

Development of boutique denim clothing by the "upcycling" method

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Abstract. In the present article have been developed denim models for women's figures with deviations from the conditionally nominal sizes, using the method of re-creative use - upcycling, in pursuit of motivation to reduce the textile waste from the sewing industry. A combination of three approaches is used: a concept for a boutique vision when creating the design of the models, as an attraction for each user; upcycling as an idea for reusing sewing products; moulage method in the development of the construction of clothing, based on a classic basic construction. To confirm the results, physical samples of the products were made. The research and creative activity is aimed towards realization of a design and construction-technological concept of denim clothing, which is the most common clothing used by absolutely all age groups, from babies to centenarians and is present in both the prêt à porter and haute couture. This makes the production of denim products, one of the most voluminous and polluting in the textile industry.

1 Introduction

Overproduction and the rapid development of the industry worldwide are causing catastrophic damage to the environment and the planet. Various world organizations are developing new methods of clean production led by the motto "Save the planet". The fashion industry is the second most polluting industry after the oil industry, worldwide. Therefore, the fashion designers empathic to protecting the environment for future generations should engage in solving these problems. For this purpose, they create bio or eco fashion, use recycled raw materials and reused textiles, create "upcycling" clothing, etc. Creative reuse has grown significantly in countries such as the United States, where in recent years the number of products labeled "upcycled" has increased by between 300% and 900% [1]. The proposed approach opens a market niche with the possibility of Internet-based small business and is aimed towards developing of an active attitude to global environmental problems, both for designers and clothing users.

In search of motivation to reduce the textile waste from the garment industry, denim models have been developed [2], using a combination of three approaches: a concept for a boutique vision of the design; upcycling as an idea for reusing sewing products; moulage method in the development of clothing design, based on a classic basic design for women's

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figures with deviations from the conditionally nominal sizes [3]. Upcycling or creative reuse to increase the value of the original product by changing and / or adding a personal view to the design of an already manufactured and used product [1]. The upcycling resources are used for as long as possible. Maximum value is extracted out of them, afterwards they are recovered several times, unlike the model purchase - use - disposal as waste. Upcycling as a method of clothing transformation is one of the solutions for sustainable living.

According to the moulage method [4], [5], the patterns are obtained directly from the human body or from a mannequin torso, by applying pieces of fabric or paper on its surface, after which the contours of the individual details are outlined in accordance with the model. The final shaping is done during the cutting and sewing. Several tests and corrections are mandatory.

2 Methods and Results

2.1 Development of models

Using the above combination of methods, two models of women's clothing were designed - a skirt and a jacket. Sketches of the designed products are presented on Fig.1.



Fig. 1. Fashion sketches and technical drawings of the designed clothes

The first model is a women's skirt in a straight silhouette, with a length above the knee and a gathered element along the hips, covered by ethnic motifs. The fastening is central

with a zipper and a button. The waist line is shaped with a belt and five loops. The side pockets are in shape. A triangular yoke is made on the back side. The pockets are externally attached with embroidered floral motifs.

The second model is a women's jacket in a semi-fitted silhouette with a length to the hip line, cut at the waist, with attached a long two seam sleeves. The front part is structurally divided in two along the waist line. The waist darts are transformed into princess seams. The design is completed by inclined decorative pieces in the front and back, which allow the use of multicoloured pieces. Along the waist in the front part there are 2 externally sewn pockets with a rounded shape. The fastening is by means of seven wire buttons, as the front parts touch frontally and are decorated with metal buttons. The back part has middle seam. A slit is made in the bottom part. The jacket has a collar with rounded edges. Three pairs of denim trousers in different colours were used for the production of the model - light blue, dark blue and black.

2.2 Development of clothing construction

The proposed combined approach, for creative reuse of clothing, is illustrated by creating two models of denim. Four jeans in different colours have been recycled. The designed clothing is made in two different ways, using the moulage method.

According to the first one the lady's skirt is formed directly on the human body, after the preliminary sketch, using direct cuts, outlining, fixing with pins and manual sewing. The finishing is done after undressing the products. A trial dressing is made to make further corrections, if necessary. The cycle is repeated until the desired result is achieved. Accepted corrections are fixed by stitches, according to the selected technology.

