thanks to its open API toolkit, enabling the entire industry to work together in sync.

The main challenges facing the value chain are how to improve collaboration and communication. The textile industry is unique, it doesn't have industry clusters, and information is dispersed and siloed, making integration challenging.

When we developed the TextileCloud™ platform, seamless and efficient collaboration was always one of the fundamental challenges we strived to overcome — co-work, co-design, and co-develop was the aim of the game.

To solve collaboration conundrums, the TextileCloud™ platform incorporates a myriad of collaborative features to enhance, optimize, and speed up workflows.

Design Hub™ enables easy and efficient external collaboration between brands and their suppliers. In particular, Design Hub™ assists brands and brand designers with efficient, inspirational digital sourcing and allows for quick decisions regarding choosing fabrics, narrowing down options, and ultimately creating the product in the "real world."

Beyond Design Hub™, the TextileCloud™ platform also offers solutions to the typical burdens of internal collaboration and communication, whether that be across teams, departments, or the organization.

It's worth mentioning that Frontier.cool's TextileCloud™ is not 'just' a platform; we also offer a painless shift to a digital workflow through our onboarding, coaching, and

TextileCloud™ – The Path of Material Digitization
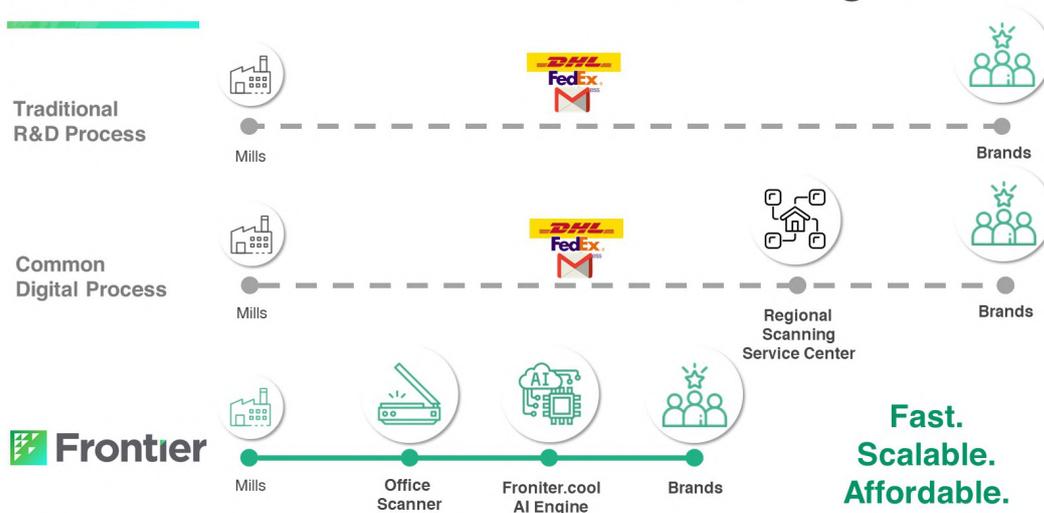
Fast.
Scalable.
Affordable.

mentoring services. In addition, our follow-the-sun model ensures that support is always available — regardless of time zone or geographic location.

Do you see digital fabric sourcing co-existing alongside already established models in a hybrid arrangement, or are you predicting a complete retooling of how the industry operates? Where is the tipping point between digital and physical?

We have found that the more "advanced" brands that are further along their digitization journey intend to not use physical samples at all — eliminating them entirely from the development process. Again, this is because they see great value in digitization.

The intermediate majority, which makes up an estimated 80%, use more of a hybrid model with both systems working in harmony.

> " TO SOLVE COLLABORATION CONUNDRUMS, THE TEXTILECLOUD™ PLATFORM INCORPORATES A MYRIAD OF COLLABORATIVE FEATURES TO ENHANCE, OPTIMIZE, AND SPEED UP WORKFLOWS. "

Eliminating samples enables a more cost-effective, efficient, leaner workflow. We are not doing it just for the sake of it; it will cut costs dramatically. We're pretty confident that nobody wants to make a single sample.

Regarding the tipping point between digital and physical, we often think about this in a similar vein to a social media platform or a social media community.

Take Instagram, for example; it's easy to get involved in, with a friction-free entry point, there is a community vibe, and when there are enough people involved and "doing it," there is a snowball effect, and users no longer feel like they're firstcomers, they're made to feel more like a member of a community or network.

Just as we at Frontier.cool are striving to build up the community or ecosystem, there are many solutions out there that are easy to use, frictionless, more user-friendly, accessible, and affordable — a lower cost of ownership.

Fashion tech, in general, is easier to adopt and robust, and there are more and more people getting involved than ever before — this is becoming the new normal.

Where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

We are often asked how businesses can scale digital product creation to support multiple use cases both downstream toward e-commerce and upstream to development and manufacturing. DPC should seamlessly connect upstream and downstream, it can be done now, but it's not commonplace.

Extending the value of digital assets in both directions should be the ultimate objective — increasing the usage of digital assets in consumer-facing scenarios, targeting digital fashion business models, and matching digital twins to the physical counterparts that must eventually be produced.

In our experience, the main goals of digital product creation are for companies to 'accept change' and to adapt their business strategy, solution modeling, and processes linked to new market realities.

Change and opportunity are everywhere, up and downstream. A comprehensive digital product creation strategy, including a solution such as Frontier.cool and the TextileCloud™ platform, can be the key to unlocking the right mindset to overcome challenges and seize new possibilities.

Additionally, the market of virtual fitting rooms has seen increased growth and demand in the last few years, reaching a market value of 2.97 billion USD in 2020 and is extending downstream. Looking towards the future, we can envisage a new generation of sizing surveys that work from continuous data feeds and tweaking measurement modules.

Further down the line, we can expect leading retailers to offer made-to-measure products.

On-demand manufacturing is, of course, one of the ultimate goals. We want to break away from the standard of minimum order quantity.

Instead of over-producing mindlessly, factories and production lines will be connected to downstream retailers and upstream material suppliers and integrated into a timely supply and demand network. We are firm believers in connecting the entire value chain, and this connectivity will open the possibilities for ODM.

Frontier.cool revealed the world's first single-chip for the textile industry — based on FPGA (Field-Programmable Gate Array) hardware acceleration — at the Consumer Electronics Show (CES) at the beginning of this year.

The chip, which uses Xilinx FPGAs with Arm processor architecture, was developed to convert physical fabric into digital material, thus allowing virtual apparel to be designed directly from real-world textile fabrics — expanding the benefits of virtual fashion and powering up the value chain.

This innovative world-first can be installed in textile and garment factories and fabric manufacturers to speed up digital fabric layer computation, facilitating the connection to 3D apparel design software and enabling the representation of the physical fabric in the virtual apparel or fashion space in real-time.

Thanks to this groundbreaking technology, the product development process can now be achieved in the virtual world, regardless of geographical location or time limitations.

The future's looking bright. We are positioned in front of a potential $2 trillion market. Beyond this, with the data Frontier.cool gathers from suppliers and brands, we can leverage this to work on advanced manufacturing and the stock market to predict demands and trends. Therefore, there are plenty of opportunities beyond "just" digitizing the value chain.

KALYPSO
A ROCKWELL AUTOMATION BUSINESS

KALYPSO.COM

2012
YEAR FOUNDED
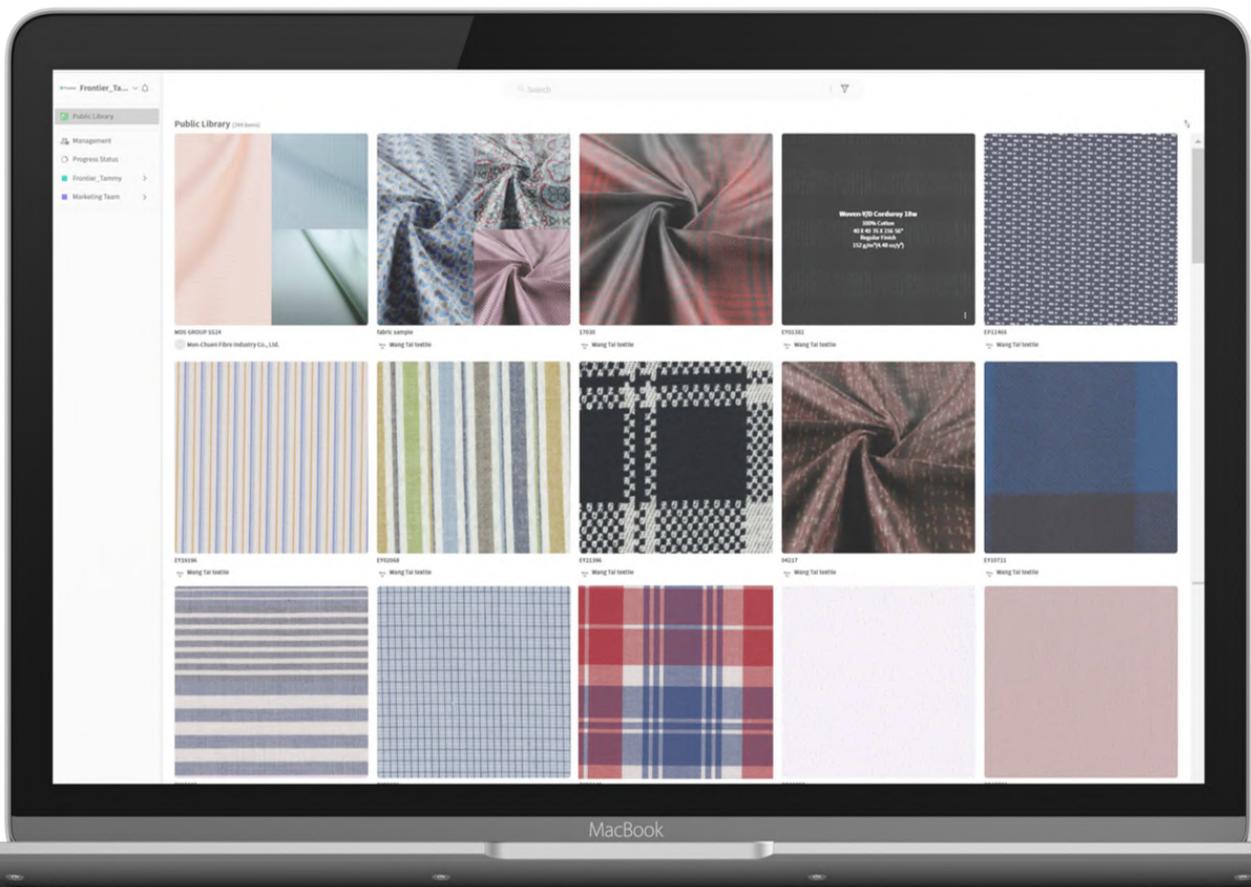
Kalypso helps companies create products consumers want – where, when and how they want them. We are the leading digital product creation (DPC) consultancy in the retail industry. We offer end-to-end services from strategy to technology implementation and organizational change management.

We help accelerate and optimize DPC transformation by leveraging our deep expertise in product creation process and product lifecycle management (PLM), along with knowledge of 3D technologies and experience supporting leading brands. We help companies create an end-to-end solution and connected ecosystem to digitally create, manufacture and sell products. Our expertise helps clients rapidly accelerate their digital product creation programs at any stage of maturity.

WHICH DPC SOLUTIONS / SUPPLIERS DO YOU WORK WITH?

We support our clients with partnerships across the digital thread, from concept to consumer. Our expertise helps clients define their needs and build the appropriate digital product creation tool ecosystem.

We partner with a wide variety of solutions to support the needs of our clients. Below are the types of solutions that we have helped our clients explore or implement:

- Product Lifecycle Management
- Digital Asset Management
- 3D Modelling / Creation Solutions
- 3D Collaboration
- Material Design
- Material Libraries / Management
- Artwork & Graphics

- Rendering, Render Management and Real-Time Rendering
- Visual Line Plan & Visual Assortment Tools
- Virtual Store / Showroom
- Voice-of-Consumer Analytics
- Digital Fit & Analytics
- Augmented Reality / Virtual Reality / Extended Reality

RECENT CLIENT EXPERIENCES:

Strategy & Roadmap for Future State of Digital Product Creation
Global Athletic Footwear & Apparel Leader

Assessment & Pilot of DPC Technology
European Digital Native Direct to Consumer Retailer

3D Proof-of-Concept in Apparel
Leading Menswear Retailer

DPC Roadmap & Business Case
Global, Multi-brand Footwear & Apparel Manufacturer

Process Redesign
Apparel, Footwear & Accessories Manufacturer & DTC

Digital Collaboration Assessment & Implementation
Global Toy Manufacturer & Entertainment Leader

DPC Roadmap & Operating Model
European Luxury Fashion House

Design & Development Transformation & Acceleration
Large Apparel Retailer

Digital Asset Management - Strategy, Requirements Gathering, Implementation & Integration
Multinational Apparel Brand

*Full case studies are available upon request. Please reach out to hadley.bauer@kalypso.com to schedule time to walk through the approach and results of our top case studies. Our team would be happy to meet with you.

WHICH STRATEGIC SERVICES DO YOU OFFER?

ASSESSMENT & EDUCATION: Assessments, workshops and training, including foresight capabilities to develop a proprietary view of the future of product creation. We help you take stock of your current capabilities and future aspirations to provide a strong foundation for building a DPC strategy that is tailored to your business needs.

STRATEGY & ROADMAP: Strategy, scope, business case and strategic roadmap. From alignment and readiness to platform architecture, data governance and vendor selection, we develop a comprehensive plan to ensure your DPC program is successful.

OPERATIONS & ORGANIZATIONAL CHANGE MANAGEMENT: Process redesign, program management, stakeholder alignment, organization readiness and redesign, process and solution training, communications and change management. We lead workshops to build team alignment and provide educational support, to help your team adopt the digital process.

TECHNOLOGY & DATA: Technology strategy, proof of concepts, requirements definition, vendor selection, platform architecture, integrations to PLM and voice of customer platforms, data governance and digital asset management. We connect the digital thread across your entire value chain to build an effective, collaborative digital environment tailored to your workflows for a sustainable transformation.

KALYPSO
A ROCKWELL AUTOMATION BUSINESS

KALYPSO.COM

HOW DO YOU DEFINE 'DIGITAL PRODUCT CREATION' FOR FASHION?

Digital product creation is an industry-wide transformation in how brands design, develop, adopt and bring product to the customer. DPC leverages innovative technologies to create digital twins before a physical product is ever made.

DPC enables connected data for the end-to-end product development process, enabling the power of product lifecycle intelligence and advanced analytics.

DPC is improving products and customer experiences while accelerating time-to-market and enabling critical shifts in business models to gain market share. Significant benefits include reduced costs, increased margins, improved sustainability and a more collaborative global workforce.

WHAT DPC PROCESS AREAS DO YOU COVER?

FOUNDATIONAL
· Operating Model, Product Processes & RACI
· Internal & External Resource Models
· Change Management, Education & Training
· DPC Sustaining Governance Model
· Foundational Product Technologies (e.g. Product Lifecycle Management, Data Asset Management)
· Uniform Visual Quality Standards
· Platform Integrations
· Libraries (Materials, Trims, Avatars, Blocks, etc.)

PRODUCT CREATION
· Voice of Consumer Analytics Testing
· Digital Color & Artwork Design
· Photorealist Rendering
· 3D Product Development
· Material Visualization

ADVANCED UTILIZATION
· Virtual Fit Testing
· Visual Line Planning
· Digital Product Design

EFFICIENCY & AUTOMATION
· Design Task Automation
· Development Task Automation
· Visual Assortment Planning / Line Review

CONSUMER-FACING CONTENT
· Virtual Showroom for Store Planning
· Digital Assets for eCommerce
· Digital Assets for Marketing

CONTACT

We help companies create an **end-to-end** solution and connected ecosystem to **digitally create, manufacture** and **sell** products.

Accelerate and enhance your product development with digital product creation. *Get started now*

Learn More:

KALYPSO
A ROCKWELL AUTOMATION BUSINESS

KALYPSO
A ROCKWELL AUTOMATION BUSINESS

## IN CONVERSATION WITH

WILL YESTER

DIRECTOR, KALYPSO

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

We initiated a digital maturity survey in 2016 while also serving clients in the space, and for the first four years of collecting data, we observed organizations making slow but steady progress. The rate of adoption changed in 2020 as COVID-19 and pandemic-related supply chain issues were an inflection point and a massive driver of acceleration in 3D fashion capabilities. Travel restrictions, factory and showroom closures and low availability of physical samples forced brands to work and make decisions in different ways, with different tools.

Organizations that were on a digital product creation journey prior to 2020 found themselves in a strong position to leverage their capabilities and react to the situation. Those who were behind on the journey quickly understood the potential benefits, and many rushed to partner with vendors and other 3rd parties in an effort to catch-up.

Current Maturity Across 18 DPC Capabilities: 2020 to 2022

Source: Annual Survey on Digital Product Creation Maturity in Retail, Footwear and Apparel. Kalypso, 2020
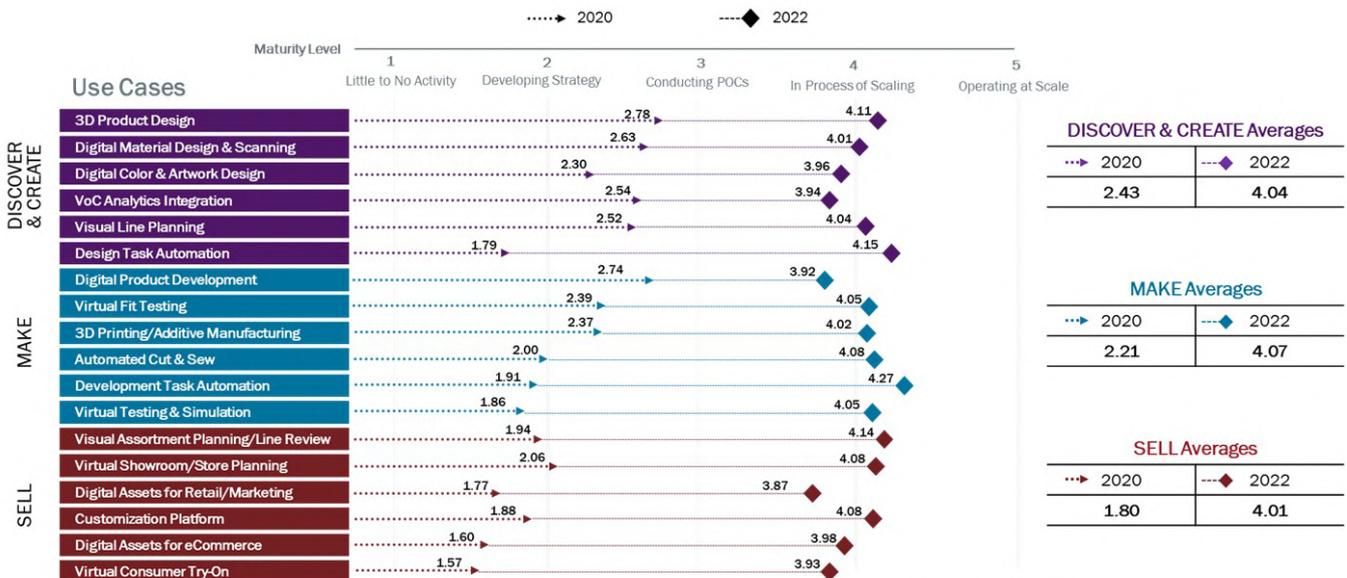
What have been the key advances in DPC maturity at a whole-industry level over the last twelve months, and why do you think those areas in particular have progressed the most?

Our [2022 digital maturity survey](#) shows adoption has increased dramatically across all capabilities in the digital thread since our last data point in mid-2020.

The most adopted areas in 2020 were in the "Discover & Create" space; these progressed steadily over the last two years.

What surprised our team was the extent to which "Make" and "Sell" capabilities also accelerated as brands looked for ways to leverage 3D and digital across their full value chain. In the "Make" space, brands looked for new digitally enabled ways to collaborate with their factory partners in lieu of traveling and using physical prototypes. In the "Sell" category, brands accelerated their use of rendering technologies to share products and experiences with wholesale customers and consumers. The data collected on "Sell" capabilities also captured some of the intense hype over the last 18 months around digital products (NFTs) and metaverse technologies.

Now that the world is coming out of the pandemic and trying to get back to a "new normal", many organizations are catching their breath and resetting their DPC initiative plans. While great progress was made over the last two years, it was rarely aligned to the roadmaps they had planned against before March 2020, and there are many opportunities to realize the potential of digital product creation.

Conversely, where has industry-wide progress either stalled or started to fall behind the industry's ambitions? What do you think are the root causes?

While our survey indicated that retailers are adopting and scaling digital product creation capabilities across the digital thread, our direct experience with clients tells us they are still not mature in these capabilities. Organizations may have some users trained and potentially even working with 3D or digital capabilities, but companies are still falling short of many of their goals.

We observed that brands underinvested in foundations over the past two years as they focused on fighting supply chain and calendar fires. DPC initiative teams were scrappy and delivered value where and how they could in an effort to solve existential business threats. During this time, there has been a lack of consistent investment in improving underlying product technologies such as product lifecycle management or digital asset management, architecting integration to connect data and assets across the ecosystem, building automations that drive user efficiency and evangelizing via a well-defined organizational change management plan. We believe that now is the time to reassess the status of these foundations and ensure brands are on good footing to transition from basic adoption to true maturity that drives ROI.

KALYPSO | **CORESIGHT RESEARCH**

Digital Product Creation in Retail
Understanding the Path Forward

Do you believe the primary value of digital product creation will be realised in digital-for-physical use cases (i.e. using 3D assets and digital workflows to optimise the production of physical end goods) or digital-for-digital opportunities such as the sale of digital goods, or the use of digital assets in real-time and immersive experiences? And do you see those as complementary objectives, or are they liable to compete with one another?

We strongly believe in the value of digital-for-physical use cases, especially when those assets can be reused and leveraged across the value chain. While there is immense potential to leverage these capabilities and change the way a company works from end-to-end, brands should be clear-eyed about the size, scope and complexity of this kind of transformation. Digital-to-physical is hard, and brands and technology partners are constantly working to solve challenges that make the concept of "digital twin" a reality in the retail and apparel industry.

Digital-for-digital opportunities have accelerated recently, and we think they have been competitive with digital-for-physical. Attention and investment that was needed for building DPC foundations was likely diverted to explore digital-for-digital concepts. Digital goods are unconstrained from the reality of physics and production, making them easier to stand up in the short-term. While some brands were able to capitalize on the hype by offering their own NFTs, the market for many digital goods has collapsed and long-term potential value creation for brands is very unclear. Exclusively digital frameworks can completely dissolve or be supplanted as fast as they are stood up; brands should recognize that the impact of a misstep in this area could do more damage than good.

There have been benefits to the digital-for-digital hype. It has elevated executive-level visibility to the concepts of product visualization and rendering and exposed the need for visual effects (VFX) resources and digital artists. I am also bullish on the metaverse as an incubator of new venues and experiences where consumers will one day shop for physical goods and disrupt the outdated eCommerce paradigm. This will drive forward-looking brands to scale digital product creation and to connect their design and production pipelines to feed these new omni-channel marketplaces.
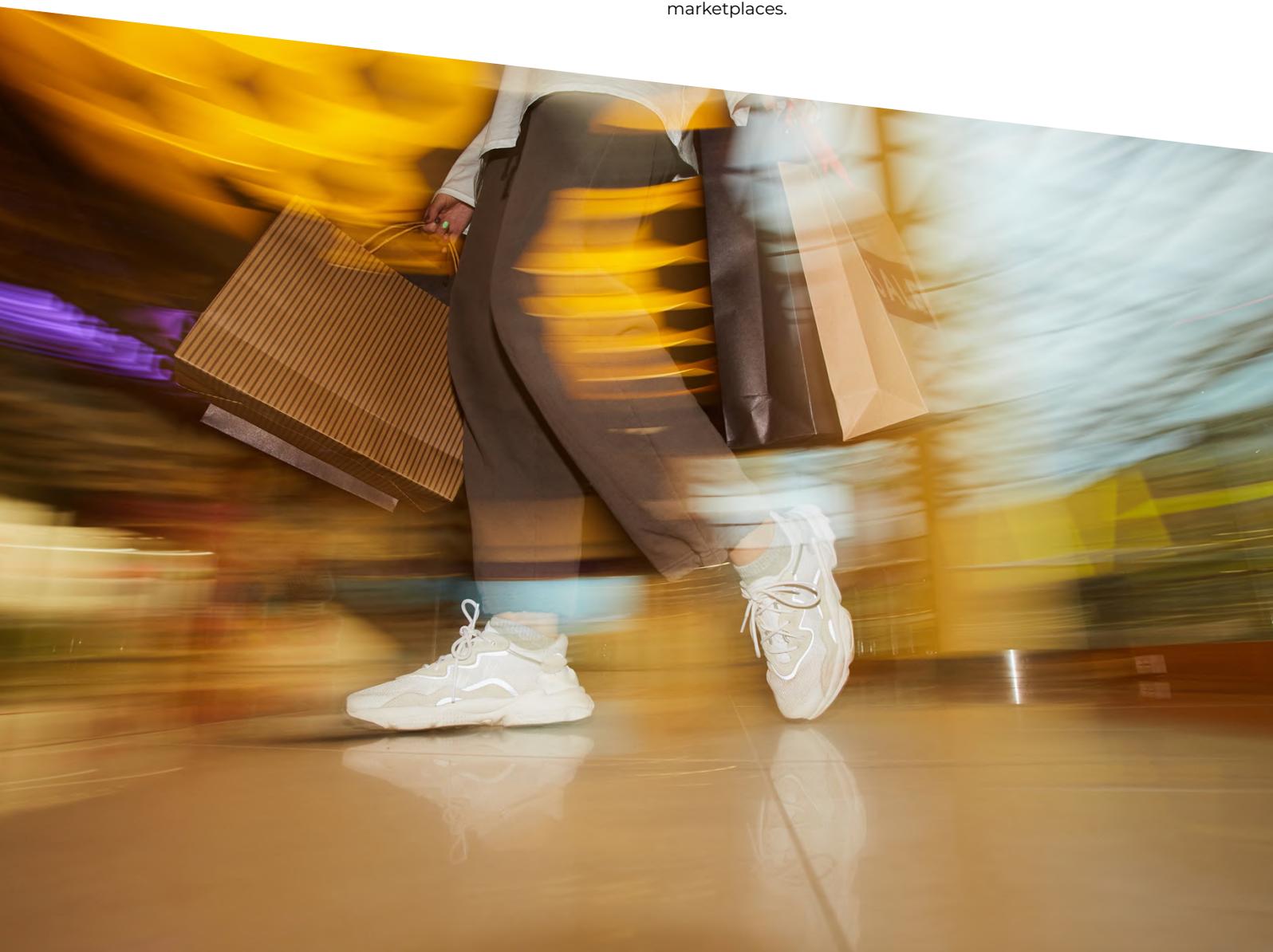
For an organisation that is just beginning its DPC journey, what use cases should they be prioritising to realise the most value in the least time? And for businesses that are further into that journey, how should they be looking to set - and meet - their strategic DPC targets?

