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Efficiency of 3D Simulation Software Usage to Fit the Jacket Pattern for Obese Women

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Abstract

Effectiveness of the 3D Software in pattern making and assembling the jackets for obese women using the Turkish method, through a comparison between the real and the 3D virtual methods, The research relied on the experimental approach, six different sizes for obese women jackets were selected and assembled by the Turkish pattern block-making method (Real method). In parallel, Gerber software was used to make the pattern block with CLO 3D software for Simulation (Virtual method). The Real and virtual methods for making the jacket were evaluated using a questionnaire by academic expertise. The results were statistically analyzed. It was found that there is no significant difference between the Real and virtual methods, and it was proved that the efficiency of the 3D garment software for obese women jackets, reduces the time and waste of fabric during the garment manufacturing process, and it can also be replaced in the future by the samples and rehearsal section in the garment field.

Keywords: Simulation, 3D garment Software, Fitting, Jacket pattern block, Obese woman.

Introduction

The garment industry is one of the most important economic sectors in terms of investment, trade, and job creation in the world. It contains many stages and steps beginning with the receipt of orders and ending with the shipment of garments to produce various garment types and fashion products, which change frequently according to the fashion lines in style and season[1]

The increasing competition in the global market and the continuous development of information technology, continuous development of information technology, considering the individual needs of consumers in terms of design, fabric type, and clothing size, lead to the garment industry becoming highly productive. Consequently, this was one of the development reasons for clothing companies to absorb the manufacture of products in larger quantities [2].

Under global economic pressure, there was an imperative need for industrial enterprises to design new various products with short life cycles and low costs to meet the personal requirements of consumers in terms of functionality, comfort, and fashion [3].

Given the fierce global competition, the garment industries face multiple challenges to increase productivity and reduce internal costs, keeping pace with rapid development and change. Therefore, the continuous development of the garment industry Is

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due to the change in social and economic life. This makes all producers of garments and researchers compete to provide the necessary factors for the development of this industry [4].

The garment development industry depends on scientific foundations to choose what fits with our society and work on its application in a manner that fits the hypothetical pattern block of the human shape. The hypothetical pattern block was made based on the model block, fabric material, and textile structure of the outfit with different directions of 3D view that helped to develop and improve the product. The simulation of 3D garments shall have a high level of efficiency in designing during the movement of the fabrics, and the more complex the simulation systems the more difficult the design[5]

The possibility of 3D patterns in the market provided an opportunity to visually assess the design from different angles. Gavels' design system by utilizing 3D programs helped to choose the suitable type of fabric for each design from among the more types available through the screen. Also, some systems could make the designer move the cloth around the body, and this type of system was always done to raise the price and the total value of the garments [6], [7].

A study published by (Hong, Y et al) about 3D simulation to control the relationship between design and pattern, proved the effectiveness of 3D simulation for the human body and was used in adjusting the pattern blocks completely to find solutions to problems of adjusting clothes with the body and the accuracy of implementing the design [6].

Many studies aimed to analyze the current state of the garment industry through 3D simulations and to study commercially available software. What were the selection criteria adopted by these companies and what forms of support are provided by other organizations for the implementation of 3D[8].

Jintao pointed to Implementing new garments, representing a garments pattern block, with start-up and operating easily, and processing some parts such as sweaters and hats with the required accuracy by setting curves on the pattern block of the garments, in return for that in the clothing parts of the prototype of the upper clothing for people with scoliosis [6].

Yong Joon Lee et al., 2013 study included how to transfer the flat pattern block on the 3D body without changed or distorted the basic pattern block, the study noted to the succeed of the experiment in simulating skirts and pattern blocks that do not require a lot of folds, but faced a problem in The places of overlap, especially between the feet, and resulted in the realistic use of the simulation system in the method of formation and simulation of the cloth without took a lot of time and with high quality[9]. Also, Huang H.Q. et al., 2012 reached the development of a method to generate 2D and 3D design pattern blocks by scanning from the body, the results indicate that the proposed method was easy to implement and could generate new pattern blocks to create a specialized clothing library with the low cast [10]

L. Jianget all, 2019 designed a simulated pattern block of the human body and dress pattern blocks for the body designed of 4D system and used independently to control the body and clothing and pattern block, to represent distortions in the garment, then was applied to the human body, the results concluded that this approach was implemented well and could be used in the manufacture of ready-made clothes, and self-adjustments are made to the defects of the pattern block, making it suitable for t for the human body pattern block and reducing the cost of these stages, time and labor availability [11].

