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The Virtual Design of Women's Shoe Collections Inspired by the Heritage of Previous Civilizations

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Abstract:

Nowadays, various industrial CAD software (Computer-Aided Design) have been introduced in the footwear industry, to reduce the time dedicated to the development of shoe design and its production cost. In addition, it is an effective methodology that can accelerate the sampling process and marketing approaches. It provides the right fit and accurate customization, even for feet with medical issues. On the other hand, it facilitates methods designers use to create new style lines, soles, and accessories and to apply the required pattern. Therefore, the researcher found that it is essential to revive her heritage by directing students to virtually design women's shoes inspired by previous civilizations, using current three-dimensional (3D) software, in a contemporary method. This approach could provide new learning techniques along with encouraging innovation, helping predictions for production, and harnessing undergraduate students' creativity.

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This study aims to guide second-year students of the Fashion Design Department, Faculty of Arts and Design, Pharos University in Alexandria, to utilize their digital and computer skills so that they can create women's shoe collections using 3D design software in an innovative way, while maintaining culture and heritage. The collections were evaluated by designers and specialists in terms of three aspects, namely functional, aesthetic, and creative. Moreover, results of the designed questionnaire highlighted that there are statistical correlations and that there is evidence that designers and specialists have viewpoints linking new virtually designed shoe collections to Egyptian civilizations, as a modern trend.

Keywords:

Footwear Industry - Fashion visualization - Simulation

Introduction:

The 3D design methodology is a current approach that helps achieve new, zero-waste designs. It is a vital link between pattern drawing and design, which allows users to visualize the design before production [1]. 3D fashion simulation can provide very accurate fitting and a new contribution to sustainability. The simulated design process is self-correcting and can use a wide range of fabrics.

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That is why fashion education must take the direction of digital development in fashion and accessories, as it is considered a useful teaching tool to keep up with current styles and development flows [2]. On the other hand, the currently employed shoe-making process can be considered a manual method that needs a template or a sample to create the design manually, which leads to a complex workflow and a lack of new styles [3]. The introduction of designs, models, and styles must be synchronized with shoe production [4]. That is why the available 3D shoe-design software simulate the conventional method of shoe styling in an easy, effective, and creative manner [5]. Digital tools are a strategic technique to create new products and decrease waste and time consumption. Moreover, the trade-off among comfort, attractiveness, and manufacturing is difficult to achieve. In order to design comfortable high-heeled shoes and achieve optimization in the design manufacturing process, researchers use digital methodologies to design models and reconstruct shoe and foot topologies [6]. A CAD system is a strong and effective way to design a customized shoe with various features and styles. It also allows users to automatically make a flat plane of the design, which facilitates the production of shoe designs with various styles and sizes [7].

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On the other hand, education plays an important role in teaching different digital design programs, so that undergraduate students gain professional skills matching the current manufacturing techniques. Such a distinguished approach provides them with the opportunity to participate in the research field and gain the necessary skills for their professional life. Additionally, it is essential to direct students to get their inspiration from heritage and previous civilizations, which protects our Egyptian and Arab cultures and overcomes the negative impact of current modern technologies and trends [8].

Nowadays teaching and learning strategies should include and encourage the digital learning approach, in which students learn to visualize the design before production. This helps reduce sampling time and initial cost [3]. Nevertheless, we should also encourage our students to get inspiration from our civilization, in order to revive our heritage. Islamic art explores classical aesthetics. It has been employed over the years up until now [9]. Islamic culture is also diverse and rich in elements that could be found in Islamic architecture. Arabesque elements can be considered one of the most famous Islamic elements along with Arabic calligraphy and other patterns [10]. On the other hand, African art is also a distinguished and simple art, which is rich in different colors and various symbols. Its colors and unique patterns define real life and culture in Africa [11].

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From the above literature overview, the problem statement is thus: The possibility of making use of students' soft skills and their digital skills through upgrading them with 3D digital techniques. Moreover, this is the opinion of those specializing in the industry of producing women's shoes from an aesthetic, functional, and creative points of view. Finally, the possibility of employing students' design skills in reviving our heritage and following current style trends should be taken into consideration.

