The 3D Virtual Prototype- A Sustainable Solution For The Clothing Industry

Manuela-Lacramioara Avadanei[1], Emil-Constantin Loghin[1], Sabina Olaru[2], Antonela Curteza[1], Cezar-Doru Radu[1]

(1)"Gheorghe Asachi" Technical University, Faculty of Industrial Design and Business Management,28,D.Mangeron,700050,Iasi, ROMANIA
(2)"National Research and Development Institute for Textiles and Leather", 16, Patrascanu Lucretiu Street, Bucharest-Sector 3, 030508, ROMANIA
E-mail: manuela_avadanei@yahoo.com

Abstract

Textile and clothing industries are in a new point of development: digitalization and forward to industry 4.0. Digitalisation brings essential changes of the production process in the clothing industry: it offers the possibility of producing individualised/personalised models, it reduces the time between the design stage, in which digital CAD patternmaking and grading solutions are employed, and the production stage, which is usually carried out by digital machinery or robots. In this case, designers will be able to make faster decisions, subject their collections to simulations in the market (to identify the customer's needs), reduce the quantity of waste resulting from the manufacturing process (to the possible extent), and involve the consumer in the design process of the new product model (co-design). The virtual prototype of a model is a virtual representation of the new item which enables one to assess the extent to which it matches the model sketch/ photo, see whether the design method was adequately chosen and if the process was carried out correctly, to evaluate the fitting degree of the garment (dimensions, proportions, position on the virtual body/ dummy), and to decide if it fulfils the customer's requirements. In this paper, the authors present a tutorial about how to obtain a 3D prototype and to virtually try it on a virtual body/ dummy, by using a Lectra software solution. This tutorial is suitable for any person who is working in the field of clothing design, and who has got access to this advanced Lectra module.

Keywords: Virtual prototype; Clothing design; Patternmaking; Customer

1 Introduction

"Fashion" is a unique word, which suggests beauty, originality, emotions, used not only for clothing but also for lifestyle, accessories, jewellery, make-up, soft goods, body proportions, etc. This word is magic, captures the attention of any person, but the way they perceive it is influenced by their age, the society they live in, their level of education, financial resources, cultural heritage, the geographical area where they live, etc. The meaning of this concept is changing at a fast pace, and many consumers are willing to buy goods that they do not necessarily need for the sole purpose of being "fashionable". From time to time, new items are created from either already existent materials or new ones, created explicitly for this purpose. The demand for garment products has increased dramatically over the past two decades. Unfortunately, a significant fraction of these items end up either not being worn or used only for short periods before being eventually thrown away, and if they are not properly disposed of.

Climate change and air and water pollution are critical problems, which affect the balance of ecosystems, the lives of the animals, and the behaviour of the human society as well. To successfully deal with them, one has to determine the necessary changes, how they can be

implemented, and to make sure that they withstand the test of time in a society dominated by consumerism.

In order to turn the concept of "clean, friendly and green" clothing industry into a reality, it is vital to reduce the consumption of raw materials (all types of materials and accessories), energy and water, to cut down on the levels of air, water, and pollution, and waste, while extending the life cycle of the product, and educating the consumer to use the garment product to the maximal extent and to recycle it in the end.

In order to stay competitive and creative in launching and manufacturing new collections, a clothing company must employ cutting edge equipment and IT applications in producing diverse and complicated models, in a personalised/customised manner to fulfil the client requirements. Under these circumstances, the first step that must be taken is to design the new collection in a virtual environment, as this allows the designer to carry out the process in an interactive, efficient, fast, and creative way. By taking this approach, the designer can explore a combination of different materials, styles, and lines in new shapes and structures of models, while simultaneously testing the fitting degree of the garment on a virtual dummy (e-prototyping). The virtual environment offers the possibility of exploring new ideas without consuming physical materials.

This paper presents a gradual e-learning tutorial of how to obtain a virtual prototype of a garment model using the 3D module developed by Lectra. This module enables the user to verify if the adopted design solution leads to the desired result: a correctly sized model (as it is shown in the sketch) that fits well on the human body. By carefully following the instructions, the student/ learner will be able to test various design features, to identify issues as early as possible during the design stage, and to provide a virtual model for company stakeholders that they can use in order to obtain a greater understanding of the characteristics of the product.

