# Virtual prototyping & used tools

Open educational resource developed by:

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# Introduction

More than ten years ago, academic research opposed towards the clothing and textile industry for their lack of of effective garment-oriented CAD packages to design directly in 3D and simulating the behaviour of the product in use. Due to the growth of demand for sustainability, e-commerce, mass customization and advances of virtual reality applications, the digitization of the garment is strongly desired for the optimization of the industry's design and development process.[1]

**Keywords**

Virtual, avatars, 3D, textile, garment, digital prototyping

1. E, P. and N, B., 2017. 3D Virtual Prototyping Traces New Avenues for Fashion Design and Product Development: A Qualitative Study. Journal of Textile Science & Engineering, 07(02).

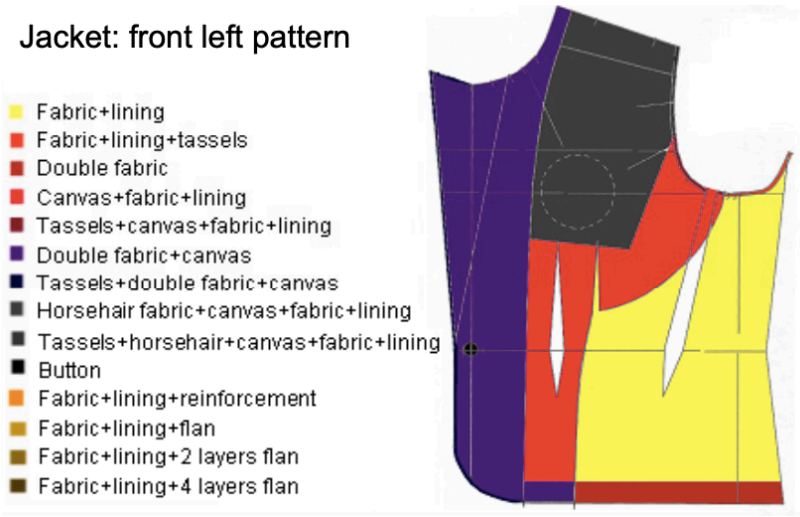
# Goals

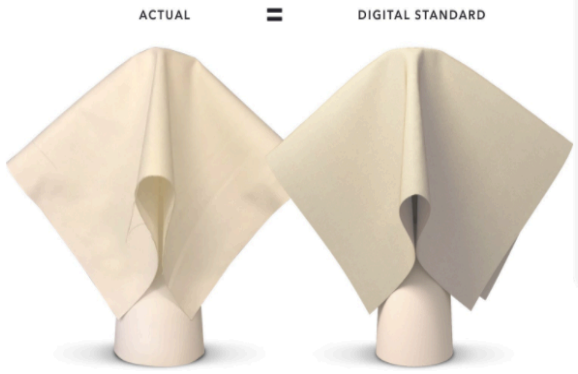
The awareness and information of new-comers in the textile sector is the main scope of this educational resource. That is because Design, Development and Production have largely relied on the same, often manual, methods despite all the technological advances happening in the world outside of fashion and apparel[2].

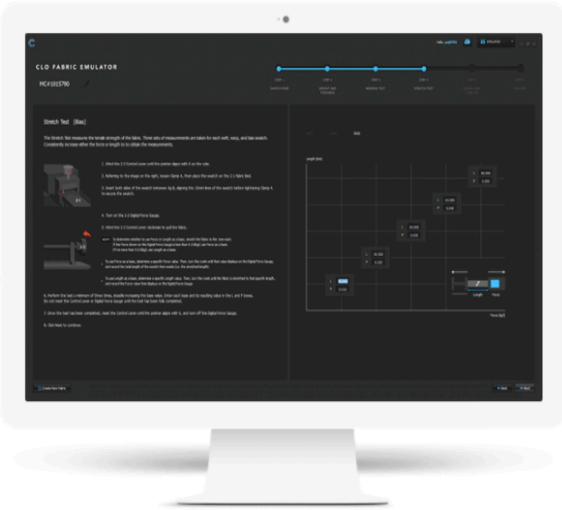
Nowadays, with the growth of demand from better educated consumers, mass customization, e-commerce, advances in virtual reality applications, the virtual garment development is strongly desired in order to optimize apparel industry's design and development processes. Although this is now commonplace in the aeronautical, automotive, furniture and shoe sectors, development in the apparel industry has been slow and complex; mainly due to the dropping and stretching properties inherent in fabric, which are not only radically different between different fabric types and constructions, but also in the direction off weave or knit within the piece

2. E, P. and N, B., 2017. 3D Virtual Prototyping Traces New Avenues for Fashion Design and Product Development: A Qualitative Study. Journal of Textile Science & Engineering, 07(02).