We strongly suggest that organizations start with a focused effort against strategy and leadership alignment. Brands will appropriately prioritize different use cases based on many factors such as product categories, product mix and channel strategy, and leaders need to identify the most critical benefits DPC can unlock in the context of broader business imperatives. Because the digital thread is end-to-end, cross-functional leaders will need to be aligned on the benefits, commit their support and hold their teams accountable to drive the desired outcomes.

> " DIGITAL GOODS ARE UNCONSTRAINED FROM THE REALITY OF PHYSICS AND PRODUCTION, MAKING THEM EASIER TO STAND UP IN THE SHORT TERM. "

Regardless of whether your organization is just starting or further along in the journey, we always recommend building and maintaining foundations that will support and accelerate these new capabilities. A technology ecosystem that enables seamless collaboration and ensures clean, well-governed data will lock in value with users. The industry seems to be refocusing on building impactful technology ecosystems to drive scale and user adoption, but brands also continue to underestimate the level of change that these technologies will have on their resources and networks; a well-considered organizational change management approach, supported by visible cross-functional leadership support, is a critical success factor in driving maturity.

Where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

Technology vendors play a key role in where things go and how fast they get there. We anticipate continued investment in the retail and apparel DPC arena and continued growth in the vendor landscape, driving greater competition and innovation. The landscape is currently complex and fragmented, with many technology vendors competing on an overlapping set of technologies and use cases. We anticipate needed consolidation that will help drive focused and more integrated efforts. Brands should dedicate time to consistently monitor the technology arena to stay on top of the latest technologies, evolutions, and trends.

I believe automation and artificial intelligence (AI) are both underutilized today and poised to make an impact in the next few years. These technologies have the potential to take DPC to another level of creativity and efficiency, and I believe we'll see these technologies incorporated in exciting ways in the near future.

DPC leaders will be challenged to continue to deliver value in an uncertain business environment while they simultaneously architect the future ways of working. Our role as consultants who specialize in end-to-end digital transformation is to help them do both; operationalize new capabilities and technologies that can drive this value, but also be strategists and thought partners to help anticipate what could be coming next. We will continue to champion research like the 2022 digital maturity survey and other efforts to help inform our clients and partners as we all move together towards a digitally enabled ecosystem.

Metail®

WWW.METAIL.COM

2008
YEAR FOUNDED

Metail's mission is to use technology to accelerate positive change and sustainability in the apparel industry.

We have fifteen years of experience in the apparel-technology space. During this time, Metail has been granted more than 20 patents internationally. In 2019, we were acquired by TAL Apparel to fund our long-term R&D capabilities. We strive to push the boundaries of 3D body modelling and true-to-life visualisations of 3D garments.

In 2020, we launched EcoShot after hearing the frustrations of 3D users that struggled to get buy-in and trust from buyers and leadership. EcoShot lets you go from your 3D design to selling with real-life models in under 24 hours. It gives you a quick way to bring back context, emotion and aspiration to your 3D designs. All without the need for a physical sample. It is why we called our product EcoShot - a more sustainable form of model shots.

Our customers utilise EcoShot images in a wide range of uses geared towards selling with 3D. These include 'Internal Selling' such as line approval meetings and visualising print placements. The second area is wholesale 'Business-To-Business Selling' to retailers in presentations and catalogues. The final area is 'Direct-To-Consumer Selling' such as eComm websites, packaging and display.

At its core, EcoShot makes it easier for buyers to SAY YES to your 3D design without the need for physical samples.

METAIL IS USED BY A RANGE OF BRANDS, MANUFACTURERS, AGENCIES AND PARTNER COMPANIES. OUR USERS HAVE AN APPROXIMATE DISTRIBUTION OF:

30% USA

10% Europe

60% Asia
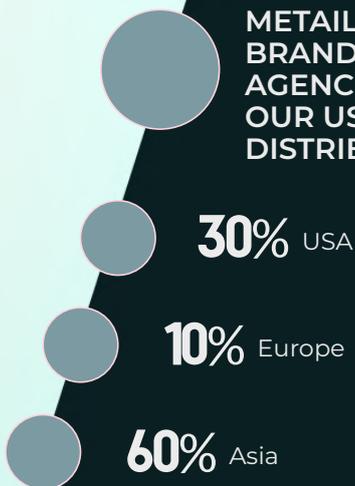
HEADLINE CUSTOMERS

DELTA GALIL	PUMA
FEATURING LTD (OTTO GROUP)	PVH
GAP	THE NORTH FACE
HANIN	WALMART

Metail®

WWW.METAIL.COM

PRICING MODEL:

EcoShot uses SaaS based package pricing, which includes a company-wide license (unlimited users).

EcoShot SaaS packages vary by:
1. Length of software access

2. Number of EcoShot images included.

EcoShot SaaS Packages range between $995 - $9,995.

Digitisation of brand-specific models for EcoShot is an optional extra. Costs range between $4,495 - $9,995.

7

TECHNOLOGY PARTNERSHIPS, INCLUDING:

ADD EASE

AVAIL CORPORATION

BROWZWEAR (VSTITCHER)

SIZE STREAM

SNAPCHAT

UNMADE

WEAVE

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

EcoShot's role is demonstrated by feedback from Delta Galil's Senior 3D Director: "We just did a pre-meeting and everyone LOVES the addition of EcoShot to our presentation!"

"I cannot stress how much everyone LOVES the images we could add."

"They do not believe it is 3D!"

The last line in particular is key. Combining digital 3D garments with physical real-life models makes the technology more invisible. Making the technology invisible allows people to focus on the real task to be completed.

Early on in the process, this task involves getting agreement on which designs to produce. Later on, this task involves getting buyers to place orders for your designs. And at the end of the process, the task involves giving consumers the confidence to buy your products.

That is the power of this hybrid of 3D garments and real-life models. Minimise distractions created by the technology and instead complete the real task.

As Joshua Young (Director, Digital Product Creation at VF Corporation) says: "We're moving from a place where we think of digital product images and physical product images, to just 'product images'. Digital vs Physical is irrelevant."

Leveraging real-life models with EcoShot makes this mindset change easier.

CONTACT

Sell better with EcoShot!

Get buyers to say YES to your 3D Designs
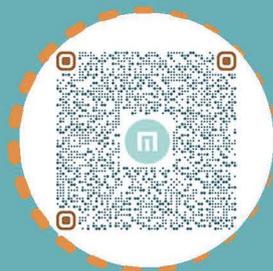## without physical samples!

Go from 3D designs to selling with real-life models in less than 24 hours

See what you can do for free
with EcoShot Intro!*

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

Part of it is a sign of where we are in terms of tech adoption diffusion and maturity - it feels like the early adopters have proven the value, and the early majority are now adopting DPC, and that is an inflection point in adoption. I think that early adopters bringing DPC technologies into wholesale and retail was always going to be critical to that; it builds an ROI case that speaks to opportunity not just cost reduction.

There are also both strategic and tactical forces driving things right now. I think more brands have realised that DPC is going to be a key component of a more agile, accelerated GTM, which in turn will be important for competitiveness in the medium term. Quality is often cited as one of the differentiating attributes of seasonal, non-fast fashion brands. When 3D is used across a brand's supply chain, it is probably the best technology to achieve the speed and agility benefits of fast fashion whilst maintaining the quality of their products. This is especially true if that supply chain extends all the way through to providing imagery which allows you to sell directly to consumers.

The combination of quality, agility and speed are reasons why customers are interested in EcoShot. Normally brands have to wait for physical samples to be made, shipped and photographed on models to have the type of high quality imagery they need to sell to consumers. But with EcoShot, customers can use their digital garments to get high quality images of their products on their existing real-life models within 24 hours. It's all part of this wider movement towards agility and speed without sacrificing quality.

Finally, the last couple of years have been tough for apparel and with potentially ongoing economic stress and supply chain disruption to come, I imagine that the cost efficiencies and flexibility of DPC look like welcome solutions to shorter term problems too.

To bridge the gap between digital assets and real fit models and consumers, the industry has tilted heavily in the direction of digitising the people to meet the garments. You're looking in the opposite direction: creating a turnkey way to dress real people in digital garments. Can you walk us through the workflow?

Yeah, absolutely. We start by body scanning a diverse range of models before photographing them in a wide range of poses using synchronised cameras from multiple simultaneous angles - a bit like a stripped down mocap studio, but with fashion studio lighting. We create a rigged avatar for each model, and for each photo, we repose the avatar using a combination of computer vision and artistry so that it is a really close match to the photo pose.

Users use the posed avatars through the EcoShot VStitcher plugin, dressing and styling their designs on the model, then we run the simulated garment through our rendering and compositing pipeline.

By leveraging VStitcher's great physics simulation and dressing an avatar that's of realistic shape and in the right pose we can show the highest level of physical realism. The images don't suffer from the strange lack of creasing and poor drape effects you get with legacy approaches based on warping (digital or physical) mannequin images. It's the closest true-to-life representation of how the final physical garment would look and sit on that model if you conducted a real photoshoot with them.

Why do you believe having real, identifiable, people offers such a benefit over more generic fit forms? How does that change impact the way in-house teams and downstream consumers perceive a digital garment?

One of the great things about digital design is how easy it is to interact with and visualise the garment in different ways.

You can look at technical fit on a fit form, and then when you need to communicate the context and intent of the design you can use an EcoShot on-model image. Then you can even see how the garment would look in-store. I think that rich communication of the design is something that on-model really helps with, and has previously been a weak point in 3D product design.

When it comes to generic fit forms, it's worth taking a step back and considering what happens with the current physical process. Many brands use standard fit mannequins and real-life fit models as well. They often need the security of seeing the product on a real person before signing off on a design. Real people help give brands the confidence that they are picking the right designs to manufacture for their customers.

Ultimately, EcoShot makes it easy for 3D users to show their designs in their intended end-use form; clothes worn by real people in the physical world. It means that you're not asking people who are not familiar with 3D to imagine what it would look like in the real physical world. Instead they can see imagery which shows it.

A Director of Digital Product Creation at VF Corporation - Joshua Young - wrote on LinkedIn:

"We're moving from a place where we think of digital product images and physical product images, to just 'product images'. Digital vs Physical is irrelevant."

The EcoShot combination of digital garments and physical real-life models makes this mindset shift change easier.

By bringing those two piece - digital garments and real models - together, you touch on a lot of different instances where a decision is being made on a hybrid of digital and physical components. Those decision-making processes are going to be one of the keys to unlocking more comprehensive digital transformation, so can you explain how your approach can create greater confidence in the choices a brand, their wholesale customer, or their downstream consumer might make?

That's a really good observation.

In most cases the digital garment is a proxy for a physical sample, and despite the different-but-better advantages of 3D, it's inevitable that the biggest contributor to confidence in a digital garment is how well it proxies for that physical sample. We've heard of a number of cases where buyers' and leadership's confidence in the digital garment is undermined because an avatar was used. The lack of realism of the digital avatar made the attitude towards the digital garment much more critical. And real humans are really good at spotting fake humans!

Feedback we received from Delta Galil's Senior Director of 3D - Elizabeth Al Shehabi - also demonstrates how EcoShot creates greater confidence.

"We just did a pre-meeting and everyone LOVES the addition of EcoShot to our presentation! I cannot stress how much everyone LOVES the images we could add. They do not believe it is 3D!"

The last sentence in particular is key.

Combining digital 3D garments with physical real-life models makes the technology more invisible. Making the technology invisible allows people to focus on the real task to be completed.

On the consumer side, one of my favourite applications of this hybrid technology is to create product images on a diverse range of body shapes. As well as being an important way for inclusive brands to live up to their values, consumers use model photos as their first and most available way to assess size and fit. As a shopper, I've got less guessing to do if a retailer has used a model close to my body shape than if they've used the usual "aspirational" shapes.

This also opens up the possibility space of augmented reality - applying the same philosophy to real-time, consumer-facing applications of body projection mapping to allow anyone to virtually wear a digital garment. How far has AR come recently, and how important do you see it being in the near future, for both in-house and consumer-facing use cases?

The technology has been accelerating really fast, most excitingly by Snap Inc, and it's been great to see the tech being used in the amazing work coming from the digital fashion community and in some brand marketing. The ultimate goal there is product marketing and e-commerce which is the area we've been exploring, winning a Snap GHOST R&D fellowship to look at ways to make apparel AR better and more scalable. I see the importance of AR being tied to the importance of Smart glasses. If (and it's still a big "if") Meta and others succeed in replacing smartphones with headsets and smart glasses, then AR and VR (and 3D as a consequence) will be massively important.

Shorter term, there are a few challenges that apparel AR needs to overcome to expand. The first is scalability of content, which is why we released our "Skinner Plugin" beta, which makes it really quick and easy to create AR Try-On lenses from Browzwear VStitcher garment files. Another challenge is that Snap is really the only marketing channel that can support AR try on, but they don't seem to be top of mind for most brand marketing departments. Until there's ad spend on channels that support AR, I think it will struggle for traction. The biggest challenge, though, is that the technology's garment and fabric representation hasn't yet hit the mark needed to make many brands comfortable publishing their garments in AR.
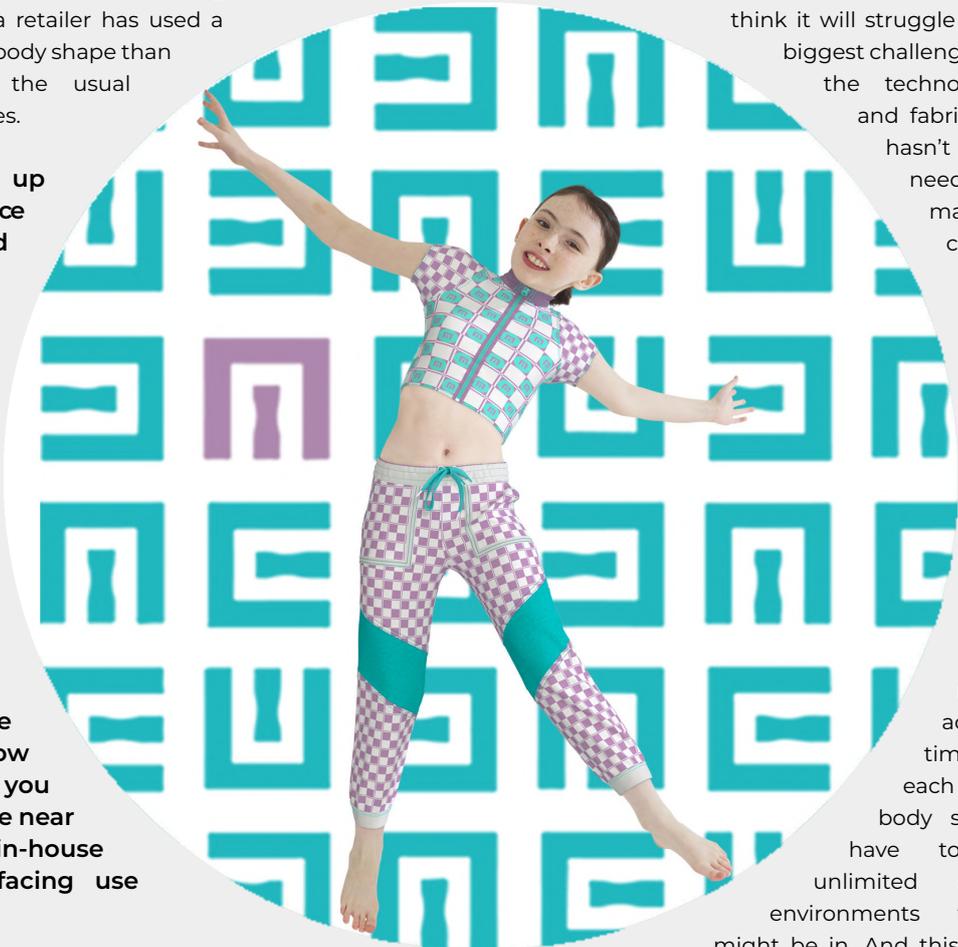
3D faced similar challenges but the scale of this challenge is even larger for AR try-on. You need to have a means of achieving a real-time simulation on each consumers' own body shape. Also you have to handle an unlimited set of light environments the consumer might be in. And this all needs to be achieved on a much lower powered mobile device than the computers currently used for 3D DPC. It's a tough technical challenge. However, we've been impressed with how Snap have been creating components which other people can build on. The best example of this is currently in footwear try-on where PUMA have integrated Snap's footwear AR try-on technology into their own mobile app. We think footwear is a good early bellwether of when AR try-on will become important for apparel.

Beyond augmented reality, where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

Whilst there are going to be innovations and exciting new tech developments and applications, I think the biggest progress is going to be in the area of emergence of best practice and standardisation, and the use of digital assets in more use cases, especially in e-commerce by D2C brands, who have a great opportunity for differentiation over the multibrand retailers who have dominated in the last decade or so. I'd really like to see better interoperability between CAD solutions, and between rendering approaches emerge as part of that standardisation. We're excited to see how EcoShot evolves as part of that movement too. Longer term Metail is looking to innovate in the application of 3D in e-commerce; at different ways to improve the interaction between customers and brands using our 3D and AI expertise.

Recently we developed the capability for brands to photograph their existing models and have them digitised for EcoShot. This is important because of the point you made earlier about decision-making becoming hybrid processes. Currently the decision about which models a brand uses to sell their products is inherently a physical process because they are choosing from a selection of real-life physical models. This new capability means that they don't have to revisit this decision. Instead they can use their existing real-life models with their digital garments.

Our hope is that the brands take this capability and go from only showing each product on one brand model to showing each product on a set of brand models with different sizes and shapes. If we get to that point, more consumers benefit as they get to see an accurate representation of that product on a model that is a closer size to them. This will then make it easier for the consumer to assess if they are buying the right product for them.

MM
MODERN MIRROR

WWW.THEMODERNMIRROR.COM

2006
YEAR FOUNDED

Modern Mirror is a fashion innovation house creating exclusive digital couture experiences for luxury fashion brands from the moment a client walks into a store, to an everlasting digital relationship, while streamlining digital transformation and management of 3D asset creation.

Modern Mirror's Avant-Garde Fitting System (AFS) is a truly singular virtual try-on experience that is intertwined between the physical and digital, instilling confidence in the consumer, making the purchasing decision simple. Providing consumers the ability to see how garments actually fit, look and wear on themselves, giving assurance that the style provides the optimal fit and look prior to purchasing – made possible by superior fitting technology. Garments are visualized with an unrivaled exactitude, enabling consumers to experience the texture, drape and movement on their own digital replica, complete with their shape, dimensions, details and motion.

Leading the digital transformation journey from initial design to final purchase, the AFS solves challenges and creates efficiencies across the entire value chain. From 3D digitizing a collection, to the organization and management of digital assets across departments while transforming the fitting room experience of today and tomorrow, unlocking the next level of personalization in Web 3.0.

MODERN MIRROR IS USED BY A RANGE OF BRANDS, RETAILERS & MANUFACTURERS. OUR USERS HAVE AN APPROXIMATE DISTRIBUTION OF:

83% Europe

13% Americas

4% Asia

MM
MODERN MIRROR

WWW.THEMODERNMIRROR.COM

PRICING MODEL:

Enterprise

Licensing - SaaS

Subscription

6
TECHNOLOGY PARTNERSHIPS, INCLUDING:

CLO

UNITY

UNREAL

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

Modern Mirror is recognized as a brand partner throughout the full life cycle of digital product creation. Supporting fashion houses by bringing their designs to life in 3D and then furthering the profitability of their digital assets.

Whether it's a single sketch, pattern or physical garment Modern Mirror creates 3D digital replicas of collections from any medium with a specialty in couture. Modern Mirror further expands and enhances the life of a digital asset by applying assets to the AFS virtual try-on system, creating highly realistic AR/VR runway shows and NFT's, and converting them for Web3.0 use.

In addition to digital product creation, Modern Mirror has an interactive bespoke platform to assist brands with their workflows and management of digital assets. The Virtual Atelier streamlines the digital product creation workflow by providing a collaborative work environment assisting in organizing and managing the exchange of digital product assets between departments and manufactures, where teams can comment and annotate in real time on latest iterations and track the history and communication of each asset.

Assisting brands at any point in their digital product creation life cycle.

CONTACT

THE FUTURE OF

THE FITTING ROOM

IS HERE

UNLOCKING
THE NEXT LEVEL
OF PERSONALIZATION

MM

THE HOUSE OF MODERN MIRROR

FASHION INNOVATION HOUSE 3.0

MM
MODERN MIRROR

IN CONVERSATION WITH

Nicole Reader

FOUNDER & CEO, MODERN MIRROR

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now? There have been a number of factors over the course of the past three or more years that have been the driving forces behind the mass adoption we've seen digital product creation reach.

Covid has been the leading driver in accelerating the digital transformation in the fashion industry. The pandemic didn't just affect the in-store shopping experience, but also greatly affected sampling, production, wholesaling and runway experiences for brands, buyers, manufacturers, and retailers. Forcing fashion brands to turn to alternative solutions such as digital product creation in order to stabilize themselves and continue the releases of their collections while the world was in lockdown.

The pandemic made it almost impossible to get any physical samples at all, and if brands did receive physical samples they were often delayed, weren't able to be photographed or showcased at a runway show and difficult to time for market dates for the buyers to see. Leading to design, production and merchandising teams relying heavily on digital product creation and turning to sample makers and manufacturers to retrieve digital patterns to showcase to buyers instead. This is where companies like NuOrder began to really take shape by offering digital showrooms to brands assisting in showcasing their digital collections to buyers on their B2B wholesale marketplace platform.

The transformative trends of digital product creation are no longer just attractive additions to the buying experiences, but are essential to assisting fashion brands in recovering and rebuilding from the economic downturn many have faced while maintaining their ecological goals and futureproofing.

Even before the lockdowns and supply chain disruptions caused by the pandemic, industry analysts and brands themselves were largely in agreement that changes were overdue in multiple aspects of business operations, sustainability and customer-centricity of the segment, with sustainability being a substantial focal point on how brands can cut down on waste, but also speed up their time to market. Taking a digital product creation approach has assisted in cutting down on physical sample production costs, excess, and overproduction for smaller labels, having these digital versions of the garments accessible allows for pre-sales.

As brands rebuild and strengthen from the pandemic and are seeking ways to re-engage with clients, we are starting to see a boom in areas such as Web3.0. An extensive amount of digital products have been created for NFT's, metaverses and gaming, wich is resulting in an enormous amount of skilled talent appearing on the scene, with the help from

Modern Mirror Custom 3D Image Cabin Design

institutions like The Digital Fashion Group, offering specialized courses to enhance skill sets and techniques for digital product creation.

Digital product creation has provided designers and creatives with a global stage full of opportunities where designers can gain mass exposure at an expedited rate without the need to manufacture physical products, capital or risk exposure, by taking their digital designs and transforming them into NFT's, digital campaigns, virtual runways, AR filters and digital photoshoots. The question we need to ask ourselves is how do we leverage DPC to it's fullest?

Two of the key benefits of replacing disconnected analogue processes with digital ones are making people's lives easier - across creative and commercial disciplines - and providing greater visibility and accountability into those processes. How far do you think those benefits are being realized today?

We are just touching the surface when it comes to realizing the benefits.

We're only as good as the processes that we have in place when organizing, storing and sharing the data we have at

our fingertips. Digital processes have the ability to expedite product creation, shorten supply chain timelines and launch products to market at a rapid rate. However, it comes down to ensuring the proper digital processes are in place within organizations and there are strong foundations. If strong foundations and structure are not in place, the management and organization of the digital product creation process can become overwhelming, cumbersome and out of control quickly.

