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Employment of the Programs (3DS MAX & MARVELOUS DESIGNER) in Draping the Pleats on the Mannequin (A Comparative Study)

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ABSTRACT

Draping on the mannequin is considered one of the arts that belong to the Plastic Arts, and it is also considered one of the most important methods that help the fashion designer in achieving his ideas, it is a realistic and practical method that helps in creating and designing fashion, In addition to the ability to judge the suitability of designs and innovative ideas for the implementation process, in addition to judging the suitability of the design for the different bodies patterns, in addition to the above, the experience of dealing with the materials that used with a delicate and high artistic sense with all the different technical possibilities that can be carried.

The recommendations of this study is to Seeking for all that is new in studying the art of draping on the mannequin and discovering more computer programs, and to experimenting the draping on the virtual mannequin with various types of materials, and also to employing the universities and the higher institutes in the Kingdom of Saudi Arabia and urging them to procedure more research and studies that serve the industry.

Keywords: 3DS MAX, MARVELOUS DESIGNER, Mannequin.

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Introduction

Draping on the mannequin is considered one of the high level methods that used by the designer, which requires talent, deep skill and experience of a high level. And the draping on the mannequin is considered one of the arts of scientific origins, in addition to the manual skill that must be acquired in order to reach a work of art that has quality and mastery, as well as achieving the aesthetic aspect, so that the designs produced perform their utilitarian and aesthetic function. Draping on the mannequin is also considered one of the Applied Arts that depends on the artist's skilled hands in forming materials on the three-dimensional body, and by coordinating the elements of modeling in a unified artwork, in addition to reaching aesthetic and functional relations, and at the same time you can embody the idea of the modeling artist on the mannequin in designs characterized by creativity that the recipient can taste and accept them to wear. (Khafaji, 2021) and this agrees with the study (Hassouna, 2003 AD) and the study (Nour, 2006 AD), which emphasized that the design on the mannequin is the result of the production of the innovative process carried out by the designer to bring out his idea and embody it into fact.

Working in the style of draping on the mannequin provides more than one opportunity for creativity and devising new dimensions in the design, especially when analyzing how the fabric hangs and moves with the shape of the human body (Mo'men, 2001 AD). The mannequin itself helps to innovate because its presence in its size and shape in its three dimensions "height, width, depth" during the molding process, be enough to imagine the proportions and details of the design, so it immediately shows the appropriateness of the design with its proportions, cuts and folds, and its consistency with the size and shape of the actual mannequin (Kus, Unver & Taylor, 2009). And the above agrees with the study (Ali, 2005 AD), and the study (Hijazi, 2005 AD), which aimed to identify the properties of some materials in light of the possibility of modeling them.

Besides that draping on the mannequin is one of the methods of innovation and high-end sewing that requires high ability, skill, talent and experience, and knowledge of sufficient information about fabrics and the human body to achieve design requirements (Aldrich, 1996), but it is also one of the methods used in designing and preparing the pattern through modeling fabrics on the mannequin to achieve harmony between design and fabric (Al-Zeftawi, 1999 AD), and it is an artistic and scientific method that needs artistic talent and the ability to innovate as well, and it is a scientific method that needs to study and be familiar with everything new in the artistic fields (Mo'men, 1995 AD), and techniques for implementing models and familiarity with technological progress in the field of fabrics and tools that help to implement this method by using fabric, which is the basis in the modeling process (Armstong, 2000 AD).

The process of draping the fabric on the mannequin to make folds or pleats requires high efficiency, flexibility and freedom during the implementation, and it does not depend on certain rules or laws or a certain amount of fabric inside each fold to make the pleat (Hassouna, 2003), but the draping process takes place

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according to the feel of the person who makes the draping and his skill and ability on perfection according to the requirements of the fabric and the shape and size of the body (Al-Zeftawi, 2002).

One of the most important fabrics that have special requirements and nature is chiffon fabrics, which are characterized by looseness, flexibility and dropping over the body, so it takes its shape no matter how many pleats are, to give a good result in making folds and that due to the low weight and thickness, which makes it easy to bend and drape it on the mannequin. (Mo'men, 2000)

The studies that use the draping of pleats folds on the "virtual" mannequin by using the computer and applying them by using the (Marvelous designer & 3DS MAX) programs or using the computer in draping on the mannequin is one of the most important issues that must be addressed, especially in the current era (the era of technology and advanced technologies) and relying on it by using the "virtual" mannequin and this agrees with the study (Sanjeev Muralikrishnan & Parag Chaudhuri-2016)) as well as the study (Umetani, N. Kaufman.D. M, Igarashi.T & Grinspun. E (2011)), which emphasized the importance and effectiveness of using the computer in draping on the mannequin in the virtual reality and how to apply that, and which had to study its steps, implementation and comparing between them and from here the research problem crystallized.

Problem of the research:

The draping method on the mannequin is considered one of the innovative methods by using computer programs, so the researcher chose the MARVELOUS DESIGNER & 3DS MAX programs in her application because of their efficiency and wide spread in use, where the researcher draped the pleats on the "virtual" mannequin and made a comparison between the two programs in regard of the designs that resulted from the draping process, and from the above, the research problem can be identified and crystallized in the following questions:

1- What is the possibility of employing the programs (3DS MAX & MARVELOUS DESIGNER) by using the computer in draping the pleats on the mannequin on the "virtual" mannequin?

2- What are the scientific steps used in draping the pleats on the "virtual" mannequin by using the computer in the 3DS MAX & MARVELOUS DESIGNER programs?

3- What is the difference between the designs produced from the process of draping the pleats on the "virtual" mannequin by using the computer in the 3DS MAX & MARVELOUS DESIGNER programs?

4- What is the extent of the acceptance of the fashion design specialists and modeling on the mannequin for the designs that are implemented by the computer by using the 3DS MAX & MARVELOUS DESIGNER programs?

Objectives of the research:

1- Employing the programs (3DS MAX & MARVELOUS DESIGNER) by using the computer in draping the pleats on the mannequin on the "virtual" mannequin.

