

## 3D Virtual Try-On: The Avatar at Center Stage

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### Abstract

Being the true clones of real humans – regardless if they have been body-scanned or built from scratch –, 3D avatars are getting more attention in the fashion industry, thanks to the development of virtual try-on. With increased confidence in the virtual representation of reality (human body, garment and fabrics), fashion designers and pattern makers now work collaboratively. The 3D representation of a garment on a 3D avatar is now the base of discussion between professionals with different technical backgrounds and vocabulary – before a single piece of fabric is cut and assembled! Thanks to body-scanning capabilities, the numerous postures of a 3D avatar can facilitate the development of styles and collections. A demanding consumer can now literally give his/her own avatar – his/her body-scan – for apparel professionals to adjust garments to his/her own morphology. The 3D avatar is at center stage, boosting virtual try-ons. The lecturer will present how the 3D representation of postures, garment pieces, and fabrics are crucial in making informed decisions, before a garment is produced. Both ready-to-wear and made-to-measure market segments will benefit from a 3D-based enhanced collaboration between fashion designers and pattern makers.

*Keywords: 3D body-scanning, 3D prototyping, virtual try-on, 3D avatar, mannequin, garment, customization, fashion, apparel, designer, pattern maker, technical designer.*

### 1. Introduction

The wooden mannequin is a traditional working tool for pattern makers creating garments for ready-to-wear and for haute couture. It corresponds to a "theoretical" body, made up of body measurements in a given size, a volume and a posture. The wooden mannequin is a support used to finalize the garment, from a technical and a style point of view.



*Fig. 1. Developing a model on a mannequin in an apparel design department*

The way in which a garment is worn is linked to its use ("casual", "tight-fitting" etc.). The mannequin used corresponds to the commercial size of the garment, which is still a theoretical size.

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Fig. 2. Examples of the different mannequins used in apparel design departments

## 2. Consumers and sizing: an economic problem

In recent years, body scanner technology has been used to gather the measurements of different populations for different industries who need to take human body measurements into account when designing their products [2]. For example, the apparel industry uses this data to create garment sizes, whereas for the furniture and automotive industries this information is essential when calculating seating space. These sizing systems are based on anthropometric data, including measurements and morphotypes.

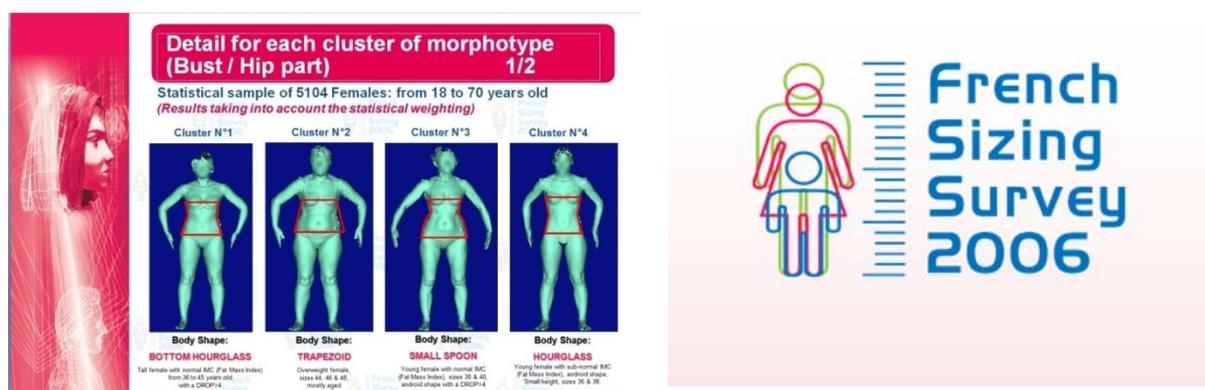


Fig. 3. 2006 French sizing survey [2]

In apparel, to finalize a garment in the different target sizes, it is not sufficient to simply "scale up" the wooden mannequin. We also need to take into account morphological changes. This is especially clear when we look at children's wear and plus sizes, where the morphologies are very different from one size to another.

