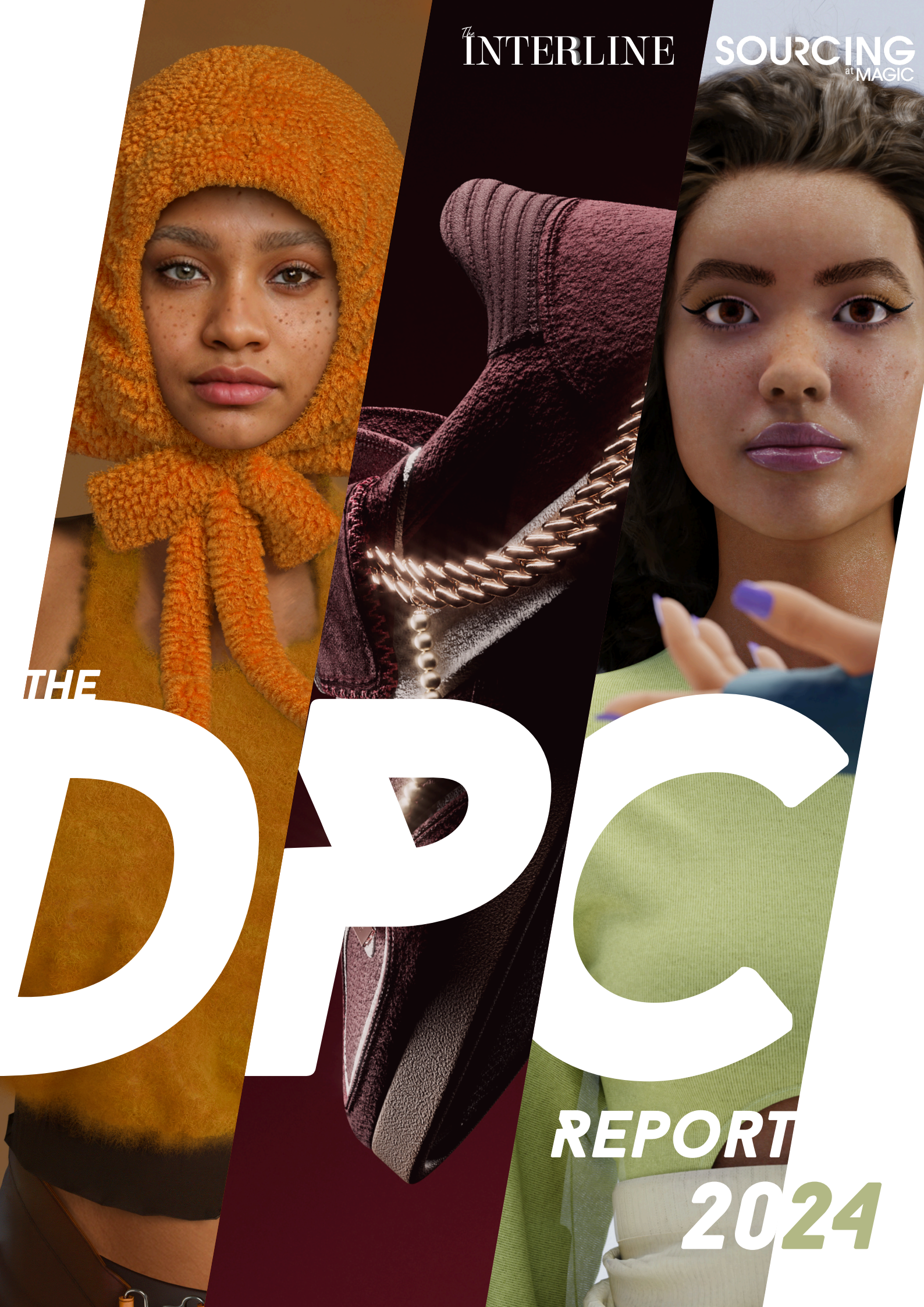

The INTERLINE
SOURCING at MAGIC
THE
DPC
REPORT
2024



INTRODUCTION

BY BEN HANSON,
EDITOR-IN-CHIEF, THE INTERLINE

PUTTING A PERSONAL AND PROFESSIONAL SPOTLIGHT ON 3D.

I have an admission: when we started the first DPC Report, we did it because we just plain like 3D.

I'd love to say we had a concrete vision, back in 2022, of what the eventual audience and the ideal format for talking about and wrapping up digital product creation annually would be. Those elements definitely crystallised quickly, but the thing in the driving seat at first was the axiom that 3D is cool - and 3D for apparel, footwear, and accessories is even more compelling.

Now, in a role like mine you really do need to be across a lot of different elements of fashion - and every product category that sits under that umbrella. And you also need to take a detached vantage point on the value that each technology segment has the potential to create.

That's still the philosophy behind this report, just as it is with our other deep-dive reports from this year, on AI and Sustainability. But if you ask me which technology segment has occupied the most of my personal time and attention beyond the veil of journalistic objectivity, the answer has always been 3D.

To be clear: I've never been a 3D designer of the creative or the engineering persuasion. I wasn't good enough at art or maths for that. But I did have the luck of being part of the generation that watched computer graphics - at the raw technical level - start with abstract ASCII stand-ins for objects and progressively mature to the point where real-time raytracing is table stakes.

And I've also had the privilege of being in a job where I've watched, debated, analysed (and even worked a tiny bit on) the advancement of the commercial case for 3D. It's easy and cliché to get misty-eyed about how 3D as an artform has grown up, but for me it's inarguably more impressive - and more worthy - to stand back and really take stock of how far 3D as an engine for business has come.

Today a huge amount of creative endeavour starts (and even ends) life in 3D, but probably an equal amount of commercial products and services follow the same journey. We've been talking for years about how other industries have already transitioned to 3D-first working - which remains true - but these reports are an opportunity for us to check back in and see how fashion is moving along that same curve. And every year I find at least one new reason to be optimistic about how fashion as a whole - and apparel, footwear, and accessories as different segments underneath it - is internalising, industrialising, and innovating across not just core 3D design and development, but simulation, real-time experiences, virtual photography, augmented reality, material digitisation and more.

This year, I found a lot of reasons.

First, we put out an open call for 3D designers in three different categories: apparel, footwear, and digital-only fashion. Last year's DPC Report was the first time we'd commissioned a 3D artist (we did continue to work with 2D illustrators and even AI artists for our other 2024 reports) and this time we wanted to go a step further and find the best creatives, give them free rein to experiment in an extended DPC playground, and then work with them to reflect on and contextualise the results.



Designed by Canberk Karakas for The Interline. Modeled, textured & rendered in Cinema 4D and Redshift.

We found Yasmin Koppe, Canberk Karakas, and Diane Wallinger. You'll have seen a snapshot of the amazing creations they made for us on the front cover of this report, but if you turn to the editorial section of this report (just after the opening remarks) you'll find a full set of their designs, along with deep conversations about their workflows, pipelines, and processes.

With so much of 3D and DPC adoption hinging on supporting, listening to, and including the design community, what all three of them have to say about the purpose, potential, and power of 3D is essential reading for creators and executives alike.

Second, those creators we commissioned each received some unprecedented technical and creative support to help showcase the evolution of 3D pipelines and the flexibility with which a single piece can travel through different channels, environments, and use cases.

Yasmin collaborated with the digital fashion team at PTTRNS to stage and "photograph" her design (made in CLO, and textured in the Adobe Substance suite) using their scalable rendering platform and AI avatars.

Canberk partnered with the specialist Twinmotion team at Epic Games to demonstrate how his footwear designs could make the move from his personal workflow (centred around Cinema 4D and Redshift) into Unreal Engine through a turnkey, drag-and-drop frontend and real-time environment.

And Diane also worked together with Epic Games, with a technical artist bringing her design (again created in CLO and textured in Adobe Substance) into Unreal Engine directly and showcasing how garments can flow from one tool to another.

Those external creative and technical folks also share their thoughts on what these workflows might mean for the future of digital product creation as a whole.

And helping to oversee the way all these different subject matter experts worked together to create incredible end results has been one of my highlights of the year.

Third, I think we're welcoming our most diverse range of writers for this year's report. From strategic perspectives from major brands and suppliers, to deep analysis from different angles on the broad spectrum of DPC challenges and opportunities, the stories contained in this report cover the most ground I think we ever have. Combined with our designers' perspectives, there's something here for everyone who's part of the global DPC community.

And finally we have our technology vendor partners and our headline sponsor, SOURCING at MAGIC. Like everything The Interline published in 2024, if you're reading this report you won't have been asked to part with any personal details to get it. We continue to believe that an educated, engaged fashion industry is an industry that can make the most of technology - and the companies that support these reports are part of a tapestry of partners who allow us to keep commissioning artists, keep telling stories, and keep distributing deep-dive reports like this one free and ungated.

You'll hear more from Kelly Helfman, President of Informa Markets Fashion, over the page. And you can find detailed profiles of all the key DPC technology vendors in that dedicated section of this report - including interviews with senior executives across the full span of DPC processes, from material capture and creative design to digital asset management and generative AI.

And you'll also find an article from me. Because while I'm incredibly proud of how much these annual Reports have become a focal point for the DPC community, and while I want to give as much of the floor to new creatives, technical experts, and industry voices as possible... I still just really like 3D.



The Interline would like to thank CLO Virtual Fashion, Epic Games, and PTTRNS for collaborating with our designers, and helping to further the case for DPC in Fashion.

CLO Virtual Fashion

EPIC GAMES

PTTRNS.ai

Designed by Canberk Karakas for The Interline.
Modeled, textured & rendered in Cinema 4D and Redshift.

PRESSURE AND POTENTIAL - THE DUAL ROLE OF DPC



BY KELLY HELFMAN,
PRESIDENT, MMGNET GROUP

The magic of fashion happens in the space between an idea and a finished product.

The end result can be a garment, a shoe, or an accessory. The idea can start with a sketch, a material, or any source of trend or inspiration from live events, street style, or social channels.

Whatever the combination, that middle ground, between their creative idea and the commercial result, is where everyone from solo entrepreneurs to huge global companies identifies their opportunity and works to build and grow success.

But in a complex economy, that success is not always easy to find. Not just for emerging designers or independent labels, but for the biggest names in contemporary fashion, and even luxury groups.

The limitless possibility space of fashion can start to feel narrower when profitability is under threat, which is something our forward-looking Fashion & Technology In 2025 research, created in partnership with The Interline, tells us is fashion professionals' top priority for the coming year.

Against that backdrop of shrinking margins, decreased buying power, and high costs for both creators and their materials and manufacturing partners, fashion professionals need to find new and more creative ways to keep the magic running.

This is something we have catered for for decades at MMGNET Group, across our portfolio of live events throughout North America. Shows like SOURCING at MAGIC, MAGIC, PROJECT, and COTERIE are the key touchstones for fashion businesses to connect, explore emerging trends, and go hands-on with products and technology. All of those interactions and experiences are evolving as the industry changes in response to global shifts.

That same blend of possibility and pressure is also one of the reasons that the majority of fashion businesses - close to 90% according to our data - have either already adopted or intend to adopt 3D or digital product creation strategies in 2025.

More than investments in sustainability solutions (or even AI) fashion companies are turning to DPC to provide a new way to create, commercialise, and market products with reduced overheads and commitments. And DPC also continues to create entirely new possibilities in places like virtual photography, virtual try-on, cross-media collaborations, real-time rendering, and much more.

The time has passed where fashion professionals would look past technology. Today, industry-wide, designers, buyers, managers, makers and other job roles all recognise the unlocks that can come from working digitally wherever possible - and now the challenge is to see just how much of that magic DPC can capture.

That's why we are proud to be supporting The Interline's DPC Report for a third year running. It's also why the teams at MMGNET - and especially SOURCING at MAGIC - are committed to continuing to provide ways for fashion professionals to understand, experience, and make the most of 3D, DPC, and the broader spectrum of fashion technology at milestone live shows and all-year-round.

MMGNET Group and The Interline will continue to collaborate in 2025 across live events, year-round content, and education.

For more insights on how DPC - and technology in general - is shaping fashion's strategic outlook for 2025, download the Fashion & Technology In 2025 report, a brand-new partnership between MMGNET and The Interline.

To explore fashion technology content, quiz The Interline's Editor-in-Chief, and discover solutions, services, and partners across the spectrum of sourcing, visit SOURCING at MAGIC, live in Las Vegas, from 10th to 12th February 2025.

MMGNET GROUP

The INTERLINE

KEY TAKEAWAYS

1. CREATIVITY PUSHES TECHNOLOGY FORWARDS

Similarly to how traditional craftsmanship and creative design have informed and advanced one another, a new generation of designers (self-taught and institutionally-trained) are testing the frontiers of digital design and, in the process, nudging the window of technological progress forwards.

2. CREATE ONCE, USE AS MANY WAYS AS POSSIBLE

New (or even continued) spending on technology-enabled and tech-adjacent projects can be hard-won in an adverse economic climate. Demonstrating a deeper return on the investment required to create digital workflows and assets will be easier for organisations that then use those elements everywhere possible.

3. CULTURAL TRANSFORMATION WILL DELIVER STRATEGIC RESULTS, BUT A NEW STEP-CHANGE IN TECHNOLOGY WILL BE THE NEXT UNLOCK.

For many businesses, digital product creation has been a compartmentalised project - creating value in narrow areas of design, development, and communication. Changing cultures will help to extend that value further, but a move towards real-time 3D for a full spectrum of different audiences could be the key to a more profound, business-wide transformation.

4. DPC CAN ANCHOR INTO INCLUSIVITY, REPRESENTATION, AND SUSTAINABILITY - IN POSITIVE AND NEGATIVE WAYS.

As DPC strategies are extended to wider audiences, and as they further streamline and accelerate product creation, brands may have to make a conscious choice to avoid using DPC capabilities to speed up unsustainable business models. And similarly proactive decisions will need to be made around the use of AI avatars in B2C selling, as consumer attitudes to digital representation evolve.

5. TRAINING AND TRUST

For DPC to continue moving towards the ideal end state, both the full cohort of creative and technical designers and a wider community of end users will need to be supported in building trust in digital assets. For the most advanced brands, this is manifesting as full-time, dedicated 3D and DPC training resources.

6. WHERE DIGITAL FASHION AND DPC DIVERGE, AND WHAT THE TWO DISCIPLINES HAVE IN COMMON

Although direct interest in buying and using digital-only fashion has waned, the creative and commercial lessons learned are beginning to cascade backwards into the use of 3D for creating physical products that have longer digital lifespans - and many of the tools, processes, and pipelines are shared between the two different endpoints.

7. EDUCATION, THE TALENT POOL, AND THE NEED FOR ENTERPRISE COMMITMENT.

The prevailing attitude amongst most fashion brands is that a dearth of digital talent is holding back whole-enterprise expansion of DPC. But with the growing realisation that 3D should be part of core fashion curriculums, the less charitable read is that the median brand is waiting for others in industry to take the lead and become lighthouses for wider transformation rather than directly pursuing innovation themselves.

8. AMBITIOUS OUTLOOK; WELL-TRODDEN NEAR-TERM GOALS

For forward-thinking brands, there is a wide-open horizon of possibility when it comes to maximising the value of digital product creation initiatives - but even for these organisations the key to securing continued support and investment is delivering on near-term goals for majority-digital prototyping and virtual photography. “Virtual sampling” may articulate a very limited view of what DPC can do, but it nevertheless remains an important yardstick for judging the success of digital strategies.

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Yasmin Koppe, The Interline, CLO Virtual Fashion, and PTTRNS



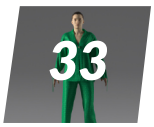
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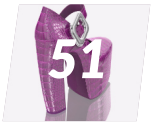
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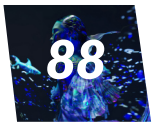
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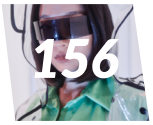
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Exploring The DPC Ecosystem
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DPC Market Analysis 2024/25
A clear picture of the size, shape, and scope of the technology market for 3D and digital product creation.



Designed by Yasmin Koppe for The Interline.
Rendered using Flair PTTRNS, by Cristina Codreanu.
Avatar creation by Charlotte Stobrawe



YASMIN KOPPE

The Interline commissioned Yasmin Koppe to create for our "Apparel" category this year. After years of working with both emerging and renowned fashion companies in London, Barcelona, and Berlin, Yasmin transitioned into the field of digital fashion. She now specialises in bridging innovative technologies with proven craftsmanship, focusing on redefining the way garments are designed, created, and experienced.

Yasmin's work spans from creative visualisation to education, empowering industry professionals and the next generation of fashion designers to embrace the potential of digital tools.

Our team sat down with Yasmin - and some notable figures from CLO Virtual Fashion and PTTRNS, who have shared their expertise and, in PTTRNS' case, collaborated with Yasmin on the creative and technical side of the final results - to cover everything from creative inspiration and inclusivity, to hardware, pipelines, and cross-industry best practices.

Find more from Yasmin on her Instagram or her website.

The Interline: Tell us about the creative inspiration behind your piece for this year's DPC Report - and what influences your style in general.

Yasmin Koppe: A recurring theme in my designs is modularity. I enjoy creating pieces with customisable features that invite wearers to engage with them in a personal way—adjusting or styling them to reflect how they feel on any given day. Recently, I drew inspiration from a conversation between Adwoa Aboah and Paloma Elsesser, where they shared their frustration with the fashion industry's slow progress in addressing narrow perceptions of figures and body standards. This prompted me to challenge my own ideas about size and proportion. Combining that with my passion for adjustable elements shaped the dynamic and varied volumes throughout the piece.

Additionally, early in the ideation process, I had the chance to exchange ideas with the team at PTTRNS. I always strive to connect with collaborators whenever possible, and their input influenced my material choices while also playing a key role in bringing my vision for the character to life.

The Interline: Your commitment to representation and diversity is evident in the way the pieces are staged, and the avatar wearing them, but you also have strong feelings about inclusivity when it comes to digital product creation as an ecosystem, and how it can permit more people to take part in fashion. How do you see those two elements coming together?

Yasmin Koppe: Digital product creation allows us to rethink not only the design and manufacturing process but also how we present garments to the people we design for. I'm particularly excited about Virtual Try-On technology because of its potential to transform the online shopping experience, making it more inclusive and representative.

Currently, many product shots online still feature narrow beauty standards—typically very slim and tall body types. When I chose to work with a full-figured avatar for this piece, I had to confront my own biases. I wasn't sure if my design language would translate to a different body type, as I've been conditioned to design for industry standards. This forced me to let go of terms like "flattering" or "figure-friendly" and instead focus on having fun with the design.

Over time, I grew deeply attached to the avatar-model, and her confident, unapologetic pose in the final render reflects that transformation. It's encouraging to see major players like Google and Pinterest expanding body type representation in their search tools and Virtual Try-On offerings—proof that there's a growing appetite for showcasing the diversity of all body types.

The Interline: Tell us about the technical pipeline and the workflow you used to create this look.

Yasmin Koppe: Typically, my workflow involves three main software tools: I start in CLO3D to model the 3D garment, move to Adobe Substance Painter for texturing, and finish in Blender, using the Cycles render engine for staging and rendering.

However, for this project, the process was slightly different as I got to collaborate with PTTRNS, who supported the texturing and rendering stages, adding their expertise to the final result.

The Interline: The drive with this particular design was also to really push the envelope of representing different soft and complex materials in 3D, to help demonstrate that not all fashion created digitally needs to have a typically "digital" look. How did you approach this challenge?

Yasmin Koppe: Before transitioning into 3D, I worked in both the design and development departments of various brands, which gave me a solid understanding of pattern cutting, garment technology, and material characteristics. These insights now play a central role in my digital creation process. For this project, I referred to a simple real-world sentiment and translated it in my digital design: It was winter in Berlin, and I found myself craving something cozy and cheerful to offset the grey November skies.

That feeling guided my choice of incorporating plush, soft materials and this is also where one of the key features of PTTRNS came into play. Their advanced texture enhancement process intrigued me, and I was eager to explore how it could bring an extra tactile dimension to the design.

Hopefully, the warmth and vibrancy come through in the renderings and evoke a soothing sensation for readers.

The Interline: When we consider the spread of different textures on display in Yasmin's work, and the fidelity of the avatar, there was a high bar to clear when it came to showcasing the final result in its best possible light. To help achieve this, Yasmin was able to tap into support from the team at PTTRNS, and the company's fashion rendering platform, which is now part of the CLO ecosystem partnership program. We asked Cristina Codreanu, a 3D Fashion Specialist, and Charlotte Stobrawe, Head of Digital Fashion & Transformation at PTTRNS, how the team approached this collaboration, and what they believe it has to teach the wider industry.

Cristina Codreanu: This collaboration was particularly distinct for us, as our typical process involves clients directly engaging with our platform to generate renders at scale, maintaining a consistent and streamlined aesthetic. However, this project allowed us the opportunity to work closely with Yasmin to render her garment on an AI avatar, bringing her creative vision to life.

We collaborated on refining the AI avatar to represent diversity and inclusivity, moving away from the generic, overly generated AI look common in digital models. Notably, the avatar was designed as a curvy representation, emphasizing inclusivity in both form and aesthetics. Beyond the avatar itself, we focused on perfecting the lighting, colors, and material details to authentically showcase the garment's intricate textures and drapes, highlighting how 3D can adapt to highly creative, complex designs.



Designed by Yasmin Koppe for The Interline.
Rendered using Flair PTTRNS, by Cristina Codreanu.
Avatar creation by Charlotte Stobrawe

Charlotte Stobrawe: This project underscores how automation in 3D fashion is a powerful tool but not a complete solution. Creative freedom is essential for realising distinctive artistic visions, particularly when garments feature elaborate textures, layered details, and unique draping techniques. Yasmin's design required careful attention to these elements, demonstrating that 3D rendering can faithfully capture the essence of even the most intricate and unconventional creations. By exploring creativity within the framework of automation, the industry can learn to enhance efficiency without compromising individuality, setting new standards for inclusive and texturally rich fashion visualisation.

ULTIMATELY, I BELIEVE THAT LOOKING AT BEST PRACTICES FROM OTHER INDUSTRIES HELPS US BRIDGE THE GAP BETWEEN TECHNOLOGICAL ENTHUSIASM AND CONSUMER ACCESSIBILITY.

The Interline: Yasmin's design began life in CLO, so it was essential that the unique blend of natural materials was accurately represented from the beginning, and that the 3D simulation remained pattern accurate. But it was also essential for her to be able to seamlessly work on those materials outside of CLO, and to be able to then export her work to create final pixels in another platform. To better understand how the technology sector is catering to this combined drive for accuracy, fidelity, and interoperability, we asked Alex Kim, Software Product Manager of CLO for his current thinking on what the DPC software ecosystem needs to do to empower not just designers, but the growing community of users for 3D assets.

Alex Kim: As the industry moves forward and adopts digital product creation more broadly, we believe that building strong partnerships with like-minded collaborators is essential. At CLO, we're committed to expanding our ecosystem of services and partners with the aim of empowering our users; our goal is to help everyone in the community effortlessly create digital garments, collaborate more easily on production and e-commerce, access digital materials with less barriers, and utilize 3D garments in more virtual environments. And we're not just focused on increasing the quantity of digital assets - we're also trying to improve the quality of them. Our hope is to support the creation of accurate, production-ready designs, while at the same time, improving interoperability with other products and services out there. We're certain that our efforts to work together with our stakeholders will generate new possibilities for creativity and innovation in DPC.

Our goal is not just to increase the quantity of digital assets but also to improve their quality and visualization. At CLO, we ensure creators can produce accurate, production-ready designs while enabling smooth integration with other products. By working together with our partners and the growing community of users, we aim to open new possibilities for creativity and innovation in DPC.

The Interline: Yasmin, There's a lot of confusion and crossover between the terms "3D," "digital product creation," and digital fashion. How do you define these? And do you actively use these terms, or do you talk about your specialism differently?

Yasmin Koppe: I completely understand the confusion around these terms, and it's actually one of the first things I clarify when introducing the 'digital fashion ecosystem' to my students. While closely related, each term serves a slightly different purpose.

'3D' is probably the broadest, rather technical term and isn't necessarily linked to fashion. We model digital garments in 3D, but those models can also be used for other applications, like in games, for instance.

'Digital product creation,' for me, specifically refers to the process of designing, developing, and showcasing garments entirely in a virtual space using 3D tools, with a focus on detail and realism.

To me, 'digital fashion' is more of an overarching term that applies to a range of use cases. It can describe everything from an AR filter that's purely conceptual to a fully producible digital twin of a physical item, complete with added value, like care instructions or a garment's provenance. Personally, I tend to use 'digital fashion' when discussing the fusion of technology and craftsmanship, or how technological innovations are transforming the way we create and experience garments.

The Interline: How did you begin working in 3D? What was the initial spark of interest? And how much of your skills are self-taught versus being acquired through formal education?

Yasmin Koppe: I've always had a strong interest in fashion technology, and in 2019, the spark for 3D specifically ignited through a cross-disciplinary collective spanning Berlin, Prague, and Amsterdam. I was fortunate to attend a weekend workshop in Prague, where I was introduced to tools like CLO3D, body scanning, and motion tracking. At the time, I was frustrated with the limitations of traditional sampling and production processes, and deeply concerned about the fashion industry's impact on pollution and exploitation. These new technologies provided me with a hopeful path toward positive change.

Most of my skills are self-taught, which is quite common in the Digital Fashion field. I took a class with CLO in Munich, which gave me a solid foundation and helped me transition from a 2D to a 3D workspace. From there, I spent countless hours on YouTube tutorials, Discord channels, and other online resources. I'm a huge fan of the open-source mentality

in this space. Today, I also teach Digital Fashion at various educational institutions, and it's exciting to see more programmes recognising its relevance and incorporating it into their curricula.

The Interline: What hardware and operating system do you use?

Yasmin Koppe: I was lucky to have the opportunity to build my own desktop tower with the help of my brother, an IT specialist. It turned out to be more fun than I expected, and it's great that I can easily upgrade or swap out components as needed!



Designed by Yasmin Koppe for The Interline.
Rendered using Flair PTTRNS, by Cristina Codreanu.
Avatar creation by Charlotte Stobrawe

Currently, I'm working with an AMD Ryzen 9 processor, an Nvidia GeForce RTX 3080 Ti graphics card, 32 GB of RAM, a UHD screen, and Windows 11.

When travelling or meeting clients, I also rely on an equally powerful laptop (a Lenovo) and my Samsung Galaxy Tab S6 Lite tablet, which I use to quickly sketch ideas.

The Interline: As a 3D fashion designer, do you follow the development of 3D in other industries, like automotive and consumer product design, to keep a finger on the pulse of best practices? Or do you believe apparel is sufficiently different that you concentrate on what's happening within the industry's own walls?

Yasmin Koppe: Since my entry into Digital Fashion came through an interdisciplinary network, I'm a strong advocate for looking beyond the fashion industry and exploring how other sectors adopt and use technology. It's a two-way process: I'm keen to understand how consumers respond to transformations in other industries and how I can apply those insights to communicate innovation in my sector. For example, architecture's use of high-fidelity renderings to visualise a project or how AR is now commonly used by consumers to test interior products in their homes offers valuable lessons for fashion.

Ultimately, I believe that looking at best practices from other industries helps us bridge the gap between technological enthusiasm and consumer accessibility.

The Interline: How do you believe DPC maturity is progressing industry-wide, for apparel? Are companies building the right in-house capabilities and thinking about the potential on the right business-wide scale? Or is the industry still primarily looking at digital product creation as a way to streamline a narrow set of tasks in design and development?

Yasmin Koppe: While progress in DPC maturity is encouraging, there's still much untapped potential across various operations. As a digital fashion designer, I think it's our responsibility to help businesses recognise the full scope of DPC—not just in design, but in areas like supply chain management, marketing, customer experience, and sustainability efforts.

Instead of focusing on isolated tasks, a comprehensive, company-wide strategy is essential.

I'm seeing more and more brands recruit tech talent across departments, which is a promising trend. Identifying the necessary roles for transformation and either attracting or developing the right in-house talent is crucial.

The Interline: Do you see smaller brands and retailers embracing DPC the same way that larger businesses are?

Yasmin Koppe: As per the current status quo, not yet, which is understandable. Embracing DPC requires a transformation that comes with upfront costs, which can be a significant challenge for smaller businesses with limited budgets. That said, I often point out that in the long run, DPC can make a brand's or retailer's operations not only more cost-effective but also strengthen customer loyalty. Take the post-purchase dilemma, for example. Right now, it's difficult for brands and retailers to assess customer satisfaction with a product or understand why an item doesn't sell. With DPC, we can create more direct feedback channels or even co-creation opportunities between the brand, retailer, and consumer.

The Interline: Do you believe consumers are prepared to make buying decisions based on 3D renders - either static or real-time? And what would you like to see happen with the virtual try-on ecosystem to bring digital assets closer to the consumer?

Yasmin Koppe: Absolutely! Consumers are already comfortable making significant purchases, like a sofa or a bed, based on 3D renderings, without ever seeing the physical item. Fashion can definitely follow this path.

For example, I worked with an animation studio on a campaign for a major Spanish high-street brand, and the rendered animations received twice the engagement compared to photos of the physical product. Their followers were excited and eagerly anticipating the item's release.

As for virtual try-on, I'd love to see more customisation options for sizing and styling.

BODS, an emerging tech firm, offers a great example with its VTO experience: It allows users to set up avatars with precise measurements reflecting their own, combining high-fidelity 3D visuals with fast loading times, size recommendations, and even a 'stress map' to show areas where an item might fit too tightly.

The Interline: Finally, how do you believe DPC interacts with sustainability? Elsewhere in this report there's a strong case being made for virtual samples being more important than ever, as a lever to help blunt the environmental and humanitarian impacts of physical sampling. But at the same time, there's a real concern that 3D could serve to increase the throughput of unsustainable business models. What's your perspective on how fashion can incorporate the speed and flexibility of digital product creation without turning it into more fuel for a damaging system?

Yasmin Koppe: The concern you've raised resonates with me. DPC can indeed support more sustainable practices in several ways. Take, for example, a well-designed Virtual Try-On experience, which enables consumers to make better informed purchase decisions and could ultimately reduce returns. Additionally, the material savings from virtual sampling and fitting before producing any physical pieces are significant.

However, digital fashion is still in its early stages, and it's crucial to take proactive measures now to ensure it doesn't unintentionally fuel the fast fashion cycle.

Industry-wide guidelines are essential, as it's crucial that the responsibility isn't placed solely on brands alone. While the goal for DPC should be to prioritise higher-quality releases over frequent, fast-turnaround drops, I would like to see a unified vision for digital fashion. This would involve bringing together brands, technology providers, and regulatory bodies to define standards and establish best practices, in the spirit of "prevention is better than cure."

DIGITAL FASHION IS STILL IN ITS EARLY STAGES, AND IT'S CRUCIAL TO TAKE PROACTIVE MEASURES NOW TO ENSURE IT DOESN'T UNINTENTIONALLY FUEL THE FAST FASHION CYCLE.



Designed by Canberk Karakas for The Interline.
Modeled, textured & rendered in Cinema 4D and Redshift.



CANBERK KARAKAS

The Interline commissioned Canberk Karakas to create for our "Footwear" category this year. Based in Istanbul, Canberk is a 3D Designer & Art Director who specialises in digital design and development in fashion, footwear, and luxury goods.

With a background in classical design, a broad 3D skillset, and cross-industry knowledge and experience, Canberk focuses on helping brands to hit their production and marketing goals in creative and innovative ways.

Our team chatted to Canberk - and to Martin Krasemann from Epic Games, who brought Canberk's designs to life in Twinmotion, the intuitive real-time visualisation solution for Unreal Engine - about how he approached the challenge of designing for The Interline, how he believes the footwear industry is embracing 3D, and what's next for DPC in education and industry use cases.

Entered into the 5TH GFA Global Footwear Awards 2024 Edition, Canberk's Retrouvailles Trackstar sneaker design recently won an award in both the Independent Fashion Sneaker Winner and Best Overall Fashion Sneaker categories.

The Interline: Walk us through the creative intent behind your design for this year's report, and tell us a little bit about where you find footwear inspiration in general.

Canberk Karakas: The pair I've designed for this year's report carries fashion-aware notes along its silhouette, with layers of panels and embellishments. The creative and performative intent behind this production is to showcase methods, possibilities and hopefully new ways of creation, which I find to be quite important when it comes to an industry like footwear, where the design work, materials and resources are more expensive to actualise - making the power of 3D to virtualise them even more vital.

Footwear is one of those things where I count it to be more than a wearable, it's almost like a household object that occupies space and demands attention. The more rigid nature of it enables me to approach it in a very different way than clothing. And because of that, finding inspiration means looking at a broader canvas, because the ideas that spark an early concept can be found in architecture, sculptures and experimental design.



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The Interline: This is the first year that The Interline has featured a 3D footwear designer. How different a discipline is it compared to traditional footwear design and engineering? And while a lot of first principles are different between categories, how much crossover is there in terms of the toolset and workflow with 3D design for accessories, apparel, and consumer products?

Canberk Karakas: There are lots of different steps to start from when approaching footwear design on a more traditional path, but I'd say doing it in a 3D space is very similar. There are still a lot of calculations and numbers going in; even though it's 3D, we still have to have a good understanding of shape, harmony, form and materials. The biggest difference though, is the speed of your workflow. In 3D, there isn't really a limit, and there are no

resources to run out of. This non-stop progress makes way for better performance for a designer, and gives you more time to think through the design and explore different ideas.

Toolsets are another big difference I've seen develop. Most 'traditional' footwear designers still use CAD software like Rhinoceros or Solidworks, targeted for a more industrial design use-case, and a lot of 3D Designers like myself will usually work with Polygonal softwares like Cinema4D, Maya and Blender. Computer Aided Design programs focus on accuracy, tolerance and production. Modelling programs like Cinema4D focus on visual quality, animation and usability for digital use-cases. I've had the chance to work with a few models that were created in a CAD software, and it usually needs a lot of work for it to look good within the render engine.

So even though the idea is the same, the end result and overall experience and objectives are not. This case isn't that dramatic for apparel I'd say, since cloth simulation tools like Clo3D or Style3D are widely used for any kind of soft-goods, both for production and digital use-cases.

The Interline: How did you initially become interested in working in 3D? Where did the first spark come from? And is that the same thing that motivates you today?

Canberk Karakas: When I was a kid, I was obsessed with sneakers. I was also into fashion and styling, but footwear has always been different. When I eventually got into Yeditepe University, in Istanbul, to get my BFA in Graphic Design, I found myself surrounded by creative people more than at any time in my life before. Coming from a smaller town in Turkey, this was a big deal for me. As I was carrying on with Graphic Design, I realised that it eventually wouldn't be enough to feed my creative hunger, so I returned to what I knew I enjoyed a lot when I was a kid, which was sketching concepts of sneakers. But since I'd had, by that point, more exposure to design, I had to find a way to standardize my ideas. That's when I started researching different methods of design, and I eventually found 3D workflows.

I wanted to recreate my early designs in 3D, but I realised I needed to get good at it first. I knew I wouldn't be able to physically produce the styles I was imagining, as I was a student and production is expensive - especially in footwear. So 3D was basically my gateway to being able to do what I loved and see my ideas brought to life, and that's still the way I think about it today.









Bottom-left: Designed by Canberk Karakas for The Interline. Staged and rendered in Twinmotion by Martin Krasemann.

Top-left, top-right, and bottom-right: Designed by Canberk Karakas for The Interline. Modeled, textured & rendered in Cinema 4D and Redshift.

Everything then branched out from that point on, and even though my biggest motivation is helping brands and creatives worldwide now, I know I'm a step closer than I've ever been to creating my own pair of shoes!

The Interline: How much of your current 3D skillset is self-taught, and how much did you acquire through formal education?

Canberk Karakas: A big chunk of it is self-taught. After getting my BFA from Yeditepe University, I moved to Vancouver BC to study Animation & VFX at Vancouver Film School. I already knew quite a lot about 3D before heading out there, but I was fortunate enough to then get the opportunity to improve my skills further with professionals from a different industry, and to make meaningful connections.

The Interline: How should educational institutions that either focus on footwear or have dedicated footwear modules approach teaching 3D? Should it be part of the standard curriculum, to help prepare the next generation of designers and engineers for digital-native workflows, or is 3D still seen as a narrow specialisation in-industry, making it a better fit for elective courses?

FOOTWEAR IS ONE OF THOSE THINGS I COUNT TO BE MORE THAN A WEARABLE - IT'S ALMOST LIKE A HOUSEHOLD OBJECT THAT OCCUPIES SPACE AND DEMANDS ATTENTION.



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Staged and rendered in Twinmotion by Martin Krasemann.

Canberk Karakas: I strongly believe 3D should be taught if it's even slightly useful for whatever profession the school focuses on. It's the fastest way of actualising concepts, and allows the student to find out what their creative tendencies are. It opens different doors like animation, lighting, rendering and so on. These are incredibly valuable skills for a creative person to have, whatever discipline they then decide to get into.

I think 3D in general came a long way in the past couple of years - even more in fashion than in footwear, I'd argue, because brands and manufacturers worldwide are realising what 3D can do for their business. Not only design-to-production use cases, but across the spread of different ways that 3D Designers and the assets they create can help with marketing as well.

All of these skill sets and talent squeezed into a tight-knit team can honestly do wonders for this industry. Being educated on it isn't an absolute must, but I'm sure if institutions wanted to integrate 3D training into their curriculum, people would be more interested in learning it now that it's becoming such a heavily sought-after skill.

The Interline: And what about the existing footwear community? We know from interviews in last year's DPC Report that there's a major drive from big sports and lifestyle brands to start every new design in 3D. But footwear is also both an engineering-driven industry and one with a lot of deeply concentrated expertise that people (the seasoned "shoe dogs") acquired through hands-on work, and this could translate into inertia when it comes to building trust in 3D.

Canberk Karakas: It differs for each brand for sure, but 3D is already heavily used in the footwear industry, and that trust is being built. But I think it can get a bit more expressive, and that's where we're going to see more development.

Rather than only thinking of the product, why not think of the environment around the product in 3D as well? Why not strategise content and marketing in 3D? When photography first gained traction many years ago, painters were also questioning it. But obviously it didn't end painting, it ended up evolving it. So I'm very positive we're going to see the industry evolve in the hands of designers and engineers in 3D space, making use of each and every aspect it can offer to a business.

The Interline: Tell us what your hardware setup looks like. What operating system do you use? And what's sat on and around your desk?

Canberk Karakas: I'm running a desktop workstation on Windows with an NVIDIA GeForce RTX 3090 GPU and an Intel Core i9 12900K CPU, paired with the beautiful LG UltraFine Ergo Display. On and around my desk are usually a few pairs of shoes to quickly check a design choice, a few of my mom's hand-made miniature models, and Rizzoli's 'Jeff Staple - Not Just Sneakers' edition.

The Interline: As well as demonstrating different colourways, we're showcasing your work in two different ways across this year's report. One is using your personal workflow and pipeline, and the other is bringing your designs into Epic Games' TwinMotion, the intuitive frontend for real-time visualisation and contextual



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Staged and rendered in Twinmotion by Martin Krasemann.

storytelling in Unreal Engine. First tell us what your main workflow looks like, and what tools you used to concept, model, texture, and then create these renders.

Canberk Karakas: My typical workflow will usually start with rough sketches and then a 2D blueprint illustration of what I'm creating and what it will include. Once those are done, I'll jump on to Cinema4D for early concepting, explore measurements, form and silhouette.

Once the detailed modeling is done, I'll unwrap the model for fabrics and materials, to be textured in Substance Painter. Each project requires its own specifications, so the time in and between these softwares differs a lot depending on what I'm working on. After texturing, I'll kick start the Redshift Render engine and start the look development stage. Lighting plays a huge role in 3D. To help the viewer understand what they're looking at, I'll recreate a realistic-ish look & feel with a few stylistic touches here and there.

The Interline: What was the process, from your side, of exporting your designs for use in Unreal Engine? And how do you think this ease of interoperability should influence the way footwear companies think about the different use cases for their digital assets?

Canberk Karakas: I absolutely loved this part, as it basically required nothing special. Once the model and textures are ready to go, so is Unreal Engine and Twinmotion. It sure was exciting to see my design in a real-time environment. This, to me, is huge, because there are lots of things that can be done in real-time that can't be done with offline rendering and static images. Brand activations, interactive experiences and immersive environments. In this time and age, if there's one thing a brand should prioritise, it's their community, and Unreal Engine and Twinmotion are amazing tools for that - ways to create meaningful connections for their community via digital experiences.

The Interline: After exporting his designs, Canberk collaborated with Martin Krasemann, a Twinmotion Product Specialist at Epic Games. Martin used the Twinmotion toolset to demonstrate the flexibility of incorporating standard objects and materials into different real-time scenes, allowing him to showcase Canberk's designs in unique environments quickly and easily, so that creative ideas can be seen in context. Martin also set out to demonstrate how the fidelity gap between offline rendering and real-time rendering is closing. So we asked him what his process looked like, and what implications he thinks this onramp from 3D creation to real-time 3D storytelling has for how the footwear and fashion industries think about digital product creation.

Martin Krasemann: The process was pretty straightforward. I imported the shoe into Twinmotion in the FBX file format and started to apply all the materials created by Canberk.

One of Twinmotion's cool features is its templates, which anyone can use to quickly get started on a new project. There is actually a template dedicated to creating a packshot, so I used that as my starting



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Modeled, textured & rendered in Cinema 4D and Redshift.



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point. I quickly assigned materials simply by dragging and dropping them on to the various parts of the shoe, and then, using the preset camera views in the template, it took me just a couple of clicks to create the packshot covering all angles from the shoe.

The next step was to create the colour variants; again, it was a matter of minutes to create them within the same real-time scene.

The workshop scene is actually a Twinmotion scene one of my colleagues has been working on and that's planned to ship as a new Twinmotion template. We decided to use this scene on this project to test its quality and see what can Twinmotion achieve in a more in-context environment. Dropping the shoe variants into that new scene and doing all the shots took me just an hour or so. The ability to navigate in real time in the scene at that level of quality means it's really quick to position the camera and try many camera angles.

Working in a real-time environment like this is amazing for designers. Not only can you experiment with different materials and colourways and see the results instantly, but you can respond to feedback on the fly, right in front of stakeholders. And you can show them what the product would look like in any context, from the retail shelf to any indoor or outdoor environment. It's incredibly fun to be able to set the scene and tell any story you want so quickly and easily.

The Interline: Finally, Canberk, what's your perspective on how consumers and retailers feel about seeing renders rather than physical photography? Aside from homewares and automotive, the footwear and accessories sectors have probably pushed the furthest forward in showcasing their products using 3D assets in place of real product - especially in advertising and storytelling. But are eCommerce marketplaces set up to receive and showcase 3D objects? And are shoppers ready to make pretty fine-grained, subjective buying decisions based on those objects?

Canberk Karakas: This is just another beautiful usage of 3D. I think most eCommerce marketplaces have already integrated their own 3D solution or already worked with a provider, as the bigger chunk of shoppers prefer online shopping.

If not done accurately though, it might turn into an unpleasant experience for consumers, and most brands cannot afford that. This is what's going to push brands, and stress-test whether their systems, pipelines, and processes are up-to-date and open for further innovation.

3D is already pretty realistic, and now consumers can explore their products in 3D with their fingertips and make better-informed decisions around whether they'll like the product or not, across a lot of different subjective criteria. I see this as an investment made by both parties, both in time and money, and I think everyone would love to see more advanced and accurate versions of the products they're buying and selling.

I THINK EVERYONE WOULD LOVE TO SEE MORE ADVANCED AND ACCURATE VERSIONS OF THE PRODUCTS THEY'RE BUYING AND SELLING.



Designed by Canberk Karakas for The Interline.
Modeled, textured & rendered in Cinema 4D and Redshift.



Designed by Diane Wallinger, for The Interline.
Rendered in Blender, using Daz3D avatars.



DIANE WALLINGER

The Interline commissioned Diane Wallinger to create for our "Digital Fashion" category this year. Diane is a versatile (digital) fashion designer and Positive Fashion advocate with more than a decade of academic and professional experience spanning traditional, digital and sustainability in the fashion industry.

A graduate of Vogue College of Fashion and London College of Fashion, Diane has worked with renowned brands, including The Fabricant, on visionary digital fashion projects. Her expertise lies in combining creativity, innovation and technology to drive positive change in the industry.

Our team sat down with Diane - and some notable figures from CLO Virtual Fashion and Epic Games who have shared their own perspectives and, in Epic's case, supported Diane with their own skills - to look behind the curtain on her design, to understand her workflow, and to discuss how the puzzle pieces of digital fashion and digital product creation fit together.

The Interline: What was the inspiration behind your design for this year's report? What did you set out to convey, and how did you develop those ideas into the final look?

Diane Wallinger: Traditionally, fashion has always been influenced by external factors and I believe that digital fashion imagery has a similar ability to mirror or respond to the zeitgeist. We are going through troubled and uncertain times, and I wanted to reflect on a need to balance this out with comfortable clothing, protective layers and softening colours and materials. Sometimes braving a complex geo-political climate starts with putting on a comfy sweater and I think that even digital-only imagery can convey such feelings.

The Interline: While you worked in the "digital fashion" category, so there was less of an emphasis on producibility and more on form and expression, your design is still anchored in realistic materials. We all wanted to demonstrate that digitally designing garments to be physically worn, and designing garments that will only be worn digitally, have common foundations and share a lot of skills and tools - even if the intent and the endpoint are different. How do you think about that crossover between digital fashion and digital product creation?

Diane Wallinger: I see digital-only fashion as a natural follow-up of digital product creation (DPC). After all, once a product is digitised or digitally sampled, the sky - as in, the file size - is the limit. I wanted to use the opportunity of the report to show that a product prototyped digitally for production's sake can come to life with digital imagery like a physical sample would in a magazine editorial. And that stepping beyond pure digital product creation can have so much impact, so fast.

The Interline: What do you believe the use cases for purely digital fashion are today?

It's fair to say that we're not all wearing digital garments and accessories in online meetings the way some people predicted we would be. But some of us certainly are.

And it's equally valid to point out that NFTs didn't result in anything like the shake-up in the core principles of fashion ownership that was being touted a couple of years ago. But at the same time, fashion brands are continuing to collaborate on and sell digital items through videogame ecosystems - most recently demonstrated with the addition of the "kicks" footwear category to Fortnite, and Nike's initial drops in that space.

So digital fashion might not be what the initial hype said it was going to be, but it's clearly still something as a consumer market - as well as being its own frontier of creative expression. Where do you think it stands? And where does it go from here?

Diane Wallinger: I think that digital fashion currently sits in a fun, yet not totally comfortable place - something I also wanted to convey with my imagery. We passed the hype phase fuelled by COVID-19, the run to implementation has slowed down and brands seem to focus on carefully integrating digital fashion for production. This in itself is a good thing, but it doesn't leave much space for digital-only fashion, or at least less than a few years or months ago. However, I do think that digital fashion, notably in combination

with AI, has an amazing potential for creating tailored marketing content that can showcase the impact of a product in unmatched ways. And I'll keep pushing for this vision while waiting for a future of wearing a handful of physical garments made out of innovative fabrics for the sake of protection, and multiple statement digital pieces for adornment.

The Interline: How did you get started working in 3D? And what was the earliest trigger you can remember that prompted you to recognise the potential in creating digital fashion?

Diane Wallinger: I started learning CLO3D by myself during my Master in Fashion Futures at The London College of Fashion - the course gave me the space, time and context to begin my digital fashion journey. But the first trigger came much earlier, during my Bachelor's. I remember having to create a deck on the future of fashion and including a full slide on digital fashion - it seemed obvious that this would be part of the future of fashion. Funnily enough, what was on that slide at the time were pieces from The Fabricant's DEEP collection and I remember thinking the visuals felt so refreshing and new. Little did I know that a few years later, not only would digital fashion be my medium of choice, but I'd get to work for this incredible company I found so innovative and mysterious!

The Interline: What does your working environment look like today? What hardware and operating system do you work on? And what sits on top of and around your desk?

Diane Wallinger: I've recently returned to my home country - Switzerland - after six years of living abroad and one spent as a digital nomad travelling from Costa Rica to the Canary Islands. So, I'm settling into this new life phase and my desk is very representative of that - not to say messy.

I still work on my ASUS ROG Zephyrus laptop (which I love) because with the travelling a desktop PC wasn't an option. I have the G15 model, with an AMD Ryzen 9 5000 Series processor and an Nvidia RTX 3080 graphic card. It's already 3 years old but I'm glad I went for those high specs at the time, because it means I can still work with my laptop today. And I also bought the unit they had on display rather than customising and having one shipped, so it was a more sustainable and affordable purchase decision!

I've also scheduled a little winter clean-up for my desk, to shed the old and make space for the new. I've built up my digital designer "kit" over the years as I spent an increasing amount of time in front of my multiple screens - I think we've all realised the necessity of a comfortable workspace and I believe that's probably where work-life balance starts.

The Interline: In your experience, how far has the fashion industry really adjusted to working in 3D? It seems like shoppers are perhaps ready to buy digital assets, but they're also likely much closer to being ready to buy physical fashion based on seeing a digital representation of it. But in a good amount of cases, 3D initiatives and objects are still confined to design, development, and in-house review - and sometimes extended into B2B showrooms and retail selling. What do you think needs to happen for the wider community to reach the next level of trust and confidence in 3D, and take it further downstream?