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2- Determining the scientific steps that can be used in draping the pleats on the "virtual" mannequin by using the computer in the 3DS MAX & MARVELOUS DESIGNER programs.
3- Comparing between the proposed designs of the process of draping the pleats on the "virtual" mannequin by using the computer in the 3DS MAX & MARVELOUS DESIGNER programs.
4- Determine the specialists' opinions in fashion design and modeling on the mannequin in the proposed designs.

Importance of the research:

The importance of the research is due to:

1- An attempt to highlight the importance of using the computer to the Marvelous Designer & 3DS MAX programs in draping the pleats on the mannequin by using the "virtual" mannequin.
2- The research presents a new artistic vision for the use of computer for the (Marvelous Designer & 3DS MAX) programs in the style of draping the pleats on the "virtual" mannequin
3- The research is considered an addition to the Arabic library due to the scarcity of research on draping the pleats on the "virtual" mannequin by using the computer.

Definition s of the research:

Draping:

It is a method of fabric drooping over the mannequin's body, starting from the shoulder line to the waist line, and the word "drape" means the fabric (Al-Thubaiti, 2009 AD).

Mannequin:

It is considered an inspiration element from the elements of draping on the mannequin, and one of the main tools used in draping , which represents the shape of the human body in the form of a three-dimensional mold, and it is considered a source of inspiration for the fashion designer with his ideas and designs. It also used in designing, preparing models, modeling and adjusting clothes (Al-Zeftawi, 1999).

Draping on the mannequin:

It means "Draping" or "Modeling", also it can be as "Modeling on the dress-stand" or "Modeling on the dress-form", and it is one of the methods of producing clothes by an individual method, also it has fixed foundations and rules and requires skill, experience and accuracy in the person using this method. Draping may enter into one of the stages of producing the ready-made clothes, and it is also one of the methods of fashion design and the preparation of the incarnate patterns for clothes. It is also considered a special method for the distinguished designs, which are difficult to implement by means of flat patterns (Mo'men, 2001).

Draping on the mannequin is considered one of the fashion design methods that depend on achieving harmony among the design, the fabric and the shape of the body, and through it the designer can implement his idea in a direct way and know its results immediately. The method of draping on the mannequin has its own techniques, because it is considered one of the high-end sewing methods that require techniques

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at a high level of accuracy and skill during the processes of formation and implementation. (Shukri et al., 2003 AD).

Pleats:

They are the folds and pleats so that the area of the fabric is equal, and in the normal pleats they are ironed by heat fixation of the fabric and they consist of folds inside and outside mutually and evenly (Calasibetta, 1983).

They are folds that result from folding the material on top of each other to form three layers, then they are sewn from the upper part of them, and the depth of the fold varies according to the type of the material and the design to be implemented. The folds are formed by adding an extra amount of fabric and the bottom line of the piece (tail line) to be folded is first folded down and then the folds are pressed (ironed) with steam. (Al-Desouki et al., 2021 AD).

Chiffon Fabric:

It is a transparent, lightweight fabric with a plain weave composition that is woven from natural silk, rayon or cotton threads. Chiffon fabric is characterized by forming soft folds and calm, streamlining designs that give a sense of femininity.(Abd Al-qadir, 2002 AD)

3DS MAX program:

It is one of the most powerful 3D engineering design programs created by Autodesk, the program is based on finding an environment to work on a wide land and creating incarnate models as imagined by the designer and it is controlled and modified by the program tools that are available in the program and simulating them in reality in the final Marvelous designer stage, the stage of presenting the design in 3D image. (Nasr Allah, 2015 AD).

Marvelous Designer program:

It is considered one of the best three-dimensional design programs currently in depicting the shape of the three-dimensional costume with showing the shapes of the fabrics (Taylor, A, Unver & Worth, 2003)) and the way they are drooping around the body and their touches, colors and printing in addition to moving the "virtual" mannequin. (Kus, Unver & Taylor, 2009).

Hypothesis of the research:

1- There are statistically significant differences between the mean scores of the two methods "3DS MAX, Marvelous" used to drape the pleats on the mannequin for the first design.

2- There are statistically significant differences between the mean scores of the two methods "3DS MAX, Marvelous" used to drape the pleats on the mannequin for the second design.

Procedures of the research:

A) Methodology of the research:

This research follows the following two approaches:

- The experimental approach:

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It is the use of experiment to measure and control variables in proving hypotheses (Badr, 1982 AD). The current study is limited to procedure the design steps and draping the pleats on the "virtual" mannequin by using the computer and the method of implementing them.

- The descriptive approach:

It includes a lot of forms, the most important of which is to prove hypotheses (Obeidat et al., 1989 AD) to evaluate the method of draping and implementing on the "virtual" mannequin, and it includes general descriptive and analytical studies, and expresses them qualitatively or quantitatively, which are represented in the evaluation scale analysis (evaluation items form) for designs that are implemented by using the techniques of Marvelous Designer & 3DS MAX computer programs agreed upon in the study with the use of appropriate statistical analysis in linking the results of the design steps and draping the pleats on the "virtual" mannequin with the results of the techniques of using the computer programs Marvelous designer & 3DS MAX, the subject of the current study.

B) Tools of the research:

Programs and tools used in this study:

- 3DS MAX computer program
- Marvelous Designer 2 computer program
- "Virtual" mannequin
- A questioner of the arbitrators' opinions on the implemented and draped designs on the "virtual" mannequin by using Chiffon fabrics, and it included five axes as follows:

The front: 5 items. The back: 5 items. The side: 5 items
The drooping: 3 items. The general shape: 3 items

- Digital Camera

C) Sample of the research:

The research sample includes the designs that draped on the "virtual" mannequin, which number is (2) clothing pieces, represented by the design and pleats draping steps of the "virtual" mannequin, and the implementation of the correct and appropriate technique for the used skill type. The number of arbitrators came (8) academically specialized in the field of draping on the mannequin, fashion design, and specialized computer, where they judged the designs that implemented with the appropriate techniques for the type of skills that formed on the "virtual" mannequin.