2 Work method

There is a great diversity of CAD's with a 3D module that allows one to test and validate a design solution by obtaining the virtual prototype of a garment model. This module offers the possibility to import the 2D patterns and virtual seams besides the virtual mannequin or to directly design the 3D patterns on the virtual mannequin (suitable for fitted garments, placed very close to the surface of the human body, without pleats or folds) and then to export them as 2D pieces. Designers usually take the first approach, which consists of importing 2D patterns into a 3D environment, because these modules offer the possibility to design diverse category of garments, with complicated styles and layers at affordable prices.

In order to obtain a virtual prototype of a garment by importing the 2D patterns, the user (learner) must:

-prepare the patterns for virtual sewing process (design the variant of the model, figure 1). The patterns are designed using the Modaris module developed by Lectra, by taking into account the style of the model and the size of the human body. The user declares the garment sewing lines (figure 2). In the end, the user selects the button "Check 3D fitting", and the software verifies the model (if everything is OK) and then automatically launches the 3D module.
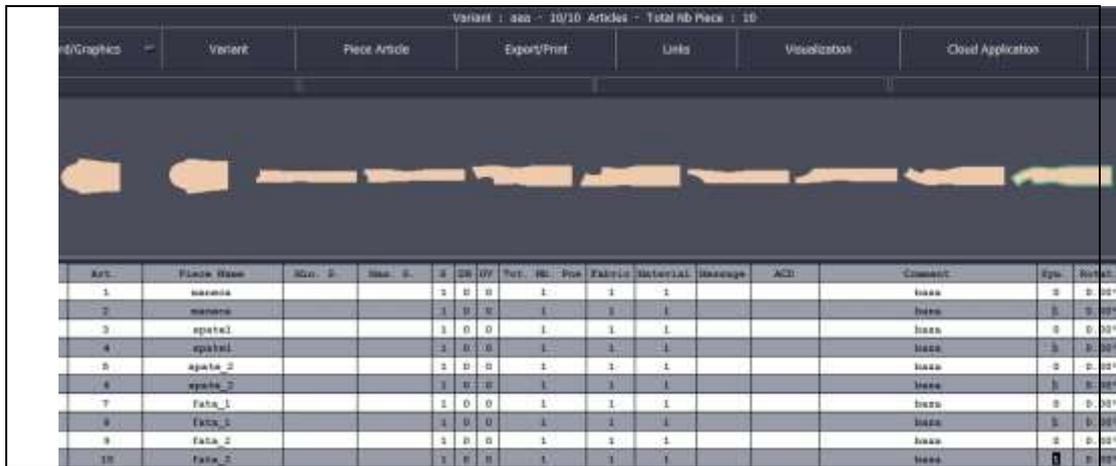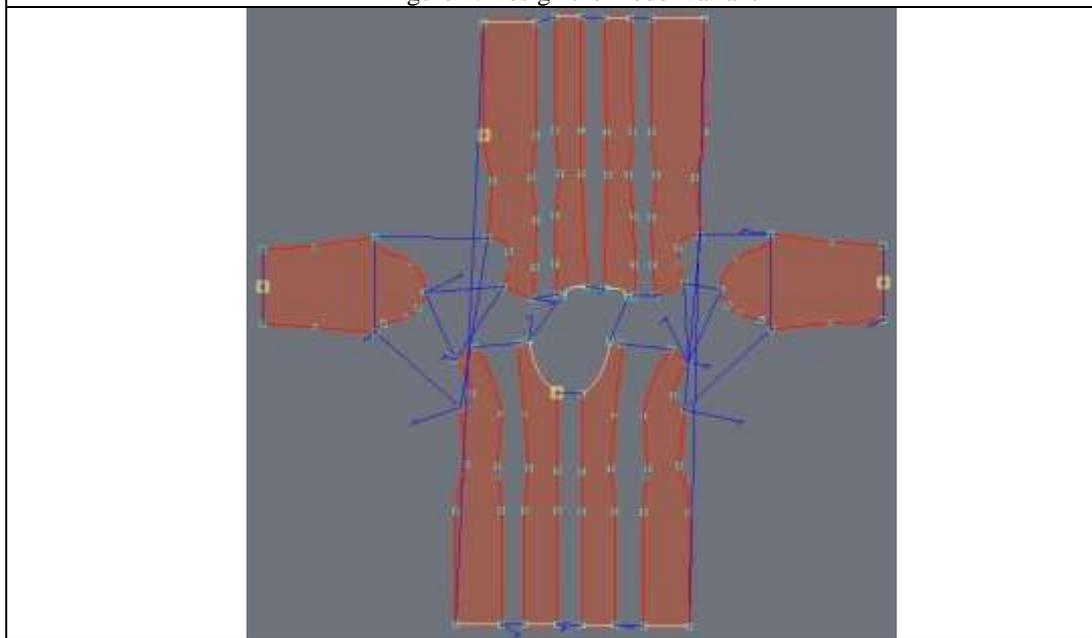
Figure 1. Design the model variant

