



3D VENDOR EVALUATION

BROWZWEAR | 2017

BROWZWEAR

Born out of our popular PLM evaluations, a WhichPLM 3D Evaluation applies the same stringent, ethical, expert approach to a new set of scientific assessment criteria – designed to benchmark 3D solutions and their vendors in the areas that really count for retailers and brands looking to find the right solution to fit their needs, and to deliver a return on their investment.

Our assessment criteria are as follows

- 1 The vendor's industry knowledge, technological expertise and experience.
- 2 The technical capabilities of the vendor's 3D solution and broader portfolio, where applicable.
- 3 The immediate and mid-term solution roadmap.
- 4 The vendor's vision for the future.
- 5 Feedback from a selection of customers chosen by WhichPLM.

GENERAL SUPPLIER INFORMATION

BROWZWEAR

CORPORATE HEADQUARTERS

30 Purvis Street #02-02, Singapore, 188607

TEL: + 65 6338 4005

WEB: www.browzwear.com

BROWZWEAR AT A GLANCE

Browzwear is one of a select few names that have become synonymous with three-dimensional working in the apparel sector. Incorporated shortly after the turn of the millennium, the Singapore-headquartered software vendor has evolved its portfolio over the course of seventeen years in business - pushing forward with pioneering products that have, to some degree, influenced the way the industry as a whole has responded to 3D.

Originally founded with the goal of improving the fledgling online shopping experience, Browzwear has since come full circle. Following an executive re-shuffle in the mid-2000s, the company began to create solutions that would power greater efficiency in design and development. Over the next decade, technology (and industry attitudes) caught up, and the high-fidelity output of those 3D garment design and technical development solutions now has intense value in marketing and e-commerce.

Today, Browzwear's design tool (Lotta) and its tightly-coupled patternmaking and simulation solution (vStitcher) are joined by Stylezone - a SaaS sharing platform intended to improve communication and collaboration – and a solution for outputting a limited set of manufacturing instructions intended for factories. These solutions are packaged and sold as an annual subscription, advertised as providing a "holistic digital workflow" centred around the use of true-to-life 3D equivalents in place of physical garments across a variety of different processes.

Broadly speaking, Browzwear's pure 3D solutions are at the forefront of the market. Functionally broad and capable, and supported by a growing partner ecosystem, Lotta and vStitcher have seen adoption by some of the apparel and footwear industry's biggest names. And Browzwear itself is actively participating in pilot projects that promise an intoxicating vision for the future.

Less fully-featured is the aforementioned technical output tool, which provides an accurate summary of some essential construction elements, but falls short of the standards set elsewhere in the industry for communication with manufacturers and suppliers. Browzwear does, however, emphasise its ability to integrate with a variety of PLM platforms to plug this gap.

Despite those limited concerns, Browzwear's understanding of the value of true-to-life, technical 3D, and its ability to unlock that value through experienced professional services teams, have the potential to add considerable value for customers of all shapes and sizes. Coupled with its vision for a future of open standards, Browzwear are all but guaranteed to play an even bigger part in next stage of the 3D revolution they originally inspired.

EVALUATION METHODS & ETHICS

WhichPLM prides itself on total impartiality. This ethical stance has led our day-to-day work with PLM and extended-PLM for almost a decade, and it remains consistent in every new initiative we undertake.

The decision to evaluate 3D solutions (and the vendors who develop and sell them) arose naturally from our evaluations of core PLM, with a growing number of businesses seeking ways to supplement PLM functionality to fulfil their goal of “digital transformation”. This is a transition we have witnessed first-hand: our CEO has been directly involved in implementing and working with 3D software since the 1990s, as well as playing a role in designing its functionality a decade earlier.

As articulated in our 5th Edition publication – issued in 2015 – we believe 3D to be a transformative technology, and one that, after a challenging introductory period, is becoming indispensable for large numbers of our readers. To help these brands, retailers, and manufacturers make better-informed decisions about which partner(s) to choose, our 3D evaluations adhere to the same scientific structure as their PLM counterparts.

We begin by benchmarking the vendor’s solution (and portfolio, where applicable), drawing on experience gained through decades’ worth of hands-on PLM and 3D experience and research. But unlike other industry benchmarks, we also take a more holistic view of the vendor themselves: we seek to understand their ethos, competencies, fashion industry knowledge inside and outside 3D, customer insights, services and support capabilities, geographical presence, international resource pool, roadmap, and business sustainability.

This extension of what might otherwise be a purely technical evaluation is done for several reasons. Firstly, as an emerging technology, the broader insights provided by a vendor can help readers to better understand the potential applications of 3D in their business. Secondly, just like with PLM, we recognise that choosing a 3D supplier is a matter of more than just picking software; it extends to discovering the right partner for a long-term journey into the future of fashion.

KEY SUPPLIER PERSONNEL



Name (left to right)	Position/Department
Sharon Lim	CEO / Managing Director
Avihay Feld	CPO
Lena Lim	CCO
Noam Nevo	VP R&D

3D SOLUTION OVERVIEW

SOLUTION NAME: Lotta and vStitcher (also packaged are Stylezone and the tool currently named Tech Pack).

DATE EVALUATED: February 2017

VERSION NUMBER: 7.5

ANALYSIS METHOD: Live, multi-day demonstration and R&D office visit, followed by remote executive interviews.

REFERENCE CUSTOMERS

LuLuLemon	Columbia Sportswear
Global Brand Group	Adidas
Nike	VF Corporation
Li & Fung	Bodynits International
Walmart	PvH Corporation

ABOUT BROWZWEAR

Browzwear's history can be split into three distinct periods. Originally incorporated in Tel Aviv, Israel, in 2001, the company operated for five years under the supervision of its founders. In 2006, the original executive team departed, while Browzwear continued as a going concern. Its modern period began in 2012: Browzwear's original founders returned, and the company headquarters were relocated to Singapore while research and development was reignited in Israel.

The bulk of Browzwear's growth – at least insofar as is relevant to this evaluation – has occurred in that modern period. In addition to its operations in Israel and Singapore, the vendor now has two centres in the USA – in New York City and Corvallis, Oregon – and maintains a partner network that extends throughout Asia and South America.