Since ten years now, the necessity of digitization has taken over the re-planning and reforming of business models into integrating the 2D (then) and 3D (currently) models into their activities. Manufacturers and suppliers in the textile industry are already making use of a well-established 2D CAD technology for pattern drafting and sizing, or CAM systems for automatic cutting and sewing; and have already entered the 3D technology world provided with simulation capabilities, prediction of actual behaviour of the cloth, in terms of prototyping and finally the making of completely digital textiles, Multi-layered fabrics, textiles used in daily clothing, protective wear for sport and working activities, as well as coverings, tarpaulins and other textiles used in home/vehicle furnishings, architectural structures, etc[3].




3. Fontana, M., Rizzi, C. and Cugini, U., 2004. Physics-Based Modelling And Simulation Of Functional Cloth For Virtual Prototyping Applications. 1st ed. [pdf] Available at: <https://diglib.eg.org/xmlui/bitstream/handle/10.2312/sm20041400/267-272_fontana.pdf?sequence=1>

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# 1. 3D/ digital/ Virtual prototyping

Digital prototype (or one of the three mentions in the title above), in the textile and garment industry enables technologies in the process of product development where various operators are involved in the different stages, with various skills and competencies, and different necessity of formalizing and defining in a deterministic way the result of their activities[4].
In other words, it can be considered as the digitization of some of the steps followed by supplier and manufacturer in the process of product development.

### 1.1 Digital prototyping and supply chain

Focusing on the prototyping stages of the supply chain 3D technologies are being developed in order to cover the needs of communication between producer and supplier for shorting the prototyping stages and their economic and environmental impact.  Digital Prototypes are used as an essential tool in the modern design process. The integration can speed up the design process and affect competition between companies[5].

4. E, P. and N, B., 2017. 3D Virtual Prototyping Traces New Avenues for Fashion Design and Product Development: A Qualitative Study. Journal of Textile Science & Engineering, 07(02).
5. PAPACHRISTOU, E., 2015. How to integrate recent development in technology with Digital Prototype textile and apparel applications. MARMARA UNIVERSITY JOURNAL OF SCIENCE, 27(3).

# 2. Used tools

The first thing needed for a successful prototyping in the textile industry is a high tech and specialized CAD program.

Since the beginning of the smart era in product design, R&D and manufacturing in textiles, the software supporting the digitization varies and keeps developing onto a large pace scale.

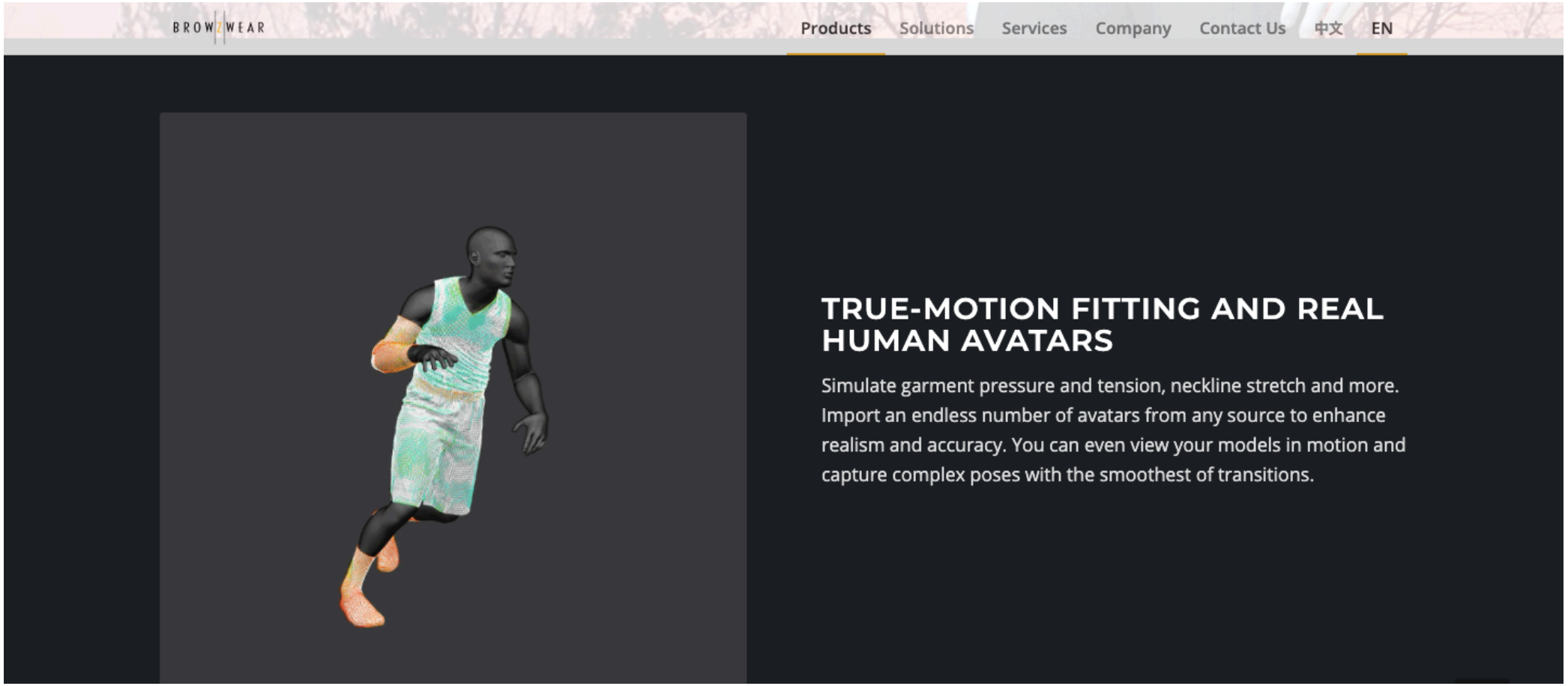
Some of the used tools are:

- *CLO3D*
- *CAD*
- *TAILORNOVA*
- *BROWZWEAR*
- *OPTITEX*
- *IDESIGNIBUY*
- *CDESIGNFASHION*
- *VIRTUALITY.FASHION*

6. E, P. and N, B., 2017. 3D Virtual Prototyping Traces New Avenues for Fashion Design and Product Development: A Qualitative Study. Journal of Textile Science & Engineering, 07(02).

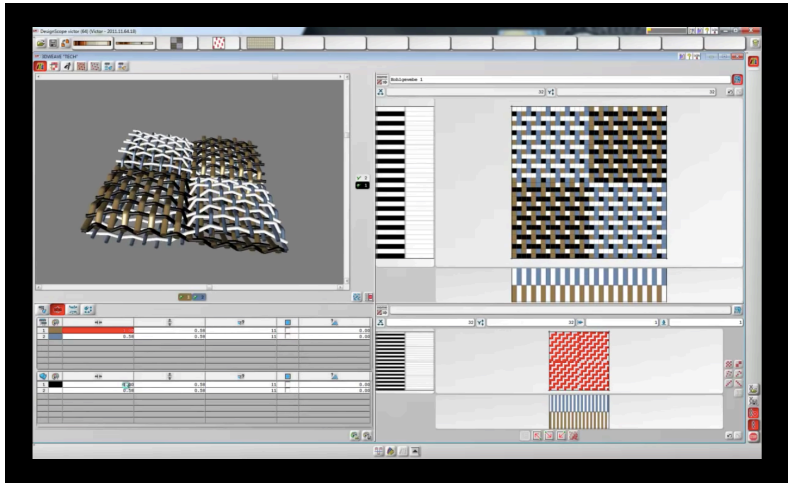
Sports garment simulation on the tool Browzwear.

Aiming to represent as close to reality as possible the movement of the garment while the athlete is moving.




Images: https://browzwear.com/company/

With the constant development of 3D tools, the user is able to go  online and share information with the manufacturer concerning the garment and its utility. The textile textures. Wraps, wefts, the garment movements, the different textile behaviours in several conditions such as water resistance, are now available online without the necessity of exchanging the prototypes multiple times.