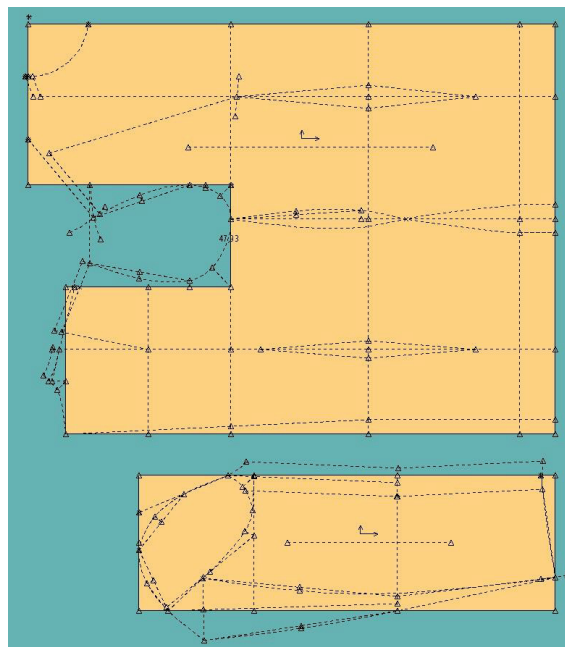


Fig. 2. Pattern making of the women's jacket - back, front and two seam sleeve

The women's jacket is developed by combining a base pattern according to a classical computational-analytical method and modeling as per the moulage method, following the "upcycling" principle. The product is modeled on the base construction, afterwards it is

formed directly on the torso, according to the preliminary sketch. For the purpose has been developed a basic construction of a jacket in a semi-fitted silhouette. The initial construction is made out of textile waste. After several consecutive tests on a human body, the patterns are outlined and the details are tailored. The basic construction is developed for a female figure of standard size 48 (164/96/104). The horizontal structural sections are dimensioned with the following ease values along the main structural lines: along the chest line 8.0 cm, along the waist line 8.0 cm, along the hip line 7.0 cm. The calculated front balance height is 5.2 cm. The functional dependences for calculating the structural dimensions are according to [6]. The take away value in the middle back is 2.0 cm. The additional length for gathering of the sleeve, obtained geometrically, is 3.7 cm. The functionality [7] of the specialized clothing software AccuMark, version V10 of the company Gerber Technology, USA were used for the pattern making of the construction. An algorithm for automated construction has been developed. The output pieces - back, front and two seam sleeve are presented in Fig. 2. They are used as a initial stage for moulage.

Both products - skirt and jacket are obtained by transforming women's denim pants with an elastomeric component (Fig. 3a, 4a).

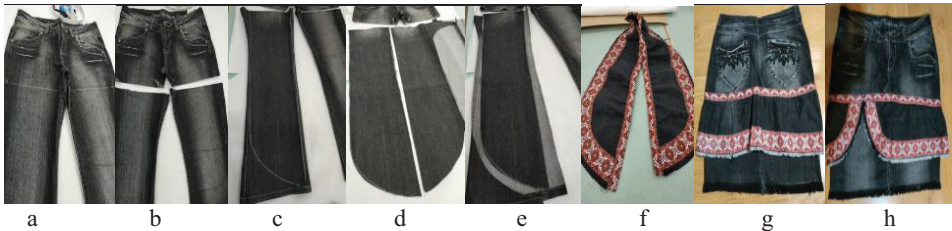


Fig. 3. Photos of selected stages of the sequence for transforming the pants into a lady's skirt

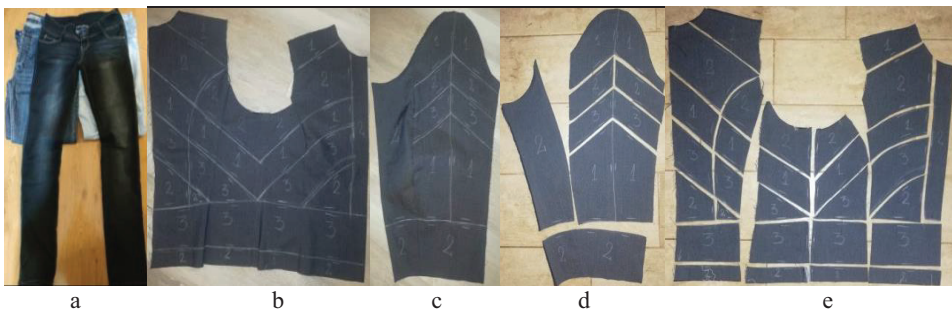


Fig. 4. Final adjustments, marking the details on the textile waste and cutting the patterns



Fig. 5. Laying the production patterns on the jeans and cutting the details of the jacket