At the time of this evaluation, Browzwear claims 500 customers (and around 4,500 active users) worldwide, spread across its portfolio. With Stylezone and Tech Pack being recent additions, it is fair to assume that the vast majority of these are users of the Lotta and vStitcher 3D solutions – which are the primary focuses of this evaluation.

Despite a slightly fractured history, Browzwear's current executive team appear committed to both the company and to the future of 3D for fashion. Iterations appear quickly for both Lotta and vStitcher, and an intuitive user experience and timely Mac release have secured healthy adoption in the design community as well as among technical professionals.

A private company, Browzwear employs around 50 people through its international network, and its customer base is spread throughout the USA, Asia, Europe, South America, and Australia. While financial information is not a matter of public record, the company's seventeen-year history and high-profile client roster suggest that ongoing stability is likely. It is also important to note that Browzwear's customer base is comprised not only of what they refer to as "tier 1" brands and retailers, but also their closest factories and suppliers – a less advertised but no less important source of revenue, which is likely to expand as technology is pushed further upstream in the value chain.

Benefitting from close to two decades' experience, Browzwear's 3D solutions are extremely mature, blending technical underpinnings with the requisite high-gloss finish, and offering value at every stage of the product lifecycle – from initial inspiration to consumer engagement. And although Lotta and vStitcher are not yet available on a SaaS or cloud basis– local installations are currently the only deployment method on offer for these local simulation solutions, while Stylezone is cloud-based – a change from perpetual to annual licensing has gone

some way to opening the potential of 3D to smaller businesses. Our evaluation team were told that future products (and potentially future iterations of existing solutions) would make the move to the cloud.

Browzwear has rightly made headlines for its bullish approach to an open future, advertising its belief that for 3D to attain its true potential, its assets must be interoperable across the widest possible range of solutions. This commitment to openness is borne out with published APIs, a well-documented SDK, and ready-made integrations to popular material scanning software & hardware, ray-trace renderers, material capacity software, IP management platforms, and PLM solutions.

This attitude towards an open future is one that WhichPLM shares, and it is encouraging to see a leading vendor in a rapidly emerging market avoiding the easy lure of proprietary systems and formats. While these may seem an attractive way to lock customers into a particular ecosystem in the short term, they would inevitably place barriers on innovation, and negatively impact the value that customers can obtain from their investment.

While its dedicated tool for communicating specifications to factories and suppliers (currently named Tech Pack, and considered in further detail later in this Report) is basic, Browzwear's 3D technologies are cutting-edge, intuitive, mature, and competitively-priced. These products deliver comprehensively on the promise of 3D and, judged on their own merits alone, Lotta and vStitcher deserve the chance at a central place in any forward-thinking brand, retailer, wholesaler or manufacturer's workflow.

FINANCIAL INFORMATION

As a private enterprise, Browzwear does not publish its financial information, and did not wish to part with ballpark figures or revenue and investment bands for the purposes of this evaluation.

Broadly speaking, the company's long history of driving the cause of 3D stands it in good stead to seize the opportunities presented by the explosion of the market in the near future. Browzwear's customer base is diverse, including some of the world's biggest brands as well as smaller customers and factory clients, so the company is unlikely to be too greatly affected by a downturn in any particular market sector.

On the basis of publically-available information, Browzwear appears to be a relatively stable enterprise – at least in its modern phase, from 2012 until today – with a clear roadmap, dedicated executive team, and a significant untapped market for its solutions. Without access to clear revenue and investment information, however, we encourage prospective customers to undertake their own due diligence.

OUR ANALYSIS

Although this is WhichPLM's first published 3D evaluation, concrete assessment criteria were established prior to our visit to Browzwear's Israel offices. As with our PLM evaluations, we used objective, scientific scoring tables to measure core 3D software functionality, allowing for readers to compare Browzwear with other 3D vendors who have committed to undergo an evaluation of their own.

Our evaluation team was provided with an exclusive, multi-day on-site demonstration of the latest release of all Browzwear's solutions. Adopting the perspective of a potential customer, we examined, in detail, what we consider to be essential functionality, and invited the vendor to demonstrate features that it believes set it apart from the competition.

As is the case with our PLM evaluations, this scientific assessment was complemented by further investigation into the broader Browzwear business – a practice that will continue with all future 3D evaluations. During our visit to Tel Aviv – and later, over the course of multiple remote conference sessions - we were given access to Browzwear's senior executive team, who we questioned on the company's history, its long-term strategic goals, its driving vision, its financial and market performance, and their own personal predictions for the role that 3D will place in the future of the retail, footwear, and apparel industry.

The results of our combined functional analysis and executive interviews are collected over the following pages, where they are broken down into four distinct sections:

- Approach & Overview analyses the way that Browzwear approaches 3D, looking at the vendor's take on where its value lies in the extended enterprise, and comparing their solutions' core functionality against market expectations.
- Implementation & Resourcing examines the professional resources that Browzwear has at its disposal in various territories, and looks at how the vendor typically handles both research & development and implementation projects.
- Customer Distribution briefly sets out the geographical distribution of Browzwear's customer base for 3D design and development.
- 3D Competencies lists the particular functional areas in which the vendor has chosen to demonstrate competencies (out of a possible 37) and assigns a star rating to each, providing prospective customers with a method of cross-referencing the processes and functionality that matter to them against other vendors who choose to undergo a WhichPLM 3D evaluation.



APPROACH & OVERVIEW

Browzwear believes that “true to life 3D” represents the future of fashion, and its approach to the market is structured accordingly. From design to marketing, the vendor's portfolio is oriented around the central concept that a high-fidelity, technically-viable, 3D asset has added value everywhere its physical counterpart would – and often beyond.

To use a relatively straightforward, and common, example: the average garment that reaches store shelves is the outcome of multiple rounds of prototype and sample production iterations. In a traditional workflow, each of those iterations is produced as a physical garment (or shoe, watch, jewellery, or accessory), then shipped from the chosen factory to the brand's headquarters – which are often on another continent entirely. The benefits of handling most of these iterations digitally are obvious: lower costs, no delays in logistics, and greater reactivity to trend in a rapidly-changing market. These are compounded by the speed of designing and developing in 3D in the first place, since initial concepts and iterations can reach the comment and approval stage far more rapidly than ever before. And it is easy to imagine similar scenarios throughout the product lifecycle – where replacing a physical garment with a 3D, digital alternative can improve the efficiency, accuracy, cost, sustainability, or innovation rate of a given process.

