

# Historical Costume Simulation

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## Abstract

*The aim of this study is to produce accurate reproductions of digital clothing from historical sources and to investigate the implications of developing it for online museum exhibits. In order to achieve this, the study is going through several stages. Firstly, the theoretical background of the main issues will be established through the review of various published papers on 3D apparel CAD, drape and digital curation. Next, using a 3D apparel CAD system, this study attempts the realistic visualization of the costumes based on the establishment of a valid simulation reference. This paper reports the pilot exercise carried out to scope the requirements for going forward.*

## Key Words:

## I. INTRODUCTION

The progress of technology and the digital revolution have brought about changes within many aspects of society. New forms of media have become widely prevalent across the spectrum. In the context of museums, new advances in visualisation have affected the way in which these institutions display their exhibits, how they conduct their operational processes and how they build the relationship with visitors [2]. The development of new media has promoted the establishment of databases of information, such as the digitisation of collection information, the use of which has become commonplace. The distillation of media into computer data is characterised by its programmability, as a result of which the possibility of other features such as modularity, automation, variability and transcoding now become conceivable [4]. These characteristics of new media reflect the potential for more attractive and efficient means of delivering the information that museum collections possess, and leaving behind traditional ways of displaying their materials.

Meanwhile, the advance of technology has assisted the world of fashion in developing a variety of computer-aided design systems. Most promisingly, 3D apparel CAD is attracting attention as a remarkable technology which could enable a reduction of time and cost in the design process through virtual simulation. Aside from this, the technology behind 3D apparel CAD is being applied in diverse ways. It has been combined with

information technology to produce new collaborations and breakthroughs with the fields of cyber space, interaction and visual techniques. The prominence of fashion in virtual space has brought about many changes. One such change enables the emergence of fashion designers whose work is presented on the internet or through digital technology [5]. Many fashion brands are trying to provide personalised products using online avatars and virtual clothing. ‘Cybercouture’ [5]<sup>1</sup> and ‘digital clothing’ [3]<sup>2</sup> are words that are part of the new lexicon derived from this phenomenon. Additionally, digital clothing technology has been utilised in the film and game industries. It is expected that the range and the scope of the technology will increase over time.

However, despite the possibilities, research on digital clothing has been parochial in nature, inclining primarily toward improving aspects of the engineering, such as simulation techniques and the development of tools on the technical side, and basic pattern development on the design side. Though these aspects form the fundamental base of its utilisation, this study claims that the industry needs to pay more attention to the user experience as the technology becomes more prevalent in our daily lives. In this respect, the authors try to explore the applications and prospects of digital clothing technology, and to extend the existing boundaries of its practical use. They aim to do so through the subject of reproduction of historical fashion, which optimises the benefits associated with new media. This study expects that the project will produce meaningful results not only for museums and their audiences, but also for the field of digital clothing technology and new media.

## II. MUSEUM OF LONDON

Contact was made with the Senior Curator of The Museum of London and at an invited presentation the outline of the project was introduced to The Museum curation staff. It received a favourable response and the meeting moved on to discuss the help this study required as well as the support which the museum could provide. Following this, access was provided to costumes within

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<sup>1</sup> [5] used ‘Cybercouture’ to describe a fashion code which is created in the cyberspace being affiliated with IT, visual representations and interactivity.

<sup>2</sup> [3] depicted digital clothing as synthetic technology which enables digital representation of garments. This includes design, pattern making, 3D simulation and rendering of clothing.

the museum's collection, and the team was able to engage in data collection for the historical investigation of each dress from the museum. Additionally, the museum staff provided helpful information on topics such as guidelines governing the use of neutral mannequins, which are used in order to avoid sensitive ethical issues.

The schedule for a second visit to the Museum of London was arranged which aimed to select the subjects most relevant to this research from the museum's collection, and to obtain the requisite data.

The process of the subject selection and data collection was carried out with the help of the fashion and decorative art curator. The researchers were advised to use [1]'s costume pattern books in order to obtain more accurate and efficient results.

During the second visit, data collection on three costumes was carried out. The costumes were a c1861-3 day dress, a c1911-2 day dress and a c1928-9 evening dress. The researchers aimed to map out specific parts of the costumes which demonstrated complex structures, irregular shapes or sophisticated techniques by measuring, illustrating and taking photographs (Figure 1). Although [1] identified the important features the additional data collected in the second visit was necessary because the complicated 3D shapes sometimes failed to correspond to the 2D images and textual information.



Figure 1 Data collection

Next, information regarding materials, textures, colours and patterns was identified. The material information was provided by [1]. The textures and patterns of the fabrics were recorded by a digital camera and a scanner, and the size and space of each pattern motif was measured using a tape measure.