The applied "practical" aspect:

Presenting and analyzing the clothing designs and the steps of draping and implementing them on the mannequin by using the 3D design programs (3DS MAX & Marvelous Designer).

About Marvelous Designer program

It is an interactive three-dimensional program to design fashion , clothing and high-end sewing, it supports folding, bending, wrapping, gathering , and a lot of features such as cutting, bending, density, thickness and control by simulating

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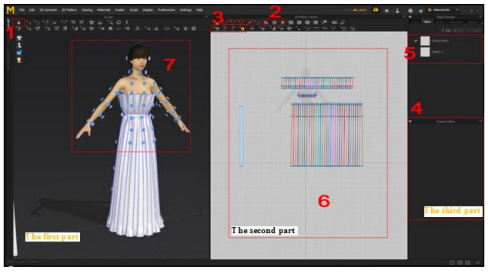
different types of materials and fabrics. The program accepts importing files of models exported from the most famous 3D design programs.

The second part



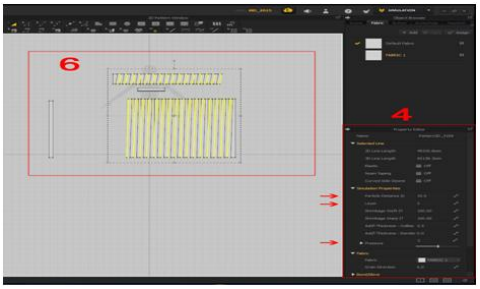
Picture (1)

Program interface:

The program has an organized interface in a way that makes it easy to deal with the model, as it is divided into three main parts as shown in Picture (1)

- The first part contains the body of the mannequin and can be controlled through the simulation toolbar.
- The second part contains the pattern and can be controlled by the pattern drawing toolbar, the sewing toolbar and the textile tools.
- The third part contains the objects browser and properties editor:

1- Library and simulation tools
2- Pattern drawing and sewing tools
3- Textile tools
4- Properties Editor
5- Objects Browser
6- Pattern drawing screen and its show
7- Screen of applying on the mannequin.



Picture (2)

The steps in Marvelous Designer program:

The first stage: drawing the pattern as shown in Picture (2)

1- Open the program and choose drawing properties (Shadow - Light Ratio - Edge Enhancement).
2- Open a new file from the (file > new) list to start a new design, or the (open) command to open a pre-worked design.
3- Select the mannequin (men or women) from the (file > open > avatar) list from the drop-down list after selecting the drawing scale.

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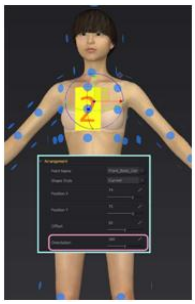
4- Start using the drawing toolbar to draw the required pattern in Part 6 of the interface.

The second stage: synchronization

When finish drawing the pattern pieces, we select from the (cloth) list the (sync) command to sync until the pattern pieces appear on the mannequin.

1- Arranging the pattern pieces in their correct places by using the (Arrangement Sphere) property and it appears when the mouse is standing on the piece to be arranged, and this property enables us to control the coordinates of the depth of the piece (the blue straight line) and moving it horizontally (the red straight line) and longitudinally (the green straight line).

2- We can also control through it the rotation of the piece 360 degrees horizontally (the green curved line) longitudinally (the red curved line) and rotating it around itself (the blue curved line) as shown in Picture (3).



Picture (3)

3- After arranging the pieces, we select the command (show Arrangement Points) from the (avatar) list in order to rotate the pattern around the mannequin by using the points that will appear as shown in Picture (4).

Picture (4)

The third stage: sewing

1- At this stage, the lines to be sewed are selected by using the sewing toolbar, either with partial sewing or free sewing.

2- The sewing lines should appear parallel and not intersecting as in Figure (1), where the wrong sewing is shown on the right of the image and the correct sewing on the left of the picture.

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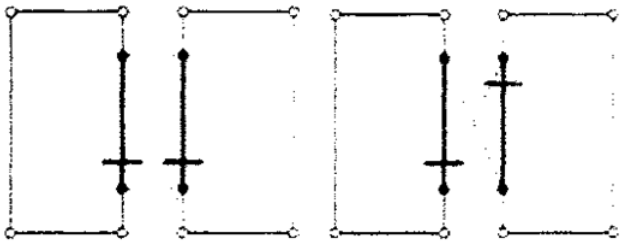
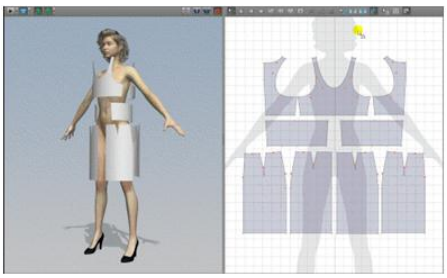


Figure (1)

3- When the sewing of all pieces is finished in the correct way, they will appear in the form of colored threads connecting the pieces in the windows of the mannequin and the pattern as shown in Picture (5).



Picture (5)

The fourth stage: Simulation

1- This stage is controlled by using the simulation toolbar.

2- After making sure that all parts are arranged and sewn in the correct way, a simulation of the pattern is made from the (Cloth Simulation) list, and then the clothing will begin to droop on the body of the mannequin until it is complete by 100%.

3- All patterns around the mannequin can be rearranged from the (Patterns > cloth > Rearrange All) list.

4- The simulation quality can be selected (Normal - Complete - Best), then we check the realism of the droop when the 3D rendering is achieved.

Video link explaining the simulation process from the official website of the program: https://www.marvelousdesigner.com/learn

The fifth stage: preparation of the fabric properties

And that by importing a sample of the material to be implemented on the model through the scanner or selecting it from the materials library, then opening the material image file and dropping it from the folder to the program directly.