To fulfil that purpose, however, the physical garment and its digital equivalent must be identical in extremely specific ways – sizing, components, thread types, material print, repeats, grain lines and more – that extend far below the surface. And while the market at large may think of “3D” as a single homogeneous entity, the reality is that not all 3D solutions are created equal – and not all can replicate the utility of physical garments throughout the product lifecycle.

The primary distinction to be made, when assessing any 3D vendor, is whether their solutions deliver what we might call “technical or scientific 3D,” where the output of the 3D simulation is a garment that is viable for manufacture, or “aesthetic or marketing 3D,” where the output is intended for use in non-technical design, marketing, and consumer engagement. (Note that these are not official terms; there is currently no accepted lexicon for separating the two kinds of 3D.) That a vendor emphasises one over another is not necessarily a failing – although customers may prefer to obtain both from a single source – but rather an indication of the market segment they have chosen to pursue.

By way of example: one product may offer comprehensive high-definition ray-tracing and compositing, allowing a brand to showcase their latest garments in photorealistic catalogues and photoshoots, even before those products have been produced. Here, a digital model (rendered offline, potentially over several hours) is used in place of a physical garment to fulfil an aesthetic purpose; to look real, rather than to be production-ready. Another product may offer a less polished – but more technically accurate – real time simulation that is directly linked to accurate materials libraries, and synchronised with 2D patternmaking information.

Both of these would be labelled as 3D solutions, but their purposes are very different.

This is a distinction that will be relevant to every 3D evaluation that WhichPLM undertakes, but is especially applicable here. By design, Browzwear’s solutions focus on delivering “true to life” 3D, where real-time 3D simulation is married to exacting technical specifications under the hood. Photorealistic rendering is handled via integrations to either Open Source or paid renderers, while Lotta and vStitcher combine to provide a degree of technical accuracy that the vendor refers to as “what you see is what you get: from design, to pattern, to showcase”.

In practice, this means that 3D visualisations of garments are entirely synchronised with their underlying 2D patterns, and changes made to

one affect the other. 3D drawing, draping, fabric colouring, pattern repetition, logo’s artwork and print positioning (with full integration to Adobe Illustrator and Photoshop), scaling, rotation, and styling are all handled within Lotta, while vStitcher allows for the direct manipulation of patterns, pieces, markers, and material consumption – with scientifically accurate simulation unifying the two. So while self-shadowing and subsurface scattering are left to integrations with offline renderers like Blender and Modo, scientific simulation of the difference in draping between straight-cut and bias-cut grain lines are where Browzwear has focused its attention.

That is not to say, though, that Browzwear entirely ignores the showcasing of high-fidelity 3D assets; the aforementioned Stylezone allows users to rotate and interact with 3D visualisations from a web browser or mobile device. Simple integration to leading rendering packages is also available, allowing for single-click creation of photorealistic output. Along with Tech Pack, Lotta, and vStitcher, Stylezone is the final element of the Browzwear portfolio.

While this evaluation’s primary focus is 3D, Browzwear nevertheless advertises its portfolio as offering a “holistic digital workflow”, and as a PLM publication we must remind customers that Tech Pack – the vendor’s tool for outputting what it calls “the minimum viable data for manufacturing an accurate garment,” and what we would refer to as a simple “sample pack” - is not a suitable alternative to a fully-fledged PLM solution when it comes to communicating with factories and suppliers in real-time. Neither does it offer the broad functionality (a possible 60 or more processes and sub-processes) that allows complete PLM platforms to support collaboration, data integrity, security, and other essential elements of the design, development, and production cycle.

While Browzwear advertises Tech Pack as a way to “turn any 3D design into a manufacturing specification, instantly,” our evaluation revealed that significant elements of what we consider to be essential manufacturing information were absent from Tech Pack’s output: assortment planning, materials, components, trims, packaging, labels, markers, lab dips, ratios, BOL, sourcing management, CSR, workflow, critical path, dashboards reporting, material utilisation by size, and so on.

And while the remainder of this evaluation reveals considerable strengths in Browzwear’s 3D offering, we advise customers to exercise due care in making sure that 3D forms only a part – albeit a core part – of their comprehensive, complete, end-end-end ecosystem. To its credit,



Browzwear is careful to explain that 3D can “drive the digital sample workflow,” but does not qualify as a digital workflow in its own right. The vendor’s Open Platform – with its integration to some popular PLM solutions – is designed to help customers create these more complete workflows, by offering standardised integration with a range of different digital solutions.

This evaluation will now turn to a technical assessment of Lotta and vStitcher (hereafter referred to separately, or together as “Browzwear’s 3D solutions”) as sold and as demonstrated to our evaluation team in February 2017. Although the following pages describe that functionality in detail, high-level scoring for the 25 different competencies we assess can be found by turning to the section titled “3D Competencies,” while overall scoring for Browzwear as a whole – including broader business considerations and roadmap potential – resides on the final page of this document.

“Browzwear’s solutions deliver comprehensively on the promise of 3D.”

Beginning with core design functionality, Browzwear’s solutions offer extremely strong drawing tools, giving users the ability to draw and manipulate vector lines in 2D and 3D. This is joined by advanced Bezier tools (including the addition, subtraction, and manipulation of points) and the ability to draw on patterns even after they have been stitched and simulated.

All changes are synchronised between 2D patterns and 3D simulations, and inner lines and details can also be drawn in either view – 2D or 3D – allowing for accurate placement of artwork, drill holes for pocket positioning and other fine detail tasks. The solutions also provide support for designing “inside” the garment, or on the side facing the wearer’s body. Creation of complex inner linings and pockets is possible, with this work again fully synchronised between 2D and 3D.

Trims and seams can also be added and manipulated in both 2D and 3D, with a degree of accuracy that exceeds 0.1 millimetres. Although a library of standard trim and seam types is included, and the Open Platform provides a simple method for connecting to existing storage systems, we would like to have seen more complete libraries included as standard.