CLO, Adobe Substance, SEDDI, Lectra, Browzwear, NuOrder, Joor, Vntana are some of the best tools out in the marketplace today, but if we don't have processes in place to manage the output of the data then teams aren't as efficient as they could be. Having insufficient processes can lead to teams spending more time navigating and sifting through enormous databases of files to locate digital patterns, trims, fabric swatches and graphics. After spending significant time in locating files they hope they have triumphed in locating the updated final versions of the files that were signed off and not just alternate versions. Brands need to reflect on how it affects productivity when departments are waiting to receive assets between teams when unweidly searches are going on when locating the correct files. If you're just getting started in digital product creation it may not seem like it's too difficult to build a process, but when you get to a collection of 100 – 500 pieces, per season teams need to take a look at the number of digital files that are produced per product between patterns, swatches, trims, hardware, graphics, 3D object files etc...and then need to multiply.

Safeguarding the information and data is essentially as important. The digital products, in essence, are a brand's intellectual property so having proper procedures in place for departments and tracking how the data is being shared, on what platforms and by who will assist in reducing security risks, breaches and leaks.

Modern Mirror AFS 3D image system
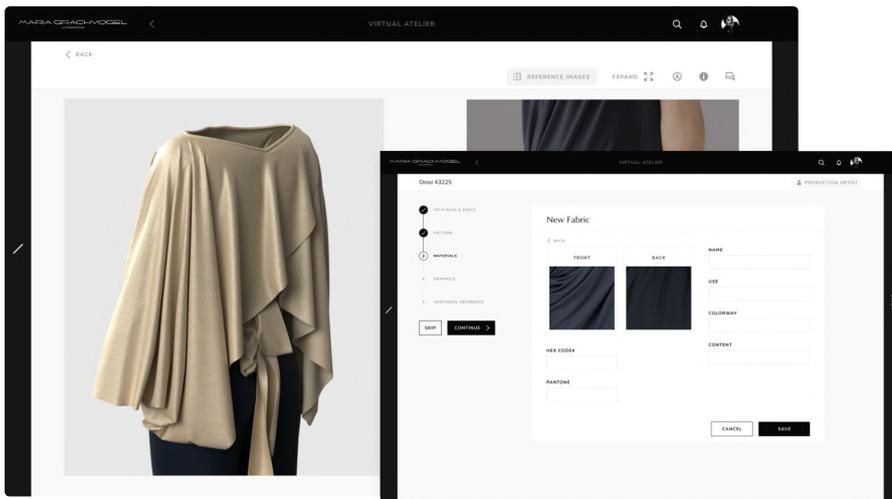
Modern Mirror Virtual Atelier

This is particularly relevant in luxury fashion, as luxury brands regularly reissue classic products or use them as the basis for new designs.

Sometimes organizations that have to handle legacy data also retain out-of-date hardware and software configurations for when it's necessary to access older files but that poses security, maintainability, and scalability problems. It is apparent that as we proceed down the transformation journey there is a need for automated systems that will open archived design files on a reoccurring basis and export them to the latest file formats so that designers and brands can be confident that their intellectual property is being protected as well as maintained in a fully functional state to serve their future needs.
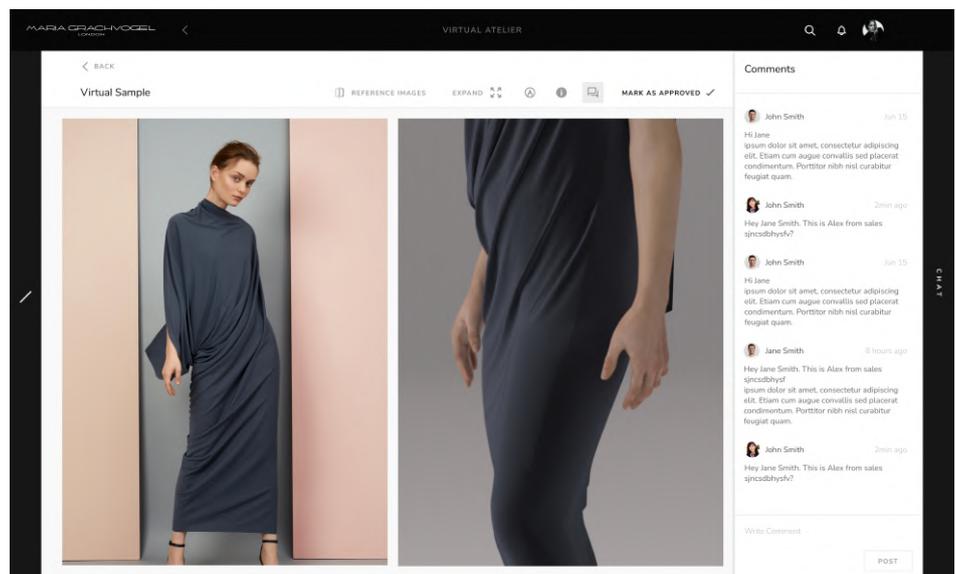
We identified this very early on in our organization in our initial pilot launch of the Avant-Garde Fitting System (AFS) VTO in 2018. Our team of Virtual Sample Makers were creating digital replicas of a luxury designer's collection, who was also very digitally savvy. While working together we found inefficiencies in the process and communication breakdown when it came to file sharing, deadlines, collaboration and receiving final approvals on the digital versions of the products, not to mention the security risk of how the files were being shared. This is what inspired the Virtual Atelier, our 3D digital asset creation and workflow platform.

The Modern Mirror Virtual Atelier streamlines the 3D digital asset creation workflow by providing a collaborative work environment that assists in organizing and managing the exchange of digital fashion assets while tracking the history of communication and the latest iterations of virtual garments and accessories for final sign-off across multiple departments. The platform was crafted specifically for the design and production workflows of luxury fashion houses.

Another question at the forefront is as our digital product footprint increases, how are we able to efficiently manage and archive thousands of digital files when older digital files from previous collections may be in outdated formats and can no longer be opened by current software?

Runway is another area where we can see significant improvement in terms of digital product creation. Specifically for couture lines where there are lead time issues and disconnect when it comes to 3D digitizing collections before they have hit the runway. This is primarily due to last-minute design changes and for some can be seen as a security risk as some brands may want to keep access to the runway collection limited to a small number of team members before its unveiling. However, opportunities are being missed where the runway collection can be tried on virtually by the audience as it hits the catwalk, therefore, generating pre-sales and increasing consumer engagement. In order for this to be

Modern Mirror Virtual Atelier

successful, the digital process needs to mirror the physical sampling design process, where a digital designer or virtual sample maker is able to make the adjustments on the spot following the physical designer's lead.

By making this process efficient for designers and brands, greater success can be achieved by taking advantage of see now, try now, buy now off the runway resulting in pre-sales, better inventory forecasting, minimizing production and waste, and reducing productions costs.

Research we partnered on a little while ago suggests that a good number of brands have been able to achieve self-contained success with 3D in specific use cases, but have struggled to translate that success into more comprehensive enterprise-wide change. Now, with the demand for digital assets increasing in a dramatic way both up and downstream, that seems like a more essential task than ever. How do you suggest brands approach the integration of digital tools and assets into all the different areas of their business that it can help to transform?

Prior to investing in any tools for design, production, merchandising, innovation, and marketing, all teams should come together to build a strategy around the specific use cases of digital products. Identifying the needs and desired outcomes for each department is a critical stage in the planning process, as it will determine the output format, the types of file formats required for creating the digital assets, and the timelines for their creation.

Depending on the use of the assets your teams will require a variety of file formats for NFT's, Web3.0 platforms, AR/VR virtual runway shows, virtual try-on applications, e-commerce, virtual showrooms and so on.

As an example, for Modern Mirror's AFS virtual try-on, our Virtual Sample Making team is required to produce two versions of each digital product which require different approaches: one for use in static renderings and the other for animated videos.

For the static imagery, the digital garment will be created using specific techniques to achieve the accurate fit and drape of the real garment, with a level of accuracy visible in extreme close-up images. Our Virtual Sample Makers are required to have real-life experience when it comes to pattern cutting and garment construction, as it enables them to note and recreate the hidden features that affect the final appearance.
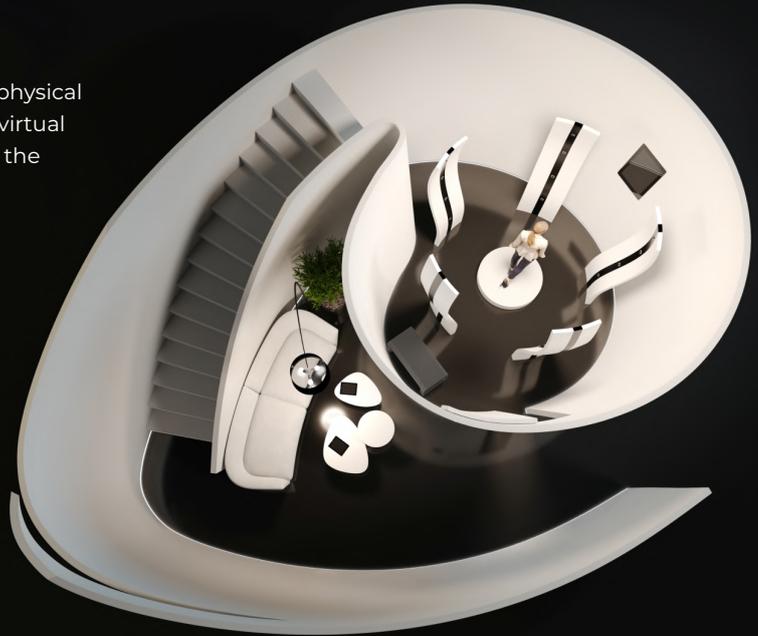
For the second, animated, version the digital artist will selectively simplify the garment while maintaining all aspects that influence the fit, movement, and behavior of the garment. If the same garment also appears in Virtual Reality headsets, like the Oculus Quest, the asset will need to be simplified even further to accommodate the limitations.

Once use cases have been determined, teams will be better able to plan, set up a workflow and process of management, organization, transfer, and safe storage of digital files. This will streamline the approval process, facilitating sharing amongst teams, suppliers and buyers, maximizing success across the entire enterprise.

A lot of time and investment has been directed towards finding the right way to represent real people - both models and consumers - in digital applications, whether they're immersive real-time experiences or virtual try-on. The figures suggest that this is having a significant impact on return rates, but it still doesn't feel as though the industry has truly made sense of what it means for people to create and truly own digital selves that they are happy to represent them in multiple different applications - and that are portable enough to cater to both current and future use cases. What's your perspective on this?

Since founding Modern Mirror in 2006 I have witnessed dozens of companies enter the virtual try-on and virtual fit marketspace trying to solve the main pain point of knowing how a product will fit and/or look like on yourself without the need of trying on the physical product.

This pain point is not new, but the market and consumers have been slow to adopt such solutions. Technology has had to develop further in order to provide adequate results that will meet the needs of the consumers and brands, without leaving them wanting more and expecting better.

Over the course of the last several years, I have heard virtual try-on companies, industry leaders, and investors continue to say that people don't want to see themselves, that a paper-doll cut-out version of themselves with a garment superimposed over their photo would do, that its sufficient to capture one's face and apply it to an avatar even though the body and skin might not accurately represent them, or that a cartoon look-a-like is perfectly fine. I've even been told by many industry leaders that fashion brands would insist on owning the 3D client data if clients were to be 3D imaged.

I have continued all these years to disagree and continue believing that people do want to see a true 3D representation of themselves with their own motion but

3D DIGITIZED   Balmain Design Digital Product Creation by Modern Mirror

> " WE'RE ONLY AS GOOD AS THE PROCESSES WE HAVE IN PLACE. "

may want a few feature enhancements added such as filters, and in no way would allow anyone to own their personal 3D image data. This theory was proven with the first release of the AFS prior to covid.

Luxury London designer, Maria Grachvogel, had her Mayfair studio full with 50 of her top elite clientele, ranging between the ages of 18-77 years old in attendance waiting to be 3D imaged to try out the AFS Virtual Try-on system. A 2-hour event turned into a 10-day affair with many wanting to book
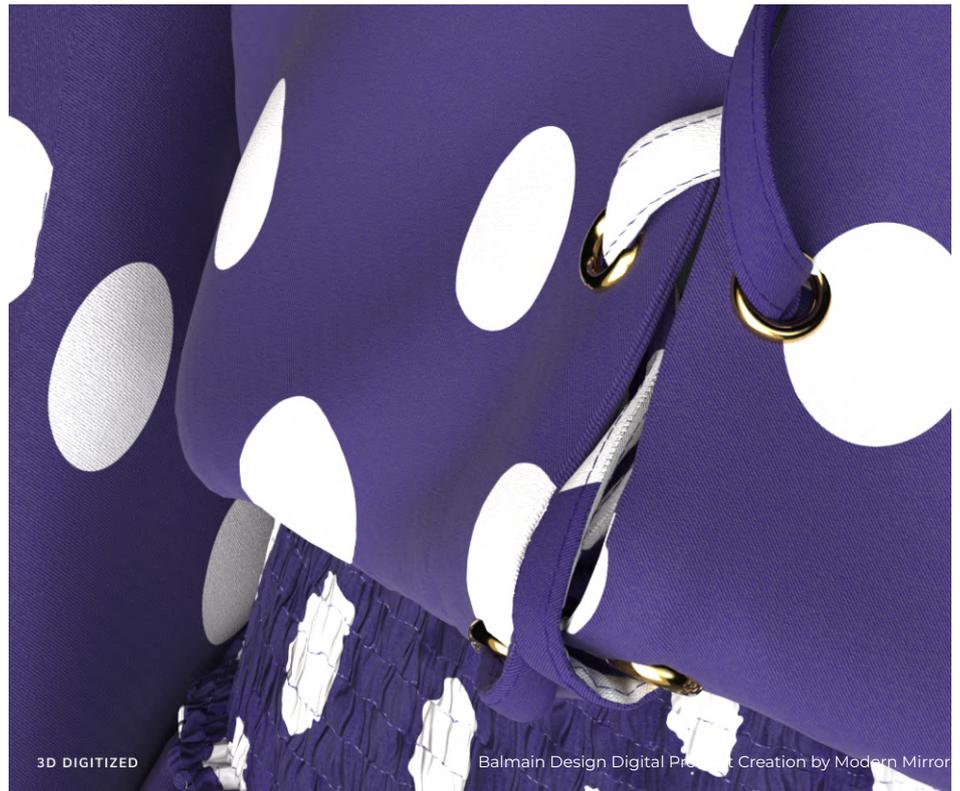
private appointments specifically to go into her studio to be 3D imaged.

The overall pop-up experience affirmed that clients enjoy virtual try-on experiences and want to have a collection of digital versions of themselves to dress and use for other applications. The majority of the attendees felt it to be a confident and accessible experience and were looking for further features to be developed such as style profiles, personalization, digital self-enhancements such as adding digital hair and makeup, larger quantity of products to virtually try-on, and access to their personal shoppers online so they could have their digital selves styled.

"The CEO at Modern Mirror has an incredible eye for detail and is really pushing the boundaries and truly thinking about the customer experience holistically. From the experience when the client comes for her initial 'imaging' – creating a luxury fitting room experience, the fact that the image represents the client, not only in measurements but also with the details- the hair, movements and poses – as if it were an actual mirror and finally movement – clothing needs movement to have a sense of how you look and feel.

This level of detail is what my client expects to replicate the luxury shopping experience as closely as possible." Maria Grachvogel, Luxury London Designer.

Luxury brands are specifically looking to offer these solutions to VIC's to assist in re-engagement and to offer an elevated and unique experience to them, in order to stay connected and strengthening their everlasting digital relationship. However, with this comes a list of specific criteria when it comes to the experience, ease of use and integration and finally the craftsmanship, quality and accuracy of the visual results, which is why we haven't seen VTO systems deployed on a larger scale.

We are beginning to see further traction and acceptance of Digital Humans, with Web3.0 being a main factor. Web3.0 has propelled the excitement and acceptance of Digital Humans, however, there is still not an industry standard when it comes to how to integrate digital humans into multiple platforms, and how to navigate the security, data and ownership issues of people's digital selves.

Virtual try-on (VTO) systems are of particular cybersecurity concern to brands, as they tend to capture very detailed and confidential data of customers' measurements and/or images and may also capture sales activity and analytics of business operations.

In a typical VTO system, multiple full-body images of the customer, in either form-fitting clothing or undergarments, are captured by a mobile camera or 3D body scanner. A range of measurements are extracted from these images, leading to fit recommendations or made-to-measure garments. In advanced systems like the AFS a photorealistic and dynamic animated model of the customer's own body can be shown dressed in 3D digital models of garments in recommended sizing. Furthermore, detailed analytics can be generated about customers' body shapes, fit and style preferences, interactions, and purchasing behaviors.

The purchasing history and customer preference data collected are similar to what e-commerce sites have been collecting about consumers for over two decades. However, the high-fidelity body data of the customer that can create images and videos indistinguishable from the real photos and videos, is what adds a whole new set of risks and opportunities for abuse if not protected adequately.

Proper protection of personal data and openness about its use is obligatory when maintaining trust. Luxury Institute CEO Milton Pedraza observed, "It stands to reason that [consumers] should overwhelmingly trust luxury brands with their data far more than mass-market brands, but this is not yet the case. In a digitized world where privileged access to personal data for advanced personalization and deeper relationship building will be absolutely critical, luxury brands need to step up their trust quotient far above commodity mass market brands immediately." (Luxury Institute, "Luxury Brands Missing Big Opportunity In Building Trust With Affluent Clients On Relationship Building And Data Sharing," 19 May 2020)

Maria Grachvogel design Digital Product Creation by Modern Mirror

We have always believed in a customer-facing business model centered around a unique approach to data ownership and control. Customers who are imaged by the Avant-Garde Fitting System (AFS) retain ownership of their data, have control over how it is shared and used, with what brands and platforms, and when it should be deleted. When aggregated analytics information is provided to brands about their customer bases the datasets are "de-identified" using the same processes that HIPAA-compliant organizations use when aggregating data for medical studies.

By designing a comprehensive cybersecurity architecture and implementation plan that takes into account best practices and regulatory requirements, and data ownership, a VTO technology partner can address the concerns of data breaches and empower consumers to have control of their own data.

What role do you see digital assets and experiences playing in the future of retail? Obviously a lot is being done to replace traditional product images with virtual photography, but this is more of a time and cost saving than a real re-examination of what consumers in different sectors want from online and offline shopping.

There is a huge opportunity to explore between digital assets and consumers. At Modern Mirror we've completed projects for fashion brands' VIC's providing interactive VR virtual runway experiences where the client can be their own model on the runway through the use of their own digital selves wearing the brand's digital products. Gartner has predicted that over 100 million consumers are expected to use virtual try-on applications, so providing elevated realistic virtual try-on experiences in-store and online for client's will be essential moving forward. Building platforms where clients can take advantage of special features once they have been 3D imaged and motion captured and have ability to participate in experiences such as see now, try now, buy now right from the runway knowing how the latest trends will fit.

We see this expanding further by brands' stylists and sales personnel building a deeper relationship with their clients both offline and online. Pulling the latest looks and styles together digitally and virtually styling their clients, when provided access to the data by their clients. Continuing this trend to Virtual Atelier for Couture, where designers can use the platform to curate couture pieces with their clients, through virtual fittings versus physical, taking personalization to the next level.

As the Web3.0 market continues to grow, it will allow for clients to build digital wardrobes of both garments and NFT's they have purchased, where they can utilize the digital assets in a variety of ways in metaverse and gaming platforms to have a more unified experience. The key to success when it comes to any digital asset is the variety of utilization behind the asset and the ownership and control of it

Noe Bernacelli design Digital Product Creation and Digital Human by Modern Mirror AFS
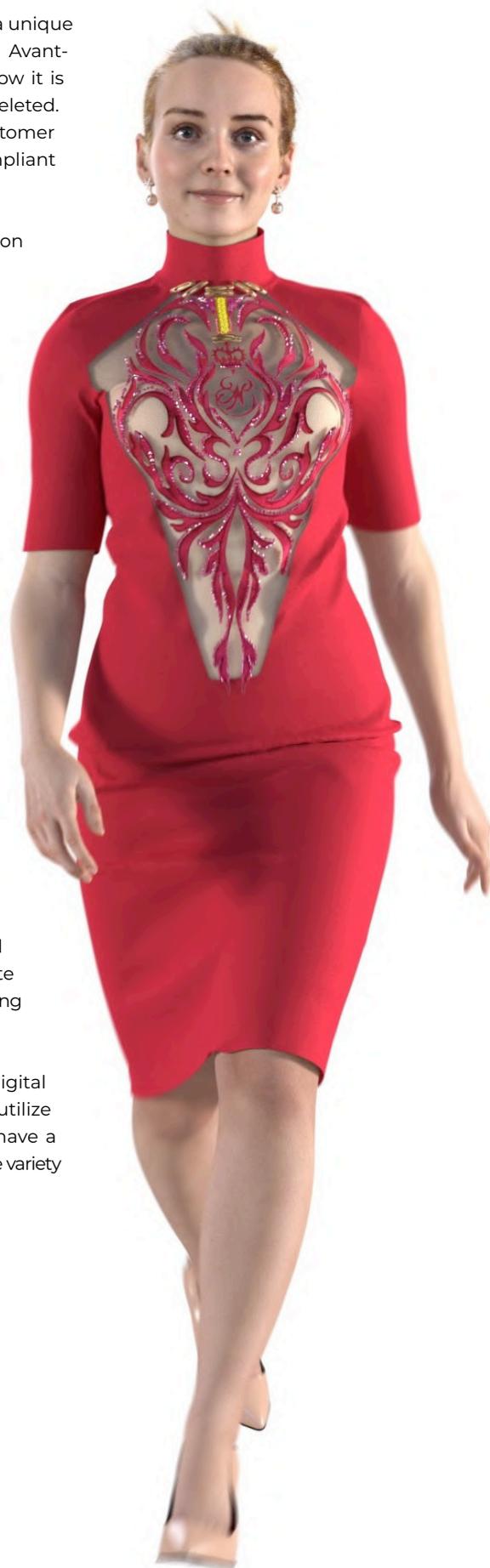
OPTITEX

WWW.OPTITEX.COM

1988
YEAR FOUNDED

Optitex is a global software provider of integrated 2D-3D CAD solutions for apparel brands, retailers and manufacturers. Serving over 30,000 users, our solutions focus on pattern accuracy and predictable fit. With highly intuitive tools, we help our customers streamline design, development and production throughout the supply chain, enabling efficient workflows and tight collaboration for better fit, higher speed to market and sustainable production.

30000
TOTAL NUMBER OF ACTIVE USERS WORLDWIDE

HEADLINE CUSTOMERS

ALISON HAYES	**ELCATEX GROUP**	**NIKE**
ARIZONA STATE UNIVERSITY	**LI & FUNG**	**PETIT BATEAU**
ASOS	**LONDON COLLEGE OF FASHION**	**PERRY ELLIS**
BROOK SPORTS	**M&S**	**RAPHA**
CARMEL	**MACRON**	**SCHOOLBLAZER**
CIOVITA	**MAUREL**	**TARGET**
DECATHLON	**NEXT**	**UNDER ARMOUR**

OPTITEX

WWW.OPTITEX.COM

PRICING MODEL:

Optitex software is delivered in modules based on specific customer workflows.

40+

TECHNOLOGY PARTNERSHIPS, INCLUDING:

3DLOOK

ALVANON

BANDICOOT

BODIDATA

BYONDXR

CENTRIC

COATS

DATATEX

DAZ3D

EMBODEE

EMERSYA

EUVEKA

FASHION ENTER

FIGURE FORMS

FIRST INSIGHT

FIT3D

FLIXSTOCK

FORSTER-ROHNER

IDEAL

JML

KORNIT

MADE2FLOW

MESHCAPADE

MYR

NED GRAPHICS

NVIDIA

PANTONE

REACTIVE REALITY

REY

SEDDI

SIEMENS

SIZEMIC

SIZER

STOLL

SWATCHBOOK

TEXEL

THE BUREAU

TWINE

VIZOO

VNTANA

YKK

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

Optitex focuses on pattern accuracy and predictable fit to enable reduction of returns, streamlined workflows and sustainable production.

Our combined expertise in 2D pattern expertise, accurate 3D simulation, and strong 3D collaboration tools, assure consistency throughout the supply chain and support fit-oriented process from the design stage and up until the production end.

With best-in-market network of technology partners, Optitex assumes the role of virtual-to-physical enabler, promoting sustainable workflows, dramatic time and material savings and earning consumers priceless trust.

CONTACT

OPTITEX

A FITTING CHOICE

Returns happen because of fit. Fix that problem with Optitex.

www.optitex.com

OPTITEX

IN CONVERSATION WITH

AMIR LEHR

CEO, OPTITEX

_____

Digital product creation in fashion seems to have reached critical mass; it seems to have hit a tipping point where almost every brand and retailer is pushing towards it, if they haven't done so already. And if they've already done it, they're looking for ways to scale it. Why now? What's changed? Why is interest in 3D and in DPC so high at the moment?