.H.McQuillan pointed to the usage of 3D programs in fashion design and implementation of pattern blocks, taking into account not wasting any of the materials, by using 3D programs to apply them to the two-dimensional pattern blocks to ensure the process of adjustment and the general shape of the clothes [12]. Where the study of C. Li and F. Cohen, 2021 present a new way to create a virtual dressing room inside the house for knitting through an integrated 3D system so that the clothes we suitable for the human body and the use of pattern blocks extracted from it in the implementation process by taking two pictures across the camera or smartphone [13].

The previous research and studies that dealt with the problems of basic pattern blocks and modified pattern blocks varied and achieved control rates for obese women, it was found that Gill S: 2015 aimed to contribute to providing reliable, and human measurements as the basis for creating appropriate and practical clothes and essential for communication With the size of the clothes, raising the retail value, the ease of comparison between the Real 2D pattern block and Real method, and the ease of providing all the required data to facilitate the development process [12].

Hernández N et al., 2018 focused on determining the amount of comfort that was added to the pattern block between the clothing product and the human body using a 3D mannequin, as this resulted in proving realistic results for the shape and properties of materials in simulation programs for

fabrics on the human body, and the results also showed the presence of other problems in pattern blocks by introduced modern simulation systems to obtain a fit pattern block [13].

Saeed M., 2018 discussed the adjustment processes in knitting garments using different materials and fabrics, but not all materials gave good and desirable results, many designers face problems regarding installing the shoulder line and, line Neck, sleeve, and waist circumference problems [14].

K. O. Kim, M. Sakaguchi, and M. Takatera, 2020 focused on verifying the appropriate place for the chest line on the upper part of the clothes and its impact on the aesthetic appearance of the body and how to provide an appropriate balance between the chest circumference and the waist circumference in terms of design and comfort. Six items shall be assessed; wrinkles, fit, attractiveness, beauty, and slimming. This study helps manufacturers create beautiful, high-quality clothing [15]. One of the studies showed that the process of draping around the neckline may differ from one design to another, depending on the desired pattern block and the method of making the pattern block, but these methods could be used in the lower part of the clothes such as skirts, dresses, and pants. [16].

Cha s. 2022 classified the upper body types of Korean adult obese women using student data and compare the difference between body types according to three age groups, results revealed seven factors according to factor analysis and three types of obese bodies [17].

Seong O., 2017 study dealt with the shapes of the bodies of obese elderly women, to contribute to modifying the pattern blocks to address the defects. CLO 3D software was used together with virtual models for obese elderly women. The study concluded that there are three forms of the bodies of obese women; Lower part obesity From the body, Obesity around the abdomen, and Obesity for the whole body. The second part of the study designed models and measured the Real sizes of women such as the waist, hip ... *etc*. to improve the external appearance of clothes for obese elderly women [18].

Through the previous review, this study aims to make a comparison between the Real and the virtual implementation of a sample of jackets for obese women, as it is a widespread category in society and lacks the appropriate design with an appropriate and acceptable external shape with the suitable cost and ease of manufacturing.

Materials and Methods

The jacket design was determined to be implemented using Real and virtual methods. Six different sizes for obese women's jackets were selected and assembled through the Turkish pattern block-making method as an Real method, and apply the virtual method on them by CLO 3D software for simulation. after that, the comparison between the two methods used was done for implemented samples of jackets.

Table 1: Body mass of samples.

	Sample (1)	Sample (2)	Sample (3)	Sample (4)	Sample (5)	Sample (6)
Weight (Kg)	92	110	113	110	93	82
Height (Cm)	151	170	161	156	156	160
Mass	40.3	38.0	43.5	45.2	38.2	32.0

Body mass was used because it is the method approved by the World Health Organization (WHO) to determine the percentage of obesity among women. The mass index used for This paper is between (30-45) gm for women with different backgrounds to present all styles in this mass category. In addition, Through the study that was conducted by (Somaia, Rania, Emad and Doaa)[19], where the study compared 3 different methods 1- Russian method [20] 2- English method [21] 3- Turkish method [22]of pattern the jacket and experimenting with them on obese women and choosing the best one. The Turkish method [22]was reached, which is the best way to adjust the jacket for obese women, which contributed to the conduct of the current study.