Designed by Diane Wallinger, for The Interline.
Rendered in Blender, using Daz3D avatars.

Diane Wallinger: I'm a big advocate for the try-and-iterate process. I understand that brands might fear consumers' reaction to digital imagery used for physical purchases, but I think that the public is much more ready than we think and that it's worth a try. After all, isn't it less risky to showcase digital products or publish a digital campaign to collect shoppers' feedback, rather than producing thousands of pieces without asking if the public even likes them? Consumers make way bigger purchases, such as cars and houses, based on digital imagery, and I don't think that there is much difference between a retouched e-commerce image of a fashion product and a 90% accurate digital sample. If brands tried it and honestly asked their community for their feedback, I think that it would give them the confidence they lack to go big on using digital fashion externally.

The Interline: How much of your 3D skillset is self-taught, and how did you approach learning it?

Diane Wallinger: When I started learning 3D for fashion there were no digital fashion degrees, so in the beginning I learnt everything by myself, mostly with Youtube tutorials. I also reached out to people working in the fields, especially when I attempted using Cinema4D, because there were times when I didn't even know what to search for or which key terms to use. Then when I finished my Master's I joined The Fabricant, first as an intern and my learning speed sky-rocketed - I learnt so much, so fast and so well from basically the most pioneering artists and designers in the industry.

The Interline: As well as being a designer, you also teach. Do you think education and industry each have a clear understanding of what the other party wants from 3D? Is there a clear enough pathway from acquiring digital design skills in university to then landing a career in digital product creation? We often hear that brands are struggling to find talent in their design, development, and marketing teams, but we also hear that 3D fashion designers aren't able to find jobs. What's happening in the middle?

Diane Wallinger: I believe that there is a bit of "mismatching" happening right now. On one side, students aren't aware of what the brands are doing in 3D and which knowledge their future role might require - mostly because a lot of it is happening internally, as we touched on before. Additionally, it's hard to even search for an open role for a digital fashion position; as it's still a relatively new field, the vacant positions are advertised in a very inconsistent way, and it takes a lot of algorithm refining on LinkedIn to see relevant jobs. This might seem like a minor issue, but this actually leads to a lot of missed opportunities on both the hirer and applicant sides.

The Interline: The other lingering question for education is whether 3D skills should be taught as part of the core curriculum for fashion design students and fashion management students, or whether it should be an elective extra. What's your take on this?



Designed by Diane Wallinger, for The Interline.
Staged and rendered in Unreal Engine by Malachi Duncan.

Diane Wallinger: I think 3D skills should be taught as part of the traditional curriculum of fashion design and fashion management students - 100%. I don't see digital fashion as a distinct industry that would need its completely separate degree. Digital fashion is a software-powered technology initially invented to make physical fashion production more efficient, and in that sense, I believe that digital product creation and creative digital fashion practices for marketing should be integrated into traditional fashion curriculums. I teach on some courses where it's already the case, and it's incredibly rewarding to see the students click when they understand the potential of the technology and what it could do for the industry.

The Interline: One of the key reasons that Diane works in CLO is that she finds it fun and creatively liberating. Another is that she doesn't feel as though she is creating in a closed system; she values the ability to bring in materials from other sources, the option to use an array of plugins, and the confidence that her work is likely to be integrated into future applications. This is important for digital product creation, since digital representations of real garments have utility across the extended product lifecycle, but it's especially vital for digital-only fashion, where the final use case is still a moving target.

So we asked Alex Kim, Software Product Manager of CLO, how he sees digital fashion developing from here, and what it means to keep those doors open for creators.

Alex Kim: At CLO, we recognize that the future of digital fashion holds a wide range of possibilities, with new use cases constantly emerging. To stay ahead of this dynamic landscape, it is important to maintain CLO and Marvelous Designer as open systems. By doing so, we enable users to seamlessly integrate their creations with various tools, materials, and platforms, ensuring a flexible workflow that encourages creativity and innovation.

Our goal is to create a thriving ecosystem where users can seamlessly connect with various assets and technologies, going beyond just providing software. This approach ensures that creators enjoy streamlined workflows while having the flexibility to explore innovative opportunities without being limited by a closed system.

Creating this ecosystem means more than just facilitating the flow of data. It is about establishing a collaborative network that supports digital fashion at every stage. By enabling the smooth integration of assets and ideas across platforms, we help designers, brands, and creators bring their creations into diverse applications. This interconnected environment enables innovation and collaboration, empowering users to push boundaries and shape the future of digital design. At CLO, we are deeply committed to this vision, ensuring that our products are both adaptable and supportive of the growth within the digital fashion industry. This commitment ultimately benefits our users by enhancing their creative potential and providing innovative features.



Designed by Diane Wallinger, for The Interline.
Rendered in Blender, using Daz3D avatars.







The Interline: We're spotlighting your designs in two different ways: one using your own software pipeline and workflow, and the other taking advantage of the link between CLO and Unreal Engine to showcase how the same designs and the same materials can be used to tell the same story from different angles. Let's start with your own renders: tell us what tools and processes you used to create, pose, stage, and generate those final pixels.

Diane Wallinger: Like with all my projects, I started with a creative moodboard on Miro and some rapid silhouette sketches on my iPad. From then I moved into CLO to draft, develop and refine the look until completion. I currently use Daz3D to develop and pose my avatars, so once this was done I returned to CLO to pose and arrange the look in its "new shape". In parallel, I created my garments' textures in Adobe Substance Painter. Once the outfit was ready on one side, and the textures on the other, I exported everything to stage my scene in Blender. And some tweaking and rendering time later, we got our final images! When I think about it, it's a bit like cooking: prepping the ingredients, incorporating them together, letting it simmer - and then time to enjoy!

The Interline: What was the process from your side when it came to preparing your designs to be used in Unreal Engine? And what do you think this kind of interoperability between existing 3D solutions and real-time rendering engines and tools means for how fashion should be thinking about the utility of digital assets?

Diane Wallinger: Independently from the type and number of outcomes, the process is more or less the same until it's export time. Different 3D software has various mesh and texture requirements, so I had to generate different sets of textures for Unreal Engine than for my workflow in Blender. This might sound complex but it's actually not that hard if the requirements are set from the start. More importantly, this opens up the doors to a myriad of opportunities for the brands that have digitised their current and future collections. Ready to sell on pre-order? Not a problem. Want to launch your new range in a game? Totally. Thinking of a FOOH marketing campaign? Let's do it!

The Interline: Alongside completing her own workflow, Diane then collaborated with Malachi Duncan, a Technical Artist at Epic Games, who brought her design from CLO into Unreal Engine (UE) where he worked in real-time to further develop the look and the environment shown in the UE renders on these pages. We asked him to describe his inspiration, his process, and his workflow - and what it means for him for digital fashion to be able to move swiftly and fluidly from one tool and one environment to another.

Malachi Duncan: This environment was actually used for the CLO LiveSync video released earlier this year. At the start of that project I was inspired by the grandeur of the Château de Versailles. The design process started with gathering visual references from various palaces in similar styles to Versailles, which served as my guiding framework for modeling and texturing.

Designed by Diane Wallinger, for The Interline.
Staged and rendered in Unreal Engine by Malachi Duncan.

To work with this project I made a few adjustments, like removing pillars from the original piece to create a more open space. The ornate hallway became the perfect setting for a digital fashion shoot.

Once I had Diane's model, along with her textures and style references, the look development began in Unreal Engine. Starting with the base colors for her garments, I focused on refining material properties such as subsurface scattering and fuzzy shading. Unreal's substrate system provided the tools to fine-tune every detail, from sheen and specularity to opacity, ensuring the materials matched the creative vision.

Lighting came next, and it's always a crucial part of my workflow. I begin by turning the scene's saturation to grayscale, allowing me to focus purely on light intensity and positioning. Once the composition feels right, I reintroduce color and adjust light hues to complement the scene's tones. This process involves multiple experimental passes to build a mood and create a balanced, visually engaging image.

With the lighting and look development complete, I move on to rendering. Shifting from SRGB to ACEScg allows for more nuanced color grading, which I finalize in DaVinci Resolve. This step includes fine-tuning exposure, contrast, color balance, and saturation.

Digital fashion is a seamless blend of artistry and technology, relying on a suite of specialized software tools for tasks like asset creation, animation, rendering, and grading. Following a well-defined pipeline ensures that each step works in harmony, resulting in a polished, cohesive final product.

The Interline: Diane, your personal projects often get into the importance of human and environmental wellbeing in both physical and digital fashion. Everyone is obviously familiar with the idea that wearing something you like, or that flatters you, can translate into feeling good, but you believe the deeper potential for clothing to be part of holistic wellbeing hasn't had the same recognition. So whether it's the interaction between material innovation and skincare, or the casualisation of work attire, tell us where you see wellbeing and digital product creation intersecting in the near future.

Diane Wallinger: I believe in what I call Positive Fashion; creating fashion outcomes that look good, do good and feel good. Digital fashion is an integral part of that, as it contributes to a significantly more efficient and sustainable production process, which falls into the "do good" aspect.

Fashion notoriously has a (negative) impact on its workers and the environment, but I think that we underestimate the influence clothing has on the wearer - production-, shape-, colour- or material-wise. I truly believe that a holistically positive fashion system where garments are designed, produced, marketed and consumed with human and environmental well-being in mind - including the mindful integration of technology - could benefit every fashion stakeholder. It might sound utopian, but we have to set our hopes high if we want to make our industry move faster towards a better future!



Designed by Diane Wallinger, for The Interline.
Rendered in Blender, using Daz3D avatars.


cotton can
do better for the planet
Choose the fabric eco-conscious* consumers prefer. Cotton fiber is all natural and biodegrades faster than synthetics, helping keep microplastics out of our ecosphere. What will you create?
Get inspired at CottonWorks.com
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* Source: CCI & Cotton Incorporated's 2023 Global Lifestyle Monitor Survey.

DPC IS NOT DONE YET

MORE VALUE IS STILL TO COME FROM DPC STRATEGIES THROUGH CULTURAL AND PROCESS TRANSFORMATION - WITHOUT CHALLENGING THE CURRENT LIMITS OF THE SOLUTIONS. BUT THE BIG UNLOCKS AFTERWARDS WILL LIKELY NEED TO BE DRIVEN BY TECHNOLOGY.



BEN HANSON, EDITOR-IN-CHIEF THE INTERLINE

Ben has been a technology analyst for the fashion industry for 15 years. Day to day, he oversees The Interline's content, partnerships, and reports. He also hosts and speaks at industry events worldwide.



Digital product creation, on the whole, has delivered value.

Where that value is found, and how deep it runs, is variable company-by-company, product category by product category. But as three years' worth of DPC Reports from The Interline now attest: the businesses that have made a concerted effort to turn 3D into a cornerstone of their ways of working, and that have combined the right doses of talent, technology, and executive and end user buy-in, have realised the benefits.

And those single-company benefits have, over the last couple of years in particular, compounded into widespread DPC adoption. We validated this just last month in findings from the *Fashion & Technology In 2025* report we partnered with MMGNET to create, which showed that around 90% of fashion organisations have already implemented 3D / DPC strategies. Even though our audience tends to be more technologically-mature than the industry average, this result is consistent across all product categories and market tiers.

The benefits those companies have obtained from DPC, though, have largely kept coming in well-defined, individual areas. There are brands that have framed digital product creation as a design and development initiative, and have achieved success there. Some have made it a pillar of fit testing, or market testing, or supplier collaboration, or leaned into product configurators or creating final pixels for B2B and B2C selling. And most of those have seen potent but focused returns.

There are way fewer companies who have rolled out DPC - and most importantly the 3D assets it generates - to all those areas in a unified way. This is why phrases like "extending the value of digital assets" (see my colleague Emma's article on that topic in this very report!) and "scaling DPC strategies" have become so commonplace. As valuable as DPC initiatives have been, there's the widespread realisation that they could do more if more people, more departments, and more job roles were brought into their orbit.

I can point to the same MMGNET / The Interline research for another up-to-date litmus test here: a similar share of fashion professionals, around 90%, agree that 3D / DPC is going to deliver significant additional value in the near future. And my industry-insider read is that that extra value is primarily going to come from deploying digital tools, talent, and assets to serve new use cases and new ambitions, rather than going deeper into existing processes. Which is not to say that depth isn't a worthy pursuit - it is - but that breadth is likely to be what DPC needs to unlock the next stages of business transformation.

In last year's DPC Report, I set out to try and put a marker down for what should constitute "new" in those various contexts, describing what I thought could be the end state for digital product creation. I'll paraphrase myself: the ideal vision for having a digital representation of a physical product is that digital-native workflows across the extended product lifecycle will use that representation as their primary reference. From that, provided the representation is properly built and sufficiently interoperable, every creative and commercial choice that's currently made based on a physical prototype, sample, or finished product would then be confidently made based on the digital representation instead.

We are not, today, at that end state. While that manifesto is, I believe, still valid as a distant-but-reachable goalpost, what it doesn't address is where the road is going in the interim between here and there. And neither does it specify what's going to fuel the different legs of the journey.

WHY ARE WE, AS AN INDUSTRY, STANDING UP AND SCALING A SIGNIFICANT 3D FUNCTION IF MANY OF OUR ESSENTIAL DECISIONS STILL REQUIRE A 3D PRODUCT TO BE DOWN-CONVERTED TO A 2D REPRESENTATION SO THAT THE FULL RANGE OF JOB ROLES CAN INTERACT WITH IT?

You'll find a lot of answers to those open questions throughout this report: everybody from in-house brand experts to independent creatives to the founders of key DPC tech companies has their take on where things have progressed, where they've stalled, and what should happen next. That diversity of perspectives is why we continue to put these reports together, because these are the people driving transformation year-over-year - and many of them have been at it for a long time.

My perspective is probably a little different from the rest, if only because it comes from a fairly privileged vantage point. As I explained in my introduction, I've been a 3D / computer graphics enthusiast for most of my life, and today I'm lucky enough to spend a bunch of time talking to brands, technology companies, educators, analysts and more specifically about where 3D for fashion and footwear stands today, and where it should be headed tomorrow.

And if I roll up the conversations I've had in 2024, they lead me to three conclusions.

The first I've already set out above: **DPC has proven itself in a range of different disciplines and processes.** This does not automatically mean that every 3D or DPC initiative is guaranteed a return (you'll find different angles on this across our 2022, 2023, and 2024 DPC Reports) but it does mean that, on aggregate, DPC is working when companies approach it smartly and sensitively.

Second: we are now in an era of smaller, more measured technological and cultural steps that will make the existing 3D paradigm work better, but that will stop short of breaking down any bigger walls.

From a technical point of view, this will result in better simulation, better staging and rendering for virtual photography, greater interoperability, more standardisation, more flexibility in file formats and file sizes. And it will also lead towards the first notable steps in DPC-enabled collaboration, with a clear through-line from people working in 3D and relying on external means to share their outputs with colleagues, to different teams starting to use 3D assets as the anchorpoint for their decisions.



Designed by Canberk Karakas for The Interline.
Staged and rendered in Twinmotion by Martin Krasemann.

Culturally, this change in reference frame will lead to some steady growth in the DPC user community, some expansion in the use cases for digital assets, and progressively more creative and commercial choices being made based on the *output* of 3D tools, but not directly in 3D environments.

But as that extension happens, the conversation will more than likely switch to a related question: why are we, as an industry, standing up and scaling a significant 3D function if many of our essential decisions still require a 3D product to be down-converted to a 2D representation so that the full range of job roles can interact with it?

This is the third conclusion: **there is a difference between a fashion industry that builds products in 3D, then exports them in 2D formats so that people can experience and make choices based on them, and an industry where the 3D product and the act of interacting with - and making choices based on - it are also 3D-native.**

For this step-change to happen, the additive technological and cultural refinement I've already mentioned will also need to happen, but those two shifts are likely to need to be accompanied by a third one: a move into real-time 3D.

The scope of this change needs much more in the way of dissection than I have space for here, but the essence is this: rather than creating 3D assets and environments at one extreme end of the product lifecycle or the other (i.e. in design or in selling) and then exporting those things to flat images when their content and context needs to be communicated, a real-time pipeline would remove the need to step down from 3D to 2D.

This might sound like a minor distinction, but the practical implications could be profound. A product, after all, is made up of much more than what can be conveyed in a sketch or a photograph. This is the entire justification for designing, developing, simulating and visualising in 3D to begin with!

When we think about what that "end state" for DPC looks like, it becomes clearer that a lot of the broad spectrum of different creative and commercial decisions that need to be taken rely on data, contextual queues, and experiences that static 3D simply doesn't provide. And when we look to other industries that have previously undergone deep business transformations catalysed by 3D, we can see that a move towards real-time 3D is where business in general is headed, and that the business case for making that transition is strong.

To get a better grasp on that cross-industry perspective, I reached out to **Bill Clifford, VP and GM of Unreal Engine at Epic Games**:

"If you want to scale the use of 3D in digital design , you need to have a real-time strategy – it's the best way for designers and decision makers to stay aligned every step of the way. Teams need the ability to make iterative changes across entire product lines while contextualising their designs in photoreal environments, whether they be a forest, a tabletop, or a store. You can bring products to life, enable real-time multi-user collaboration, and make the design review process far more efficient by using real-time tools like Unreal Engine and Twinmotion. If your design team adopts a real-time 3D pipeline, you'll have high fidelity digital representations of your products that can also be leveraged in dynamic sales and marketing experiences. What starts with driving efficiency in the design process ends with immersive, rich digital customer experiences that drive sales and build brand loyalty."

While fashion can be - probably understandably - hung up on the idea of cross-media collaboration opportunities with Fortnite and other videogame / shared world properties, I asked for Bill's perspective here for different reasons.

One is that Unreal Engine has become pretty synonymous with the idea of real-time rendering - right the way from design to downstream experiences - across a range of different industries. Another is, as you will have seen if you're reading this article as part of the sequential order of stories in The DPC Report 2024, we drafted the broader Epic team in to help visualise our designers' work in the footwear and digital fashion categories this year - primarily to help demonstrate just how the results designers can obtain from traditional and real-time workflows are converging, and to spotlight the increasingly smooth pathway between 3D creation and 3D experience.



Finally, because of the scale of the business transformation that potentially lies ahead of fashion as the industry navigates the cultural and technological shifts that are on the way, The Interline will be collaborating with Epic Games in 2025 to help document what real-time 3D could mean specifically for fashion, and to chart a practical course for capitalising on its opportunities.

Because for fashion to get closer to that end state, and for the industry to unlock the next big reservoir of value from DPC, I now see that step-change to real-time 3D being critical.

REPRESENTING REAL PEOPLE IN A DIGITAL WORLD

FASHION TENDS TO TALK ABOUT DIGITAL MODELS AND AVATARS AS AN EXCLUSIVELY TECHNOLOGY INITIATIVE, OR A ROUGH EDGE TO BE SMOOTHED AWAY BY AI. BUT HUMAN MODELS AND THEIR ADVOCATES ARE ALREADY GEARING UP TO MAKE PEOPLE A CORNERSTONE OF THE INDUSTRY'S DIGITAL FUTURE.



JONNY SYDES, CO-FOUNDER THE BUREAU AGENCY

Jonny co-founded The Bureau Agency in 2010 with his business partner Norv Bell. The agency supports established and startup brands with fitting, showroom, and photographic models. Recently, Jonny has led The Bureau's move into the digital space, exploring how models can transition from physical to digital environments, positioning the agency at the forefront of innovation in the modelling industry.



The Bureau Agency

As the Co-Founder of a modelling agency, my team and I have been closely monitoring how 3D technology (and more recently, AI) is intersecting with our world as it becomes progressively more embedded in how the wider fashion industry works.

It's easy to think of model agencies as static entities, but my first-hand experience is very different. As a category and as an individual company, we've always embraced technological advancements, whether that's through straightforward functions like 360-degree view website tools or newer experiences like augmented reality model cards.

And one area that has continually intrigued us is body scanning technology. Over the years, we've explored its potential, including a successful integration in 2019 with a 3D foot scanner, a small but significant 'step' in testing this innovative space. As readers of The Interline know, though, 3D and digital product creation adoption has continued picking up pace since then, and now we're working to answer a more pressing question: how can our models play an integral role in this exciting and evolving landscape?

BUILDING GENERATIVE ON TOP OF GENUINE.

There is a paradox at the centre of the generative AI movement - especially where it crosses over with 3D digital product creation.

The more advanced our AI systems become, the more vital the human element proves to be. While algorithms can produce avatars with flawless symmetry and porcelain-like skin textures, they often fail to capture the depth and imperfection of real human experiences. More often than not, they stumble into the uncanny valley, where something feels subtly off, leaving them just shy of truly convincing.



The Bureau x Sample & Hold

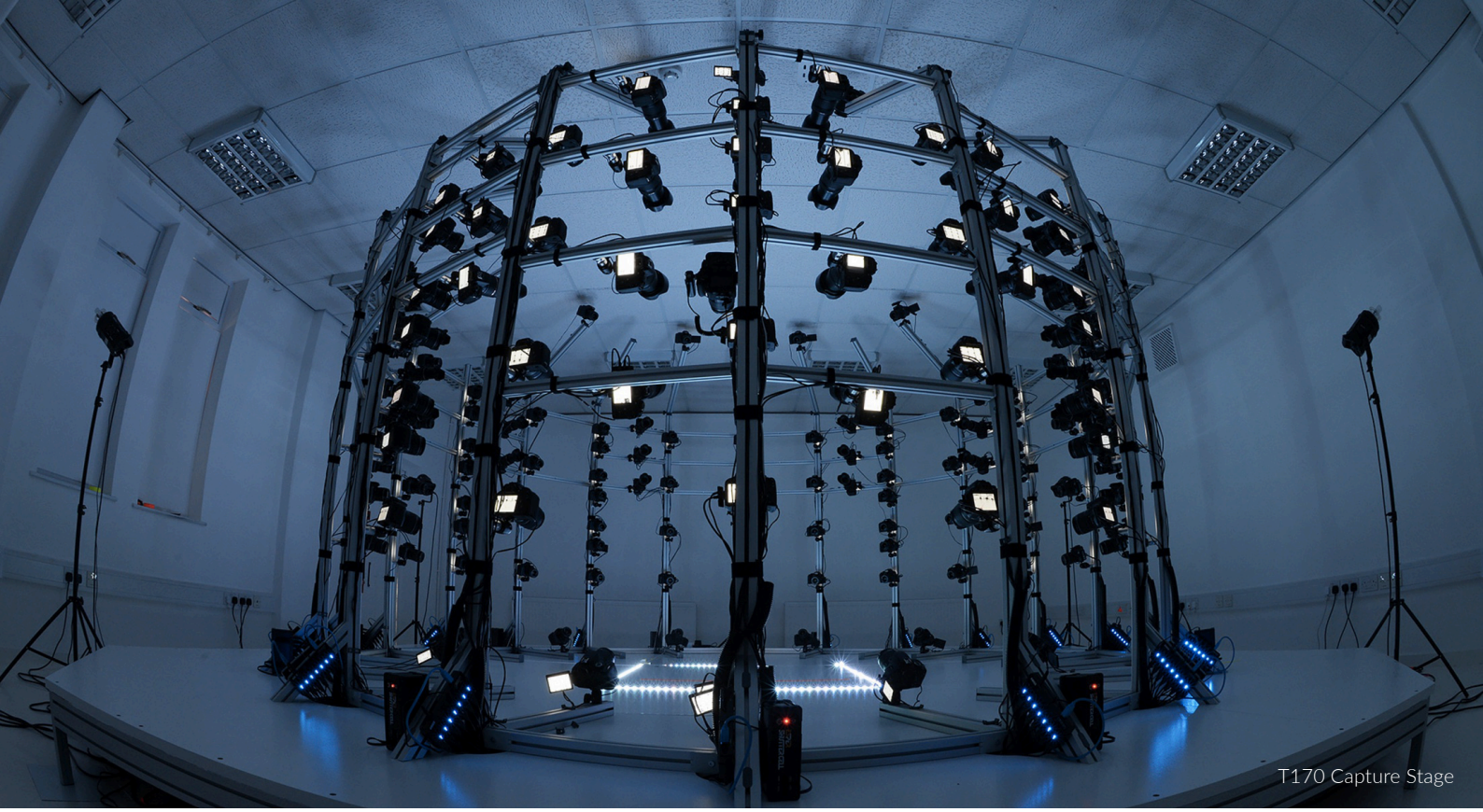
There are undoubtedly strong use cases for designing and fitting garments in 3D, and then enhancing the output with AI. But if the industry is going to avoid a slow tilt towards homogenisation - where every photoshoot and every campaign start to look like part of the same whole, we think human models are not relics of a bygone era but critical players in shaping a more authentic and inclusive digital future.

Generative AI has dazzled industries with its capacity to create text, images, and video, but beneath the sparkle lies a fundamental flaw of large, general purpose models: bias. These models rely on human-generated prompts and datasets that often skew toward societal ideals of perfection. Even when programmed to simulate "imperfections," the results feel curated: gap-toothed smiles or faint scars rendered as aesthetic choices rather than reflections of lived stories. This sanitised portrayal often fails to capture the layered histories that human models bring with them naturally.

Authenticity, whether through body language, nuanced expressions, or cultural depth, is a quality that, right now, no general dataset can replicate. This, alongside current technical limitations, is why we have seen backlash to campaigns that put generated models front and centre. Even when people are not told that photography or videography is AI-generated, or even when they put their feelings about AI to one side, the results are still not landing.

This gap underscores the pressing need to integrate real human models into digital campaigns from the start. They bring relatability, grounding the potential of 3D and AI in the reality of human diversity. They offer a way to have the benefits of streamlined design, development, and fitting with 3D, and the possibilities of staging realistic, authentic campaigns without booking a single location or pressing a single physical camera shutter.

> THERE IS A PRADOX AT THE CENTRE OF THE GENERATIVE AI MOVEMENT – ESPECIALLY WHERE IT CROSSES OVER WITH 3D DIGITAL PRODUCT CREATION.



T170 Capture Stage

This is something I believe, obviously, but it's also something that needs to be supported through actual results. So to start preparing our own models, and the wider industry, for what we think is coming next, we set out to build to a set of hyper-realistic avatars of selected models, which can be integrated into fashion campaigns. The costs for these avatars vary depending on the level of look development required and the intended use, but each of them represents the digitisation of a real human being and a real human story.

We believe this approach offers brands the opportunity to achieve significant cost savings compared to traditional shoots, while retaining the beauty and authenticity of featuring real people—now with limitless possibilities in the digital world.

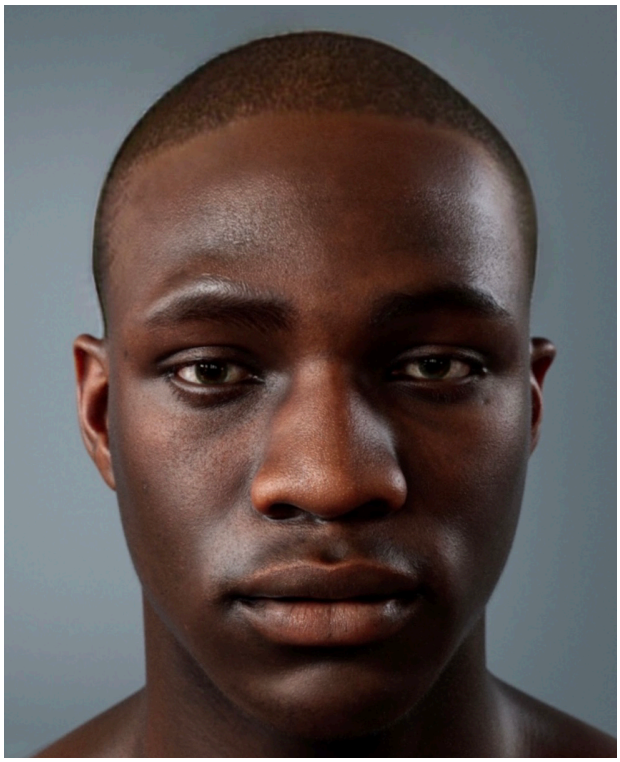
ADDING A HUMAN FACE TO THE DPC ECOSYSTEM.

The rise of platforms like Optitex, Clo3D, Browzwear, and more recently Style3D has come a long way to realising the potential of a digital-native fashion industry, enabling brands to prototype and market their designs in record time, and unlocking the ability for every in-house brand user to make virtually any creative choice based on a 3D representation of a garment, a piece of footwear, or an accessory.

Yet the role of human models within these platforms remains underdeveloped. The design and simulation tools themselves have settled on avatars that are utilitarian rather than aiming for human realism. And external providers of digital models have tended to target one extreme or the other between scientific fit and photorealism, without any really landing in the sweet spot in the middle.

But there are strong arguments for incorporating real people into 3D and DPC workflows: hyper-realistic virtual fittings, avatars informed by diverse body types, and campaigns that resonate deeply with either broad or extremely granular consumer demographics. This integration isn't just about representation, it's also about innovation. Human models can lend their data, measurements, facial scans, and movements to create avatars that embody authenticity while retaining the adaptability of 3D avatars, and the flexibility and cost benefits of AI.

This hybrid approach marries the best of both worlds, offering both creative flexibility and emotional depth. Recognising this opportunity, we've also set out to build strong partnerships with leading 3D platforms, rigorously testing our avatars to ensure seamless compatibility.



The Bureau x Sample & Hold

To add further weight to this assessment, we've also followed those models as they are used, and watched them unlock greater efficiencies across the extended value chain chain. By capturing a model's biometric data and likeness through advanced photogrammetry and proprietary processing techniques, we've also stress-tested how integrating real-life models into a brand's workflow can significantly reduce the need for physical samples, ultimately helping brands lower their carbon footprint.

ETHICAL AND PRACTICAL CHALLENGES

As encouraging as our results have been, though, , the opportunity to bridge the benefits of 3D and AI with the authenticity of real people comes with challenges. The inclusion of real human data in digital ecosystems raises significant ethical questions about privacy and security. Sensitive biometric data has to be safeguarded, encrypted, and / or anonymised to protect the models contributing to these systems.

And the biggest question the industry must address is the fairness of compensation, and what structure will be used to govern royalties or usage fees, ensuring that models who are scanned once (or a small number of times, as technology advances) benefit from the ongoing use of their likeness in perpetuity.

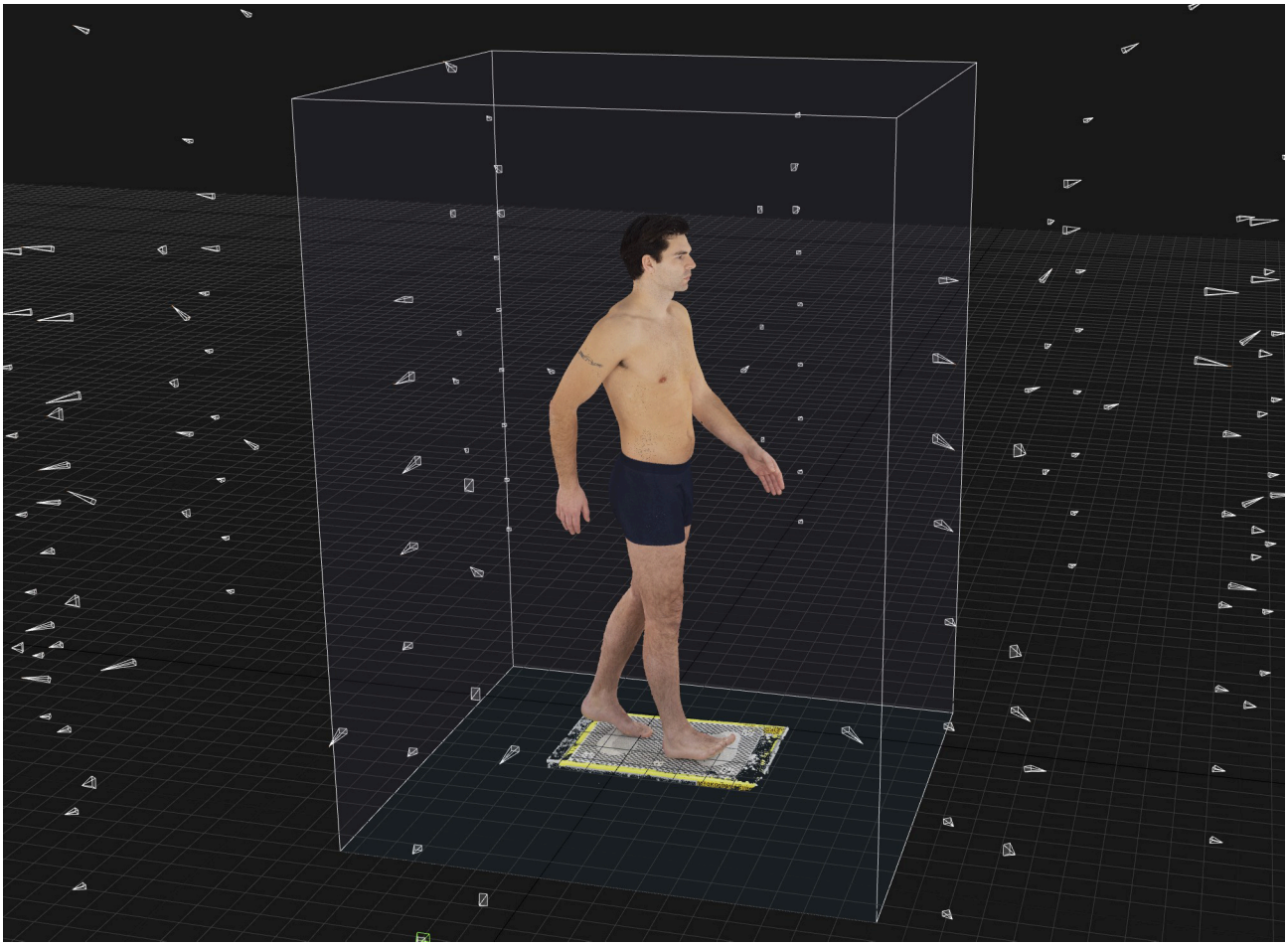
Without these safeguards, the integration of human models risks becoming exploitative rather than collaborative. A robust framework of regulations and best practices is going to be crucial to maintaining trust and encouraging participation.

This area has required significant time and development on our part, as we navigate the complexities of managing models' data in a fast-changing digital landscape. With legislation varying across regions, crafting contracts to safeguard the use of our models' digital twins has not been straightforward.. Beyond the contracts, we've also needed to establish a bulletproof framework to protect our models' data. All files are encrypted and restricted from being exported or shared outside the 3D design platforms. Additionally, we've needed to implement systems to monitor avatar usage, ensuring that our models are fairly compensated wherever their likenesses are used.

This is, I believe, work that needed to be done by an entity with direct, extensive experience in advocating for, protecting, and promoting the value of human models. The contracts that this future will require hinge on technology, interoperability, and encryption, but they have their roots in non-technological principles like fairness, ethics, and inclusivity.

CASE STUDIES IN CONTRAST: VICTORIA BECKHAM AND DOVE

While most segments of fashion are forging ahead with DPC strategies, with a lot of brands targeting majority digital prototyping, sampling, and advertising within this decade, the industry still stands at a crossroads when it comes to determining how people will be incorporated into those strategies. And the addition of AI into DPC workflows has now brought those two paths into stark relief.



The Bureau Agency

> I FIRMLY BELIEVE IN THE MIDDLE PATH: INCORPORATING REAL MODELS INTO A 3D ENVIRONMENT BRIDGE THE GAP, OFFERING THE BEST OF BOTH WORLDS.

Victoria Beckham's recent AI-infused campaign for the Dorian Bag offers a compelling example of what's possible when digital creativity pushes boundaries. Her team blended AI-generated imagery with traditional photography to create a surreal, cinematic allure. While visually striking, campaigns like this can feel untethered from human reality, more fantasy than connection.

In contrast, Dove has drawn a line in the sand, eschewing AI-generated models to celebrate real, diverse bodies. Their commitment to authenticity resonated deeply in a world increasingly saturated with digital perfection.

I firmly believe in the middle path: incorporating real models into a 3D environment bridges the gap, offering the best of both worlds, authentic connection and innovative digital integration.

TOWARD A HYBRID FUTURE

We feel the path forward is neither purely digital nor solely human but an intersection of the two. By combining the speed and scalability of 3D visualisation and generative AI with the authenticity of human models, brands can craft experiences that are both innovative and relatable. This approach not only enhances consumer trust but also positions human models as indispensable contributors to the future of digital creation.

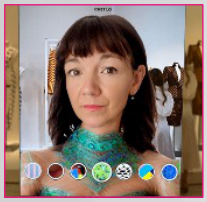
At The Bureau, our goal is to keep building that bridge, helping fashion realise (and put into practice) the truth that human beings should be not just represented but celebrated in the digital age.



The Bureau x FIA x Luke Edwardson.

FASHION'S SWISS ARMY KNIFE: MAKING YOUR DIGITAL ASSETS WORK HARDER

IF FASHION IS COMMITTED TO REALISING THE EXTENDED POTENTIAL OF DIGITAL ASSETS, THE INDUSTRY NEEDS A CLEARER MAP OF WHERE THAT POTENTIAL LIVES, AND A BETTER TAXONOMY FOR HOW TO TALK ABOUT IT.



KARINNA GRANT
EDUCATOR, INNOVATOR AND ENTREPRENEUR

Karinna Grant is an Educator, Innovator and Entrepreneur. She is a published author and speaker, previously consulting and lecturing globally on retail innovation and digital transformation within fashion. In 2019 she created HOT:SECOND a circular economy concept store trading physical goods for digital experiences. In 2020 she co-founded THE DEMATERIALISED a poly chain experiential marketspace for fashion NFTs. In 2023 she gave a TED Talk entitled 'What's the Point of Digital Fashion'.



BETHAN ALEXANDER
LONDON COLLEGE OF FASHION

Bethan Alexander is Reader in Fashion Retailing and Marketing and Research Lead at Fashion Business School, London College of Fashion, University of the Arts, London. Bethan's scholarly research interests span Multi-Sensory Fashion Retailing, Customer Experiences Online and Offline, Innovative Retail Formats, Retail technologies and Future Retailing. Results of this research have been published in various academic journals and books in the fashion, retail, marketing and business disciplines.



RAKEE CHEN AND PHYGITALTWIN

Market size predictions for Digital Fashion (DF) and Digital Product Creation (DPC) by 2030 range considerably: from the conservative - $4.8 billion (Allied Research 2023) to the ridiculous (?!) - $50 billion (Business of Fashion 2021; Kumar 2023).

There's a lot packed into both extremes of the valuation spectrum, from 3D design and simulation software, to digital assets as standalone value items.

However you parse them, though, these figures clearly signal a market belief. But beyond the analysts' predictions, people on the ground will tell you that DF and DPC are currently in a strange space. Neither is totally niche, but they are not yet mainstream either - although it's certainly the case that DPC is more widely adopted and more clearly-understood than digital fashion.

There are a few reasons for this. Post-pandemic necessity-based adoption has slowed, Tech/marketing/innovation budgets are consistently challenged due to environmental conditions, and don't get us started on the leadership and mindset requirements for digital transformation. But as fashion asks itself some big questions about what it wants to accomplish with digital workflows and 3D assets, we see two clear things the industry would benefit from:

- Clarifying the relationship between DF and DPC terminology
- Illustrating, categorising, and communicating the range of roles that DF assets can play

The terms DF and DPC are often (incorrectly) used interchangeably, and they also differ considerably between academic and industry publications. We know the team at The Interline has its own ways of demarcating these fields, but as two people who've spent a huge amount of time working in them, we think it could be time to introduce another acronym, Digital Product Management (DPM), as an overarching umbrella term.

<table>
<tr><th colspan="3">Digital Product Management (DPM)</th></tr>
<tr><td>Digital Product Creation (DPC) encompassing 3D design</td><td>Digital Asset Management (DAM)</td><td>Digital Fashion as an End Product (DF)</td></tr>
</table>

Diagram 1. Categories of Digital Product Management

Historically definitions of "3D" have focused on just the DPC aspect - honing in on it as a process and on the specific technologies involved to improve garment design and production processes for retailers and brands that sell physical goods.

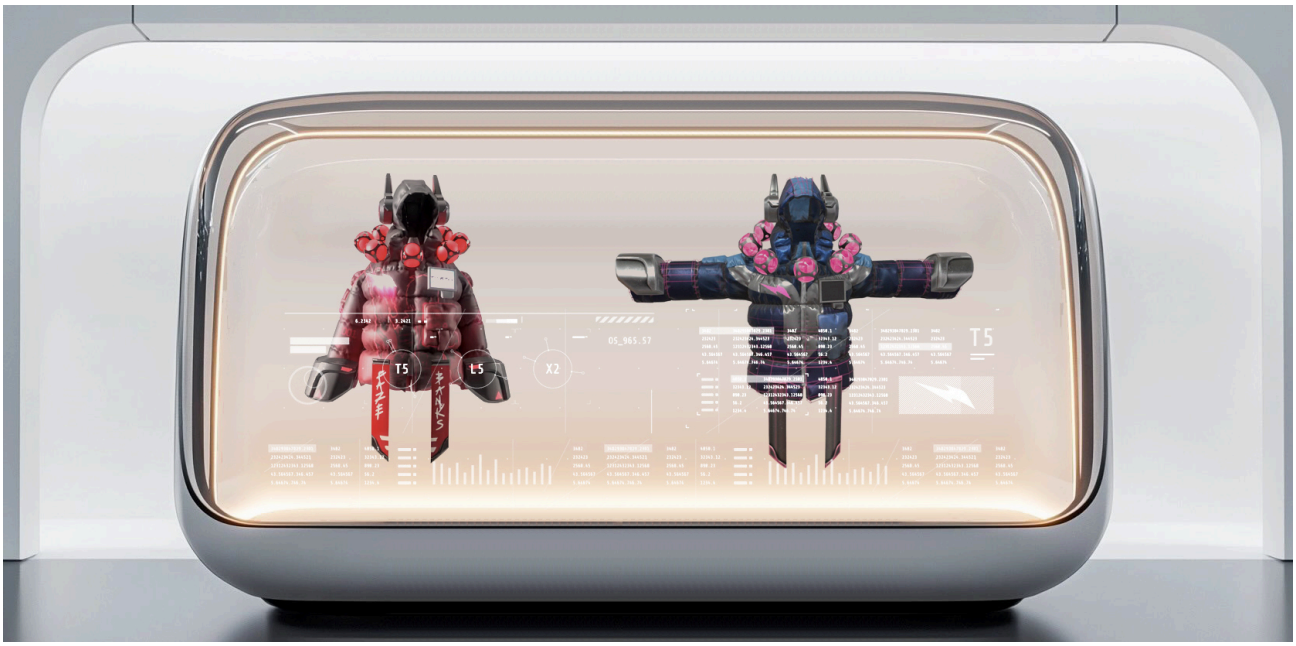
But as wide as the DPC umbrella spreads - covering core 3D tools as well as the extended ecosystem built around them - it's becoming progressively clearer that 3D pipelines and the digital items they create are not just tools, but also end products. People are keen to dismiss this part as being a quirk of the fashion NFT boom of 2020, but behind that over simplistic categorisation lies the reality that digital objects - and particularly digital shoes and clothing - are being sold by some of the biggest brands in the world today.

So we see a need to unify several discrete things: the proven use cases for digital product creation in design and development; the emerging use cases for digital assets in marketing, virtual photography, and virtual production (necessitating a more inclusive approach to Digital Asset Management); and the shifting space that is digital-only fashion.

And we believe the right mindset to bring those things together is to conceive of the combination of those things as being the realm of Digital Product Management.

But where does the Swiss Army Knife analogy come in, we hear you ask? Well, from our experience and research within fashion, DF, DAM, and DPC are still too often seen and treated as isolated activities, 'belonging' only to singular teams like design or marketing. Not only that, but despite the fact that digital assets offer multiple value-adding roles and functions they are often only really 'used' for one function, by one team, on one occasion.

This is two things: a wasted opportunity and a primary contributor to the looming idea that companies who have wrung a lot of value out of their "3D" strategies in design and development have reached the limits of the return on that investment in technology and talent. The ideal situation is completely the opposite: to realise their true value, any digital product file must have multiple lives both within the business and beyond. This makes the best commercial, environmental and experiential sense, even if it does beckon some difficult questions around interoperability, integration, and the incentives of the different fashion stakeholders.



NILS ELLIS

In order to demonstrate this potential, we created a DPM matrix with 15 distinct roles that a digital asset can play, supporting an array of different job functions within fashion. This has emerged from secondary research, personal experience and has also been sense-checked with more than a dozen experts from within the sector. It is not intended to be an exhaustive list of what a digital fashion asset can do, but rather a current snapshot of just how far the value potential of digital assets can be stretched without also needing to stretch the toolset used to create them too far beyond its current limits.

The horizontal axis of the grouping below highlights its role as a tool versus as an end product. This was determined by whether it could have a revenue stream assigned to it and therefore a potential discrete vertical. The vertical axis illustrates where in the value chain it adds value, i.e. in the supply chain or in the demand chain.

	Tool	End Product
Supply Chain Function	**1.** **DIGITAL PRODUCT CREATION (DPC)** **MADE-TO-ORDER (MTO) / ON DEMAND MANUFACTURING (ODM)**	**2.** **MASS CUSTOMISATION** **DIGITAL PRODUCT PASSPORT (DPP) CONTENT**
Demand Chain Function	**3.** **VIRTUAL TRY ON (VTO)** **WARDROBE OPTIMISATION SOFTWARE (WOS)** **B2B SHOWROOMS** **AR FILTERS** **MARKETING CONTENT** **XR EXPERIENCES** **MINI-GAME CONTENT**	**4.** **GAMING COSMETICS/SKINS** **PHYGITALS** **NFTS** **AI DRESSING**

Diagram 2. Digital Product Management (DPM) Matrix



RAKEE CHEN AND PHYGITAL TWIN



RAKEE CHEN AND PHYGITAL TWIN

> "IT'S BECOMING PROGRESSIVELY CLEARER THAT 3D PIPELINES AND THE DIGITAL ITEMS THEY CREATE ARE NOT JUST TOOLS, BUT ALSO END PRODUCTS.

SEGMENT 1: TOOL / SUPPLY CHAIN FUNCTION

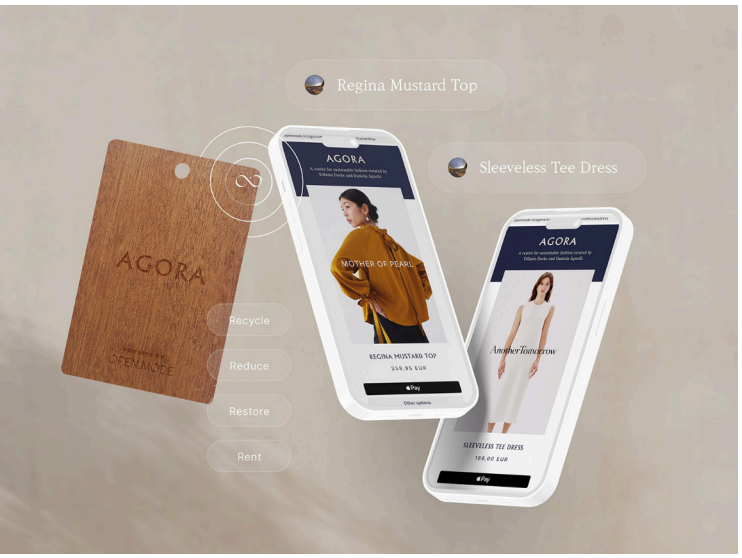
This segment includes Digital Product Creation (DPC) and Made to Order/On Demand Manufacturing (MTO/ODM). DPC is undoubtedly one of the most significant types of DPM in terms of both usage and adoption. Primarily because it holds many functions within it from CAD/3D design, to virtual patterns, prototyping and sampling and is also considered to be the most well established; existing since the 1980's (Sayem 2022; Navneet 2024).

MTO/ODM is increasingly becoming more desirable (and achievable at scale) as the problems of overproduction continue to plague the industry and the planet. Here, DF assets can be used to underwrite demand before being physically produced, moving from a push to a pull approach. This means that lead times and fabric commitment decisions are made more efficiently and closer to market, which is financially critical for directional or trend led businesses.

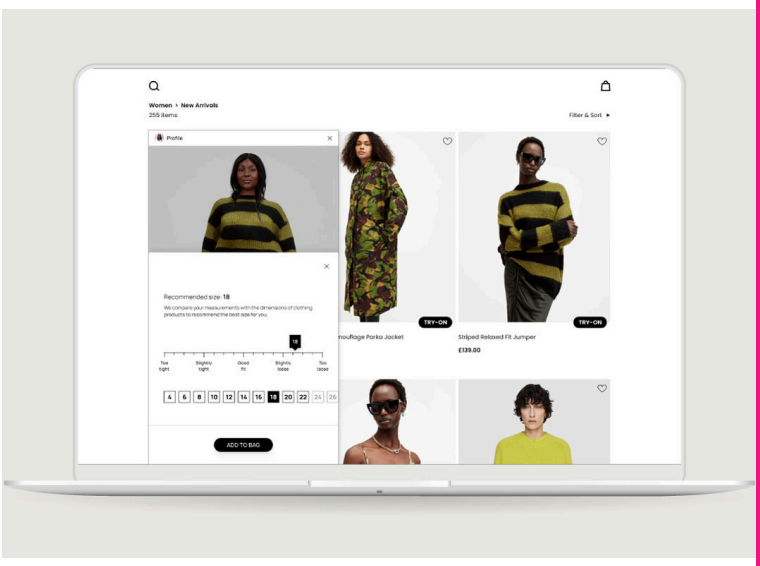
SEGMENT 2: END PRODUCT / SUPPLY CHAIN FUNCTION

Mass customisation refers to using a DF asset on an ecommerce page or instore hardware unit and allowing it to be personalised or customised in some manner. This can range from classic monogramming to more complex product configurators. The output of the personalisation is visualised to the end customer in real time as a 3D fashion asset which aids decision making and can improve the customer experience. This can have a premium price attached to it or it can be complimentary but generally can be considered as an end product.

