# THE CREATION OF CUSTOM AVATARS WITH LOWER LIMB AMPUTATION - A SUSTAINABLE MODEL IN FASHION INDUSTRY

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*Abstract: In the digital age, virtual avatars have become fundamental tools in the process of creating individualized clothing. Avatar customization is redefining the standards of the fashion industry, highlighting the importance of individuality and inclusion. This innovation opens up new opportunities for designers and manufacturers, facilitating the creation of clothes adapted to consumer preferences, simultaneously reinforcing the need for social fashion industries as a catalyst for change and environmental responsibility. The implementation of personalized avatars expands the boundaries of the fashion industry, allowing consumers to express their own identity and style in an authentic and unique way. This innovative approach not only encourages diversity and inclusion, but also helps reduce resource consumption and carbon emissions associated with the production process, promoting a more sustainable perspective in the fashion industry. In addition, personalized avatars facilitate interaction between brands and consumers through digital platforms, strengthening communities around the values and missions of these brands. The purpose of this work is to present the research on the creation of personalized avatars that present leg amputations, using various methodologies and technological approaches. The stages described in the paper give us an insight into the process of developing the personalized avatar, using elements created in specialized software. The main contribution is exploring how personalized avatars can provide innovative solutions for lower leg amputees by customizing the design to the individual needs of the user.*

*Key words: specialized software, personalized avatar, digital prosthesis.*

## 1. INTRODUCTION

Information technologies have become a central element in various industries, including the fashion industry. In this context, avatars - virtual representations of the wearers - have become increasingly important in the clothing creation process, opening up new opportunities for growth and innovation, promoting diversity and sustainability in fashion [1].

Creating custom avatars with calf amputation is an example of a sustainable model in the fashion industry for several reasons. Firstly, this model encourages inclusion and diversity in clothing design, offering solutions tailored to the individual needs of amputees. Secondly, custom avatars help reduce the waste of materials and resources because consumers can get a clearer idea of how clothes fit them before they physically purchase them. Additionally, these digital technologies can help reduce environmental impact by reducing the need to produce and transport physical clothing samples. Moreover, avatars are also widely used in the clothing customization process, giving customers the opportunity to create their own designs and test different combinations of

colors, materials and styles before making a purchase. This direct interaction between consumers and products helps increase customer satisfaction and strengthen customer relationships.

## 2. RESEARCH ON THE CREATION OF THE CUSTOM AVATAR WITH LOWER LEG AMPUTATION

The method of integrating elements into an existing avatar was used to create the avatar with lower limb amputations. This technique allows the generation of a realistic representation of a person without the need for advanced knowledge in the field of 3D graphics. The main advantages of this approach include the low cost and fast speed of creating the 3D avatar and the ability to test the clothing in both static and dynamic form [2, 3].

During the stages of creating the avatar with calf amputation, the Daz Studio software [4] was used, in which the prosthesis was manipulated; and CLO3D, in which the final result was obtained [5, 6].

Next, we present the attempts made to create virtual avatars with calf amputation (table 1).

*Table 1: The presentation of the creation stages of the digital avatar with calf prosthesis*

| **Sample 1. Initial data:** CLO3D avatar, Daz Studio prosthetic | | | |
|---|---|---|---|
| **The creation steps of the avatar** | | | |
| No | Test No. 1 | Test No. 2 | Test No. 3 |
| 1 | Prosthesis selection from the Daz Studio software library | Prosthesis selection from the Daz Studio software library | Prosthesis selection from the Daz Studio software library |
| 2 | Adapting the position of the prosthesis in Daz Studio | Adapting the position of the prosthesis in Daz Studio | Adapting the position of the prosthesis in Daz Studio |
| 3 | Exporting the prosthesis from Daz Studio in obj format | Exporting the prosthesis from Daz Studio in obj format | Exporting the prosthesis from Daz Studio in obj format |
| 4 | Selecting the avatar from the CLO library and changing the dimensional feature values | Selecting the avatar from the CLO library and changing the dimensional feature values | Selecting the avatar from the CLO library and changing the dimensional feature values |
| 5 | Creating the opacity map in Adobe Photoshop | Creating the opacity map in Adobe Photoshop | Creating the opacity map in Adobe Photoshop |
| 6 | Visualising the amputation of avatar leg in CLO using opacity map | Visualising the amputation of avatar leg in CLO using opacity map | Visualising the amputation of avatar leg in CLO using opacity map |
| 7 | Importing and placing the prosthesis in CLO | - | Importing and placing the prosthesis in CLO |
| 8 | Exporting the avatar and prosthesis from CLO to obj format to form a single object | - | Importing and placing the prosthesis on the healthy leg |
| 9 | - | - | Changing the opacity of the prosthesis on the healthy limb |
| 10 | - | - | Exporting the avatar and prosthesis from CLO to obj format to form a single object |
| 11 | Importing the avatar in CLO | Importing the prosthesis as a trim object in CLO | Importing the avatar in CLO |
| 12 | Converting the avatar in CLO | Attaching the prosthesis to the avatar's leg in CLO | Converting the avatar in CLO |