Figure 2 Declare the seam lines

-resize and re-shape the dummy from the CAD's database. The user can use a 3D scanned body, but one must verify its surface, in order to eliminate the holes or other imperfections. The most frequently adopted solution is to select a suitable virtual body from the database of the CAD and to change it according to the size and the shape of the customer's body. The virtual bodies have a particular position to allow the positioning of the garment pieces around the human body.
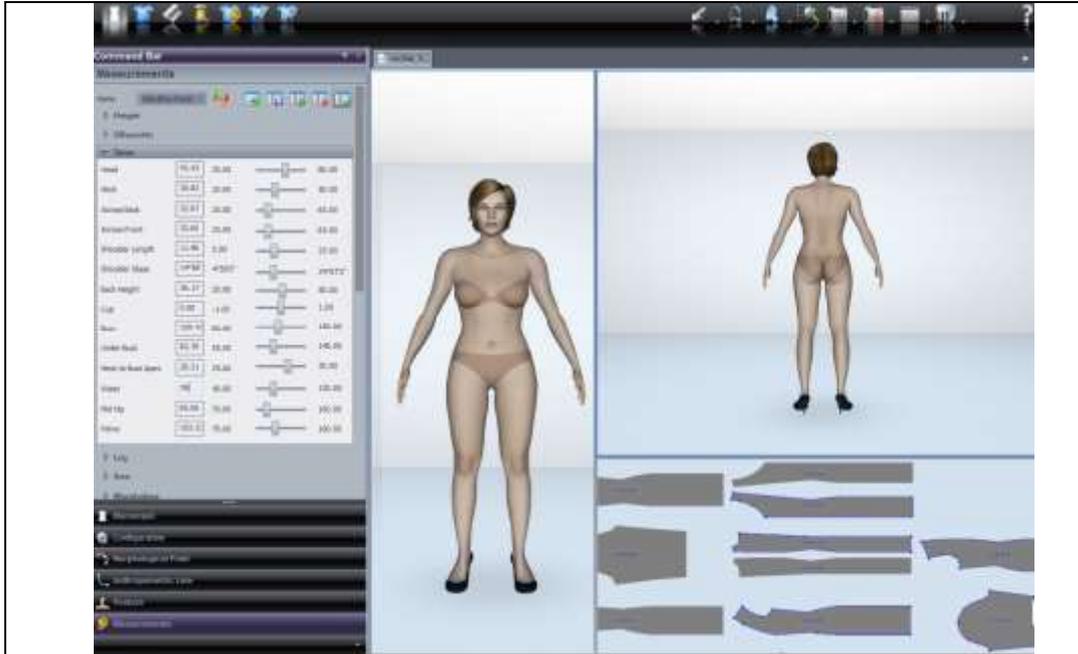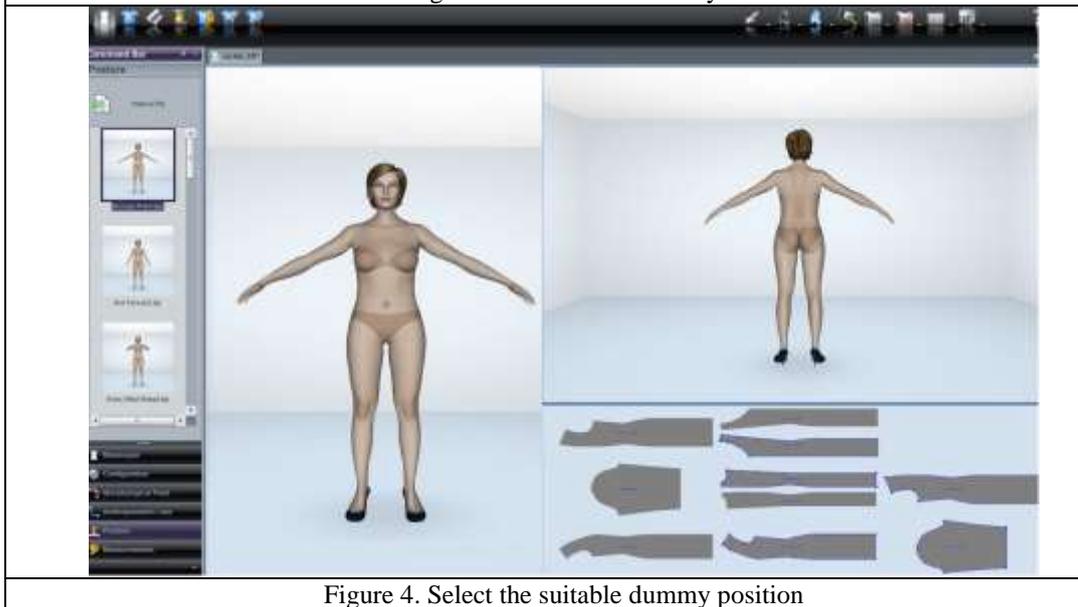
Figure 3. Re-size the dummy