Digital Product Passport Content (DPP) is very new and is commanding much attention because of the EU's policy that by 2027 all European manufactured garments must include a DPP documenting its provenance and material composition (Spicher et al. 2024). The directive has been introduced to improve the possibilities for an easier circular economy for fashion garments (Lawler 2024). Experts suggest that this will take the form of a Near Field Communication (NFC) or QR code which will contain the metadata (key information) of the item, meaning that attaching images or files and a 3D version of the item as an identifier is possible (Boston Consulting Group 2023). At the luxury market level there is considerable opportunity to go beyond the regulatory requirements to story-tell the provenance of the item in an immersive way.



DPP BY OPEN.MODE INNOVATIONS LTD



VTO BY ZYLER

SEGMENT 3: TOOL / DEMAND CHAIN FUNCTION

This segment contains the DPM roles which involve the end customer. With Virtual Try Ons (VTO) DF assets can be used within AR try on experiences and/or can be composited on a photograph of a consumer using machine learning/artificial intelligence (AI) software. Wardrobe Optimisation Software (WOS) is a relatively new application of DF assets involving the creation of a digital twin (usually via scanning) of the items in a consumer's wardrobe so they can be catalogued and learned by AI software to record usage, recommend repairs and future outfits. See Whering, Save my Wardrobe and Indyx as examples. Business-to-Business (B2B) Showrooms refers to the use of DF assets on brand websites or virtual wholesale environments; this is mostly adopted by larger scale retail brands to streamline the selling process for its wholesale buyers.

The next four types of DPM are linked to the marketing functions: Augmented Reality (AR) filters, Marketing content, Extended reality (XR) experiences and Mini game content, involve the use of DF assets as part of a brand's engagement strategy, to convey its brand identity and promote new collection or products. Each offers diverse, experiential and emotional ways for a consumer to interact with a brand touchpoint. AR filters enable try-on experiences, portal style experiences or 3D product versions. Marketing content can range from CGI (Computer Generated Imagery) social media content to anamorphic billboards and hologram window displays. XR experiences encompass immersive digital experiences designed for new hardware like the Apple Vision Pro, to more simplistic experiences like PR activations or product placement inside video games.

SEGMENT 4: END PRODUCT / DEMAND CHAIN FUNCTION

The final segment are all verticals that attract their own revenue stream potential. These include Gaming cosmetic/skins, arguably the other most established use case for DF assets, given virtual items have been available for purchase inside games and virtual worlds since the 2000's. Games and their players have long since understood the value of intangible items. The estimated market value for virtual fashion goods in-game ranges from $40bn to $50bn (Tashjian 2021). The scale of demand is increasing year on year, for example in Roblox alone, 1.6 billion virtual fashion items were purchased in 2023 (Roblox 2024). Phygitals refers to products which are composed of both a digital and and physical version aka a twin and were catapulted to mainstream attention by RTFKT in 2021 with their $7 million dollar sneaker collaboration with Fewocious (Nowill 2021).



FASHION INNOVATION AGENCY X
LONDON COLLEGE OF FASHION, UAL

Non-Fungible Tokens (NFTs) could also be considered as having a supply chain function because much like the goal of the DPP, a NFT is aligned to a blockchain system which transparently records the metadata about the item, which is a utilitarian function. The final category is AI dressing which refers to when a DF asset is composited onto a static or moving image of an end customer. DF Marketplace DressX uses this as the primary reason to ask customers to buy DF and the dressing experience is either included in the price of the garment purchase or also there is a free service offered via their AI platform.

That is, we admit, a lot of labels. But it's this precise multi-functional nature of digital tools, digital assets, and the workflows and communities built around them that make it all worthy of the Swiss Army Knife designation!

As educators and entrepreneurs, we certainly love a good acronym, but we also see that shared understandings have the best chance of furthering the adoption of this innovative technology for the greater good - and we see just how far-ranging that good has the potential to be, wherever you stand on the DF, DPC, or DPM continuum.

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THE STRATEGIC VALUE OF DIGITAL ASSETS

FACED WITH AN UNPREDICTABLE OUTLOOK, FASHION BUSINESSES THAT HAVE ADOPTED - OR EVEN EXPERIMENTED WITH 3D AND DPC - COULD BE SITTING ON VALUABLE PIECES OF A SOLUTION TO THE INDUSTRY'S MOST ACUTE CHALLENGES.



EMMA FELDNER-BUSZTIN,
NEWS & FEATURES EDITOR,
THE INTERLINE

Emma Feldner-Busztin writes about how technology is shaping our world and how global trends and patterns will impact the fashion industry. She currently serves as The Interline's News and Features Editor.





Last month, MMGNET and **The Interline** compiled surveys of over 160 fashion businesses into *Fashion & Technology in 2025*. That forward-looking report revealed that the most critical challenge for fashion businesses in the year ahead is maintaining profitability and protecting margins - a fundamental business concern that, on the surface, doesn't have a whole lot to do with digital product creation.

The squeeze goes like this: as consumers demand more value for money, brands and retailers are under increasing pressure to refine their products, optimise the speed with which they make it to market, and adjust pricing strategies and channel allocations to maximise the chances of selling them through without marking them down. This challenge is being amplified by the harsh economic realities of the past two years, including interest rates surpassing the period before the 2008 financial crisis levels and sustained inflation driving up prices across the board. These economic pressures have weakened consumer purchasing power, limited discretionary spending across various categories, and raised costs for raw materials, logistics, and other essentials vital to the fashion supply chain.

So far, so general. But this also prompts the question: how can fashion address the intertwined challenges of efficiency, supply chain disruptions, product-market fit, and risk that ultimately impact profitability and define their ability to meet capricious consumer demand? Is there a single strategic tidal push that can raise all those boats at once?

There might be. The same survey from MMGNET and The Interline also revealed (in a separate datapoint that nonetheless shows correlation) that 3D and digital product creation were both the most popular of three strategic investment pillars for 2025 - beating out spend on AI and sustainability technology - and also the area that had attracted the most investment to date, with close to 90% of fashion businesses either having already trialled DPC initiatives, or having them in-scope for the coming year.

Thanks to that large-scale adoption, and taking account of some self-selection bias given that The Interline's audience skews towards tech-forward brands, the average fashion company is potentially sitting on a lot of different parts of a solution - elements such as 3D body scans, avatars and digital material captures. But even though the continuous exchange of digital assets and information in other formats - tech specs, moodboards and so on - has become a cornerstone of communication, internally and with external partners, far fewer fashion professionals seem to feel the same way about 3D representations of finished products or their constituent parts.

So while many fashion brands are using 3D assets for marketing, e-commerce, and social media, or - on the flipside - for technical development, few are using the same assets through the bulk of the product development lifecycle.

Or, to put it a bit more simply, fashion, on average, is only making limited use of the assets and tools it has at its disposal.

Consider a brand that uses 3D only for internal visualisation. Their deployment is, technically speaking, a success - but the same company is also leaving on the table the possibility of doing consumer product testing before making final decisions on line plans, and achieving shorter lead times to ensure products better match what consumers want to buy. They're also passing on the possibilities of doing virtual try-on for improved customer experience.

STRATEGIC CLARITY AND HIGH OPERATIONAL CONNECTIVITY

To be clear, the emphasis here is on achieving the full potential of technology because much of the fashion industry is already on board with the use of technology in their business operations. MMGNET and **The Interline's** research has shown that north of 90% of fashion professionals believe technology is essential or quite important to the effective operation of their business today, and will be for the future progress of the industry.

And this is an opinion shared by senior leaders in the DPC space within fashion brands.

"To really make the most of DPC assets, companies need to take a more holistic approach," **Johnny Mejia, Lead of Digital Product Creation and Visualisation at Champion** told me. "In my 10 years of experience, I have seen companies only look at DPC as a fragmented approach to solving specific initiatives, for instance DPC only for e-comm, only for early prototypes, etc. As a result, the vision and the collaboration across all functions gets lost and DPC can suffer the fate of being a 'nice to have'."

How to avoid this fate? The short answer: building out an end-to-end digital workflow. "Before companies commit to incorporating DPC, there must be a unified business strategy, that means using 3D/DPC at every stage of product development," continues Mejia. "[There also needs to be] adequate investment, an understanding of technological integration needs, and most importantly an understanding and willingness by partners and stakeholders to embrace 3D technology as a tool for creativity rather than a barrier."

But while the potential use cases of digital assets are incredibly broad, there is still a major hurdle when it comes to interoperability and how well the format and purpose of individual objects aligns with practical needs.

This issue affects internal department collaboration as well as supply chain partners - where challenges include centralising and providing live access to product data, a lack of visibility and accountability due to communications occurring outside of established systems, and difficulty aligning different stakeholders around a unified schedule.

There are also instances where manufacturers and material suppliers that have adopted technology strategies find that their brand and retail counterparts are either unprepared or unwilling to adopt similar approaches - and vice versa. A common example is when a supply chain partner has invested in a particular 3D simulation/ visualisation technology for creating accurate virtual samples - only for brand customers to continue requesting multiple rounds of physical samples.

This leads to a common fork in the road: the need to determine the use case for a digital asset before creating it, or at the very least before building the different types of scaffolding that will support it.

Thoughts from **Dominic Sluiter**, whose career includes almost a decade working in 3D/DPC at Nike, co-founding STITCH 3D (a digital fashion startup backed by PVH Corp), and co-founding **EnhanceThat** - a





M.O.T The Label



M.O.T The Label

company that works with fashion companies to simplify and optimise their 3D/DPC workflows. “Choosing between speed and quality is crucial because each path requires a different setup, investment, and set of priorities. Clear priorities and fewer distractions are what drive the most impactful DPC strategies.”

INVESTING IN TECHNOLOGY MEANS INVESTING IN PEOPLE

“For companies to invest in the implementation of 3D tools as a part of their digital transformation, they also need to invest in their people,” J**anette Cox, VP Digital Product Creation and Technical Design at High Life LLC** told me. “The change involved in using 3D tools is immense and overwhelming for all, as it often [comes] on top of day jobs and meeting deadlines.”

Cox explained that while her colleagues appreciate the concept and value the results of incorporating digital tools into their roles, they often feel uncertain about where to begin. This makes it easier for them to stick with traditional methods because adding 3D to their already full workload feels like another task.

“People need ‘white space’ carved out of their schedules to train, learn and engage,” Cox says. “I have seen very positive results when this is achieved: not only do you start to reap the benefits of seeing change using 3D tools, you also start to see an enthused and newly energised team due to the investment made in them. This investment will enable you to scale your digital journey.”

Success, from this vantage point, is also not about acquiring the latest technology - it’s about choosing the right tools. The technology chosen by fashion businesses should support strategy closely and result in demonstrable wins - making it easier for people to get on board. By focusing on integrating and automating the tools already in use, companies can keep users engaged and make the best out of the workflows in place.

SETTING UP A SOLID DIGITAL INFRASTRUCTURE

To maximise potential, I recommend staying laser-focused on your goals,” says Sluiter. He also swears by brands laying the right digital foundation in advance, rather than working backwards from a finished asset and attempting to figure out where it can add value. “With every team I work with, we spend the most time building the foundation, after answering the big questions about priorities and balancing speed versus quality.”

Part of this foundation includes building libraries for everything - stitched up base designs, modular blocks, materials, trims, avatars. Everything that can save time and promote consistency in the design process. “In today's fashion industry, speed is essential. The more you standardise and define upfront, the faster and more consistent your workflows will be,” Sluiter continues. Another essential component is designing smooth and agile workflows, as these define success with the users and therefore the overall business and digital ecosystem. It’s also not only about optimising the work itself, but about minimising the time it takes to learn the new 3D workflow. Once this is in hand, inviting leadership teams from all departments for a hands-on experience is a worthwhile investment. DPC strategies can transform the entire company, and it needs buy-in from every link of the value chain.

A brand that feels like it’s getting this all right is *M.O.T The Label*, a Lagos-based ready-to-wear fashion brand that specialises in affordable, functional and fashionable pieces for women around the world. Founder Mo Agusto launched the brand in 2019 after “noticing a gap in the market for brands that cater specifically to black and brown women, especially ones like herself who have unconventional body proportions” M.O.T. The Label’s website details. At the heart of their operations is an innovative on-demand production model that allows the company to provide a seamless and instant direct-to-consumer experience, while minimising waste. Their operations also have a key component of that digital foundation: libraries.

Omobolanle Adeosun, Product Development Lead at M.O.T The Label told me that M.O.T is building a centralised library of 3D/DPC assets as well as equipping their team with the necessary skills for product development and to build out technology solutions for their team, external partners, and their customers. And one of their key motivations is minimising waste as well as faster time to market. “Distance is no longer a barrier or cause for delay, as samples no longer need to be physically shipped,” Adeosun explains.

MEASURING PROGRESS TO ACCELERATE SUCCESS

The final piece of the puzzle for fashion businesses to use digital assets to their full potential and for them to reap the benefits in doing so: all sides of the fashion value chain must demonstrate a mutual understanding and a shared vision for what constitutes business-wide progress.

“For example, if your goal is to speed up design, measure your baseline and show how every change improves it,” says Sluiter. “This approach matters because the journey is long, and you’ll face waves of frustration and resistance. The proof you gather - data showing progress toward your goals - is the wind in your sails. Without it, you risk being steered by feelings and frustrations rather than staying on course.”

Cox is in agreement: “Ensure you have senior leadership sponsorship and a clearly defined roadmap denoting what success looks like. Sharing this with your entire team is critical so that everyone understands the journey and is updated regularly. This investment will expedite your implementation in 3D technology ensuring your goals and initiatives are achieved by all.”



M.O.T The Label

ENABLING INNOVATION: HUGO BOSS' TRAINING APPROACH TO DIGITAL CREATION



SEBASTIAN BERG,
VICE PRESIDENT BUSINESS OPERATIONS EXCELLENCE,
HUGO BOSS

A technology enthusiast, Sebastian Berg has been instrumental in placing HUGO BOSS at the forefront of the fashion industry's digital transformation. He oversees the company's digital creation processes, and his teams are responsible for a 3D community of more than 400 people within HUGO BOSS. Building on his expertise in digital fashion design and product creation processes, he established the 3D Experience and Immersive Technologies team at HUGO BOSS.

In the dynamic world of fashion, staying ahead is about more than creativity – it also requires innovation and strategic foresight. At HUGO BOSS, this imperative led us to adopt a comprehensive training approach for digital product creation, which prepares our workforce for the future.

In line with our Global HR strategy, our training programme is designed to make every team and role digitally ready, with a particular focus on mastering 3D technology. By integrating advanced digital tools into our product creation process, we increase efficiency and foster a culture of continuous learning and innovation.

Our 360° training offering is tailored to the diverse needs of our colleagues: Whether it's a designer refining their 3D sketching skills, or a pattern maker using a new pattern shape to inform further decisions – our training programme offers personalised learning paths for different roles and skill levels.



We use a mix of on-site training, online video calls and self-paced e-learning. This practical mix ensures that each user can choose the training they need and easily fit it into their daily work schedule. In addition to training, we have added specific materials and 3D guidelines to ensure that everyone is working to the same quality standards.

To achieve this, we decided two years ago to move from a decentralised, on-the-job training model to full-time, dedicated 3D style simulation and fabric digitisation trainers who are fully focused on sharing the best and latest 3D functionality with all users. They also support everyone with regular on-the-job support and Q&A sessions to maintain close contact.

At HUGO BOSS, one of our central HR principles is that investing in the development of our employees is key. Our commitment to digital product creation training not only enhances the skills of our team but also strengthens our commitment to innovation and excellence. By fostering a dynamic learning environment, we ensure that our people are not just participants in the digital revolution, but pioneers leading the way.



All images: HUGO BOSS

THE PERSISTENT BUSINESS CASE FOR REPLACING *PHYSICAL SAMPLES* IN FASHION *FOOTWEAR*

A HUGE AMOUNT OF INNOVATION AND ENGINEERING GOES INTO CREATING NEW FOOTWEAR PLATFORMS. BUT THE "FASHION" COMPONENT OF FUTURE ITERATIONS ON THOSE PLATFORMS CAN BE RESPONSIBLE FOR SIGNIFICANT AMOUNTS OF WASTE AND INEFFICIENCY. VIRTUAL SAMPLES, DESPITE BEING THE MOST WELL-WORN USE CASE FOR DPC, COULD BE THE SOLUTION.

DUO Design Studio





EMILY STEINKE,
CO-FOUNDER
DUO DESIGN STUDIO

Emily is a footwear designer and co-founder of DUO Design Studio, with over 10 years of experience in the footwear industry. At DUO, she focuses on providing brands with digital alternatives to reduce pre-production waste while offering tools to leverage these digital assets across e-commerce and marketing channels.

Every year, the fashion footwear industry produces an estimated 14 billion[1] pairs of shoes—and generates millions of wasted samples in the process. Despite this staggering environmental cost, the design and development lifecycle of fashion footwear - which we define as being footwear designed for fashion purposes rather than athletic or outdoor performance - has remained largely unchanged for the past two decades, even as technical and process innovation has changed how engineering and platform development operates.

As a result, other sectors of the footwear industry, such as performance footwear, have been able to position themselves at the forefront of innovation where 3D and DPC are concerned, fashion footwear has fallen behind the curve, relying on outdated practices. These inefficient systems exacerbate material waste, water consumption, and carbon emissions - all of which are variables that the sector is either already being held to account for in line with sustainability regulations, or will soon be.

The tools to modernise, though, have been available for years. Digital sampling, in particular, has proven its ability to revolutionize the way footwear collections are designed and developed. It offers the potential to drastically reduce waste, streamline processes, and drive profitability. Yet, despite its longstanding presence in the industry (virtual sampling has become so synonymous with 3D that other sectors see it as something approaching table stake), many footwear brands continue to resist fully integrating virtual methods into their workflows, relying instead on traditional practices that are increasingly misaligned with the demands of a sustainable and efficient future - all in the name of designers and merchandising and sales teams feeling the need to continue touching physical samples before making any concrete decisions.

SUSTAINABILITY IS NO LONGER OPTIONAL. FASHION FOOTWEAR NEEDS TO KEEP PACE.

To meet the global demand for footwear, around 26 million[1] physical samples are created annually. On average, 13 samples are required to finalize just one shoe, with most of these having no practical end use, resulting in significant waste. By integrating digital samples into the development process, brands can reduce their reliance on physical samples in unnecessary areas such as colourway changes, simple material swaps, and other iterations that take place on top of already-proven platforms. These re-colours and material swaps can, at the scale the industry conducts them, account for a quarter or even half of a fashion footwear collection - and every re-detail currently requires its own physical sample.





As well as the impact of creating those samples (which is measured in time, cost, materials and resources) currently, physical samples are often shipped in sets to multiple different locations so that team members—both domestic and international—can review them. This system comes at a tremendous environmental cost. Flights alone emit an estimated 397 billion[2] tons of CO_2 annually from shipping, with additional emissions generated through ground transport.

Digital sampling has the potential to cut these flights, dramatically reducing the industry's carbon footprint. Beyond emissions, the pre-production process consumes substantial material and water resources, further amplifying the environmental toll. The cost to our planet is undeniable, and digital solutions offer a clear pathway to a more sustainable future.

This is, as we have already seen, one of the key levers that other product categories have already used to justify investment in 3D, as well as one of the most important metrics that have been used to judge the return on that investment - having both an environmental and a pronounced efficiency effect.

DIGITAL SAMPLING LEADS TO DIGITAL TRANSFORMATION - PROVIDED TRUST IS IN PLACE.

More than just addressing the planetary impact, by integrating digital sampling, footwear brands have the chance to significantly reduce development timelines and respond more effectively to evolving market dynamics - providing their teams are able to build trust in digital assets, and provided cultural transformation, and a willingness to challenge established product timelines, are allowed to take root. In an industry where products are often finalized nearly a year before reaching consumers, this approach can help fuel agility, and shorten the window between a trend and a finished product - allowing brands to incorporate near-time market data and consumer analytics to design collections that are both precise and profitable.



A recent McKinsey report identified reducing speed to market as one of the top three strategic priorities for 55%[3] of companies, alongside improving demand forecasting and increasing digital presence—objectives that digital sampling directly addresses. By optimizing workflows and ensuring designs are closely aligned with consumer needs, digital sampling positions brands to remain competitive in a fast-paced, data-driven marketplace.

OVERCOMING RESISTANCE THROUGH EXTENDED USE CASES

So, with all this potential stacked on one side of the equation, why hasn't the footwear industry embraced virtual sampling for fashion products more completely? The simplest answer is inertia: industry leaders feel secure in the traditional process of reviewing collections by physically touching and holding samples—a sense of familiarity and control that has defined the operations of leading brands for decades. And for many of those brands - especially in the sneaker sector - the last few years have been some of their most profitable in a long time. Why change a system that, from an internal vantage point at least, is working?

Developers also raise concerns about transitioning factories to digital workflows, reasoning that if designers are creating in 3D but manufacturers are not set up the same way, then can digital samples actually shorten the average footwear lifecycle? While these objections are often valid, the footwear industry is seeing a similar push to the apparel industry, where brands, manufacturers, and their technology partners are working to more tightly integrate 3D modelling and 2D pattern drafting to try and ensure that the design-to-production process flows more seamlessly.

But to help overcome some of that inertia, it will be important for footwear brands to realise the potential benefits of virtual samples and 3D representations of that extend beyond the design phase, and into omnichannel e-commerce and marketing - where they can stand in for physical samples and physical products in a range of applications.

E-COMMERCE

- Photorealistic Visuals: Digital samples enable the creation of high-resolution product photography, including 360° views, eliminating the need for physical photo and model samples. Many brands currently order up to six pairs of physical samples for these purposes—a significant waste that digital sampling can eliminate.

- **Pre-Orders and Demand Forecasting:** With digital samples, brands can launch pre-order campaigns to gauge consumer demand before committing to production, reducing waste and aligning inventory with market needs. Brands can also tease products on social media using digital visuals to analyze consumer interest and refine designs before launch.

- **Virtual Try-On Tools:** AR-powered virtual try-on tools build consumer confidence, reduce purchase barriers, and significantly boost conversion rates. While this innovation is often associated with performance footwear, it's time for the fashion footwear sector to embrace this technology to connect with tech-savvy, digital-native consumers.

MARKETING

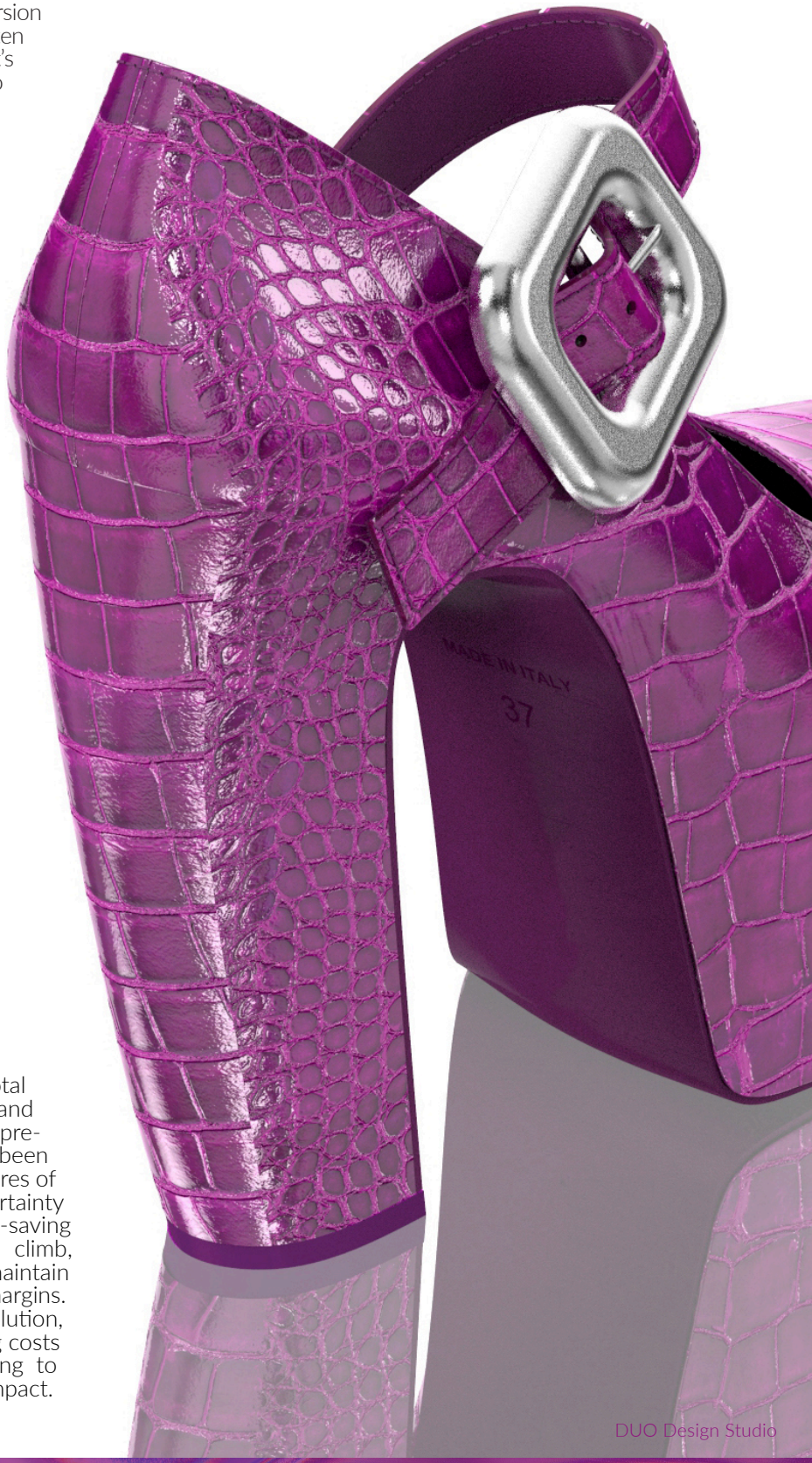
- **Dynamic Digital Content:** Brands like Jacquemus have leveraged 3D digital content to create iconic and innovative campaigns, showcasing a fresh, creative side of their identity. These efforts foster deeper consumer connections and position the brand as forward-thinking.

- **Virtual Showrooms:** Brands like Diesel are using virtual showrooms to present their collections, offering immersive and accessible experiences that increase customer reach. These digital spaces allow brands to engage with their online communities meaningfully, fostering a sense of connection and belonging.

As consumers increasingly expect brands to build authentic online communities, it's proving critical for companies to invest in their digital presence - something that can be done as a corollary benefit of creating digital twins of physical products to streamline their design, development, sampling, and production phases

CONCLUSION: THE FUTURE IS DIGITAL

The fashion footwear industry is at a pivotal moment. The environmental, economic, and operational challenges of traditional pre-production processes have always been unsustainable, but now the increasing pressures of production costs, tariffs, and economic uncertainty have created an urgent need for cost-saving strategies. As development expenses climb, footwear brands are striving to maintain competitive pricing while protecting their margins. Digital sampling presents a compelling solution, cutting both sample production and shipping costs by over 60%[1] at the same time as working to minimise waste and reduce environmental impact.



DUO Design Studio

SOURCES

1. DUO Design Studio. DUO Design Studio is currently collaborating with Colorado State University to expand on and publish these findings

2. MIT.edu, DUO Design Studio. DUO Design Studio is currently collaborating with Colorado State University to expand on and publish these findings. Based upon the average annual design cycle of 4 seasons per year, 50 styles per season, 3 SKUs per style

3. McKinsey & Co

MAKING DPC WORK FOR DESIGNERS

EVEN THE CLEAREST, MOST COMPELLING STRATEGIC VISION FOR DIGITAL PRODUCT CREATION RELIES ON THE DESIGN COMMUNITY FOR EXECUTION. EXPERIENCE TELLS US THERE ARE SOME PROVEN WAYS TO SECURE CREATIVES' SUPPORT.



ELIZABETH REEDS, INDEPENDENT CONSULTANT

Elizabeth Reeds is an experienced strategy and operations leader who is highly effective at change management. She pivoted from fashion design to digital transformation at Gap Inc where she unlocked value and drove sustainable new ways of working for Old Navy's design team. She is particularly passionate about unlocking frictionless data flow in the supply chain to benefit working teams and the final customer.

Fashion, an industry that is obsessed with the new, has been surprisingly slow to move to novel ways of working. Digital Product Creation (DPC), though, is heralded as an almost magic step-change in the way we design and develop our products. For an industry that can be so averse to advancing its processes, it's important to remember that when it comes to DPC, the end of the journey is not a mirage.

In practice, though, everyone who has started on this path has discovered the expedition was tougher than promised. The primary impetus for digital transformation is usually the cost and time savings that will be realised, but actually unlocking them isn't always a straight shot: success requires thoughtful long range plans, significant resource commitment, and steady leadership support. And shifting priorities can alter the map as it's being traversed.

Are designers just "extra", or is digital transformation just extra hard for designers?

Preparing for the transformation potential of DPC means acknowledging that different functions will require different amounts of effort and support along the way. It's a whole-business journey in the longer term, but one that needs to be walked in shorter segments where varying sets of people are shouldering the heaviest burdens at different times.

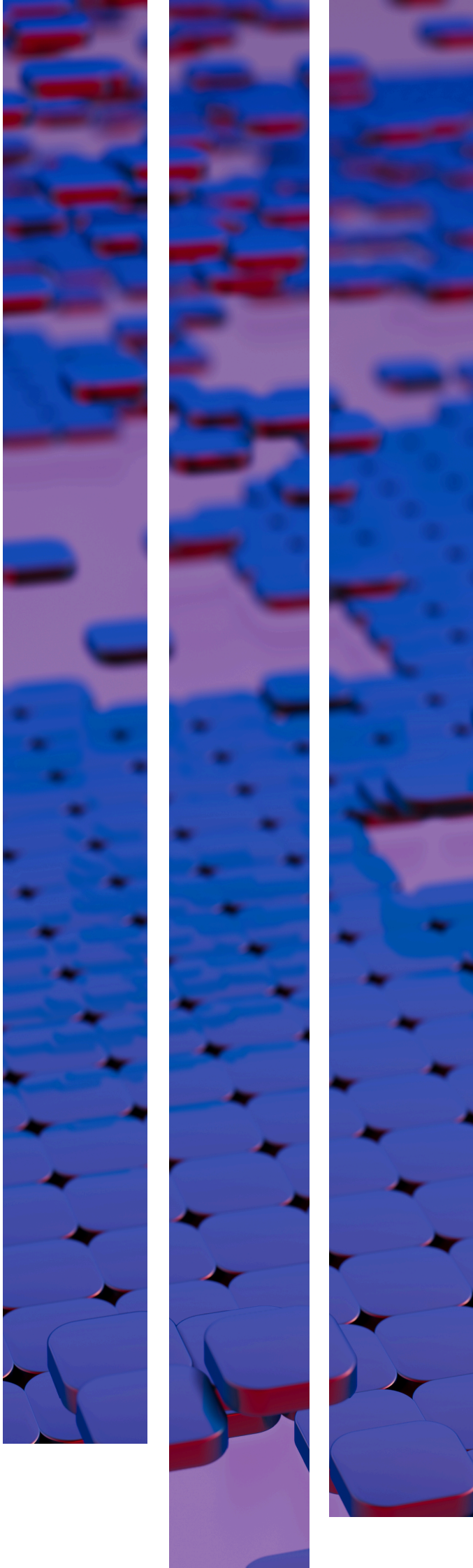
For tech designers and fit technicians, garment patterns and how they form 3D shapes is intrinsic to their remit, so digital pattern manipulation is an extension of their daily work. Nonetheless, acquiring fluency in 3D tools still requires significant time and effort on their part; traditional technical skills do not automatically translate into technology skills. For merchandisers, seeing data in multiple arrays is equally familiar, but being able to visualise their line instantly from multiple perspectives requires a new visual tool and potentially a slightly different mindset.

For designers in particular, the learning curve can be very steep and arduous. The shift from 2D ways of working to 3D requires both a conceptual shift on their part and the time to acquire (or for newer graduates refresh) complex technical skills.

Drawing is generally designers' rapid iteration tool of choice, but drawing in fashion is not the same discipline as drafting in engineering-focused industries. Hand sketches or vector drawings do not have the construction accuracy of 3D designs, and there has traditionally been a line (albeit a sometimes-blurry one) drawn between creative and technical designers.

Before a design can be created in 3D, designers need to have figured out which block to start with – a degree of precision they can postpone with 2D sketching. The aesthetic fit intent of a design might shift multiple times in the design development process: in 2D designing, the same sketch can merely be labelled differently (skinny fit to slim fit, say), while in 3D, each fit type is likely to require a new 3D style. That is to say, 3D designing requires designers to resolve many questions and a level of detail earlier than in 2D ways of working.

Additionally, for designers who are expected to design directly in 3D, they are asked to understand and manipulate patterns and virtually sew – muscles they might not have used since fashion school, if ever. These shifts in ways of working need to be accounted for in all DPC planning - and they lie at the root of many of the misaligned expectations we hear about between strategic DPC sponsors and end users.





Put Design Leaders' Oxygen Masks on First

Design leaders are an additional consideration. These lighthouses provide the inspiration for the collection and communicate storytelling as it evolves through outfitting. All planning has to take those dual creative and managerial responsibilities into account from the very start of the DPC journey.

In my research for this story, a Senior Design Director at a leading European fashion brand told me how their corporate DPC initiatives faltered, in part, by overlooking this point. What started as a reasonable plan to reduce the number of physical samples for wholesale showrooms, ended up petering out because:

- The outfitting process is iterative and creative. This is how design leads communicate key fashion ideas to buyers and the final customer. Even in a world of unlimited physical samples, the outfits are fine-tuned and perfected. When physical sampling was reduced to just the planned key looks as part of their DPC initiative, the ability to "zhuzh" and replace one garment for another ended up having a detrimental impact on the wholesale business.

- Moreover, these top-of-the-pyramid fashion ideas did not always execute well in 3D. The magic of specific trend fabrics did not show up effectively digitally. When viewed scaled down on computer screens, key textures and artwork looked pixelated, which further undermined confidence and eroded people's trust that what they saw in 3D was representative of reality. (Material digitisation and development is also its own under-recognised part of any successful DPC initiative!)

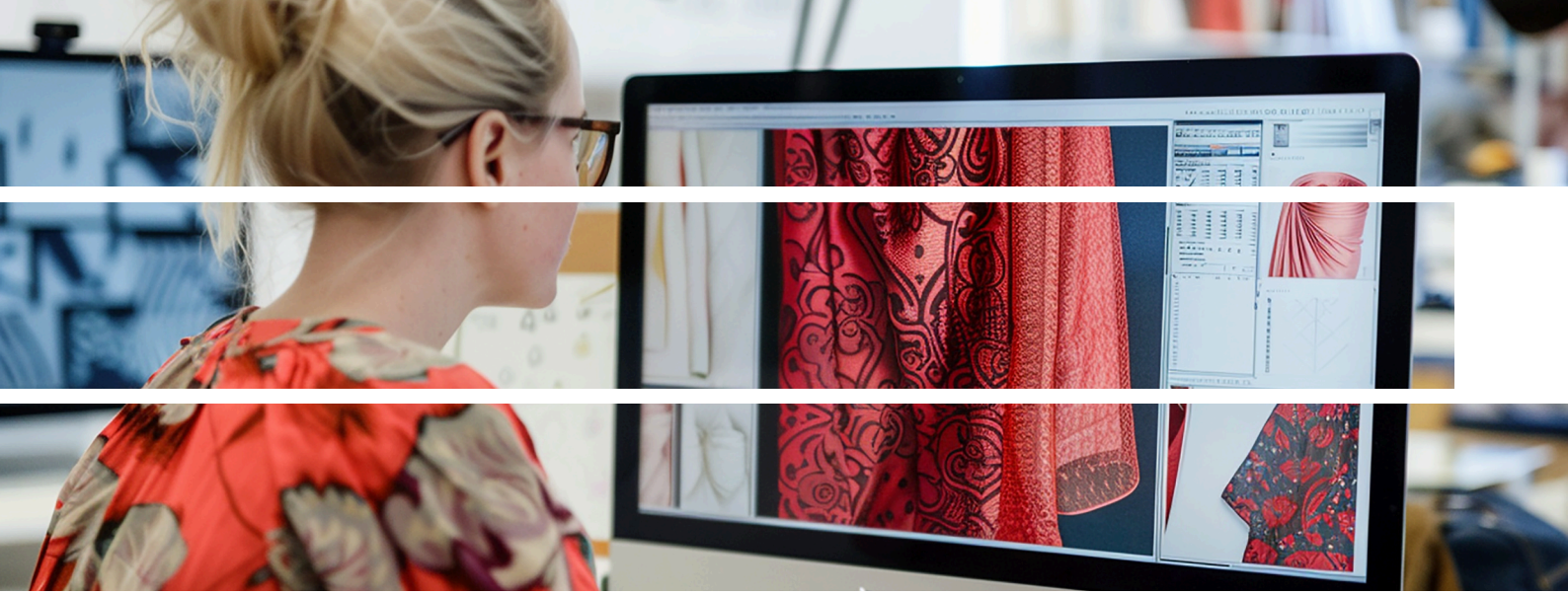
- To make matters worse, 3D sampling pipeline challenges meant essential styles sometimes were not even available in 3D. Nor were resources devoted to helping facilitate 3D outfitting.

In short, an essential creative function was kneecapped by insufficient DPC planning from the start, as well as technical and process limitations. And I'm sure almost everyone reading this report can imagine a similar set of circumstances playing out at other brands.

The key lesson: even if the challenge of resolving digital outfitting cannot be solved easily, it is imperative to address design leadership challenges and work to solve the problems they face with urgency.

Design-Specific DPC Change Management

As challenging as it is to implement and connect new technologies and streamline processes, convincing people is often the most difficult part of the journey. As changes are being implemented, communication is essential. The plan must be clearly and consistently communicated to all levels of the organisation who will be impacted, and context must be tailored to specific functions. The specific benefits for both design leads and team members need to be spelled out in language that resonates with them - not just in broad business strokes.



The strategies I've outlined here may seem like common sense, but they go deeper than traditional change management recommendations because they are calibrated for the depths of specific job roles.

Communication: In my own experience, I found that reminding the design team of the DPC Transformation roadmap twice a year was most effective for keeping morale up without overwhelming them with information. In these updates, reminding them of what they've already achieved, the benefits they've already unlocked, and what new capabilities they will encounter short term (upcoming few months) and long term (year) helped keep them as active participants in this trek.

DPC updates must be planned in relation to design calendars and when designers are most able to absorb new information. Timing them is key; avoid scheduling them when designers have many deliverables or milestone meetings. It might be more effective to have updates at smaller team meetings to help them feel like a safe space for questions.

Internal DPC newsletters are an effective way to share DPC stories across an organisation. Many companies see an upsurge in healthy competition when part of the design team's DPC wins are loudly celebrated, be it for their speed, efficiency, or creativity. At New Balance, sharing "Ah-ha" moments, where DPC saved the day, was a great way for teams across the company to consider new ways of working.

As you might expect from a strategic initiative that's so visual-focused, DPC change leaders universally agree that images are the most effective way to communicate with designers. Your supporting materials should not be wordy and should be accessible for designers' preferred way to access information. I found this meant putting documents and videos on a Miro board rather than in a Sharepoint site: small change in practice, but a big one in principle, because it meant meeting the design community on their home turf.

You may also need to document in more than one way to ensure the highest levels of buy-in, for instance creating a succinct one-pager in addition to a video. Designers often process information differently than other teams, so a one-size fits all approach is unlikely to deliver the desired results.

Training: If designers are expected to learn 3D tools, training should be targeted to specific DPC capabilities rather than everything that the software can do. Because as you page through this report, you'll notice that DPC can potentially do a lot - and there's more possibility being introduced all the time.

Comprehensive post-training support is imperative to ensure continued use and success; DPC teams need to confirm they have the resources and bandwidth to provide this assistance. Due to their calendar constraints, designers might be unable to practice as frequently as desired and may need scheduled sessions to keep new skills fresh. Where possible, remove obstacles to support designer onboarding into 3D: for instance, giving additional design support while teams gain comfort with the tools, providing complete libraries of blocks and digital fabrics to minimize frustration, and managing leadership expectations around what is feasible.

The immediacy of 3D designing has proven to be an effective enticement. Designers at a well known American clothing company are, I know, keen to design in 3D because their process enables them to receive physical samples several weeks earlier than their peers who work using traditional 2D tools. Again: healthy internal competition can be a powerful motivator.

Change agents: Designers who are embedded to promote DPC transformation, and who either start out as or become subject matter experts, are exceedingly valuable. Their ability to support their colleagues, build excitement around DPC, and provide valued insights should not be overlooked. They should come from all levels of the design organisation. The tech-savvy are often nominated for this role because of the 3D expertise, but enlisting both technically slower and DPC-skeptical team members is equally necessary. Addressing all learning speeds is more likely to get the complete team to the desired skill level. When skeptics' concerns are resolved, their personal transformation to DPC advocate is an incredibly effective narrative for their team members.

Additionally, change agents can also help capture metrics that resonate with the whole design team: less rework, more time saved, more garments adopted, better samples the first time, fewer meetings, more successes. This network is invaluable for keeping the design team involved in the DPC transformation.

Feedback: Design's feedback might not be for the faint of heart - expect to be challenged on process, timeline, and especially on the accuracy, reliability, and fidelity of the results - but should be actively encouraged. Most brands venerate and treasure their design community for a reason. Empathy is key; this transformation for designers can be really challenging. There will also be designers who are frustrated by how slowly they perceive the transformation is taking. Honesty is imperative.

Pretending the technology is already flawless is a kind of gaslighting, because as good as the best 3D design, simulation, and visualisation tools are, there are always areas where they could be improved - particularly when the designers in question work in a category that places a lot of stress and demand on 3D rendering or simulation, such as intimates, performance wear, or tailoring.

A DPC process manager at a prominent American retailer who I spoke to for this story told me they remind their team that "The tech is the worst it will ever be today!" This motto can also easily be extended to the processes and the team's skill levels as well. Feedback also allows DPC teams to recognize and prioritize high value improvements. Designers appreciate that their questions get answered and problems get solved. This feedback loop creates a culture of owning the DPC transformation rather than just being along for the journey.

The expedition to DPC maturity is both a large-scale transformation, with a long timeframe, and a lot of sets of small iterative improvements that can happen in the here and now. This metamorphosis is undeniably complex, particularly for designers, who face significant conceptual and technical challenges. But the potential benefits for designers and the entire organization are profound.

Realising these benefits requires tailored change management strategies that prioritise clear communication, supportive training, and meaningful engagement at all levels. When designers are equipped with the right tools, given time to adapt, and supported by leadership, they can harness DPC to amplify their creativity, enhance collaboration, and ultimately deliver more compelling products to customers.

Thoughtful, realistic planning and empathetic leadership will ensure that the transition to DPC not only transforms processes but also empowers designers to thrive in the digital future of fashion. As Kayla Woehr, Manager of 3D Apparel Visualisation at New Balance, has observed, "After all, we are not just doing 3D for the sake of 3D – we all see the future of a better way of working!"



WHY MANUFACTURERS ARE PUSHING THE LIMITS OF DPC

WHILE THE ATTENTION HAS BEEN FOCUSED ON BRANDS' AND RETAILERS' 3D STRATEGIES, THE WORLD'S BIGGEST SUPPLIERS HAVE BEEN MAKING MILESTONE COMMITMENTS TO TESTING NEW FRONTIERS OF DPC IN PREPARATION FOR INDUSTRY-WIDE TRANSFORMATION.



MOHAMMAD AMIR HEAD OF DEPARTMENT, DESIGN, INTERLOOP

Amir leads the Design department at Interloop Limited in Pakistan, covering a portfolio of DPC, Creative Design, and Development. He leverages a background in design and fast fashion manufacturing to elevate the company's DPC process. His remit is spearheading the integration of digitisation into design workflows, driving innovation and efficiency in the apparel industry.

Interloop Limited

Fast fashion manufacturing is a sample-intensive process. Before a product reaches the point of bulk production, the designers' vision is brought to life in a series of collaborative steps that each require back and forth communication between the manufacturer and the brand.

This process consumes time as a primary resource, but every sample also has its individual cost in terms of fabric, trims, labour, and shipping. The primary goal, of course, is a product that the designer and the brand customer is satisfied meets their original intent, but for any improvement made to the sampling process - especially any reduction of the number of samples required to fulfil the brief - the biggest beneficiary is actually the manufacturer. The sooner a product is ready for mass production, the better prepared that manufacturer is to make it the best it can be, as efficiently as possible.

This is why 3D and digital product creation have become so important to the fashion manufacturing sector. The ability to shorten the distance between the original intent and a production-ready sample is incredibly valuable - and leading manufacturers have invested in not just growing these capabilities, but building out the technology ecosystems and the in-house talent to be prepared to stay ahead of the expectations of our brand customers.

At Interloop, we see DPC capabilities as being the essential levers that help us to adapt to changing global dynamics, and as opportunities to translate our many different centres of expertise into compelling offers for leading brands who have their own digital transformation strategies.

For those brand customers - especially in fast fashion - the right manufacturing partner is the partner that has invested in ways to make the process of sampling and production as lean as possible. And in our experience DPC has proven itself to be the best possible way of reducing sampling load, collaborating more closely with our customers, and finding new ways to achieve that lean target.

From our perspective, investment in DPC has delivered a clear return that we and our partners can directly measure: as a company we are able to increase our capacity to create samples by making as many of them as possible digitally, and our customers can use those digital samples to evaluate designs and make necessary changes, which contributes to a reduction in lead times.

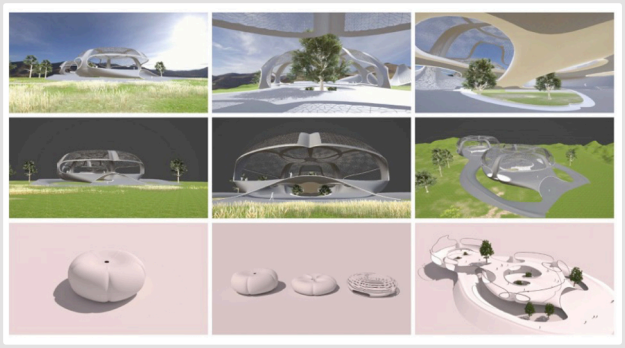


Digital Showrooms are a great place to show a collection in a virtual space. Users experience is great for shoppers to see and virtual try-on a garment before purchasing. At Interloop “Loopverse” was created with the same vision. Our designers create a collection each season to show our capabilities to our customers in a victual space. We can have a virtual meetings where our avatars interact with each other. Able to speak and interact, Staying connected through experiences. A virtual 3D space to showcase our digital capabilities and a brief profile of Interloop. The architecture was designed inspired by a cotton flower. A world was built around with 2 domes. 1 space dedicated to 3D outfits and the other for a brief interloop company profile. QR codes are added at multiple locations to see an Augmented version of an outfit.

As a key manufacturing partner, we have also positioned our drive towards DPC as part of a more complete digitisation of the whole manufacturing process. In practice, this has allowed us to bring a similar mindset to every part of production - with samples being just a small part of a bigger picture. Across this transformation, we also relied on adoption of the same workflows from our customers, and while most of them quickly realised the value of collaborating digitally, others needed a little bit more persuasion - and a deeper demonstration of the capabilities of DPC.

To demonstrate those capabilities, we would always walk through the traditional fashion production process before comparing it to the digital alternative - not just as enhanced by 3D and DPC tools, but with other new technologies and new techniques applied to it.

Usually, the process of manufacturing a new product would start with a customer sharing a tech pack over email. Instead, what if their designer's sketch was instead converted into a photorealistic picture using AI? Designers could then evaluate their silhouette and decide if this style is good enough to proceed to the next stage. Then the tech packs can be uploaded to a



PLM, with auto generated email sent to the vendor requesting a sample and a price. That tech pack is then downloaded from PLM, assigned to designated 3D designer at the manufacturer's end, and the finished work is uploaded to the same platform.

In place of iterative sampling we have a much shorter timeline to alignment, a much closer bridge between brand and manufacturer, and a host of other benefits that also come with making DPC the foundation of the design-to-production lifecycle.

Vendors, for instance, can use a digital library (either as part of a PLM or as a supplemental solution) to download digital raw material like fabrics, trims, pattern to make a 3D sample, and then upload this back to the same platform. This digital material can come from the customer, but ideally raw materials are digitised by the material supplier - including fabrics, trims, and threads - so that the whole industry shares a common reference point in 3D, making it the new norm.

At Interloop we are also working to take the practical applications of that common reference point even further, where we make use of 3D and digital assets to enable machines and solutions to talk to each other. Data from our Jenologia laser machine can be imported into CLO and exported back to the machine directly for physical samples.