Beyond the shape level, texture mapping functionality is extremely strong, with support for all elements required to achieve a photorealistic, technical end result. This includes normal maps, transparency maps, diffuse and specular lighting calculations, and support for both dependencies and independent editing at a per-map level. The management of multiple colourways is also supported to a good level, with support for cloning, import and export of various characteristics between variations. Each different colourway is also assigned its own (colourway) Bill of Materials, and

its components – materials, trims, seams, fabric properties, and artwork – are easily managed at the colourway level.

In addition to being both detailed and size-and-colour-accurate, Browzwear’s solutions also support proportional sizing for their avatars. Where sizes increase, artwork, trims, and decorative lines can, if required, increase in relative size and scale to accommodate everything from XS to XXL. Sizes can also be grouped, and clear incremental grading rules applied to either individual sizes or collections.

When it comes to actually manipulating artwork elements themselves, images can be cropped, rotated, tiled and flipped in the in-solution

image editor (as well as via integration to both Adobe Photoshop and Illustrator,) but storyboarding functionality is, at present, limited. Generally speaking, however, storyboarding is offered by various technology companies – including some PLM vendors – so low scoring in this area is common. Indeed, Browzwear believes its quick image

editing functionality is sufficient for the tasks its users require; according to the vendor’s research, its users prefer instead to manage more complex artwork tasks in dedicated vector editing and technical CAD software such as Adobe Illustrator.

As expected from a mature, design focused pair of solutions, support for colour was strong throughout. In addition to standard multiply and overlay blending, Browzwear have developed a proprietary blending model that allows users to recolour a material within an accurate RGB colour space, and to maintain that colour integrity throughout all other colouring activities. Multiple industry-standard colour palettes are supported as standard, but our evaluation team found integration to PLM colour libraries lacking – a challenge for PLM and 3D vendors to overcome together, but one that Browzwear is already tackling in concert with at least one PLM provider, using its Open Platform.

The solutions were marked down, however, on their lack of support for digital colour management and digital profiling software and hardware. Higher scoring would have been awarded had Browzwear been able to demonstrate integration with centralised, cloud-based colour libraries, that make the same consistent colour information available to brand owners, designers, printers, and other supply chain stakeholders. Similarly, the solutions currently lack support for colour management hardware – spectrophotometers – that allow for the accurate, digital definition of real-world colours, and that provide a workflow from initial digital colour testing through to certified colour approval.

Lotta and vStitcher allow designers to use colour palettes drawn from PLM libraries, Adobe Illustrator, or other sources, as well as linking those palettes with particular seasons to constrain availability, where the integration between PLM & 3D has been completed to a mature standard. All colours placed onto a garment can be consolidated into a “colour blocking area” that allows designers to make changes to all instances of that colour without needing to interact with each individual garment component.

One of the most compelling uses for 3D in the design stage is its ability to support a “design to cost” approach, whereby accurate bills of materials can be compiled from simulations of material consumption, trims, component, thread types, and so on. In Browzwear’s case, some of this functionality is present and correct, in the form of Bill of Materials (BOM) management, but higher scoring would have been awarded had the vendor been able to demonstrate extending costing functionality or more complete CAD integration - the addition of markers and ratios, for example - to support insights into material consumption. Still further recognition would be given to the development of bill of labour (BOL) functionality that would enable true synthetic (virtual) costing.

Although Browzwear is making some headway towards synthetic costing via an API integration to GSD (General Sewing Data,) both parties have confirmed that this remains a work-in-progress.

In these areas – and others – the Browzwear team cite the importance of the Open Platform, allowing for bidirectional integration between its solutions and those of ecosystem partners who handle, for example, Bill of Labour in exacting detail. While this Evaluation afford Browzwear considerable praise for its open approach – and its technical underpinnings – it does not assess or score the functionality of third-party solutions. So while Browzwear have spent considerable effort developing a well-rounded partner ecosystem, and BOL and costing functionality is likely to be well-supported within it, our scoring is confined to the capabilities of Browzwear’s own solutions alone. This approach is consistent between our 3D and PLM evaluations.

During design, Browzwear’s 3D solutions also use what the company calls a “smart asset UI,” whereby designers are presented only with those materials, colours, and components that are relevant to the style they are working on. This is intended to provide a streamlined working environment, and to minimise the asset bloat that can occur when working with different collections, seasons, iterations, and variations in 3D. This is supplemented

by the ability switch quickly between different pre-configured silhouette options, while maintaining the integrity of design decisions. This process can also be automated, and rolled out across different styles.

Once initial designs are completed, however, it is no surprise that Browzwear’s solutions are similarly mature in their ability to support technical development. 2D pattern creation and editing is both intuitive and exacting, with support for symmetrical working on both sides of a garment. This delivers not only a time saving, but will also help to deliver a more balanced quality of fit – something that is often difficult to achieve with traditional 2D pattern development, either by hand or using modern CAD

systems. Similarly, Browzwear’s solutions outmatch older CAD systems by moving from a traditional spline method to true Bezier manipulation, allowing for the creation of high quality curves with the minimum number of anchor points.

When alterations are made to 2D flat patterns in vStitcher, these patterns are stitched together on the 3D avatar, where simulation will highlight any issues and provide intuitive tools that allow even non-technical designers to make fixes that would otherwise have been solely the preserve of garment technologists and machinists. This includes visual feedback to assist users in understanding edge alignment and orientation, and support for smart stitching.

Similarly, a human-centric UI (an approach that Browzwear was keen to point out has informed much of its user experience work in the past two years) enables non-technical teams to import and export graded patterns, including internal pieces, from leading CAD/CAM solutions, as well as supporting the ability to create detailed blocks in 3D. A lack of marker making functionality, however, means that the solutions fall short of the standards set by other dedicated 2D CAD vendors.

This is not to say that the Browzwear portfolio lacks CAD capabilities, however: common tools like slice, divide, mirror, extract, offset, allowance, drill holes, and notches are all included, and the solutions as a whole place a considerable amount of power in 3D designers’ hands, allowing them to develop and structure multiple design options quickly and accurately. Importantly, stitching is preserved during edits, with the solution creating new sliced pieces and recalculating stitches on the fly to support more intuitive garment and pattern design.