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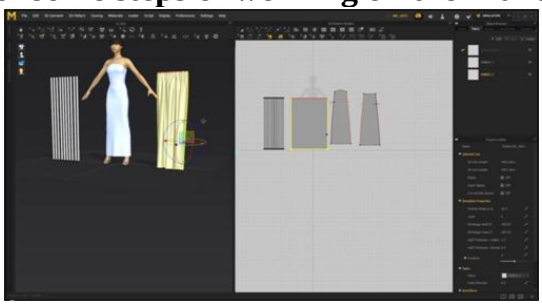
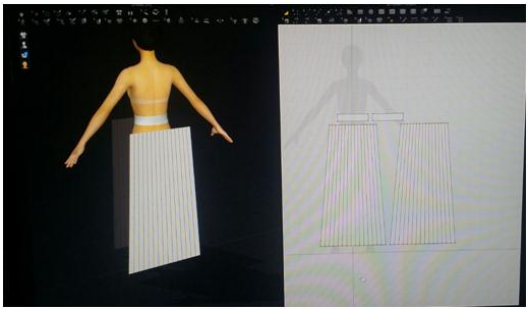
Pictures of the final output:

From the front	
	
Picture (6)	**Picture (7)**
From the back	**From the side**
	
Picture (8)	**Picture (9)**

Illustrative stages of some steps of working on the Marvelous program



Picture (10)



Picture (11)

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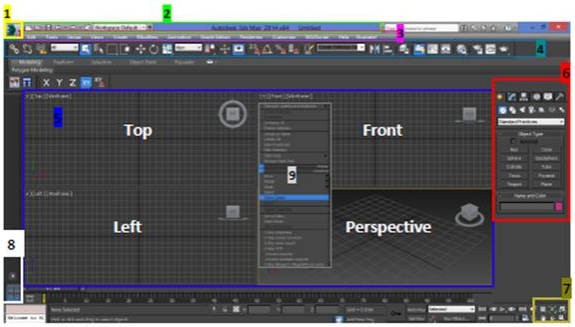
About 3Ds Max program

The AUTODESK 3DS MAX® program is considered one of the most important international engineering programs in the 3D design, as it includes enormous capabilities in designing complex shapes and objects and how they move, so that they are almost very close to reality.

It provides you with large areas, raw materials, lighting sources, cameras and means of animation that you can use to design everything that is on your mind and embodying it in 3D shape. Here we present how to design a model with 3DS Max program.

Program interface :



Picture (12)

1- Application button
2- Title bar
3- Menu Bar
4- Toolbar
5- View panel
6- Command panel
7- Viewport Navigation
8- Viewport Layouts
9- Quad Menu

The steps in 3Ds Max program:

A ready-made mannequin can be used from the incarnate models available specifically in the program or download it from its websites or it can be drawn and embodied by the program and then make the draping on it.

Here we used the draping (pleats) on the ready-made mannequin. It is not necessary to follow the same steps, but it is possible to work on the program in more than one way and by a drawing method that the designer addresses and makes it easier for him to be familiar with the program's commands. The following are the work steps that the researcher followed:

Firstly: by using the (line) command from the (Line > Shapes > command panel) commands, the figure to be embodied was drawn with a two-dimensional line as shown in Picture (13)

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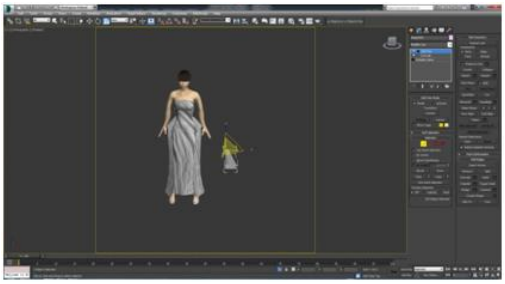
Picture (13)

Secondly: by using one of the modification commands on the properties of shapes and the embodies, the shape is uploaded and modified from the (Modify panel - Modifier List - Extrude), the shape will be uploaded from two-dimensional to three-dimensional, as shown in picture (14).

Picture (14)

Thirdly: **From the (Modify panel - Modifier list - Edit poly), the properties of the third dimension can be controlled as in the following steps**

Where to control points and lines to reach the desired result, Modifier Edit poly is often used because it is the most in-depth in controlling the three-dimensional embodied model as shown in picture (15).



Picture (15)

Fourthly: After finishing the embodied model that will be applied to the mannequin, it is installed in the place to be placed on it and exit from the command as shown in picture (16).

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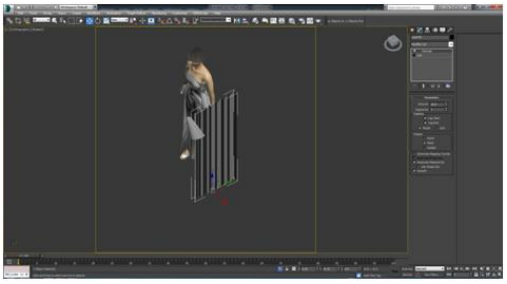
Picture (16)

Fifthly: Steps for making the pleats by using the (line) command from the (command panel - Shapes Line)

The shape to be embodied is drawn with a two-dimensional line as shown in picture (17).

Picture (17)

Sixthly: by using one of the modification commands on the properties of the shapes and the embodied models, the shape is uploaded and modified from the (Modify panel - Modifier List - Extrude, the shape is uploaded from two-dimensional to three-dimensional, as shown in picture (18).



Picture (18)

Seventhly: From (Modify panel - Modifier list - Edit poly)

Where to control points and lines to reach the desired result, Modifier Edit poly is often used because it is the most in-depth in controlling the three-dimensional embodied model. The points at the top were manipulated to gather the shape as shown in Picture (19).