Research Purpose and Importance

1. Upgrading students' soft skills with the help of 3D programs to virtually produce women's shoes.
2. Linking academic life with scientific research to serve our community.
3. Directing second-year students in the Fashion Design Department, Faculty of Arts and Design, Pharos University in Alexandria and helping them to develop their soft skills and keep up with current trends.
4. Encouraging cultural revival through designing women's shoes, which are inspired from our heritage

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Research Hypotheses

1. There are statistically significant differences among women's shoe designs in achieving aesthetics, according to specialists' and designers' opinions.
2. There are statistically significant differences among women's shoe designs in achieving creativity, according to specialists' and designers' opinions.
3. There are statistically significant differences among women's shoe designs in achieving function, according to designers' and specialists' opinions.

Materials and Methodology

The research methodologies employed in this study are the experimental and descriptive methodologies. A questionnaire was used to evaluate two virtual shoe collections for women by specialists and designers. The research had a spatial limitation: the Faculty of Arts and Design, Pharos University in Alexandria, a time limitation: the fall term of the 2020/2021 academic year, and a human limitation: second-year students of the Fashion Design Department.

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Costume Accessories is an obligatory course for second-year students in the Fashion Design Department at the Faculty of Arts and Design, Pharos University in Alexandria. The researcher teaches a curriculum educating students on issues related to the shoe manufacturing industry. This course includes material regarding the use of 3D software in the design of women's shoes, according to different inspirations, with a choice of material type, color, and accessories needed to customize the produced shoes.

Second-year students in the Fashion Design Department at Pharos University in Alexandria designed and virtualized various collections of women's shoes. The best two collections with six designs each, inspired from previous civilizations and our Arab heritage, were chosen.

Figure (1) shows the first collection, which was inspired by the African civilization. Six women's shoes were designed using African patterns and a color board to match the theme and keep up with current style trends. Elevation, plane, and side-view section photos were taken to clearly identify each shoe design.

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Figure (1): The first collection inspired by African civilization.

Table (1) demonstrates the photos and description of each design in the first collection. The main material, used to virtualize the high-heeled women's collection, is leather. Lace was also used for the ribbons. Designs were created to match the color board selected and to apply the African patterns compatible with current style trends. The shoes were designed using a boot last, ribbons were attached, and different cuts were made to achieve comfort.

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Table (1): Designs for six high-heeled women's boots from the first African-inspired collection.

Collection	Design Number	Design Description	Virtual Photo of the Design
Collection (1)	Design (1)	The photo shows high-heeled women's boots made of an African pattern. The boot is full of color and the pattern is distributed on its	

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		left and right sides. There is lace wrapped on the boots' back to provide comfort and an easy-to-wear function. The heel color is gold to match the color board and to add an aesthetic value.	

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	Design (2)	The photo shows the second design for a high-heeled boot for women, made using an African pattern. Red is the main color of the design palette used. The African pattern	

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		is distributed on the left and right sides of the boot. There is lace wrapped on the boot's front to provide comfort and give it an easy-to-wear function. The color chosen for the heel is	

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		red to match the color of the lace used.	
	Design (3)	The photo shows the third design in the collection of high-heeled boots for women designed using an African pattern. Colors from the	

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		color board are distributed equally along the pattern. There is a cut on the upper left and right sides of the boot instead of lace, to provide comfort and an easy-to-wear	

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		function ality. The heel color is gold to match the design and to add an aesthetic value.	
	Design (4)	The photo shows the fourth design of this collectio n. The pattern is distribut	

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		ed equally along the design. There are various cuts on the left and right sides of the boot to add a different edge. Wide straps are placed around the ankle and above, which	

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		are made of the same African pattern. In addition, there is lace to provide comfort and an easy-to-wear function ality. The heel color is gold to match the design and add an aesthetic	