Information regarding the ideal body shape at the time, particulars about the mannequins, and relevant details about the underwear such as panniers and corsets was provided by the Museum staff. They demonstrated the process of preparing the mannequin for certain costumes and highlighted some panniers and corsets from the same era. However the researchers could not collect precise measurements for the mannequin and the underwear matching each costume since these items did not correlate to individual dresses. Nevertheless this information would be very useful and important in

precisely representing the costumes. It will be taken into account during the preparation of the virtual bodies.

### III. PILOT PRODUCTION OF A DIGITAL COSTUME

Using the data collected in the previous section, the researchers proceeded with the production of a digital costume.



Figure 2 Evening dress c1928-1929

This was done in order to check the feasibility of the study as well as to reveal technological problems that would have to be surmounted before older and more complicated costumes were tackled.

An evening dress c1928-1929 was selected as the subject for the pilot test (Figure 2). According to [1], this dress is an example of a trend in the mid-1920s, where short skirts gradually became longer. The dress was designed by Pilgrim and Claridge and consists of two items: a slip made of black silk and a dress made of black crepe silk chiffon. The slip has a relatively simple structure; however, the hem is picot-edged and zigzagged. The chiffon dress is decorated with a number of cloth sections around the bodice cut into triangular, petal-like shapes.

### IV. VIRTUAL MODEL GENERATION

A virtual model was created using the MakeHuman software. The size of the body was determined according to the measurements of the garment patterns. A brief investigation was conducted for the expression of the body shape of the time (1920s), as it was a preliminary level test, and the garment, with its H-lined silhouette and lack of petticoat, does not reflect or exaggerate the dynamic shape of a convex body. However, this study tried to produce a somewhat flat body, since Arnold [1] mentioned that the wearer's bust and hip would have been suppressed with a bandeau and a flexible girdle.

For the facial features, this study attempted to imitate a face in a portrait painted by Gerald Brockhurst in 1939 because the information of the wearer was not identified. Although the visualisation of a face may be criticised in the context of the neutrality, this study tried to express the appearance of people from the target period. A grey skin tone was applied to convey neutrality of the model.

Next, the raw generated model was imported into Maya 2012, a 3D modelling and simulation program, for refinement: the connection of separate skin surfaces and the establishment of normal.

## V. PATTERN MAKING

The application 3D apparel CAD, DC Suite 3.0, was used for the pattern making. Based on the collected data of measurements and patterns, a total of 41 and two pattern pieces were produced for the slip and the dress respectively. The basic patterns for the dress provided by [1] actually amounted to 37 pieces; however, four more pieces were generated to take into account the binding of the neckline and the reinforcement of the fabric parts.

## VI. PATTERN POSITIONING

Pattern positioning is a preparatory stage for virtual sewing. Here, the generated patterns were converted into panels and positioned around the body. The 41 pieces of the dress pattern were converted into a total of 66 panel parts, and the two pattern pieces of the slip became five panels. This change in number was caused by the double-layering of the garment parts. Additionally, unintended division of patterns was sometimes required for efficient pattern positioning. The panels were then placed considering the actual position and the sewing sequence of each fabric piece.

## VII. ASSEMBLING

It is a time-consuming practice to assemble all the panels by designating individual seam lines as there are some constraints; for example, any single seam line should not intersect any other, and it should not pass through the virtual body or a panel. In the case of this costume, iterative work of positioning and defining seam lines was required due to the complex structure of a large number of panels.

## VIII. SIMULATION

Three sets of static simulation data sets were produced to check the proper visualisation of the garment. After considering the efficiency of the work, the virtual garment and the model were exported and imported into Maya 2012. In order to achieve the same simulation effects as the DCS, a cloth simulation plug-in called Qualoth was used for the simulation. The multiple uses of these applications have the merit of providing a faster simulation than DCS. For the expression of material properties, this study applied the same values of silk chiffon provided by the DCS. Figure 3 shows the simulation results for the slip, dress and the combination of the slip and dress.

At this stage, the motion data for the project had not yet been designed. In order to observe the dynamic movement of the costume, this study applied a moving

body which was created for another work. Figure 3 shows a scene of the dynamic simulation.



Figure 3 Dynamic simulation

## IX. CONCLUSION

Aside from the superficial representation of the crepe mentioned above, this pilot test showed some limitations.

- Firstly, it was observed that the front neckline was more curved than the actual costume. The pattern of the dress will be modified to angulate the centre of the neckline in the actual development stage.
- Secondly, the seam lines of the garment were not visualised. Since this was a pilot test, only rough visualisation on trial was performed, and it did not take into account the detailed elements. The seam lines of the garment can be expressed by the bump mapping process.
- Thirdly, the drape of the virtual costume was generated using the sample material parameter values suggested by DCS.

It was suggested that this was a reasonably successful pilot study. The research team are now going on to make a real costume of this and other styles in [1] (as the Museum's costumes cannot be removed or deconstructed) and then more accurate simulations will be produced.

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