As one of the most vital assets, avatars are supported extremely well in Browzwear’s solutions. In addition to the vendor’s own parametric bodies, avatar libraries can be easily imported from third party sources (Browzwear has a partnership with Alvanon

“The primary distinction to be drawn is between technical 3D and aesthetic 3D, which have very different purposes.”

and Bodylabs), and size sets allow for automated simulation. Browzwear's own avatars are fully parametric and based on the Non-Uniform Rational Basis Spline, or NURBS model. This allows for good flexibility and support a wider range of different surfaces than a traditional polygon model, enabling a variety of different body shapes and variations without the loss of integrity.

The solutions offer support for built-in poses, imported poses, varying skin tones, hairstyles, body shapes, and animation – with full rigging allowing for the simulation of “true to life” actions as well as sculpting and fitting on a 3D model. Some limitations are present, however: avatars can be moved dynamically to enable true-to-life evaluation of dynamic range, but poses and animations that fall into the “showcasing” category – a walking animation, for instance – are currently absent.

Other assets – particularly materials – are managed well, with physical properties of a huge range of fabrics held in a single database for re-use. Import and export from third party software and hardware sources is straightforward, with quality integrations already being demonstrated. Browzwear is also in the process of commercialising its own software and hardware that offers analysis of the physical properties of fabric.

With accurate materials drawn from an imported or scanned library, Browzwear's simulation engine shines. The physical parameters of each fabric – including grain lines, weight, drape, roughness, bumps, light absorption and many more – are factored into true-to-life simulation, with extremely accurate draping that accurately

translates grain lines, biases, differences in folding between light and heavy fabrics, non-linear stretching and tension mapping, shearing, bending, torsional rigidity, mass density, thickness, full static thickness, the Poisson effect, and other scientific characteristics and behaviours.

Even in real-time, a strong lighting engine ensures that the optical characteristics of fabrics are also well represented, and when animated, avatars' poses affect tension maps in a dynamic way. During the initial design stage, realistic lighting (including support for High Dynamic Range, which preserves in detail in situations of extreme contrast) allows for more accurate translation of design intent and better-informed choice of materials, lines, and artwork positioning.

Responding to customer demand, Browzwear now offers the ability to export a limited product specification, which it claims includes the “minimum viable details for production,” and which is intended to serve as a first-stage method of communication and collaboration with suppliers. Our concerns about the limitations of this tool have previously been listed in this Evaluation and will not be rehearsed in detail here. In summary, though, this portion of the portfolio strays into territory traditionally owned by pure PLM vendors whose products are considerably broader in numbers of modules and more mature in terms of depth, security, automation, and other essential elements.



Browzwear, as previously noted, works with many of these PLM vendors, so in this sense its Tech Pack tool should best be thought of as supplemental to integration between Lotta, vStitcher, and fully-fledged PLM solutions. Indeed, Tech Pack's functionality will provide some value to customers who are currently managing their sample process without the need for a fully blown technical specification. To support this, Browzwear says several customers are using Tech Pack for that purpose, successfully, today – but it should not be considered an adequate alternative to modern PLM. We caution Browzwear, then, to be cautious about how it positions Tech Pack in the market, and to consider renaming the tool in order to avoid unnecessary confusion.

Beyond the technical level, Browzwear's solutions also offer a good level of aesthetic rendering – both in-solution, and via single-click export to popular open source and commercial offline rendering tools. In real time, the solutions offer comprehensive rendering presets, camera control (including field of view and focal length), virtual room sets, and styling tools that allow for some limited arranging, punching, and flattening of the 3D garment. Some non-technical styling possibilities and special effects – primarily those intended for photographic perfection rather than realism – are not included.

For offline rendering and export, Lotta allows for single-click push to popular Open Source platforms like Blender, as well as commercial solutions like RTT and MODO, with the guarantee that lighting presets, camera positioning and setting, and all essential product characteristics will carry over. Batch export and raytrace rendering is also supported in Blender and other solutions, and the Browzwear team believe that their solution is unique in requiring no further edits to the raytrace rendered image in order to ensure complete accuracy (albeit higher fidelity) to the real-time original.

The aforementioned Stylezone also allows these offline renders to be exported in a format (this is, in practice, a series of static renders that the solution then stitches into a 360-degree rotatable, zoom-able garment model) that can be viewed on virtually any device, and shared easily, with support for bi-directional chat and collaboration.

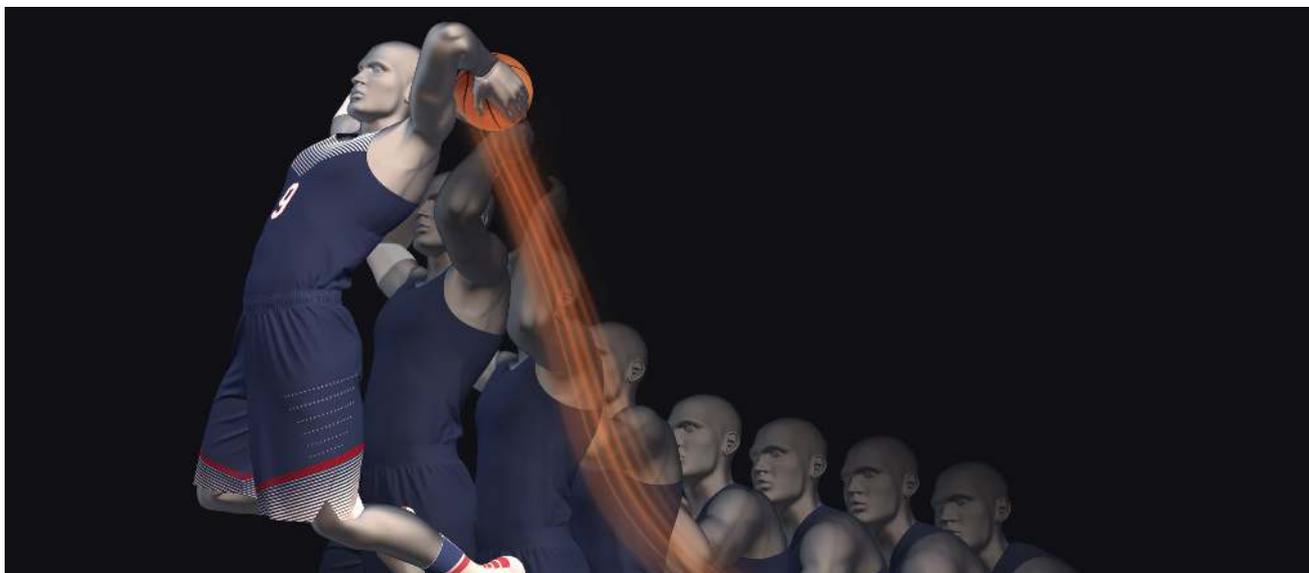
Both solutions integrate well with Adobe Illustrator and Photoshop, as well as to a growing number of other solutions – from IP rights management to knitting and weaving. Using an open, well-documented API, common frameworks like JSON, and popular languages like Python, Browzwear's current partner ecosystem is likely to expand in the near future.