It's interesting that you use the term 'tipping point' because there are multiple reasons why this is happening. One of these is talent. The creation of fashion is a combination of art and science. The designers are on one side, with a concept or an experience that they want to communicate to the consumers. On the other side you have the pattern makers and the people in production, that work on the science end of it. The talent that we see coming out of school leans heavily towards the art side and shies away from the science side. We even hear young designers that are intimidated by patternmaking and perceive it as potentially creativity restrictive. And that is where our technology delivers high value.

That's one factor. Another is social media, which is doing two things. Firstly, it dramatically accelerates the speed of communication in fashion; take the Coperni dress during Paris Fashion Week, for example. We saw it instantly, but fifteen years ago it would have taken a few weeks to penetrate and travel. It also creates a scenario where fashion is not dictated top to bottom, today anyone with a TikTok account can be an influencer. The combination of speed of message and the fact that they're coming from all around creates micro trends, which travel fast. In order to maximise

on that you need
to sell it immediately.
And you need to do this
repeatedly. The speed in which a brand
has to deliver from concept to general
availability on the shelf is moving from 14 weeks (or thereabouts) to almost real time. Then, when you add other parameters like shipping costs and sustainability, you get to a phase where you don't want any stock because you can't afford it. With the fact that you have more artists and less scientists in order to manage that, meaning you run the risk of compromising quality.

One key parameter that keeps customers loyal to a brand in general is consistency of fit. And it's becoming ever more difficult to manage. When you combine increasing speed of concept-to-production, large volume of items and supply chain alignment, next to finding the right fit, the conundrum becomes obvious.. Add in remote work and lack of access to a physical mannequin, and you have a host of new challenges.

If you review all of this you have: sustainability concerns, supply chain challenges with often unpredictability in shipping, increased speed and validation with customers before actually producing an item. All of these factors combined is getting into a tipping point, forcing everyone to adjust to the digital journey. But that journey needs

optimization. Every piece needs to be connected to multiple stakeholders or functions in an organisation, including the different technology partners that are providing these different pieces. And there's still work to be done in this regard. It's a journey, but the entire ecosystem is moving in the right direction.

Because of all these forces at play, there's a big weight of expectation being placed on 3D tools and the assets they create because brands are required to bring those assets into more different use cases than ever before: downstream where aesthetics are everything, and also upstream as aids into production. How important do you think it is for 3D assets and 3D tools to be able to facilitate all of those different kinds of deliverables and workflows you've spoken about? And, as a result of that, how vital is that continuous connection between 3D simulation and 2D patterns, so that people can start to trust in the assets?

This is key. There are trade-offs between short-term and long-term optimization. Looking at short-term, the focus will be on is ease of use for fast onboarding, and the fact that you can create while minimizing the science usage. A designer can create an downstream item that looks aesthetically pleasing and showcase that on social media to potential buyers and get early feedback, maybe even place an order. The frustration comes later when you hit surprises in the production process. These surprises can be around cost or fit and are a mismatch between what you can deliver and what you have sold. And it's difficult to optimise these two ends.

If you look at Optitex, we provide outstanding solutions upstream. Others might be providing good solutions downstream, and the industry is yet to connect these two ends together. This is a big challenge. As we, and others, move on with development this link is becoming more sustainable and reliable, but we still need to fine tune those ends and make sure that it's a continuous spectrum.

How can digital product creation workflow, specifically 3D tools, bring brands and suppliers closer together? And in the near-term future, how do you think the kind of work of asset creation at the scale that's going to be required is going to be shared by different participants in the value chain? At the moment, you have a lot of brands who are trying to do their 3D asset creation in-house, but you have suppliers who have a lot of development and creation expertise who are also building their own. How do you see that relationship between brand and supplier working? And who is going to be responsible for leading on 3D asset creation in the future?

The leading question is a geographical one and the answer varies from one vertical to another within the fashion and apparel industries. Typically, the large players with deeper pockets and commitment to investment will set the tone but, even before that, we have to put some infrastructure in place. When it comes to 3D creation, multiple entities that are manipulating a piece that eventually has to be sold and produced; we're talking about focusing on the same avatar and body measurements that you are fitting on. We're talking fabric characteristics - the visual and physical measurements of the fabric. And then we're discussing the available components and trims and about the design and the science aspect: the concept (Design) and the pattern making and all of those components. When you have multiple stakeholders at multiple entities manipulating or creating a product, all these pieces need to be in harmony.

A brand can't ask a vendor to create patterns and deliver samples if both sides are not working on the same avatar, or if both sides are not referring to the same fabric measurements and characteristics. You need a functioning digital infrastructure for that. That infrastructure today is extremely complex because you have ERP and PLM systems, and then you have 2D/3D systems and there is some gap in between which we address with Optitex O/Cloud. There is a need for a 3D-friendly abstraction layer, one that can work with PLM and ERP systems, and provide a mechanism to assure that when you share avatars and body sizing between different companies, brands and their suppliers, you all have the intellectual properties (IP) rights and the ownership rights managed properly. That information contains the DNA of a certain brand that should not be shared without control. You need to have elements that enable you to have multiple parties share these assets and make sure that all the rights and access rights are being well managed.

The more you can put on the cloud, digital assets and processing the better. There is a technical question of accessibility and cost effectiveness that is changing over time. When it comes to maturity and completeness of interoperability standards, we are not yet in a scenario where you can easily mix and match technologies without having someone from the technology supplier side cooperating with the client and making sure that all the pieces are really talking coherently with each other.

How significant a role do you think digital product creation tools have to play in improving the sustainability profile of products? We all know that it's clearly beneficial to replace physical samples with digital ones, but there are also opportunities like automated nesting, ways to improve material yield etc. What are the extended possibilities where 3D and sustainability interact?

There are multiple sides to that. If you look at *how* we can influence sustainability, then you have the reduction in number of samples between the patternmaking and design and the associated shipping costs or shipping fuel that is involved with that. You have the reduction of stocks by making sure that you produce the most relevant items to order and don't produce wasted stocks and minimise returns. And then you have the quantities and qualities of your bill of material and how you optimise that with fabric
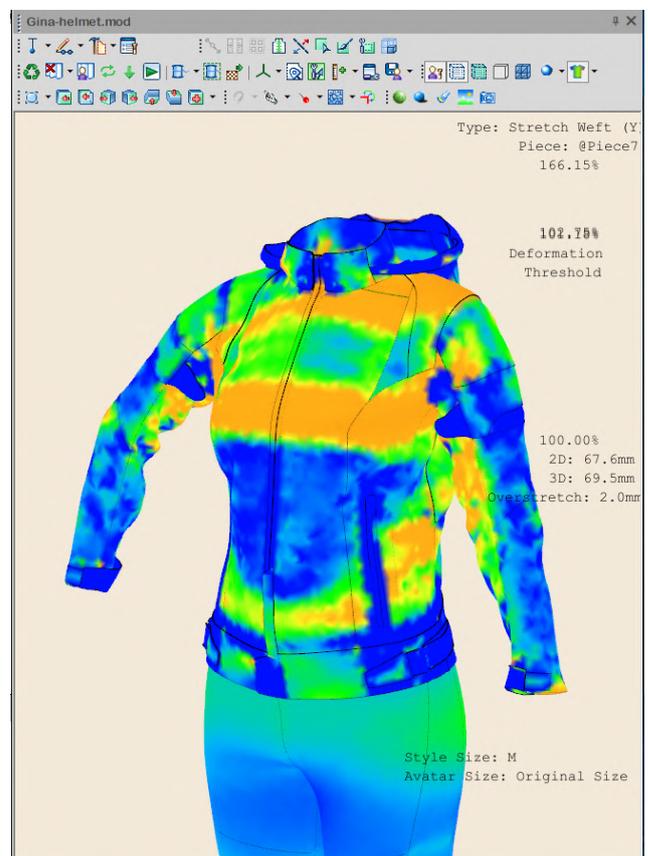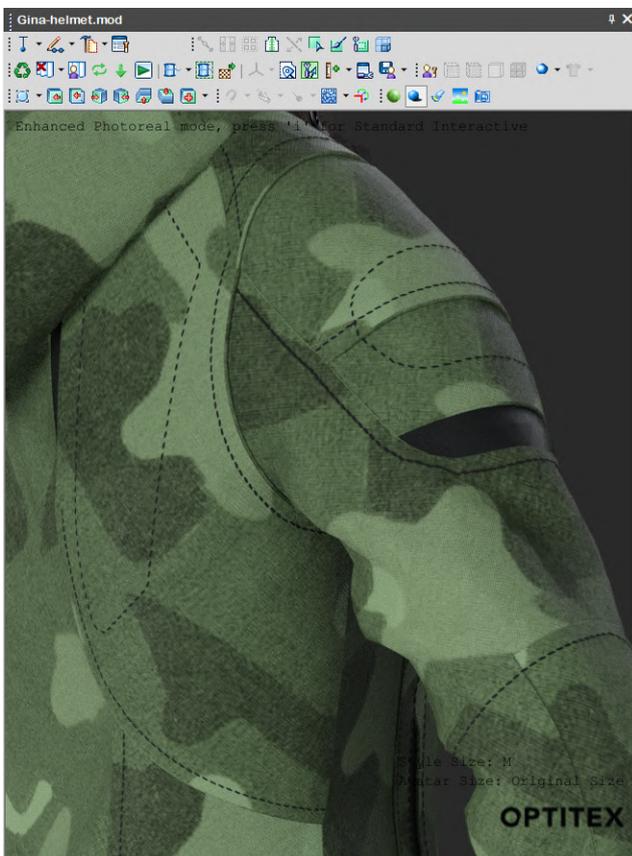
nesting, length of stitches, use of accessories or trims that you have. All of the discussed technologies involved here - the pattern making, the 3D, the PLM and the ERP systems - have critical roles in optimising all of that. The other element is how do you embed and track data along the entire product development process that over time you can refer to and assure you are moving in a sustainability improvement direction. If you don't measure it, you can't manage it. Lastly, we tend to wear items more when they fit well.

Where do you see digital product creation, and more generally 3D assets, going from here? What does the near future look like for the way the fashion industry is going to make use of DPC / 3D tools and processes, and what does the near future look like for Optitex?

In the next two years two things will happen in parallel. One is that brands and vendors that have already adopted and committed to 3D technology or digital journey in general will expand it into more of their categories and more departments. There is a tendency to think that everyone is already there using digital pipeline, but we're still in the early phases of this transition. Technology keeps moving forward and the utilized standards keep evolving. Whether this is body measurements and avatar technology, fabric scanning, visual and physical 3D technologies, upstream and downstream and cloud infrastructure - everything will be connected to really enable those hands that work on a piece work in harmony, track and manage sustainability parameters.

In the longer term, we believe that the industry is moving gradually toward of made-to-order, made-to-measure and one-piece items. Kind of bespoke qualities at mass production cost-structure and availability at least for some fashion and apparel categories. This is a very long-term aspiring objective: to order something online that is really tailor-made to our body measurements. I cannot overstress how critical fit is for our experience. We all very tuned into design, but eventually what drives customers to keep an item for longer and wear it more or avoid returns is the fit quality: how does it drape, looks on and feels comfortable on a specific body. That is a very long journey that the industry still needs to optimise, and it requires tight communication between individuals and between brands and suppliers. Digital infrastructure enables this and will drive it toward a better end, But this is still the beginning steps of a long term, continuous journey of improvement.

PRINTFUL | ENTERPRISE

WWW.PRINTFUL.COM

2013
YEAR FOUNDED

Printful Enterprise is a brand service provided by Printful, a tech unicorn and a global leader in white-label print-on-demand and dropshipping services. We help enterprise-level brands build and scale their merchandise business fast, and without investing in inventory.

Printful fulfils and ships custom clothing, accessories, and home & living items. With Printful's on-demand service, you can choose and design merchandise from 420+ items in our catalogue, and then add those products to your online collections. Once a customer buys from you, Printful automatically receives the order, fulfils it in 2–7 days, and ships the custom-designed goods under your brand.

Since Printful's founding in 2013, we've been trusted to deliver 55M+ items and have scaled to a team of 1,600+ people across the US, Canada, Mexico, Brazil, the UK, Spain, Latvia, Japan, Poland and Australia. Printful is the first American unicorn company with Latvian roots, valued at over $1B.

395,000
TOTAL NUMBER OF ACTIVE USERS WORLDWIDE

80% North America

NOTABLE RFA CUSTOMERS

AMC	HOUSE OF CHINGASOS	PRIVY
COCA-COLA	MATCH KICKS	SWISH EMBASSY
COMEDY CENTRAL	MTV	THE PHILOSOPHER'S SHIRT
DUNKIN'	NBC	VASTITCH

Our customers include direct-to-consumer ecommerce brands, merchandise agencies, creator platforms, as well as gaming, entertainment, media, and fashion companies.

PRICING MODEL:

It's free to sign up and use Printful. You can start experimenting and creating new fashion collections without any upfront investment. You pay for products only once an order is made.

Our product prices include one standard print/embroidery placement. For all-over-print products, the price includes the entire all-over-print design. If you want to add additional design placements, that's possible for an extra fee. You get monthly and bulk discounts, and can save on sample orders.

For our enterprise-level customers, there's also the option of special pricing for products and design placements. We offer optional branding add-ons, such as custom packaging, additional prints, and more.

20+
TECHNOLOGY PARTNERSHIPS, INCLUDING:

AMAZON

BASE

BIG CARTEL

EBAY

ETSY	STORENVY
PIETRA	SQUARE
PRESTASHOP	TIKTOK SHOP
SHOPIFY	VEXELS
SHOPIFY PLUS	WEBFLOW

To support our customers, we have also partnered with companies such as Fiverr, Klarna, Kornit, and others.

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

On-demand manufacturing streamlines digital product creation for brands. It helps businesses expand product variety, increase production capacity, reduce upfront costs, and avoid inventory risks.

Companies can easily test new designs and products to see what sells best. With print-on-demand, releasing a new design is simply a matter of uploading the design to your online store. This reduces speed to market from months or weeks to just hours, enabling companies to quickly monetise trends. Once your store is set up, orders are automatically fulfilled by Printful.

With print-on-demand, brands can also offer a unique experience to the end consumer by enabling product customisation. This differentiates brands from the competition, can improve profit margins, and over time, increase brand loyalty.

Having the ability to quickly scale is also key for digital product creation. Printful's global network of facilities offers the exact capacity customers need, regardless of order volume. And since everything's produced on demand, products are only made once they're purchased. This means no leftover stock or lost revenue from markdowns.

Ultimately, print-on-demand helps companies scale their business without the risk.

CONTACT

We print. You earn.

Sustainable growth made easy with on-demand production

✔ Inventory-free ✔ Global network ✔ Premium apparel

ΛΛΛ PRINTFUL | ENTERPRISE

Leading print-on-demand supplier

IN
CONVERSATION
WITH

KASPARS KIRSIS

HEAD OF SALES, PRINTFUL

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

There are multiple factors at play. There's significant economic uncertainty and the fashion industry is quite slow to respond to such movements. The post-pandemic consumption boom seems to be over as interest rates climb and inflation soars. At the same time, the fashion industry hasn't been prepared for this, and products manufactured and ordered in advance are now sitting in warehouses, being sold at heavy discounts. If fashion brands were using an on-demand production model, the situation would be considerably better. Instead of trying to forecast inventory, companies would have produced and sold just what was demanded during the busier period. With an on-demand model, we could eliminate unsold inventory, reducing pressure on margins and improving certain sustainability efforts.

Today, brands are wasting time and resources dealing with excess inventory when instead they could be focusing on releasing new collections.

In addition, being agile is crucial. Fashion trends change weekly. There's a great deal of power in the hands of the creator economy. Most notably, through social media. You simply can't capture trends with lead times of 1–2 months. Take television merchandise for example. The product needs to be readily available at the pinnacle of the show's success. In another 1–2 months, the next successful TV show will have captured your target consumer base.

The on-demand model is perfect for smaller businesses as you can build a brand without worrying about large upfront investments and inventory risks. However, we're seeing a massive shift in terms of how larger companies—particularly in fashion—think about this. They are relatively slow, and struggle with being agile. They tend to sit on billions of dollars worth of unsold inventory, with supply chains that take anywhere from 6 to 70 weeks to produce.

In terms of scalability, it still depends on product personalization methods. Digital prints on apparel (direct-to-garment) are extremely scalable. The industry has come a long way, and we're able to produce on-demand apparel effectively and quickly through enhancements in automation. More complicated fashion items (dresses, jackets, etc.), though, are much more difficult to scale due to complex operational processes.

And above everything else is sustainability. We're in 2022, and throwing unsold garments into landfills is (or should be) a thing of the past. With on-demand, you only produce what consumers want, and when.

Being able to produce digitally, on-demand is valuable by itself, but it's also the final stage in what can be a full end-to-end digital workflow that carries through style, colour, and other key attributes from initial design right through to print. Do you see these workflows becoming more common in the near future?

I see very clearly a future where a fashion designer opens the software, designs a product, runs it through the approvals process, and pushes it straight to the DTC store. And the production facility is perfectly capable of producing this item on demand. We're talking about complete agility. The biggest bottleneck is the operational ability to adjust processes for highly-customised lines. For example, we can of course print fabric with a particular pattern on demand—we can even cut it automatically now—but the problem lies in the next stages: sewing, adding more complex attributes, etc.

Having production available on tap is likely to do a lot to lower barriers of entry for small brands and emerging designers, but being able to access the same network at an enterprise scale could also change the way bigger brands think about the way they work. How scalable is printing and dropshipping on demand, and how do you see the balance between small and large businesses evolving?

One of the primary justifications for producing locally is the sustainability benefit—garments that can be printed and distributed from locations as close as possible to the end consumer can have a significant impact on carbon footprints, as well as allow brands to react as quickly as possible to more regionalised demand. Tell us more about the sustainability and speed benefits of producing and printing on-demand.

Having more localised fulfilment (i.e. nearshoring) is indeed a more sustainable way to think about fashion. Shorter shipping distances mean less emissions. Producing and printing on demand also allows brands to react to fashion trends anywhere in the world quickly and in a more agile way, which results in less excess stock.

Where do you see digital product creation—and digital printing—going from here? What does the near future look like for the industry and for your business?

Companies with the most adept digital supply chains will thrive, and we can already see this. Companies like H&M have been dominating for a long time. Companies like ASOS then began to disrupt the industry, followed by ultra-fast-fashion businesses like Shein. But the latter isn't the best example in terms of sustainability and ethical principles.

Still, building something like this, that responds to trends, scales easily, and is sustainable, is a big leap for the fashion industry.

SO REAL
DIGITAL TWINS

WWW.SOREAL.CH

2019
YEAR FOUNDED

Using patented scanning and twinning processes, SO REAL automates the creation of AS BUILT, photorealistic, metaverse-ready 3D and 4D objects.

For a great example of SO REAL products in eCommerce, simply visit the TWINVERSE.

PRICING MODEL:

Revenue Sharing: The clients grant rights to the sale of the digital version of their products. We share the revenue. We all make money on every download.

Backup model: Volume-based, B2B pricing. Price per item twinned.

HEADLINE CUSTOMERS

A BRAND OF THE LOUIS VUITTON GROUP	ATRACSYS
	ETON

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

SO REAL brings realism into the picture. By creating 3D objects and digital twins of the products AS BUILT, we handle the "last mile" of the journey from production to retail AND we close the loop by providing files of the real thing for use in future design loops.

CONTACT

IN
CONVERSATION
WITH

IAN
RAVENSHAW BLAND

CO-FOUNDER + CEO, SO REAL

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

It is reaching critical mass for the smart brands; those who might want to have the term "thought leadership" associated with them, anyway. One huge reason is, of course, corona. The leading brands already had a program going before corona and the fast followers were probably thinking about it and were thrust into the world of eCommerce as the result of the lockdowns. Once their eyes were opened to the world of 3D downstream at the interface with the customer, I'm sure some of them saw the logic in beginning the 3D journey way upstream in the design phase. Again, these are the smart brands. We are still running into brands who keep comparing the cost of a 3D model with that of a photoshoot. This is mainly because they have nobody who looks at the issue holistically. It is usually the person in charge of getting images for sales &

marketing purposes and that person has very little to nothing to do with anything upstream like design or manufacturing.

The second reason is sustainability. I cannot imagine a brand that does NOT feel the intense pressure to respect the environment and the people throughout the supply chain. At this point, the arguments FOR an all-digital, all 3D supply chain are irrefutable. From virtual sampling to virtual try-on to build-to-order, it all makes sense.

If we are not there already, we soon will be at the FOMO phase of the rollout. The fear of missing out is always a factor in every paradigm shift. This will be no different.

How is the nature of what brands and consumers need from digital assets changing? Beyond the capability to stage products and create static renders, it seems as though there is a strong

mandate than ever for 3D assets that people all along the value chain can interact with.

At SO REAL, we refer to the 5 levels of engagement for eCommerce. We single out eCommerce opposed to upstream processes because we have had the most experience here.

At the very bottom, LEVEL ZERO, we have your garden variety online shop with photos.

Those who have gone up to the next level to LEVEL ONE report an increase in engagement and conversion; sometimes it is massive! 3D models for this use case are the simplest. They include just geometry and texture. They can be shown and manipulated in a basic 3D web viewer.

At LEVEL TWO, the next level up, the product in question can be configurated. That means the models must be segmented into the parts which will be configurable. These models must also be packed with metadata such as product information which can pop up upon hovering over or clicking on a given area of the 3D web viewer.
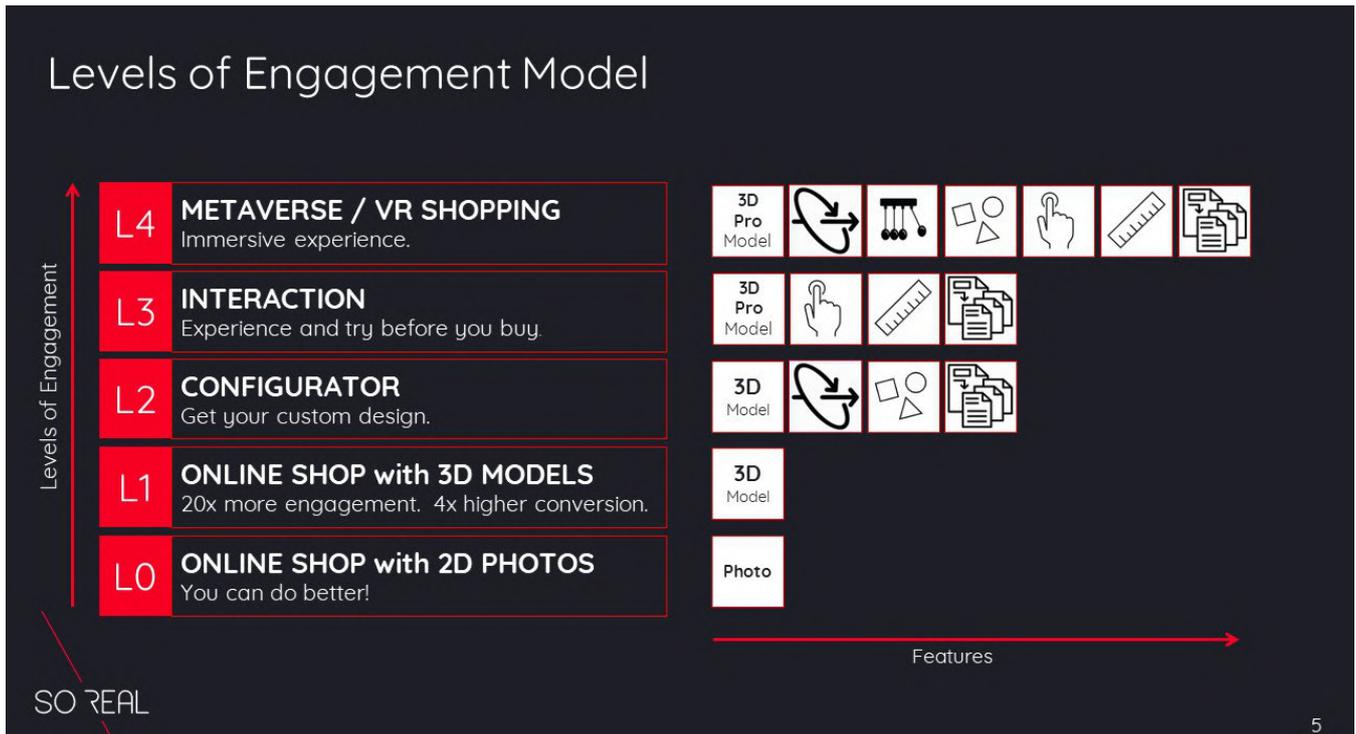
At LEVEL THREE, the models must be integrated into an AR "try before buy" app. This is usually a different model depending on the AR app.

Finally, at the very top of the ladder, LEVEL FOUR, we have the immersive experience where one can clothe one's avatar. Eventually, there will be a LEVEL FIVE which incorporates a fitting function. One's avatar will be dimensionally accurate as will the 3D model of the product. These models will most likely have to be "AS BUILT" models, meaning they will have to be done from scans of the real thing, not models from scratch for from CAD.

Every brand is moving up the ladder. Those who do not will be left behind. As one progresses up the ladder, the need for interaction, the need for more "contact" with the product is necessary.

What does it mean to take that interactivity to another level? A lot of eCommerce and augmented

reality use cases are going to be catered for by accurate-looking representations of physical products, but there are also other applications that might demand more - including internal research and development, detailed product inspections and configurations, and more. What is the distinction between a 3D representation of a product, and a true digital twin?