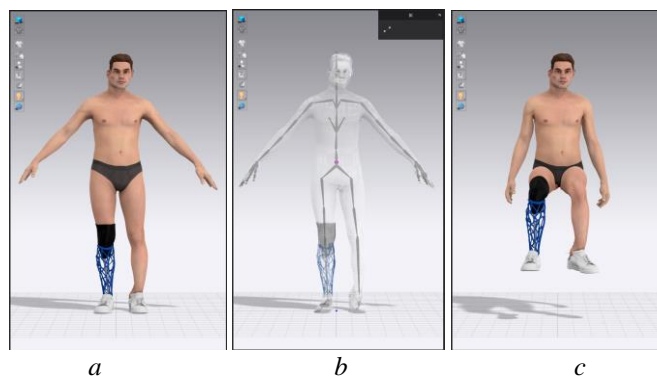The results of the prosthetic avatar creation tests are shown in 1, 2 and 3 figure.



|        a        |        b        |        c        |

***Fig. 1****: The result of Test No. 1: a - visualization of the avatar in statics, b - visualization of the skeleton of the avatar in statics, c - visualization of the avatar with the modified body position*
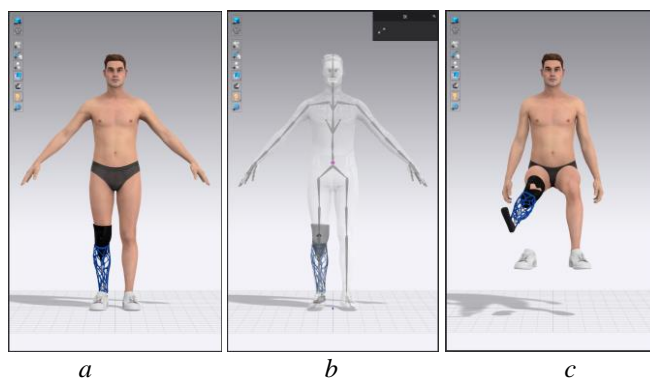


|        a        |        b        |        c        |

***Fig. 2****: The result of Test No. 2: a - visualization of the avatar in statics, b - visualization of the skeleton of the avatar in statics, c - visualization of the avatar with the modified body position*



|     a     |     b     |     c     |     d     |

***Fig. 3:*** *The result of Test No. 3: a - visualization of the avatar in statics, b - visualization of the skeleton of the avatar in statics, c - visualization of the avatar with the modified body position, d - viewing the avatar in dynamics*
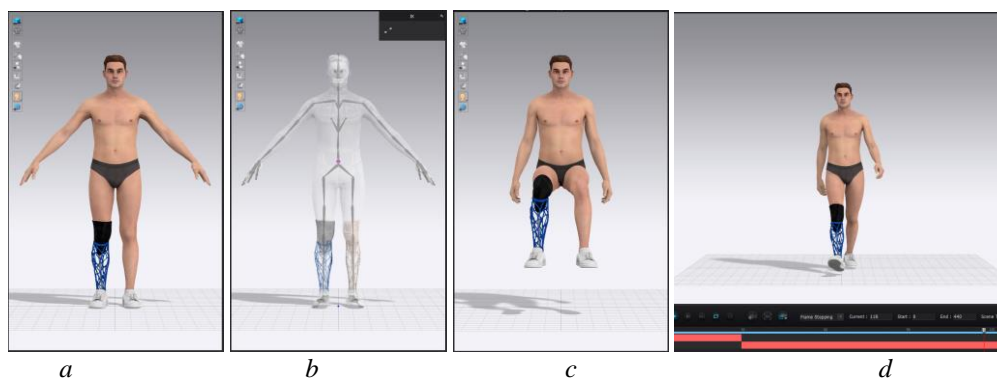
Performing an analysis of the obtained results, we notice that not all avatars correspond to the criteria submitted to them (table 2).

*Table 2: Analysis of the obtained results*

| No | The analyzed criterion | Test results | | |
|---|---|---|---|---|
| | | No. 1 | No. 2 | No. 3 |
| 1. | Creating the avatar with calf amputation | + | + | + |
| 2. | Changing the external visual characteristics of the avatar | - | + | - |
| 3. | Changing the dimensional characteristics | + | + | + |
| 4. | Changing the body position | - | - | + |
| 5. | Checking the placement of the product on the avatar's body in statics | + | + | + |
| 6. | Checking the placement of the product on the avatar's body in dynamics | - | - | + |
| 7. | Animation | - | - | + |

As a positive result that will be used in further research to create personalized clothing, the avatar obtained from Test No. 3 can be considered. It has only one disadvantage: the non-change of the visual external characteristics of the avatar, information that is not important in the creation and verification of digital clothing.

## 3. CONCLUSIONS

The creation of personalized avatars with calf amputations is an essential and innovative initiative in the current context of digital technology and social inclusion. For the fashion domain, this is a necessary approach that brings significant benefits to several amputees, fashion designers and manufacturers.

Analyzing the experiments presented above, we notice two major directions for creating the digital avatar with a prosthetic leg:

1. Creating the avatar by integrating a prosthesis into the body of an existing avatar and converting it – samples 1 and 3;

2. Creating the avatar by converting it and then integrating a prosthesis into its body – sample 2.

Furthermore, we can note that all attempts allowed to obtain a digital avatar with amputations of the lower limbs, however their shape was not perfect in all of them. We also obtained avatars that allow the modification of dimensional characteristics.

Thus, the creation of personalized avatars with lower leg amputees for the development of special clothing represents an initiative with enormous potential for improving the quality of life and autonomy of people with disabilities. By integrating these technologies into the design and production process of adjusted clothing, this allows the assurance of greater diversity, accessibility and inclusion in the fashion industry.

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