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Sustainable fashion with elements of the Bulgarian national garb– reducing, reusing and recycling through mulage method

Magdalena Pavlova^{1,1}, Ivelina Ivanova^{1,2}

¹Technical University of Sofia, PEPM, Sofia, Bulgaria

mpavlova@tu-sofia.bg, ivelina_13@mail.bg,

Abstract. A Communication from the European Commission in Brussels, dated 30 March 2022, to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, presents an EU Strategy for Sustainable and Circular Textiles as a standard. In line with the strategy, this paper is aimed at creating women's clothing with elements of the Bulgarian national garb, bearing the characteristics of sustainable fashion. The design and manufacturing of the models is realized through the methods upcycling and mulage, looking for the effect of 3'R's – Reduce, Reuse, Recycle. The models are segmented appropriately to combine several products in a common vision. The artistic design is realized through image creation and processing software. The technology was developed with graphics software.

1. Introduction

The EU strategy for sustainable and circular textiles recognises an increase in the production and consumption of textile products, as well as their impact on the climate, water and energy consumption and the environment. Consumption of clothing and footwear is expected to increase by 63% by 2030, up from the current 62 million tonnes to 102 million tonnes in 2030. The clothing accounts for 81% of textile consumption in the EU [1]. The 2020 Circular Economy Action Plan and the 2021 update of the EU Industrial Strategy identify textiles as a key product value chain that urgently needs a transition to sustainability due to the high environmental and climate footprint of the sector.

- Fashion and water consumption - a huge amount of fresh water is used for dyeing - up to 200 tons of water for 1 ton of dyed fabric. For the production of 1 kg of cotton are needed up to 20,000 liters of water.
- Fashion and microfiber in the oceans - every time you wash synthetic clothing, microfibers are released into the water. Once in the oceans, they are absorbed by small aquatic organisms and along the chain the plastic reaches our food chain.
- Fashion and waste – In the Western world, a family throws away an average of 30 kg of clothing each year. Only 15% is recycled or donated, and the rest goes directly to the landfill or is incinerated. Over 50% of the fibers in our clothes are synthetic.
- Fashion and chemicals – Chemicals are a major component of our clothes. They are used in fiber cultivation and production, dyeing, bleaching, etc.
- Fashion and greenhouse gas emissions - Apparel production accounts for 10% of global carbon emissions.



- Fashion and soil degradation - the overgrazing of animals bred for their wool; the use of chemicals for growing cotton, etc.
- Fashion and destruction of forests – the felling of forests and replacement with tree species used for the production of fibres such as silk and viscose.

To break out of the vicious circle of fast fashion, efforts need to be made in areas such as ecodesign, fibre development, innovative textile manufacturing, repair and reuse [1]. The main idea of sustainable fashion, as an alternative trend to fast fashion, is to minimize the harmful human footprint, both on nature in terms of water, energy consumption and recycling, and on society [2,3]. Following the requirements of the EU Strategy for Sustainable and Circular Textiles, an approach is proposed which is aimed at educating an active attitude towards global environmental issues. The approach is built by combining design solutions aimed at segmenting the models in an appropriate way to combine several products into a common vision and use of undersized and residual pieces of fabric, as well as fabrics with local defects dropped from production. Looking for ways to utilize textile waste, six models of women's clothing have been developed. The concept of sustainability is based on a combination of the following approaches: Upcycling, as a practice of giving new life to a garment that is no longer necessary. This is done by deconstructing and creating something new or by adding and/or combining with another product. [4,5].

The 3' R's model, as a sequence of steps for sustainable fashion. Using the 3'R's – Reduce, Reuse, Recycle – these three words with "R" are an important part of sustainable life as they help to reduce the amount of waste that is thrown away, giving new life to the products. Globally, this helps to minimise the amount of space required for storage of waste materials [6].

To the three main R, two more R can be added – Rethink, Recover. Rethink how our actions affect the environment and restoration in terms of the practice of using waste products [6]. The third approach is related to the use of elements of the Bulgarian national garb [7,8] by embedding them in clothing with a modern look. Elements from the characteristic ethnographic regions of Bulgaria will be used. In today's global world, the preservation of traditions is part of the awareness and preservation of national identity and ancestral memory.

To implement the overall concept, design solutions are applied aimed at segmenting the models in order to combine parts of several products into a common vision. This will allow the use of undersized and residual pieces of fabric, and fabrics with local defects dropped out during cutting [9]. The design of the models in the collection is realized with the help of image processing software called "FireAlpaca". This program is free digital painting software that is compatible with both Mac and Windows.