A case which we have proposed, but to date have no takers on, is the marriage of "AS DESIGNED" with "AS BUILT" in the digital product creation process. We think the ability to compare what was built with what was supposed to be built and do it digitally will be the future. We think this will come to pass after companies improve their "AS DESIGNED" skills.

A 3D representation of a product can come from product creation software and often it is good enough for LEVEL ONE (see above). However, the Digital Twin Consortium's definition of digital twin is clear about one thing. It is a
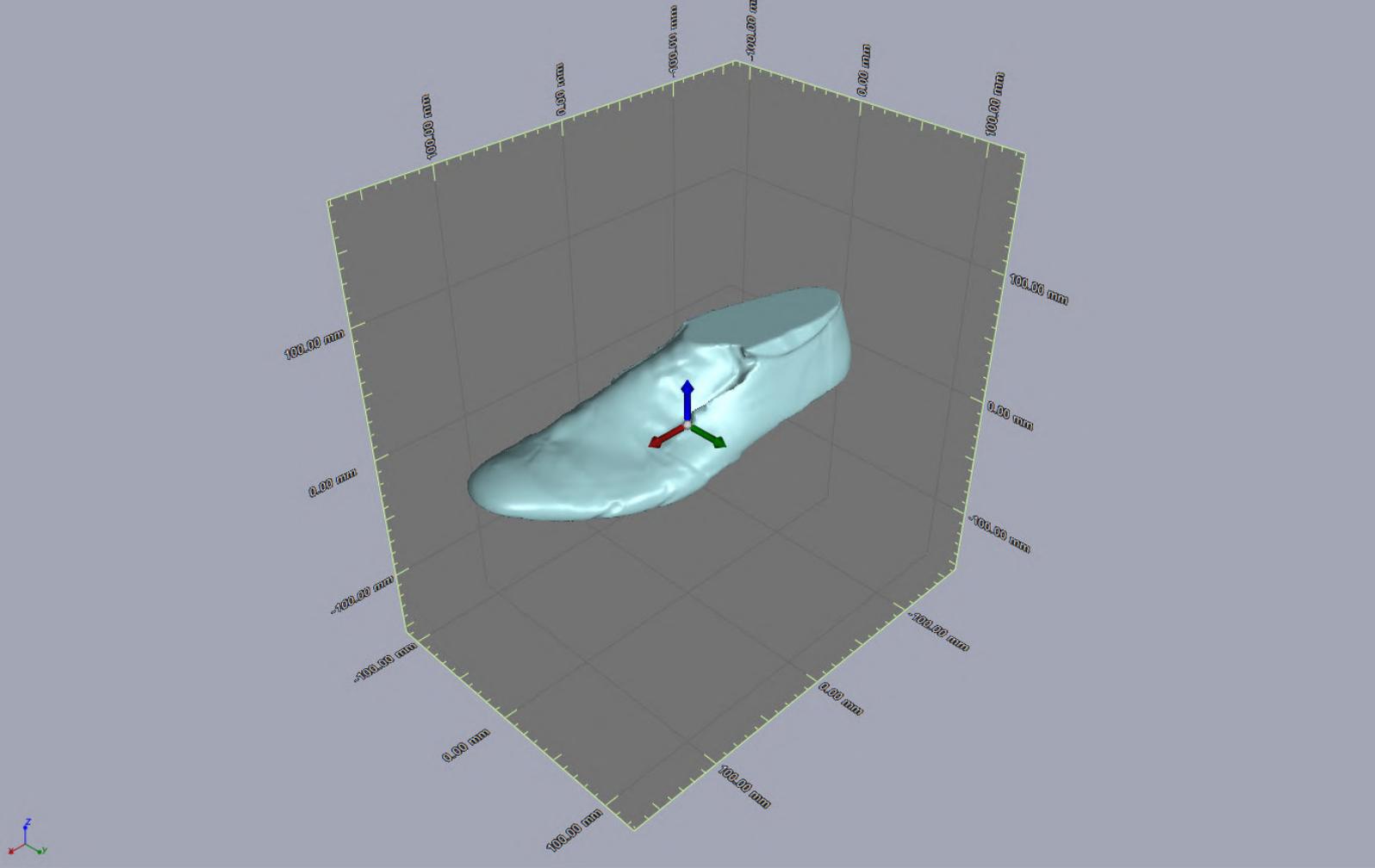
"virtual representation of real-world entities…" This more than implies that the digital twin should, wherever possible, be an "AS BUILT" model. At SO REAL, we believe a digital twin should look and behave exactly like the real thing. That means it must have:

- an interior,
- everything needed for interaction,
- embedded physics parameters,
- rigging (if parts of the object move), and
- metadata about its materials, origin, etc.

To cater to all of these current and potential use cases, it will be essential for digital assets (of either level of complexity) to be portable across different solutions, rendering engines, and environments. What is SO REAL doing to futureproof the digital assets it creates for clients?

A SO REAL model starts with scan data from which we create a master file from which we can create any Level of Detail (LOD) and any file format. Everything the client needs is available.

The issue of 3D asset interoperability for the metaverse is a big one. The good news is that it is being tackled by the most serious players in the industry, including SO REAL.

With some of the initial hype subsiding, how do you see the Metaverse and the physical world colliding, and what does this mean for the future of digital product creation and product digitisation?

If they don't already, millennials and especially Gen Z[ers] will expect a digital version of everything physical. For them, a digital only product is normal. I imagine a toggle switch in future versions of AR glasses that switches between real and virtual versions of everything within the field-of-view. Both the real version and the virtual version will be for sale. The viewer will be disappointed when there is no digital version to be had. She/he will also be disappointed when buying a real thing does not look like the thing she/he saw and purchased. This is why we believe that "AS BUILT" models will win out over "AS DESIGNED". Hyperreal models will still have their place in the digital only world.

The designers of digital only products are not bound by physics or manufacturability, only their imaginations.

The designer of physical products will have to take into account that her/his workflow does not end with manufacturing drawings. There will always be a digital version of her/his creation as well as the physical which is presented to the consumer. They will then realize that

the workflow is actually circular, not linear. The product will be scanned and digitally segmented. Those segments can become parts of a library for use in future designs, closing the loop.

Then there is the topic of rights to the digital versions. The days of creators creating something and getting screwed over by pretty much everyone are (hopefully) over. The same goes for the strict "We make. We own. Period!" stance by brand owners. What happens with derivative digital works? Web3 and NFTs offer a way for the creators always to benefit from the sale of their work as well as derivative works. Dealing with the legal rights will become part of the workflow for digital products.

More generally, where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

From the point-of-view of the consumer, in the mid- to long-term, we believe that "AS BUILT" models will be preferred over "AS DESIGNED" models for products that have both a digital and physical version. That means a scan'n'twin step must be included in the DPC workflow.

It looks like we will spend the near, near future populating the metaverse with objects. As everything must be accessed over the web, that means using all our tricks to make an object look good while not taking forever to load. As for the industry, we await the fast-followers in the metaverse and expect we will go through the same process with them; that of aligning expectations with what is now possible with the web.

We think that the industry will realize that a stitch in time saves nine. In other words, it is 10 times cheaper to invest one level upstream in a process. In the case of 3D products, it is far cheaper to invest in creating that "master file" up front than paying for one model for eCommerce, then another for the configurator, then yet another for AR try-on.

At the macroeconomic scale, I see copyright law being steered by a court case rather than proactively via legislation. I see a showdown coming at high-level court regarding the copyrights to digital assets and their derivatives. It will turn into a landmark case which shapes the way business is done until the legislation can catch up. What case will it be? Good question.

stitch

STITCH.FASHION

2020
YEAR FOUNDED

Stitch is a fashion-tech startup that is future-proofing the fashion value chain, by digitizing how collections are created and sold. Our solutions aim to activate change in three dimensions of the value chain: learn, create and sell.

The Stitch Academy offers consulting, training and e-learning for fashion professionals. Covering new digital skills and practices, from 3D design workflows to physical showroom transformation. The Stitch Hub is an agnostic render platform that visualizes the design workflow for 3D teams. The Stitch Showroom is a digital showroom and presentation product that brings together marketing, merchandising and sales, allowing sales teams to sell digitally both in the physical showroom as well as remotely.

Global brands like Tommy Hilfiger, Calvin Klein, Havaianas, The North Face and Scotch & Soda are future-proofing their value chain with Stitch.

1064
TOTAL NUMBER OF ACTIVE USERS WORLDWIDE, ACROSS THE FOLLOWING REGIONS:

21 North America

3 LATAM

956 EMEA

84 APAC

HEADLINE CUSTOMERS

CALVIN KLEIN	**SCOTCH & SODA**
HAVAIANAS	**THE NORTH FACE**
LSTNR	**TOMMY HILFIGER**
NZA NEW ZEALAND AUCKLAND	

stitch

STITCH.FASHION

PRICING MODEL:

The Stitch Showroom and the Stitch Hub are priced per user. Plans range between 99 and 159 user/month.

The Stitch Showroom is optimized for all kinds of hardware, from iPads and laptops to touch screens. We also support brands in building an in-showroom digital experience. Prices vary depending on the hardware set-up desired.

The Stitch Academy - which comprises of workshops, transformation services and consultancy - starts from EUR499 for a workshop.

Custom consultancy and services are also available and are priced per hour.

7+

TECHNOLOGY PARTNERSHIPS, INCLUDING:

BROWZWEAR, 2020

JOOR, 2020

VIZOO, 2022

BYNDER, 2022

VNTANA, 2022

EMERSYA, 2022

SKETCHFAB, 2022

CLO 3D (COMING SOON)

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

We believe that fashion brands can future-proof their business when they bring collections to market digitally.

Stitch's offering helps brands to do just that: create your collections fully digitally with your 3D design software of choice and then unlock the ability to immediately sell from these assets in the digital showroom.

We don't just offer software. We also provide brands with our expertise and consultancy to succeed. From change management, to 3D processes, to physical showroom transformation - we've got you covered.

Stitch will be a co-pilot to change for you. We help you define new processes and workflows to make the fashion value chain smarter, more flexible and more sustainable. No waste, no excess, just great collections. This is how we can change the fabric of fashion together.

CONTACT

From 3D to showroom

Learn
3D skills and workflows with the Stitch Academy.

Create
collections digitally and in 3D with the Stitch Hub.

Sell
straight from 3D collections with the Stitch Showroom.

Watch the video

stitch

stitch.fashion

stitch

IN CONVERSATION WITH
ANNE-CHRISTINE POLET

FOUNDER, STITCH

DPC in fashion seems to have reached critical mass with more brands than ever kickstarting and scaling DPC strategies. Why do you think that is now?

There are multiple reasons, and some are more obvious than others. Of course COVID had a huge impact, especially for brands, who couldn't get samples or photos, and whose teams couldn't travel. But beyond COVID, I think there are some underlying trends that are happening - sustainability being a critical one. And it goes beyond brand reputation; employees and teams want to work differently, too. It's not at critical mass yet, but as the younger generation starts to weave into the industry, they'll bring fresh minds filled with different ideas when it comes to sustainability.

Web3 also sparked a further need for digital garments. But the latest change is that there are simply more solutions out there today. And the solutions are getting increasingly better, with an increasing amount of funding, too.

We're seeing a combination of all of these factors coming together and positively impacting the way that we're tackling these problems.

Your new motto is "changing the fabric of fashion", which means fundamental change to the way fashion operates from concept design all the way downstream. What would you say is the major force(s) that makes that kind of sweeping change necessary? Why does fashion need a new fabric?

In fashion, we're operating a little bit like Titanic: right now the ship from above still looks beautiful, the music's playing, and people are still dancing, but at the same time, there's this gaping hole in the bottom of the ship, with water literally streaming in, but not everyone realizes it yet. And that's really where we sit.

At the same time, there are a couple of things that we know to be true:

1. People will always use fashion as a form of self-expression. This can be done digitally, but we're always going to have physical context. So, how do you enable people to still express themselves through fashion?
2. Businesses still want to make money.

So the big crux sits in those two elements that you might not be able to change, because consumers are difficult to change. That's why ultra-fast fashion still lives; younger consumers who might not have much to spend still want to dress themselves in what makes them feel good. But what you *can* change is what sits in between. How does supply and demand get matched? If we know what the consumer needs, and we know what we want to create, how do we not over produce? That's something we can change. Because we want this industry to live and we don't actually want the Titanic to sink.

And that's where I think digital really starts to take a front seat. I'm a really strong believer in digital as an enabler, and not just tech for tech's sake. So I think that technology is a way to enable that kind of change. And that is really where Stitch, as a company, plays a really big role. We want to help brands at least be able to create and sell B2B digitally - and to do that without your produce, without your samples, and in a much better and a much faster way. And, aside from the immediate reduction of samples, you'll also start to see brands unlocking a new value chain: maybe they can go to market even faster, and maybe they go straight to the consumer without producing in between.

It's a way to unlock new models for us. And it's a way for the industry to leapfrog ahead of itself again, and prepare for the future.

Beyond tech and funding, one of the key barriers to either kickstarting or growing digital native workflows, is skills. You've got brands who are very keen to hire in new generations of people with hybrid skill sets, and you've got universities or colleges that are trying to train the next generation of that sort of talent. There's a big gap in the middle, which comprises all of today's fashion professionals who are very immersed and well versed in

the traditional processes you've mentioned. These are the people who are keeping the Titanic afloat and there is a need for them to get a grasp on new ways of working if the industry is going to move towards these sort of digital native workflows. What do you think is the right approach to doing that?

In my own experience, and in our experience as a company, once fashion teams get past the initial hurdle that is the fear of digital product creation taking over craftsmanship, and instead realize this is actually a way to create better garments with less waste, fashion teams are very willing to learn. Where the challenge sits instead, is in the fact that many businesses have optimized and crunched their overall calendar to such an extent that there literally is no time for learning. And they see that DPC is still so much in its infancy, its uncharted territory. When you're in territory like that, the best way to learn is by doing. You learn through experimentation: through trying, and failing, and trying again.

Now, the irony is that the calendar doesn't have time for teams to learn by trying and failing, but it is exactly this that would create more time. As an industry, we need to find a way for teams to learn, whilst still keeping that calendar going. We need to change some systemic way of working to allow teams to upskill. And we can do gradually. At Stitch, with our Academy, we really help brands to do this.

The past years we have trained over 1000+ people - from designers and product managers to global sales teams - in digital workflows. Our Academy offers both online trainings where you can learn at your own pace, as well as on-site workshops for fashion teams that help accelerate transformation. Our trainings range from the first steps of digital transformation (including change management), to 3D design and digital go-to-market workflows. We are now expanding our offering to individuals, not just teams, and are excited to share our experience & knowledge with more and more people in the industry.

There are a lot of people very interested in the new business models that you can build for digital assets that then go on to become digital goods, whether that's the

slightly nebulous promise of the Metaverse, or whether it's something a bit more grounded in selling digital goods, or in creating digital goods in a way that allows you to interact with them. Do you see a synergy between the reasons to create digital workflows today and those new business model opportunities? Is there a link between DPC for the sake of doing fashion better, and DPC for the sake of enabling these new sorts of downstream business models? Or should you be looking at those two things as completely separate?

Maybe there are two schools of thought, but a lot of people believe in digital for digital, and others in digital for physical. It's one of my deepest wishes that those two are intertwined. On a macro level, the way you create digital

> ❝ DPC AND SUSTAINABILITY ARE SO INCREDIBLY INTERTWINED. AND IT COMES DOWN TO BOTH MINDSET AND SOFTWARE – WITH BOTH THERE'S NO CHALLENGE WE CAN'T SOLVE. ❞

garments, no matter where they end up, is quite similar. Yes, there are a lot of differences when you're creating for manufacturing versus when you're optimizing for different digital channels, but it requires a basic knowledge of 3D design. And it requires a certain mindset / curiosity / exploration that you need to do because, just like DPC, the world of Web3 is completely unexplored. And the way that brands are embarking on it now is learning by doing.

In the long run, businesses will be remiss not to invest in talent that knows how to create digital for digital, and how to really optimize for all the different platforms.

It feels a little reductive to say that working digitally automatically means working more sustainability, but surely it does, if every decision you take based on a digital asset instead of having a physical one, means less waste, less overproduction, less over ordering etc. What's your take on how intertwined DPC and sustainability have become?

For me, technology and sustainability are completely interlinked. I want to stress here that technology isn't the 'silver bullet', but it is an enabler for us to solve problems that we haven't been able to solve before, working in the way that we do. And this goes across all of the big topics: traceability, overproduction, better decision-making, and even new models. If we open our minds to be able to look for solutions outside of the industry and take the technology that works well, and apply it to our own

problems, we're going to be able to make a lot of great changes. And I think you can see clear examples in ultra-fast fashion (which I'm not advocating for), just by matching consumer demand with production in a really fast and new way. It's a terrible model, but at the same time these businesses solve problems using technology, and become very successful. It's a way of thinking differently, and solving problems differently.

So DPC and sustainability are so incredibly intertwined. And it comes down to both mindset and software – with both, there's no challenge we can't solve.

We've seen a big push towards the use of 3D assets in selling - both brand to consumer, and in B2B wholesale relationships. One of the primary engines for encouraging businesses to scale their asset creation pipelines right now is because they want to sell with digital assets. This is an area you've been active in for a long time. Have you seen things change? And how strong do you think that mandate is now for using and creating digital assets for sales purposes?

The mandate is there. A lot of brands see the opportunity to tell better stories in wholesale, so grow their wholesale business without needing to invest in physical samples and invest in physical space.

With the unpredictability we're seeing in the supply chain, DPC is going to become a necessity. Overall retailers are also looking at changing their business models, to get to market faster. If you think about doing a quick response capsule, or working with an amazing ambassador, these things are time-sensitive. They have to happen within the coming weeks (or maybe months). And that can only happen if you work digitally, because you just don't have the time to wait for samples. DPC becomes an enabler to change and to grow wholesale businesses as those business models evolve themselves.

And some sales teams still need encouragement to work with digital samples. So we need to build trust around 3D samples. But how do we build enough moments that allow you to compare the digital with the physical, or compare the digital with a photograph to realise how awesome

digital is? This is where collaboration comes in. Maybe you can leverage a virtual model to show your garments in 3D, and that becomes a really amazing asset for sales to use – and it has life. Exploring these kinds of things is exactly the opportunity that DPC gives you.

Whether you're selling business to business, or whether you're selling business to consumer, having those digital assets unlocks so many different ways for you to engage with the various stakeholders involved in that lifecycle, to make choices that previously they wouldn't have been able to make. Where do you see DPC digital assets going from here? What does the near future look like for the industry? And for Stitch?

In the near future, the immediate win would be to have all of those physical prototypes replaced by 3D prototypes, and your physical samples replaced by 3D samples. And when you speak to the manufacturing space, they're really ready for this. They really want it.

So now, it's about how we can help brands to see that this is worth the investment – whether that's direct, like reducing your FOB, or whether it's because you can leverage these assets later in the chain. My hope is that brands truly collaborate, internally; marketing teams need to see the amazing wealth of assets available digitally, and get other teams on board to help take those assets to the next level, so that in B2B and wholesale, businesses can start giving a whole new experience to retail buyers that just wasn't possible with physical assets.

That's the future, especially for us at Stitch. That's where the opportunity sits. Once multiple teams within a brand realize that they can all contribute to these assets, all take these assets and enhance them and give them new life and purpose ...that's when we're going to see even more use cases take off.

Can we change the fabric ?

Of course ;)

Style3D

2015
YEAR FOUNDED

Style3D provides a 360-degree fashion and textile design ecosystem by intelligently combining scalable software tools, cloud-based content, pre-built components, and customizable services.

The solution is easy. It includes seamless access to over 40,000 ready-to-use DPC assets: fabrics, trims, garment styles, avatars, accessories, and more. It's everything that designers need to quickly create new fabrics and styles—and to share inspiring animated presentations, interactive trend books, and virtual showrooms.

Style3D's solution consists of four elements:

Style3D Fabric is a 3D textile lab that clones visual and physical textile attributes to create 3D digital twins. The app is a gateway to working with—and sharing—textile information, product data, and insights about potential buyers.

Style3D Studio is a digital design studio for producing 3D market-ready fashion collections. Designers and pattern makers can edit styles in 2D and design directly in 3D, all in real time. They can review fit and present collections on virtual models using assorted poses, movements, lights and presets—all within the app.

Style3D Cloud is a secure and protected browser-based platform to collaborate, visualize, and share 3D styles in infinite variations, with internal/external teams and clients.

Style3D Market is an online space that compiles current industry data and offers an abundance of easy-to-find, ready-to-use 3D assets. This content stays refreshed and includes components like 3D digital fabrics and avatar accessories.

Style3D's software and services make a 100% digital workflow possible, enabling you to reach new levels of creativity and productivity, while reaching your green goals. Our team brings together experts, engineers, designers, and artists that work on product development and services delivery—with the latter including custom content creation, DPC training, digitization support, and advising.

HEADLINE BRAND CUSTOMERS

ANTA GROUP
BOSIDENG
EEKA FASHION GROUP
EP YAYING FASHION GROUP
JNBY

SKECHERS CHINA
UMBRO
URBAN REVIVO
XTEP
YINGER FASHION GROUP

HEADLINE ODMS

CATHAYA, CHINA TING, DISHANG, EVERGREEN, GUOTAI, HANDA ENTERPRISE, HIGH HOPE, HODO GROUP, JIAXIN SILK, JIMAY TEX, KANETOP, KASHION, KIMHAIE, LEVERSTYLE, SHENDA GROUP, SHENZHOU GROUP, SUMEC, SUNWIN

Style3D

PRICING MODEL:

Available on demand.

4

TECHNOLOGY PARTNERSHIPS, INCLUDING:

ALVANON

BOK TECH

JEANOLOGIA

VRAY

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

Through the use of 3D digitization, Style3D improves daily life for businesses, individuals, and communities.

· **Businesses:** Style3D embraces the entire design cycle, from fabric to eCommerce. Our platform includes thousands of assets: fabrics, trims, blocks, avatars, and accessories. Users can import third-party 3D assets to collaborate, create, edit, review, comment, rate, and approve.

· **Individuals:** We offer a creative tool that allows you to generate and showcase new concepts and ideas quickly, at no cost. Everyone can become a designer.

· **Communities:** Our suite of digitization tools facilitate DPC, to help textile and apparel industries lower their environmental impact. We decrease the need for physical fabric and garment samples—contributing to reduced material waste, energy consumption, and carbon emissions. We optimize GPU energy use through our green algorithms that deliver 10 x performance, with 5 x more energy efficiency.

"I believe that the physical world of the future is digital. We want to be the provider of the underlying technology and, like some great companies, to participate in the industry's transformation.

After all these years of experience, we've validated that with 3D, we can deeply connect and improve the efficiency of the whole industry. We have pushed to build the base of an efficient, tangible, and reachable digital fashion future. Our vision from now on is to responsibly improve our global presence. I believe our technology can make the world a better place to live."
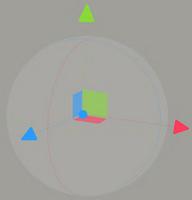
—Eric Liu, Founder & CEO, Style3D

CONTACT

Style3D

√ 3D design and development

√ Virtual swatches

√ Augmented reality

√ Parametric fitting

√ Collaboration cloud

√ Dynamic trend book templates

√ Interactive showrooms

√ DAM platform

√ Over 40,000 3D assets

√ Tapping into the metaverse

and more...

Digital Apparel

www.linctex.com

Creativity — Productivity — Service — Perfomance

Style3D

Style3D

IN CONVERSATION WITH

ERIC LIU

FOUNDER & CEO
STYLE3D

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

I think the entire apparel supply chain is changing in response to consumer preferences and this requires digital R&D to adapt accordingly; the pandemic has also accelerated two industry challenges: skyrocketing labor costs and apparel companies' shorter internal development cycles, and DPC helps to solve both; moreover, DPC workflows are more environmentally friendly than traditional processes by implementing digital transformations, apparel and textile companies can achieve more ambitious sustainable operations goals.

Perhaps the most powerful element of digital product creation is the ability for creative teams to bring their ideas to life quickly - experiment, iterating, and innovating without having to produce anything physically. The challenge is now making that same power available to everyone who influences the value chain, allowing them to

tap into the same benefits, to interact and collaborate, without needing to actually be 3D designers themselves. **What is your vision for the Style3D Cloud in helping to unlock the potential of DPC for a wider audience?**

Our vision is to remove the main barriers to DPC. For example, creating your own fabric, trim and block libraries. This phase can slow down adoption at a time when the organization wants to move fast. We have an entire team dedicated to creating digital assets for our users; our Marketplace library is one of the largest apparel databases in the world. At last count, we had almost 50,000 assets including fabrics, trims, animations, avatars, artwork and more. Royalty free, downloadable and fully customizable by the user.

Another important point is to make digital tools more user-friendly. This empowers users to accelerate concept idealization and encourage experimentation. At the same time, provides the freedom to visualize and experiment with materials at an early stage, users can engage with materials in an immersive way and refine their decisions before committing to physical materials.