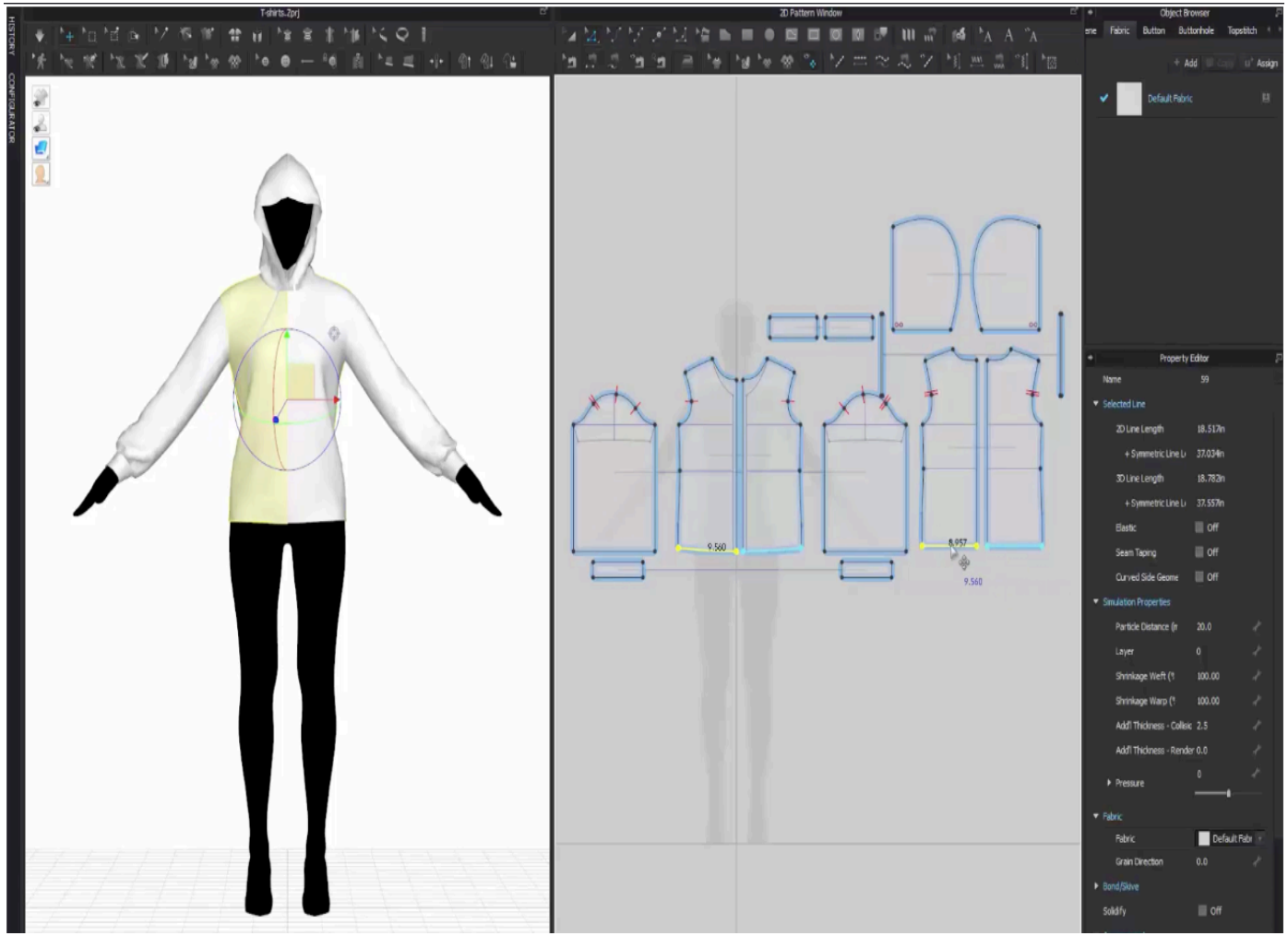



Images: https://www.clo3d.com/

The user of those tools can aslo have full image and access to the patterns of a garment.

Thus the reaccordination and reformation of the garments' pattenrs can be done

Digitally wihtout needing to be actually made in hand.




Images: https://www.clo3d.com/

# 3. The importance of 3D virtual prototype in the textile industry

A scenario of an apparel industry with fashion designers who do not use pencil and paper and do not pass these designs to the pattern maker to digitally sew and evaluate them in a 3D model is too optimistic.

A future scenario of a fashion designer comfortable enough with 3D technology to create from the beginning that initial fashion drawing in a three-dimensional space making quick decisions, trying out different fabrics, colors and contrasts, communicating his/her ideas with the pattern maker and the entire development team in true to life 3D and within hours instead of days or weeks, sounds science fiction. Tree-dimensional (3D) technology - while well established in many other industrial sectors like automotive, aerospace, architecture and industrial design-, has only just started to open up a whole range of new opportunities for apparel designers.[1]

7. Minghua, T., Faming, X., Huijuan, Z., Anyi, W. and Xiaoguang, W., 2016. Effect of Electron Beam Irradiation Cross-Linking on Polyolefin/Phenyl Silicon Rubber Composite. Journal of Fashion Technology & Textile Engineering, 04(03).