The Gerber Accumark program was also used to ensure accurate manufacturing and execution for implementing the six 6 jackets. The estimation scale in the women's jacket for obese women was divided into 5 different elements, which are (front - back - collar - sideline - sleeve), each of these elements was evaluated by several items (balance - grain – set - ease- drooping) to achieve garments fitting. The lines' garment consists of (chest line - waist line - hip line - half front line - halfback line). For each cotton jacket implemented with the Turkish method a different mass index, additionally differences in the chest dart to the inside line, the placket in the middle of the front, the center dart in the front and back, and the dart of the shoulder line. The sleeves had 2 pieces, and the jacket tall is 5 cm under the hip line.

The statistical parameters were divided into 6 parts; front, back, collar, sleeve, sideline, and total jacket, and compared between implemented jackets by Real and virtual methods, the questionnaire was done depending on the opinions of arbitrators, and studied the statistically significant differences in results.

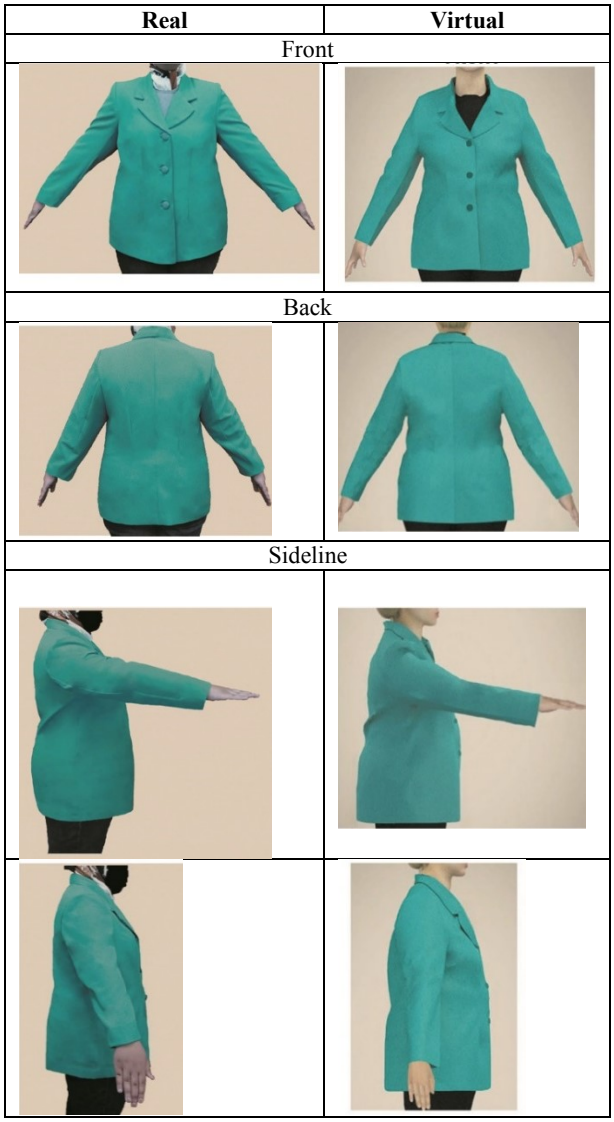

Fig. 1. Real and Virtual jackets' sample

Results and Discussion

The variables were evaluated questionnaire results for the implemented samples of jackets by Real and Virtual methods, and the comparison between the two methods used was done through the following variables: front, back, collar, sideline, sleeve, and all jackets. The statistical treatments were conducted to find out if there are statistically significant differences between the Real and Virtual methods of garment fitting.

Table 2: The differences in results of a questionnaire between the samples implemented with Real and virtual methods.

Variables	Execution	No.	Mean	SD	T-Value	df	Sig. (2-tailed)
Front	Real	11	46.55	2.632	-3.005	130	.003*
	Virtual		47.62	1.237			
Back	Real	11	47.00	1.336	-1.709	130	.090
	Virtual		47.41	1.414			
Collar	Real	11	32.52	1.460	.246	130	.806
	Virtual		32.45	1.372			
Side line	Real	11	32.17	1.117	-.678	130	.499
	Virtual		32.35	1.869			
Sleeve	Real	11	22.88	1.741	-1.374	130	.172
	Virtual		23.29	1.680			
Total Jacket	Real	11	181.11	6.039	-1.940	130	.055
	Virtual		183.12	5.895			

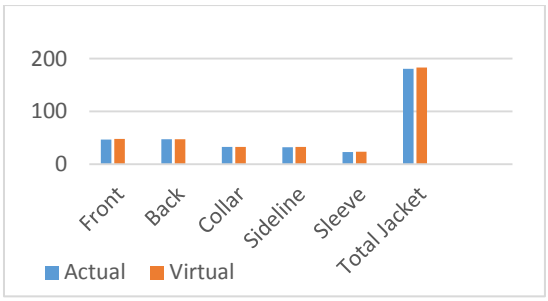

Fig. 2: The graph represents the mean difference between the samples implemented with Real and virtual methods.