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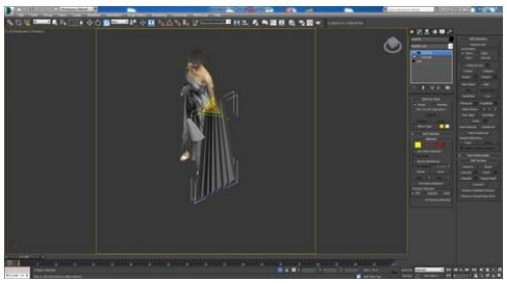
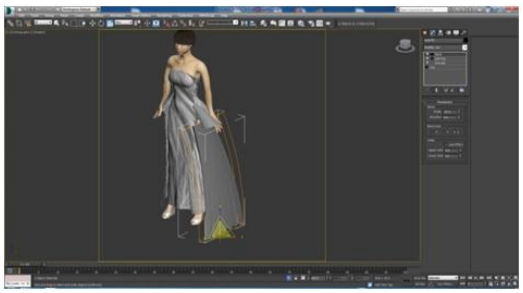


Picture (19)

Eighthly: by adding one command of the modification commands to the three-dimensional embodied model to make the necessary bending and folding

The (Bend) command is selected from the (Modify panel - Modifier list - Bend), as shown in Picture (20).



Picture (20)

Note: More than one Modifiers command can be used to modify the shape as desired by the designer.

Output stage: The appropriate color and material is selected from the Materials library for 3Ds Max program or download them as an picture from the Google search engine, then from the Material command it is polarized and applied and then do Render to get the final image.

Final output pictures:

From the front	
	
Picture (21)	**Picture (22)**

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From the back

Picture (23)

Picture (24)

From the side

Picture (25)

Validity and Reliability

Validity of the questionnaire:

It means the ability of the questionnaire to measure what it was put to measure it.

Validity of the internal consistency:

1- Calculating the correlation coefficients among the degree of each statement of the statements that constituting each axis, and the total degree for the axis in the questionnaire.

2- Calculating the correlation coefficients among the total degree for each axis of the questionnaire axes and the total degree in the questionnaire.

The first axis: The front:

Validity has been calculated using internal consistency by calculating the correlation coefficient (Pearson correlation coefficient) among the degree of each statement and the degree of the axis (**the front**), and the following table shows this:

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Table (1) values of the correlation coefficients among the degree of each statement and the degree of the axis (the front)

S	Correlation	significance
-1	0.824	0.01
-2	0.791	0.01
-3	0.604	0.05
-4	0.885	0.01
-5	0.948	0.01

It is clear from the table that all the correlation coefficients are significant at the level (0.01- 0.05) because they are close to the whole one, which indicates the validity and homogeneity of the questionnaire statements.

The second axis: The back:

Validity has been calculated using internal consistency by calculating the correlation coefficient (Pearson correlation coefficient) among the degree of each statement and the degree of the axis (**the back**), and the following table shows this:

Table (2) values of the correlation coefficients among the degree of each statement and the degree of the axis (the back)

S	Correlation	significance
-1	0.637	0.05
-2	0.709	0.01
-3	0.917	0.01
-4	0.764	0.01
-5	0.893	0.01

It is clear from the table that all the correlation coefficients are significant at the level (0.01- 0.05) because they are close to the whole one, which indicates the validity and homogeneity of the questionnaire statements.

The third axis: The back:

Validity has been calculated using internal consistency by calculating the correlation coefficient (Pearson correlation coefficient) among the degree of each statement and the degree of the axis (**the side**), and the following table shows this:

Table (3) values of the correlation coefficients among the degree of each statement and the degree of the axis (the side)

S	Correlation	significance
-1	0.952	0.01
-2	0.837	0.01
-3	0.775	0.01
-4	0.741	0.01
-5	0.643	0.05

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It is clear from the table that all the correlation coefficients are significant at the level (0.01- 0.05) because they are close to the whole one, which indicates the validity and homogeneity of the questionnaire statements.

The fourth axis: The drooping:

Validity has been calculated using internal consistency by calculating the correlation coefficient (Pearson correlation coefficient) among the degree of each statement and the degree of the axis (**the drooping**), and the following table shows this:

Table (4) values of the correlation coefficients among the degree of each statement and the degree of the axis (the drooping)

S	Correlation	significance
-1	0.856	0.01
-2	0.737	0.01
-3	0.612	0.05

It is clear from the table that all the correlation coefficients are significant at the level (0.01- 0.05) because they are close to the whole one, which indicates the validity and homogeneity of the questionnaire statements.

The fifth axis: The general shape:

Validity has been calculated using internal consistency by calculating the correlation coefficient (Pearson correlation coefficient) among the degree of each statement and the degree of the axis (**the general shape**), and the following table shows this:

Table (5) values of the correlation coefficients among the degree of each statement and the degree of the axis (the general shape)

S	Correlation	significance
-1	0.856	0.01
-2	0.737	0.05
-3	0.612	0.01

It is clear from the table that all the correlation coefficients are significant at the level (0.01- 0.05) because they are close to the whole one, which indicates the validity and homogeneity of the questionnaire statements.

Validity by using the internal consistency between the total degree for each axis and the total degree for the questionnaire:

Validity has been calculated using internal consistency by calculating the correlation coefficient (Pearson correlation coefficient) between the total degree for each axis (the front, the back, the side, the drooping, and the general shape) and the total degree of the questionnaire; and the following table shows this:

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Table (6) values of the correlation coefficients between the degree of each axis and the degree of the questionnaire

	Correlation	significance
The first axis: the front	0.718	0.01
The second axis: the back	0.864	0.01
The third axis: the side	0.782	0.01
The fourth axis: the drooping	0.848	0.01
The fifth axis: the general shape	0.726	0.01

It is clear from the table that all the correlation coefficients are significant at the level (0.01) because they are close to the whole one, which indicates the validity and homogeneity of the questionnaire statements.