This process is a time consuming and wasteful procedure.
The digitization of the partnership between designer and manufacturer is close and already automating and minimizing steps on the process.

**The garment sample development process**

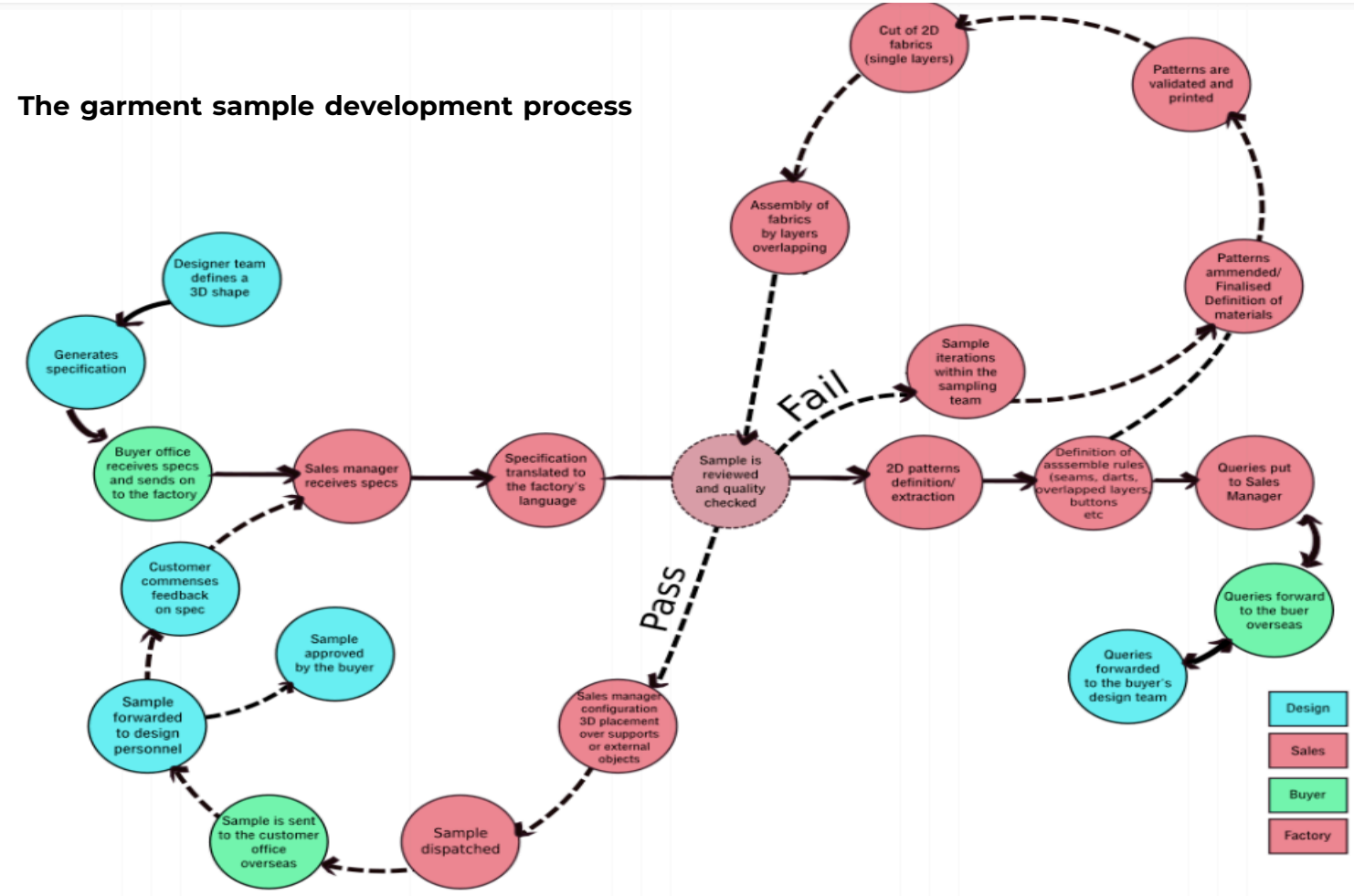



Image:
https://www.researchgate.net/profile/Evridiki_Papachristou/publication/299982121_Can_3D_Virtual_Prototype_Conquer_the_Apparel_Industry/links/57872eb608ae36ad40a6a310.pdf

# 4. A paradigm of software virtual prototyping

CLO3D, a new digital based tool, has optimised the digitisation of its products by enhancing the ability to imprint the moves of the body onto the garment and give a scope of natural effect and physical approach·