* Significant

Table 2 Shows the following results:

- In the Front: There are statistically significant differences between Real garments and Virtual garments, where T-value is (-3.005), a statistically significant value on the significance level (0.01) in favor of Virtual garments.
- In the Back: There are no statistically significant differences between the Real and Virtual garments, where T-value is (-1.709), and the level of significance is (0.09).
- In the Collar: There are no statistically significant differences between the Real and Virtual garments, where T-value is (0.246), and the level of significance is (0.80).
- In the Sideline: There are no statistically significant differences between the Real and Virtual garments, where T-value is (-0.678), and the level of significance is (0.49).
- In the Sleeve: There are no statistically significant differences between the Real and Virtual garments,

where T-value is (-1.374), and the level of significance is (0.17).
- Total Jacket: There are no statistically significant differences between the Real and Virtual garments, where T-value is (-1.940), and the level of significance is (.06).

The previous results show that nodifferences between the Real and Virtual garments for all parts except in the front,this leads to an inevitable result, which rel ied on the virtual method for garment fitting, Especially for obese women).

Conclusions

There is a lack of comparative studies between the different ways of producing clothes in Real and virtual methods using simulation programs. Therefore, in this study, the researcher chose the classic women's jacket for obese women as the main focus for the comparative study between the Real and virtual methods of jacket production. Six samples were selected with a mass ranging from 30 to 45 with a difference between length and size. Then the basic pattern block for the classic women's jacket was drawn using the Turkish pattern by Erbil Cihangir [21].
The cotton material was used to implement an Real jacket and deternined the thickness and weight of cotton cloth were for recording in the Clo3D software and printing the block pattern for the six samples. cut and perform were done for the jackets, after that, the pattern block of pieces for each sample was exported to the Clo3D program via the DXF extension. And after selecting a suitable virtual mannequin through the CLO 3D program, and taking fixed snapshots from the front, back, and sideline. also after implementing Real jackets, the researcher photographed each sample of the samples while wearing the realistic Jacket from the front, back, and sideline.
The evaluation was done through arbitration by professors specialized in the field of making the pattern block for a jacket for women, after that the comparison between the samples produced with the two methods was done by statistics. it is evident from the results that there are no essential differences between the real and the virtual jacket.
The study proved that there are no statistically significant differences between Real jackets and virtual jackets, and so in the future it is possible to rely on virtual programs in determining the proportions of control and comfort for clothing for obese women in many products. in addition to many studies must be conducted for different materials other cotton to produce the obese women' jackets.

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كفاءة استخدام المحاكاة ثلاثية الأبعاد لضبط نموذج الجاكيت للمرأة البدينة

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الملخص

يهدف البحث إلى قياس فاعلية البرامج ثلاثية الأبعاد (3D Program) في بناء وتنفيذ نموذج الجاكيت للمرأة البدينة باستخدام الطريقة التركية وذلك من خلال المقارنة بين الطريقة التقليدية والطريقة الافتراضية الثلاثية الابعاد (3D) بناء النموذج وتنفيذة، وقد اعتمدت الباحثة على المنهج التجريبي لتحقيق أهداف الدراسة وتكونت عينة الدراسة من ستة مفردات، وتم استخدام مقياس التقدير للنماذج المنفذة، وتم التحكيم من خلال الأساتذة المتخصصين في مجال تثصنيع الملابس الجاهزة، حيث تمت المقارنة بين الطريقة التقليدية على القماش القطنى والطريقة الافتراضية المطبقة من خلال برنامج CLO3D Fashion Software. واوضحت النتائج الأثر الإيجابي لاستخدام الطريقة الافتراضية في عمليات ضبط الجاكيت للمرأة البدينة، كما تشابه الجاكيت التقليدي إلى حد كبير مع الجاكيت الافتراضي عند المقارنه بين الطريقتين. وأكدت النتائج ايضا عدم وجود فروق جوهرية في الشكل العام والضبط بين الطريقتين، مما يشير الى ان استخدام الطريقة الافتراضية تقليل من الوقت وهالك القماش اثناء عملية تصنيع الملابس الجاهزة، كما يمكن الاستعاضة بها مستقبلا عن قسم العينات والبروفة في مصانع الملابس الجاهزة.

الكلمات الدالة: CLO 3D- المحاكاة ثلاثية الأبعاد- الضبط- باترون الجاكيت الحريمي