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		value	
	Design (5)	This design represents the fifth of this African-style collection. Colors from the color board are distributed equally along the design. The African pattern	

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		is concentrated on more than half of this half-boot's front, to add a touch of creativity. There are cuts on the left and right sides of the half-boot, instead of lace to provide comfort	

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		and to make it easy to wear. The heel of this design is golden to match the colors in the design.	
	Design (6)	This is the sixth design of the collection. The pattern is concentrated on the	

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		boot's front to create originality. There are also various cuts on the boot's front, with golden straps alternating with straps made from the African pattern, to give this design a different	

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		edge. In addition, there is lace on the shoe's back to provide comfort and add an easy-to-wear function ality. The heel is red, the main color in the design of this collectio n.	

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Figure (2) shows the second collection, inspired by Islamic art. Six women's shoes were designed using Islamic arabesque patterns and a color board that adds harmony with modern style trends. Elevation, plane, and side-view section photos were taken to clearly identify the shoes' designs.

Figure (2): The second shoe collection inspired by Islamic art.

Table (2) shows the photos of each design in the second collection. The main material, used to virtualize the high-heeled women's shoe collection, is leather. No other accessories were used. Designs were created to match the chosen color board and apply Islamic patterns compatible with current style trends. The shoes were designed using a high-heeled shoe last, different cuts were made on the design to achieve comfort.

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Table (2): Six high-heeled women's shoe designs of the second collection inspired by Islamic art.

Collection	Design Number	Design Description	Virtual Photo of the Design
Collection (2)	Design (1)	The photo shows a high-heeled shoe for women with an Islamic pattern. The pattern is concentrated on the shoe's front to create originality. There are straps all over the shoe to add a distinguished look and	

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		provide comfort. The heel color is gold, the main color of the collection's color palette.	
	Design (2)	The photo shows the second design in this high-heeled shoe collection. Two colors, black and red, were added along with gold to heighten the aesthetic	

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		value of the design. For originality, the pattern is concentrated on the shoe's front. Several straps were added to the design for comfort and distinction. The heel color includes gold and black to match the color palette of the shoe.	

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	Design (3)	The photo shows the fourth design within this Islamic-inspired shoe collection. The two main colors of the design are gold and black. The pattern is concentrated on the lower front part of the shoe, where small straps crisscross to form small rectangles. The design	

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		also includes three wide straps, two in black (one horizontal and one vertical) and a third with an Islamic-inspired pattern in golden gray. The heel of this design is golden.	
	Design (4)	The photo shows the fourth design of the specified collection. The two main colors	

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		of the design are gold and black. For this design, the pattern is concentrated on the shoe's back, making it different from all previous designs. There are several long cuts on the front of the shoe to provide comfort and to give it a different look. The wide straps within this	

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		design are black with a small golden strip on each end. The heel combines both gold and black to match the color of the model.	
	Design (5)	The fifth design in this collection can be seen in the adjacent photo. Red was added to black and gold to give this model a	

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		different edge. The pattern is again concentrated on the shoe's front. There are three small golden straps on each side of the design and a wider red strap running laterally. This design has a black-colored heel.	

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	Design (6)	The photo marks design number six in this collection. Two main colors are characteristic of this design, namely gold and black. The pattern is concentrated on the shoe's front to create originality. The tip of the shoe holds the Islamic pattern,	

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		followed by a golden colored lozenge shape. The latter element is connected to the side of the shoe with small golden straps, forming cuts on both sides of the design for comfort and for a special look. The heel is black to match the color palette of the design and to	

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		increase its aesthetic value.	

Results and Discussion

A questionnaire was created to evaluate the two specified collections by specialists and designers and to highlight the degree to which they were able to achieve the functional, aesthetic, and creative aspects. Results of the evaluation were calculated and analyzed using Microsoft Excel. The results reached were able to prove the study's hypotheses.