As commendable as this Open Platform is – with rigorous documentation and sample plugins to aid third parties in integrating their solutions and workflows to the Browzwear portfolio - WhichPLM believes that Browzwear and leading PLM vendors should take more proactive steps to cultivate value-added relationships and to build standardised integrations between their solutions.

At present, though, there are very few barriers to any business wishing to integrate Browzwear's solutions – or the assets they create – to almost any other component of their I.T. ecosystem that supports common methods of data interchange.

CUSTOMER DISTRIBUTION

Region	Percentage of customer base
Americas	30%
Asia Pacific	50%
Europe	20%



To ease both user adoption and integration, the entire Browzwear portfolio is available in English, Turkish, German, Thai, and both Traditional and Simplified Chinese.

Finally, while the Browzwear team shares the same spread of international knowledge and apparel industry expertise, our evaluation team believes that its resources in Europe are currently limited. The implications of this are analysed in the next section of this evaluation.

IMPLEMENTATION & RESOURCING

With more than a decade's experience, WhichPLM has no concerns about the fashion and retail credentials of Browzwear's senior leadership. To support its active growth, however, the vendor is now faced with the common challenge of recruiting equally experienced fashion 3D professionals in what is sure to become a competitive international talent market.

Browzwear has already made a strong start in several areas, hiring salespeople with considerable retail, footwear, and apparel experience to fulfil its ambitions in North America. The company's centres in New York City and Portland, Oregon, have also been carefully positioned to offer close support to high-profile American customers as well as new sales channels in the region. Outside of the USA, Browzwear retains all research and development activities in its original home city of Tel Aviv, Israel, while its headquarters operate from Singapore. As mentioned above, however, its skilled resource pool in Europe is currently small – although this may be accounted for by lower levels of 3D adoption within the EU to date. Our evaluation team were given assurances that expanding this resource pool to take advantage of new opportunities in Europe is a priority for Browzwear's senior management.

The vendor has also established distribution and implementation arrangements with other software vendors and consultants, including several PLM providers. Although it has recently taken greater control of its distribution channels, Browzwear is currently pursuing deeper relationships with its existing PLM partners, as well as working with other leading suppliers.

Beyond the solutions themselves, Browzwear recognises that 3D – particularly in the technical sense – remains a relatively new

concept for many prospective customers, and the vendor offers a number of professional services designed to help project teams and end users acclimate to a new way of working. Although Lotta in particular is more intuitive and user-friendly than ever, WhichPLM still considers these professional services – or equivalents provided by a qualified third party – to be essential for obtaining true value from working in 3D, from the scoping stage right through to training and process on-boarding.

Currently, Browzwear's professional services are coordinated from its main R&D and sales centres, but this is another area in which being at the steering end of an emerging market will create challenges. As demand for 3D grows, Browzwear will need to scale up its resources – particularly in key regions in Asia, Europe and South America – if it wishes all customers to obtain the full benefits of working in true-to-life 3D.

Finally, during our evaluation, WhichPLM interviewed a small number of Browzwear's existing customers to confirm their satisfaction with both the vendor's 3D solutions, and its sales, implementation, and support teams. All were satisfied with the value they obtained from working with Browzwear, but WhichPLM will revisit these reference customers in the future to gauge ongoing success.



3D COMPETENCIES

The following table presents a functional breakdown of the Browzwear 3D solutions, with a star rating (out of a possible 5, with our scoring system explained on the adjacent page) assigned to each in order to provide further context to our written Evaluation findings.

Technical 3D Competency	Browzwear score	WhichPLM comments
Drawing (2D and 3D)	★★★★★	Detailed, with real-time 2D/3D synchronisation.
Colourways	★★★★★	Full flexibility and variation.
Texture Mapping	★★★★★	Accurate texture mapping.
Design in Sizes	★★★★★	Relative and proportional sizing.
Lighting	★★★★★	HDR rendering.
Interior Design	★★★★★	Support for designing "inside" a garment.
Image Editor	★★★★★	Adequate canvas for quick image editing.
Colouring	★★★★★	Various palettes and blending / recolouring methods.
Design-to-Cost	★★★★★	Bi-directional integration missing.
Smart Asset Filtering	★★★★★	Irrelevant assets hidden, to streamline working.
Silhouette Design	★★★★★	Support for preconfigured silhouettes.
Pattern Design	★★★★★	Symmetrical working and Bezier manipulation.
Garment Creation (3D)	★★★★★	Patterns stitched on avatars.
Grading	★★★★★	Import / export from CAD / CAM.
CAD Functionality	★★★★★	Rapid, intuitive design, with stitching maintained.
Avatar Types	★★★★★	Parametric, posable, import from other sources.
Avatar Pose Generation	★★★★★	Dynamic pose creation.
Avatar Management	★★★★★	Support for size sets, IP management, and more.
Pre-costing	★★★★★	Lacks BOL detail.
Colour Management	★★★★★	Strong links with libraries.
Fast Colouring	★★★★★	Quick colouring and "colour block"
Asset Management	★★★★★	Import of fabric properties.
Predictive Simulation Capability	★★★★★	Improves on physical prototypes.
Draping	★★★★★	Extreme accuracy, reflecting all physical parameters.