Another example is Shima Seiki, which allows us to select a digital yarn and conduct digital knitting within the software - including selecting the gauge. As well as being the connective tissue between the manufacturer and the customer, DPC data can also go directly to knitting machines. As we have tested the limits of DPC even further, we have also begun pushing further towards the vision for a comprehensive digital twin that exactly mirrors the physical: the behavior of the fabric stretching, the drape and, crucially, the fit of a style (which we can simulate using stress and strain maps) is all also the same across the physical and the digital.

As you may already be thinking: this is a lot of trust to place in a suite of technologies. This is true, and this is also why we believe in the development of DPC standards. Just as we have standards for physical samples, the fashion industry needs to be able to rely on digital baselines and frameworks that allow us to standardise the 3D process. Crucially, those standards also need to work to lower the barrier of entry for everyone, so that we, as manufacturers, can meet the market's needs - not just in good quality bulk production, but as partners with expertise across the full spectrum of digital product creation.

Virtual FIT test can be done using stress and strain maps within a 3D software but the need is to standardize the results from a recognized authorities which can easily be understandable and recognized by anyone, for example we know what 1CM or 1 Inch means similarly the data showing in the 3D software on stress and strain maps needs to be in a standardized for easy understanding and acceptability with in the fashion industry. Which will result in FIT approvals over digital sample.

But there is still work to be done in reaching this level of standardisation and interoperability. Right now there is a significant need to improve the way different solutions collaborate and integrate, which will be necessary to take multi-stakeholder DPC to the next level.



This is not just a challenge for 3D technology companies, either. If you break down the manufacturing process it consists of yarns, fabric, dying, patterns making, cutting, sewing, trims application and washing. All these processes are managed by different machines, made by different companies around the world, with competing priorities. Each machine runs its own software or mechanical process.



Interloop Limited

A genuine digital twin would have the power to integrate with each system. Imagine a near-future scenario where the 3D software has the built-in capability to select yarn type, which can be produced to the same exact specifications with a click of a button. 3D software then makes a digital-knitted / woven fabric without scanning any fabric texture, to a specific color. A dying recipe can then go directly to the machine from 3D software. Patterns can be fed into cutting machines that will work with 3D product definitions to maximise the utilisation of fabric. Most sewing operations would be automated, with the type of thread and the length of the stitch being fed from 3D simulation software to machine. Wash recipes would be simulated in DPC to shows how the garment will look after wash.

This is, in many areas, a future vision rather than a current reality, but it remains a vision that forward-thinking manufacturers are already working towards - ready for the wider industry to request it, and preparing to work together, openly, to realise it.

As a further extension of the potential of DPC, the next step for the vendors should be not to settle for digitising samples, and to forge further ahead with creating digital twins of entire factories., to create a digital model for manufacturing that can predict bottlenecks,monitor output, maintain hardware, foresee issues, and create solutions... And if a truly digital, end-to-end production process, can predict exact delivery dates and control the flow of production, brand and retail customers then get an entire different level of digital product creation, with the ability to track orders in real-time.

For suppliers, investing in DPC should not just be a way to make 3D garment samples, but part of a bigger picture, where the entire flow from design to store shelves is digitally transformed. The boldest manufacturing companies are already thinking this way, and building comprehensive DPC capabilities in anticipation of an increasingly digital future.

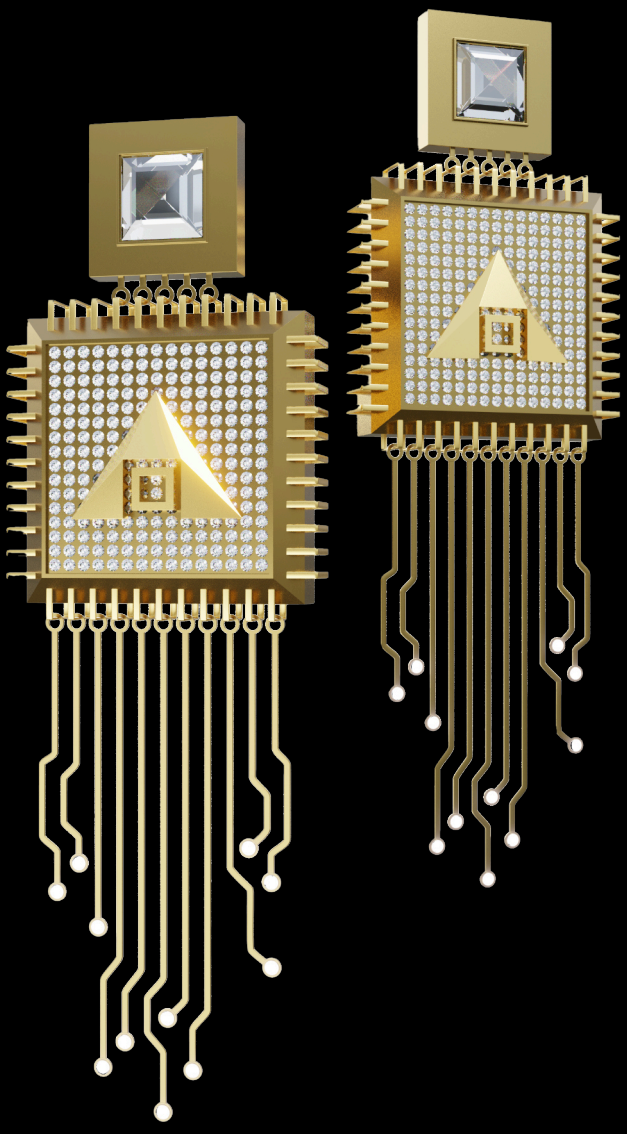


CLO

Shima Seiki

THE IMPERATIVE TO TRANSFORM DESIGNER FASHION THROUGH DIGITAL INNOVATION

BRANDS MAY NOT BE UNIVERSALLY RUSHING TO SELL DIGITAL-ONLY GOODS RIGHT NOW, BUT FROM TECHNOLOGY TO PROCESS, DIGITAL AND MULTI-CHANNEL "PHYGITAL" FASHION INITIATIVES COULD STILL HAVE A LOT TO TEACH FASHION ABOUT HOW TO APPROACH DIGITAL PRODUCT CREATION.





LAUREN (ALTRA) KACHER, FOUNDER, ALTERRAGE

***Lauren Kacher, also known as ALTRA**, is a creative director with 15 years of studio experience. She led sustainable and digital initiatives at luxury houses like LVMH and Kering, contributing to projects that generated €3 million in additional revenue. In 2019, she founded ALTERRAGE, the first activism-driven designer label to pioneer physical, augmented, and digital fashion collections, featured in The New York Times.*

E-SHCK Earrings, ALTERRAGE

Fashion - especially at the high end - is yet again at a major crossroads. News of declining luxury profits have sent a disconcerting shockwave throughout the industry. Can we solve this as we did before; by cutting labor costs while scaling collection volumes? Or is this a fundamental shift that outdated methods cannot fix?

Creative fashion professionals worry about balancing high performance demands with unstable roles. Their workloads continue to pile up, while access to essential resources dwindles. Layoffs and budget cuts are increasing. Still, they are expected to continue business as usual. They face pressure to drive growth while trying to preserve their craft. Many are striving to make a positive impact in an industry that often feels like it's sabotaging their efforts.

In 2020, my role as a luxury designer ended due to the pandemic's hiring freeze. Before that, I worked in fashion studios across Paris, London, and New York. I loved the creative process but was nearing burnout and searching for solutions. That led me into the world of digital fashion and digital product creation, and it also prompted me to ask some big questions about ownership, Web3, and a host of other non-traditional solutions.

I was, in other words, leaving a very analogue world and sidestepping into a digital one.. My goal wasn't to leave the fashion system. Instead, I felt like I'd discovered transformative tools that could supercharge our design and development processes and solve for a lot of the problems I'd observed first-hand, and that I knew the people left in traditional roles were still struggling with.

The key thing I've found: we already have the solutions to solve fashion's most meaningful challenges. They may not be as seamlessly connected as they should be, and they might not exist in their fully final form yet, but across the spectrum of digital product creation and digital fashion systems and solutions, the keys are there.

So as brands and designers, I believe we have a responsibility to push the industry to higher standards by turning those keys. I know technology can feel intimidating or overwhelming, especially when the risk of being too early is as real as a lot of Web3 and digital fashion advocates think we were. But as I've learnt, there's no such thing as being too early when the key task is preparing for a future that's going to be defined by digital, and where success is going to be heavily influenced by the maturity of our digital capabilities and digital asset libraries, and by how well we adopt these tools to be both actionable and authentic to our brands.

ALTERRAGE Avatar

THE FIVE CULTURAL SHIFTS TRANSFORMING FASHION

I've identified *five shifts* that we can no longer ignore as we move into 2025, and for which digital product creation tools and mindsets (and the lessons taught by digital fashion) can prepare us. These trends represent fundamental changes driven by the acceleration of digitisation.

Technology, at its core, is a tool created by people. As an industry, we may believe we shape society through dress, but fashion is ultimately a reflection of the world around us and the people who wear it. To future-proof your brand, staying ahead of these shifts is essential.

Authenticity Is the New Luxury

***71% of fashion executives are increasing spending on brand marketing in 2024, prioritising authenticity and relatability to secure their brand legacy* (McKinsey & BoF, 2024).**

Years of relying on Pinterest for research and rushing development timelines are starting to show their negative effects. In a recent conversation between Kate Moss and Bella Freud on the Fashion Neurosis Podcast, Moss remarked, "I go to brand stores, and everything looks the same." That homogeneity comes, at least in part, from relying on streamlining existing processes (which only get faster through a process of progressive averaging) rather than being willing to invent new ones.

Even in luxury, which is defined by uniqueness, we have sacrificed brand heritage in favor of chasing trends and sanding down rough edges. Customers are starting to notice.

If you want to build loyalty in the future market, it's time to reconnect with the core DNA of your brand. Pure acceleration will make it harder for followers to stand out. By staying true to your brand's history, vision, and story, and using this as the framework through which you approach digital product creation, you can endure the test of time.

I recently attended an exhibition in Paris celebrating 100 years of Maison Lesage, a prestigious Parisian embroidery house, founded in 1858. The exhibition showcased historic embroidery collections created for legendary fashion houses such as Chanel and Yves Saint Laurent, alongside their digital twins meticulously replicated using photogrammetry techniques. Each embroidery piece was paired with a captivating digital narrative, bringing its story to life in stunning detail. To mark this milestone, Maison Lesage also presented an immersive video installation that invited the audience to delve into the very essence of the materials, offering a mesmerizing journey into the heart of their craft.

Transform digitally or risk irrelevance

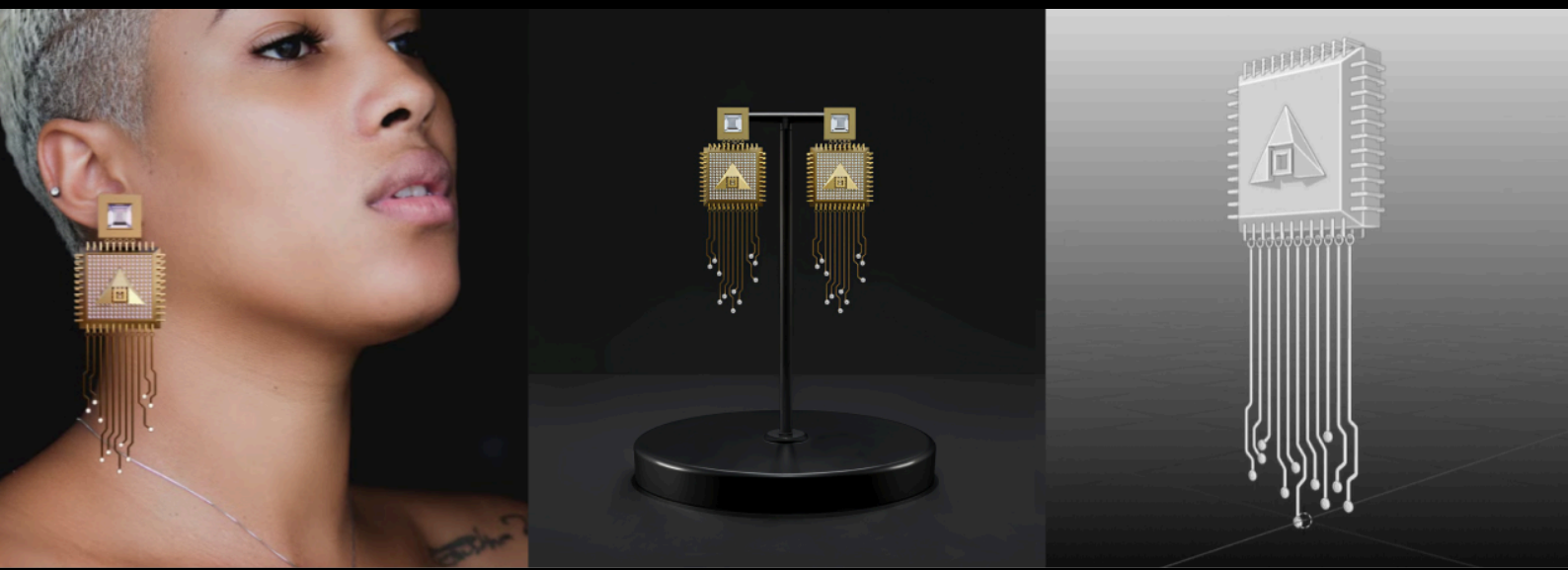
***Digital-native brands grow 15-30% faster than those that lag in digital adoption.* (Doxee)**

As a tech-positive designer, I believe in the power of digital tools. I also recognise the importance of preserving essential savoir-faire like sketching and construction. These skills are foundational to our craft and should not be overlooked.

The short-term cost of training teams in 3D is significant, and it takes time. Artificial intelligence models are still generating ugly versions of what we could design better ourselves. But according to Moore's Law, technology advances at an exponential rate. Performance doubles roughly every two years. In the case of AI, advancements are happening even faster.

As we hone the right combination of AI and 3D tools, we will create and visualize products more easily. This is already happening today, and these tools can help us serve our clients in ways that were previously impossible.

Ask yourself: Are you serious about building a brand for the future? Isn't long-term growth more valuable than short-term costs? Especially when it comes to equipping your creative and commercial teams with the right tools to adapt and deepen the relevance of their craft for a new era?



3D Creation by Stella Achenbach

Transparency is non-negotiable

***By 2030, all textile products in the European Union must carry a Digital Product Passport* (Renoon).**

Technology is sustainability's new “petite ami." Greenwashing has long been a threat to our progress in reducing waste. Circular processes are essential to make fashion less polluting.

Legislative discussions on sustainability have been ongoing since as early as 2009. Now, a digital certificate is mandated for anyone creating textile products. Technologies like blockchain are helping create these new “care labels.” These labels visibly add value for everyone in the product value chain—from brands and producers to consumers.

Customers are becoming more informed. They are increasingly aware of the importance of transparency and sustainability.

Your community is your competitive advantage

Digital marketing with community-focused strategies can increase revenue by 15%. (Doxee)

We’ve never been more connected, yet never felt more alone. Consumers want to be a part of something bigger than themselves.

During the pandemic isolation, I experienced an incredible phenomenon. I launched my brand and transformed my career by engaging in a decentralized, online community.

There was no single time zone, yet we united over one mission: to explore the newest technology applications for the fashion industry. Our values were driven by autonomy, contribution, and collaboration. In my time in fashion, these values often felt lacking. This movement was fast, furious, and punk. The level of commitment I experienced was unparalleled.

Community presents a major opportunity for your brand to connect with consumers on a deeper level for continued sales. Create your community on shared values. Unite them through a collection of iconic products. And, as you’ll see below, grow those communities through new channels that meet consumers where they are.

Brands will become seamless worlds

Brands adopting immersive tech like AR and virtual gaming experiences see 20% higher conversion rates. (Harvard Business Review)

Digital is fashion, and fashion is digital. In today's world, there is no longer a clear divide between our physical and digital lives.

In 2007 the term "phygital" was introduced by Chris Weil of Momentum Worldwide. This described the integration of physical and digital experiences.



ALTERRAGE Avatar

Customers find your products through social networks and smart search assistants like ChatGPT. New technologies, such as Ray-Ban's Meta glasses and Apple's Vision Pro, provide immersive ways for your brand to tell its story.

The challenge for brands is understanding how to link these technologies together. The goal is to create one seamless experience for customers to connect with your brand, which spans digital and physical channels.

In 2019, I coined "METARALITY" to explain the blend of three realities: physical ("In Real Life"), augmented ("On Real Life"), and virtual ("Larger Than Life"). As a designer, I create for all three spaces.

ONE PRODUCT, FIVE VERTICALS

In 2021, we launched the first earrings to be owned and worn digitally - which you can see in some of the images accompanying this article. This product would teach me a huge amount about what it means to create in 3D, to build products for both digital and physical endpoints, and to articulate the stories around those products across all those different avenues. So much was wrapped up in this one project, in fact, that it became our brand's framework for holistic digital transformation.

Inspired by the issue of e-waste, the E-SHCK Earrings aligned with our ethos of activism. Crafted using recycled e-waste gold, for the physical version, the product raises awareness through storytelling while connecting deeply with our community.

We used Blender 3D to prototype the product. This reduced sampling waste by 70% and cut production timelines by 50-75%. By visualising the design digitally, we avoided errors and streamlined the entire process.

Each pair includes a digital label. This tracks its lifecycle, from sourcing to end-of-life recyclability. The label provides transparency, builds trust, and ensures compliance with upcoming sustainability regulations.

With the data from the digital label, we gain valuable insights into customer preferences. We can engage with our collectors, notifying them about upcoming drops and events. This helps us better understand how to create products that are in demand.

The E-SHCK Earrings exist in three spaces: in real life, on real life, and larger than life. They are wearable in the physical world and produced on demand with 3D printing. Their digital twin powers AR experiences and is compatible with gaming platforms. This blend of physical and digital creates a truly immersive experience for our customers - and it's also helped to set the template for how digital product creation, traditional product creation, and digital brand-building should coexist.

HOW TO FUTURE PROOF YOUR BRAND IN 2025

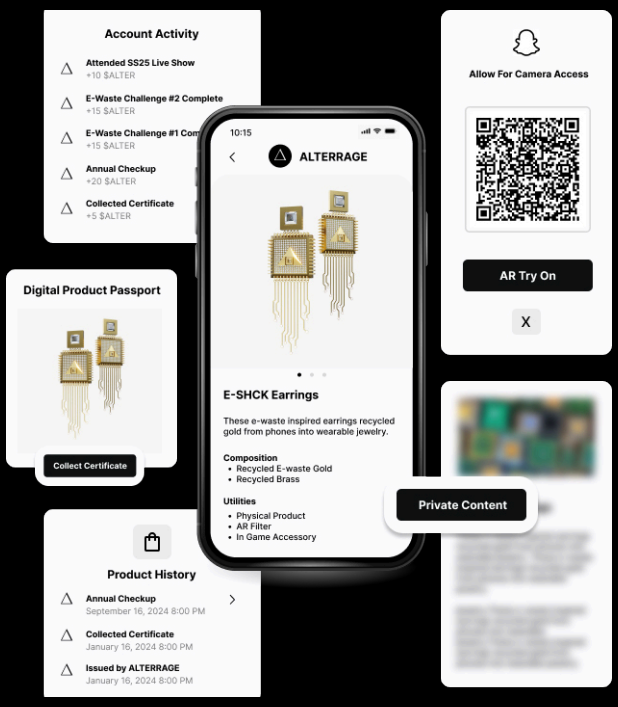
Align Your Brand: Focus on building authentic narratives instead of chasing fleeting trends. Today's consumers are conscious of sustainability and ethical practices. Brands that stay true to their mission will build lasting loyalty.

Digitise Design: Streamline your design process using AI workflows and 3D sampling. The integration of digital tools reduces waste, accelerates production timelines, and helps maintain a consistent, high-quality product. As the fashion industry moves towards sustainability, digital tools are crucial in eliminating inefficiencies.

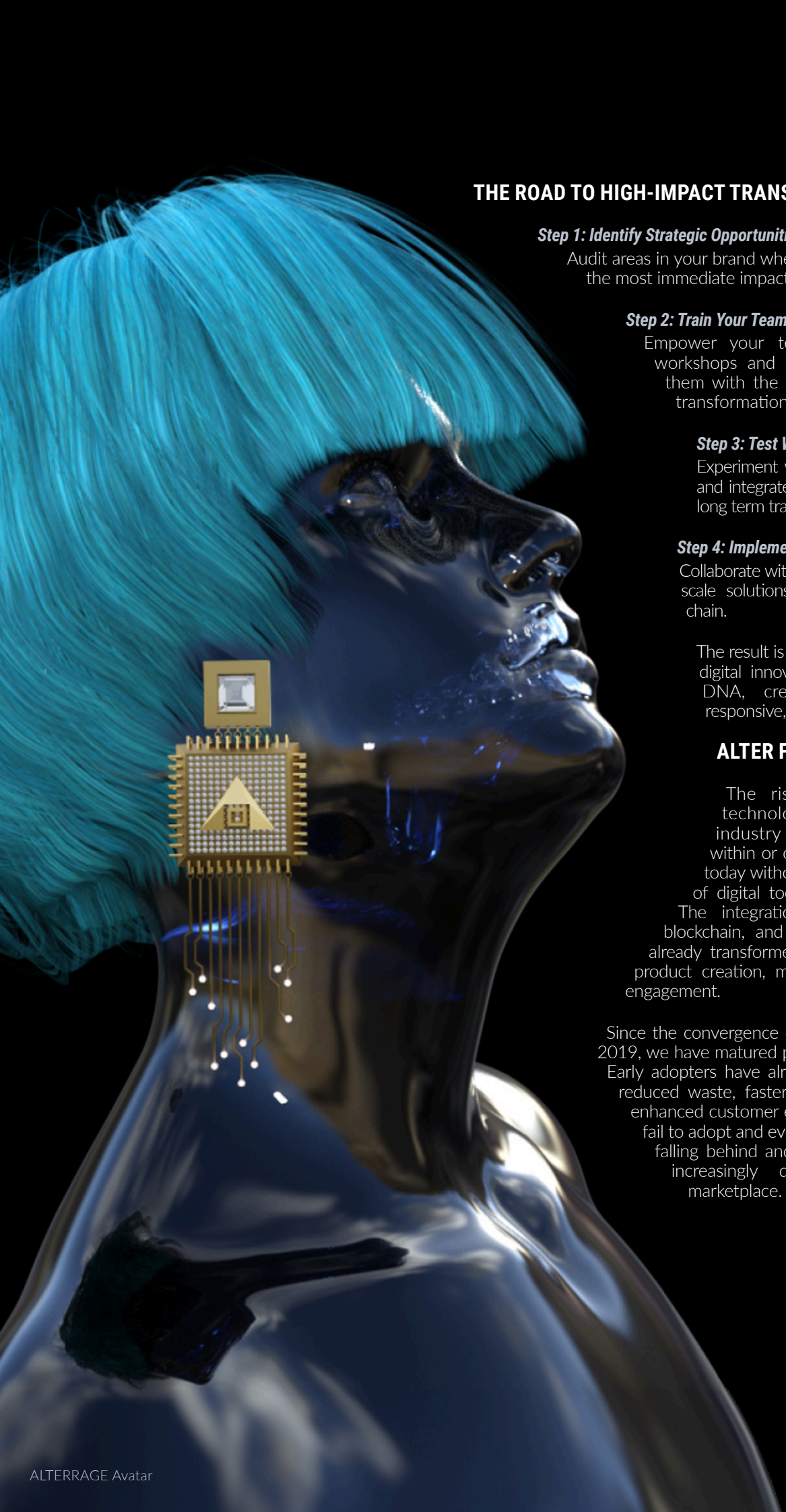
Authenticate Products: Implement Digital Product Passports (DPP) to provide transparency and traceability. This digital certification ensures compliance and builds trust with consumers by offering insight into sourcing, production methods, and end-of-life recyclability.

Connect With Community Collectors: Secure loyalty by building innovative community initiatives. Use digital platforms, real-time experiences, digital assets, product renders and more across social media and other channels to create a direct line to your customers, keeping them engaged and informed. Consider offering exclusive content, limited-edition products, and other experiences to build a deeper relationship.

Expand Your Reach: Explore hybrid markets such as gaming and AR-enhanced collections. By integrating your brand into virtual spaces and platforms, you can reach new audiences while offering a multi-dimensional experience that blends the physical and digital worlds seamlessly.



E-SHCK Earrings Digital Product Passport



ALTERRAGE Avatar

THE ROAD TO HIGH-IMPACT TRANSFORMATION

Step 1: Identify Strategic Opportunities

Audit areas in your brand where digital tools can have the most immediate impact.

Step 2: Train Your Team

Empower your team through targeted workshops and masterclasses to equip them with the skills needed for digital transformation.

Step 3: Test With Capsule Collections

Experiment with limited-run products and integrate successes holistically for long term transformation.

Step 4: Implement & Partner

Collaborate with technology providers to scale solutions throughout your value chain.

The result is a seamless integration of digital innovation into your brand's DNA, creating a more agile, responsive, and sustainable business.

ALTER FASHION'S FUTURE

The risk of not embracing technology in today's fashion industry is significant. Working within or owning a designer brand today without leveraging the power of digital tools is nearly impossible. The integration of 3D design, AI, blockchain, and augmented reality has already transformed how we think about product creation, marketing, and customer engagement.

Since the convergence of these technologies in 2019, we have matured past the initial use cases. Early adopters have already seen success with reduced waste, faster production times, and enhanced customer experiences. Brands that fail to adopt and evolve with these tools risk falling behind and losing relevance in an increasingly data-driven, digital-first marketplace.

TESTING THE FRONTIERS OF DPC AT DECATHLON

WHY PUSHING TECHNOLOGY FORWARD, RECOGNISING THE LIMITS OF TRUST, AND SUPPORTING CULTURAL TRANSFORMATION HAVE BECOME THE ESSENTIAL PIECES OF 3D TRANSFORMATION AT ONE OF THE WORLD'S BEST-KNOWN SPORTS BUSINESSES.



INTERVIEWEES



CYRILLE ANCELY, COMPONENT DIGITAL TWIN LEADER, DECATHLON



FREDERIC FRACHE, MODELLING AND TEXTURE ARTIST, PRODUCT ASSET TEAM, DECATHLON

Image courtesy of Decathlon

With The Interline's designers demonstrating the capabilities of DPC in multiple categories this year, it's clear that different types of products have different challenges and different considerations when it comes to working in 3D.

How has a business that covers many, many different categories - all with unique performance demands - approached the strategic, technical, and cultural sides of digital product creation? And what have been some of their key findings from testing the frontiers of possibility in DPC?

To find out, The Interline sat down with Cyrille Ancely - Component Digital Twin Leader at Decathlon - and Frederic Frache, Modelling And Texture Artist for Decathlon's Product Asset Team.

Trained as a transportation and industrial designer (with experience working for automotive giants like Renault, Stellantis, and Lexus) Cyrille began working with Decathlon as a freelancer, before being invited by the group's Head of Design to join the team and co-write the 'digital chain'. Today, Cyrille is a key member of the team facilitating the global sports retailer's multi-year transition into 3D, and he has recently also been working with the CGI team to develop new strategies for the company.

Frederic has a similar background in product design and 3D modelling, working for both automotive giants and in the creation of CGI for architecture. He initially joined Decathlon as a footwear 3D modeller, before joining Cyrille's team to work on material digitisation.

The Interline: Working for a company that covers so many different product categories - everything from yoga mats and exercise bands, to technical running apparel, camping equipment, and performance footwear - how have you approached the challenge of building 3D pipelines? Has the philosophy been to build specific workflows for each type of product, or to try and codify a standard that works across all of them?

Cyrille & Frederic: When we started the project in 2019, the first phase was to get an overview of what was already accomplished within the company. Decathlon was, at the time, made up of many independent brands (85 brands) and about nearly 30 different specialised industrial processes within them, covering categories as different as helmets, optics, lighting and many more.

Some of those brands and processes were already incorporating 3D, and they had begun to build their own pipelines. So in February 2020 we hosted an internal event to showcase what had already been achieved - and we also invited some external companies to participate, including luxury fashion brands, automotive giants, and technology companies like Substance, which had just been acquired by Adobe.

Then Covid happened.

It might be weird to say, but the pandemic was really helpful from a DPC perspective because it served to push this topic to the top of our priority list. And what emerged out of that global emergency was a drive at Decathlon to create a seamless workflow that would push the design process forward - covering the full cycle from first sketches to production and marketing.



Image courtesy of Decathlon

We defined four main product areas and started to build pipelines based on existing knowledge: apparel and footwear were the own categories, then we had a dedicated category for soft equipment which mainly focused on bags but also included tents, and then another area for hard equipment, which focused mainly on bikes.

Our purpose was (and still is) to set those pipelines at a company level. This has been the key to creating and standardising workflows, upskilling our teams, developing digital tools when we needed to, and standing-up services internally.

Diving deeper in each product category, we have found it necessary to establish some more granular workflows (tents, seamless products, golf clubs and other narrow categories needed this) but we always start from that top-level global segmentation.







All images courtesy of Decathlon

The Interline: What's your perspective on how the user community for digital product creation has evolved? Do you see 3D and DPC primarily serving design and development roles, or are these initiatives delivering value to other personas in merchandising, sourcing, marketing etc.?

Cyrille & Frederic: We first focused on the Design community, because our driving principle is that every step in 3D should be towards the creation of an ideal, "dreamed" seamless workflow that will allow us to create digital twins at the start, that then serve every requirement along the entire value chain.

Quite quickly, though, we realised we had to also focus on the marketing part, which is the visible part of the 3D iceberg.

We also use CGI content to give the entire company visibility into what our strategic goals with DPC are, to demonstrate what's possible, and to align everyone on the vision for why we need digital twins of not just our finished products but also our components - materials, accessories, spare parts and so on.

The merchandising process is also an interesting topic, because 3D gives our visual merchandisers the ability to visualise what their stores and shelves will look like, without needing to mock them up with real products.They can also work on tomorrow's in-store experiences, such as allowing customers to visit a tent in VR when stores do not have enough space to install the whole range.

Using 3D also allows us to work from the first design stage towards product repairability, including some interesting work around how we can repair products using 3D printing.

From a component point of view, especially in textiles, 3D also allows our teams to test new fabrics without having the physical swatches, or even asking for our supplier to produce anything if we are not at least 80% certain we will use it. This, for us, is a huge step in sustainability, so DPC is also extending all the way to that community and that strategic mission.

The Interline: One of the keys to extending the DPC community - and realising extra value from digital assets - is going to be building trust in the knowledge that a digital asset, whether it's a material, a trim, or a complete finished product, is a one-to-one representation of the physical asset. Where have you seen that trust working well?

Cyrille & Frederic: That trust-building is indeed one of our main problems. As we want to remove some physical prototypes, but not all of them, we still need to validate physically what we will sell to our customers, because we are, after all, selling physical products.

In terms of where trust is effectively being built, from a visual perspective, our stylists and designers seem really confident in the ability to visualise products in 3D before even producing a single prototype. We still have some minor issues with building trust in colour selection, but it is more a matter of best practice than any concrete limitation - and I'm sure everyone reading this report understands that even in real life colour perception is a huge and complex topic.

Colour blindness remains a fairly common disorder (it affects around 8% of men and 0.5% of women, moreover it seems that men and women don't see colours exactly the same way to begin with) and on top of that lots of people visualise colour - and make colour-related decisions - on non-calibrated screens. So our challenge there has been providing training to point out why issues arise, and to help correct them with a set of best practices.

Our marketing teams are also completely into it, especially in footwear and hard products, since we can automate packshot creation and build a consistent set of contents for all our different products before even receiving a physical product. This has been a game-changer for them.

The Interline: Conversely, where do you believe it's currently more difficult to establish trust in digital assets?

Cyrille & Frederic: For some other communities such as pattern makers and prototypists, the ability to simulate product behaviour early in the design process is vital. So when we talk about products where each project starts with a soft material, such as apparel or even a tent, we're dealing with a different set of demands and expectations

At Decathlon, we are focused on performance products, which cater to everyone from beginner to expert. Implicit in that is the understanding that we need to use a lot of technical fabrics that are complex and difficult to simulate, for a wide range of different purposes.

The main apparel 3D software is built around simulating "prêt à porter", which means its tools and algorithms are aimed at representing basic structured fabrics.

That gap is, today, one of the main problems we are facing. Because for the teams we have working on performance-oriented apparel,, if we are not able to properly simulate a product's



Image courtesy of Decathlon

behaviour to the extent that they can trust it enough to sign off on the type of products they need to create, why should they even use 3D workflows?

Even with the gains that we're seeing elsewhere in digital product creation, it's important to recognise that the 3D workflow does increase the amount of daily tasks our users need to perform - especially if the physical step is still necessary.If that's the case, then we're arriving at the same result via a route that introduced more friction. This is the kind of concern that can lead to pushback against the 3D process, and it definitely works against the idea of building trust.

The Interline: There has been a significant push towards "digital twins," or digital representations of products that can stand in for every use case where a physical example would normally be required. Which product categories do you believe are currently the closest to having that vision be viable? And which are maybe the furthest away? This seems to be very much a question of trust at its heart.

Cyrille & Frederic: To be honest, I don't think we will have a single digital twin that will be able to cover all the use cases or needs we have. At some point, we will need to convert it to another file for a specific purpose (simulation, VR, animations) But having a 3D file that evolves through the product design process, helps to have the most accurate reference at every step.

There is a technology gap also. In the design of hard products, files are created for production that use surface or volumetric 3D modeling, while rendering and animation 3D technologies are based on polygons. So at some point of the process, we will have to convert one format into another.

This is where the accuracy and the standardisation of the model is so important, because it dictates how easy or difficult that process of converting from one use case to another will be. So we have to define what each role needs to be provided with in order to move forward, and we need to settle on standard modelling procedures.

Textile / Apparel categories actually have a bit of an advantage here, since 3D apparel design software uses the same kind of geometry that CGI imagery is using, which makes it potentially one of the most promising pipelines.But here again, it depends on the end use, and there is a lot more to take into account than just geometry when it comes to building complete trust in 3D in apparel..



Images courtesy of Decathlon

We also have some more unique processes and products, such as tents or welding, which are so individual that there is no specific software developed for them. Those are the areas where we work on crossover processes, or where we develop internal plugins to allow us to move forward.

The Interline: When it comes to simulating different elements of products, from fit to performance, it feels as though there is perhaps a gulf between the demands of ready-to-wear fashion and other categories - especially outdoor and performance gear. Is this something you're encountering?

Cyrille & Frederic: As I mentioned earlier, there are some difficulties when it comes to simulation on the apparel side- especially because we are working on products that use technical fabrics. By their nature, some products are very tightly-fitted, which makes it even more difficult to have a workable simulation of those.

We also work with seamless products which are constrained on the body, with different compression zones. And we create equipment, like tents, where we want to be able to simulate how the materials and the construction will behave in specific conditions like wind and rain, but as far as we know there's no software out there that currently answers to those specific demands.

The Interline: Do you believe that there is still some runway to go with current 3D design, simulation, and visualisation tools, or are brands now beginning to test the limits? In the case of the latter, how do you believe fashion companies and technology vendors can work together to expand those limits - and in what areas?

Cyrille & Frederic: We are at the beginning of a new area for digital design. For the past six years, lots of software companies have invested in the building or translating solutions and capabilities from other sectors into product-centric industries. Companies from video games, like Unity, Epic or Adobe (with Substance) clearly see a lot of potential in those fields.

I also see AI opening up new horizons that will help us transform our processes at a larger scale.

To be clear there are still lots of things to work on, especially in creating standardised protocols like mechanical measurement to simulate apparel consistently in different software and file formats - to give us a standard material that can be transferred. But if we want to accomplish that, then it will require technology companies, suppliers, and brands to work together.

The Interline: The other side of building trust in digital representations is on the consumer end, where it's not just a case of reflecting the products accurately, but showcasing them on convincing-looking avatars. And where sportswear and performance wear is concerned, that also means showing them in motion. Where do you believe the industry is at on this journey?

Cyrille & Frederic: On the consumer end, we have nearly no technical limitations. We can showcase digital products, we are able to do face swapping, we can create realistic avatars and animations.



Images courtesy of Decathlon

I think the bigger concern downstream is a cultural or sociological one. Across AI, 3D, and the combination of both we are now firmly on the edge of the uncanny valley - a theory coined by Japanese roboticist Masahiro Mori in 1970 which tells us that the closer something gets to looking human or realistic without being 100% there, the more it provokes a feeling of anxiety and unease. The effort required to pursue hyper-realism and get past that feeling is significant, and there is an ethical core to the discussion of how far we should be pursuing that goal.

Should we be promoting content featuring real humans, which I would describe as more authentic, or content that is very similar but generated by AI or via advanced 3D rendering, which saves money and production time? Which of those avenues will society ultimately value the most - especially from a sustainability point of view?

The Interline: Finally, how do you see AI and DPC interacting in the near future - whether that's enhancing one another, or even prompting a re-evaluation of where the frontiers between the two are?

Cyrille & Frederic: AI is already present in our daily tools, the question is not if we need to use it, but how and where.

On the creative design side, those tools can help to quickly extract new ideas from creative minds. But humans need to be involved in the process, because AI is not able to think outside the box - meaning outside its training data - and at some point content will become less and less interesting if we have AI generating materials based on AI-generated data.

On the other hand, AI could give us the capability to more quickly generate some types of data, such as the mechanical properties of components, or enrich other types so that we can build fewer prototypes than before, meaning less production and less pollution.

The difficulty in the AI field, for me, is that there is a very thin frontier between beautifying a render and moving, consciously or unconsciously, away from reality - to the extent that sometimes a brand could end up over-indexing on a sub-optimal design and putting it into production. The goal of DPC, of course, is to reduce lead time and to increase the confidence in our design choices, and the use of AI cannot end up being adverse to that.





Images courtesy of Decathlon

THE DIGITAL ROADMAP TO IMMERSIVE LUXURY EXPERIENCES

THE JOURNEY FROM TRANSACTIONAL SHOPPING EXPERIENCES TO IMMERSIVE ONES HAS NOT BEEN STRAIGHTFORWARD, BUT THE RIGHT COMBINATION OF 3D ASSETS AND REAL-TIME TECHNOLOGY COULD BE THE KEY - PROVIDED FASHION HAS THE RIGHT AMBITIONS.



The New Face



ROMAIN JAPY, CEO, THE NEW FACE

Growing up in Paris, Romain Japy was immersed in a world of innovation and creativity. With a father pioneering video-on-demand and a mother working in the fashion industry, he developed an early appreciation for the thrill of new ideas and the importance of personal passion.

Romain pursued his education in the UK before returning to France to study at ESSEC, where he joined the esteemed LVMH Chair. When asked about his ideal role within the luxury group, his unconventional response—"service provider"—reflected his ambition to help brands authentically connect with his generation, shaping his forward-thinking approach to the luxury industry.



For nearly a decade, brands and startups have collectively poured **billions of dollars** into crafting immersive experiences, only to yield - I would argue - less than stellar results . From branded websites to metaverse platforms, the dream was clear enough: a future where consumers would shop for real-world products in captivating virtual environments. Yet, here we are. While the **video game industry soars towards $350 billion, and in-game purchases (many, or even most, of which are cosmetic in nature) surpass €50 billion**, all using the same paradigm of real-time interaction and immersion, no one seems to have cracked the code for building immersive e-commerce experiences for real products.

Which begs the question: does fashion actually know what it wants to accomplish with these kinds of experiences in the first place?

THE BROKEN PROMISE OF IMMERSIVE COMMERCE

In 2021, McKinsey and other consultancy giants championed a bold thesis at the height of the metaverse frenzy: The internet is transactional; immersive experiences will make it relational. The idea was simple: by mimicking in-store experiences using real-time 3D environments, populated with digital representations of their products, brands could build deeper connections, enhance desirability at both the product and company level, stand out from a bloated marketing crowd, and boost conversions and sales.

In theory, this made sense. Data shows that **better customer experiences lead to higher revenue and loyalty**. It stood to reason that replicating the same strategies that worked in physical stores to grow that loyalty could also work in virtual ones.

But while they might serve as good marketing exercises, why does it seem as though real-time, immersive environments haven't actually driven much traffic, let alone sales?

The answer is as straightforward as it is brutal: **the experience, in most cases, just wasn't good enough**. WebGL—the once-heralded tech stack behind the majority of web-based real-time rendering —was, in my mind, simply not fit for purpose. Its graphics quality, lagging **a decade behind** consoles like PS5 and Xbox, left consumers underwhelmed, and a lot of the



The New Face

experiences built on top of it also fell short of expectations in usability. Consider this: 60% of gamers consume luxury products. This is a relatively captive market. But why would these savvy, visually spoiled customers, who have extremely well-codified expectations for interactivity, engage with a branded experience that felt archaic compared to what they enjoy daily on consoles and PCs? Is that the level that luxury expectations should be set at?

And even for consumers who didn't already live at the high watermark for real-time graphics and controls, the same nagging questions dogged many virtual stores. "Why doesn't this look more realistic? And why is it so hard to navigate?!"

Behind the scenes, brands and agencies have been grappling with frustration at the platform and raw technical level, interrogating both perspectives to determine why those questions have proven so hard to answer.

From their perspective, countless hours and resources have gone into projects that failed to deliver sufficiently on their primary ROI As someone who's spent a lot of time decoding and working to answer the same queries, I can take a stab at breaking down why these efforts fell flat, which is a critical step prior to figuring out what should happen next to put real-time 3D endpoints, environments, and experiences at their rightful place in the digital product creation ecosystem:

1. Aesthetic and interactivity benchmarks missed

The subpar quality of WebGL-driven environments couldn't capture or hold consumers' attention. Navigating these clunky experiences felt more like using Google Maps' street view than exploring a PS5 game.

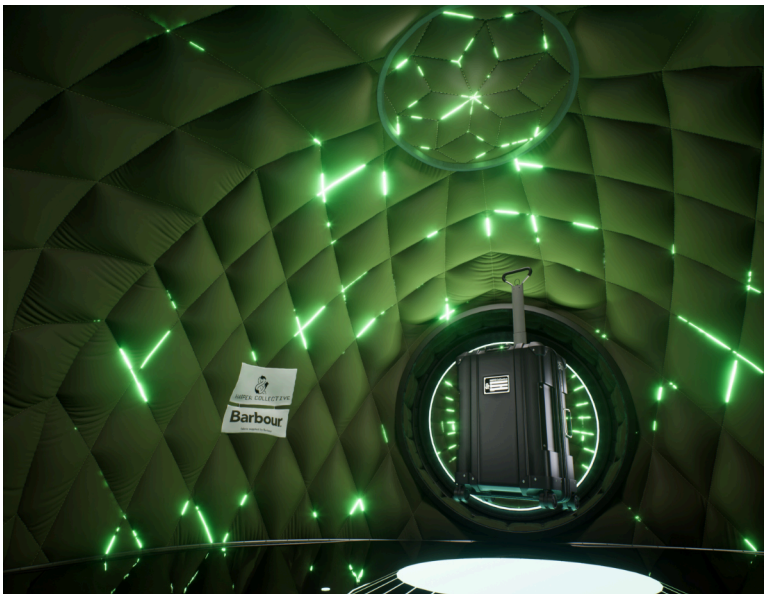
2. Misguided platform strategies

Many brands trusted third-party platforms to deliver traffic that then didn't materialise at the scale they expected, or that offered little direct control over the experience itself, or over where the transactional side of things actually took place.

3. Mismatch of Audience and Platform

Platforms like Roblox - fashion's favourite media crossover success story - have found success by hosting branded experiences, but their primary audience—**58% under age 16 (as of December 2023)**—doesn't align with luxury brands' target markets. While collaborations like Shopify x Roblox hint at potential, the long-term value remains unproven. Similarly, Fortnite integrations are successful when the brand's audience overlaps with the game's demographic and fits with its approach to storytelling. This kind of calibration is essential - and it places some limits on brand freedom.

With a different hat on, I would argue that startups in this space raised too much money, too soon, for a technology that simply wasn't ready and without always having the right market fit and positioning. Fashion, in general, was right about the opportunity—but **timing is everything**, and what we've seen from immersive 3D experiences to date has, in my opinion, been too early.



The New Face



The New Face

SO, WHAT NOW?

Allow me to make a prediction. In ten years, e-commerce will split into two paths: Convenience and Discovery.

The Convenience path will cater to informed shoppers who know what they want, using voice assistants like Siri or ChatGPT to streamline purchases with zero clicks. When people talk about the frictionless, "endless aisle" appeal of online shopping, where anything you want is a tap away, this is the logical destination.

The Discovery path, on the other hand, will mimic the joy of in-person shopping, where customers explore immersive, engaging experiences online, seeking inspiration and unexpected finds.

In my experience working at The New Face, we believe the right approach to reframing and updating the concept of immersive experiences is to start from the assumption that every brand is a storyteller waiting for

the right canvas. Whether they're showcasing a unique lifestyle or promoting exceptional savoir-faire, brands need more than pictures and text to captivate audiences. It's time to meet consumer expectations with AAA graphics that rival what gamers experience on consoles—because the market expects it, but also because it's technically achievable to a standard it hasn't been before.

Thanks to pixel streaming, this is no longer a dream. This technology enables brands to deliver state-of-the-art visuals to any device, bridging the gap between brand storytelling and the gaming world. The real-time rendering is done on the cloud, and an extremely low-latency video feed is streamed to the user's device, with their control inputs being pushed back up to the cloud with similarly super-low input lag.

This is the foundation of what we've set out to build - giving brands a viable way to balance heritage and brand value with a straightforward web plugin that brings immersive, PS5-quality visuals and experiences directly into websites and apps.

Once dismissed as costly, pixel streaming is now economically viable, supporting thousands of concurrent users while delivering ROI-positive e-commerce results. And we're not stopping there. Our goal is to extend beyond the web to gaming platforms like GeForce Now—where Harper Collective, our first project, will soon be live, tapping into a 25-million-strong monthly audience of gamers who are primed for immersive experiences and have hours to engage.

As well as testing and validating the limits of the technology, we have also monitored and researched the results. We can see first-hand how these new, real-time immersive experiences drive organic traffic to brand websites, addressing a major challenge: online differentiation.

In real life, if you're interested in *experiencing* a Prada bag, you'd visit a Prada boutique—not a department store like Printemps. Yet online, customers flock to platforms like Farfetch because brand websites often offer an undifferentiated experience, making the frictionless transactional route the preferable one. By creating unique, immersive experiences, brands can stand out, enhance customer engagement, and generate compelling social media content that drives organic traffic—ultimately reducing reliance on costly paid ads and lowering cost-per-click spending.

This isn't just a step forward; it's a game-changer—for brands, web navigation, for the long-term value of digital product creation and 3D assets, and for e-commerce as a whole.



SEPARATING DPC SKEPTICISM FROM DPC SUCCESS

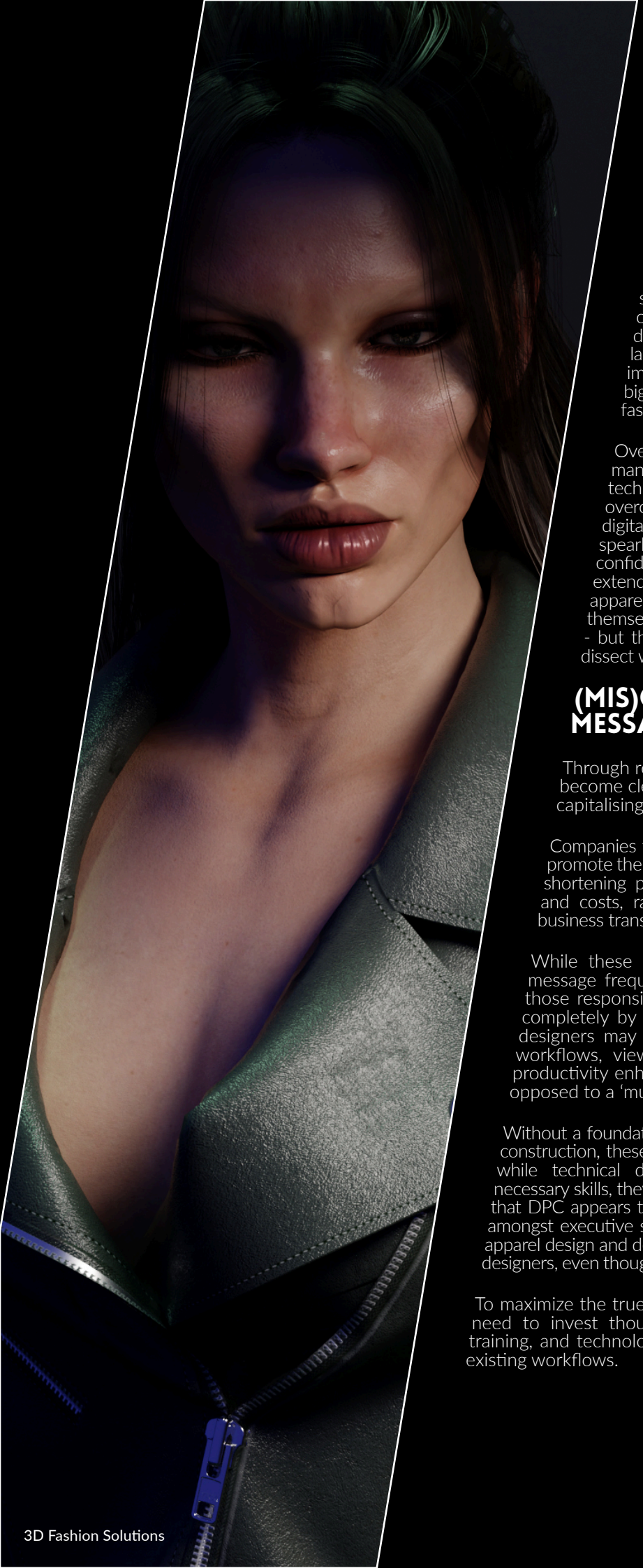
EVEN AFTER SEEING THE VALUE CREATED BY DIGITAL PRODUCT CREATION IN CORE DESIGN AND DEVELOPMENT APPLICATIONS, MANY BRANDS ARE WAITING FOR THE REST OF THE INDUSTRY TO TAKE THE NEXT LEAP. BUT WITH SO MUCH POSSIBILITY SPACE TO EXPLORE, PROACTIVITY COULD BE THE BEST POLICY.