The first hypothesis suggested that there are statistical significances among the shoe designs in achieving the aesthetic aspect, as per designers' and specialists' point of view. To test this hypothesis, the percentage of each score and their means were calculated, as per Table (3). Furthermore, the ANOVA test for variance analysis of the average of the scores was performed. It was found that the statistically significant difference among the different shoe designs was 0.0087 (less than 0.05), as seen in Table (4).

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Table 3: Arithmetic percentages and means for the achievement of the aesthetic aspect in the design of women's shoes.

First Aspect	Statistical Indicators	Means	Percentages	Total Arithmetic Mean	Total Percentage
Achieving the Aesthetic Aspect	Color Board	4.52	90.34	4.45	89
	Suitability of Material	4.55	90.92		
	Virtual Techniques Used	4.38	87.68		

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	Application Precision	4.35	87.04		

Table 4: Mean score variance analysis in achieving the aesthetic aspect in the design of women's shoes.

Aesthetic Aspect	Total Squares	Degree of Freedom	Mean Squares	*F*-Value
Between Groups	0.96	27	0.36	3.33
Within Groups	0.95	8	0.12	
Total	1.911	35		

The second hypothesis suggested that there are statistical significances among the designs of women's shoes in achieving the functional aspect, according to designers' and specialists' point of view. To test this hypothesis, percentages of the scores and their means were calculated, as per Table (5).

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Furthermore, the ANOVA test for variance analysis of the average score was performed. It was found that the statistically significant difference among women's shoe designs was 0.0058 (less than 0.05), as seen in Table (6).

Table 5: Arithmetic percentages and means for the achievement of the functional aspect in the design of women's shoes.

Second Aspect	Statistical Indicators	Means	Percentages	Total Arithme Mean
Functional Aspect	Harmony among Designs, Comfort and Techniques Used	4.3	86.09	4.38
	Marketing Possibility	4.47	88.52	
	Manufacturing Capabilities	4.38	87.68	
	Degree of Compatibility between Shoe Designs and Heritage	4.35	87.24	

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Table 6: Mean score variance analysis in achieving the functional aspect in the design of women's shoes.

Aesthetic Aspect	Total Squares	Degree of Freedom	Mean Squares	*F*-Value	Significanc
Between Groups	0.71	27	0.026	3.57	0.0058
Within Groups	0.75	8	0.094		
Total	1.46	35			

The third hypothesis suggested that there are statistical significances among women's shoe designs in achieving the creativity aspect, according to designers' and specialists' point of view. To test this hypothesis, the percentage of scores and their means were calculated, as per Table (7).

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Furthermore, the ANOVA test for variance analysis of the scores' average was performed. It was found that the statistically significant difference among women's shoe designs was 0.01 (less than 0.05), as seen in Table (8).

Table 7: Arithmetic percentages and means for the achievement of the creativity aspect in the design of women's shoes.

Third Aspect	Statistical Indicators	Means	Percentages	Total Arithmetic Mean	Total Percentage

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				n	
Creativity Aspect	Combination of Materials and Accessor	4.37	87.35	4.25	85.05

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	ies				
	Definition of Identity and Uniqueness	4.2.3	8 4.4 3		

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	s				
	Matchwith Current Style Trends	4.16	82.98		

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Table 8: Mean score variance analysis in achieving the creativity aspect in the design of women's shoes.

Aesthetic Aspect	**Total Squares**	**Degree of Freedom**	**Mean Squares**	***F*-Value**	**Significance**	**Tabulated *F*-Value**
Between	0.86	8	0.11	2.35	0.01	2.51

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Conclusion and Recommendations

It can be concluded that each shoe design from the virtual collections, demonstrated in this research achieved the aesthetic, functional, and creative aspects. This proves the importance of the role played by the Fashion Design Department at Pharos University in Alexandria and its ability to serve the community. In addition, it is recommended to involve student projects in scientific research to encourage students to make more efforts in their studies, to value their skills and thinking, and to create a link between the professional and academic worlds. Furthermore, the researcher recommends the upgrade of teaching and learning strategies and the provision of a link between these strategies and digital design software to keep up with current trends in the world, to save time, and to reduce sampling cost.

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