Reliability:

Reliability means the application accuracy in the measurement and observation, not a contradiction with itself, and its consistence in providing us with information about the examiner's behavior, and it is the ratio between the score difference on the scale, which refers to the actual performance of the examiner. The reliability has been calculated by:

1- Alpha Cronbach coefficient

2- Split-half method

Table (7) values of the reliability coefficient of the questionnaire axes

Axes	Alpha coefficient	Split-half
The first axis: the front	0.829	0.791 – 0.856
The second axis: the back	0.911	0.888 – 0.942
The third axis: the side	0.753	0.728 – 0.780
The fourth axis: the drooping	0.934	0.905 – 0.962
The fifth axis: the general shape	0.791	0.764 – 0.825
Reliability of the questionnaire as a whole	0.866	0.831 – 0.894

It is clear from the previous table that the all values of the reliability coefficients: the Alpha coefficient, the Split-half are significant at the level of 0.01 and that indicates the reliability of the questionnaire.

Results

The first hypothesis:

The first hypothesis states the following:

There are statistically significant differences between the mean scores of the two methods "**3DS MAX, Marvelous**" for draping the pleats on the mannequin of the first design.

To verify the validity of this hypothesis, a **t-test** was applied, and the following tables show this:

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Table (8) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the front"

The first design "the front"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	17.789	1.267	8	7	9.528	0.01 in favor of Marvelous
Marvelous	23.265	2.991				

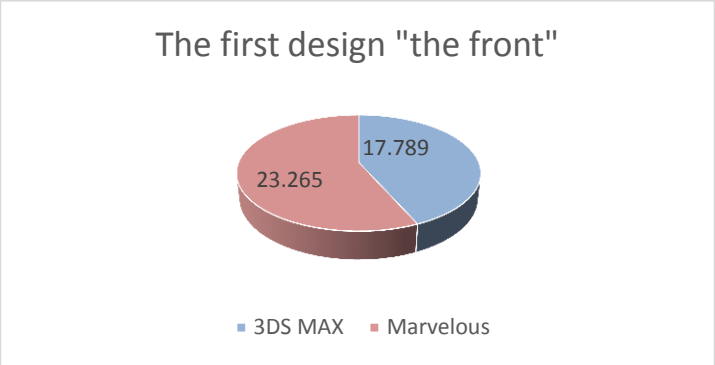

Figure (1) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the front"

From table (8) and figure (1), it is clear that the value of (t) is (9.528) for **the front**, and it is a statistically significant value at the significance level of (0.01) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (23.265), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (17.789).

Table (9) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the back"

The first design"the back"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	18.071	1.357	8	7	2.111	0.05 in favor of Marvelous
Marvelous	20.225	2.492				

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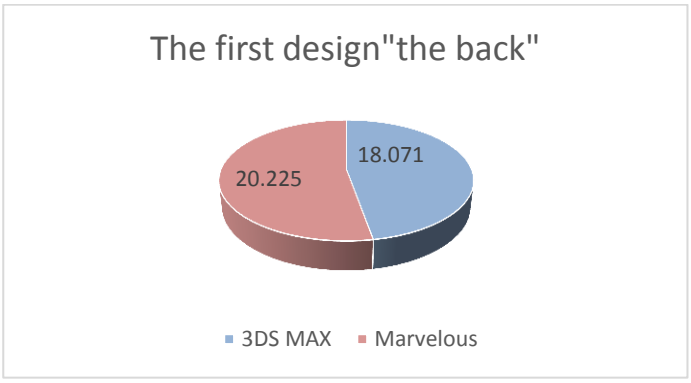

Figure (2) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the back"

From table (9) and figure (2), it is clear that the value of (t) is (2.111) for **the back**, and it is a statistically significant value at the significance level of (0.05) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (20.225), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (18.071).

Table (10) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the side"

The first design"the side"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	17.071	1.426	8	7	2.750	0.05 in favor of Marvelous
Marvelous	19.537	1.398				

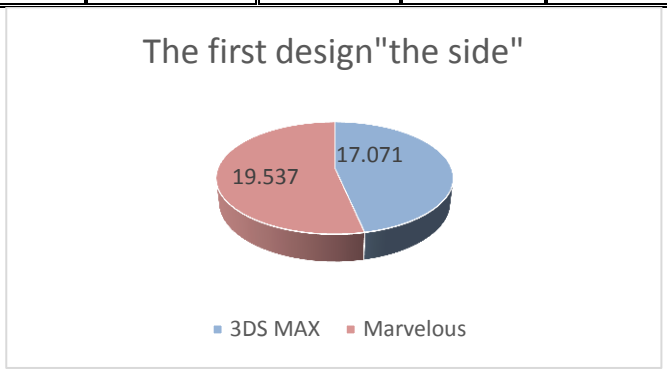

Figure (3) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the side"

From table (10) and figure (3), it is clear that the value of (t) is (2.750) for **the side**, and it is a statistically significant value at the significance level of (0.05) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping

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the pleats on the mannequin was (19.537), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (17.071).

Table (11) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the drooping"

The first design"the drooping"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	9.993	1.340	8	7	8.637	0.01 in favor of Marvelous
Marvelous	14.227	1.536				

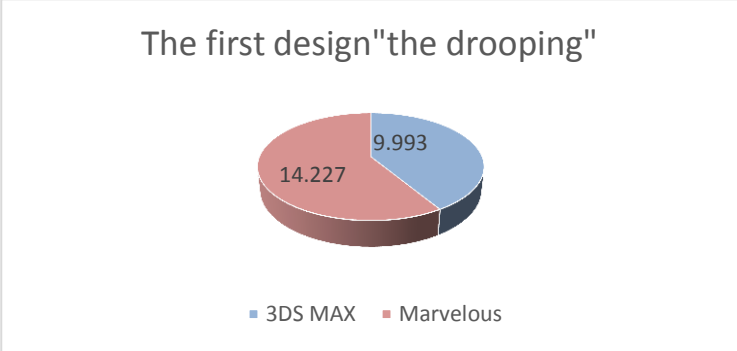

Figure (4) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the drooping"

From table (11) and figure (4), it is clear that the value of (t) is (8.637) for **the drooping**, and it is a statistically significant value at the significance level of (0.01) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (14.227), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (9.993).