Image:https://i.pinimg.com/originals/0c/03/36/0c03363e5423264bb95ffa47b5cde631.jpg

## 4.1 Digital prototyping software CLO's features:

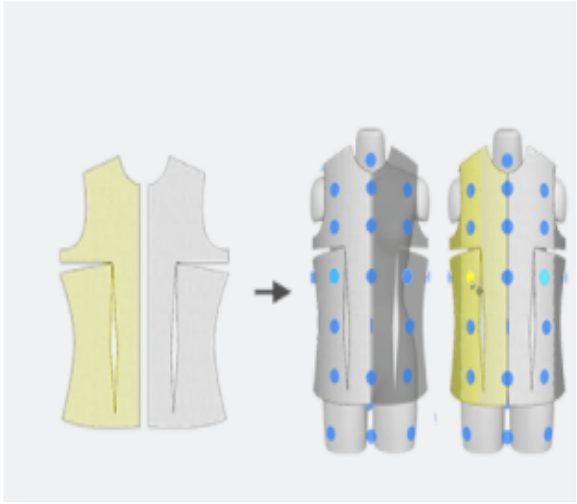
### MODULAR DESIGN

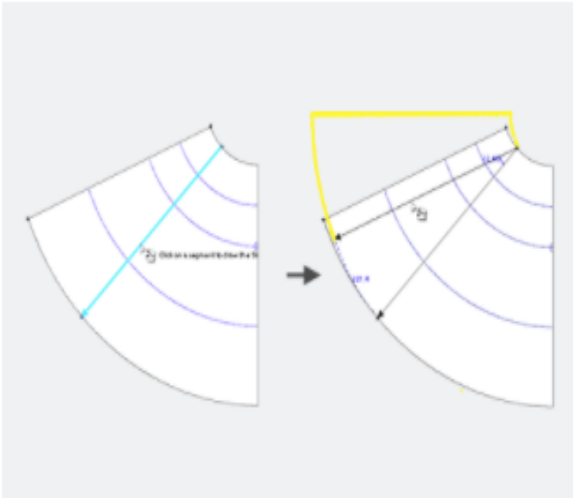
- Configurator
- Modular Template Files
- Sewing Blocks
- Edit Block Components

### 3D SIMULATION & LAYER

- Real Time Sync/ Simulation
- Real time Garment Move
- High-definition Garment
- Pattern Layer
- Pattern Sublayer
- Sewing Layer
- Fold Pattern
- Fold Seam Lines

Images: https://www.clo3d.com/explore/features





### 3D GARMENT EDIT

- 3D line on pattern
- Cut 3D Pattern
- Flattening
- Select Single Multi Meshes
- Single/ Multi Pins
- Freeze/ Deactivate
- Strengthen
- Glue Trim/ OBJ

### 3D ARRANGEMENT

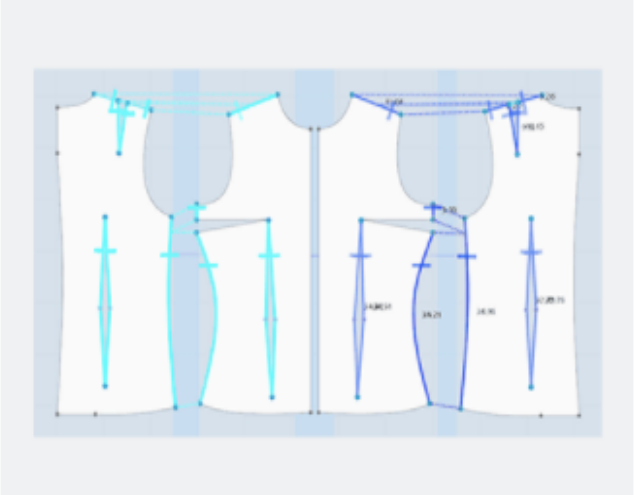
- Gizmo
- Arrangement Point
- Direct Positioning
- Fold Arrangement
- Arrange as Flat/ Curved
- Flip Patterns
- Superimpose
- Smart Arrangement