AFSHA IRAGORRI, CO-FOUNDER AND HEAD OF 3D TECH DESIGN, 3D FASHION SOLUTIONS LLC

Afsha is the Head of 3D Technical Design and co-founder at 3D Fashion Solutions, an end-to-end service company focused on digital product creation that helps brands transitioning to DPC unlock the full potential of 3D technology to streamline their workflows, reduce time-to-market, and enhance their overall product quality.

She earned a B.A. in Fashion Design from Massachusetts College of Art and Design and holds a Masters in Fashion Management from IED Madrid. Afsha also worked in 3D and Tech Design departments at Coldwater Creek, Ralph Lauren and Calvin Klein, advising internal teams on best practices when working with 3D and AI software helping establish their 3D standards for their vendor teams.



As the name suggestions, digital product creation is about much more than just 3D. It represents a full-on digital transformation of how garments are designed, developed, and brought to market - and it has the potential to positively impact efficiency, sustainability, and marketing, collaboration and the innovation pipeline.

Despite - or perhaps because of - the sheer scope of those possibilities, many companies are only scratching the surface of DPC's potential due to resistance to change, missing trust, and a lack of strategic direction, sponsorship, and implementation. There is, to put it another way, a big gap between what DPC can do and what fashion, in general, is willing to let it do.

Overcoming that gap is as much of a change management and cultural challenge as it is a technical one. It will involve investing thoughtfully, overcoming internal resistance, building trust in digital representations of physical fabrics, and spearheading technological advancements with the confidence that they will deliver value across the extended lifecycle. The benefits are compelling - apparel brands that move towards 3D can position themselves as front-runners in a competitive industry - but the industry is still in hesitation mode. So let's dissect why.

(MIS)COMMUNICATING THE MESSAGE OF DPC

Through recent discussions with industry leaders, it has become clear to me that the fashion industry is not fully capitalising on the real scope of DPC.

Companies that develop 3D apparel solutions still tend to promote them as a solution for eliminating physical samples, shortening product development cycles, and saving time and costs, rather than positioning them as fundamental business transformations.

While these advantages are enticing to executives, the message frequently becomes diluted as it filters down to those responsible for implementation - and it may be lost completely by the time it reaches real end users. Apparel designers may struggle to incorporate 3D tools into their workflows, viewing them as additional tasks rather than productivity enhancers, or in other words, a 'nice to have' as opposed to a 'must have.'

Without a foundational knowledge in pattern making or garment construction, these tools can seem ineffective and daunting, and while technical designers and pattern makers possess the necessary skills, they are often overwhelmed by the extra workload that DPC appears to introduce. And the long-running assumption amongst executive sponsors has been that people with traditional apparel design and development skills can automatically become 3D designers, even though the two disciplines are not one and the same.

To maximize the true value of digital product creation, companies need to invest thoughtfully by strategically aligning resources, training, and technology in order to fully integrate DPC into their existing workflows.

One approach we've seen be successful is to focus on training employees who show genuine interest and aptitude for the technology from the outset, rather than forcing it onto everyone at once. This increases the likelihood of successful adoption in the short term, and the users who opted to take a back seat are then likely to see their colleagues demonstrating the benefits of working in 3D, and to gravitate naturally towards it themselves.

Outsourcing DPC is another viable strategy. As the market for freelancers and service providers in this space continues to grow, these external experts can help establish high-quality digital block libraries quickly and efficiently, alleviating pressure on internal teams. Again, there is a prevailing sentiment that the only effective way to implement 3D / DPC strategies is to grow all the necessary capabilities in-house, when the reality is that skilled resources are available to deploy from outside the organisation - including in the supply chain.

Considering the rigid timelines of many fashion development cycles, it's also important to triage and prioritise: not every product may benefit equally from initial 3D development. Creating a true digital twin—a photorealistic virtual garment that perfectly matches its physical counterpart—requires fabric digitisation and multiple digital fit sessions, which may not be feasible within a four-week cycle. Therefore, it may be more practical to utilise DPC for products that are more likely to proceed to production.

Megan Seyler, VP of Design for Women's Fashion at Mad Engine - which creates "merchandise for anyone and everyone" across private labels, brands, and "influencer celebrity products" - recognises the disconnect between leadership expectations and practical implementation:

> **"DPC IS REALLY HELPFUL IN PRESENTATIONS, BUT FOR DEVELOPMENT, IT'S AN EXTRA LIFT. 3D IS NOT BEING USED IN THE WAY THAT IT IS SUPPOSED TO BE. THEIR EXPECTATIONS ARE THAT IT SHOULD BE CUTTING DOWN ON SAMPLING WHEN, IN REALITY, ON THE DEVELOPMENT LEVEL, IT IS NOT. WE STILL NEED TO PRESENT A PHYSICAL SAMPLE OF EVERY SINGLE STYLE."**

To overcome these kinds of challenges, companies must adopt a realistic and committed stance when it comes to DPC. This involves setting clear goals for its use, aligning expectations across all organisational levels, and allowing time for teams to gain proficiency.





Hands-on experience tells us that hesitation around DPC adoption often stems from a lack of understanding or a fear of increased workloads, rather than any intrinsic distrust of the idea of designing and developing digitally. By addressing these concerns heads-on and providing support to the teams being asked to do the heavy lifting, companies stand the best chance of mounting a successful cultural transformation that then becomes the scaffolding for extending the many benefits of DPC throughout the rest of the product lifecycle.

TRUSTING DIGITAL GARMENTS TO MIRROR REALITY

Building trust in digital garments is crucial for widespread adoption of DPC. So many of the benefits I've already written about rely on the axiom that the different roles and responsibilities within fashion can all align on the digital garment as an accurate representation of the physical garment. Getting to this level of trust, though, requires time, patience, and a commitment to continuous improvement. By comparing digital garments with their physical counterparts over multiple seasons, teams can refine their processes and improve accuracy, and over time new business units and different product categories can be brought under the DPC umbrella with that base of trust to rely on.

Timberland is an example of a brand that has successfully implemented 3D in their product development process, resulting in reduced physical sampling with the right foundation of trust. As Sylwia Szymczyk, 3D Apparel Specialist at Timberland, recently noted:

"TRUE INNOVATION WILL EMERGE AS AN END-TO-END PRODUCT DEVELOPMENT CYCLE FULLY INTEGRATED WITH DIGITAL PRODUCT CREATION (DPC) AND ARTIFICIAL INTELLIGENCE (AI). THIS MEANS LEVERAGING AI TO DESIGN COLLECTIONS, UTILIZING 3D FITTING TECHNOLOGIES, AND RELEASING DIGITAL PRODUCTS TO THE MARKET BEFORE PLACING PURCHASE ORDERS WITH MANUFACTURERS. PRODUCING ONLY WHAT CUSTOMERS HAVE BOUGHT BECOMES THE ULTIMATE SUSTAINABLE SOLUTION. HOWEVER, THIS REQUIRES A DRASTIC TRANSFORMATION IN MANUFACTURING—WE CANNOT WAIT MONTHS FOR PRODUCTS TO REACH THE CUSTOMER."

The future of DPC, though, depends on advancements in both technology and workflows as well as a cultural shift towards trust in digital representations of physical things. Rozh Roux, Senior Director of Technical Design & DPC at Athleta, believes that innovation must address the tactile limitations of the digital process to bring all those different elements together:

> **"WHAT IS STILL MISSING FROM THE FIT PROCESS IS 4D—THE ABILITY FOR THE MODEL TO DESCRIBE THE SENSATION OF THE FABRIC, THE FIT, AND COMPRESSION. THE PRODUCT DEVELOPMENT PROCESS IS STILL VERY TACTILE, AND UNTIL THE DIGITAL PROCESS IS FULLY INTEGRATED INTO A TACTILE EXPERIENCE, THE COMMITMENT TO AN END-TO-END PROCESS WILL NOT BE THERE."**



Client feedback has been instrumental in refining these technologies, ensuring they meet real-world needs. Building on this, innovations such as soft body avatars have emerged in response to the general concern over hard surface avatars, offering a more realistic virtual representation of how garments interact with the contours and movements of the human body. The same feedback from a large number of industry experts pressures further innovation - or, to phrase it differently, the more people start to test the limits of DPC ecosystems, the better those ecosystems will become in both a holistic sense and at the individual solution level.

Another potential solution born out of this kind of innovation is the development of tech bodysuits for fit models that simulate pressure and tension points, enabling digital garments to provide sensory feedback during virtual fittings. While hardly widespread today, these kind of bleeding-edge ideas could significantly reduce reliance on physical samples and eventually eliminate the need for physical fittings altogether.

AI-driven 3D garment creation presents another area of opportunity. Software capable of generating garments from simple prompts or hand sketches would simplify workflows - at least in non-technical applications - and improve accessibility. For companies like Browzwear and CLO3D, evolving to accommodate such capabilities is likely to be part of what it takes to remain competitive. Without continuous innovation, they run the risk of more user-friendly alternatives overtaking them.



WHO WILL ACTUALLY PAVE THE WAY IN DPC ADVANCEMENT?

A crucial question remains: which organisations will actually pioneer innovation in Digital Product Creation? Across a wide spectrum of cultural and technical metrics, there is a lot of ground to be gained, but little clarity on who will - or should be - first across the line.

While many fashion brands are experimenting with different digital technologies, true innovation could come from those willing to fully integrate DPC into their processes and invest in emerging technologies like AI and tactile feedback systems. This can be a difficult pill to swallow in an uncertain economy, but it seems clearer than ever that extracting the full set of benefits from digital product creation will require companies to commit to pushing the envelope.

Technology providers play a crucial role in this evolution. Companies that develop game-changing solutions addressing current limitations will lead the industry forward. Whether it's through advanced AI-driven design tools or integrating tactile experiences into digital fittings, the innovators in this space will set new standards for what's possible in fashion.

As has been well-documented in these reports, and in plenty of other industry coverage and analysis, DPC's value extends far beyond the product development process. Digital assets can be repurposed for marketing, e-commerce, and even participation in virtual fashion markets. Footwear and accessory brands are already utilising digital animations to create engaging content, and apparel brands have the opportunity to do the same - beyond the use of static virtual photography.

The rise of digital identities and virtual environments presents another avenue. Selling garments designed exclusively for virtual use eliminates manufacturing costs entirely, allowing fashion brands to tap into a flourishing market while addressing sustainability concerns. This approach not only opens new revenue streams but also aligns with growing consumer interest in sustainability and digital experiences.

However, achieving this level of integration requires companies to commit to DPC projects from start to finish, learning from successes and setbacks alike. Those with established DPC workflows will have a significant advantage when new technologies become available, as their experience will enable them to adapt more quickly. The idea of “Metaverse fashion” might not have played out the way its biggest proponents hoped it would, but whatever the future holds for digital fashion, the companies that invest in innovation today - especially innovation that helps them build capabilities, tools, pipelines, and libraries of digital assets - will be the ones that push the boundaries of technology and redefine what's possible. And becoming one of those companies likely means committing to digital product creation today.

HOW DPC AND AI COULD COMBINE TO ADVANCE DIGITAL TRANSFORMATION

WITH DIGITAL PRODUCT CREATION ANCHORED IN STREAMLINING CREATIVE WORK, AND AI AT THE TOP OF THE INVESTMENT PILE THANKS TO ITS PROMISE OF RADICAL AUTOMATION, THE TWO SEGMENTS SEEM SET TO CONVERGE. WHAT'S LIKELY TO HAPPEN, FASHION-WIDE, WHEN THEY DO?





MOIN ROBERTS-ISLAM, TECHNOLOGY & INNOVATION MANAGER, FASHION INNOVATION AGENCY

Moin Roberts-Islam is a fashion-tech consultant, innovator, public speaker, mentor, and writer with a decade of experience working at the intersection of technology and fashion. His expertise comes from exploring and working with bleeding-edge technologies, devising ideas for how to apply them to the fashion industry and brands, and overseeing collaborative industry projects from a technical standpoint. His current role as the Technology and Innovation Manager at the Fashion Innovation Agency has led to collaborations with household names including Microsoft, Snap Inc, Epic Games, Shopify, Ganni and Burberry.



As we have seen throughout this report, DPC encompasses a range of digitally-led processes like designing, prototyping, and marketing products. And the key benefits are just as far-ranging: DPC can be used to streamline workflows, enhance sustainability, and speed up time-to-market.

But there is, of course, another technology segment that has been shaking up all kinds of industries in the last two years, and challenging maybe an even broader range of processes than DPC: AI. Many brands, including household names like Adidas, Nike and Zara, have been using digital product creation tools some time now, for rapid prototyping and market responsiveness. Are they - and the wider fashion industry - now taking the same steps using AI? And where do we see those two different but equally broad fields interacting?

WHERE FASHION IS USING AI

Fashion has been exploring the use of AI within supply chains for a while now, using it to transform many traditional workflows over the years. The global fashion industry generates over $1.7 trillion annually, but inefficiencies in design, production and distribution can equally cost companies billions.

AI is particularly well suited to solving these issues, because of its ability to process vast volumes of data, predict trends and simulate realistic designs. From design ideation to material optimisation, AI is embedding itself into every stage of the fashion workflow. Here are some of the key areas where it has the potential to reshape the fashion landscape.

GENERATIVE DESIGN AND IDEATION: With the development of tools like generative adversarial networks (GANs) and natural language processing (NLP), designers can now create multiple variations of designs quickly. GANs work by using two neural networks—a generator and a discriminator—that compete to produce highly realistic images of garments, enabling designers to explore innovative styles and patterns through AI-generated outputs. NLP leverages language models to analyse trends, interpret design briefs, and generate detailed textual descriptions of garments, which can be transformed into visual prototypes or inspire new creative concepts.

AI-powered generative tools analyse inputs such as colour palettes, textures, and trending silhouettes to create a range of design variations. For example, a designer might input keywords like 'minimalist streetwear,' and the AI will generate multiple options that align with these themes, all while adhering to specific brand guidelines or seasonal trends. These tools use machine learning models trained on extensive datasets, including historical designs, fashion shows, and even social media imagery, to produce outputs that feel both innovative and market-relevant.

The overall impact of using AI in this way is a reduction in the time and cost of brainstorming and sketching, allowing designers to focus on refining ideas. An early example of this approach was when Tommy Hilfiger worked with IBM's Watson to revive archival designs, blending the brand's heritage with modern aesthetics in a fraction of the time it would take a human team. More recently, Nike have been using AI to create pattern designs for personalised prototypes for a range of athletes within their roster, across a number of sports.

VIRTUAL SAMPLING AND PROTOTYPING: Virtual sampling and prototyping represent a paradigm shift in how fashion brands approach design iteration. By integrating AI into 3D design tools like CLO3D, the vision is now to create hyper-realistic digital garments that mimic the drape, texture, and movement of real fabrics. This not only eliminates the need for excessive physical samples but also allows teams to refine designs collaboratively in virtual spaces, significantly accelerating the development cycle while reducing waste.

AI-driven virtual prototyping combines body scan data with advanced fabric simulation algorithms to create lifelike digital garments. By analysing the physics of fabrics—how they stretch, fold, and flow—AI ensures that each virtual piece behaves as it would in the real world, offering designers and clients an accurate representation of drape, fit, and movement without needing a physical sample.

The use of data-driven body simulation, virtual sampling and digital prototyping cuts down on material waste and shortens the product development cycle by around 35%, whilst maintaining the accuracy of the final designs before putting them into production. Solutions like SEDDI's Textura software use AI to produce accurate digital fabrics that mimic both the visual and the physical properties of the materials they are simulating.

Future directions for these processes could include linking virtual samples with AR/VR platforms for customer try-ons before production. The Fashion Innovation Agency explored these processes in collaboration with visual-effects company Digital Domain, combining AI for cloth deformation with real-time motion capture data.

TREND FORECASTING: AI-driven trend forecasting is overhauling the way brands anticipate consumer preferences and market shifts. By leveraging machine learning and natural language processing, these systems sift through vast datasets—from social media hashtags to online shopping patterns—identifying emerging styles and behaviours long before they reach mainstream adoption. This proactive approach allows brands to stay ahead of trends and align collections with evolving consumer demands.

Companies like Heuritech use advanced AI to analyse millions of social media images and identify subtle shifts in consumer preferences, helping brands like Louis Vuitton (since 2020) stay ahead of the curve in luxury fashion. By decoding patterns in emerging styles, colours, and materials, the platform enables designers to make data-backed decisions that resonate with their audience before trends peak.

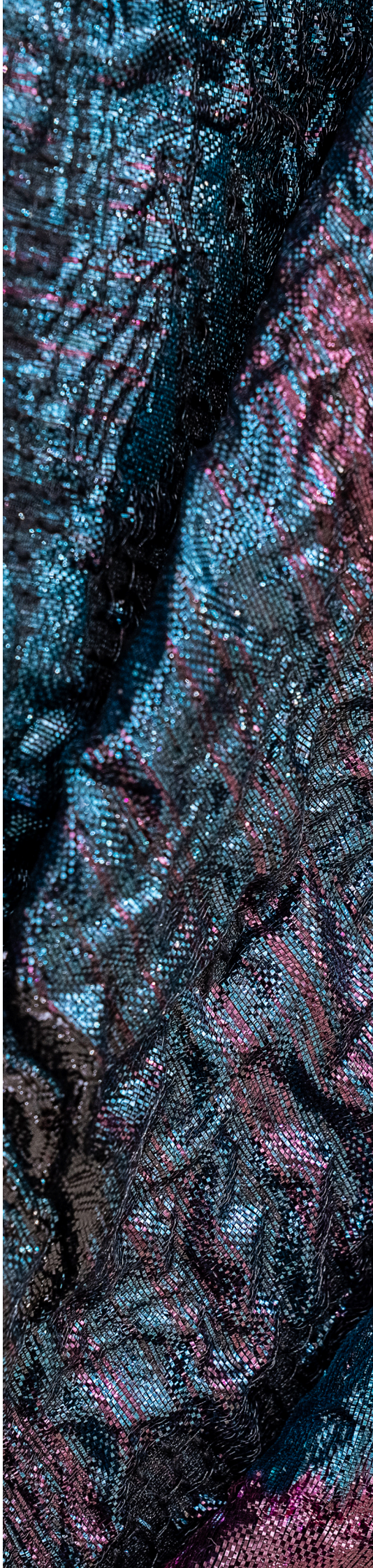
Similarly, EDITED applies AI to vast datasets of e-commerce activity, tracking everything from sell-through rates to competitor pricing. This granular analysis allows brands to set optimal pricing strategies for new collections, ensuring a competitive edge while maximising profitability in a rapidly changing retail landscape.

US fashion house FINESSE combines AI algorithms with votes from their online community to produce the most appropriate styles, in the correct volumes, for their customer base.

MATERIAL SELECTION: AI-powered material selection tools are reshaping how designers and manufacturers approach sustainability and innovation. By analysing parameters like durability, environmental impact, and compatibility with design requirements, these systems recommend materials that balance cost-efficiency with creative vision. This ensures that each choice aligns with both the product's function and the brand's sustainability goals, often encouraging sustainable practices and reducing material experimentation costs.

Finnish company Spinnova, who developed pioneering sustainable textile solutions by creating fibres derived from wood pulp and other waste materials, use AI to optimise material development, ensuring that production processes are both efficient and scalable.

Nanoloom is revolutionising fabric and knit design by using advanced AI algorithms to optimise fibre combinations and predict the precise properties of the resulting materials. By intelligently analysing the ratios of different fibres, Nanoloom's systems can create blends with tailored characteristics, such as strength, flexibility, and texture. A key innovation lies in the manipulation of graphene nanomaterials, with AI-driven insights that enhance the fibres' performance.



PRODUCTION PROCESS AUTOMATION: AI-driven robotics and automation systems are redefining the fashion manufacturing landscape by streamlining repetitive tasks, such as cutting, stitching, and assembly. These innovations not only increase throughput but also ensure that production is faster and more cost-effective.

Vision-based AI systems are central to this transformation, guiding robotic arms with remarkable precision. These systems analyse digital designs, translating them into exact movements for cutting machines and sewing robots, ensuring each piece is produced to exact specifications. The integration of deep learning algorithms allows robots to adapt and refine their processes over time, improving efficiency with each cycle.

The result is a significant reduction in human error, as robots execute repetitive tasks with consistent precision. This not only enhances the overall efficiency of production but also reduces labour costs, making manufacturing processes more scalable and cost-effective. The increased automation also offers the potential for faster turnaround times, allowing brands to meet demand more swiftly without compromising on quality.

Sewbo is addressing the growing challenge of labour shortages in the garment industry by automating the sewing process with its innovative robotics. By combining AI with robotics, Sewbo's system is capable of autonomously stitching garments with minimal human intervention, making it a vital solution for manufacturers facing workforce gaps. This technology not only reduces the reliance on skilled labour but also ensures that production processes remain consistent and efficient.

A significant challenge with this type of technology is the high cost of implementation, as well as understandable resistance from traditional craftspeople and those currently employed in garment production.

AI'S POTENTIAL TO REPLACE CREATIVE ROLES

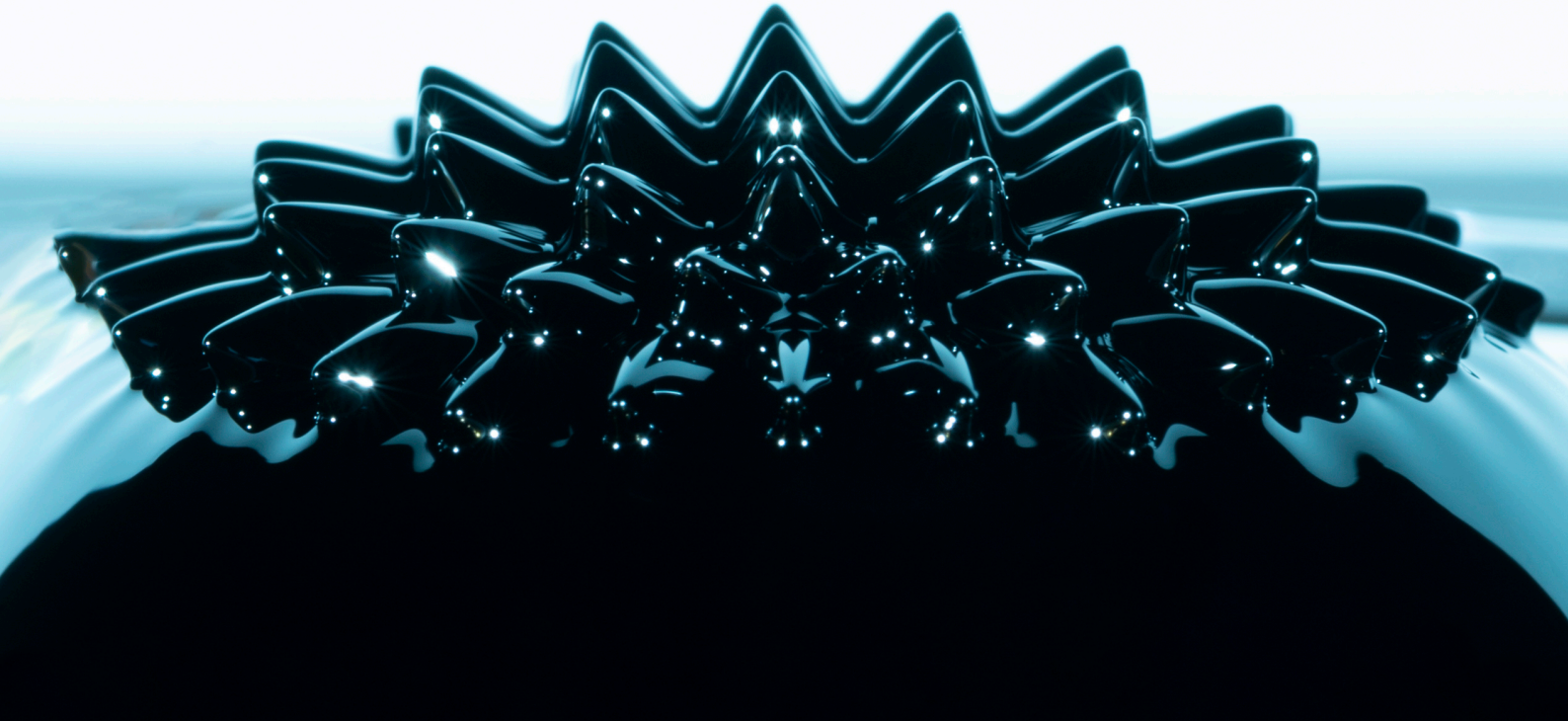
In the evolving world of fashion, AI's growing involvement in the creative process has sparked a fundamental debate: can a machine truly replace the ingenuity of human designers, or will AI remain a powerful assistant? As AI continues to improve in generating designs, it is important to understand the scope of its strengths and limitations, particularly in relation to its potential to reshape creative roles.

AI excels in areas where speed, volume, and pattern recognition are key. By processing vast datasets, AI systems can identify emerging trends, predict consumer preferences, and generate large quantities of design variations in a fraction of the time a human designer might. This efficiency allows brands to rapidly iterate on designs, refine concepts, and experiment with new combinations. Tools like generative design software have already demonstrated AI's ability to optimise pattern-making and even explore aesthetics that might otherwise be overlooked. These capabilities are invaluable in fashion, where staying ahead of trends and market demands is crucial.

Despite these advantages, AI still struggles with areas fundamental to creative work: storytelling, emotional resonance, and the deep, cultural understanding that drives brand identity. While AI can create designs, it lacks the emotional intelligence required to weave these into a narrative that resonates with audiences on a human level. In the fashion world, where brand identity is intricately woven into the fabric of storytelling, AI's limitations become glaringly evident.

Fashion brands are built on a delicate balance of history, tradition, and identity—elements that AI, no matter how advanced, cannot currently fully understand or replicate. AI-generated campaigns may be able to produce visually compelling content, but without human oversight, they risk missing the intricate subtleties that imbue a brand's story with authenticity and emotional resonance. This is why human intervention remains crucial in the creative process, ensuring that the final narrative reflects not only the visual aesthetic but also the core values and cultural nuances that make a brand unique.

As AI plays an increasingly prominent role, the ethical implications are profound. The potential for job displacement in creative industries is a real concern—could AI replace designers entirely? Beyond job losses, there is the question of what it means for creative expression. Can machines truly create art, or is creativity an inherently human quality that should not be outsourced to algorithms?









All images: Fashion Innovation Agency

Rather than replacing human creativity, AI is more likely to serve as a powerful ally. In hybrid workflows, AI can handle the technical aspects—generating variations, predicting trends, or streamlining the design process—while human designers bring the vision, emotion, and narrative that make designs truly stand out. This collaborative model could herald the future of creative industries, where AI enhances, rather than replaces, the human touch.

SUSTAINABILITY AND RESOURCE EFFICIENCY

Sustainability and resource efficiency are becoming cornerstones of the fashion industry's shift towards more responsible practices, and AI is playing a pivotal role in driving this transformation. With growing pressure from both consumers and regulators, brands are increasingly relying on AI to optimise their resource use and reduce their environmental impact.

One of the most significant ways AI contributes to sustainability is by forecasting demand more accurately, thereby reducing overproduction and excess inventory. Through the analysis of vast amounts of sales and consumer data, AI tools help brands predict trends and consumer preferences with remarkable precision. This not only prevents waste but also ensures that supply chains remain lean and efficient. For example, Hyran uses AI alongside point-of-sale data to optimise production volumes and profitability for brands, balancing the fine line between meeting demand and minimising unsold stock.

AI also plays a key role in evaluating the environmental impacts of various materials, offering insights into more sustainable alternatives. By assessing a material's lifecycle—from sourcing to disposal—AI can recommend the most resource-efficient options for production. In some cases, it can even suggest new materials that have a lower environmental footprint. This helps brands reduce their reliance on non-renewable resources, creating more eco-conscious products.

AI is also integral to advancing the circular economy, by enabling better recycling and upcycling processes. Machine learning algorithms are being used to sort and identify materials that can be recycled or repurposed, thus reducing the reliance on virgin resources. By automating these processes, AI ensures greater efficiency in material recovery, encouraging a closed-loop system where waste is minimised and resources are continually reused.

CUSTOMER ENGAGEMENT AND PERSONALISATION

Artificial intelligence has created a raft of new opportunities in terms of how fashion brands engage with consumers, offering highly personalised experiences that resonate on a deeper level. By leveraging consumer data, AI tools provide tailored recommendations, virtual interaction opportunities, and efficient support, ensuring a more seamless shopping journey.

PERSONALISED RECOMMENDATIONS: Brands and retailers have begun to utilise AI to curate outfits based on individual preferences. For instance, Zalando's ChatGPT-powered fashion assistant enables users to describe their desired looks in natural language, generating outfit ideas based on weather, events, and even mood. This conversational AI model is accessible across its European markets, creating a personalised shopping experience for millions of users.

Sociate AI have introduced a tool that enables shoppers to search retail websites through a conversation with a chatbot and find personalised results in real-time, regardless of the original state of the website's metadata or product attribution.

VIRTUAL FITTING ROOMS AND AR TRY-ONS: AI-driven technologies, such as Zalando's virtual fitting room pilot, allow customers to visualise garments on avatars built from their own measurements. Partnering with Levi's, Zalando offers tools for accurately fitting items like jackets and jeans, reducing returns by up to 40% in initial trials. Such innovations address both consumer satisfaction and environmental impact by mitigating waste from returns.

Similarly, Google introduced a virtual try-on tool last year utilising generative AI that enabled online shoppers using the Google search tool to see how items would look on a range of models with different sizes, ethnicities and body shapes.

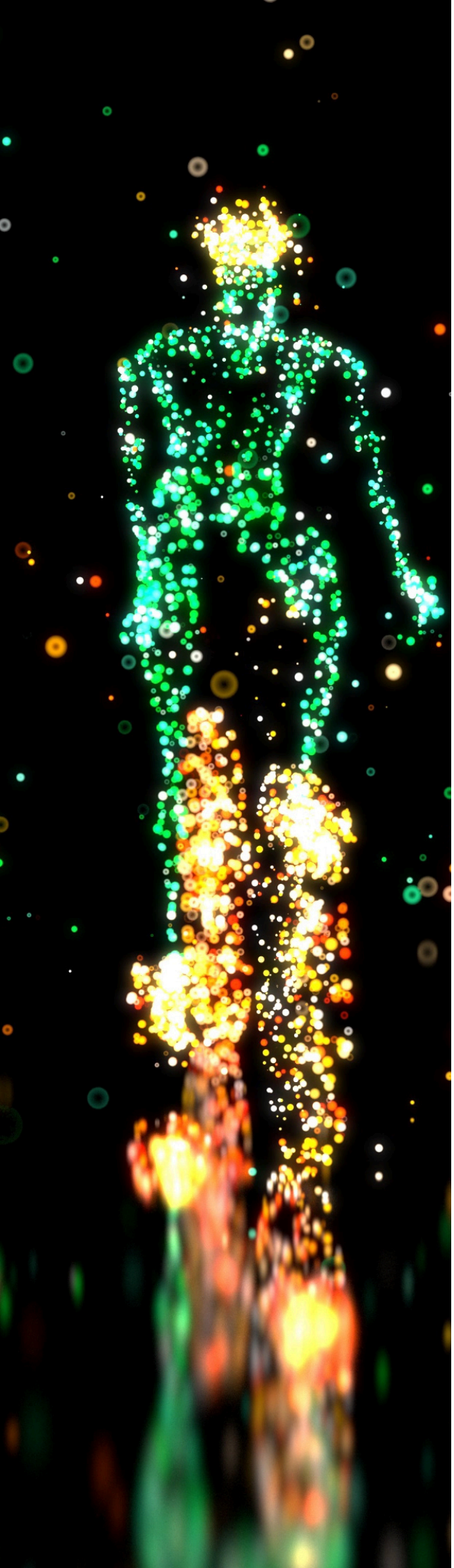
ENHANCED CUSTOMER INTERACTIONS: AI chatbots, such as the My AI tool integrated into Snapchat, not only assist with technical queries but also provide styling advice. These chatbots create engaging, interactive experiences, enabling consumers to visualise products in real-time through augmented reality, offering brands an opportunity to connect with tech-savvy audiences. Through my role at the Fashion Innovation Agency, I worked on a project in collaboration with MIcrosoft that combined scanning the items in your wardrobe through mobile-phone-based photogrammetry with state of the art natural language processing (NLP) to produce a Digital Human Stylist. This stylist would integrate with your calendar of upcoming events and the weather for your region to make styling suggestions for outfits using the entire breadth of your wardrobe and could be refined and directed using speech as an input.



LIMITATIONS OF AI WITHIN THE DPC WORKFLOW

While AI holds immense potential for digital product creation in fashion, there are still some significant limitations that hinder its full integration. As mentioned earlier, one prominent challenge lies in creativity and cultural nuance. AI excels at generating designs based on patterns and trends but often fails to capture the emotional resonance or culturally specific elements that underpin truly impactful fashion. For instance, a garment inspired by traditional Japanese aesthetics might require a nuanced understanding of cultural symbolism—something an AI trained on global datasets might overlook or misinterpret. This can result in products that lack authenticity or even risk cultural appropriation.

Another critical issue is dataset biases. AI tools rely on training data, which, if skewed, can perpetuate narrow aesthetic norms or exclude diverse perspectives. This has been highlighted in instances where generative AI models reinforced Eurocentric beauty standards or failed to account for body diversity in virtual fitting tools. There are multiple stories online about AI biases perpetuating stereotypes or excluding groups of people, including failing to represent diverse skin tones, reinforcing unattainable beauty ideals, and perpetuating stereotypical beauty aesthetics.



Additionally, the high implementation costs of AI pose challenges, particularly for small-to-medium enterprises (SMEs). Advanced AI systems require substantial investments in hardware, software, and skilled personnel, making them accessible predominantly to larger brands. A recent McKinsey report highlights that while AI adoption in the fashion industry is growing, it is particularly prevalent among large-scale enterprises, with over 30% of major fashion brands utilising AI for various functions. However, the uptake among small-to-medium enterprises (SMEs) remains low due to challenges such as high implementation costs and limited access to talent and technology. This disparity underscores the financial and operational barriers SMEs face in integrating advanced AI solutions, particularly those requiring significant investment in infrastructure and expertise.

FUTURE DIRECTIONS AND EMERGING TRENDS

The future of AI in fashion's digital product creation workflow is defined by a delicate balance between automation and human creativity, alongside groundbreaking technological advancements that promise to reshape the industry.

AI is poised to complement, rather than replace, human-led processes. Designers increasingly leverage AI for initial ideation and rapid prototyping, delegating repetitive or time-intensive tasks like fabric simulation or colour-matching to machines. For instance, platforms like CLO3D allow AI-powered visualisations of garment concepts, which designers can refine manually to ensure creative intent is preserved. This synergy enables designers to focus on artistry while benefiting from AI's efficiency. Similarly, sketch-to-image and image-to-video tools utilising generative AI can allow designers to get a compelling visual output from even a basic sketch, producing video outputs that show increasingly accurate representations of textures and fabric movement, allowing them to quickly iterate and refine their ideas.

As AI automates routine tasks, the role of workers is shifting toward managing technology and interpreting AI-generated insights. This evolution could demand retraining initiatives, ensuring traditional skillsets adapt to a tech-centric workflow.

AI has the potential to democratise access to professional-grade design tools, empowering emerging designers and SMEs to compete with established brands. Tools like Generative AI in Canva already allow individuals to create sophisticated designs without extensive technical expertise, foreshadowing a more inclusive fashion ecosystem.

OUTLOOK

Artificial intelligence is undeniably transforming digital product creation in fashion, offering unparalleled efficiency, precision, and scalability. From automating mundane tasks to enabling hyper-personalised consumer experiences, its impact is vast. However, as has been discussed, AI cannot currently replicate human creativity, cultural sensitivity, or emotional depth—qualities at the heart of fashion design.

The future lies in a harmonious collaboration between AI and human talent, where technology enhances, rather than replaces, creative workflows. With continued innovation and a commitment to inclusivity and ethical practices, AI holds the promise of democratising design and reshaping the industry for the better.

EXPLORING THE DPC ECOSYSTEM

From the pioneers and mainstays of 3D design and simulation, to disruptors across the wide spectrum of digital product creation, meet the companies that are working to underline and expand the business case for DPC.



Over the last two years we have tracked the digital product creation technology ecosystem through a turbulent time.

In late 2022, with fashion still acting on the active memory of the pandemic, investment was flowing readily into initiatives - new and existing - that progressed fashion's desire to digitise its processes and to create digital representations of its products. This was a period we referred to as the "tipping point" for 3D and DPC adoption - building on a decades-long legacy of innovation, research, technical development, and the proving-out of business cases.

At the end of 2023, we saw how this tipping point had translated into a demand for scale, with the rapidly-expanding spectrum of use cases for digital assets creating a heightened demand for them - and for all their constituent parts. This was also the year where we saw the growth of the DPC user community accelerating, with more job roles than ever interacting with digital products, digital materials, virtual photography and more.

This year, mirroring the scrutiny we see in other technology sectors within fashion (and across other industry's) the focus has turned to measuring the value of DPC, with new scrutiny being applied across both core 3D design, simulation, and visualisation capabilities, and throughout the extended ecosystem of solutions that make up the business-level transformation ambitions of digital product creation.

As we said last year, the choice to embrace digital product creation is not just a matter of selecting a 3D design and simulation tool, but building an entire DPC pipeline, and re-orienting multiple components of your business around it. And building that pipeline, and the processes to go with it, is perhaps one of the most defining series of choices that any brand will make over the next few years.

In 2022 and 2023, those choices were made with a complex set of priorities. In 2024, that remains the case, but return on investment (and the shape and scale of that investment to begin with) have, for many companies, jumped to the top of the pile.

Throughout this report, you will find insights from brands, educators, thinkers, and contributors - all oriented around the creative and commercial logic of fashion's shift towards digital product creation. The following section is where you will hear from the technology vendors themselves. Each of them has supported this report and helped keep it, and The Interline's other output - free to read. Each of them has also provided a series of datapoints, answers, and insights that correspond directly to the information brands, retailers, and suppliers are looking for in order to make informed investments in technology.

To support this decision-making process, we asked each vendor the questions that we believe matter the most when companies like yours are looking to discover, shortlist, and work with new partners. So each vendor contained in this section was 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 spent time with a senior executive from each company to better understand their ethos, their strategy, their roadmap, and how they believe the digital product creation ecosystem and community for footwear, apparel, and accessories will evolve in the near future.

Every vendor has also provided a point of contact, so if you see a solution or service you believe has the potential to deliver a concrete return on investment at a difficult time for fashion and retail, 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 - each of whom is a paying sponsor of this report. 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.

While it can be tempting to start and end your search with the most recognisable names in 3D, we encourage you to explore the full suite of vendors contained in these pages, as well as conducting additional research through The Interline and other sources. You may be surprised by what they are capable of, and what synergies there are to be discovered in their partnerships, which could provide ways to unlock new use cases and new capabilities from your digital tools and assets.

BROWZWEAR

CLO VIRTUAL FASHION

HYLAND

KALYPSO

KORNIT

MESH01

STYLE3D | ASSYST

TUKATECH

VIZOO

browzwear

www.browzwear.com

Founded
1999



PRICING MODEL:

Browzwear's priority is to ensure customers have the right solution to fit their needs from start to finish. Therefore, our team works closely with customers, providing expert support and guidance throughout onboarding. For enterprise pricing, please contact our team directly.

Born in the fashion industry and trusted by top apparel brands, Browzwear has transformed tedious physical processes into efficient, collaborative digital workflows.

Browzwear goes beyond beautiful 3D renderings, enabling technical designers, pattern makers, and supply chain stakeholders to collaborate on a digital twin of the physical garment. This ensures a trusted fit, consistent product development, and reduced time and resources from sketch to store.

With the 2024.2 edition, Browzwear takes digital product creation even further with new advanced 2D tools in VStitcher, minimizing the need for external CAD software, and expanded Stylezone capabilities, cloud-based platform that streamlines product development and alignment among all stakeholders.

Browzwear's platform continues to lead the fashion industry toward a more sustainable future by cutting time and waste in sample-making and production—resulting in lower sample costs, tighter demand planning, and better sell-through rates with fewer returns.

HEADLINE CUSTOMERS

DICKIES
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LULULEMON
MAS HOLDINGS
NIKE
OTTO INTERNATIONAL (BONPRIX)
PERRY ELLIS INTERNATIONAL
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TARGET
TENDAM
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VF CORPORATION
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Browzwear is a trusted partner of **1000+ customers, 150+ schools** and **100+ technology partners.**

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Founded
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Tronog
Vizoo
VNTANA

What role do you see yourself playing in the 'digital product creation' journey?

Browzwear plays a pivotal role in the Digital Product Creation (DPC) journey by empowering brands to move from concept to consumer with speed, precision, and scalability.

As DPC enters a phase of scale and industrialization, Browzwear's tools bridge the gap between traditional methods and digital innovation, enabling brands to scale up product development workflows without compromising quality or consistency. By delivering highly realistic virtual twins and seamless integration across supply chain platforms, Browzwear supports the industry's move towards a fully digital product lifecycle. Through integration tools and automation of repetitive tasks and batch processes, Browzwear frees teams from manual workflows and increases efficiency across the board.

In this next phase, Browzwear is set to be a foundation for brands looking to streamline processes, optimize resource use, and explore new avenues like on-demand production and hyper-personalization. It's not just about digitizing design; it's about reimagining the entire production ecosystem for a faster, more sustainable future in which the boundaries between physical and digital are virtually erased.

CONTACT

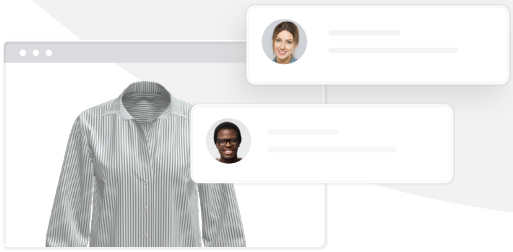
browzwear

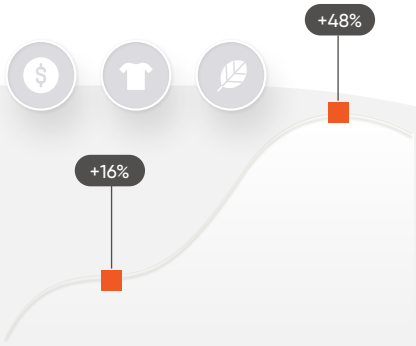


Real Value. Real Results.

Browzwear is trusted by the top apparel businesses to digitize product creation.

Browzwear goes beyond beautiful 3D renderings, enabling technical designers, pattern makers, and supply chain stakeholders to work together on a virtual twin of the physical garment. This ensures a trusted fit, consistent and efficient product development, and reduced time and resources from sketch to store.





Browzwear's digital platform is advancing fashion toward a more sustainable and agile future by significantly cutting time and waste in sample-making and production processes – resulting in reduced sample costs, tighter demand planning and better sell through rates with fewer returns.

Talk to Our Team Today to Find Out More

Born in the fashion industry, Browzwear has transformed tedious physical processes into efficient, collaborative digital workflows.

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CRAIG PLANSON

Chief Revenue Officer, BROWZWEAR

KRISTEN OHLSSON

Head of Strategic Solutions Offering, BROWZWEAR

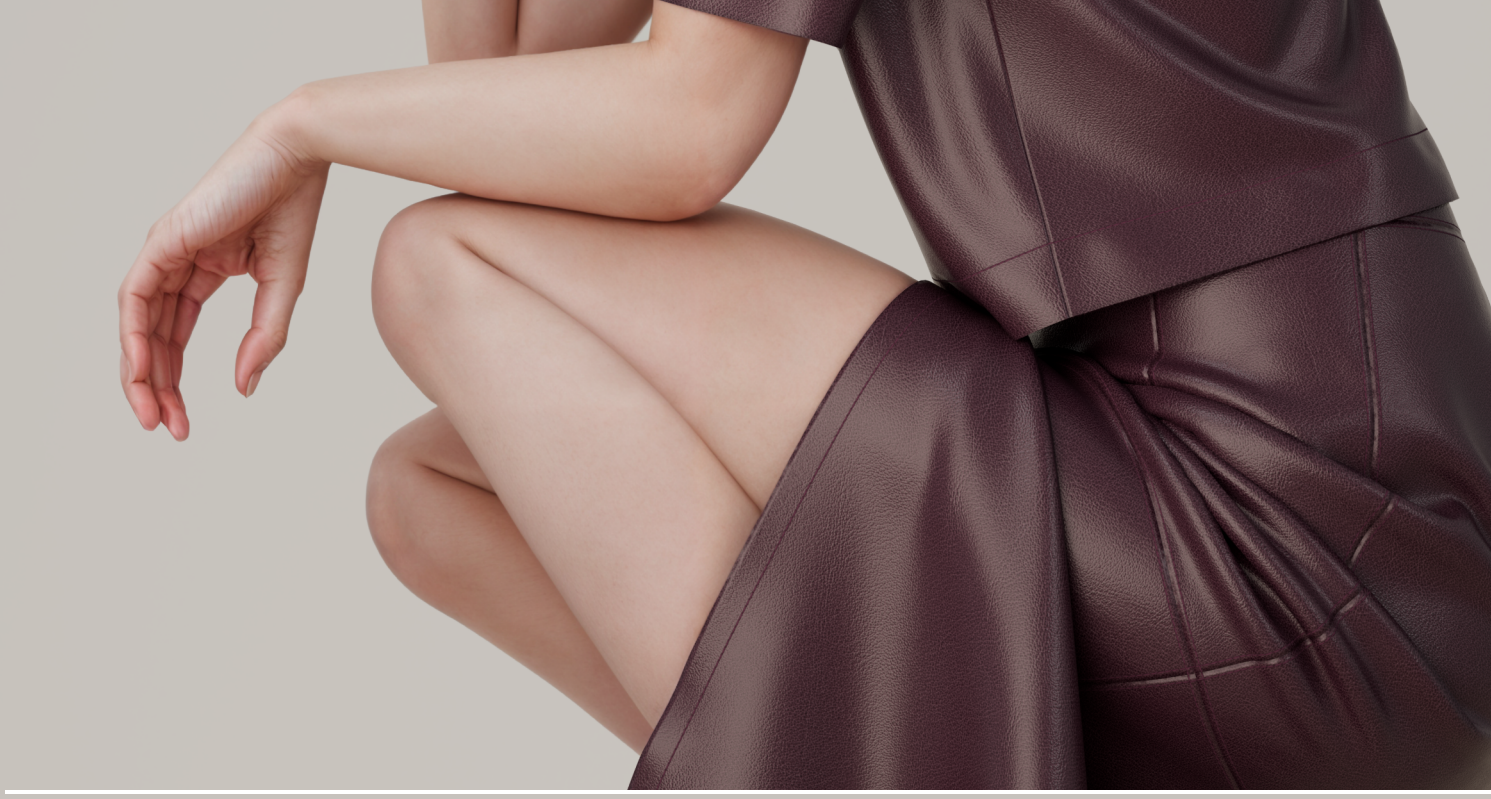
In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify. Do you believe the business case for 3D / DPC is strong enough? And how is that business case evolving to meet a changing industry?

Craig Planson: The business case for DPC is sound. The compression of the product development cycle has strong ROI by itself. Reduction in returns and samples combined with increased sell through rates drives multiples in return impact. Add Supply Chain diversity and consistency and the justification is significant. The critical components are to unify the organizational silos and secure buy in for change so the full impact can be realized. Organization's want to do more without adding headcount. Integration with key systems is critical to maximising productivity. There are many mundane steps that are repeated and take time. We have captured a library of these steps and built integrations and automated plays to reduce time.

Fashion has always struggled with waste, but there are two forces making the industry's legacy of material, time, and process waste a more acute challenge than ever: the difficult economy, and the drive towards sustainability. What's your take on how DPC can help manage those billions in lost revenue, and assist in mitigating the industry's environmental impact?

Kristen Ohlsson: Many companies are already experiencing the benefits of integrating digital development processes into their go-to-market cycles. They're achieving shorter lead times, significantly reducing sampling waste, and minimizing production errors by improving digital collaboration and co-creation with vendors from the outset. These advancements are also starting to address return rates by tackling fit issues earlier in the process and driving greater fit consistency across their supply base.

However, significant revenue losses still stem from overdevelopment and missed market opportunities. Companies that have taken the additional step of overcoming tech sprawl and building a strong foundation of organized data and digital assets are positioning themselves with even greater advantage of connected digital ecosystem. By integrating market data into their digital workstreams, these organizations can react more quickly to shifting trends, reduce inefficiencies, and scale operations without increasing overhead. These capabilities will be essential as brands face continued pressure to capture consumer demand amidst cautious spending and navigate ongoing supply chain disruptions heading into 2025.