At the same time, working on increasing interoperability between different DPC tools so that users of all levels, with access to varying assets, can make use of DPC ecosystems and also contribute to enriching them.
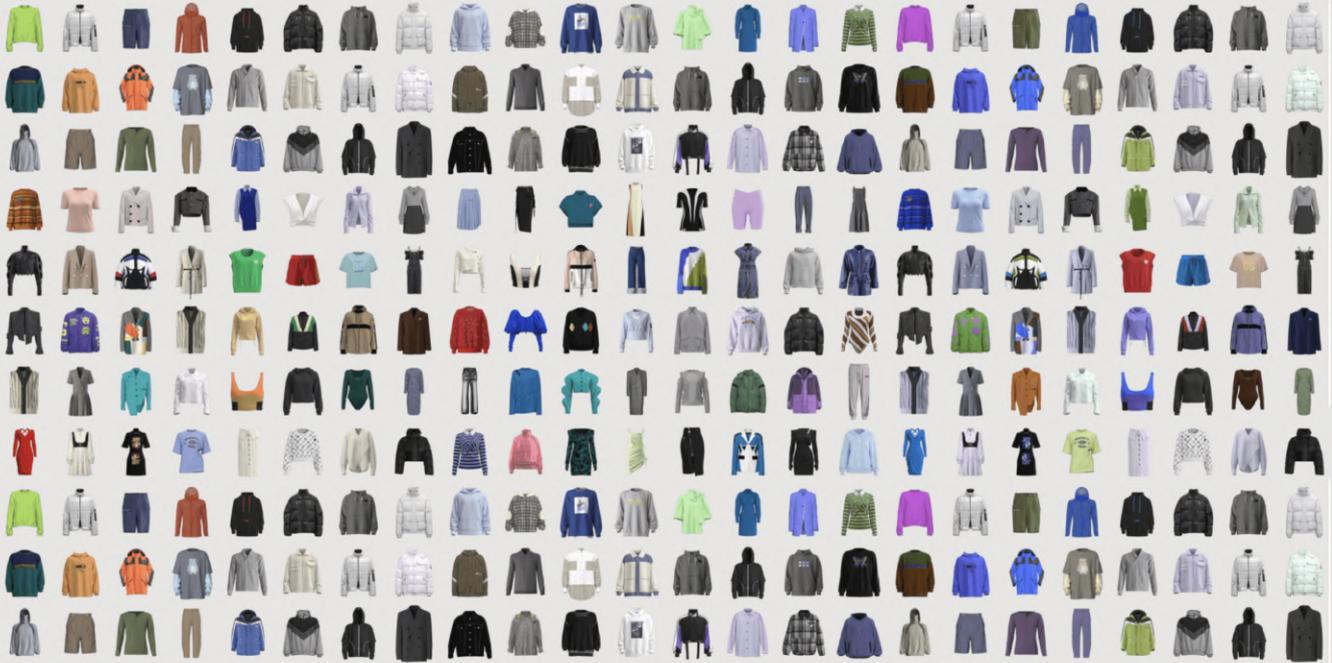
In Style3D, we are also supporting DPC education and adoption for our next-gen fashion talents, so that they can understand and use our tools, and we can showcase curated DPC creations.

For companies that haven't yet started working in 3D, or that may have piloted it in a particular area of their business, a significant question mark may be hanging over their ability to manage asset creation and use at the volume that's going to be required. Do you believe the Style3D asset library - which contains fabrics, components, avatars, props and other assets - can answer that question?

Yes, Style3D's asset library is designed for ever-changing internal and external-facing business needs.

Our library provides a rich source of pre-built fabric samples that can be searched, viewed, and exported. Users can edit and share their 3D files within one cloud-based place—anytime and anywhere.

Style3D users can also upload and import assets into their libraries. For example, uploading from local devices and importing from other applications (PLMs), third-party collaborators, and our Official Market. The cloud-based asset libraries are compatible with various formats (including OBJ, FBX, glTF, u3ma, GLB, SBSAR, DXF, etc.) and provide centralized, company-wide asset storage for 3D files (such as styles and fabrics).

Our digital asset management functions (DAM) are built in, to make business scaling easier. For example, a batch of assets can have descriptions fields customized to make search and retrieval simple. Platform users can also do online tasks, like reviewing and annotating a 3D file online.

Or importing a supplier's 3D fabric asset to preview the draped fabric on a garment.

We also ensure an easy, safe, and secure asset sharing by using embedded functions like generating QR codes, adding watermarks, and exporting share links. Users can gain strategic business insights using the asset library platform.

There is a significant focus in this report on digital materials, and specifically on the need for material capture to take place at the source, followed by cataloguing, discovery and collaboration. What do you see as the near-term and longer-term figure of managing the material supply chain (both new materials and waste) effectively, digitally?

Based on our experience with numerous vendors, we can share some learning for global end-to-end supply chain digitization:

Style3D has been championing this from our first day as a company. Everything starts with the fabric which is why we invested so much in developing our own simulation engine and tools to make digitizing fabric easy, accurate and cost effective. Furthermore, our Fabric solution can create digital fabrics that can be used on all the major 3D creation tools today.

With our Style3D Cloud, brands and vendors can connect and share digital fabrics from anyplace in the world before a physical swatch has been mailed. Both parties can be confident that the fabric will drape and behave on the screen the same as it will in real life. The textures will come alive.
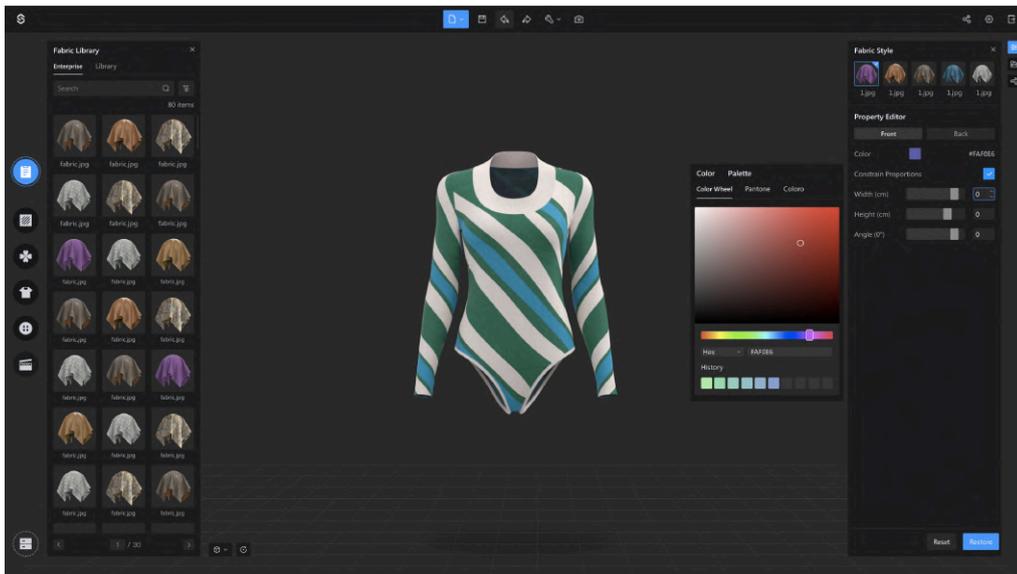
partner teams too. As ecosystem use is widely adopted, more and more assets are available across the digital supply network. That helps everyone proceed effectively, without the many delays, expenses, and waste embedded in current offline processes.

They can allocate digital materials to a line plan library, and provide customized access to each of their partners. Using our SDK, allows fashion professionals to view 3D models and create 3D designs straight in your application. Transform your creative workflows and perfect your ideas using the power of Cloud SDK. Time, materials, costs, and confusion are reduced in this DPC framework.

Increase the utility of digital assets. When assets are used in multiple ways, by stakeholders, compelling efficiencies can be achieved. We can continue our brand example, thinking of a digital shirt as the asset. The virtual style can be easily duplicated and edited to generate color combinations, and preview various dimensions. The assortment can be fit on avatars that showcase the brand's full size range, and the styled shirts can be used to quickly generate assortment boards for wholesaler presentations that buyers can confidently choose form. Boards could also be presented within Style3D Cloud, so potential buyers can browse. The brand can analyze digital engagement to guide future designs and in-season production orders.

Shift most activities online to elevate the ecosystem. With Style3D Cloud tools, everyone within an organization can transition their workflow to DPC and ramp up their productivity—this seamless digital collaboration extends to

Continually develop your materials digitization. There is no endpoint for materials digitization. Every single day, our scientific team is working hard to provide an even more exceptional level of fabric illustration and rendering. To achieve scaled up DPC, we need scaled up digital fabrics. To establish digital supply chains, we need reliably precise materials—especially for soft-tissue simulation.

The potential to create and sell digital fashion is something that a lot of businesses want to tap into, although a lot of uncertainty remains around the shape of the metaverse and the commercial opportunities it creates. This makes a strong argument for taking an approach to digital product creation that benefits digital-for-physical processes, as well as laying the foundations for digital-for-digital business models. Is this the approach you're taking? And do you see fashion brands having genuinely viable digital business units in the near future?

There are a lot of uncertainties about the metaverse. Different companies and organizations are continuing to discover its true value and we don't really have an answer yet, in terms of its actual shape.

Yes, at Style3D we're taking an approach that benefits both kinds of processes because we see them as interrelated.
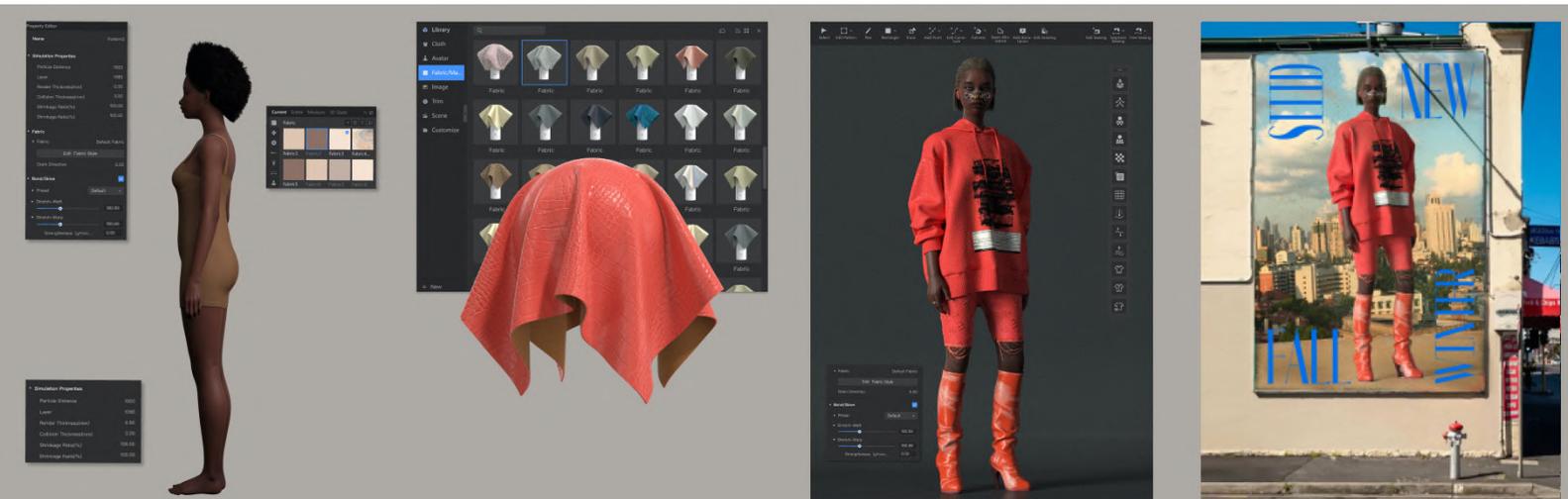
We are taking steps into the metaverse, leveraging our unique strengths and exceptional scientific talent to create stunning digital content for each of our clients. By providing our users with exceptional content services and assets, we're empowering their own discoveries in the metaverse.

At the same time, by creating incredible digital twins—a fundamental element for the 'metaverse industry'—the physical apparel industry is significantly optimized.

Within the current apparel industry, we're witnessing the booming trend of digital content, and we look forward to seeing digital fashion, in all its forms, continue blooming in the near future.
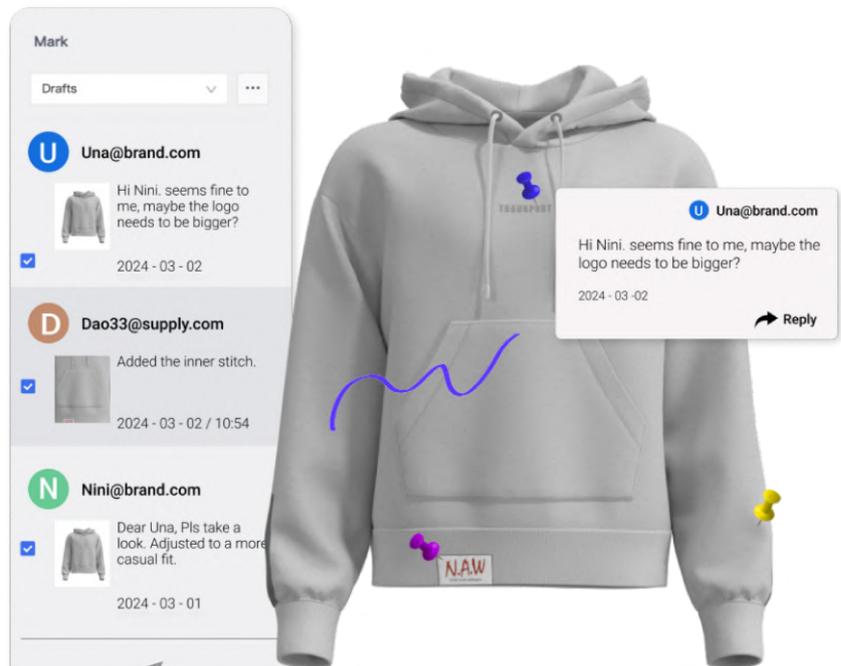
Where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

Overall, barriers to DPC entry will keep shrinking. Physical and digital products and experiences will be increasingly combined, and their adoption across product categories and end-consumers will widen. We've already seen large suppliers and brands striving to establish internal DPC teams.

Instead of digital 3D being isolated to special projects for dedicated specialists, DPC tools and processes will underpin product life cycles. Advances in computer processors, algorithms, cloud computing, and more will continue shattering the expectations for realistic and real-time 3D interaction and as visualization becomes nimbler and lifelike, more businesses and consumers will embrace emerging concept such as metaverse or web3 participation. How this business could grow, is still open ended.
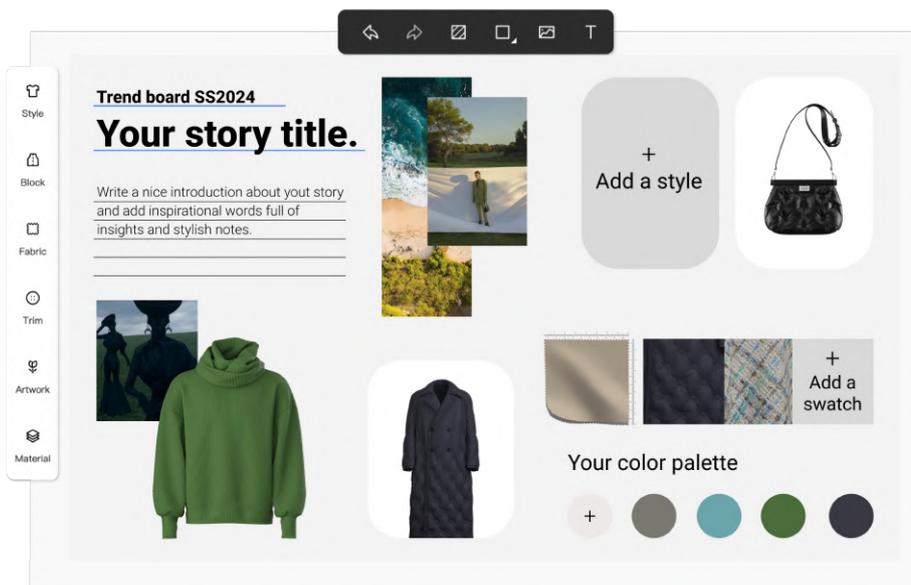
From a technical industry standpoint, a necessary progression for digital assets will be the creation of shared industry standards for digital material properties. Mass industrial adoption is directly related to digital-to-physical reliability. Once materials assets have standardized attributes—across platforms and file formats—we'll reach a new stage of digitization.

We are ready to accept the challenges and the unknowns of the future. We plan to help the industry lead, during this transistion, by providing the best in class digital tools.

swatchbook

WWW.SWATCHBOOK.US

2017
YEAR FOUNDED

swatchbook is a design & software company that develops applications that make you smile.

Founded in 2017, the company focuses on the development of cloud, desktop & mobile software applications that help integrate the creative community within an organization into the product development process.

swatchbook is located in sunny Irvine, CA. Its founders share a deep passion for good design & workflow, as well as a deep understanding of the challenges in the digital product development process & the future needs of companies in many industries.

5000
TOTAL NUMBER OF ACTIVE USERS WORLDWIDE, ACROSS THE FOLLOWING REGIONS:

30% North America

30% Europe

30% Asia

10% spread

HEADLINE CUSTOMERS

ADIDAS	**KAPPA**
ALDO	**NEW BALANCE**
BRU	**TARGET**
DECKERS BRANDS	**WOLVERINE WORLDWIDE / MERRELL**

s swatchbook

PRICING MODEL:

SaaS based licensing based on a per user agreement.

Different pricing tiers for different user types both at the brand as well at the supplier levels.

17
TECHNOLOGY PARTNERSHIPS, INCLUDING:

ADOBE

BANDICOOT

BROWZWEAR

CENTRIC

CLO 3D

COLORO   PANTONE

EMBODEE   SHIMA SEIKI

FOUNDRY   STRATEGIES / ROMANS CAD

METIS   VIZOO

OPTITEX   VNTANA

OTOY   XRITE

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

Digitization of the supply chain.

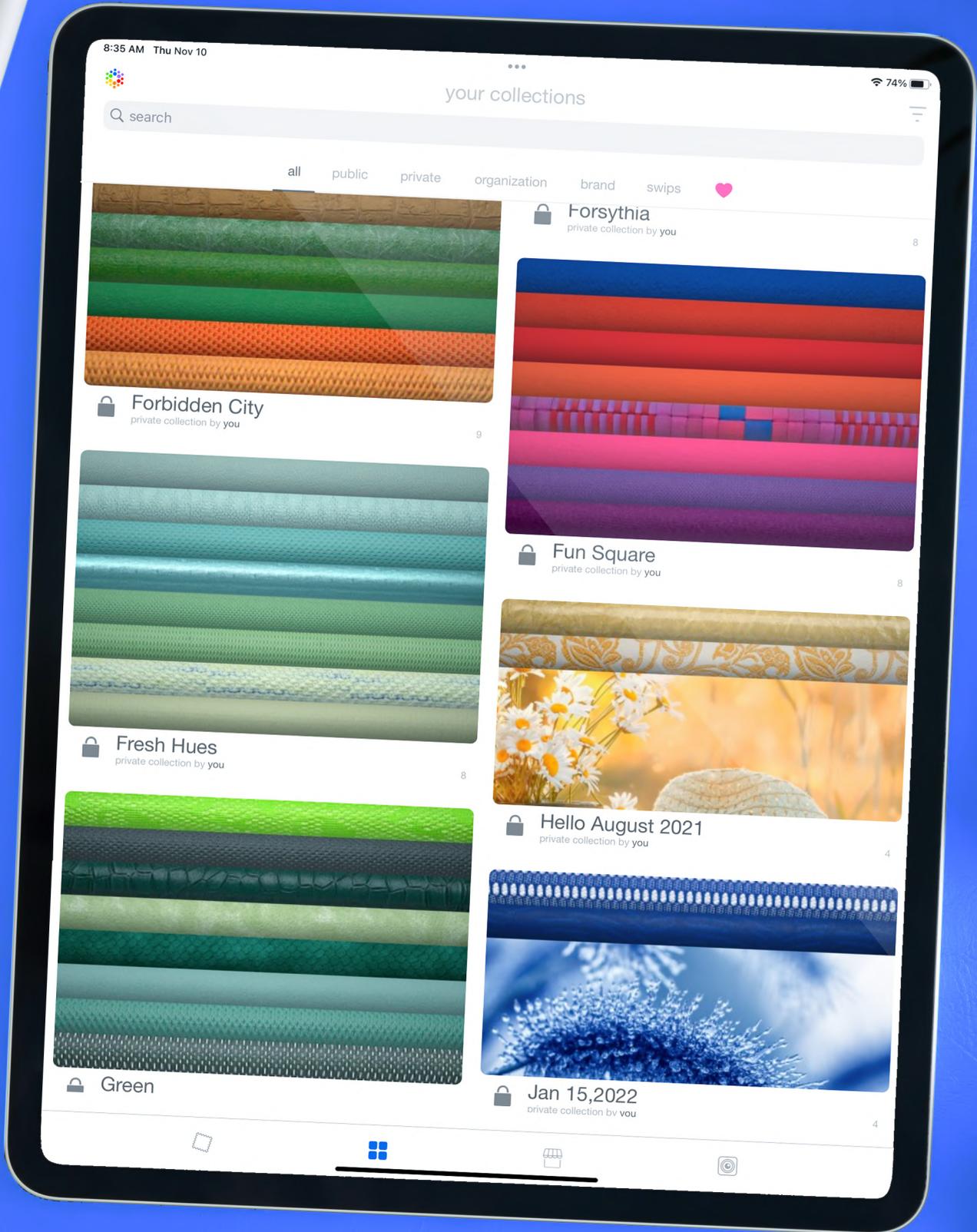We understand that in today's competitive marketplace, instant & accurate access to information is critical.

Since its inception, swatchbook has strived to create a more transparent & scalable governance system that would benefit the entire industry. We connect brands & suppliers in a transparent way, so that they can create sustainable solutions.

Collaboration is critical when brands & suppliers try new things, especially those who are just starting out! We want everyone who participates in our swatchbook community (including ourselves) to learn more about what works best for them & how they can benefit from working together. We know that there are challenges & opportunities on all sides of the debate & we want to help find solutions that work for everyone.

CONTACT

swatchbook

search

all   public   private   organization   brand   swips   ♥

Forbidden City
private collection by you
9

Forsythia
private collection by you
8

Fresh Hues
private collection by you
8

Fun Square
private collection by you
8

Hello August 2021
private collection by you
4

Green

Jan 15,2022
private collection by you
4

connecting suppliers & brands
one swatch at a time.

www.swatchbook.us

IN CONVERSATION WITH YAZAN MALKOSH

FOUNDER + CEO, SWATCHBOOK

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

Prior to COVID many of the larger brands had their eyes on digital transformation. But when COVID hit, they realized that they should have done this years ago. The technology was there but change is hard so it was something that can be kicked down the road. Now they know that it can no longer be delayed. The industry doesn't want to be caught in the same situation again whether it's from COVID or other disruptions like geopolitical challenges, supply chain issues or general economic downturns.

Can you explain why digital materials have such a pivotal role to play in digital product creation? Because while importing them into 3D tools is the obvious application, there is also a lot more a comprehensive digital materials workflow can do - from visualisation and experimentation, to sourcing and virtual photography.

Every product is a combination of ingredients and a recipe. The recipe is the design & development process to which the materials are the ingredients. They are the starting point to take that idea from zero to hero. That material certainly holds value visually but also holds actual

manufacturing data such as MOQ, lead time, pricing and sustainability tracking info that are all a part of the product story. Now more than ever, tracking all this information transparently and putting it into the hands of the consumer is a critical part of the selling journey for products. Customers want to know where their products came from and what are they made of.

Now, there are several different approaches being put forward to capture and work with digital materials - all of which are trying to achieve the right balance between speed and quality in their own way. How would you describe your approach to digitisation, and what does it mean to capture materials in a fast, futureproof way?

We still focus on quality above all else. We believe in measuring twice and cutting once. Digitized content is already losing some fidelity due to software constraints such as simulations and approximations. We try to reduce the reliance on guesswork and translation until the fidelity increases. This is crucial in order to gain the trust of the user given they are already facing a challenging time in their own digital transformation of process. Followed by affordability and then speed. We want to make sure the cost on the supplier is reasonable and we've been able to reduce these costs so it's on par if not lower that creating the physical sample books or having a booth at a material show.
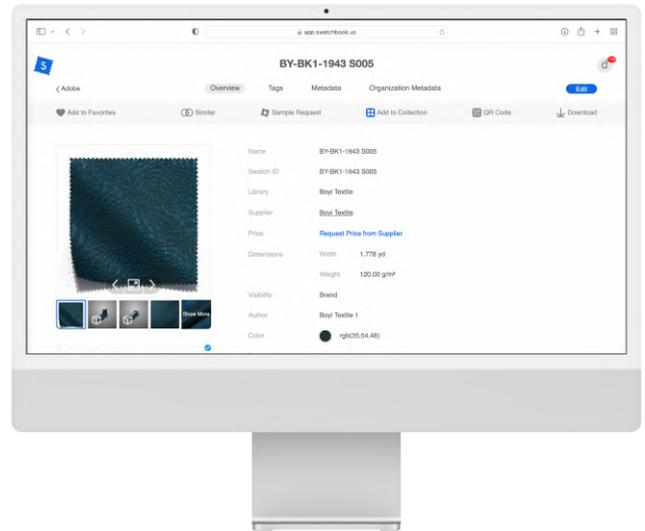
Across the landscape of DPC, there's an ongoing push to extend the benefits of 3D assets to new audiences, and to create easier, more intuitive ways into digital workflows. How do you see this trend developing in material digitisation and in the use of digital fabrics?