Table (12) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the general shape"

The first design"the general shape "	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	8.627	1.001	8	7	9.370	0.01 in favor of Marvelous
Marvelous	13.388	1.450				

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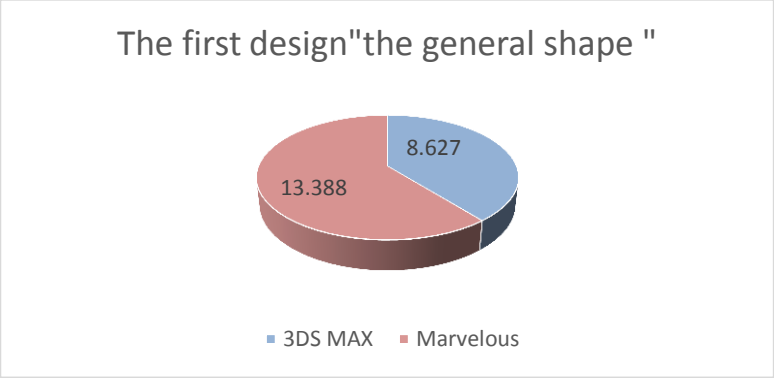

Figure (5) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the first design "the general shape"

From table (12) and figure (5), it is clear that the value of (t) is (9.370) for **the general shape**, and it is a statistically significant value at the significance level of (0.01) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (13.388), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (8.627).

Table (13) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the total sum for the first design

the total sum of the first design	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	71.551	7.391	8	7	25.088	0.01 in favor of Marvelous
Marvelous	90.642	8.225				

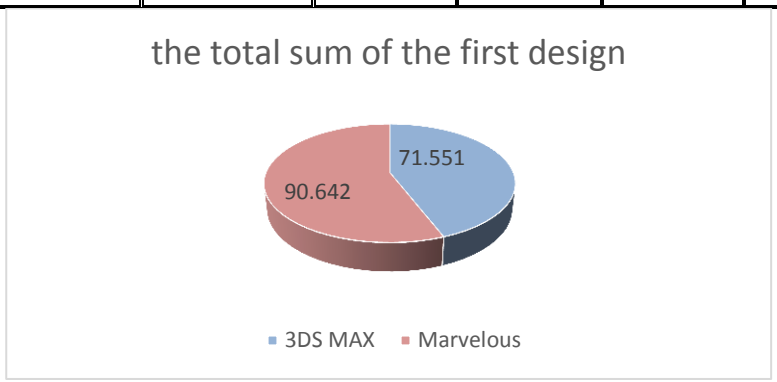

Figure (6) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the total sum for the first design

From table (13) and figure (6), it is clear that the value of (t) is (25.088) for **the total sum of the first design**, and it is a statistically significant value at the significance level of (0.01) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (90.642), while the

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mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (71.551). Thus, the first hypothesis was verified.

The second hypothesis:

The second hypothesis states the following:

There are statistically significant differences between the mean scores of the two methods "**3DS MAX, Marvelous**" for draping the pleats on the mannequin for the second design.

To verify the validity of this hypothesis, a **t-test** was applied, and the following tables show this:

Table (14) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the front"

The second design"the front"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	16.350	1.492	8	7	12.381	0.01 in favor of Marvelous
Marvelous	24.014	2.381				

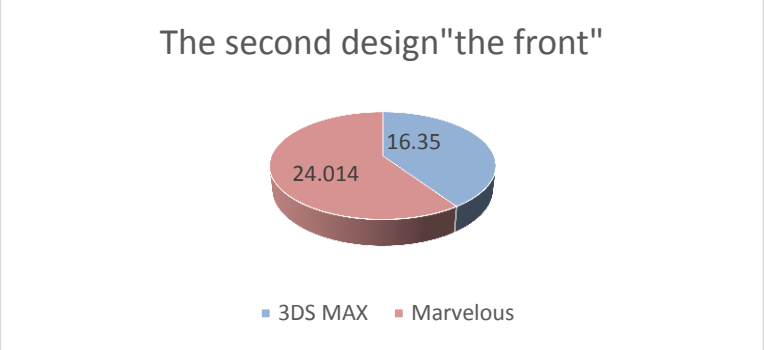

Figure (7) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the front"

From table (14) and figure (7), it is clear that the value of (t) is (12.381) for **the front**, and it is a statistically significant value at the significance level of (0.01) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (24.014), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (16.350).

Table (15) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the back"

The second design"the back"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	14.367	1.254	8	7	9.076	0.01 in favor of Marvelous
Marvelous	21.213	2.089				

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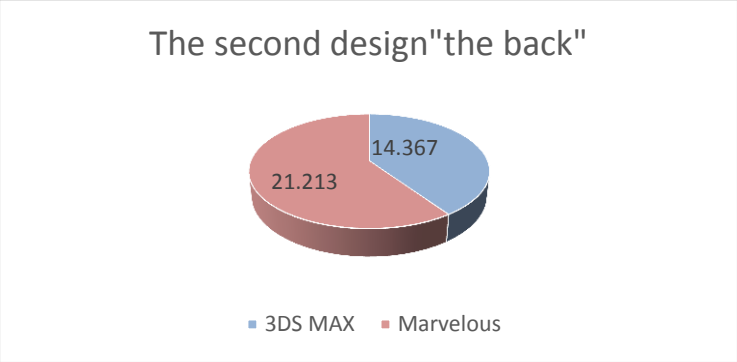

Figure (8) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the back"

From table (15) and figure (8), it is clear that the value of (t) is (9.076) for **the back**, and it is a statistically significant value at the significance level of (0.01) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (21.213), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (14.367).