Technical 3D Competency	Browzwear score	WhichPLM comments
In-Motion Fit Evaluation	★★★★★	Comprehensive tension maps.
Fabric Physics Parameters	★★★★☆	Supported, but incomplete.
3D Trims	★★★★★	Closed and open formats supported.
Fabric Testing	★★★★★	Compression simulation.
Tech / Design Pack	★★★☆☆	Basic specifications.
Packaging for Production	★★★☆☆	Essential information missing.
Rendering Presets	★★★★★	Full camera control and multipack support.
Photorealism	★★★★★	Integration to raytrace renderers.
Styling	★★★☆☆	Baseline functionality, but missing special effects.
Integration	★★★★★	Strong links to Adobe Creative Suite and others.
Usability	★★★★☆	Intuitive UI; single-sign-on missing.
Interoperability / API	★★★★★	Open and documented; more PLM integrations required.
Automation	★★★★★	Strong batch processing functionality.
Collaboration	★★★★★	Fit and approval functionality.
Localisation	★★★★★	Good localisation capabilities.
Professional Services	★★★★★	Resources lacking in Europe.

OUR SCORING SYSTEM

0 star = Non-compliant (this functionality is not supported at all)

1 star = Basic (limited functionality; further enhancements are required to meet market expectations)

2 star = Fair (essential functional elements are present and correct, but are likely to only meet baseline standards)

3 star = Good (above average functionality, but further expansion and integration is likely to be required)

4 star = Very good (strong functionality, approaching the best the industry has to offer, but refinement, automation, usability, or integration may prevent it from reaching our highest grade)

5 star = Best in class (functionality that can be improved upon no further at this time; exceeds all market and customer expectations, with appropriate integration and an intuitive interface creating additional value)

EXECUTIVE INTERVIEW

AVIHAY FELD, CPO & AMY ARIEL, MARKETING MANAGER



WhichPLM: What do you believe is the primary value of 3D in retail, footwear and apparel today?

Avihay Feld: “One of the easiest ways to understand the value of 3D is to think objectively about how things work without it. Today, where 3D doesn’t exist, the real part of the workflow between brands and factories only begins when someone gets to see the physical garment. All the designing, sketching, and developing has been done, but there’s no real understanding of the end result until you see the first physical sample. And that’s what every business does today that doesn’t have 3D: the wait to make important decisions and to begin their real relationship with a product until they see physically.

One of the most valuable things 3D can do is to substitute a digital alternative for the physical garment – one that’s true to life. Once that’s achieved, and the people involved in taking that product to market have seen and made decisions on the basis of that 3D asset rather than a physical sample, you have overcome many of the hurdles in your current workflow. It’s now possible to see the garment in the very earliest design stages, straight out of the

designer’s imagination. And from there everything happens so fast – decisions are made, communication with factories occurs – and those things happen in hours and days, rather than weeks and months.”

WhichPLM: And what does “true to life” mean to you?

Avihay Feld: “Good looking 3D has been achievable for some time, and has been a big deal for many of the world’s biggest fashion businesses. But what we’re talking about is different: those solutions may have allowed designers to express their imaginations, but there is still often a long way to go in order to turn the result into a physical garment.

With true to life 3D, we are giving designers the ability to create garments from their imagination, totally digitally, and then, with the click of a button, turn them into a very accurate set of instructions so that a factory can create a physical sample. That’s a goal we’ve been pursuing for years. And it works because a true to life 3D garment is made up of the same things that will be the essence of the physical garment, used by the factory - only rendered in 3D. From there it’s

possible to build a digital workflow. Costing, material visualisation, iteration – these and more can be done here and now, digitally, because our foundation is a true to life digital equivalent of the physical garment.

It is impossible to cost accurately if your patterns are not correct. It is impossible to cost correctly if your stitch lengths are wrong, and so on. But when those elements are present, in true to life 3D, everything you do digitally and physically is connected – and your workflow is going to be so much better as a result.”

WhichPLM: Given the extent of the technical links required to deliver against that vision, it seems as though true to life 3D solutions will, by necessity, be industry-specific?

Amy Ariel: “We think of Browzwear as the only business-critical 3D solution for the modern apparel enterprise. Most of our competitors’ solutions were designed to address another specific market segment, or were born out of their parent company’s background in other industries. Some originated in the movie and videogame industries, for instance; others came from a manufacturing hardware background. None of them are pure software companies looking at the need for modern fashion businesses to have a complete digital process across the entire product lifecycle – one that truly interoperates with the processes, people, and technologies they already have in place.

We address that need with apparel-specific, true to life 3D, but we’re also the only 3D vendor that has the professional services in place to help customers realise that vision. We work with our clients from the earliest stages, understanding their needs, conducting training, implementing alone or with partners, and scaling our solutions as the organisation grows.”

WhichPLM: You hinted there at bringing people on board. Just how receptive are end users to working in 3D today, and just how usable are modern 3D solutions for non-technical team members?

Avihay Feld: “The industry’s attitude to 3D has changed considerably since we founded Browzwear, and it’s changing even today. In the past, we were the ones pushing 3D to prospects, and the ones who responded were early adopters in the sportswear market. Over the last two years, that flow has completely reversed; 3D is no longer just for early adopters, and potential customers approach us on a

regular basis.

The industry as a whole, I believe, now recognises that 3D is essential, even if individual brands and retailers don’t quite understand why. For them, they’re seeing a tidal wave of 3D passing them by, and they know that to really optimise their processes and remain competitive, that 3D is a must.

Another significant factor in adoption has been accessibility and usability. As I mentioned before, 3D technology has been viable, technically speaking, for several years, but it was only recently that the user experience improved to the stage that designers could really work with it. That was a real tipping point”.

WhichPLM: Browzwear places a great deal of importance on creating an open standard for 3D. Can you tell us why proprietary formats are not sustainable for the future of the fashion industry?

Amy Ariel: “It’s because 3D is the heart of the digital process. People talk often about digital transformation, but as the key to that entire process, 3D must be interoperable with all the other components. Every organisation has their own way of doing things; their own in-house systems, so it’s essential that 3D remains an open platform and that it can interact smoothly with all these other pieces of the puzzle.”

WhichPLM: Finally, what do you see as the future for 3D – assuming the industry takes up the idea of an open future?