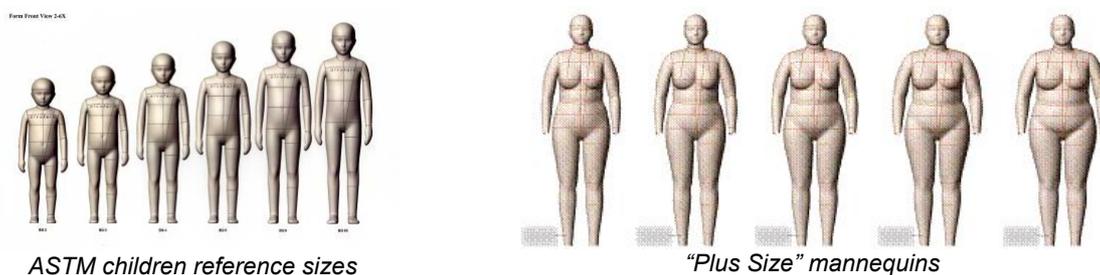


Fig. 4. Alvanon mannequins in different sizes and morphologies

Hence the importance for a brand or a retailer to know their end-consumers and to take their morphology into account right from the start when finalizing the garment [3], by trying it on real people.



Fig. 5. Example of how the Levi's brand handles consumer morphology [3]

Until now, this problem was handled by the technical departments in apparel companies (pattern-making or technical-design departments). With the advent of the 3D virtual representation of the human body (body scan and 3D avatars), it is now easier for the marketing departments to view customer morphology for a given country and to make decisions about their target clientele.

### 3. Integration of virtual prototyping to the product development process

For several years now, the apparel industry has been using virtual prototyping in its collection development process as part of the ongoing search to optimize costs and time-to-market. Several apparel CAD editors have a 3D prototyping offer. They are based on taking into account the human body, fabrics and the garment pieces (pattern) in 3D.



Fig. 6. 3D simulation of a skirt pattern (straight part) on an avatar of a scanned person (source: Lectra)

The success of a model lies, not only in its stylistic and technical pertinence in the basic size, but also in all of the brand or distributor's target sizes as defined by their marketing strategy – which sizes for which consumers?

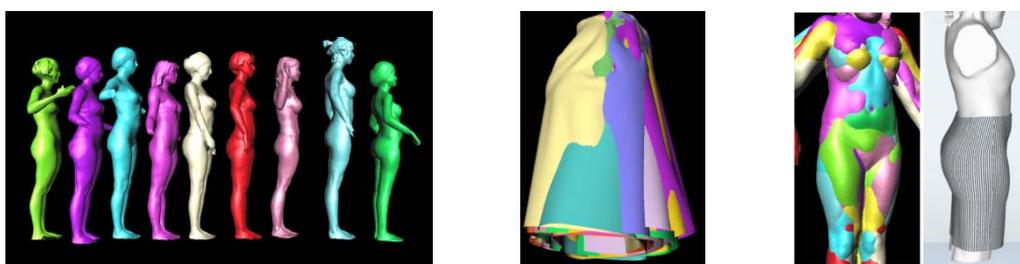
In a made-to-measure garment development process, the 3D avatar based on the end-customer's scan comes into its own, as it avoids the need for the customer to be physically present to try on the garment after each adjustment [4]: only one fitting session with the customer is necessary (compared to three on average to finalize a model for a given customer). The other fitting sessions are done on the 3D avatar.

#### 4. Taking the end-consumer into account

Having a collection of scans corresponding to a representative cross section of customer morphotypes – and the corresponding 3D avatars – lets brands carry out more accurate trying-on sessions during the collection finalization phase.

If a brand or a distributor does not use the results of the last measurement surveys to define their target and the mannequins needed to finalize their garments, using body scanner technology, they are able to identify different morphological groups and sizes so that they can select the people who best represent their target customers. Once transformed into 3D avatars, these people can be used as a base for developing the collections.

As part of an experiment, students in the same age range and the same clothing size developed the same skirt using a pattern-making, grading and 3D simulation solution, based on their scans which had been transformed into 3D avatars. Using the 3D simulation, they were easily able to see the adjustments necessary for a better fit and better balance of the garment for this group of people considered to represent a size.