Table (16) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the side"

The second design"the side"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	20.136	2.157	8	7	2.341	0.05 in favor of Marvelous
Marvelous	22.351	2.398				

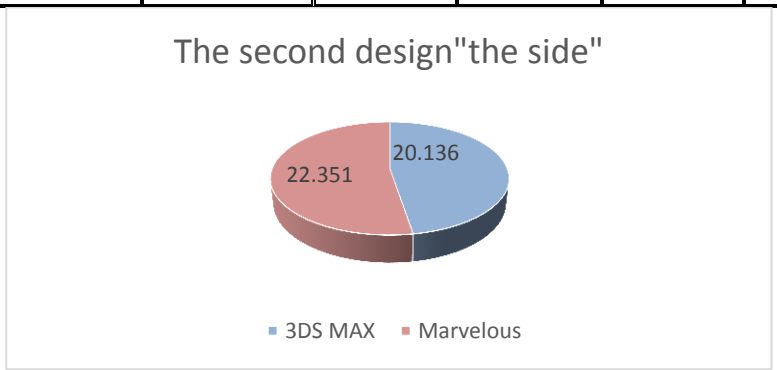

Figure (9) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the side"

From table (16) and figure (9), it is clear that the value of (t) is (9.076) for **the side**, and it is a statistically significant value at the significance level of (0.05) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping

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the pleats on the mannequin was (22.351), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (20.136).

Table (17) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design " the drooping "

The second design"the drooping"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	10.103	1.870	8	7	2.069	0.05 in favor of Marvelous
Marvelous	12.558	1.693				

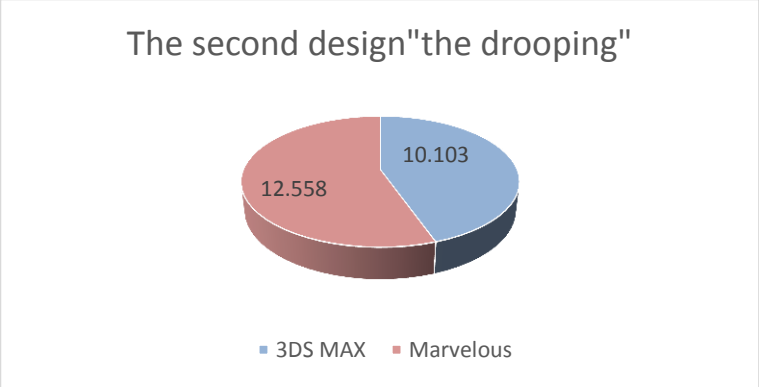

Figure (10) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the drooping"

From table (18) and figure (10), it is clear that the value of (t) is (2.069) for **the drooping**, and it is a statistically significant value at the significance level of (0.05) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (12.558), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (10.103).

Table (19) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the general shape"

The second design"the general shape"	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	8.038	1.692	8	7	7.791	0.01 in favor of Marvelous
Marvelous	14.197	1.277				

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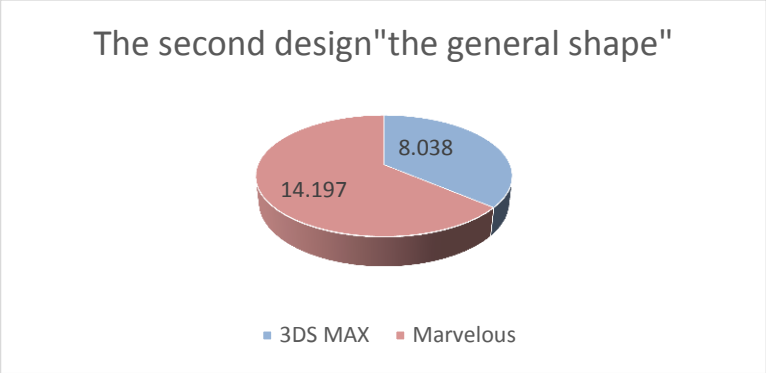

Figure (11) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the second design "the general shape"

From table (19) and figure (11), it is clear that the value of (t) is (7.791) for **the general shape**, and it is a statistically significant value at the significance level of (0.01) in favor of **Marvelous**, where the mean degree of the **Marvelous** method for draping the pleats on the mannequin was (14.197), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (8.038).

Table (20) The significance of the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the total sum for the second design

the total sum of the second design	Mean	Std. Deviation	N	df	t	Sig. & its direction
3DS MAX	68.994	6.149	8	7	30.561	0.01 in favor of Marvelous
Marvelous	94.333	8.705				

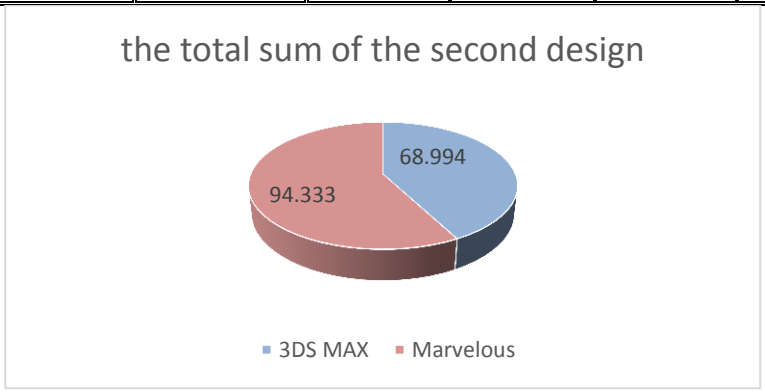

Figure (12) show the differences between the mean scores of the two methods "3DS MAX, Marvelous" that are used for draping the pleats on the mannequin for the total sum for the second design

From table (20) and figure (12), it is clear that the value of (t) is (30.561) for **the total sum of the second design**, and it is a statistically significant value at the significance level of (0.01) in favor of **Marvelous**, where the mean degree of the

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Marvelous method for draping the pleats on the mannequin was (94.333), while the mean degree of the **3DS MAX** method for draping the pleats on the mannequin was (68.994). Thus, the second hypothesis was verified.

Research recommendations:

1- Seeking for all that is new in studying the art of draping on the mannequin and discovering more computer programs that can be employed so as to be compatible with this type of art.

2- Experimenting the draping on the virtual mannequin with various types of materials with different characteristics and different nature in order to reach artistic effects and new aesthetic visions.

3- Employing the universities and the higher institutes in the Kingdom of Saudi Arabia and urging them to procedure more research and studies that serve the industry.

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