Avihay Feld: “There’s no doubt that we’re barely scratching the surface today. If we were to fast-forward 3-5 years, what we’re doing today in design and initial development will have hit the entire workflow process throughout the entire industry. We’ll have a complete, end-to-end, 3D solution that runs right the way through design, development, production and sales.

Sports, fast fashion, haute couture – all of these will turn completely digital. And that means two things, for me. First, that they will steer the industry towards a sell then produce model, where products are marketed and sold before physical goods actually exist. Secondly, the digital shopping experience will be completely transformed. I may not know what shape the latter is going to take just yet, but I know big things are guaranteed to happen now that we’ve crossed the biggest barriers.”

“We think of Browzwear as the only business-critical 3D solution for the modern apparel enterprise.”

ROADMAP ANALYSIS



Unlike the PLM market, where core functionality has reached feature parity across many of the leading suppliers, improvements to 3D simulation will be ongoing until true, real-time technical photorealism is achieved. As a result, while the technical portion of this evaluation examines the progress that Browzwear has made towards that goal, improvements to 3D rendering are assumed to be part of every 3D vendor’s roadmap.

Where individual vendors will stand out, however, is in their innovation, and in the way they choose to apply their technologies to create unique selling points and experiences.

Throughout our demonstrations and executive interview, Browzwear reiterated the importance of its “human centric” user experience, which the company cites as one of the key turning points for broader adoption of its solutions among the creative communities. This manifested as a complete user interface overhaul in mid-2016, and several iterations since. This evaluation was conducted on a release-ready version of Lotta and vStitcher than incorporated yet further usability changes, and that was subsequently released to the market in March 2017. Further work to enhance usability and make the more technical portions of the solutions accessible to designers is already underway.

While Browzwear has been consistent in its vision for an open, interoperable future for 3D, its officially-labelled Open Platform is

due to launch in the first half of 2017. Our evaluation team are keen to see how this combination of open APIs and a well-documented Software Development Kit are commercialised, and during the evaluation process we strongly suggested that it be accompanied by a greater push for standardised integration with leading PLM platforms.

Although many of these are currently confidential, Browzwear is working with leading retailers on pilot programmes for virtual fitting, personalisation, and laying the foundations for creating a more demand-driven supply chain. WhichPLM has seen some of these in action, and while many may not become commercially viable, it is encouraging to see the vendor experimenting with additional processes and applications of its technologies.

Browzwear is also in discussions with select retailers and design partners to improve the online shopping experience, and is in the process of branding and commercialising its first piece of hardware: a fabric testing machine that can analyse all the physical properties of any material and import these into Browzwear’s material libraries. This hardware was demonstrated to the WhichPLM evaluation team during our visit to Browzwear’s offices. As exciting as these sound, however, neither has a concrete release assigned to it, and neither was ready for public exhibition at the time of this evaluation.

FINAL THOUGHTS

As one of the earliest businesses to stake a claim to 3D for fashion, and one of very few to remain exclusively focused on apparel, Browzwear's long history is evidenced in the maturity of its solutions. Out of the 40 processes that we evaluated, the Browzwear portfolio scored 4 out of 5 possible stars in more than half (22), and 3 out of 5 in all but 3 of the remainder.

In terms of technical 3D, there is very little that Lotta and vStitcher combined do not do to an extremely good standard, and only minor work will be required in some areas to achieve improved scoring. But while pushing the vanguard of 3D for so long has had a positive impact on their software, Browzwear now faces a different kind of struggle. In the very near future, the vendor will be forced to ratchet up its professional services, global resourcing, and other broader business elements if it hopes to retain a podium position in what is rapidly becoming a competitive market – one that has already seen competing entries from some of fashion technology's biggest names.

Browzwear's second immediate challenge is one of education. In a market that has accelerated quickly from emerging to essential, it is rare for prospective customers to truly understand the difference between technical and aesthetic 3D. With close to a decade of reporting on digital design, development, and supply chain solutions, WhichPLM recognises the value of the former, but the market at large may be slower on the uptake. As Feld intimated during our executive interview, many brands and retailers now believe they need 3D, but they do not necessarily understand why. This is simultaneously empowering – since a mature vendor can capitalise on this opportunity to educate and inform – and concerning, because customers convinced by the need to buy into 3D in a hurry may be swayed by bigger businesses with bigger budgets unless Browzwear is able to tailor and scale its marketing and services in time.

Our evaluation team believes, however, that Browzwear stands every chance of continuing to lead the 3D market for retail, footwear, and apparel, with solutions matched by only a small number of close competitors. In short, Browzwear has proven its ability to deliver on its promise: bringing the value of true-to-life 3D to bear at every stage of the product lifecycle, in theory and in practice.

NOTABLE STRENGTHS

Browzwear's strengths unquestionably lie in its vision for technical garment 3D. From perfect synchronisation between 3D simulations and 2D patterns, to its long-term commitment to creating clear and open standards, the vendor is taking every step possible to bring about an industry where a high-fidelity, true-to-life 3D garment is

perhaps a retailer or brand's most valuable asset.

Despite a current lack of cloud, hybrid cloud, or SaaS deployment methods, our evaluation team believes that any retailer, brand, or manufacturer considering adopting a 3D-based workflow should seriously consider what Browzwear has to offer.

While being early to market is not always a positive thing, in Browzwear's case seventeen years' worth of apparel-specific experience have directly contributed to high-quality core products. And while it will not be impossible for new entrants to make a splash in this market, faced with mature vendors like Browzwear, they will have their work cut out for them.

FINAL SCORING

On the basis of version 7.5 of its 3D solutions, Lotta and vStitcher, as well as its broader business roadmap, resourcing and implementation strategies, Browzwear has earned the following star rating in March 2017:

3.5/5 possible stars, and an overall grade at the highest end of "good".

NB: This score is not a mathematical average; it represents WhichPLM's subjective, scientifically-based opinion of the vendor's place in the market.

Overall Supplier Score (out of a possible 5 stars)



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WhichPLM Limited

Company No. 7055021

1 Jeremy's Barn, Lily Lanes, Ashton-under-Lyne,
Lancashire, England OL6 9AE

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