Figure 4. Select the suitable dummy position

     -the user declares contacts point between the garment and the human body (figure 5), and select the type of material from which the model is made. Optional he/she can select to visualise the sewing lines between the garment parts (by activating the button Seams/ All Seams), (figure 6).
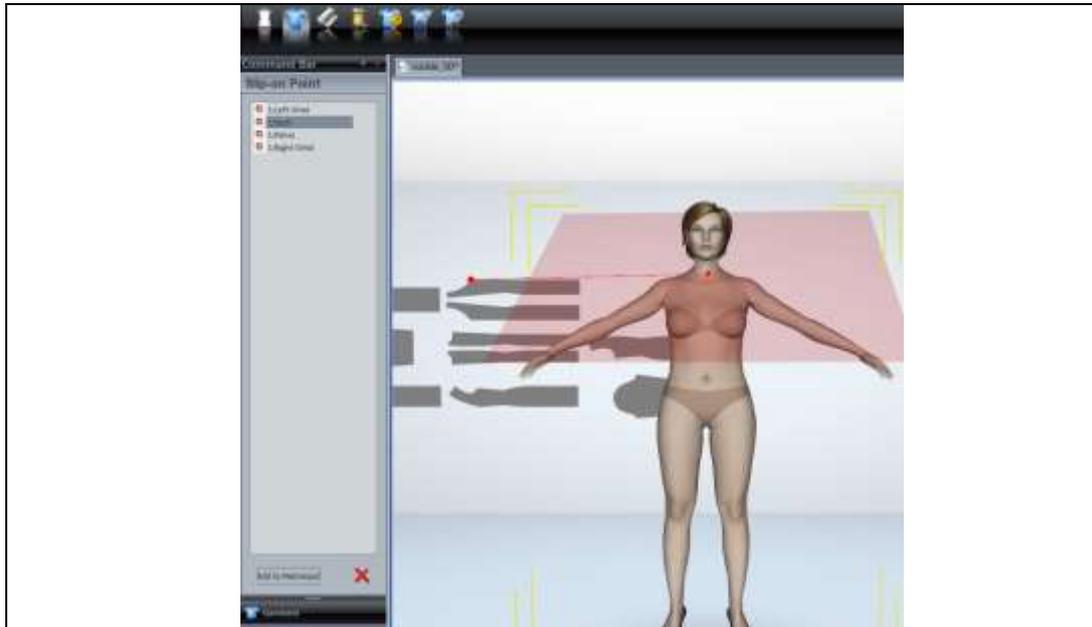
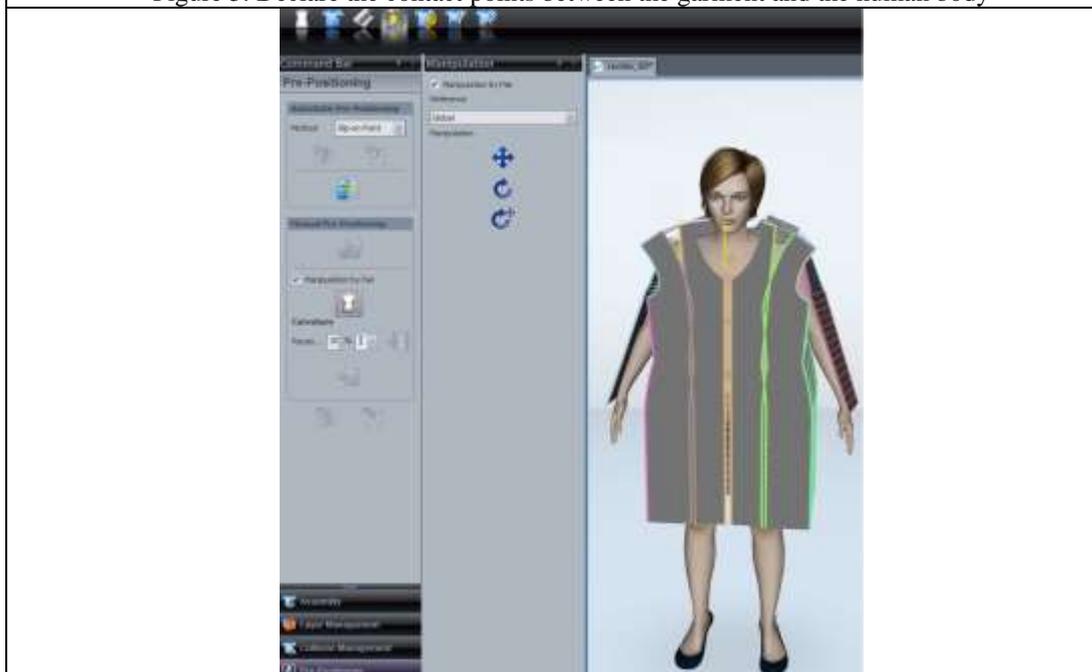Figure 5. Declare the contact points between the garment and the human body