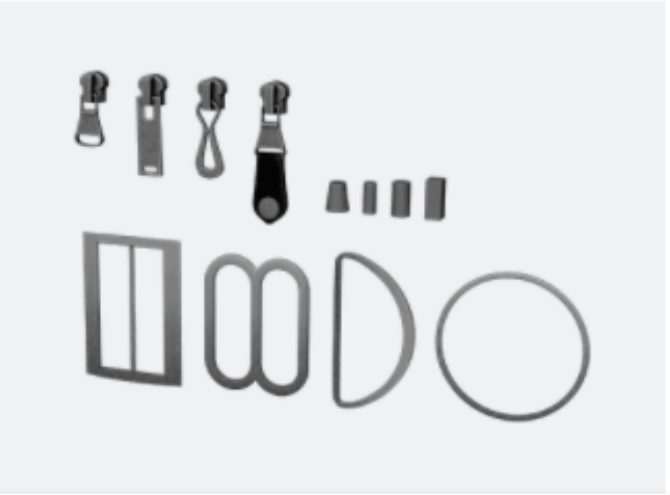
### 2D PATTERN DESIGN

- Create/ Edit Pattern
- AI Curve (Bézier Curve)
- Symmetric/ Instance Design
- Dart/ Pleats fold
- Notch
- Trace
- Symbol. Annotation
- Seam Allowance
- Reference lines

Images: https://www.clo3d.com/explore/features

## 4.1 Digital prototyping software CLO's features:



### GRADING

- Add Pattern size
- Edit Pattern size
- Pattern size table

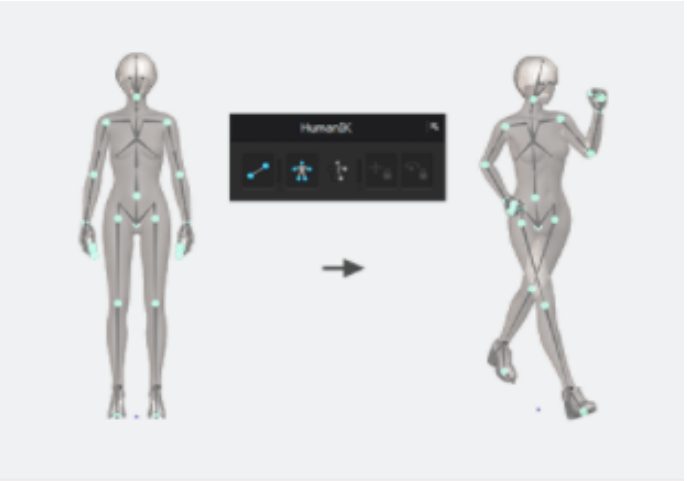
### SEWING AND TACKING

- Segment Sewing
- Free sewing
- M:N Sewing
- Sewing Notch
- Symmetric sewing
- Tack on garment
- Tack on Avatar
- Pleats Sewing

### HARDWARES & TRIMS

- Zipper
- Button/ button hole
- Elastic
- Glue trim/ OBJ
- Custom trim/ OBJ
- Scale trim/ OBJ
- Topstitches (OBJ/ Image)
- Piping

Images: https://www.clo3d.com/explore/features



**FINE - TUNNING**

- OBJ Weight
- Puckering
- Bond/ skive
- Press
- Steam
- Solidify
- Pressure

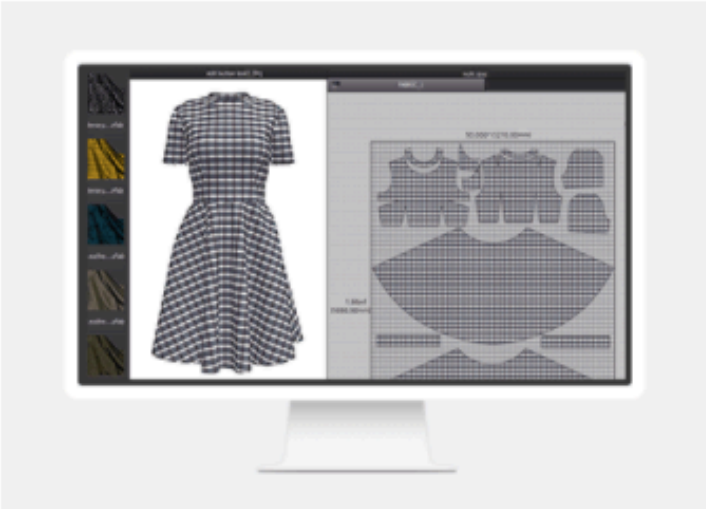
**FIT CHECK**

- 2D pattern measure
- 3D garment measure
- Check 2D Sewing length
- Transparent map
- Pressure points
- Strain/ Stress map
- Fit map
- 1:1 view
- 3D state history