Well for one, we see this becoming the standard way of working with products and interacting with designs. We think consumers will be the end goal to sell them digitally first before cutting a single yard of fabric. Along the way, we have the opportunity to include merchandising teams, marketing teams and even management. All of which will benefit from utilizing the virtual outputs from DPC.


swatchbook

We've focused on brands so far, but when we start to think about truly scaling material digitisation, there's the question of what that digitisation takes place. How do you see that workload being balanced between brands and their partners, what methods of collaboration stand the best chance of making those relationships sustainable, and what standards should the two parties be trying to set to ensure that everyone is working towards a common goal?

Since day 1 we believe that the digitization should eventually happen at the doorstep of the supplier. The owner of the material. Right now, that's a bit challenging for a variety of reasons including financial, technical and overhead factors. This is a long journey that will take the collaboration of the tech industry, brands and suppliers working together to make it happen one step at a time. In terms of standards, those should be utilized, when possible, with the understanding that they need to be updated pretty rapidly given how early we are in that field.

Where do you see digital product creation - and digital materials - going from here? What does the near-future look like for the industry and for your business?

We are super excited for what's to come. The technology we are seeing being developed to provide better digitization solutions is what excites us because we still haven't seen true full market digital transformation just yet. Once we do, the benefits in sustainability, time savings and general supplier reach is going to transform how we do business as an industry.
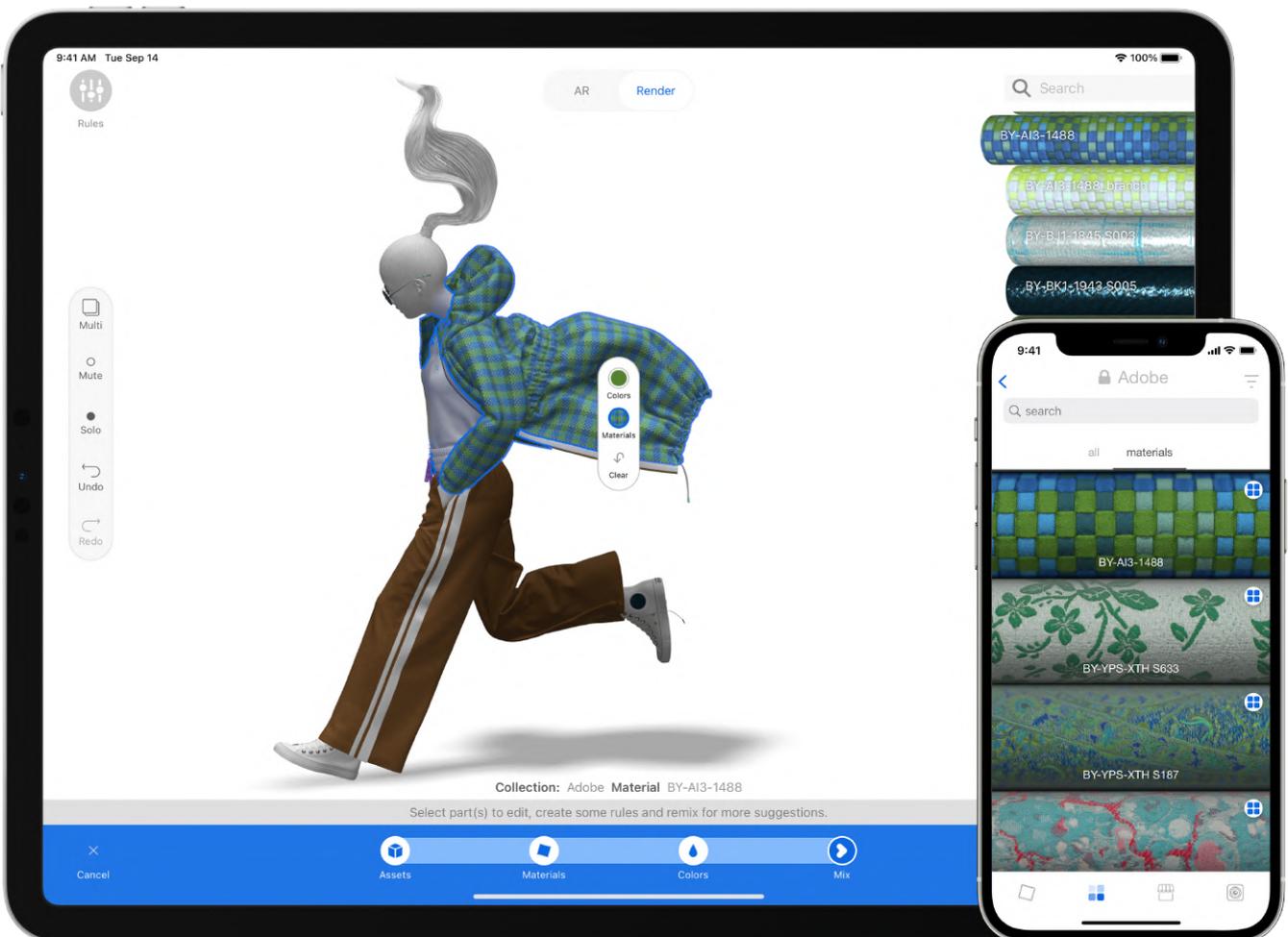
VIZOO

WWW.VIZOO3D.COM

2013
YEAR FOUNDED

The Germany-based company Vizoo is the number one supplier of solutions for industrial digitization of materials.

Since 2013, the company helps fashion brands, manufacturers and fabric mills to create digital twins of their physical samples and digitize their material processes.

Vizoo products are made with the objective to create realistic digital materials in no time. Clients appreciate the ease-of-use and the consistent output, which makes xTex the technology of choice when it comes to mass production of digital materials.

In more than 45 countries globally, fashion, interior and automotive clients are using Vizoo technologies to feed their 3D Design, virtual prototyping, marketing or eCommerce applications.

Our offering:

- The xTex scanner to accurately capture the visual surface of the material (PBR textures)

- The xTex software to provide intuitive tools, even for non-3D experts, to process the materials

- (tiling, recoloring, rendering) and to generate output compatible with any 3D tool

- The physX platform assigns the mechanical parameters needed for 3D apparel simulation

In addition, leveraging their industry expertise Vizoo consults brands and suppliers alike to digitize their material supply chains, in order to expedite the brand's digital product creation process.

900
TOTAL NUMBER OF ACTIVE USERS WORLDWIDE, ACROSS THE FOLLOWING REGIONS:

20% North America

<1% LATAM

45% EMEA

35% APAC

HEADLINE CUSTOMERS

ADIDAS	IKEA	PVH
AVERY DENNISON	KERING GROUP	RALPH LAUREN
BESTSELLER	LI & FUNG	S.OLIVER
COTTON INC.	MAS INTIMATES	TARGET
FORSTER ROHNER	MATERIALBANK	UNDER ARMOUR
H&M	NIKE	VF
HOLY FASHION GROUP	OTB GROUP	VITRA
HUGO BOSS	PUMA	VOLKSWAGEN
IB COMPANY	POU CHEN GROUP	W.L. GORE
		WAYFAIR

VIZOO

WWW.VIZOO3D.COM

PRICING MODEL:

Apart from the scanner hardware which clients usually purchase per location or depending on fabric quantity, the xTex Software licenses are sold either node-locked or as floating.

Access to the Vizoo physX platform is provided on a subscription basis.

Material Services are charged per piece. High volume discounts available on request.

20
TECHNOLOGY PARTNERSHIPS, INCLUDING:

ASSYST

ATOM SHOEMASTER

BAMBOO ROSE

BEPRODUCT

BLENDER

BROWZWEAR

CENTRIC PLM

CLO3D

CLOTHINGTECH	OPTITEX
DMIx	ORCHIDS3D
EMERSYA	STITCH DESIGN HUB
JEANOLOGIA	SWATCHBOOK
KEYSHOT	VIRTUALITY.FASHION
MIND	Z-EMOTION

WHAT ROLE DO YOU SEE YOURSELF PLAYING IN THE 'DIGITAL PRODUCT CREATION' JOURNEY?

The foundation for a digital product creation workflow are high-end material libraries. This is an area which is initially often overlooked, and many companies regret to not have started building this basis for their DPC process first.

Materials, Fabrics and Trims have to be readily available in 3D to have a positive user experience in the Design workflow. If users have to stop their creative process because not all assets are available, it will delay results and cause frustration. Not to mention that 3D is perceived as too time consuming.

Looking further down the creation process, 3D prototypes look much more realistic resulting in a wider acceptance internally and allowing for more accurate decision for approval or changes.

Last, high-quality assets allow customers to streamline their process all the way to ecommerce, instead of creating a quality barrier for any customer-facing use cases.

In short, 3D – being an entirely visual approach to product creation – is very dependent on quality. The more realistic the materials, the more likely it is for 3D to be accepted.

Vizoo is entirely focused on providing customers with technology to consistently and easily create foundational libraries for the digital product creation journey.

CONTACT

VIZOO

A Simple Path to Digital Materials

xTex

ASSYST
BROWZWEAR
CLO
OPTITEX

| Scan Fabric | Color Variant | Add Physics | Design in 3D |

Bring photo-realism to your digitization project with xTex scanning technology from Vizoo, the industry leading fabric digitization solution for fashion, lingerie and swimwear.

Contact Vizoo for samples and product info.

www.vizoo3d.com

VIZOO

IN CONVERSATION WITH

RENATE REDER

CHIEF COMMERCIAL OFFICER, VIZOO

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now?

Indeed, we do now see an exponential growth of brands and suppliers adopting 3D technology.

Even some years ago, 3D was still questioned as a technology which might not last, as a hype. When advocating that less physical samples mean higher speed, less waste and reduced travels many brands did not feel any need to change the status quo – in times where sampling was easy and travelling exciting.

Then, during covid everyone experienced what it means to be without sample, and not being able to attend meetings physically. Consequently, 3D started to be accepted by a broader audience, as it moved from a nice-to-have technology to a tool to mitigate risks and dependencies.

However, it is important for me to say that this all would not have been happening if the appetite for 3D had not been established before the pandemic. It started already as early as the beginning of this millennium, where a handful of early adopters in the sporting goods and fashion industry were pathing the road for all the clothing & textile companies who are today enjoying easy to use state-of-the-art 3D tools and established processes.

How is this heightened demand for digital assets translating into greater need for digital materials? Have similar scale-ups taken place in other industries, and is the fashion industry prepared to meet that demand?

Companies are moving away from selective 3D sampling to a scaled 3D process. However, scaling DPC will not happen without assets, like materials being available in the form of a digital twin even before 3D Designer start their work. It is the foundation.

Many of our clients are now actively expanding their material creation efforts. They are formalizing quality standards and business processes to move to mass digitization. Technology features like scanning speed and consistent workflows become more relevant as well as which platform to use for storing the materials.

Looking at other industries, 3D is a bit more established in their creation pipeline. We all know that automotive is using 3D for a long time. Also, the furniture and home fashion business is worth mentioning as the organisational setup is like the fashion business: Furniture brands are implementing 3D and are also requesting their suppliers to provide the assets.

Taking account of the importance of digital assets and digital materials, what steps can brands and their suppliers take to define and adhere to archival quality standards for material digitisation - incorporating the right resolution, PBR properties etc to cater to both current and future requirements?

First, every brand has their own expectations and problems to solve when it comes to 3D and the related assets. Requirements for a speedy 3D Design workflow differ from eCommerce high-end visualisations. This is where our expertise come into play. We consult clients how to define quality standards which work for their use case and future goals and how to communicate those to the scanning entity aka supplier. To further standardize this process, we have recently launched a certification & auditing program to make sure the onboarding of the scanning entity was successful, and all quality measures are in place.

Obviously capture hardware is a significant part of a material digitisation workflow, but it's only part of the picture. Can you explain why the right unity of software and hardware - physical scanners and cloud-based systems - is going to be critical to truly scaling material digitisation to meet the industry's needs?

The current situation is that there is working technology to efficiently capture materials, regardless of whether this is done by the brands or by the suppliers directly. However, to truly scale material digitisation and digital product creation, we also need to efficiently transport materials from the digitizing source to the user.

This is where cloud platforms for material management (like swatchbook) come into play. They allow for a supplier to digitize all their materials using xTex technology, and thanks to a native integration, to directly upload the digital twins onto the platform.

A brand designer sitting on the other side of the globe can further access the 3D material via the cloud instantly, without the need of sharing the data explicitly first via email.

As we are facing millions of digital materials and assets, centralized platforms that simplify the transfer of digital data will become essential to scale and transform the industry.

Considering the scale of the task of digitising existing material catalogues and new fabrics, how do you believe the average brand-to-supplier relationship is going to be reshaped in the near future? Where is the task of digitisation going to fall, and how can sourcing processes evolve to accommodate and take advantage of wide-scale availability of digital materials?

In my previous job at adidas the mantra was that the digital ownership has to sit with the same party with the ownership for the physical item. Thus, in my view the only logical consequence is that the fabric mill must own the responsibility of the material digitization task. And we do see more and more fabric mills and vertical suppliers are getting prepared for this.

I can imagine that it could foster relationships and evolve as some brands still see them as pure fulfilling party and not a technology partner.

Digitization will soon become an inline task for a fabric mill as their ROI for digital materials is increasing. As an example, when it comes to material sourcing, the selection of material is supported by digital twins already now. As an example, in our cooperation with the functional fabric fair Performance Days we make digital materials available for the exhibiting mills. Thanks to this initiative a vast number of suppliers understand the importance of digital materials and how to enhance the customer experience with digital files.

More generally, where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry and for your business?

I guess now, mentioning the Metaverse and NFTs would be a suitable answer. However, whether the fabric fair happens physically or in a virtual world is not the point in my opinion. And 3D is a foundational technology of the metaverse anyways.

In any case digital assets will be an integral part of the brand and supplier conversation. Relying on and sharing high-quality assets will result in more sustainability and speed gains on both sides.

Suppliers like MAS (Sri Lanka) show that the topic is not only pushed from the brands but also from supplier side. This turns the table and puts responsibility on the brand to commit to sample reductions and faster decision making as they promised.

In my opinion it is now time to deliver and commit to the promises the brand make towards suppliers when it comes to sample savings and speed gains. Let's start leveraging the foundation we have built over so many years by also putting trust in digital swatches.

Having been involved in DPC since 1985 (footwear) and 1999 (apparel), we have spent decades analysing the vendors operating within the DPC space. During this time we have scoped and even implemented various 3D solutions. We have carried out audits on 3D apparel solutions, so we truly understand the DPC space at an expert level.

We have created a 'first of a kind' end-to-end DPC brand and retailer workflow that is now being used by DPC fashion businesses from around the world.

We have written numerous reports and articles on the subject of DPC which can be found on both **WhichPLM** & **The Interline.**

WHICH DPC SOLUTIONS / SUPPLIERS DO YOU WORK WITH?

WhichPLM Advisory supports the majority of DPC solution providers as an expert on the broader best-practice digital workflow. We help brands and retailers looking for support and education related to best-practices and the proof of value relating to the extended DPC ecosystem.

We work with DPC vendors, auditing their solution maturity, and helping them to extend their value by joining processes with the extended ecosystem partners.

HEADLINE CUSTOMERS

CLARKS FOOTWEAR	**SEASALT CORNWALL**
MEC (MOUNTAIN EQUIPMENT CO-OPERATIVE)	*+ Several other customers who are under NDA*

WHICH STRATEGIC SERVICES DO YOU OFFER?

- Education on Extended Workflow
- Solution Scoping
- POV (Proof of Value)
- Workflow & Best-Practices
- Process Maturity Audits

- Vendor Workflow Support
- Technologies & Value Creation
- Project Planning & Support
- Third Party Project Support
- Third Party Expert Mediators

HOW DO YOU DEFINE 'DIGITAL PRODUCT CREATION' FOR FASHION?

Digital Product Creation (DPC) in the Apparel and Footwear industry allows companies to conceptualise, develop, produce and sell products in a virtual, collaborative environment.

DPC is helping transform the RFA (retailer, apparel & footwear) sector, enhancing the product & customer experiences, both downstream and upstream, via workflows, and creating new business models that are now generating new value streams. The values include: reduced impact on the environment, speed to market, reduced costs, increased margins, enhanced sustainability and impact analysis prior to physical development.

DPC is still in its infancy. There are numerous solutions and processes that need to be connected to help create a seamless workflow. There are many solutions operating within the DPC workflow that should be carefully considered to help enable a successful implementation of a DPC end-to-end workflow.

whichPLM

WWW.WHICHPLM.COM

WHAT DPC PROCESS AREAS DO YOU COVER?

Inspiration & Concept	**Digital Materials**
2D Creative Design & CAD/CAM	**Digital Printing**
Adobe Cloud Suite	**DPC Development Workflow**
Body & Component Scanning	**Digital Colour Management**
3D Authoring Solutions	**Digital Asset Libraries**
	DPC Downstream & Upstream

CONTACT

ADVISORY
S E R V I C E S

whichPLM

With close to 49 years of experience in fashion design, manufacturing & information technology, Mark Harrop of WhichPLM is a digital transformation expert advisor & process futurist supporting brands, technology businesses & fashion technology start-ups.

WORK WITH US

markharrop   **+44 7872 822648**   **www.whichplm.com**

IN CONVERSATION WITH

MARK HARROP

FOUNDER & CEO, WHICHPLM
BOARD ADVISOR, THE INTERLINE

What do you see as being the key differences between 3D, which has a long legacy in fashion, and digital product creation?

They are essentially the same in their objective, but with the key difference being scope. Where 3D projects were normally confined to quite narrow applications that began and ended at well-defined stages of the product lifecycle, digital product creation (DPC) begins life much earlier and extends much later - to the extent that there is almost no part of the product journey that it doesn't touch.

The fashion industry has concentrated for a long time on the creative end of the spectrum, with 2D CAD and 2D CAM being supplemented (and in some cases transformed) by 3D, but we are now starting to see brands, retailers, and manufacturers really unboxing the potential of digital-native working and extending it everywhere from initial concept right through to downstream retail.

As a result, where we once tracked 3D solutions and processes in a concentrated segment of the fashion value chain, we now see more than twenty different solution categories - each with their own data inputs and outputs - that together make up a more complete, end-to-end digital product creation workflow.

I don't believe that any technology vendor or any brand has truly maximised the potential of that full end-to-end digital workflow, but the key difference today is that many are actively working to bring that full vision to life, instead of settling for smaller, more isolated use cases.

Digital product creation in fashion seems to have reached critical mass, with more brands than ever kick-starting or scaling DPC strategies. Why now? Are we seeing a technology change, a cultural evolution, or a combination of those and other factors?

It's important to remember that none of the ideas behind digital product creation are completely new. Many businesses have already been able to realise serious value from their investments in digitising design, patternmaking, material planning, and more. The pandemic and the hype curve around digital fashion have definitely raised more awareness of some of the potential end points for digital assets, but realistically we are seeing DPC reach an inflection point rather than seeing any entirely new ideas being proposed.

So I don't believe the question is whether fashion has now stumbled on a new opportunity, but instead whether the industry is in the right position - and has the right mindset - to really tackle both the technological and cultural aspects of rebuilding its ways of working up and downstream.

The positive side to this is that there are now more sources of value, and greater opportunities than ever to realise a return on investment in DPC. The negative side is that the scope and scale of the change required to deliver on more complete digitisation are vast, and they are going to demand integration, best practice adoption, and radical process re-engineering. There is much more to consider today than which 3D design tool to invest in.

What are the primary barriers to wide-scale DPC adoption today? Solution maturity? Integration? Mindset and culture? Executive sponsorship? Or a combination of them all?

The major barriers are no longer technological. There will always be improvements to be made in material capture, fabric simulation, virtual costing, augmented reality and much more, but the reality is that there are solutions to most of the fashion industry's major challenges, and viable platforms to explore for taking advantage of new opportunities.

Instead, the issue is one of process maturity and a lack of clear, codified best practices. It's easy for a brand, a retailer, or a manufacturer to claim that they are experienced in DPC, when it's more likely that they have seen success from deploying 3D scanning or authoring tools in a specific, focused way, but that has been the extent of their DPC strategy so far.

From this perspective, organisations need to realise the differences between 3D and DPC, and to conduct honest appraisals of whether they truly have gone after the latter, or whether they have only obtained good-but-limited results from 3D. Because I can foresee scenarios where a brand assumes that knowledge of 3D will automatically translate into success in digitising the extended value chain, when in fact the two are very different prospects.

A lot of brands are particularly interested in the new business models that can be built from digital assets that become digital goods, and from the nebulous promise of the Metaverse. Do you see a link between the reasons to create digital workflows today (that support and streamline the creation of physical end products) and those new business models, or should brands be looking at these as two separate opportunities?

I believe brands should start by ensuring that the value chains that contribute to the creation of their physical products are as streamlined as possible. There are strong business cases today for controlling costs, overhauling sustainability, unlocking creativity and much more - all of which can be realised through intelligent deployment of 3D and digital product creation tools.

That streamlining will then also make it easier for the industry to mirror the physical world in the digital world, and to begin to both extend the value of existing digital assets, or to explore the possibility of creating entirely new, all-digital styles that make use of the same tools, workflows, pipelines and skillsets.

If fashion tries to rush into the metaverse too quickly, we'll find that virtual worlds will be half empty!

Where do you see digital product creation - and digital assets - going from here? What does the near-future look like for the industry?

I refer to the work that fashion has done towards 3D so far as being the industry's "laboratory" phase, and it's now time to outgrow that experimentation. The technology is mature enough, and the opportunities up and downstream are compelling enough that every brand that has already implemented 3D to some extent should be looking to now scale that initiative. And brands, retailers, and manufacturers who haven't yet made their first steps have never had a better time than now!

I believe the near future of digital product creation is going to be built by a wide range of partners working together - each providing interoperable digital assets that, in turn, become the inputs of the next stage in the value chain. Working together in this way will be the key to unlocking the real possibilities of DPC.

It will also be vital for the fashion and textile sectors to improve their own in-house capabilities, at the same time as making use of the digital expertise that exists in their supply chains. From talent to process maturity, fashion has some foundational pieces that need to be put in place if the industry is going to achieve its DPC ambitions.
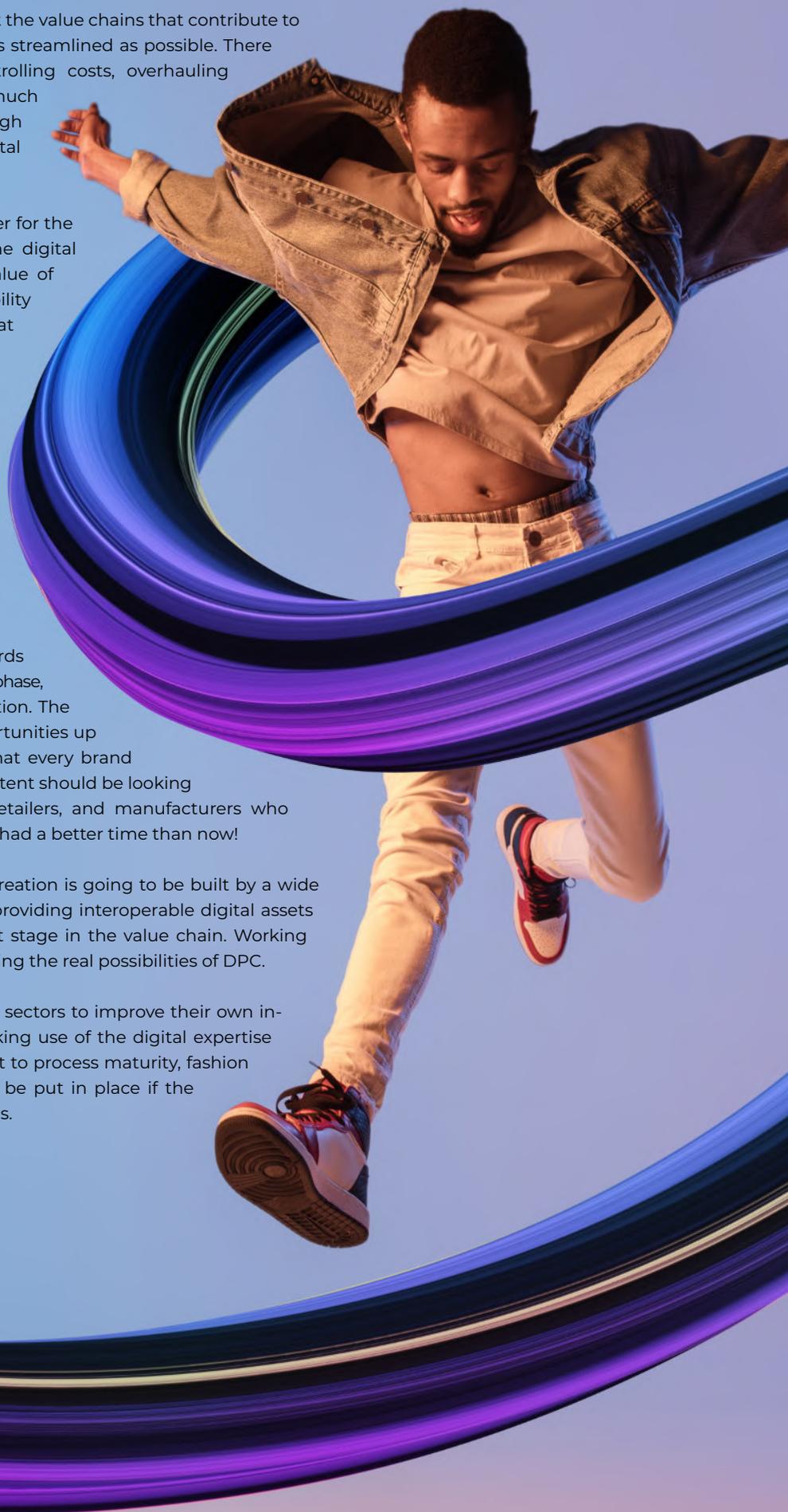
DPC MARKET ANALYSIS

HOW ACCESSIBLE SOLUTIONS, EARLY-STAGE INTEROPERABILITY, FAST-PACED DISRUPTION, AND ACCELERATED DIGITAL TRANSFORMATION TIMELINES ARE SETTING THE BASELINE FOR GLOBAL DPC ADOPTION.