From a purely financial point of view, every industry sector is under pressure to identify where AI can help automate processes, deliver savings, accelerate existing initiatives, free up skilled resources - or a combination of all four. As one of the key technology players in both the creative and technical sides of fashion, what's your perspective on the near-term value of AI and how to realise it? And how is that philosophy showing up in Browzwear's products and services?

Craig: AI is clearly changing everything. All four of the efficiencies are relevant and we are hearing customers assess and action them. Everybody is looking for speed and scale and AI is a big piece. We are hearing customers expressing caution on some of the creative components due to legal and regulatory concerns. Most of the focus has been on automating repetitive processes, which AI is exceptionally good at. We have built several AI driven automations to drive scale in the short run and building key ecosystem partnerships with best of breed solutions. We very much believe that an open approach and willingness to cooperate with the strongest players is critical. AI is changing rapidly, and our customers will work with multiple AI technologies. We need to embrace bringing relevant partners into our ecosystem efficiently.

One of the biggest promises of 3D has always been to shorten the distance between having a creative idea, and being able to visualise and articulate it. The value of that proposition is probably stronger today than ever, with cycle times shrinking, and creative and technical teams being put under increasing pressure. What does the next stage of that promise look like? How can DPC, potentially with the help of AI, give a growing spectrum of users the freedom to create quicker?

Kristen: The next phase of digital development must evolve by integrating AI-driven automation and predictive tools. Repetitive tasks such as material application, colorway generation, and managing changes across collections can be streamlined, allowing designers to shift their focus toward understanding consumer trends and driving innovation. It's not just about designing and creating faster; it's about equipping apparel professionals with the right data and feedback to design with intention—meeting specific consumer needs and making well-informed decisions.

This approach enables teams to dedicate more time to critical milestones, ensuring that each product aligns with market demand, resonates with consumer preferences, and meets quality and sustainability standards. The ultimate goal isn't just speed; it's precision—developing the right products with greater confidence in their success in the market.

A lot of what fashion wants or needs to accomplish in 2025 and beyond is going to rely on data and digital assets - those are the common building blocks that 3D, AI, and automation strategies will be built on top of. How should brand and retail businesses be thinking about building those foundations? And what role will pattern-accurate 3D assets play?

Craig: It is critical that brands, retailers, and manufacturers have a sound digital foundation. Everybody should be developing data standards and creating an archived data process for their design assets. This dataset will be essential to leveraging AI in the future. The more organized the data and the larger the data set, the more impactful AI initiatives will be. We are strongly recommending that our customers capture all of their

digital design assets in a centralized location. It is essential that these assets are true digital representations of the final product. Fit accuracy and the integrity of the assets have strong correlation to the performance of the style. The winners will unify all of the DPC and performance data to make faster decisions that drive higher sales and stronger margins.

To realise the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset, with total trust. Which of those decisions do you think meet that high bar today? And which do you believe has the furthest distance to travel?

Kristen: Today, digital twins are transforming upstream product lifecycle decisions by reducing physical samples and enabling faster approvals. They allow companies to confidently decide print and graphic scale across sizes, fit and grading, and overall design aesthetics.

To fully realize the long-term vision of a digital twins, we must address both technological and human aspects of decision-making. Technologically, while we've made great strides, replicating the nuanced physical behaviours such as true soft body dynamics across all sizes, is still imperfect. While the gap can be bridged by leaning on known product expertise, I'm excited to see the advancement we're making in this space.

Equally important is the tactile nature of the apparel industry. Even after years away from the industry, I still instinctively reach for a fabric's hand feel when shopping, a reminder that trust isn't built on visuals alone. Digital twins must address both practical and emotional needs of the professionals interacting with them.

By understanding how different personas—designers, technical teams, manufacturers—make decisions we can bridge the gap between the digital and physical worlds. Staying focused on this balance is key to unlocking the full potential of digital twins.



CLO Virtual Fashion

www.clo3d.com

Founded
2009

PRICING MODEL:

We have a wide variety of options and tiers based on types of users.

More details are available below.

PLANS **PRICING**

CLO Virtual Fashion's mission is to empower everything related to garments, from concept to design, manufacturing to marketing, and fitting to styling. With more than 20 years of research and development in accurate garment simulation, CLO is leading the market by digitally creating, merging, and converging all aspects related to digital garments through our state-of-the-art 3D cloth simulation algorithm.

CLO's Ecosystem of products and solutions include: 3D garment design software, digital asset management systems and a collaborative design platform. In addition, we offer consumer-facing solutions such as e-commerce virtual fittings. With our latest release, CLO 2024.2, designers can create garments faster, easier, and more accurately than ever before, as well as creating hyper-realistic garments ready for application in entertainment, games and the metaverse. CLO has also launched several new initiatives to push the fashion industry forward, including virtual try-on services and showrooms, a Metaverse Converting Service, and a Web3-powered digital fashion marketplace. We are confident that our technology will power the future of everything related to garments, and we're excited to build it together with our user community.

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UNIVERISTY OF THE ARTS LONDON (CENTRAL SAINT MARTINS & LONDON COLLEGE OF FASHION)
VF CORPORATION
YKK

COMPREHENSIVE LIST OF INDUSTRY & ACADEMIC CLIENTS

USERS WORLDWIDE

CLO is used by more than **1 million users** globally (individual designers, fashion brands, and schools) in **100+ countries.**

CLO Virtual Fashion
www.clo3d.com

Founded
2009

TECHNOLOGY PARTNERSHIPS, including:

Adobe
Alvanon
Epic Games
GoVise Technologies
Lectra
Meshcapade
NVIDIA
Pantone
PixelPool
SwatchOn
YK

Newly added to CLO's Ecosystem Partnership Program (EPP): **BeProduct** (PLM), **Tronog** (Applications), **Revobit** (Scanner), **PTTRNS.ai** (Pipeline Software), **SixAtomic** (Pipeline Software), **SimplySoft** (Knitwear Solution), **KM.ON by KARL MAYER** (Knitwear Solution), **Frontier** (Materials), and **DMIx by ColorDigital GmbH** (Color & Materials).

COMPREHENSIVE LIST OF PARTNERS

What role do you see yourself playing in the 'digital product creation' journey?

CLO's technology is trusted by a wide range of industry leaders for its realistic simulations of fabrics, draping and garment movement. With CLO, designers and brands can take advantage of reduced time and cost associated with traditional sample-making processes, all while unleashing their creativity with ease, which can accelerate the product development process and improve the overall quality of their designs.

CLO has the potential to be a game-changer for many across the entire Digital Product Creation pipeline – including, but not limited to, designers, manufacturers, as well as marketers. For example, designers can create digital twins to physical samples to enable virtual fit sessions, online merchandising assortments, internal sales reviews, digital photoshoots and even marketing campaigns, to name just a few applications - all while collecting data points and metadata to generate analytics and tech packs. CLO's offerings have helped entire organisations to collaborate more efficiently and effectively by speaking the same (3D) language.

We believe that our technology can play a key role in reaching a sustainable, waste-free fashion future where digital assets replace physical samples and 3D-based collaboration improves communication between designers and manufacturers, and other consumer-focused innovations are the norm – such as "responsive design" where consumers can purchase designs before they're even produced and 3D virtual try-ons which can minimise returns and exchanges.

CONTACT



NEXT-LEVEL PRECISION.

CLO 2024.2 NOW AVAILABLE AT CLO3D.COM

CLO Virtual Fashion

JADEN OH

Founder, CLO Virtual Fashion Inc.



In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify. Do you believe the business case for 3D / DPC is strong enough? And how is that business case evolving to meet a changing industry?

As many of your readers know, there's never really been an easy or best time to undertake big investments; the real question is, can you really not afford to do it, when the upside of these initiatives are so great when implemented properly? The road can seem long and daunting, but when we look at some of our most successful clients, many have effectively implemented 3D/DPC by adopting a **step-by-step approach**. For instance, they start by using 3D software in the design and development stages and then gradually expand their application to other processes.

From a platform perspective, what we see is that companies are not entirely replacing their existing Asset Management Systems or PLMs with 3D-based platforms. Instead, they use **3D-based platforms alongside their existing systems**, progressively expanding the scope of 3D within their workflow. Our communication platform, **CLO-SET**, is one way for companies to embark on their **DPC journey**, as it integrates seamlessly not only with CLO software but also with various PLM and Asset Management systems that they already work with.

Through this incremental adoption approach, many of our clients have benefited in these key ways:

1. **Efficiency and Speed:**

3D technology reduces repetitive tasks in the design and sampling stages, significantly shortening time-to-market. This allows companies to respond more quickly to dynamic market demands.

2. **Sustainability:**

Virtual sampling and digital prototyping greatly reduce physical sample production, minimizing environmental impact. This aligns with the growing emphasis on sustainability among both brands and consumers.

3. **Cost Reduction:**

By decreasing the need for physical sample production and shortening development cycles, companies can achieve substantial operational cost savings.

4. **Personalized Customer Experiences:**

New areas like digital fashion enable highly customized experiences, opening up fresh business opportunities, particularly for the digitally native generation.

5. **New Revenue Models:**

Virtual clothing sales in the metaverse, digital exhibitions, and virtual fittings are just a few examples of how 3D/DPC can drive new streams of revenue.

In conclusion, 3D/DPC offers a practical and scalable approach for companies to begin their digital transformation journey and gradually expand its scope. It addresses current industry challenges and serves as a powerful business case to support sustainable growth in an ever-changing market.

While DPC adoption is generally increasing, this is by no means a universal trend; the speed, shape, and scope of the digitalisation of design, development, sourcing, and storytelling varies a lot depending on brands, product categories, and a host of other variables. Is there such a thing as a single strategic direction that can be applied to any brand to help them capitalise on the core benefits of 3D? Or does every initiative need to be unique? And where do practical applications of AI come into the picture?

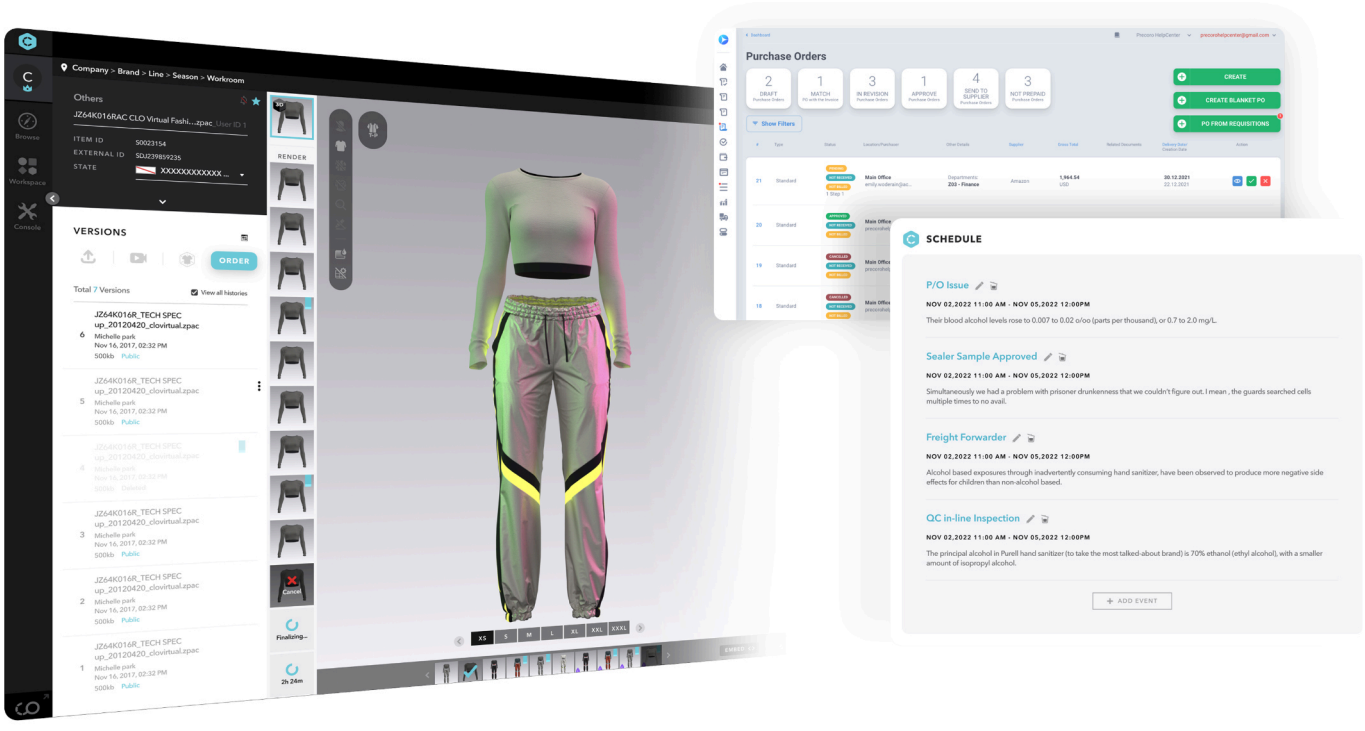
Each company's 3D/DPC adoption journey will inevitably vary. We at CLO are proponents of developing a tailored solution for each of our clients that reflects their unique circumstances and goals. For example, brands already working with vendors proficient in 3D workflows may focus on leveraging 3D technology in processes like planning, production, and retail rather than prioritizing asset digitalization. On the other hand, companies without such capabilities must first address the foundational task of asset digitalization before moving toward workflow digitalization.

Delving deeper, each fashion company has its own priorities and areas where they aim to adopt or enhance 3D usage. For some, this might mean focusing on the design and development phase, while others may wish to integrate 3D into supply chain management or customer engagement.

Our approach is to provide consulting services tailored to each customer's environment and objectives - the way CLO offices are located and are staffed reflects this. By working closely with clients, we help identify the most effective methods for implementing DPC, ensuring that their digital transformation journey aligns with their specific needs and delivers measurable value. This flexibility and focus on customization are key to ensuring the success of 3D/DPC strategies across diverse companies and use cases.

How do you see the balance between DPC as a technology project and DPC as a whole-industry cultural transformation? We talk a lot about change management as a key dimension of fashion technology, but there's a difference between implementing an individual solution and rolling out a fundamentally different, value-chain-wide approach to creating and communicating products. What's your approach to getting the wider fashion community to collaborate, co-create, and make better-aligned decisions?

Our belief is that DPC should be regarded as a **cultural transformation** in the fashion industry, with technology serving as one of the tools to achieve this shift. The key to realizing this transformation lies in automating the extraction and application of data required for day-to-day operations without additional effort from practitioners. True innovation occurs when professionals, such as designers, developers, and production teams, can focus entirely on their core work rather than being burdened by manual data entry and analysis.



Unfortunately, most traditional PLM systems in the fashion industry have treated data entry and analysis as integral parts of the workflow, making it difficult to fully capitalize on the benefits of data utilization. In contrast, industries like automotive and industrial design have successfully implemented 3D PLM systems for over a decade, leading to significant workflow and cultural shifts. This success is largely due to the wealth of actionable data already embedded within 3D files, which has driven meaningful innovation.

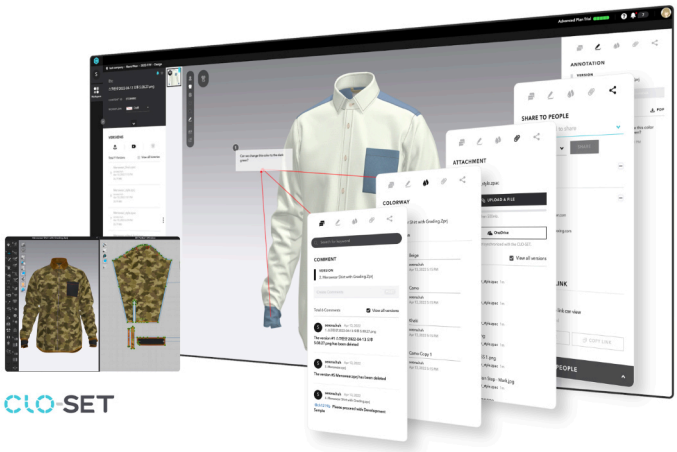
The same potential exists for the fashion industry. Current DPC solutions are evolving into **3D-based platforms** designed to support cultural and operational transformation. However, the fashion industry faces unique challenges compared to other sectors, as it must produce a much greater variety of items within shorter timeframes. To overcome these challenges, innovation is needed in areas such as:

1. Simplifying the creation of **fabric, trim, and garment assets.**
2. Automating **data extraction and analysis.**
3. Supporting **data-driven workflows**, including tools to easily generate tech packs, POM, and BOM based on 3D data.

Our solutions, including but not limited to **CLO** and **CLO-SET**, are designed to address these challenges. By enabling easier asset creation, automating data integration, and providing tools that streamline complex workflows, we are helping the fashion industry move toward a more efficient and innovative future where the focus can return to creativity and product excellence.

One of the selling points of 3D working has always been virtual sampling: a way to cut costs, reduce time to market, and blunt some of the environmental impact of iterative and redundant sample creation. This promise has been advertised for so long, though, that it no longer feels novel - and the reality of it has been difficult to quantify. What's your perspective on how real the positive impact of 3D on the environment, and on people has been? And what, if anything, needs to change for that well-worn vision to be realised?

The creation of 3D garments provides significant benefits in the design phase by enabling various iterations and reducing the time and cost associated with physical sample production. However, from the perspective of practitioners and companies, this can sometimes feel like an additional workload. Beyond creating and reviewing 3D garments, practitioners often spend a significant amount of time managing related tasks, such as preparing tech packs, POM, BOM, and construction sheets. To truly achieve cost savings and lead-time reduction, 3D platforms must streamline these processes, allowing practitioners to focus on their core responsibilities.



For some of the fast fashion companies, production decisions are made based on consumer feedback after samples are created, often leading to overproduction and waste. In contrast, 3D technologies can reduce fabric consumption by minimizing physical samples during the design and development stages and can also aid in recycling surplus inventory. Furthermore, 3D can be utilized throughout the entire lifecycle of a garment, including presales to gauge consumer reactions and optimize inventory levels. This ability to cut waste across the lifecycle has the potential to make a massive, measurable impact on sustainability in the fashion industry.

Beyond operational and environmental benefits, 3D and other digital technologies contribute to a fundamental shift in how work is performed in the fashion industry. By reducing time spent on labor-intensive, repetitive tasks like manual data entry, double-checking, and redundant operations, these technologies free up practitioners to focus on more creative, value-driven tasks. This shift not only enhances efficiency but also fosters a less stressful, more fulfilling work environment.

For example, practitioners could spend more time designing innovative products or refining creative concepts rather than managing tedious details. This transformation echoes a broader trend in the digital era, where technologies like AI are helping to reallocate human effort toward creative and intellectual pursuits. In essence, 3D technologies support the evolution of human work by amplifying creative thinking and reducing the mental burden of repetitive tasks—making the industry not just more efficient but also more human-centric and sustainable.

While a lot of the tools and skills are shared between them, there are two "endpoints" for 3D. One is the streamlined creation of physical products, with the support of digital tools. The other is digital fashion - garments, footwear, and accessories that are only ever intended to be worn digitally. We've showcased both disciplines in this report, but between CLO and Marvelous

Designer, and your deeper push into interoperability across different digital spaces, you are in a unique position to see how those trends are developing, where they're diverging, and what comes next.

Until now, the physical fashion world and the virtual fashion world have developed largely independently of one another. While there have been intersections—such as using the same technologies to create CG costumes for live-action films or hiring CG modelers in fashion companies and fashion designers in VFX studios—these instances remain limited. The virtual fashion industry within games and metaverse platforms faces similar challenges. Most virtual garments are designed by platform developers and offered to players. However, gamers increasingly seek trendy, fashion-forward clothing in these virtual spaces, and the supply often falls short of demand.

Although CLO has enabled fashion brands to create a vast number of garments, these garments are not easily integrated into gaming or virtual platforms. Why? Because **converting garments for virtual platforms requires significant effort**, including:

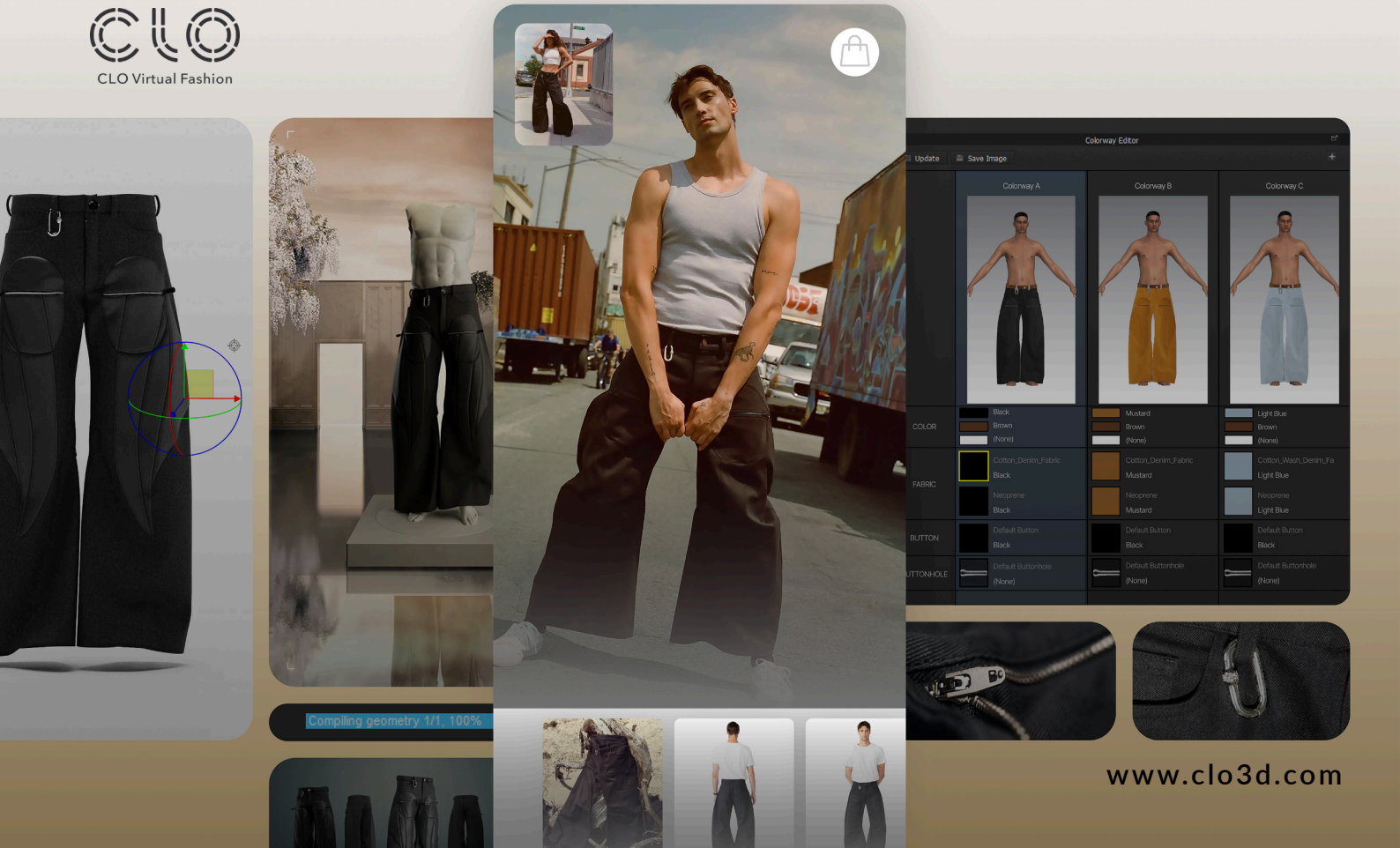
1. **Auto-sizing:** Adjusting garments to fit various game character sizes.
2. **Rigging:** Ensuring garments move naturally with character animations.
3. **UV Map Baking:** Efficiently creating texture maps.
4. **Polygon Optimization:** Reducing polygon counts to meet game performance requirements.

Recently, we have developed technologies to **automate these processes**, drastically simplifying the integration of garments into virtual platforms. As a result, it is now much easier for anyone to design clothing for games. Furthermore, these virtual garments can also be produced as physical garments for real-world use.

This creates an entirely new environment where **virtual fashion designers can gain recognition**, potentially becoming household names. In the near future, we anticipate a world where **digital fashion brands** evolve into **luxury fashion brands**, and their designers achieve widespread fame. This merging of virtual and physical fashion worlds is set to create a dynamic ecosystem with endless possibilities for innovation and creativity.

By bridging the gap between physical and virtual fashion, we envision an exciting era where the boundaries between these two worlds blur. This transformation will not only change how fashion is designed, consumed, and experienced but also open up unprecedented opportunities for collaboration, expression, and innovation in the industry.

To realise the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset that travels across the extended ecosystem, with total trust. Which of those decisions do you think meet that high bar today? And which do you believe has the furthest distance to travel?



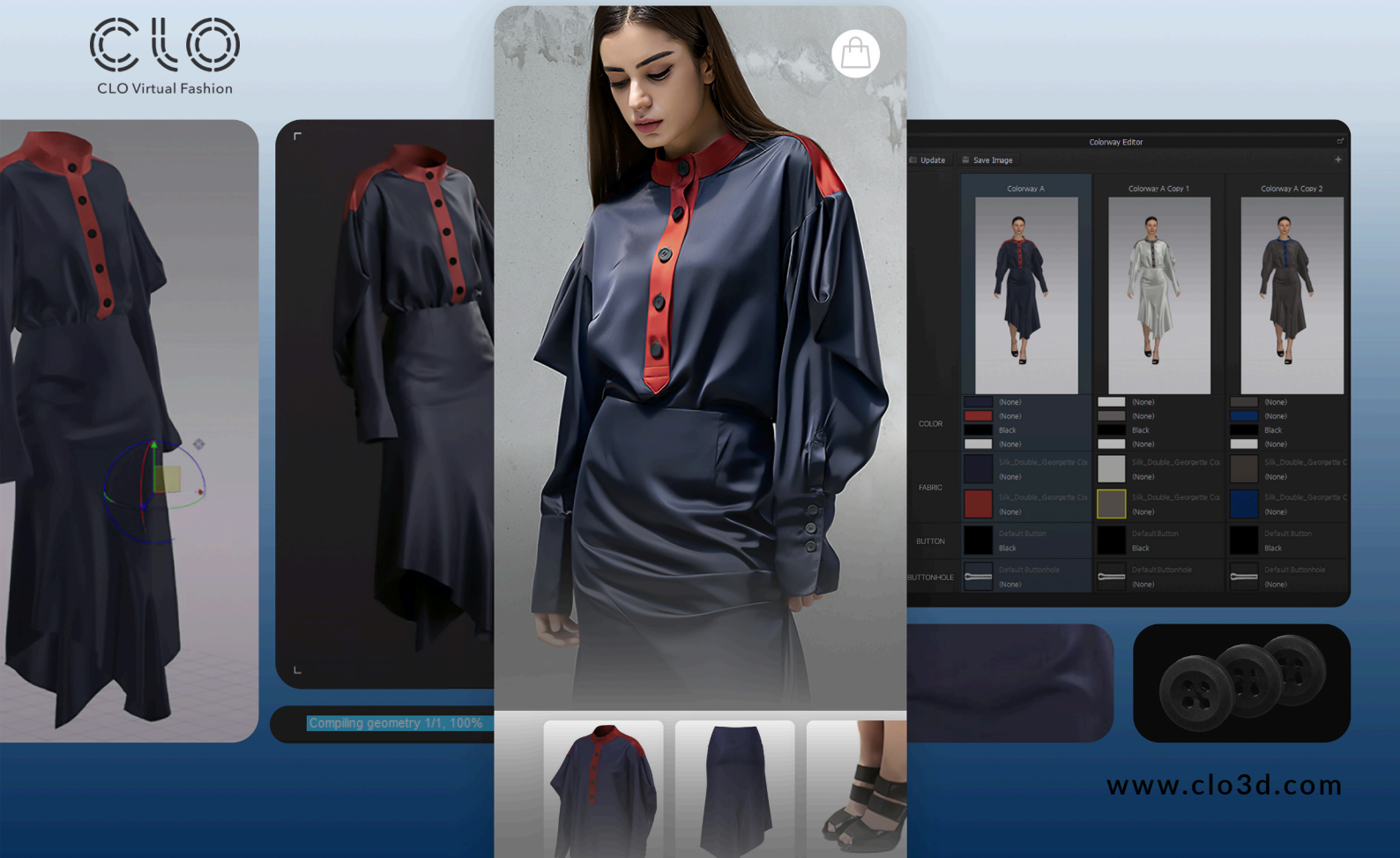
Achieving a complete **digital twin** of a garment requires digitalizing not just the garment itself but all its components, such as fabric, zippers, and buttons. For this to be truly effective, the digitalization process must capture not only the **visual and physical properties** of these components but also their **meta-information** (e.g., supplier details). However, due to the complexity of this process, achieving full automation remains a significant challenge.

Before garments can be fully digitalized, it is essential to first digitalize individual components like **fabric and trim.** However, this task is inefficient if every fashion company undertakes it independently. Components such as fabrics and trims are often shared across multiple brands. If each company creates its own digital version of the same material, it can lead to inconsistencies and duplicated effort, ultimately reducing efficiency across the entire industry.

The most practical approach is for **fabric and trim manufacturers** to handle the digitalization process at the source. However, not all manufacturers are equipped to do so, and there are many cases where digitalization is not feasible at their end. In such situations, companies can rely on services like **Swatchbook**, which specializes in digitalizing fabric and trim assets. Alternatively, for publicly available assets, platforms like our **CONNECT** provide an ideal solution. CONNECT has onboarded numerous fabric and trim suppliers, enabling them to share and sell their digital assets directly on the platform.

For trims, digitalization is relatively easier since they are hardware components, and manufacturers often already have **CAD files** for their designs. However, fabric digitalization remains more challenging due to the physical nature of the material itself. To address this, we are developing a new **device** that can easily measure both the **visual and physical properties** of fabrics. This innovation will make it significantly easier to create digital twins of fabrics, helping to bridge a major gap in the digitalization process.

By facilitating fabric and trim digitalization through specialized tools and platforms, we are working to establish an ecosystem where fashion brands can efficiently access accurate digital assets without duplicating efforts. This will not only save costs but also ensure consistency across the fashion industry, paving the way for a more seamless and scalable implementation of digital twin technology.



Hyland™

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Founded 1991

Hyland provides intelligent content solutions that empower our customers to transform the way they work and deliver exceptional experiences to those they serve. Our solutions capture, process and manage high volumes of 2D & 3D content to improve, accelerate and automate operational decisions and workflows.

Using Hyland's Nuxeo Platform, product companies accelerate ideation to production cycles, with global collaboration and enhanced process intelligence.

Nuxeo makes upstream systems for materials scanning and texture mapping visible to designers, so texture is easily visible in design previews. Design tools (like Adobe Illustrator, Photoshop, 3D rendering software, etc.) can be enhanced with connectivity to the materials reference library information that product designers depend on. Designers can drag-and-drop chosen materials onto their designs for faster ideation and design times. They can keep design files connected in their master formats and easy-to-share previews for review and approval, using the platform's native capabilities for handling compound file types.

They can establish consistent review workflows and make approvals easier, using built-in annotation tools and a configurable, low-code studio to build and modify workflows. Nuxeo federates search across systems and teams all over the globe, making it easy and fast for your teams to discover and modify existing designs from sister brands, other teams or past seasons.

Designers can also use Hyland's Nuxeo Platform to put design in the context of the overall supply chain, automatically verifying that all created designs can be manufactured with current supply chain constraints or available ingredients.

HEADLINE CUSTOMERS

Hanes Brands Inc.	Mad Engine Global	PVH
lululemon	Nike	VF Corporation

Users worldwide, split across the following regions:

North America	LATAM	EMEA	APAC
60%	**< 5%**	**30%**	**< 5%**

PRICING MODEL:

The Nuxeo platform has a capacity-based licensing model. In terms of core consumers: we target brands, retailers, and suppliers that all collaborate or play an active role in the end-to-end supply chain.

Hyland™

www.hyland.com

Founded 1991

20+ TECHNOLOGY PARTNERSHIPS, INCLUDING:

CLOUD VENDORS:

- AWS SUITE
- GOOGLE CLOUD PLATFORM
- MICROSOFT AZURE

- BROWZWEAR
- CLO
- ECHO3D
- LOCI.AI

- VNTANA
- *VARIOUS PLM, PIM & MDM VENDORS

What role do you see yourself playing in the 'digital product creation' journey?

The headache, expense and lead time of sample manufacturing is one reason many manufacturers have moved to digital samples and prototyping, using 3D renderings instead of physical objects.

Hyland's Nuxeo Platform makes it easy to find and access materials information (ie: waterproof, available in yellow, price, etc.). Users can easily filter searches to take supply chain constraints into account. For instance, materials with a large minimum order size might only be made available for designs that don't require a physical sample.

These benefits are especially clear at apparel companies, and the digital product design can shorten the fashion cycle by days if not weeks.

For wholesalers, digital samples can be taken even further. With digital showrooming, manufacturers can work closely with retail partners to iterate on designs quickly and inexpensively, accelerating orders.
Manufacturers can use Nuxeo to create digital showroom portals that showcase products in an on-brand, on-trend way for retail customers. Using easy annotation and markup tools accessible directly in the digital showroom interface, buyers can make their needs clearer — and designers can respond faster than ever.

Whether your samples and prototypes are physical or digital, Hyland's Nuxeo Platform is ready to help you boost your ability to design in context and iterate on samples faster.

CONTACT

Hyland™



Transform your enterprise digital content supply chain

Accelerate concept to consumer
Make content actionable

Automate your go-to-market
Ensure data-driven decisions

Democratize and contextualize data access
Connect fragmented data sources to speed decisions

Explore Hyland's Nuxeo Platform for DAM →

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CHAD MALLEY

Global Director Digital Asset Management Practice

HYLAND

In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify - especially compared to newer, hotter topics like AI. Do you believe the business case for 3D / DPC is strong enough? And how is that business case evolving to meet a changing industry?

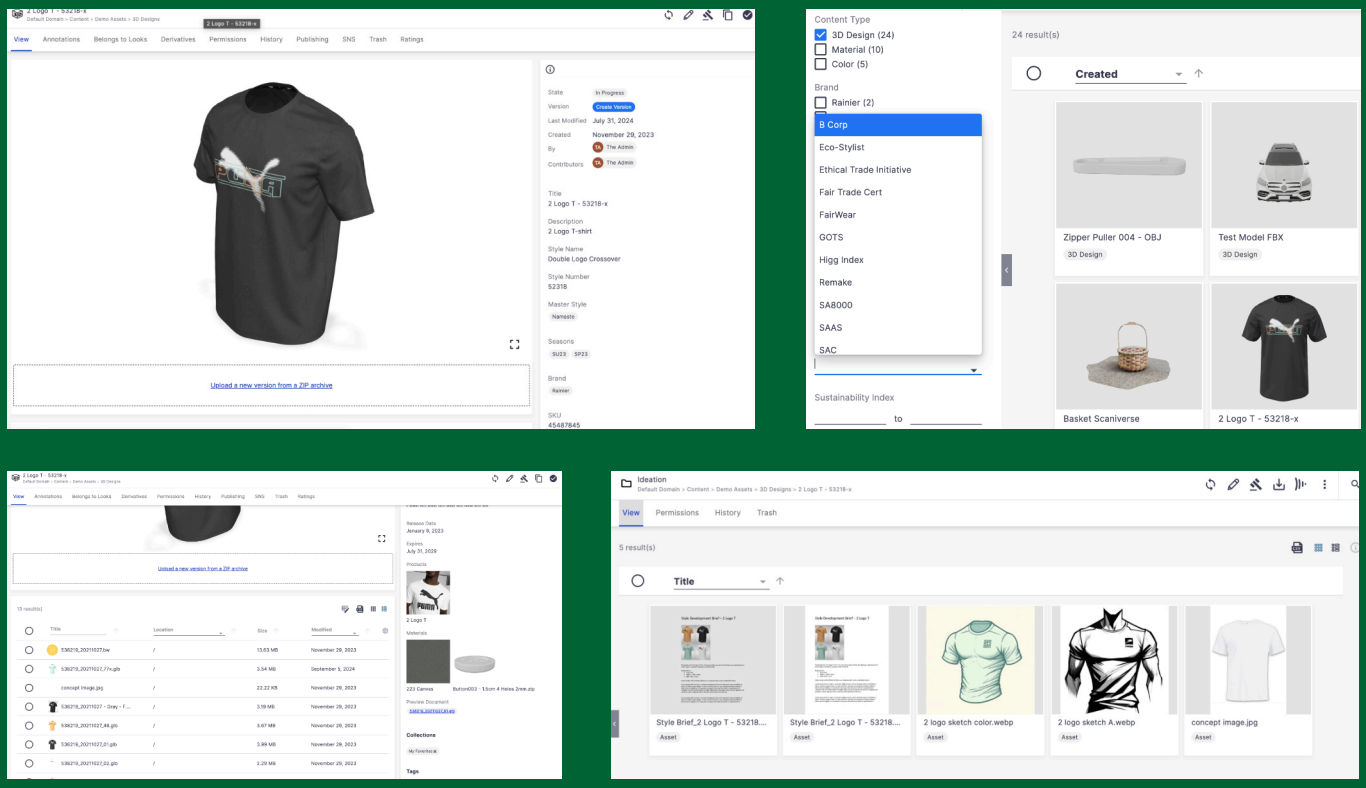
The business case for DPC by itself can be difficult to prioritize for a number of reasons. Having said that, DPC is a foundational prerequisite for many of the broader initiatives that brands are investing in like sustainability and traceability. There is definite risk in being distracted by popular trends like AI, however business cases should always be grounded in outcomes vs. technology benefits and job aides. The key for DPC justifications is to represent its role serving the entire integrate supply chain. DPC teams can be perceived to be small groups in comparison to other areas of the business, but they are a lynchpin to unlock KPIs that are activated further downstream in the production pipeline.

In terms of the evolution of the business case as the industry changes, I would say that trends remain cyclical but the expected outcomes remain constant. Satisfying consumer demands remains the quintessential objective and DPC plays a pivotal role in activating the production process agility to respond to those evolving consumer preferences.

Taking account of that economic context, what do you believe are the strictly necessary or must-have parts of the DPC capability umbrella today, and which are more driven by hype, with longer timelines to a less certain return?

A connected data and content pipeline is a DPC capability necessity. One of the biggest challenges that most brands have today is how fragmented data & content stores are. Key operational data lives in a PLM or a MDM system or worse in Smartsheet & Excel and the product imagery and virtualized material libraries live in shared drives, SharePoint or some other disconnected repository. There is no governance or version assurance or validation of the accurate information in which to make informed decisions.

The two areas of hype that I would caution the readers on are systems that represent a myopic view where all operational data and workstream tasks can be performed in one unified application experience. That simply isn't feasible for most organizations' operating models. Either system access is restricted to a only a subset of process contributors or the limitations of that centralized system require brands to conform the way they work to the rigid system design. The second hype that I caution readers to contemplate is the immediate value of AI adoption. Most organizations are being forced to "do more with less" and they believe AI gives them the immediate fulfilment of this proposition. The truth is that most AI services require experimentation, tuning, and most importantly oversight.



All images Nuxeo, Hyland. Clockwise from left to right: main 3D product view with PLM fields; eco certification search; compound view showing Browzwear fileset; ideation subset.

Oversight that requires staffing assignment and training. If headcount and competency gaps exist today, the adoption of AI isn't going alleviate the pressure in short term.

From your perspective, what have been the major shifts in the DPC landscape this year beyond the economic context? How have you seen your clients, or the wider industry, thinking differently about digital assets and workflows?

I believe firms are starting to recognize DPC is more than just about design tools and product visualization. They are starting to recognize that a 3D package is one of the most valuable assets an organization can produce because all of the ways a 3D package can be leveraged across the end-to-end supply chain from ideation to eCommerce.

Our most successful clients see digital asset management as a program and not a project. They are transforming the way their organizations view DAM as not just a file management application, but as a digital backbone that connects various data sources and system applications to curate virtualized content and make those artifacts actionable and optimized for syndication.

The early phases of DPC seemed to focus on proto-typing and sample reduction, but in the last year there has been a propensity to think beyond just content creation into content orchestration, merchandising, line planning and other downstream consumption channels.

The challenge of creating a digital-first culture, a 3D pipeline, and a content ecosystem around a single product category can be significant. But for multi-category brands - especially those that cover not just apparel and footwear, but accessories, cosmetics and other packaged goods - that challenge can be multiplied several-fold. What are you seeing emerging as the right way to tackle DPC initiatives for companies with a wider spread of products?

I don't think there is a one size fits all approach or the "right way" to tackle DPC initiatives. The issue that many multi-category brands have is a lack of consistency of process and applications. Ideally, a DPC initiative introduces standards, governance and core operating principles. That's difficult to achieve and to reconcile if each team is using a different application, views a different system as the source of truth and feels processing procedures are unique to their individual function.

An emerging practice that we are seeing that establishes the proper alignment has two key pieces: Senior-level sponsorship and the creation of a mission statement for the DPC initiative. The mission statement serves as baseline of what we are solving for and gives the teams a sense of "what's in it for me." Change management remains one of the biggest hurdles in any enterprise initiative. One way of mitigating change management resistance is establishing "what's in it" for the core stakeholders involved and the reinforcement from Senior level sponsorship of the DPC program's corporate benefits.

What do you believe is standing in the way of companies adopting digital-first DPC workflows? Where is trust in 3D assets falling down?

Unrealistic expectations is what's standing in the way of companies adopting digital-first DPC workflows. Whether its quality control standards or physical production preferences or a resistance to change, many organizations lack the universal buy-in for the digital transformation. 3D is not perfect and does not lend itself easily to every production stage for every product category. Whereas the advantages over traditional physical production or 2D digital workflows are tangible, it is often not sufficient for the immediate Return on Investment demands that many brands have.

Digital-first DPC workflows should follow the crawl-walk-run philosophy. The transformation and benefit return is not going to happen overnight and shouldn't be measured on short-term gains.

The trust issues with 3D assets stem from the fact that it's a digital file. You can't touch the digital twin. You can't inspect the quality or craftsmanship of the replica and most citizen consumers don't have optimized visualization tools to leverage when interacting with the assets so the representation of the digital twin aren't enhanced.

To realise the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset, with total trust. Which of those decisions do you think meet that high bar today? And which do you believe has the furthest distance to travel?

Our expertise isn't based on every decision that is made across the extended product lifecycle but we would say that data driven decisions are most pertinent and decisions that are judgement oriented have the furthest distance to travel. For instance, data driven decisions around consumer demand, supply and inventory management, concept and design specification, and assortment planning are all immediately applicable. Decisions around fit testing, durability, color saturation all have accuracy and authenticity hurdles to still navigate. As the industry and technology advancements continue, the distance will naturally shorten but long-term vision for a complete digital twin remains a ways off for apparel and footwear providers particularly.



Nuxeo, Hyland generative 3D asset and product scan.

KALYPSO
A ROCKWELL AUTOMATION BUSINESS
www.kalypso.com

Founded
2012

Kalypso, a Rockwell Automation Business, provides world-class industrial automation and digital transformation solutions where you need it.

At Kalypso, we bring digital solutions to product problems. We are the leading digital product creation (DPC) consultancy in the retail industry. Leading with a value-first, lean startup approach, we support leading brands in their digital programs at any stage of maturity.

We help rapidly accelerate and optimize DPC transformation. Our people are innovators, strategists, data scientists and technologists and we leverage their deep expertise in product creation process, organizational change management, foundational technologies such as PLM, along with knowledge of 3D technologies and experience.

We help companies create an end-to-end solution and connected ecosystem to digitally create, manufacture and move products.

SOLUTIONS WORKED WITH:

We support our clients with world-class capability through acquisitions, investments and 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 technologies to support unique needs and to co-innovate industry-leading solutions. Below are the types of solutions that we have helped explore or implement:

- Market & Product Insights
- Generative Design
- Concept & Brief Management
- 3D Material Design & Scanning
- Intelligent Line Planning
- Operating Model, Product Processes & RACI
- Render Pipeline
- 3D Product Design
- Digital Color & Artwork Design
- Change Management, Education & Training
- Voice of Consumer Analytics
- Digital Product Development
- Virtual Fit Testing
- Development Task Automation
- Foundational Product Technologies (e.g. PLM, DAM)
- DPC Sustaining Governance Model
- Virtual Testing & Simulation
- Visual Assortment & Line Review
- Inventory Planning & Localization
- Traceability & Sustainability Management
- Component Libraries (e.g. Materials, Trims, Avatars, Blocks)
- Uniform Visual Quality Standards
- Virtual Showroom & Store Planning
- Virtual Try-On
- Digital Assets for eCommerce
- Product Customization Platforms
- Digital Assets for Marketing & Retail
- Production Automation
- Digital Direct Manufacturing
- Product Platform Integrations

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HOW DO YOU DEFINE 'DIGITAL PRODUCT CREATION' FOR FASHION - ESPECIALLY AS IT ENTERS A PHASE OF SCALE, INDUSTRIALISATION AND WIDE-OPEN POSSIBILITIES?

Digital product creation is evolving beyond the introduction of new tools to create assets. Today, it's about transforming the entire process to make product development more agile, strategic, and aligned with brand goals. **The value of DPC lies not in implementing a single solution, but in creating efficiencies and insights across every stage of product creation. This holistic approach enables brands to make informed, faster decisions.**

Over the next 12 months, AI will continue to reshape DPC in profound ways. Brands will need to look at their data strategy and streamline data management and workflows to effectively integrate AI, ensuring that digital products are not only innovative but also inclusive and attuned to customer expectations. As AI advances, it will push brands to refine their approach, balancing the drive for fresh, unique products with their core ethos, vision, and values. The integration of AI into the DPC ecosystem will be key to staying competitive and relevant in a rapidly changing digital landscape.

DPC PROCESS AREAS COVERED:

Product Operating Model
Real Client Results

- Reduced Time to Market 40%
- +3.5% Margin Gain With 13wk Responsive Track
- Redesigned Global Product Ops After 30% Reduction in Force

3D Digital Product Creation
Real Client Results

- 87% of All New Product Creation Fully-Digitised
- 25K Physical Samples Saved Per Year
- 22% of Design Tasks Eliminated With Automation
- +15% eComm. Conversion Using Virtual Try-On

Product Lifecycle Intelligence
Real Client Results

- 6% Margin Gain Using VoC Tests
- 3% Returns Reduced Using Predictive AI
- 40K Product Record Errors Eliminated Instantly
- 10K Hours of Human Data Entry Saved Annually

Sustainability, Traceability & Compliance

- Over 100K MT CO2e Cut from Product Development
- 1K Quality Risks Called Out with Predictive AI
- Identified 100% of Product at Risk of PFAS & Forced Labor

Product Data Ecosystem & Security
Real Client Results

- Secured $35M in Digital Product Ecosystem Funds
- Deliver 99.9% Solution Up-Time Reliability
- 80% Reduction of Rendering Times
- Connected 1T+ Data Records to AI Backbone

PLM Solutions & Digital Asset Management
Real Client Results

- Cut 10K Hours Spent on Line Sheet Mgmt
- Delivered 5% AUC Cuts Thru New Workflows
- 1500+ Global Users Trained & Supported
- Rationalised 400 Extraneous PLM Licences Saving $600K Annually

Digital Make Inventory & Distribution

- 10-15% Increased Throughput Across 42 DC Network
- Realised $400M Savings in Labor & $70M in Inventory
- 0.5% Revenue Lift from New Rapid Replenishment Strategies

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2012

HEADLINE CUSTOMERS

At Kalypso, our clients remain confidential, but we have served 20 major retail brands on 70+ projects in digital transformation initiatives across product categories including apparel, footwear, accessories and hardlines.

CASE STUDIES

100% apparel sampled first round in 3D within 2 years of program launch
$5B+ European Luxury Fashion Brand

Reduced wait to time to review and assess updated samples from 8 weeks (for physical) to 2 weeks (for virtual)
$45B + Multinational Footwear & Apparel Retailer

$24M CapEx & 12M OpEx in investment in return for $113M in margin gains
$10B+ Multinational Apparel Retailer

280 Proofs of Value DPC projects completed in first 60 days
$24B+ European Fast-Fashion Retailer

Full case studies are available upon request. Please reach out to hadley.bauer@rockwellautomation.com to schedule time to walk through the approach and full set of results of our top case studies.

DPC STRATEGIC SERVICES

DPC Digital Value Accelerator:

- Establish a vision, strategy, justified roadmap, and mobilization plan to start realizing value from digital transformation
- Foresight capabilities for a proprietary view of the future of product creation
- Evaluate current capabilities and future aspirations
- Tailor a DPC strategy aligned with business needs

Strategy & Roadmap:

- Formulation of strategy, scope, business case, and strategic roadmap
- Ensure alignment, readiness, platform architecture, data governance, and vendor selection
- Develop a comprehensive plan for DPC program success

Operations & Organizational Change Management:

- Process redesign, program management, and stakeholder alignment
- Organization readiness and redesign
- Process and solution training, communications, and change management
- Workshops for team alignment and educational support for digital process adoption

Technology & Data:

- Craft technology strategy, proof of concepts, and requirements definition
- Vendor selection, platform architecture, and integrations with PLM and voice of customer platforms
- Implementation of data governance and digital asset management
- Connect the digital thread across the value chain for an efficient, collaborative digital environment tailored to workflows and sustainable transformation

CONTACT

We are Rockwell's digital services arm.