**AVATAR**

- Edit avatar style
- Edit avatar size
- Avatar Measurement
- Avatar tape
- Edit avatar pose (FK/IK)
- Edit arrangement point
- Avatar skin offset
- Avatar friction

Images: https://www.clo3d.com/explore/features



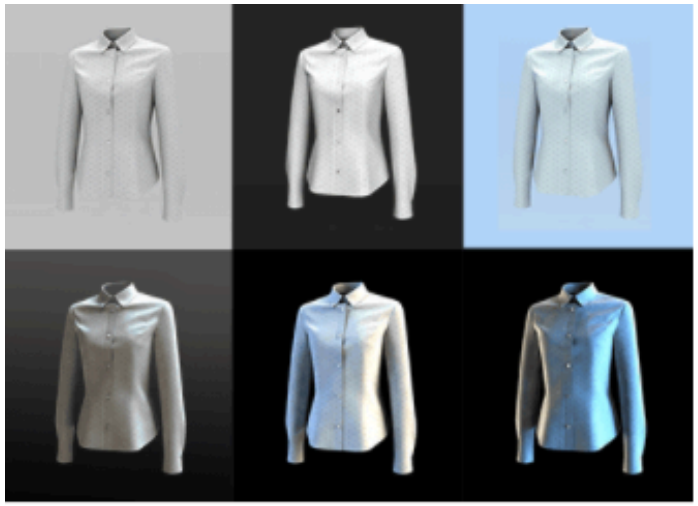
**COLOURWAY**

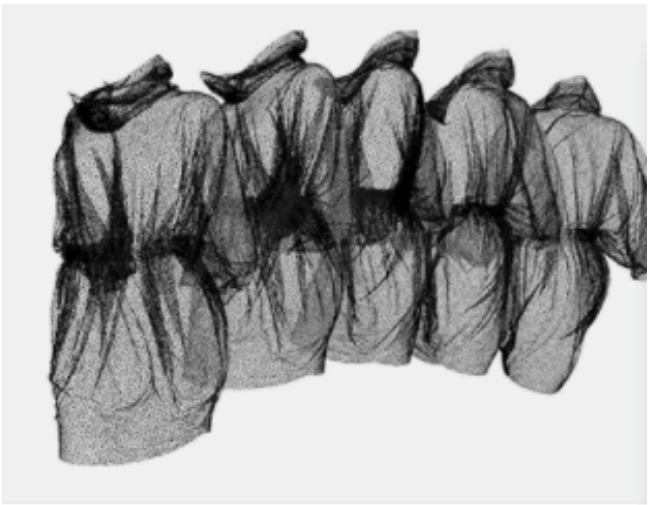
- Create colourways
- Edit textures/ colours
- Colour name input
- Viewer code

**PRINT LAYOUT**

- Print layout 2D snapshot
- Arranging patterns
- Roll width settings

Images: https://www.clo3d.com/explore/features





**RENDER IMAGE/ VIDEO**

- High quality render
- Single/ multi images
- Turntable images
- Turntable videos
- Light properties
- Render properties

**ANIMATION (RUNWAY)**

- Record
- Play
- Edit
- Animation video capture

Images: https://www.clo3d.com/explore/features

# Conclusions

- The minimum amount of prototyping stages in a supply chain between a designer and manufacturer in the textile sector are 4. This mean four times the transportation therefore the air emissions from the means of transport, and four times the processes of the production of the prototypes from scratch, including of course the human hours spent for these stages.

- The digitisation of at least three of these steps will minimise and ultimately bring a big impact on the environment and on the cost of production and communication between designer and manufacturer.

- However the digitisation is still on early stage in the textile sector considering the lack of education in the new norms that appear through the technological growth, coming to replace some traditional ways of things.

# Conclusions

- The way is still long and the human touch and physical contact with the product is impossible to replace, but in the meanwhile, making the contact of the human resources and their work easier and less complicated will improve and develop the production process and benefit the sustainability efforts of the textile sector.
- The production of advanced textiles is a complicated process and the many different materials and pieces that complete the smart textile are of different production that need to be added up together, therefore many different production collaborators must come in touch multiple times to search, design, receive and probably re-receive a material. What would happen and how many efforts would be saved and sacrifices avoided if a big amount of these processes is being completed by a few online tools.

Visit http://destexproject.eu/ to see the rest of the intellectual outputs of the project



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DESTEX project (INDUSTRIAL AND CREATIVE DESIGN IN ADVANCED TEXTILE MANUFACTURING; project reference number 2019-1-SE01-KA203-060379) is co-funded by the Erasmus+ programme of the European Union.

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