The mulage method has been applied during the construction and modelling phase. The patterns of the models are developed directly on a dummy torso by imposing slices of fabric or paper on its surface and outlining the contours of the details.

2. Methods

2.1. Development of models

Six models based on the above points have been developed. The models are represented by sketches created with the software product "Procreate" – Fig. 1÷6. Model 1 is a ladies dress in two colors. The dress is strapless, with bare shoulders, with a length above the knee, segmented into three parts. The top and the skirt are connected with transparent black lace in the waist area. Decorative elements with golden petals on the black and red background are used, reminding of the ornaments and colors of the Shoski and Northern regions:



Fig. 1. Model 1



Fig. 2. Model 2



Fig. 3. Model 3

. Model 2 is a dress in two colors, typical of the Shopski national garb. In the neckline area are embroidered elements of Bulgarian embroideries – Elebetitsa and Tree of Life. The dress is decorated with a red long belt by three leather strips



Fig. 4. Model 4



Fig. 5 Model 5



Fig. 6. Model 6

Model 3 is made of two parts, a blouse and a two-layer skirt. in two colors. Two of the most typical colors of the Bulgarian national garb were used – white and red. Embroidered ribbons, embroidery of roses and wooden plates, typical of the Thracian, Northern and Dobrudzha costumes, were used as decorative ornaments. Model 4 is made of two parts – white blouse with embroidery on the neckline and skirt trousers with embroidery element “Elbetitsa” on the belt and hem.

Model 5 is a two-piece blouse and shorts. The blouse is white with embroidery of ornament – space turtle. The trousers are in blue color with embroidery at the hem. Model 6 is a dress in white and black. Along the hem of the skirt is sewn a wide white strip. On it, above the waist and on the sleeves are embroidered varieties of the element “Kanatitsa”.

2.2. Development of clothing construction

The construction process is automated. Algorithms for computer-aided design of the structures have been developed through a specialized clothing CAD system called “AccuMark V10”. The basic construction of a lady’s blouse with darts for basic size 44, a female type figure with a height of 164.0 cm, a chest circumference of 88.0 cm and a hip circumference of 96.0 cm is made. – fig. 7. The developed base is used as a modeling pad for the mulage method using the "upcycling" principle of. The products are modeled on the base construction. Afterwards they are formed directly on the torso according to a preliminary sketch. The technical drawings of the three models are illustrated in Figures 8, 9 and 10, with front and back view. For the manufacture of the garments is used textile waste from garments with dirt and stains, garments with damaged structure, such as local ruptures, unraveling or stretches. Undersized pieces of fabric with local defects were also used – destruction, discoloration and other visual defects. The use of this type of raw materials is facilitated by the segmentation of models in the sketching phase.

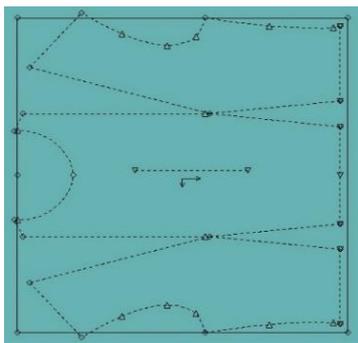


Fig. 7. Pattern making of the women's blouse



Fig. 8. Model 1

Fig. 9. Model 2

Fig. 10. Model 3

2.3. Technology for manufacture

The proposed sustainability concept is illustrated by creating three models of women's casual clothing with elements of the Bulgarian national garb. The models are presented with fashion sketches on Fig 1, 2, 3, and technical drawings on Fig. 8, 9 and 10.

The models are made mainly of textile waste – garments prepared for disposal in a container. Eight pieces of clothing were recycled. The designed clothing is made in two different ways. The first one is development by combining a base pattern according to a classical computational-analytical method and modeling as per the moulage method.

The product is modeled on the base construction, afterwards it is formed directly on the torso, according to the preliminary sketch. According to the second one, the clothing is formed directly on a human body. Direct measurements, outlining, cuts, fixing with pins and manual sewing, according to the preliminary sketch are used. A trial dressing is made to make further corrections, if necessary. Accepted corrections are fixed by stitches, according to the selected technology. The cycle is repeated until the desired result is achieved [10].