KALYPSO
A ROCKWELL AUTOMATION BUSINESS

Our people are innovators, strategists, data scientists and technologists.

We bring digital solutions to product problems.

- Speed time to market
- Improve quality
- Increase productivity
- Ensure compliance
- Reduce waste
- Increase profitability





CHELSEA SNYDER

Senior Technical Consultant

KALYPSO

In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify. Based on your research, which took a new approach this year, do you believe the business case for 3D / DPC is strong enough? And how is that business case evolving to meet a changing industry?

We received some great insight into the evolution of the business case for 3D/DPC through this year's research. We adopted an interview approach for gathering data vs. surveying our audience, allowing us to capture a more accurate picture of digital adoption maturity across brands. Through these interviews, we could "look under the hood" to see what was genuinely working and where brands still faced obstacles. According to our research, the benefits of 3D/DPC are clear, but brands need to be tactical and take a holistic approach to see the real results.



I believe the business case for DPC is stronger than ever. Through digital, retail brands are finding success by reducing samples, saving time in the development stage, and as a result, reaching their customers quickly with new fresh products in more compelling ways.

The key though, is that the value of DPC lies not in implementing a single solution, but in creating efficiencies and insights across every stage of product creation. Organizations achieving the greatest ROI share three key characteristics:

1. Implement comprehensive KPI measurement frameworks
2. Develop clear value realization plans
3. Ensure digital tools integrate seamlessly across the product creation process

When responding to the challenges brands may face in building a DPC business case, it's important to set a prioritized roadmap aligned with specific business challenges, identify the necessary resources and stakeholders, and establish a strong governance model. This foundation ensures not just successful implementation, but measurable, sustainable value creation that justifies the investment even in challenging market conditions.

The extended business case for DPC also goes far beyond the core design and visualisation tools - relying on brands having the support structure, the culture, the skills, the libraries, and the investment mindset to successfully scale. What does your research suggest it's going to look like to resource and implement those things in 2025?

Our research indicates that successful DPC scaling in 2025 will require a three-pillar approach: robust digital asset management, comprehensive skill development, and strategic organizational change management.

First, brands must strategically evaluate their product creation assets by evaluating complexity, reusability, and component types. This assessment forms the foundation for building efficient digital libraries that scale. The key is not just digitizing assets but structuring them to enable streamlined workflows and earlier visualization in the development process.

Second, while DPC tools continue to become more intuitive, the skills gap remains a critical challenge. Successful organizations are investing in multi-faceted learning ecosystems that include:

- Comprehensive documentation including SOPs and digital quality standards
- Structured training programs aligned with brand-specific workflows
- Centralized knowledge repositories that evolve with technological advances
- Accessible peer-led support networks

Third, and perhaps most crucial, is the organizational change management framework. Our research consistently shows that brands achieving the greatest success have dedicated OCM teams that focus on user adoption, continuous improvement, and cultural transformation. These teams create an environment where users are equipped not only to learn new tools but foster innovation and evolve workflows that become second nature.

Industry collaboration will play an increasingly important role in 2025. The most successful organizations will be those that combine internal capability building with external knowledge sharing to create sustainable, scalable DPC programs. Networks like the 3D Retail Coalition (3D.RC) are also an excellent forum for brands and educational institutions tackling the DPC challenges we face today. By sharing experiences and best practices, we accelerate the learning curve for the entire industry.

Kalypso's findings this year also highlighted the importance of automation, with business transformation teams citing it as one of the most critical returns on investing in digital product creation. How do you believe fashion companies can make automation a realistic goal for the near and mid-term, and where do you see it delivering the biggest return?

Automation is top of mind for brands as they continue to be expected to move at a faster pace with less traditional resources. Our research shows successful automation strategies focus on high-impact achievable targets.

In the retail footwear and apparel industry we've identified four key categories where automation delivers the strongest returns:

1. **3D Asset Creation:** automating silhouette stitch-ups, color/art application, and marketing asset generation
2. **Asset Deployment:** streamlining DAM workflows, render pipelines, and consumer testing processes
3. **Asset Enrichment:** enforcing virtual quality standards and automating asset attribution
4. **Specification Translation:** generating cut patterns, tech packs, and costing estimates

To make automation achievable, businesses need a clear understanding of their foundational capabilities. It's essential to assess data infrastructure maturity and current system integrations to determine which automation goals are most viable. From our experience in implementing hundreds of automation solutions across the industry, a prioritized set of high impact use cases delivers a rapid ROI -often within weeks of deployment.

The biggest returns come from automating repetitive data-intensive tasks that require significant manual effort. For example, render pipelines can reduce asset creation time greatly while also ensuring consistency. When selecting automation targets, it's important to balance the technical feasibility with gains that foster increased adoption and digital transformation.

One of the biggest hurdles when it comes to wide-scale adoption of DPC is a lack of standardisation and interoperability. For 3D to really take root, digital tools and assets need to work together across complex organisations - and while the vision to realise this kind of compatibility is there, the speed of progress is perhaps slower than some companies expect. Where are you seeing the most success here?

While interoperability remains one of the most complex challenges in scaling DPC we're seeing success lies not only in technical infrastructure but also in strong organizational alignment.

A PRIORITIZED SET OF HIGH IMPACT USE CASES DELIVERS A RAPID ROI -OFTEN WITHIN WEEKS OF DEPLOYMENT.

Successes are emerging from brands that have established robust foundational frameworks, for example:

- Standardized SOPs and naming conventions that create a common language across teams
- Comprehensive data management practices that ensure consistency from concept to customer
- Clear virtual quality standards that translate across tools and teams
- BOMs and tech packs that maintain data integrity throughout the product lifecycle

Kalypso collaborates closely with clients, their global supplier networks, and the 3DRC to drive standardization and advance best practices across the industry. For example, the 3DRC Education Committee has developed a Certification Matrix to help brands and educational institutions standardize role base competencies. Additionally, the 3DRC Innovation Committee is working to create universal digital fabric standards that benefit both brands and mills. Through these initiatives, we are fostering meaningful progress in standardization and interoperability.

Interoperability isn't just about technology; it's equally about people and processes. Alignment between design, development, and technical teams is critical to ensure smooth implementation and adoption, even across complex global networks.

There's a lot of talk about AI being the next piece of the 3D puzzle, alongside its wider role in enterprise technology. What's your take on whether brands can realistically incorporate AI into their DPC strategies in a way that protects creativity and streamlines work without creating new frustrations?

Much like the initial excitement around 3D-authoring tools in product development, GenAI has quickly gained attention for its potential to streamline workflows and boost creativity. Effectively integrating GenAI requires a realistic understanding of its capabilities and how it can enhance things like business processes, boost efficiency, and foster creativity and customer satisfaction.

We're seeing realistic, immediate value in several key areas:

- Automating repetitive tasks like data entry and product description generation
- Accelerating early-stage ideation and concept visualization
- Streamlining asset management and metadata tagging
- Enhancing pattern adaptation and grading processes

The key to protecting creativity while driving efficiency is to understand AI's role as a tool to enhance rather than replace human expertise. The following are critical to successfully implement AI:

- Clear scope definition based on available data and specific business needs
- Dedicated technical teams that can customize AI solutions to existing workflows
- Comprehensive training programs that help users understand both capabilities and limitations

The key to unlocking the value of AI is understanding its true capabilities. AI's quality depends on input data and user expertise. AI doesn't do the work for the user. We recommend starting with focused use cases that have clear ROI potential and building from there. This approach allows organizations to maintain creative control and eliminate misconceptions that could potentially cause friction in the creative process.

To realise the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset, with total trust. Which of those decisions do you think meet that high bar today? Which do you believe has the furthest distance to travel? And what can brands do to avoid a pushback towards physical sampling?

The journey to total trust in digital twins varies across organizations and product creation decisions. Currently, we see the highest trust in visualizing artwork placements and scaling, and detail positioning. These processes traditionally can be quite daunting. By using 3D, designers have seen immediate benefits through faster iterations, more accurate size grading and reduced communication cycles between design and production teams.
I still see the widest trust gap in exclusively fitting garments in 3D, especially when dealing with new or unfamiliar materials, patterns, fit models, or complex constructions. Despite significant advancements in fabric simulation and avatar sophistication, users often struggle to trust something they haven't experienced in real life. This will improve as users experience 3D and see the tools evolve and become more robust.

To prevent regression to physical sampling, organizations need to focus on three key areas:

1. Workflow Reimagination: Rather than digitizing existing processes, successful brands are fundamentally reimagining their product creation workflow for the digital age. This means establishing new decision points that leverage digital capabilities while acknowledging where physical validation adds genuine value.

2. Trust Building Through Validation: The most effective approach combines side-by-side physical and digital comparison during the transition period. This creates a feedback loop that builds confidence in digital assets while helping teams understand where digital tools actually outperform traditional methods.

3. Organizational Infrastructure: Success requires a robust support framework including:

- Structured training programs that evolve with technology capabilities
- Clear RACI frameworks that define digital decision-making authority
- Integration with industry standards groups like the 3DRC to leverage collective learning
- Leadership commitment to digital transformation even when challenges arise

The key to achieving total trust lies not in eliminating all physical samples, but in creating an environment where digital becomes the default and physical sampling serves as validation only where truly necessary.



Kornit Digital
www.kornit.com

Founded
2002



PRICING MODEL:

The shift from analog to on-demand digital production is accelerating, evidenced by a growing number of screen printers adopting Kornit Technology and Kornit MAX-powered platforms. Kornit offers the All-Inclusive Click (AIC) model, providing predictable costs, lowering barriers to entry, and unlocking a significant incremental market opportunity on top of the classic capex model.

Kornit Digital is at the forefront of revolutionizing textile printing with its innovative solutions that span the entire Digital Product Creation pipeline. From design to finished product, Kornit offers a seamless and efficient process that transforms how textiles are produced and consumed. What makes Kornit stand out in the industry? It's their commitment to sustainability and versatility, providing eco-friendly, on-demand production methods that minimize waste while maximizing creativity.

In the design stage, Kornit's digital printing technology allows for limitless creativity, enabling designers to bring even the most complex patterns to life without compromising on detail or color vibrancy. Moving into the production phase, Kornit offers systems that are not just printers but comprehensive end-to-end solutions. These systems integrate pre-treatment, printing, and curing processes, making production swift and reducing the need for excessive resource use.

But Kornit doesn't stop at production. The company also plays a crucial role in logistics and distribution, offering solutions that ensure products can be created closer to the end consumer. Its solutions facilitate a more agile supply chain with less waste, aligning with the idea of localized production that minimizes environmental impact and maximizes speed to market.

Kornit Digital isn't just participating in the digital transformation of the textile industry; it's leading it with an enthusiastic and inspired approach. By integrating every step of the product creation process, Kornit empowers businesses to innovate and operate sustainably, making bold design statements while echoing a strong environmental voice.

HEADLINE CUSTOMERS

ALLESklarDRUCK
Custom Ink
DO Apparel
Estilmar
Hybrid Digital
Mad Engine Global
Pixart
Print Palace
T-Formation
T-Shirt & Sons
TSC Miami/Monster Digital
Wonderaw

USERS WORLDWIDE

Kornit has more than **1000** customers worldwide.

Kornit Digital

www.kornit.com

Founded
2002

TECHNOLOGY PARTNERSHIPS

Kornit works and collaborates with many companies throughout the supply chain from garment to fabric manufacturers, PLM 3D designs SW, Ecommerce platforms, finishing and more.

Examples include:
Acquisition of **Orion** in 2018
Custom Gateway **(Kornit X)** in 2020
Voxel8 in 2021

Plus ongoing partnerships including:
Sol's, Stanley Stella, Canva, Sutex and more.

What role do you see yourself playing in the 'digital product creation' journey?

Kornit sees itself as a pivotal enabler of the Digital Product Creation (DPC) journey, transforming how brands design, manufacture, and deliver products. As the industry moves into a phase of scale and industrialization, Kornit's digital textile printing solutions play a central role in streamlining and personalizing production at a global scale. The company's advanced technology allows for high-quality, on-demand printing, reducing the need for excess inventory, minimizing waste, and improving the agility of production lines.

Kornit's integration of automation, sustainability, and innovation helps brands transition from traditional manufacturing methods to more efficient and sustainable digital workflows. This is particularly important as brands look to meet evolving consumer demands for customization, rapid turnaround times, and eco-friendly products. By enabling mass customization without compromising speed or quality, Kornit is setting the stage for the future of product creation, where digital tools empower designers to create, prototype, and scale products faster and more cost-effectively.

The company's platforms are critical in unlocking new creative possibilities, supporting the growth of digital ecosystems that bring products to market faster and with less environmental impact. Kornit's vision is to lead the way in reshaping manufacturing, ensuring that Digital Product Creation is not only efficient and scalable but also increasingly sustainable and consumer-driven.

CONTACT



Fashion Is Choosing On Demand

For more information visit
Kornit Website kornit.com

Kornit Digital



GUY YANIV

President EMEA
KORNIT DIGITAL

In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify. Do you believe the business case for 3D / DPC is strong enough? And how is that business case evolving to meet a changing industry?

The business case for 3D and digital product creation (DPC) has never been more compelling, even in challenging times. These technologies allow brands to stay agile, cut costs, and make smarter, faster decisions. As demand for personalization, sustainability, and efficiency grows, 3D and DPC deliver significant ROI by reducing lead times, minimizing waste, and enhancing collaboration across teams. Kornit's solutions are perfectly aligned with this shift, integrating digital printing directly into these workflows. This ensures brands can move seamlessly from concept to production, with reduced risk, enhanced creative freedom, and greater operational efficiency.

An important driver for the adoption of 3D and DPC is better alignment and better-informed decision-making. When different stakeholders have a common reference point, in a digital representation of a garment or a material, they can make smarter, more sustainable choices. How do you see Kornit supporting that ambition, and deploying digital printing and workflow solutions to help fashion brands make the right decisions?

Kornit's vision is to revolutionize on-demand production, where every decision is driven by data and digital precision. Our digital printing technology seamlessly integrates with 3D and DPC, enabling accurate sampling and production that faithfully reflects digital representations. This approach minimizes unnecessary iterations, shortens time-to-market, and ensures sustainability is embedded at every stage. With innovations like our XDi decorative printing and NeoPigment™ inks, we empower brands to unify their creative and operational teams, translating digital concepts into physical products with unparalleled accuracy and efficiency.

How do you believe DPC and digital printing should integrate with one another? We often talk about how 3D has the potential to directly inform production, but you have a unique perspective on what it looks like to actually put agile, context-aware apparel sampling and production into practice.

DPC and digital printing must work together in a continuous, iterative loop. Kornit makes this possible by seamlessly connecting virtual designs with real-world production. For instance, our direct-to-garment (DTG) and roll-to-roll systems can quickly transform 3D designs into physical samples, eliminating the need for traditional sampling methods. This not only accelerates production timelines but also enables rapid adjustments based on consumer feedback or market trends. Agile sampling and production become a reality, where every print reflects the most up-to-date, data-driven iteration of a design.

Another major element of a lot of DPC strategies has been sustainability - with the most direct return on that investment being measured in the creation and shipping of fewer samples. Tell us what role digital printing can play in not just supporting but enhancing this?

Digital printing is key to eliminating unnecessary waste and overproduction. Kornit's waterless printing process and on-demand manufacturing capabilities dramatically reduce the environmental impact of sampling and production. Rather than producing countless physical prototypes, designers can rely on high-fidelity prints that accurately bring their vision to life. Furthermore, our technology enables local production, cutting down on shipping emissions and aligning with brands' sustainability objectives. It's not just about producing fewer samples—it's about enabling smarter, more sustainable production at every stage, from concept to completion.

With digital printing as an endpoint for a new, end-to-end digital design-to-production workflow, what possibilities do you see being the most compelling for the near future? And how is Kornit intending to evolve its solutions to keep pace as the demand for digital-first fashion production scales up?

The greatest opportunities lie in building fully demand-driven, localized supply chains. With Kornit's technology, brands can get closer to their customers, producing only what's needed, when it's needed. This approach eliminates excess inventory and enhances personalized consumer experiences. To enable this, we're constantly advancing our printing platforms to accommodate new materials, incorporate cutting-edge effects like 3D textures, and scale effortlessly for mass customization. Additionally, Kornit is developing smarter, integrated workflows that streamline production and make digital-first fashion more accessible to a broader range of industry players. This empowers brands to operate more sustainably and responsively in a rapidly changing market.

One example is T-Shirt & Sons (TSS), a prominent European apparel manufacturer serving e-commerce platforms, high-street retailers, and promotional businesses, is further expanding its digital capabilities with the Kornit Apollo production platform. With locations in the UK and the Netherlands, TSS has been a leader in print-on-demand services, helping brands adapt to the increasing demand for quick turnaround times and customizable products.

By integrating Kornit Apollo into its operations alongside existing MAX systems, TSS has significantly increased its production capacity, enabling millions of additional impressions annually. This enhancement streamlines workflows, improves time-to-market, and supports the company's commitment to maintaining the highest standards of quality.

To realise the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset, with total trust. Which of those decisions do you think meet that high bar today? And which do you believe has the furthest distance to travel?

Today, decisions around design validation, sampling, and consumer feedback are well-served by digital twins. Designers and marketers can trust virtual prototypes to represent final products with a high degree of accuracy. However, the furthest progress needs to happen in areas like supply chain integration and end-of-life decision-making. To truly close the loop, digital twins must incorporate data about material sourcing, recyclability, and post-consumer impact. Kornit is committed to advancing this vision, creating systems where every decision-from conception to recycling-is informed by reliable, real-time digital data.



MESH01™

www.mesh01.com

Founded 2010



PRICING MODEL:

MESH01 is an enterprise-grade platform that provides scalable pricing designed to accommodate everything from single-product startups to the world's biggest brands and retailers.

For smaller startups and emerging brands, MESH01 provides introductory options that allow for limited testing with a lower entry cost, perfect for brands looking to start small.

For larger, enterprise clients with extensive testing needs, we offer comprehensive subscriptions that deliver volume-based discounts and custom solutions tailored to fit specific product creation goals.

MESH01 provides best-in-class product feedback solutions to enhance the product creation process and deliver exceptional product experiences. Featuring purpose-built concept and product testing technology and a reliable product tester community, MESH01 is trusted by the most recognized brands to infuse their product creation process with the voice of the customer at every stage.

The flexible MESH01 Concept Testing solution allows brands to generate critical product feedback from relevant testers, often in less than 24 hours. With MESH01 Concept Testing, brands can even test their product concepts in 3D for a more immersive experience that generates detailed and actionable product feedback. MESH01's 3D Concept Testing solution supports all major 3D file types ensuring that various product teams can seamlessly gather valuable product feedback throughout digital product creation.

From market research to trend analysis, competitive product concept testing, color direction and beyond, MESH01 provides the product feedback platform and product tester community to identify the right product direction, right away.

Once product concepts advance to physical prototypes and samples, MESH01 Product Testing completes the pre-market feedback loop. Brands can validate key attributes like fit, comfort, performance, and quality with real consumers before launch, minimizing inventory risks and enhancing customer satisfaction. Whether evaluating concepts or samples, the MESH01 product feedback platform equips brands with the critical insights needed to move forward confidently at every stage of the product lifecycle.

HEADLINE CUSTOMERS

ALLBIRDS	COLUMBIA	NEW BALANCE
ASICS	GILDAN	NIKE
ATHLETA	HOKA	TARGET
CALERES	L.L. BEAN	THE NORTH FACE
CENTRIC	LULULEMON	WALMART

USERS WORLDWIDE

Most of our customers are subscription-based, and we are proud to have a very high retention rate. Many of our customers have partnered with MESH01 for several years, leveraging our platform to drive impactful product creation and testing processes. Our customer base includes some of the most recognized global brands, actively utilizing our solution to enhance their product development workflows.

MESH01™

www.mesh01.com

Founded 2010

TECHNOLOGY PARTNERSHIPS

MESH01 takes a platform approach and integrates with numerous third-party tools to support and expand our offering from 3D asset management tools like VNTANA to email delivery services like SendGrid to logistics capabilities like ShipEngine, cloud-based media and content integrations including Vimeo, Adobe, and many more.

What role do you see yourself playing in the 'digital product creation' journey?

As brands continue to pursue digital product creation as a new norm means to increasing speed to market with increased efficiency and collaboration while mitigating associated challenges like inventory risk, MESH01's customers continue to lean more on its high-speed, accurate and actionable product feedback solutions. By leveraging digital assets like 3D product renders for voice of the customer feedback, brands can generate more detailed consumer feedback before committing to further design or development. This allows for a fast, iterative product design process based on pre-market feedback brands know they can trust.

Essentially, the core benefits of DPC allow for increased and accelerated consumer engagement throughout the process, meaning brands can not only develop products closer to market, but develop better products closer to market.

As DPC scales, MESH01 is uniquely positioned with deep industry experience, advanced platform capabilities and a highly engaged tester community to act as the critical bridge between product teams and real consumer insights helping brands to leverage their DPC process and output and make data driven decisions.

Further, MESH01 leads the front edge of concept and product testing with a relevant, reliable and transparent product feedback community, ensuring brands make decisions by "talking to the right people".

As a purpose-built product feedback solution, MESH01 is designed to integrate seamlessly into the product lifecycle, driving critical feedback from product concept, to launch and beyond.

CONTACT

MESH01™

WHERE DPC MEETS VOC

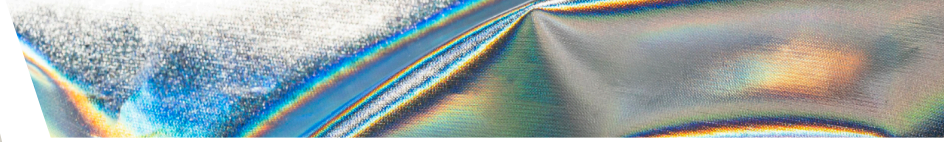
Infuse your digital product creation process with the voice of your customers.

From trend analysis to 3D concept testing, find the right direction right away on the MESH01 product feedback platform.

See more at mesh01.com







JOHN LOONIE

CEO, MESH01



In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify. Do you believe the business case for 3D / DPC is strong enough? And how is that business case evolving to meet a changing industry?

In challenging climates like we have today initiatives like DPC make more sense than ever. Leveraging DPC assets can significantly enhance product design and development and inform production and buys while decreasing inventory risk. Additionally, early consumer feedback aids in creating exceptional product experiences through an interactive, iterative design process.

Lowering the cost and effort to collect and analyze consumer feedback throughout the product lifecycle to better inform critical business decisions saves resources and helps avoid costly mistakes, all while decreasing time-to-market.

A lot of successful DPC roll-outs have incorporated internal product testing to some extent, with 3D being used to bring concepts, revisions, and ideas to life in a format that allows in-house audiences to make better-informed choices about what to adopt. Other DPC initiatives have focused on applying the same principle downstream, using 3D to sell-in to wholesale partners and end consumers with renders of finished products. It seems like we're now converging on something in the middle: where 3D assets can be used to capture the voice of the real target consumer early in the product creation process. What does that look like in practice?

Brands don't need to choose here. Collecting product feedback using 3D assets should be leveraged at every point in the development process where feedback from the proper audience can provide value. This includes internal stakeholders, external partners, and of course end consumers. Further, the combination of physical product test feedback from the current or previous tests with similar products is uniquely powerful.

In practice, we've seen customers reap significant benefits by leveraging their assets externally with real customers to identify the best design direction, gauge receptiveness to aesthetics, home in on color and more. Weaving digital assets like 3D between internal and external reviews from early concept development through refinements and even sell-ins allows brands to essentially test the market and act on feedback without committing to manufacturing and buys. Example after example of this process takes place daily on MESH01, where brands can infuse their future products with the voice and guidance of their customers from the very beginning of product creation and continue through the launch of highly successful new styles and designs.

Taking that approach further, the key capability to build is the flexibility to actually incorporate data streams coming from consumer testing into a more agile model for future design, development, and all-round go-to-market workflows. How do you see those capabilities developing?

We completely agree. All groups involved in the design, development, manufacturing, marketing, and selling of

products should be able to leverage internal and external feedback in their processes and decision making. They should be able to share their findings with other groups and leverage the findings from other groups' testing. The combined dataset, across different products, should be available for analysis to inform key decisions.

When we consider the move towards digital-native product creation, testing, and refinement, are there generic, industry-agnostic best practices that fashion and outdoor brands should be working to apply? Or are those industries going to be better-served by technology and service companies using retail and fashion-specific expertise to develop more tailored solutions?

While some aspects of DPC may be industry-agnostic, data collection and analysis methods that are context-aware will perform better. When collecting feedback, understanding the right questions to ask, and the most effective way to ask them, will result in more valuable feedback. On the analysis side, large language models that are specifically trained to recognize the product- or category-centric areas of interest, will provide better insights then generic models.

Not only can the use cases be unique, but tools built with the end-user in mind are much easier to adopt and will then bring greater value. Just as MESH01 lives to connect brands to customers so that the end products are exactly what their customers want and need, the tools that product creators use will benefit by the same approach. With accelerated product development calendars and go-to-market processes along with the volatility of the customer base and their shopping habits, the usability of DPC tools is critical. Specific to product feedback solutions, essential functionality built for product creators is key. The nature of a product test can be notably different from a concept test or market research survey. Similarly, the analysis and reporting needs may be quite different between a merchant and a marketing analyst.

Simply put, purpose-built consumer product solutions that understand the challenges specific to these areas will outperform generic solutions.

To really extend the value of digital representations of physical products, a key objective is to grow the community of users who interact with those assets - and with the data they incorporate and generate. This is true of 3D renders, but is it also true of the datapoints that are created when those assets are shared with potential consumers? How do you see the pool of users and creators for product testing tools expanding over time as DPC communities grow?



We see the community continuing to grow both internally and externally as the tools improve and the barrier to entry is reduced. We should strive to enable every team involved in the product lifecycle to easily gather feedback to any questions they have, whenever feedback is needed. Involving more consumers at key points should also be easy to accomplish. Through ML, the collective dataset can then be leveraged by product teams and leadership to make key tactical and strategic decisions.

Just as the deployment of concept testing and product testing can be done across the product life cycle and bring different value at different touchpoints, the distribution of findings can be leveraged to different ends by different roles. Where a product team may be within a period of development focused on the customers' experience of a material or construction, a merchant may be leveraging an expanded dataset, looking across multiple styles, while working on a new collection. At the same time, trims may be identified across styles that need improvement or a new supplier while executives are looking cross-categorically at performance.

It's within applications like these that machine learning and AI are being leveraged to make the breadth of data, through multiple streams and touchpoints, truly usable by product creators.

To realise the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset, with total trust. Which of those decisions do you think meet that high bar today? And which do you believe has the furthest distance to travel?

While we've seen solutions drive consistent trusted decisions in areas such as fit and grading, the digital representation of physical materials and beyond, there will still be elements of the customer's product experience that cannot be solved for digitally, like the hand-feel of a woven, stretch of a knit, finish of an overlock seam or durability of a bond. Our goal should be to continue to strive toward leveraging digital assets wherever possible and lowering the barrier of entry for including key voices in as many aspects of the process as possible.



Style3D | ASSYST

www.style3d.com
www.assyst.de

Style3D
founded 2015

Assyst
founded 1985



Style3D | ASSYST is a leading provider of 3D digital product creation (DPC) solutions for the fashion and apparel industry. The platform supports the entire 3D/DPC pipeline, from initial concept design to production-ready outputs, ensuring seamless integration between creative and technical workflows. With its superior GPU Style3D is at the forefront of simulation, real-time rendering, and AI driven improvements.

Its advanced 3D + AI tools deliver hyper-realistic fabric simulation, accurate draping, and true-to-life garment visualization, enabling designers to create and refine their work in real time.

Style3D | ASSYST uniquely bridges the gap between 2D CAD and 3D workflows by integrating with 2D pattern software to ensure the accuracy of digital designs is carried through to production. This connectivity enhances collaboration across design, development, and manufacturing stages, creating a single source of truth for all assets and ensuring precision at every step.

The platform also reduces time-to-market and supports sustainable practices by eliminating unnecessary prototypes, material waste, and physical samples. Its AI-driven features connected to the 3D automates NVA tasks, freeing designers to focus on creativity and providing sales and marketing teams with digital assets that can be used in B2B and B2C channels downstream within the value chain.

Trusted by major brands, manufacturers, and independent designers, Style3D | ASSYST provides a scalable solution tailored to industry needs, delivering value across the design-to-production pipeline while driving sustainability and efficiency.

Style3D | ASSYST represents Style3D in Europe.

HEADLINE CUSTOMERS

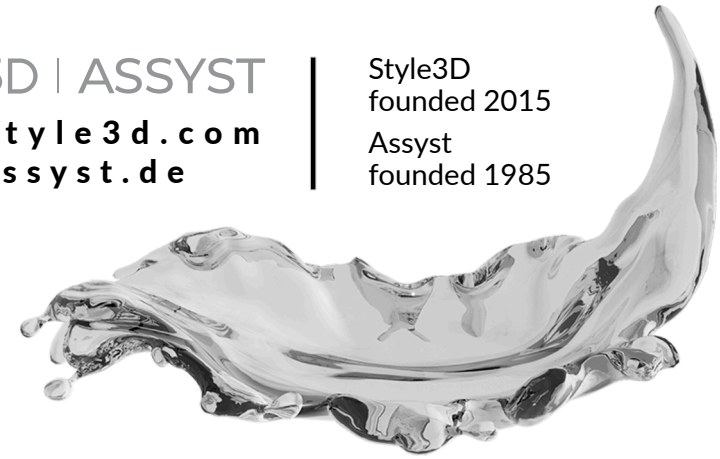
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Style3D | ASSYST

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Style3D
founded 2015

Assyst
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USERS WORLDWIDE

60,000+ Style3D users, **2,000+** Companies / CAD, Nesting & Costing

TECHNOLOGY PARTNERSHIPS, including:

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Alibaba.com	COLORO	SAB
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	KM.ON/STOLL	

What role do you see yourself playing in the 'digital product creation' journey?

Style3D | ASSYST plays a critical role in streamlining workflows within the Digital Product Creation (DPC) journey, particularly as the industry embraces digital scale and collaboration. Our platform empowers both internal design teams and external partners to work together seamlessly in real-time, facilitating faster feedback loops and enhancing productivity.

By offering cloud-based collaboration, teams can share, adjust, comment and approve designs from anywhere, ensuring a unified approach and eliminating bottlenecks caused by traditional workflows.

For wholesale / B2B models, Style3D enables selling directly from digital assets, allowing sales teams to present photorealistic 3D models and virtual garments to retailers and clients without the need for physical samples. This digital-first approach reduces SMS and courier costs and accelerates the sales process, enabling sales teams to pre-sell collections closer to market demand. Combined with our latest mixmatch technology and our interactive 3D hardware – Holobox, the sales and buying is more immersive and innovative.

Style3D empowers brands to meet the rising demand for B2C selling channels by offering tools to showcase high-quality 3D images and virtual garments directly to consumers in immersive environments. Through our simulator, seamlessly integrated with Unreal Engine-powered platforms, brands can create captivating digital experiences. With advanced AI rendering and lifelike fabric simulations, customers can virtually interact with products, enhancing the online shopping journey and driving deeper engagement. These tools enable brands to scale their operations, delivering tailored, immersive shopping experiences that bridge the gap between design and the end consumer.

As the industry moves towards broader digital adoption, Style3D | ASSYST is central to connecting the dots across the value chain, enabling companies to innovate, collaborate, and grow efficiently in this new digital-first era.

CONTACT


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CREATE, DEVELOP, AND SELL POWERED BY AI + 3D
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More on style3d.com or assyst.de (Europe)



ERIC LIU

CEO
Style3D

In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify. Do you believe the business case for 3D/DPC is strong enough? And how is that business case evolving to meet a changing industry?

Especially, in this difficult climate, the business case for 3D/Digital Product Creation (DPC) is more compelling than ever. While upfront investments in technology and talent are significant, they are offset by tangible, long-term benefits that address critical industry challenges. In an era where speed-to-market, sustainability, and consumer expectations are paramount, 3D/DPC offers solutions that are impossible to ignore.

In recent months, we even see the business case evolving. Beyond reducing costs, accelerating time-to-market, and reducing physical samples, 3D is now driving revenue. High-quality 3D and AI assets are increasingly used in consumer-facing channels, such as e-commerce and virtual try-ons, where they enhance the shopping experience and drive engagement. Additionally, they open opportunities for innovative approaches like digital showrooms and B2B sales tools, creating new value streams.



AI + 3D + AI WORKFLOW



CREATE



DEVELOP



SELL

At Style3D | ASSYST, we focus on creating an ecosystem where 3D is more than just a design tool—it's a connector across the entire workflow, from concept to consumer. By integrating with legacy systems and emphasizing scalability, we make the transition to DPC more accessible, ensuring brands can achieve both immediate efficiencies and long-term innovation. In today's market, the case for 3D is not just strong—it's essential.

While a lot of the success of DPC to date has come from single-department use cases, the untapped potential lies in using it to connect creative users with technical teams, and to bridge the gaps between design, development, and manufacturing. Why do you believe that value has been left on the table for so long? And how are you approaching the task of making the 3D asset the common reference frame for that full workflow?

The industry is evolving rapidly. Not only in Europe also in Asia and in the US, many fashion brands are beginning to recognize the high cost of data silos. For years, single-department use cases like design or prototyping provided measurable wins, but these successes rarely extended across the entire product lifecycle. Bridging the gaps between design, development, and manufacturing has been hindered by legacy workflows, lack of standardization, and resistance to change in adopting shared digital assets.
Unlocking the value of digital products across all areas of the business not only reduces costs but also drives growth and innovation. It's an exciting time for the sector, and embracing these tools is becoming increasingly essential.

At Style3D | ASSYST, we recognize that 3D assets are not just design tools—they are the cornerstone for collaboration. Our approach centers on transforming the 3D asset into a universal reference that seamlessly connects creative and technical teams. By integrating our platform with existing tools like 2D CAD systems and incorporating AI-powered enhancements, we ensure that data flows effortlessly from concept to production to selling. This unified framework reduces miscommunication, minimizes errors, and accelerates decision-making across departments.

This way, we empower brands to unlock the full potential of DPC—delivering efficiency, scalability, and innovation for the entire product journey.

On top of the 3D asset itself, there is also the platform question to consider. Having a 3D asset serve as the anchor for that unification of creative and technical processes is a big part of the puzzle, but there's still an open question for a lot of organisations around where those assets live, how they should be shared, and what it means to communicate with them and around them. What's your strategy for building a cloud-based asset library and collaboration platform to answer that question? And how do you think that framework is going to change the way brands and their partners work together?

The question of where 3D assets live, how they are shared, and how they facilitate collaboration is central to the future of Digital Product Creation (DPC). As mentioned above, we view 3D assets not just as design tools but as critical data points that unify the entire supply chain. To realize their potential, we've built a cloud-based platform that serves as a centralized, accessible library for storing, sharing, and collaborating around these assets in real-time.

Our strategy is twofold. First, we ensure 3D assets are compatible with multiple systems and formats, making them usable across departments and partners. This avoids

the siloing of assets and ensures that a design created in 3D carries its integrity through to development, manufacturing, and even e-commerce. Second, we focus on collaboration. Our platform integrates tools for communication, annotations, approvals and cloud design enabling seamless exchanges between internal teams and external partners.

For example, we enable manufacturers to share digital garments with their customers—and vice versa—using a QR code linked to an interactive product catalogue. Scanning the code allows customers to adjust colours or fabrics in real time while accessing detailed material information. This level of digital transparency enhances traceability across fabrics and trims, ensuring accurate sourcing data. Any updates made online are instantly reflected across the platform, streamlining workflows and fostering seamless collaboration.

By centralizing assets in this collaborative way, we're making it easier for brands and their partners to work seamlessly together, reduce misunderstandings, and accelerate decision-making. This framework not only improves efficiency but also fosters innovation by enabling more dynamic and interactive ways of working. It's a game-changer for how brands connect with their partners and customers.

AI has become one of the foundational pillars of your approach to DPC, with the "AI+3D+AI" strategy. The most visible applications of AI in that workflow are at the beginning and the end of the new product lifecycle, with AI deployed in early concept design and then all the way downstream, where it's used to enhance virtual photography deployed in B2B and B2C selling. There's potentially much more happening more quietly in the middle, though, in terms of using AI to automate, connect, and augment human skills. How big of a shift do you believe combining AI and DPC is? And how much of that shift is coming from the outward-facing use cases compared to the internal transformation?

The integration of AI and DPC represents a profound shift for the fashion industry, fundamentally redefining workflows both internally and externally. Our "AI+3D+AI" strategy emphasizes the transformative potential of AI across the entire product lifecycle, from generative ideation to consumer-facing applications.

AI's role in rendering is crucial for promoting ideas. It makes 3D designs more realistic and authentic, providing the right background and avatar models to complete the product vision—without requiring advanced skills in rendering tools. This is a big change because it democratizes product presentation and market access. Now, any company—regardless of size—and any designer with great ideas can create impressive, high-quality results. It's about putting the focus back on ideas and concepts, which I think is the truly exciting part of Artificial Intelligence.

While the most visible impacts are in early concept design and downstream virtual photography for B2B and B2C, the real game-changer is the quieter revolution happening mid-process.



AI in the middle of the DPC workflow automates and connects traditionally fragmented tasks, streamlining processes such as stitching of patterns to connect directly to the 3D. AI can also emphasize layering or how a fabric can drape, enabling faster iterations and more precise execution of the final visual.

As we've seen in our designer profiles this year, where two of our creators had their visions brought to life in Unreal Engine, 3D assets can have a huge amount of storytelling potential when they can be brought into other tools and environments - especially real-time ones. How is Style3D helping users to meet the growing demand for new content and immersive experiences through existing and emerging consumer channels?

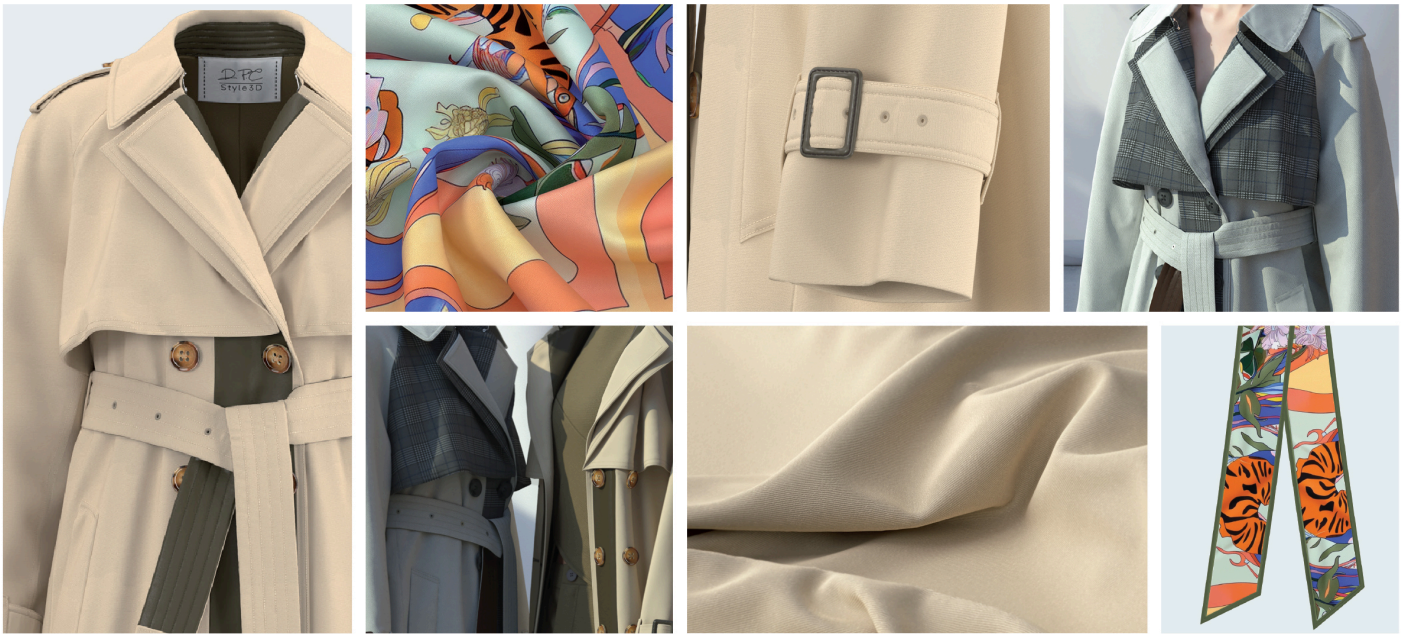
Style3D | ASSYST empowers users to meet the demand for immersive, real-time content by creating highly detailed, production-ready 3D assets that integrate seamlessly with platforms like Unreal Engine. Our tools enable brands to craft virtual environments, showcase interactive product visuals, and deliver engaging consumer experiences across B2B and B2C channels. By combining AI, 3D precision, and flexible asset interoperability, we support dynamic storytelling that connects creators, brands, and audiences effectively.

To realize the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset, with total trust. Which of those decisions do you think meet that high bar today? And which do you believe has the furthest distance to travel?

The concept of a "digital twin" is transforming decision-making across the product lifecycle by providing trusted digital representations of physical assets. Today, decisions around design iterations, prototyping, and virtual sampling meet this standard effectively, offering precision and reducing the need for physical samples. Similarly, AI-enhanced 3D visualizations enable confident choices in marketing and sales to use these said assets to enhance consumer engagement events before a sample is made allowing insights into potential product demand.

However, areas like supply chain management and post-consumer sustainability have further to evolve. Integrating digital twins into predictive demand modeling, and circular fashion workflows still face challenges, such as data standardization and seamless interoperability across systems. Bridging these gaps requires collaboration, technological advances, and an industry-wide commitment to leveraging digital twins as a unified framework.

At Style3D | ASSYST, we are redefining the possibilities of the digital twin with cutting-edge advancements like real-time rendering, soft-body avatars, and ultra-accurate garment simulations, achieving unparalleled speed and precision—and this is just the beginning. Stay tuned for the next wave of innovation that will shape the future of fashion.



TUKATECH
INNOVATIVE SOLUTIONS FOR THE APPAREL INDUSTRY

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1995



PRICING MODEL:

Monthly & Annual Subscriptions starting at $19/ month with no long term contracts available at:
www.tukaweb.com

Disruptive Technologists Since Day One

We believe in empowering our users with powerful tools to face the challenges of the fashion industry with confidence, free from technical challenges and restrictions.

Tukatech applications combine the artistry of traditional fashion production with the efficiency of modern manufacturing, culminating in an end-to-end fashion technology powerhouse. We simplify design and development processes and create fashion technology that companies of every size use to bring the right product to the consumer at the right time.

We were the first to do a lot of things – we consider ourselves true innovators. The revolution we started in 1995 is in the DNA of every Tukatech employee.

Almost three decades later, Tukatech continues to transform fashion businesses with simple, straightforward end-to-end fashion technology systems. We are truly an international company, with a presence in 6 continents and 42 countries, yet we remain devoted to exceptional customer service. We endeavor to continue the fashion technology revolution forever.

- Production Quality 2D Pattern Making, Grading & Marker Making
- 3D sample making for fashion design and fit.
- 3D Models, Motion Simulation, Digital Fabric, fully integrated with 2D pattern making.
- TUKAcloud process lifecycle management and team collaboration.
- AI -generative photorealistic models to replace traditional photoshoots for ecommerce.

HEADLINE CUSTOMERS

Adore Me	Indochine	MDL
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Columbia	Komar Brands	Pivot Apparel Group
Create a Marker	Lefty Production Co	TCW
Guess Jeans	Los Angeles Apparel	Timex Fabrics
Grupo Vanity	Matrix Sourcing	US Standard Apparel

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EcoShot by Tronog	InEdit / NeoTextil	Sowtex

What role do you see yourself playing in the 'digital product creation' journey?

It's not just a pretty picture on the screen. 3D sample making for fashion design and fit.

Create stunning presentations to showcase 3D-fit, lifelike digital collections, eliminating the need for physical samples. Host fit sessions on customized virtual avatars that perform real-time motion simulations, ensuring the garment fits right the first time.

3D Models: TUKA3D models are sculpted from 3D body scan data of live fit models.
Motion Simulation: TUKA3D models are rigged with real-time animations to show how the garment moves and fits.
Digital Cloth: We test real fabric swatches for physical fabric properties and texture effects.
Integrated CAD: TUKA3D includes the TUKAdesign system for pattern making and grading.

3D Fit Software
Fit is analyzed in motion, emulating real-life virtual fit sessions. Evaluate frame by frame, rotating the model to examine the tightness and looseness of the garment. TUKA3D models "talk" about the garment's comfort through 3D virtual sampling in 5 visual ways, including stretch, warp, weft, pressure, and x-ray.

Virtual Design Software
TUKA3D has a fabric and trims library (including buttons with 3D thread) that is frequently updated to reflect new trend developments and access to the Pantone color library. Though applying prints and logos is simple in TUKA3D's material editor, those who prefer can utilize TUKA3D's connection with graphic design applications like Adobe Photoshop or Illustrator to create design layouts to help with 3D virtual sampling.

3D Digital Photoshoot
TUKA3D has lights, cameras, and action! Host true-to-life virtual photoshoots to showcase your design in a presentation, on TUKAcloud, or your website

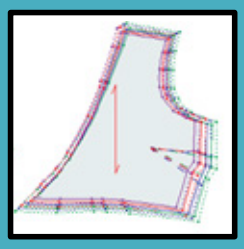
CONTACT

TUKATECH

AN AMERICAN COMPANY



TUKA3D FOR VIRTUAL **DESIGN** AND **FIT**



TUKAcad FOR DIGITAL **PATTERN MAKING** & MORE



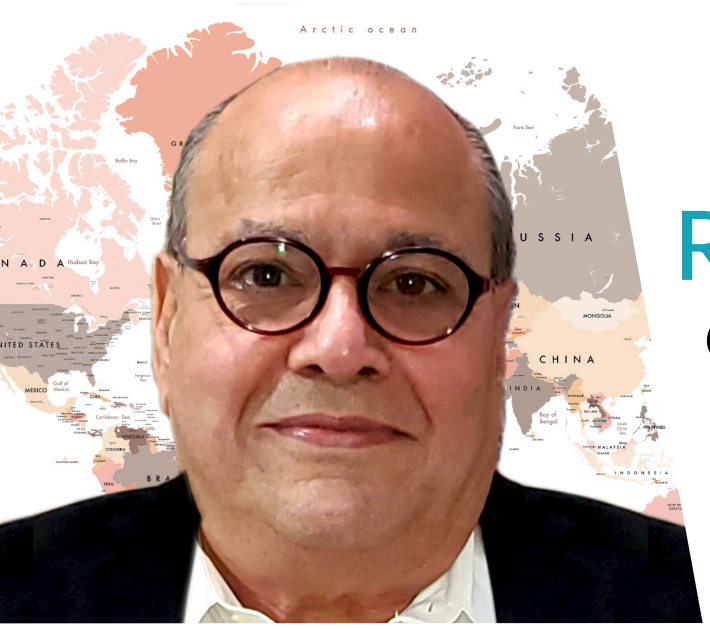
AI-GENERATED AND REAL-LIFE MODELS



TUKA3D

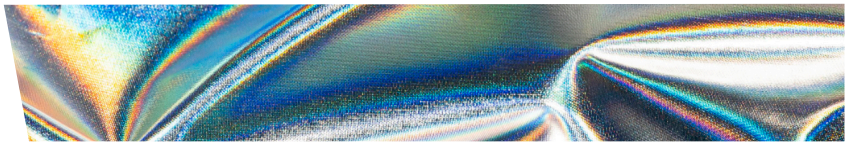
SOFTWARE

- Virtual Design and Fit
- End-to-End 3D Fashion
- Totally Open Systems
- Real-Time Motion Simulation
- 750+ Fit Model Library
- AI for Digital Product Creation (DPC)
- Photorealistic Digital Models
- Demand Manufacturing
- Accurate “Digital Twins”



RAM SAREEN

CEO & Founder, Tukatech



In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify. Do you believe the business case for 3D / DPC is strong enough? And how is that business case evolving to meet a changing industry?

Investing in Digital Product Creation (DPC) tools like TUKA3D offers a compelling business case for fashion companies, even amid challenging economic conditions. The evolving landscape of the fashion industry underscores the growing importance of such technologies.

According to Boston Consulting Group, implementing 3D design tools can substantially decrease the need for physical samples by up to 70%. Many TUKA3D users do not make physical samples, conserving resources and reducing costs. Digital prototyping enables rapid iterations, allowing brands to adapt swiftly to market trends and consumer preferences, enhancing competitiveness. By relying on digital samples, companies can reduce material waste associated with traditional sampling processes, aligning with sustainability goals.

Our Patented process, utilizing TUKAcloud, facilitates seamless collaboration between design, production, and marketing teams, ensuring alignment, faster approvals, and reduced operating errors.

The business case for TUKA3D and similar DPC tools is robust. They offer tangible benefits in cost savings, sustainability, operational efficiency, and strategic agility.

As the fashion industry evolves, embracing digital transformation becomes crucial for maintaining competitiveness and meeting market and environmental demands.