Figure 6. Visualise the sewing lines

- carry out the virtual sewing process. During this stage, the patterns are sewn around the human body (figure 7). The users can stop the sewing process, change the product position on the human body and then restart the sewing process (figure 8).

Figure 7. Simulation of the sewing process

Figure 8. Arranging the garment on the surface of the human body

-the user analyses the appearance of the model, its balance and style details and decides if the virtual prototype accurately reflects the model sketch or not (the user analyses the tension map). At this stage, the designer decides what modifications are necessary to apply in order to eliminate the

identified problems (if in the tension map the designers see red areas, they must increase the size and the shape of the pattern, and if they see blue areas, the shape and size of the pattern have to be reduced).

Figure 9. Final virtual prototype

Figure 10. Test the model appearance with a different combination of materials

These final patterns are used for obtaining markers, determining consumption, obtaining production patterns and the first physical prototype.

3 Conclusions

The virtual simulation of the first prototype offers the possibility to analyse and validate the design solution, test new materials, add new elements in order to obtain a new style, without using raw materials, energy, water or any other chemical substances. By working in a virtual environment, the user/learner can:

-explore sophisticated and diverse design solutions for atypical conformations or postures in order to verify the balance of the product when it is fitted on the surface of the human body;

-check if the materials were chosen in accordance with the category of the product (for summer, winter or spring/ autumn), and the behaviour of these materials during the virtual sewing process;

-test different colours or types of print for the materials on the selected model.

The design process of a garment model in a virtual environment requires a comprehensive study of the interaction between materials (number of layers, structure, and volumes) and the human body.

These e-learning lessons are suitable to can be easily followed by any person who is working in a design department, and who has to obtain the production patterns of a model in a timely manner. This virtual approach is environmentally friendly because it enables the user/designer to cut down on the amount of raw materials, water, or chemicals used in the production process.

Acknowledgements

References

[1] Curteza, Structurarea colectiilor orientate catre client, Casa de Editura Venus, Iasi, 2005, ISBN 973-7960-72-6, pg.15-20;.

[2] Filipescu E. – Proiectarea constructivă a modelelor, Ed.Gh.Asachi, ISBN 973-99209-0-X, Iaşi, 1999,pg.80-90

[3] Mariana Ursache, Carmen Maria Loghin, Manuela Avadanei, Savin Dorin Ionesi, Luminiţa Ciobanu, Irina Ionescu (2016), Developing new skills for the extroversion specializations of fashion industry in Europe – Extro skills-, 16th Romanian Textiles and Leather Conference CORTEP 2016, ISSN-L 2285-5378, 27-29 October 2016, Iasi, Romania, pag.508-511

[4] * * * SR 13545/2010 Îmbrăcăminte. Dimensiunile corpului şi mărimi de confecţii pentru femei

[5] https://www.lectra.com