EXECUTIVE SUMMARY

Despite the assumption that 3D and digital product creation have reached a tipping point solely because of the pandemic, and in spite of a tendency for onlookers to limit the potential of DPC to virtual sampling of materials and garments, our first-stage analysis finds a multi-faceted global technology sector that is in the process of transforming every stage of the fashion value chain.

From pioneers of digital design who have been steadily pushing the industry forward, to companies with shorter market tenures but no less ambitious technology, the DPC landscape is competitive, collaborative, and exhibits significant growth potential. Its solutions are accessible and intuitive, its

pricing models flexible and accommodating, and while skill shortages are likely to persist, a combination of software and service models is likely to help the pace of adoption continue.

Already approaching the scale of other enterprise software sectors when judged in pure software licensing revenue terms, DPC is moving rapidly along a maturity curve that could eventually transform the way fashion thinks about planning, design, development production, marketing, and its relationship with the downstream consumer.

DEFINING THE DIGITAL PRODUCT CREATION LANDSCAPE

The DPC acronym has been used quite loosely this year.

As analysts this is something we would traditionally not welcome; blurring the lines between different solution categories, data sources, and processes is normally a recipe for confusion at best and technology mis-selling at worst.

Where digital product creation is concerned, though, a catch-all umbrella is the only logical way to capture a complex, thriving ecosystem of tools, services, strategic and tactical objectives - and a community that is at once hyper-competitive and also, somehow, one of the most collaborative and open in the fashion technology space.

Under that umbrella sit everything from physical hardware designed to capture the aesthetic and physics properties of trims, components and fabrics in finite, futureproof detail - right the way through to a vanguard of developers working on refining body projection mapping to improve virtual try-on and, potentially, to unlock an entirely new, all-digital, business model for fashion.

From the hands-on mechanics of manufacturing, to the newest frontiers of marketing, digital product creation is playing a transformative role - not tomorrow, but today.

This broad scope, combined with the drive for sudden action, is what has made DPC probably the most exciting, innovative segment of technology for fashion. It is also the reason that producing a traditional market size and scope analysis is effectively impossible - at least without a baseline to work from.

Unlike other tranches of technology, where acronyms are relatively fixed, pricing models are established, implementation timelines are (to some degree) predictable, and the core features and functions of the major solutions are past the point of parity, DPC is an open field. The sale of a set of licences or seats to one brand, for one DPC-ecosystem solution, is very rarely comparable to the sale of another set to another brand - either in their revenue bracket, or in the way those licences will be used.

To put it more colloquially, there are very few apples-to-apples comparisons to be made where DPC is concerned.

So rather than getting our apple basket out and attempting to draw a clear line around DPC, this first-stage market analysis will instead focus on laying the foundations for future benchmarking and analysis. These pages do include very wide estimates for market sizing, some preliminary findings around geographical trends and business size brackets in adoption, and The Interline's analysis of some of the inner workings of DPC, but these are intended as an initial baseline from which future analysis will be built, rather than concrete conclusions in their own right.

But nevertheless, that baseline makes a strong case for the DPC industry having the international financial impact to justify its status as fashion's most sought-after set of technologies.

MARKET SUCCESS, MATURITY, AND CROSS-INDUSTRY BEST PRACTICES

There is, in The Interline's opinion, an endpoint for digital product creation. A vision that, once realised and quantified, will be the point at which we will consider the segment to have reached full maturity.

That vision is this: for almost every creative choice, commercial commitment, and customer buying decision (both B2B and B2C) that would traditionally have been made based on a physical asset, to be made based on a digital asset.

This does not mean that we are proposing that the fashion industry does away with physical samples (or rushes too quickly towards the idea of selling digital-only products), but rather that so much of the fashion value chain can be optimised - if not downright transformed - by only creating a physical asset when every possible digital avenue for iteration, experimentation, refinement, collaboration, and engagement has been exhausted.

It may be tempting to dismiss this as the idealistic vision of analysts, but it is a vision that some of the biggest companies in the world have already bought into. Today, household names in Europe, the UK, the USA, and throughout Asia are building or working towards long-term digital transformation strategies that include the use of digital twins of their products in as many areas of their businesses as possible.

Those companies are not doing this speculatively, or because they believe that designing in 3D, with accurate digital materials, or selling in to wholesale or end user communities with renders, is novel and exciting. For many brands DPC is both of those things - something new, rife with potential - but the large enterprises that have invested in building out their DPC ecosystems are doing it because of the significant potential to achieve short-term ROI by working faster, smarter, and more sustainably.

We need only glance at some of the customer names that appear in the technology profiles section of this report to recognise that DPC is big business: Adidas, Target, Walmart, Decathlon, Hugo Boss, Marks & Spencer, VF Corporation Levi's. These sit alongside a massive pool of undisclosed implementations at companies of a comparable size, and a hidden list of luxury houses who are famous for not investing in technology lightly, and for not accepting compromise in the results it provides.

These major partnerships are a testament to two forces. First, the tenacity of pioneering technology vendors who have been tirelessly pushing this space forward for decades. Second, the forward-thinking nature of the brands, retailers, and designers who recognised (before circumstances forced the broader industry to see) that building products digitally, and then wringing as much value as possible out of those digital assets everywhere from sourcing to social media, was very quickly going to become the optimal way to work.

Image provided by NOFORM

It is also important to note that, in this regard, fashion is behind the curve. It has become a cliché to point out that other industries have already started approaching the full-maturity vision we described, but that does not make it any less true.

If you buy a new car today - one that is not already sitting on a dealer's forecourt - then that vehicle will not become physical until the last possible moment. It will have been designed in 3D, prototyped and tested digitally for both form and function, 3D CAD files will have been sent to fabricators and fabric mills, before then undergoing essential testing as a physical product. You will also more than likely have chosen your options for that vehicle using a 3D product configurator, which allowed you to make an informed choice as to which upholstery you wanted, what colour your interior mood lighting should be, what size alloy wheels you wanted, and whether you were going to upgrade to metallic paint.

All of this made the process of designing, building, and buying that car as smooth, error-free, and efficient as possible. Ergo, the investment the automaker made in building out the digital-native systems, workflows, and user-facing tools that enabled that journey was money well-spent.

The inference here is not that making and shopping for cars is equivalent to making and shopping for clothing, but rather that other sectors are realising value from being further along the journey to unifying their use of 3D digital assets as the foundations for the full scope of creative, commercial, construction, and consumption decision-making.

Having other industries to aim for as a target is, therefore, useful even if those industries are not direct analogues to fashion. Or, to reframe the hypothesis, if fashion is able to scale its use of 3D the same way that other industries have, then fashion is likely to be able to realise many of the same benefits.

This is, in fact, a trend that is already occurring. The data provided to us by this year's roster of key technology vendors shows that, at this very moment, leading apparel brands are making use of the same tools and pipelines as major developers and publishers in the videogame industry. And this is not because fashion-specific tools do not exist (in many instances they do) it is because other industries have already walked the path from creating digital assets to leveraging them so many times that best practices have emerged that transcend industries.

This is as true for hardware as it is for software, too. Just as, for example, the principles and process behind texturing 3D geometry are functionally the same in footwear design or virtual photography as they are in architectural visualisation, the core idea behind production being driven by demand, and fed by digital artwork and specifications, is as viable in apparel as it is anywhere else.

As evidenced by the technology profiles contained in this report, this is no longer just an idea; the infrastructure to support printing direct to fabric and direct to garment, on demand, at scale exists and is being actively built out in a way that can challenge the notion of pre-booked production through elasticity of capacity. And, crucially, this infrastructure also fills one of the last-remaining analogue gaps in what can otherwise be an all-digital, end-to-end workflow.

A TECHNOLOGY LANDSCAPE BUILT OVER TIME

That production infrastructure, as we might expect, did not spring up overnight. Being built on a steady accretion of technology advancement and commercial expansion, digital, on-demand production may be earning greater recognition as a more viable approach today, but its roots lie a little further in the past.

The same can also be said for 3D design and simulation, digital material capture, body capture, virtual try-on, and essentially every other technology that resides under the DPC umbrella. The world has seen an explosion of interest in

all of these tools, but the fact that they were able to meet that sudden demand is a demonstration of the work that went into designing them to be scalable, usable, and accurate enough to be pressed into service when the pandemic hit.

It is no secret that COVID did tangibly increase the pace of DPC technology adoption almost universally. This was data we discovered in partnership with Kalypso at the end of 2020 - the peak of pandemic disruption. From 3D design to virtual try-on, the world's sudden inability to make physical

samples, shoot real product photography, and gather team members around real corkboards translated into a strong accelerative effect on brand and retail executives' perceptions of the importance of digital working.

In practice, this effect manifested itself in one of two ways. For organisations that already had 3D capabilities in creative design, technical development, or virtual photography, those departments (which had often been left to their own devices) became some of the most important people in the company. For businesses that had yet to start down the road towards digital product creation, that destination was quickly bumped up from the 3-5 year horizon to become the next stop on their strategic technology journey.

Both of these outcomes, though, had something in common: they revealed that a lot of brands and retailers had already considered designing their products in 3D (or scanning them in after they had been produced), whether they had actually started putting that idea into practice or not.

The pandemic did not so much prompt the market to (re)discover DPC as it did force it to re-evaluate its importance.

And when that process of rediscovery took place, the technology vendor base was ready to respond. Based on the data provided to us by key technology and service providers in this inaugural year, a good proportion of the companies that are now being held out as exciting enablers of the digital future are not new disruptors, but rather software and service companies that have been undertaking the unglamorous tasks of perfecting 3D simulation, refining material capture methods, spearheading ways of visualising 3D garments on flat model photography and much more.

Across the spectrum of technology vendors we profiled this year, some have been honing their craft since the late 1980s or early 1990s, and even the companies that are touted as being part of a new disruptor wave in other publications have, in reality, been active in DPC for a decade or more.

This does not mean, though, that the DPC sector is not disruptive. In fact quite the opposite is true, with different technology vendors vying against one another based on fresh functionality, on price, on extended capabilities and more - all on a regular basis. And, as we have established, for companies that are currently either establishing DPC strategies for the first time, or scaling existing pilot projects, the act of moving from analogue to digital processes is, by itself, disruptive when we consider how long the fashion industry has operated on the principle of physical design and development, with a physical end result.

Broadly speaking, though, DPC disruptions are being introduced to the market through new innovations, new platforms (such as VR) and new processes - or through expansions from one territory to another - rather than the founding of entirely new companies.

(We should note that there are also several younger companies that are gaining traction in the DPC space, but that have perhaps not yet reached the right level of maturity to appear in this report.)

PRICING AND DEPLOYMENT

Also key to the success of DPC technologies and services is their relative affordability and accessibility. While the learning curve involved in moving from 2D CAD to 3D design is inarguably higher than the alternative in moving from, say, one product lifecycle management or ERP solution to another, the ease with which 3D and DPC tools can be deployed - combined with their low price point - makes for a lower barrier of entry, and places the onus for project success on successfully defining and scoping the project, and acquiring and elevating skills, rather than simply buying and configuring software.

The 20 different technology vendors and service providers profiled in this report should not be considered a comprehensive list. (As mentioned above, there are companies that opted not to appear here.) But these profiles do represent a cross-section of the different technology segments that sit underneath the DPC umbrella - from core 3D design and material capture, through to virtual try-on, digital printing, and multi-channel retail transformation.

On that basis, we can analyse the DPC industry's approach to software licensing and additional services with confidence, since very few parts of the sector are not captured in this publication.

Working from the data provided to us, the mean monthly price to begin buying into the DPC ecosystem on a single-user-licence basis is approximately $75 US. (The Interline, despite being a UK publication, uses the American dollar for ease of reference for our range of international readers.)

This, though, applies only to those solutions that are sold on a SaaS subscription basis, with a monthly cost per individual user and enterprise packages that are likely to be adjusted based on volume. And based on the information we received from technology vendors this year, those subscriptions are actually not the dominant model.

At first glance this appears to be concerning, since the spectre of perpetual licences, costly implementation services, and ongoing maintenance fees will be fresh in the memories of readers who have previously worked with other enterprise software before those sectors migrated towards multi-tenant architectures and subscription pricing.

The reality is different. From usage-based pricing and packages, to modular deployments and combinations of software and service, the various components of the DPC ecosystem sit on a very wide continuum of different pricing structures - most of them pitched at inclusivity. Rather than being a potential downside, this is likely to provide greater flexibility to the brand, retail, or manufacturing buyer who might want to begin transitioning to digital-native working, but who might be uncertain about the scale of their demand. For these companies, being able to assign a cost-per-unit to digitisation could prove to be a lower barrier to entry than a mandatory subscription, even if they are likely to need to subscribe or buy seat licences to expand their digital product creation efforts into other areas.

We should also note that, where DPC solutions are sold with software (or hardware) and service components, those services should generally not be seen as equivalent to the implementation and support models that have dogged enterprise implementations liike PLM and ERP for decades. Instead, many DPC vendors are now offering bureau services designed to streamline the process of asset creation, material digitisation, and other hands-on tasks that brands and retailers either do not have the capability or the capacity to take on.

In the longer term, these bureau services are likely to be de-emphasised as the fashion industry establishes a deeper pool of DPC talent and begins to take ownership of core tasks. But in the meantime removing some of the burden of asset creation from in-house teams, or offering brands a way to digitise fabrics at-source (i.e. at the textile mill or other Tier 3 supply chain location) that would otherwise need to be shipped around the world in swatch form, should provide an easier onramp for DPC adoption as well as ensuring that DPC strategies, digital assets, and digital fabrics meet the exacting standards the industry will need to enforce.

It is also important to recognise that alternative approaches are also beginning to emerge, with some technology vendors opting to propose machine learning assistance and other routes to scale that do not rely on vendor or partner services, but on supplementing the results that users can obtain from off-the-shelf hardware.

A further consideration when it comes to cloud deployment is the necessity for intensive tasks like real-time fabric simulation to be run locally. In these cases, the shift to subscription pricing is for licensing purposes only, and does not imply that the solutions are running in a browser. While offline rendering (i.e. the production of static images or final pixels from a 3D asset that is not required to run in real-time) is, in some cases, being moved to distributed computing, creative and technical designers who wish to simulate fabrics with precision and without latency are still reliant on local CPU / GPU power. For this reason, the "seat" licensing model remains a choice that the industry is likely to welcome alongside monthly subscriptions.

Browser-based solutions and distributed storage are proving valuable, however, in centralising 3D asset libraries and marketplaces, and in serving up those 3D assets at the level of detail required for different applications. Taking account of the end-state vision for DPC that we mentioned previously, it's entirely logical and sensible for the assets that will underpin the decision-making process to reside in asset management solutions that can provide them whenever and wherever they are needed. In the short-to-medium term, the demand for these libraries and 3D DAMs is likely to increase quickly.

Finally, we wish to draw attention to one further aspect of pricing where DPC solutions are concerned. While accessibility and flexibility are key considerations, the fact remains that the fashion industry currently has a dearth of digital talent, and new designers are unlikely to be able to afford even the lowest tier of enterprise pricing. This, fortunately, is an area that 3D vendors especially are ahead of, with students, freelance designers, and enthusiasm being given either preferential prices, or even entirely free access to key tools.

This also mirrors the approach that the videogame and visual effects industries have taken, with either fully unfettered or royalty-free access to key tools like Blender and Unreal Engine for the hobbyists, amateurs and "pro-sumers" who often become the next generation of grassroots talent. We are already seeing the results of this community-led approach coming through, with more creative and technical designers than ever pursuing digital skills, and more merchandising and other professionals discovering new ways to work with real-time engines and digital assets.

INTEROPERABILITY AND INTEGRATIONS

For the long-term vision for digital product creation to be realised, it will be essential for both finished assets and their constituent parts to be useable in as many different solutions and environments as possible.

This is by no means a solved problem in other industries, but we are already seeing the fashion industry making use of interoperable material and object formats that are proven in other sectors. And we fully expect to see fashion starting to make use of universal formats that are gaining ground in other industries where there are compounded benefits from bringing together the various components of 3D graphics in a single definition, the same way brands already target common real-time and offline renderers such as Unreal, Unity, V-Ray, Blender, and Redshift.

For the purposes of this initial analysis, though, the most remarkable finding was the sheer amount of integration and interoperability that exists within the solutions that make up the fashion-specific DPC ecosystem.

To put it simply: solutions that exist under the DPC umbrella tend to either directly integrate with one another, or to share common file formats or common destinations, so often that interoperability appears to be the rule rather than the exception. This is evident in the example of DPC-enabled PLM contained in this year's vendor profiles - which boasts integrations to a roster of different solutions - as well as in the tens of common integrations and bespoke partnerships that the most well-established 3D vendors promote.

Links between solutions run the gamut from outputting digital garments and footwear to digital asset management and configuration platforms, to cutting-edge links between digital material platforms and environmental impact measurement solutions.

This does not, we should note, mean that the technology and service vendors who cater to the DPC segment have abandoned their commercial interests. Instead, unlike other enterprise software sectors where partnerships are closely guarded and vendors seek to establish a sort of soft lock-in by adding as much functionality as possible to their solutions, DPC technology companies recognise that the possibility of there being a single solution that covers the full suite of capabilities required to deliver comprehensive digital product creation is vanishingly small.

THE DPC USERBASE

The low likelihood of a single all-encompassing DPC solution emerging also complicates the task of building a picture of the total userbase, since there is considerable customer crossover between different solutions. (The same brand might be making use of, for example, a digital materials platform, a virtual photography and staging solution, multiple 3D design and simulation tools for different product categories and so on.)

Accounting for this crossover by identifying duplicate customers where they occur is also an inexact science, since each of those brand-to-vendor partnerships is a valid part of the overall DPC ecosystem. For this reason, our analysis does not attempt to single out individual brands as "DPC customers" the way we have historically done for PLM sales. Instead, to establish a low baseline for DPC adoption, we have taken a conservative assessment of the active user figures provided to us by the different vendors (not all of whom parted with this information) and applied a simple calculus to begin painting a picture of the size of the global DPC userbase.

We have also applied our own subjective understanding of fashion industry digital maturity (and our first-hand experience of discussing digitisation with brands of various sizes) to quantify what percentage of multi-industry user figures might be ascribed to fashion.

Taking these factors into account, we believe there are at least 45,000 monthly active users of DPC software solutions within fashion that vendors should be able to substantiate based on the information they provided to us.

This figure comes with some notable caveats.

Firstly, we acknowledge that the picture we have of the full DPC industry is incomplete; there are vendors who did not participate in this report, and of those that did, not all provided customer numbers. Second, we recognise that this figure applies to software licensing only, and that the real figure would be much higher if we were to incorporate customers receiving services. Thirdly, this figure only represents a proportional share of users of cross-industry suites - something that is difficult to estimate.

Finally, we are not evaluating users of other solutions that have historically played only a tangential role in enabling DPC workflows, but that are now being rearchitected to act as creative and commercial decision-making hubs that extend the use of digital assets. In this cases, depending on whether DPC functionality is sold as an additional bolt-on, or added into the core of the solution, the overall use figure could jump dramatically.

One thing we can be more certain about is DPC's global spread. Unlike other enterprise technology, which tends towards regional concentrations that fluctuate as sales teams are assigned and re-assigned, the DPC sector has achieved a relatively even worldwide spread. And while users of material platforms are, expectedly, concentrated in the supply chain, this report also provides a perspective on the amount of core 3D design and simulation expertise that has been fostered by manufacturers - both of which are balanced out by users of the same platforms in other regions.

Much of this global adoption is probably down to both the aforementioned integration - there is little need for tailored solutions for particular roles and geographical areas when integration and interoperability is so common - and to the ease with which the majority of DPC solutions can be deployed.

Another notable trend is in international expansion; while DPC solutions are generally easy to buy and deploy anywhere, we are seeing several instances of technology and service companies that have previously focused on just a single country now expanding their reach into new markets. This will, in the short to medium term, grow the userbase provided the same attitude to interoperability persists.

Image provided by DRESSX: Sailor Brinkley Cook in Varvara Korzunina.

MARKET SIZE ESTIMATION

For the purposes of establishing a simplified baseline for the monetary size of the DPC technology market for fashion (again, focusing only on SaaS software licensing) we have applied the mean per-user licence fee to what we consider to be the minimum userbase for DPC.

That calculation provides us with a figure of at least $40 million from annual recurring revenue from subscriptions alone. This does not include hardware purchases, partnership expansions, or bureau services, and again we reminder readers that we consider our userbase figure to be a conservative, minimum estimate; it is by no means exhaustive.

Even with this limited perspective, though, we can begin to compare DPC to other enterprise technology segments. And perhaps the closest of those in functionality and objective is PLM - an industry that WhichPLM tracked for more than a decade, and a sector for which we hold 2022 data pertaining to not just overall market size, but software licensing.

In the fiscal year 2021/2022, software licensing (much of which was subscription based) from new sales of fashion PLM accounted for approximately $60 million of the industry's overall revenue - with the remainder being made up of maintenance, support, and implementation services. And while it is difficult to draw direct comparisons between the two sectors in terms of customer segmentation and distribution, there is not a dramatic disparity between these two figures. In fact, there may be some sense to seeing them as adopting a logical progression, with DPC adoption being oriented around design, after which PLM adoption picks up the core tasks of development and manufacturing.

On this basis - with the caveat that our DPC figures are intended only to set a minimum baseline at this time - it is important to consider that even a limited analysis of software revenue sales across the digital product creation ecosystem is equal to a similar figure in an industry that is considered foundational in the sense that many fashion businesses above a certain size threshold have now adopted PLM.

Against this background, our key finding from this limited analysis is that DPC should no longer be considered an experiment, or an offshoot of "core" fashion technology. It is a complex, thriving ecosystem in its own right, and a high investment priority for many brands and retailers.

This, we believe, translates into a large addressable market. Given the sheer, unmet demand for digital assets - from body scanning, patterns and visualisations, to digital materials, product photography, and even downstream digital fashion - we fully expect that, as brands, retailers, and their production partners start to work on further scaling their capacity to produce those assets, they will go on to invest in multiple different solutions from across the DPC ecosystem.

CONCLUSION

This is, of course, an opportunity for technology vendors and service providers who have technology to sell. But it is also important to remember that their brand and retail customers are equally responsible for driving digital product creation forward. Based on the conversations that The Interline has had with brands this year, we know that dedicated process champions and DPC enthusiasts have been working just as diligently as technology vendors to improve (or even build) solutions, and to dedicate themselves to realising as much of the vision for digital product creation as possible.

It would also be remiss of us not to note the contributions of specialised strategic advisors who sit between brands and technology companies, helping to scope out pilots, projects, advanced use-cases, integrations and complete transformations, and working hands-on to define the roadmap from initial 3D project to more comprehensive digital product creation strategy.

Even with all of these parties working together, however, and even with the support of increasingly capable, integrated technology, traversing that roadmap will not be without its problems. Many brands have had success with 3D, but navigating a transition to more comprehensive DPC is likely to become a process of uncovering capacity bottlenecks and new challenges just as often as it is identifying new opportunities.

Fortunately, our analysis and our extensive time charting the progress of DPC for fashion gives us confidence that the community will take the right collective action to make measurable progress towards our vision for DPC by the time of the next version of this report.

All of which is why it is galling to see digital product creation being simplified as a tool for virtual sampling, when the data, the editorial perspectives, and the treasure trove of vendor information contained in these pages demonstrates how much more comprehensive the DPC ecosystem is. And with this baseline set, we look forward to returning to DPC later in 2023 to build on our analysis.

We have little doubt that the companies that pioneered 3D design, and pattern-accurate simulation are happy to see the fashion industry as a whole catching up to a goal they have been striving towards for decades. These visionaries are responsible for creating the smooth onramp to 3D adoption that has allowed for the DPC sector to reach an inflection point in 2022, and that has helped usher in a new era of diverse, capable, integrated solutions.

We believe, though, that the age of expansion, extension, innovation, and disruption is now about to dawn in fashion, and while 3D has been delivering value within for a long time, the data suggests that digital product creation is just getting started.

The Interline would like to extend our thanks to every technology and service provider who took part in this first-ever DPC Report, and to all our editorial contributors. We hope you found value in this publication, and we encourage you to bookmark The Interline for more coverage of digital product creation throughout 2022/23.