*Fig. 7. 3D avatars of same age, same size students (left), fusion of the same skirt simulated in 3D on each 3D avatar (center); fusion of 3D avatars (right) and skirt simulated in 3D*

#### 5. The importance of postures

In developing ready-to-wear garments, we must also take into account the influence of human posture on the fit and balance of the garment. For example: the raised leg posture is important when finalizing a skirt or pants and the legs together posture for a dress.



*Fig. 8. Examples of particular postures for finalizing particular garments*

This notion of posture becomes even more important when considering sportswear or technical garments: to finalize a ski suit or cycling outfit, we need to take into account the "crouched" posture, whereas for swimwear or workwear, the "raised arms" position is essential.

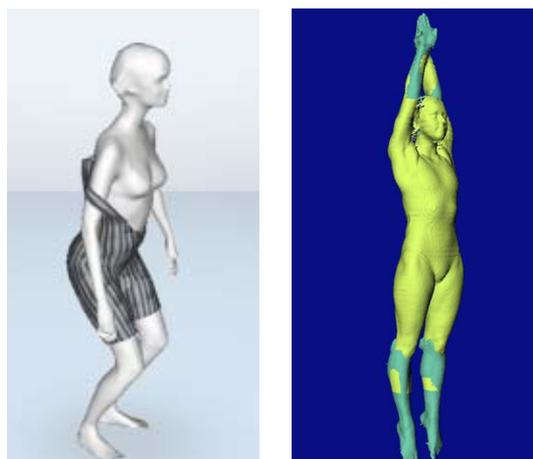


Fig. 9. Examples of particular postures for finalizing particular garments

Simply using a body-scanner to take correct measurements of a human body in order to select the right 3D mannequin is no longer enough: we have to be able, technically, to scan a human body in a variety of postures. These evaluation postures may however pose problems during acquisition: "shadowy areas" make it difficult to clearly identify certain parts of the body or parts of the model are outside the framework of the body-scanner... In that case we are obliged to use computer 3D data processing technology to recreate an avatar which can be used to finalize garments (fill-in the holes, symmetrize part of the body...) [6].

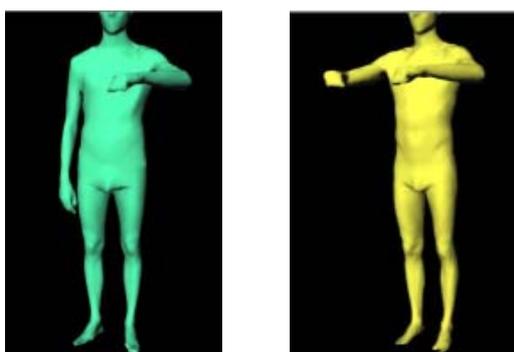


Fig. 10. Original avatar of a brand's mannequin in a special posture (left) and the same avatar (right) after symmetrization of the left side of the body using an ad hoc 3D software program.

Product development is better if the virtual trying on is carried out on a variety of 3D avatars representing the same person in different postures specific to the garment rather than a single 3D mannequin. If 3D CAD editors currently offer adjustable and "posture-able"– even moving – 3D mannequins, they do not take into account the different distribution of muscle mass depending on the different positions of the human body [7, 8]. Work is currently under way to try to predict the distribution of muscle mass based on a sample of scans [9, 10].



Fig. 11. 3D avatars showing different muscle distribution depending on the posture adopted

Scanning a person therefore enables apparel professionals to try on garments virtually, and to have complete confidence in this 3D process [11].

## 6. Conclusion: which 3D avatars for which customers?

Aesthetics are paramount for many brands and distributors. To finalize and try on their garments, they will choose as mannequins people who correspond to their image of the end-customer, particularly in luxury goods. Others (particularly in ready-to-wear and fast fashion) would prefer to use as mannequins people who most resemble their customers. The workwear segment also has to adapt to the different morphologies their customers may encounter.

To ensure a better quality of development using 3D avatars, CAD vendors and apparel consultants must know how to listen to their customers – brands and distributors – and take into account not only their target consumers, but also the range of garments offered, by line and by collections, as well as the use of said garments. With these elements, they can advise on the best choice of postures to be adopted by people during body-scanning to be able to generate the right 3D avatars. This of course implies that, in addition to taking measurements, the manufacturers of body-scanning equipment are able to capture a much wider range of postures.

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