A lot of the long-term promise of digital product creation hinges on the assumption that systems, files, and processes will be open and interoperable - allowing companies to go after new opportunities as they emerge, instead of always being beholden to a single vendor. How are you seeing that work in practice? And what do you believe are the keys to maximising compatibility in order to get the most value out of digital assets, platforms, and workflows?

Tukatech recognizes the critical importance of open and interoperable systems in Digital Product Creation (DPC), which empowers companies to seize emerging opportunities without being confined to a single vendor.

In practice, Tukatech has taken significant steps to promote interoperability. Starting with TUKA3D 2022: This version offers an open system that allows users to import and export all main elements of a 3D garment across various fashion 3D systems. This flexibility enables designers to utilize different software tools while maintaining workflow consistency.

We ensure that the 2D patterns are intact and ready for production, that the FABRIC is converted from physical to digital state with ZERO difference, and that there is zero difference between the AVATAR and the actual FIT MODEL.

By providing TUKAforms, life-like fit model clones that can be made using actual 3D scan data, we ensure that avatars are consistent across different platforms. This standardization facilitates accurate fit assessments and seamless data exchange between systems.

Tukatech aims to enable companies to fully leverage their digital assets and remain agile in a rapidly evolving industry by focusing on these areas.

It's become a bit of a well-worn argument that DPC should be delivering on more than just design and visualisation, and that a 3D garment should be evolving to serve as a product definition, so it can directly drive production. The reality today, for most organisations, is very different: it remains a process of iterative physical sampling, reliant on 3D files being accompanied by flat technical specifications. You've told us before that Tukatech's customers are different and that a fully digital flow - from 3D design to production - is the current state for most of them. What have you done differently to mature that design-to-production flow?





Tukatech's success in establishing a fully digital design-to-production flow lies in addressing the practical and systemic barriers that often hinder other organizations. Tukatech has created an ecosystem that allows its customers to harness the full potential of 3D product creation by focusing on technology, processes, and education.

Here's what has been done differently: Tukatech's 3D solution (TUKA3D) is tightly integrated with its pattern-making software (TUKAcad), ensuring that 3D garment designs are visual concepts and precise, production-ready patterns.

Unlike other platforms, Tukatech's focus extends beyond rendering. The software outputs detailed technical data, including accurate fabric consumption, measurements, and construction details, enabling direct manufacturing use.

Advanced simulation ensures that garments behave like real-world products, with accurate draping and fit validation. This minimizes the need for physical sampling by identifying issues in virtual prototypes.

Tukatech has prioritized interoperability with manufacturing systems, ensuring that 3D designs seamlessly translate into cutting machines, sewing workflows, and PLM systems.

Tukatech customers are encouraged to rely on virtual samples for decision-making, cutting physical sampling by up to 90%. This is achieved by creating photorealistic renderings and using virtual fit sessions that mimic real-world conditions.

Tukatech's solutions provide a single source of truth, with all stakeholders, from designers to manufacturers, working off the same digital assets. Tukatech invests heavily in customer training, helping teams understand how to utilize 3D-to-production workflows. This includes workshops on digital pattern-making, fit validation, and virtual sampling.

Recognizing that every organization has unique challenges, Tukatech customizes its solutions to integrate with existing processes, ensuring smoother adoption. Tukatech's leadership has been vocal about the benefits of digital transformation, creating awareness and pushing the industry toward a more integrated approach.

While many organizations struggle to integrate 3D with production due to fragmented workflows and limited software capabilities, Tukatech has designed its ecosystem to make the transition natural and effective by focusing on practical solutions and providing end-to-end support.

The maturity of Tukatech's design-to-production flow stems from its holistic approach to technology, integration, and education. By aligning tools with real-world manufacturing needs and empowering customers to embrace digital-first workflows, Tukatech has set a benchmark for what's possible in 3D/DPC since 2001.

One of the big promises of 3D has always been accessibility and agility - the idea that digital design provides the shortest distance between having a vision and bringing it to life and then testing that new idea with colleagues and even consumers. There's a similar kind of democratisation going on in production, with the microfactory model gaining more traction, and brands recognising the potential of producing on-demand, as close as possible to the consumer. What role do you see DPC playing in making this model more viable and more widespread?

Digital Product Creation (DPC) plays a pivotal role in making the microfactory and on-demand production model more viable and widespread. By reducing barriers in design, enabling hyper-localized manufacturing, and promoting efficiency, DPC is helping brands realize the promise of democratized production. Tukatech's early emphasis on micro-factories in 2012 was forward-thinking, and today, Digital twins created using DPC provide highly accurate, production-ready files. These files can be sent directly to microfactories, minimizing the need for manual intervention. On-demand production thrives on flexibility, and DPC supports this by allowing brands to adapt designs based on consumer preferences or feedback without disrupting workflows.

With microfactories strategically placed near consumer hubs, DPC enables localized production by providing digital assets that can be shared instantly. Microfactories, combined with DPC, allow brands to produce personalized products on a larger scale without sacrificing efficiency.

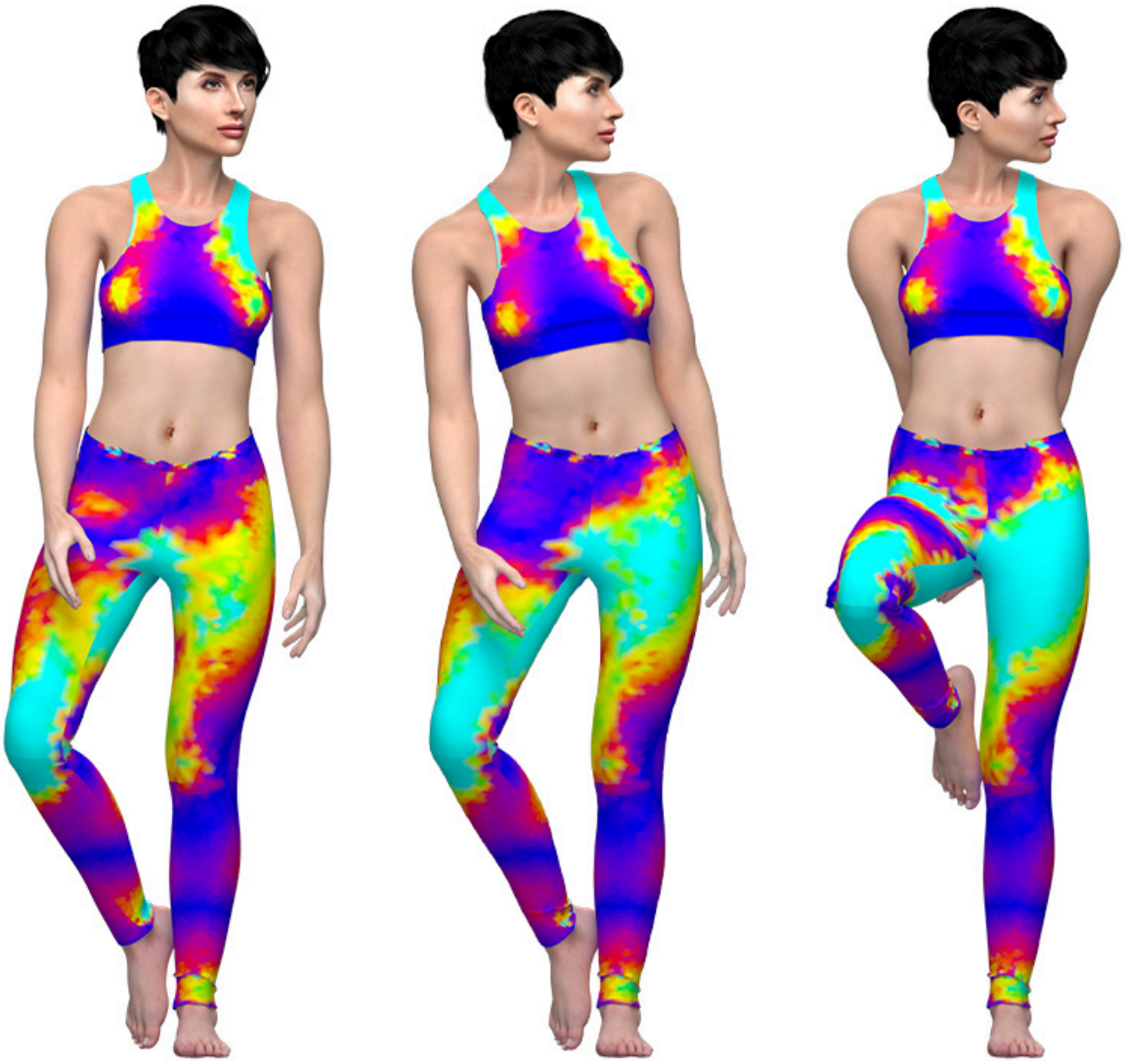
Tukatech has set up hundreds of factories around the globe who followed the concept of selling and then making. We call this REVERSE THE PROCESS (see here for more details).

One of the most significant benefits is for Brands, who can use DPC-generated digital prototypes to gauge consumer interest before committing to production. This ensures that only validated or even sold product designs are produced.

Tukatech's early advocacy for microfactories underscores the enduring relevance of this model, with DPC driving its future scalability and adoption. Obviously a lot of attention is being paid to AI right now - both standalone and as a new component of the DPC ecosystem. Do you see any use cases where AI is actually making tangible improvements to the way fashion handles design, development, and production workflows? And does AI have a role to play in helping the industry overcome the final hurdle and really commit to using digital samples to replace physical ones for virtual photography?

AI is increasingly proving its value in fashion by streamlining design, development, and production workflows. It holds significant potential to address critical challenges like adopting virtual samples.

TUKAcad APM is an automated Pattern Generation system that allows users to open existing reference blocks, input new measurement data, and automatically create new production-quality patterns updated for the new style.



TUKA3D is integrated with EcoShot from Tronog, a technology that utilizes AI to enhance the realism of digital samples. This addresses a key barrier to adoption: stakeholder skepticism about whether virtual photography can truly replicate and replace the need for physical photoshoots.

We have also introduced an enhancement to the Adobe Photoshop print design plug-in that uses the AI engine to automatically create seamless repeats with the click of a button.

AI is making tangible improvements to design, development, and production workflows and addressing key barriers to adopting digital samples for virtual photography. By enhancing realism, reducing costs, and increasing efficiency, AI plays a vital role in helping the fashion industry fully commit to digital transformation, making the vision of a seamless, sustainable, and agile workflow a reality.

To realize the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset, with total trust. Which of those decisions do you think meet that high bar today? And which do you believe has the furthest distance to travel?

The vision of a "digital twin" as a complete and trusted representation of a physical garment throughout its lifecycle is ambitious but attainable, with platforms like TUKA3D already advancing certain aspects. However, the degree to which TUKA3D meets this vision varies across the product lifecycle.





Here's an assessment of where it excels and where it has room to grow, TUKA3D excels in providing accurate visual and functional representations of garments during the design phase. Its ability to simulate fabric drape, fit, and construction allows designers to validate aesthetics, fit, and functionality digitally. Designers and stakeholders can trust that virtual samples in TUKA3D accurately represent what the physical garment will look and behave like, minimizing reliance on physical prototypes.

TUKA3D platform includes detailed fabric libraries with data on stretch, weight, and texture, enabling highly accurate simulations. This helps teams make informed decisions about fabric selection and consumption without needing physical swatches.

Virtual samples generated in TUKA3D are often used for final stakeholder approvals before production. With photorealistic rendering and accurate fit simulations, marketing teams and buyers can confidently greenlight designs for manufacturing.

TUKA3D integrates seamlessly with TUKAcad for pattern-making, allowing accurate calculations of fabric consumption and production costs directly from the digital twin. Though TUKA3D is strong in design, it doesn't yet fully replicate real-world manufacturing conditions, such as machine tolerances or production variability. Trusting a digital twin to replace physical quality control processes entirely remains a stretch.
Bottom of Form

These supply chains will need to become more agile, with companies making efforts to reduce excess inventory and minimise the risk of shortfalls. Margin pressures, as well as pressures from governments around the world to reduce emissions and fashion waste, will drive advances in inventory management. New technology will aid these efforts.

VIZOO

www.vizoo3d.com

Founded 2010



PRICING MODEL:

The xTex scanner hardware is a one-time purchase.

xTex Software and physX platform licenses are provided on an annual subscription basis.

Material scan services are charged per fabric.

The Germany-based company Vizoo is the number one supplier of digitization technology for materials and fabrics.

Since 2013, the company helps fashion brands, manufacturers, and fabric mills with the digital transformation of the product design and fabric commercialisation processes.

Vizoo technology is developed with the objective to create a digital twin of a fabric in no time. Clients appreciate the ease-of-use and the interoperable output. This makes it the technology of choice when it comes to mass production of digital materials no matter which software or platform is used in the DPC pipeline.

Many brands do actively recommend Vizoo technology when onboarding their suppliers on their DPC process. This made Vizoo a trusted partner of 520 fashion, interior and automotive companies where the technology feeds 3D Design, virtual prototyping, marketing, or eCommerce applications.

Vizoo Products and Services:

- **xTex scanne**r. Accurately capture the visual surface of a material (PBR textures)
- **xTex software.** Easily edit and enhance materials by tiling, recoloring, and rendering and generate interoperable output even without 3D experience
- **The physX platform.** Create true-to-life draping through assigning or calculating the mechanical parameters of the fabric drape, compatible with 3D apparel simulation tools
- **Physical reference geometries and standardized Drape Validation Workflow**. Quality check the digital twin
- **Vizoo Certification Program**. Ensures a high quality and wide network of scanning service providers globally

Bespoke Solutions and Consultancy:

- Supplier onboarding for brands
- Implementation support for building material digitisation processes and scanning quality guidelines

HEADLINE CUSTOMERS

Adidas
Avery Dennison
Esquel
GAP
Hanes Brands
Hugo Boss
H&M
Kering
Li & Fung
Lojas Renner
Lululemon
MAS Holdings
Marks & Spencer
Nike
On Running
Otto Group
Patagonia
PVH
Puma
Ralph Lauren
Reliance Industries
Tapestry
Target
TAL Apparel
Under Armour
VF
W.L. Gore

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TECHNOLOGY PARTNERSHIPS, including:

Adobe Substance
Assyst
Atom Shoemaster
Audaces
Bamboo Rose
BeProduct
Blender
Browzwear
caddon
Centric Software
CLO3D
ClothingTech
DMiX
embodee
Jeanologia
Emersya
Keyshot
Metis
Optitex
Performance days
Stitch showroom
Swatchbook
Trapdoor Creative
Tukatech
Virtuality.Fashion
weev.one
Z-emotion

1120 licenses with **520** organizations across **48**countries worldwide, split:

North America	LATAM	EMEA	APAC
22%	**1%**	**42%**	**34%**

What role do you see yourself playing in the 'digital product creation' journey?

Whilst DPC started off with the brands, we at Vizoo believe that the transformation can only happen in a collaborative environment of brands and vendors. Consequently, the technology must cater to everyone in the supply chain. For fabric digitization specifically, Vizoo technology enables brands, manufacturers and mills equally to generate their ROI:

Brands want the digital twin!

Brands leveraging Vizoo technology (sOliver) build true-to-life material libraries to make 3D design and prototypes stand out. Most importantly, brands need realism in DPC results to generate a wide acceptance internally and allowing for fast and better decision.

Streamlining the assets all the way from Design to ecommerce and high-end marketing - instead of creating a quality barrier for any customer-facing use case is their goal.

When scaling their DPC efforts brands expect the technology to enable mass production and consistent quality output. Therefore, Vizoo is the most recommended partner by global fashion brands.

Manufacturers' need for speed

Fashion manufacturers (like Artistic Milliners, MAS) use DPC to achieve fast turnaround times of prototypes. The so-called co-creation with brands is replacing the traditional communication using physical samples with 3D. Most of the manufacturers master multiple 3D tools to cater the individual brand requirements.

Therefore, the manufacturer value the fabric digitization of Vizoo xTex and physX platform, enabling to generate consistent, interoperable output.

Fabric Mills revolutionizing how fabrics are sold

In this early stage of the DPC process, the ease of use of the system and the possibility to validate the output are most important to enable the required mass production of fabric assets. The Vizoo validation workflow was especially developed to help mills and brands to QA the output in a reliable way.

Innovative mills enter a whole new service level with their customers (JML Apparel, Forster Rohner)

CONTACT

Fabric Communication is Our Style

Vizoo digitization solutions provide quality fabric visual capture and physical drape properties.

Your number one partner for a successful DPC implementation.



VIZOO

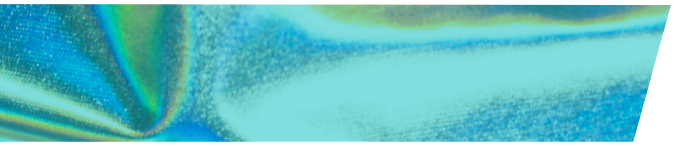
We'll take your material digitization pipeline to the next level.

www.vizoo3d.com

RENATE EDER

Chief Commercial Officer,

VIZOO





In a difficult climate for fashion (and retail in general) new and ongoing investments in tech and talent-intensive initiatives like digital product creation can be harder to justify. Do you believe the business case for 3D / DPC is strong enough? And how is that business case evolving to meet a changing industry?

Let's face it: the excessive physical sampling in the industry is still there, the old inefficient processes have not changed, and at the same time sustainability is becoming an important metric. I doubt we're going to solve any of this by continuing to do business as usual. Maybe the old habits are part of our current struggle?

It is of course hard to convince anyone to invest in technology right now. However, I think that tough times help companies focus on business priorities and what tools they already have and how to leverage those. In other words, today many are looking at what they can get out of digital in general and 3D specifically, instead of adding more tools.

Having said that, I am encouraging everyone to not stop digitizing. We are not only facing economic stagnation, but also technological disruption: the future belongs to the companies that own and interpret meaningful data. AI and other technological advantages can only be leveraged with the right data set. And 3D is data.

For material development and sourcing to switch from analogue-first to digital-first, the companies at both ends of the supply chain need to embrace the value of fabric digitisation and commit to making it the standard, in order to access the benefits. What we sometimes see in reality is an unequal distribution. Sometimes vendors and suppliers put the effort in to provide digital fabrics for one brand customer, only to find that their other customers aren't set up to work in 3D, which doesn't give them the competitive advantage they hoped. Other times, brands put out the call to receive new materials digitally first, but find that their suppliers can't provide them. How do we get to greater scale if it feels like people at each end of the value chain are waiting for the other to adopt first?

I can only echo that. It is true that companies on both sides of the supply chain are promoting the adoption of 3D technology. While brands asked for 3D samples in the past but many never really realized larger sample savings, we see an increasing number of vendors taking the initiative to invest in 3D technology. Those suppliers are influencing the way brands operate, are focused on their ROI and realize high efficiency gains quickly. This new method of so-called "digital co-creation" benefits both parties and is not contingent on the brand's level of 3D maturity.

The essential promise of a digital fabric is that it represents the physical material across every necessary parameter - from aesthetic characteristics to physics properties. You've dedicated a lot of time in the last year to designing a validation workflow, and implementing the real-time physics engine PhysX, presumably to increase the odds that a digital material is as accurate and comprehensive as it can be, first time. Why is this so important right now?

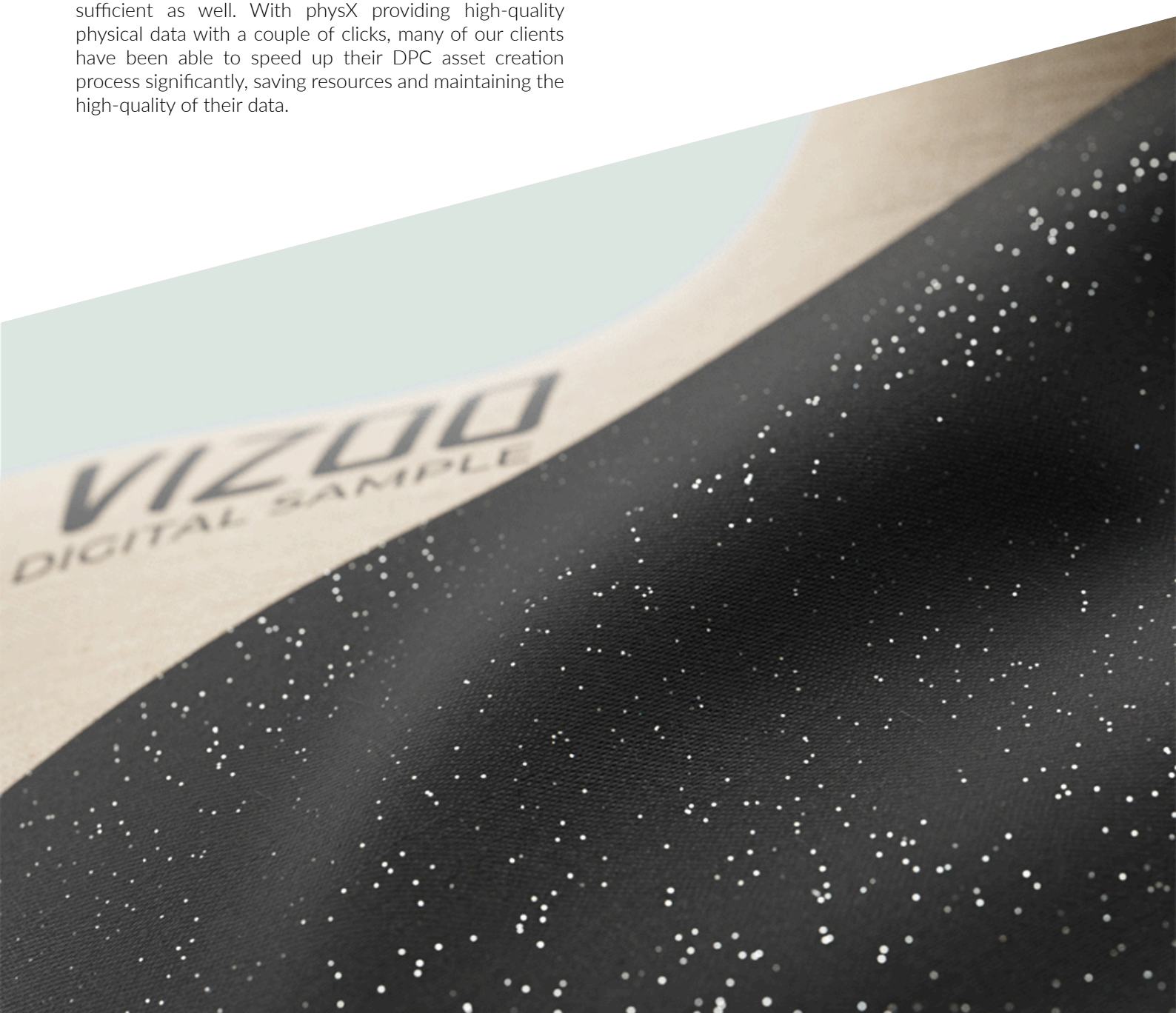
At present, there are two significant challenges to the adoption of 3D technology: a lack of general trust and limited resources.

Our validation process is addressing the trust issue. DPC does not only have supporters within the brands. Many people do not trust it and so it constantly undergoes checking and review. This results in a slower adoption process. Second, when suppliers digitize fabrics for brands, they cannot objectively assess whether they have done a good job. In this context, we have developed a standardized validation workflow which helps brands and suppliers to assess digital fabrics and build confidence.

It is evident that the creation of a high-quality digital fabric requires a certain level of effort. In particular, the manual measurement of physical properties can be a time-consuming process. Moreover, some companies request the measurement of each and every fabric – even if they are very similar. Given that a 3D real-time simulation program can only be an approximation of the real physical drape, we at Vizoo believe that for most DPC application areas, a good approximation of the physical properties is sufficient as well. With physX providing high-quality physical data with a couple of clicks, many of our clients have been able to speed up their DPC asset creation process significantly, saving resources and maintaining the high-quality of their data.

The biggest question when it comes to fabric digitisation is who should be responsible for it. For direct control and quality adherence reasons, brands might prefer to receive swatches and scan them themselves, but this is hardly the quickest approach. For speed and collaboration reasons, suppliers digitising at source is the logical approach, but this requires them to assign dedicated resources and to target different profiles for different customers. The sensible middle ground is regional scanning hubs run by technology and service companies like Vizoo, and it feels like this is perhaps the model of the moment given that it can free up resources for suppliers and increase speed and quality for brands. But what does it take to run a successful digitisation hub - or a network of them - today? How do you train, certify, and provide technology at the scale required?

We strongly believe that offering a digital twin of their fabrics will become a core responsibility of the fabric vendor. Today, progressive fabric vendors and platforms are already proactively offering 3D fabric samples for download.



Given that this is a completely new area of expertise, there are several ways to offer a digital twin. Some brands and suppliers prefer to develop this capability in-house, while others find it easier to use with external scanning hubs.

As the engagement with scanning hubs increased, we saw that price was a primary competitive factor. Naturally, many companies selected the most low-cost offering which unfortunately resulted oftentimes in low-quality fabric data output.

This issue triggered the initiation of the certification program with the goal to accredit third-party service partners. This audit should help brands and vendors to build trust in the scanning hub services. Beginning 2023, we accredited MAS in Sri Lanka as our first certified hub. Today, there are six Vizoo certified hubs and we are actively seeking to expand this network.

What do you think is necessary for fabric digitisation to help drive the next stage of all-round digital transformation? It seems today like different companies, different industry bodies, different countries, and even different departments within the same organisation are pulling in different directions. At a time when the cost of innovation is so high, how can we encourage people to pool their expertise and resources to elevate the material development and sourcing process for everyone?

This is an excellent question. I do observe, that many fashion companies are using the same tools, to achieve slightly different results. However, the path to achieving this is highly individual, with companies independently building their technological landscapes, investing significant resources and undergoing a repetitive cycle of trials and errors.

I firmly believe that there is significant potential for fashion companies to collaborate on a technological level. Undoubtedly, such a collaboration needs a neutral platform. Here I see textile associations playing a pivotal role in driving digital transformation. For example, if associations were to take on a more active role in facilitating access to technology (like setting up technology hubs) as well as providing trainings for their members, they could significantly enhance the technological proficiency of the entire industry. This could be further extended by different associations cooperating on a European level, fostering an environment of innovation and growth.

To realise the long-term vision for a complete "digital twin," it should be possible for any decision across the extended product lifecycle to be made based on a digital representation of the physical asset, with total trust. Which of those decisions do you think meet that high bar today? And which do you believe has the furthest distance to travel?

I have observed the successful implementation of digital content successfully in almost all application areas from Design to eCommerce. Recently, AI has the helped to unlock eCommerce application where missing realism was an issue.

Nevertheless, there is currently no straightforward solution for simulating haptics in a satisfactory way nor for replacing any wear testing which relies on the individual perception of the person wearing the garment. Furthermore, I do not think that there is efficiency gain (yet) in achieving a 100% digital process. Let's acknowledge that ultimately, we are selling tangible garments that are worn by real people.

To conclude, I would like to quote one of our clients: "Keep 3D as good as it needs to be."





MARKET ANALYSIS 2024/25

ESTIMATING THE CURRENT AND NEAR-FUTURE SCOPE OF THE MARKET FOR CORE DIGITAL PRODUCT CREATION TOOLS, AND PREDICTING THE EXPANSION OF CAPABILITIES AND COMMUNITIES THAT COULD TAKE DPC AS A TECHNOLOGY SEGMENT TO THE NEXT LEVEL.

DPC MARKET OVERVIEW AND SIZING

For the past two years, these reports have helped to document the growth of digital product creation, as a technology market segment, to where it has become equal in scale and importance to other enterprise software categories that also appear in the same design, development, production, and selling space.

It should surprise none of The Interline's readers, though, that the size and the outlines of various enterprise technology markets have shrunk, been redrawn, or both this year. So while the core contention that DPC is as important of a tranche of fashion technology as any other remains true, we are now at a critical juncture where it becomes important to ask whether DPC is still on a growth trajectory - and what it will take for the market to expand further.

There are, as we see it, two ways to measure current market sizing and future potential: one soft and slightly nebulous; the other harder and more cut-and-dried.

The first of these is what we'll label impact and mindshare - a rough quantification of how the fashion industry feels about digital product creation, how much impact it's having on the way creative and commercial professionals frame their work, and what amount of mindshare DPC (and the 3D assets and environments it generates) occupies.

This is obviously difficult to capture in numbers, but a quick glance through this report, or a cursory look at how fashion and footwear are emerging as bigger presences on-stage at major computer graphics and digital advertising shows and events, demonstrates just how far 3D has become synonymous with the cutting cultural edge of fashion.

Working in 3D, whether it's in creative design, engineering, or marketing, means working on a frontier of fashion that continues to occupy an outsize amount of space in the industry's psyche - and that is now firmly driving the way fashion interacts with other industries where cross-media collaborations and outreach to new demographics is concerned.

Outside of AI, there is no other technology segment, then, that occupies as much mindshare in fashion as 3D / DPC do today. And that dominant presence in the industry's thoughts is, we believe, still justified: no other technology segment offers the same combination of artistic empowerment and technical innovation; no other category touches as broad a possibility and process space as DPC, from creative experimentation to immersive experiences; and none tie as strongly into the industry's desire to reach new audiences, tell new stories, and align in-house teams and partners to a single shared vision.

From the "soft metrics" side of things, DPC has every right to be as big as our data and our industry insights tell us it is.



WORKING IN 3D, WHETHER IT'S IN CREATIVE DESIGN, ENGINEERING, OR MARKETING, MEANS WORKING ON A FRONTIER OF FASHION THAT CONTINUES TO OCCUPY AN OUTSIZE AMOUNT OF SPACE IN THE INDUSTRY'S PSYCHE.

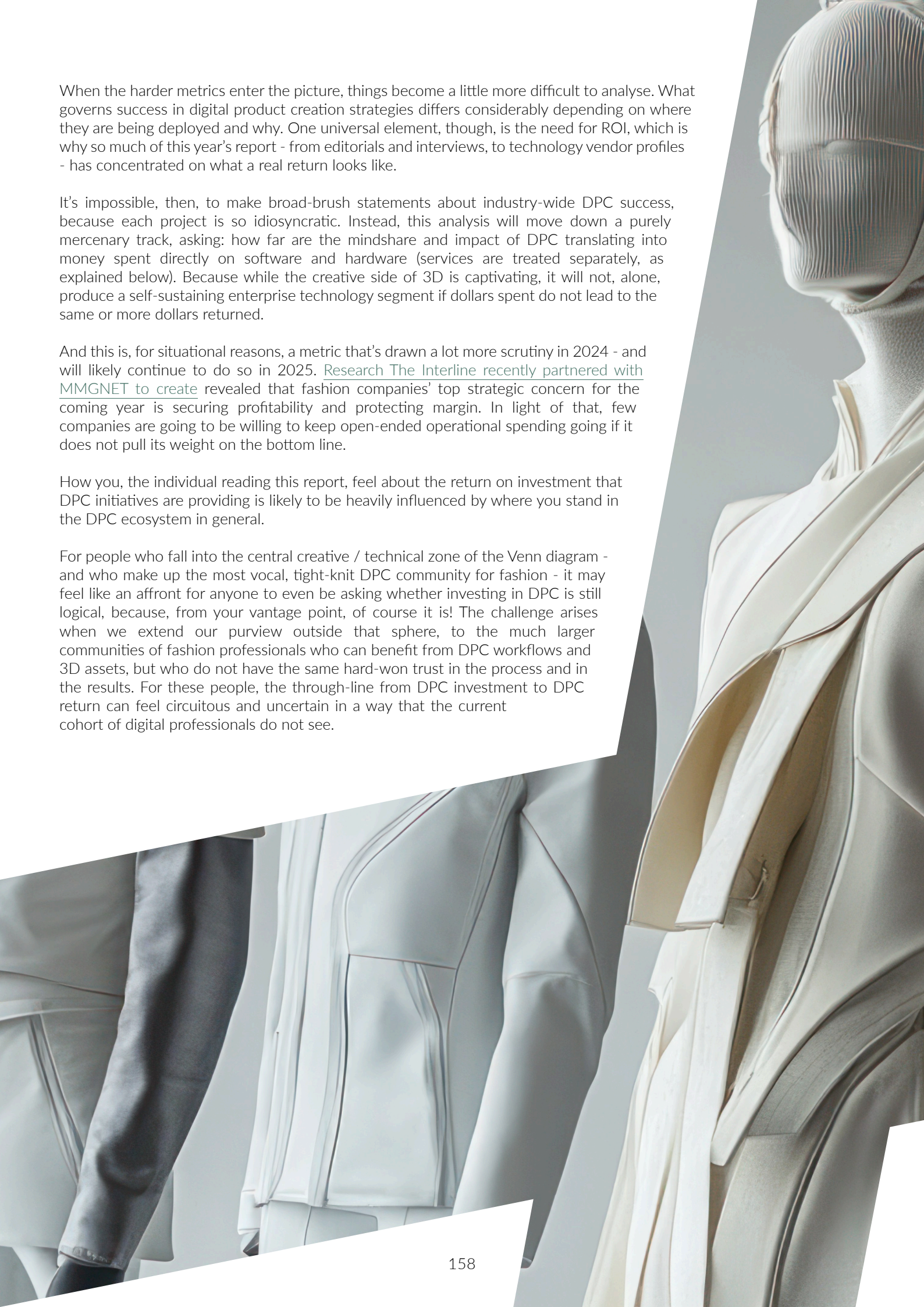
When the harder metrics enter the picture, things become a little more difficult to analyse. What governs success in digital product creation strategies differs considerably depending on where they are being deployed and why. One universal element, though, is the need for ROI, which is why so much of this year's report - from editorials and interviews, to technology vendor profiles - has concentrated on what a real return looks like.

It's impossible, then, to make broad-brush statements about industry-wide DPC success, because each project is so idiosyncratic. Instead, this analysis will move down a purely mercenary track, asking: how far are the mindshare and impact of DPC translating into money spent directly on software and hardware (services are treated separately, as explained below). Because while the creative side of 3D is captivating, it will not, alone, produce a self-sustaining enterprise technology segment if dollars spent do not lead to the same or more dollars returned.

And this is, for situational reasons, a metric that's drawn a lot more scrutiny in 2024 - and will likely continue to do so in 2025. Research The Interline recently partnered with MMGNET to create revealed that fashion companies' top strategic concern for the coming year is securing profitability and protecting margin. In light of that, few companies are going to be willing to keep open-ended operational spending going if it does not pull its weight on the bottom line.

How you, the individual reading this report, feel about the return on investment that DPC initiatives are providing is likely to be heavily influenced by where you stand in the DPC ecosystem in general.

For people who fall into the central creative / technical zone of the Venn diagram - and who make up the most vocal, tight-knit DPC community for fashion - it may feel like an affront for anyone to even be asking whether investing in DPC is still logical, because, from your vantage point, of course it is! The challenge arises when we extend our purview outside that sphere, to the much larger communities of fashion professionals who can benefit from DPC workflows and 3D assets, but who do not have the same hard-won trust in the process and in the results. For these people, the through-line from DPC investment to DPC return can feel circuitous and uncertain in a way that the current cohort of digital professionals do not see.



SO THERE IS, AS WE SEE IT, NO REASON TO ASSUME THAT DPC AS A TECHNOLOGY SEGMENT IS FARING ANY WORSE THAN OTHER TECHNOLOGY CATEGORIES DURING THIS UNPREDICTABLE PERIOD. BUT NEITHER IS IT IMMUNE TO BROADER MARKET FORCES.

This is also more than just a cultural artifact: that core DPC community has made up a large share of the overall market for DPC software, hardware, and services, so for the technology segment as a whole to grow, it must find ways to secure the trust of new audiences.

Growth, too, is just part of the picture. Based on our knowledge of wider economic uncertainty and pullback on spending in talent and technology this year, continuing to sell 3D and DPC platforms solely to the existing community has the potential, in years to come, to lead to the market shrinking.

We know from off-the-record insights that spending on DPC (by its core definition) has already been cut within some organisations over the last twelve months, and that expansion plans and ambitious targets have been softened at others. (There are, of course, still brands that are doing the opposite, and solidifying their investment and their belief in DPC, as you'll see documented in the editorial section of this report.) And the same MMGNET X The Interline research also tells us that small-to-mid-market companies who expect that DPC would deliver value for them are choosing to hold off on making the investment until they find a more stable commercial footing.

All of which is a way of saying that for DPC to scale as a technology market segment, it will need to reach a bigger audience. This is, luckily, something the best-established 3D and DPC technology providers are already working towards, and if you haven't done so already, our team encourages you to page back to the executive interviews and technology vendor profiles that precede this analysis, since the leaders of those companies have already mapped out their routes to reaching those new communities.

It's also important to call out that, from The Interline's perspective, that attitude to expansion is justified. There have been technology segments that pursued expansion simply for the sake of grabbing more land and bringing more people and processes into their orbit simply to sustain their valuations. This is not how we see DPC; instead there is a very strong argument to be made that the further the philosophy, the features, and the outputs of DPC are extended, the more value can be created as the industry's window shifts towards digital-native working and approaches the ideal "end state" for digital product creation. (See the articles from our editor in last year's DPC Report and this one for more thoughts on what the direction of DPC will look like as it expands.)



If we work, then, from the axiom that extending and expanding DPC is the right thing to do, what impact is that expansion strategy likely to have on the financial side of the market? And will it offset any pullback that the industry has seen this year?

The short "outlook" section of this analysis captures that future-facing perspective, so for now let's confine ourselves to looking back at how DPC has fared in 2024.

Last year, we pegged the market at between $50 million and $105 million when assessed through the lens of annual spending on DPC ecosystem software and licenses. (As a reference frame, the global PLM market for fashion achieves considerably higher annual recurring revenue from software licenses, but new business in that sector accounts for around $40 million per year.)

This year we have seen some market consolidation. Some of the technology companies profiled in the 2022 and 2023 DPC Reports have either been acquired, or have evolved their strategy to meet a different segment of the market. And the same trend is observable in the wider DPC technology segment, outside of those companies who have supported our reports over the last three years.

In a difficult economy, this is by no means unusual. Pivots are everywhere during times of crisis, and acquisition and takeovers are often triggered by a shaky period of spending, where disruptive companies with strong technology propositions become fortuitous deals for larger enterprises to acquire, working with the knowledge that investment and audiences will return.

So there is, as we see it, no reason to assume that DPC as a technology segment is faring any worse than other technology categories during this unpredictable period. But neither is it immune to broader market forces.

As a result, we believe that the market for DPC is not likely to have grown in 2024. This does not mean that individual technology companies have not performed well (more on this below) but in a market where consolidation is taking place and belts are being tightened, continuity is still a successful outcome.

If we were to adopt a more pessimistic perspective, and ignore growth in core solutions, we could infer that the DPC market may have contracted by between 5% and 10% in 2024 to a value of between $40 to $80 million (determined by upper and lower bounds of monthly user counts we defined in 2023, which were between 75,000 and 150,000, and which we do not believe have moved upwards on aggregate).

Realistically, though, we believe that where companies have pulled back on DPC spending, they have been doing so by reducing their headcount, or by cutting off new initiatives that were not already delivering a return; core spending on licenses is likely to have remained fairly consistent. Outside of the aforementioned acquisitions, the fortunes of the major 3D design, simulation, visualisation, and collaboration ecosystems are likely to have been left relatively untouched - and in fact some, or all, of these companies could have been beneficiaries of the drive towards profitability and the push into AI.

As a result, we believe the $50 to $105 million market figure should be carried forwards into 2025. Although, as we set out in the final "outlook" section of this analysis, and in our Editor's "DPC Is Not Done" piece in the editorial segment of this report, this figure is not likely to grow significantly until a more fundamental change takes place in the DPC ecosystem and audience.

(As a reminder, this market sizing covers software licensing alone, and excludes services. This is especially notable in 2024 and will become more so in 2025, since many DPC strategies are becoming more service-heavy over time, with a greater reliance on external partners across material digitisation, core technical design and engineering, and the traditional bureau model. And when we consider that a lot of the "savings" made in trimming back DPC initiatives have come from paring down internal resources, there is likely to be an even larger need for outsourcing in 2025.)

NO CROSS-PLATFORM WORKFLOW IS 100% TURNKEY TODAY, BUT THERE IS DEMONSTRABLE PROGRESS BEING MADE TO REDUCE THE ALREADY-MINIMAL AMOUNT OF MANUAL WORK INVOLVED.



PRICING, PARTNERSHIPS, AND DEPLOYMENT

So, despite the ringfenced pushback we have already mentioned, The Interline team does not believe that DPC has been affected by the pricing model for its software solutions. Where digital product creation strategies have been altered, it has been because of that previously-cited spend on people, or because of a re-evaluation of the priority being placed on downstream content creation - not because the cost of the software is too high.

In fact it's important that we remind ourselves that access to 3D modelling, texturing, and rendering tools is more open than ever - and the same core 3D companies that have weathered a difficult year successfully are also the companies that continue to support the influx of new creative and technical professionals through both grassroots individual licenses and self-serve education, and direct support for universities and other institutions.

We should also remember that, with such a broad spread of different tools, platforms, and purposes, there is no single "DPC model" when it comes to pricing and deployment. Just as we saw in 2023, this year's analysis shows one-off purchases, subscription licenses, tiered and modular pricing, enterprise volume discounts, and much more diversity in how DPC tools are positioned and sold.

And in another case of continuity from previous years, the hardware required to "run" DPC applications is also split between local, distributed, and regionally-located.

In the latter bracket we have material digitisation hardware, which resides either at brand headquarters or in strategic locations throughout the supply chain. (Or, for the most proactive and digital-first brands, in both locations.)

In the former we have the computers that sit on - or under - the desks of creative and technical 3D designers in brand offices, agencies, and at home - with more insight into the kind of CPUs and GPUs used provided by the three designers we commissioned and interviewed this year.

And in the middle bracket - distributed compute - we have remote offline rendering platforms and, increasingly, real-time rendering being performed in data centres, with video streams being sent to the end user and inputs sent the other way. Last year we started to see this model of pixel streaming making more inroads into content creation, but as Roman Japy's editorial on page 78 of this report explains, some greater leaps have been taken in customer-facing use cases in 2024.



THE FUTURE OF 3D AND DPC STRATEGIES - AND THE SUCCESS OF DPC AS A TECHNOLOGY MARKET SEGMENT - WILL BE DETERMINED NOT JUST BY HOW WELL THEY MEET THE NEEDS OF "3D PEOPLE" BUT BY MAKING THE BENEFITS OF 3D AVAILABLE TO EVERYONE.

In our inaugural DPC Report, in 2022, we said: "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 usable in as many different solutions and environments as possible."

This remains as true as ever, and every DPC company we examine offers ten or more active partnerships or out-of-the-box integrations. It's also still the case that the largest and longest-serving technology vendors have pursued interoperability even further.

This year, though, we deployed the creation process of this very report in service of demonstrating just how important that interoperability is, and how far the ecosystem has come in terms of moving a single asset between different environments and different use cases.

We may not, so far, have seen the cross-industry push into USD and other architectural shifts in 3D workflows that are seemingly still coming, but our first-hand experience of working with designers and technology companies to take designs created in one set of solutions and then bring them into another has been largely positive. No cross-platform workflow is 100% turnkey today, but there is demonstrable progress being made to reduce the already-minimal amount of manual work involved.

This level of streamlining carries on the spirit of openness we've documented in our previous two DPC Reports - something that is perhaps counter to expectations. Seeing companies double down on openness at a time when, thanks to a difficult economic environment, there could be a compelling commercial argument for bringing new audiences into individual platforms by pursuing proprietary formats.

Encouragingly, we continue to see DPC technology companies recognising that their solutions provide best practices in specific areas, but that integration to other tools, pipelines, and ecosystems is non-negotiable if DPC as a technology segment is to continue to grow and achieve its longer-term strategic and technical aims.

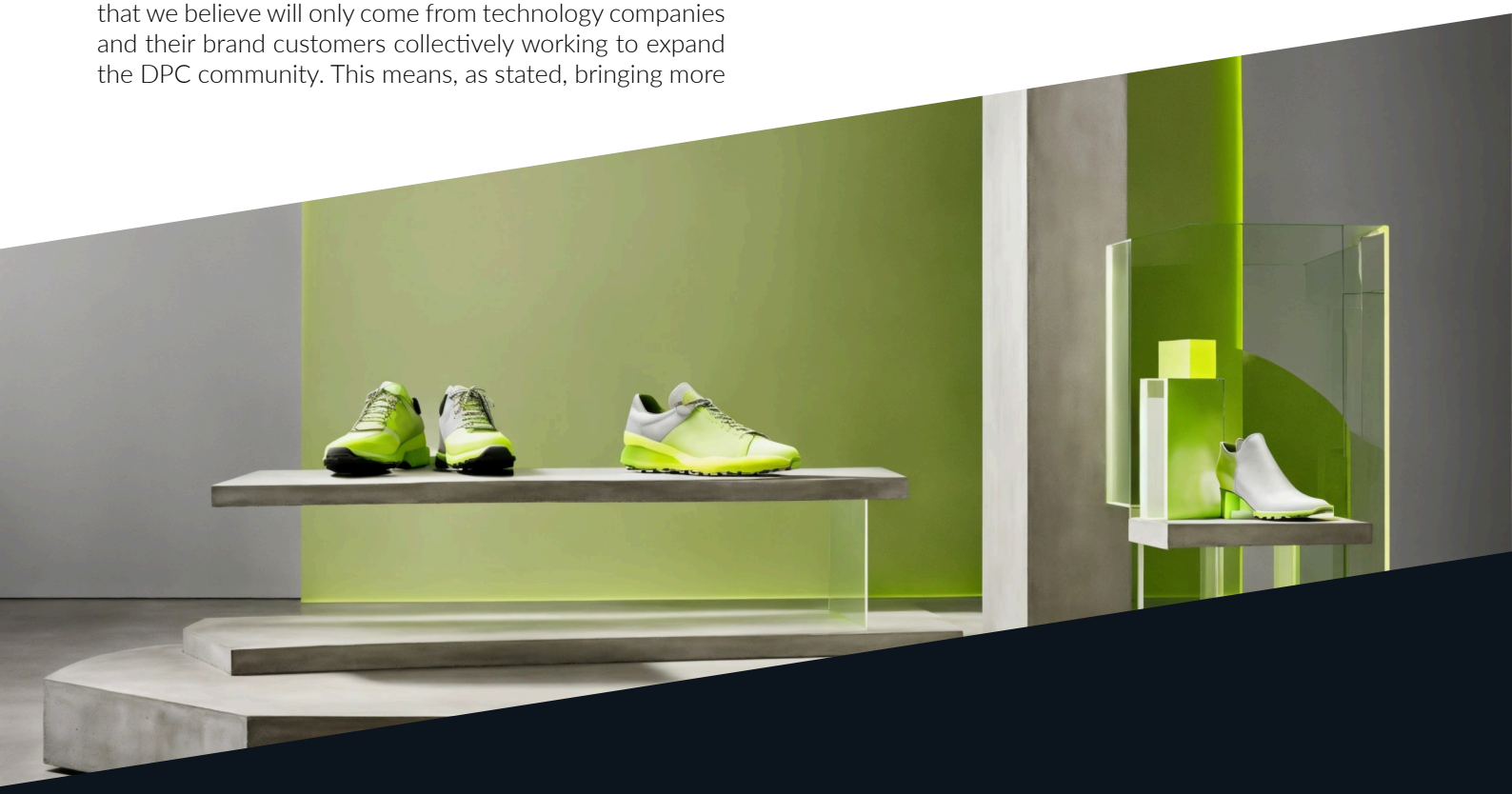


OUTLOOK AND CONCLUSION

There are, today, no small number of creative and technical designers who still do not use 3D and DPC tools. It is certainly not the case that DPC has fully taken over the design and development toolset, but as the findings from Fashion & Technology In 2025 show, this sector is now beginning to reach the point of diminishing growth from its existing community. With around 90% of the fashion businesses we surveyed reporting that they have already at least piloted 3D / DPC initiatives, this leaves limited headroom for expansion within the well-defined lanes that DPC occupies today.

Nevertheless, the same survey revealed that those same fashion professionals overwhelmingly see DPC creating additional value in the next twelve months - something that we believe will only come from technology companies and their brand customers collectively working to expand the DPC community. This means, as stated, bringing more designers on board with the core toolsets, but given the narrow growing room available within that community, it primarily means expanding the cohort of people whose roles will be touched or transformed by interaction with 3D assets and environments.

To summarise, the future of 3D and DPC strategies - and the success of DPC as a technology market segment - will be determined not just by how well they meet the needs of "3D people" but by making the benefits of 3D available to everyone. This is where business transformation will be found, and this, too, is where DPC stands the best chance of becoming - as it should - a fundamental piece of how fashion will operate in the near future.



The Interline would like to extend our thanks to every technology and service provider who took part in this year's DPC Report, to all our editorial contributors, our three fantastic designers, and the creative and technical support professionals at technology companies - as well as our long-time sponsors at MMGNET, the team behind SOURCING at MAGIC and other milestone industry events.

We hope you found value in this publication, and we encourage you to bookmark The Interline for more coverage of digital product creation throughout 2025. Our team also recommends that all readers of The DPC Report 2024 consider reading Fashion & Technology In 2025, the forward-looking report that we helped create, in partnership with the team at MMGNET, which documents the wider march of technology in fashion - with 3D / DPC being one of three strategic pillars that receives focused examination.

If you are a technology company creating DPC-ecosystem tools, or a brand, retailer, or supplier using them, and you'd like to be featured by The Interline in the future (either as part of a deep-dive report or more generally), please contact us.



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