Fig. 11. Photos of selected stages of Model 1 sewing technology



Fig. 12. Photos of selected stages of Model 2 sewing technology

To illustrate the manufacturing process of the three models, photographs are presented - Model 1 on fig. 11, Model 2 on fig. 12 and Model 3 on fig.13.



Fig. 13. Photos of selected stages of Model 3 sewing technology

3. Results

The proposed sustainability concept is finally illustrated by sewing three models of women's casual clothing with elements of the Bulgarian national garb. The sewn models are presented with photographs of a living Model on Fig. 14, with front and back view.

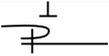
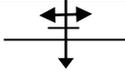
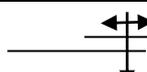
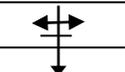
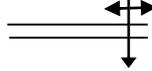
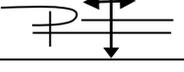
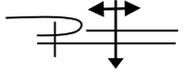


Fig. 14. Photos of the sewn Models

Model 1 is segmented into three parts. The top and the skirt are made from two ready-made garments – 100 % Polyester - fig. 11 and fig. 14. The top and the skirt are connected with transparent black lace in the waist area -90% Polyester / 10% elastane. These are two small pieces of lace with local defects dropped out during cutting. The segmentation of the design of the model allowed the use and combination of two second-hand ready-made garments and two residual pieces of lace in a common vision. Decorative elements, reminding of the ornaments and colors of the Shoski and Northern regions Model 2 is a dress in two colors, typical of the Shopski national garb. The top and the skirt are made from two ready-made garments - fig. 12 and fig. 14.. The top – woven fabric of 100 % silk, and the skirt - 20% elastane/ 40% viscose/40% Polyester. In the upper front area of the blouse is additionally made hand embroidery of Bulgarian embroidery with five colors by old technology with the help of loose fabric - panama. The dress is decorated with a red long belt by three leather strips. The belt is sewn from pieces of an old leather bag. Model 3 is made of two parts, a blouse and a two-layer skirt. in two colors - fig. 13 and fig. 14. The blouse is made from ready-made garment - woven fabric of 100 % silk. The sleeves are made of two strips, cut from textile waste. The two-layer skirt – knitted fabric of 100 % cotton - is made from second-hand ready-made garment and textile waste. The textile waste was used for the lower part of the two-layer skirt. Two of the most typical colors of the Bulgarian national garb were used – white and red.

At the Table 1 is presented in details an example of technological sequence map for manufacturing of a physical sample of the Model 1.

Table 1. Technological sequence map for manufacture the Model 1.

No	Name of the operation	Symbol	Stitch type	Comments
00.00	Preparation			
00.01	Washing the raw materials	everything		Washing machine
00.02	Pre-ironing	everything	⊥	Steam iron
00.03	Cutting the excess parts			Handwork
01.00	Rubber band 3 pieces			
01.01	Elastic band closure		301	two pieces
02.00	Upper part			
02.01	sewing the seams		516	Without bar-tack
02.02	sewing elastic to upper part		304	Without bar-tack
02.03	Ironing a seam 02.02		⊥	Handwork
02.04	Sewing on a decorative strip		304	Without bar-tack
03.00	Bottom part			
03.01	sewing the seams		516	Without bar-tack
03.02	sewing elastic to bottom part		304	Without bar-tack
03.03	Ironing a seam 03.02		⊥	Handwork
03.04	Sewing on a decorative strip		304	Without bar-tack
04.00	Belt			
04.01	sewing the lace		304	Without bar-tack
05.00	Assembly			
05.01	sewing the lace to the upper part		304	Without bar-tack
05.02	sewing the lace to the bottom part		304	Without bar-tack
06.00	Finishing			
06.01	Threads and chalk cleaning		Handwork	Handwork
06.02	Final ironing		⊥	Handwork

4 Conclusions

The main idea of sustainable fashion, as an alternative to fast fashion, is to minimize the carbon footprint on the planet. The EU Strategy for Sustainable and Circular Textiles is a guide in this direction. In the presented work is proposed an approach aimed at fostering an active attitude towards global environmental problems. Women's casual clothes are made with elements of the Bulgarian national garb, mainly from textile waste - clothes prepared for disposal in a container. The concept is based on a combination of upcycling method, moulage method, 3 R's approach and appropriate segmentation. The main idea of the presented research, in one sentence, is: "Let's meet the past with the present so that the future can happen". The proposed approach enables an active attitude and individual contribution towards reducing one's own carbon footprint.

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