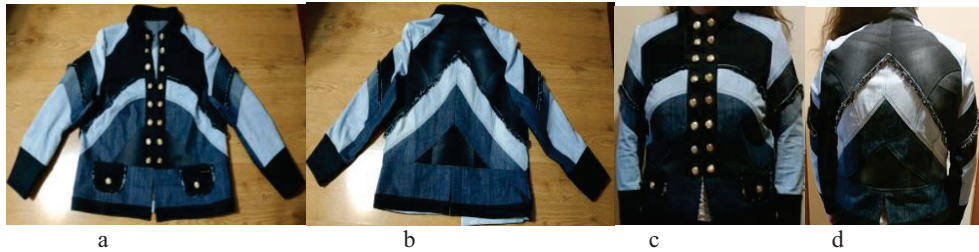


Fig. 6. Photos of the women's jacket, developed by the "upcycling" method


































The models are presented with fashion sketches and technical drawings on Fig. 1. The stepwise transformation is illustrated by the photographic material on Fig. 3 a-h for the skirt and on Fig. 4a-e, Fig. 5 a-c. The final outlook of the women's jacket is presented face and back on Fig. 6 a - d. The sequence for transformation and production of the lady's skirt and lady's jacket is presented in details in Table 1 and Table 2.
































Table 1. Technological sequence map for transforming and manufacture a lady's skirt











| № | Name of the operation | Symbol | Stitch type | Comments |
|----|--|--------|-------------|-------------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| 1 | Outlining and cutting the details | | Handwork | |
| 2 | Overedge the band | | 504 | |
| 3 | Sew the parts for front bottom, back and band | | 2x301 | With bar-tack |
| 4 | Sew the front middle seam in the area below the zipper | | 301 | in the direction of the right front |
| 5 | Sew the back middle seam | | 301 | in the direction of the right back |
| 6 | Sew the middle of the gathered element | | 401.504 | With bar-tack |
| 7 | Sew the decorative band at 1 cm from the hem of the gathered element | | 2x301 | With bar-tack |
| 8 | Reinforce the seam under the band | | 301 | Without bar-tack |
| 9 | Set up the gathering of the gathered element | | 301 | |
| 10 | Sew the decorative band and the gathered element | | 2x301 | With bar-tack |
| 11 | Outline and cut the the gathered element | | Handwork | Handwork |
| 12 | Sew the front and back bottom pieces | | 401x504 | With bar-tack |
| 13 | Sew the top and bottom part | | 401x504 | With bar-tack |
| 14 | Pressing the 13 | | Steam iron | |
| 15 | Define the position of the gathered element | | | On the body |
| 16 | Sew the gathered element | | 301 | With bar-tack |
| 17 | Reinforce the seam 2 cm from the hem | | 301 | |
| 18 | Unweave the hem of the gathered element | | Handwork | Handwork |
| 19 | Threads and chalk cleaning | | Handwork | Handwork |
| 20 | Final ironing | | Steam iron | |

Table 2. Technological sequence map for transforming and manufacture a lady's jacket

| № | Name of the operation | Symbol | Stitch type | Comments |
|--------------|--|--------|-------------|----------|
| 1 | 2 | 3 | 4 | 6 |
| 00.00 | Cutting | | | |
| 00.01 | Numbering | | Handwork | Handwork |
| 00.02 | Fuse the top and bottom collar, plastron | | Steam iron | |
| 01.00 | FRONT | | | |

| | | | | |
|-------|---|---|------------|---------------------------------|
| 01.01 | Sew the component pieces |  | 301 | With bar-tack |
| 01.02 | Overedge the seam allowances |  | 504 | |
| 01.03 | Pressing the 01. 02 |  | Steam iron | |
| 01.04 | Reinforce the seam on the diagonal seams |  | 302 | |
| 01.05 | Unweave the seam allowance | | Handwork | 1 cm |
| 01.06 | Making a decorative seam |  | 213 | Put in a thread |
| 01.07 | Sew the front middle and the front side part |  | 301 | With bar-tack |
| 01.08 | Overedge the seam allowances |  | 504 | |
| 01.09 | Pressing the 01. 08 |  | Steam iron | |
| 01.10 | Making a decorative seam |  | 302 | |
| 01.11 | Fold and press of the plastron |  | Steam iron | |
| 01.12 | Sew the front piece and the plastron |  | 301 | With bar-tack |
| 01.13 | Pressing the 01.12 |  | Steam iron | |
| 01.14 | Closing seam of the plastron |  | 301 | Without bar-tack |
| 01.15 | Sew the bottom front middle and the front side part |  | 301 | With bar-tack |
| 01.16 | Overedge the seam allowances |  | 504 | |
| 01.17 | Pressing the 01. 16 |  | Steam iron | |
| 01.18 | Sew the pieces of the hem band |  | 301 | Without bar-tack |
| 01.19 | Pressing the 01. 18 |  | Steam iron | |
| 01.20 | Sew the two bands |  | 301 | With bar-tack |
| 01.21 | Press with the edge |  | Steam iron | The edge towards the inner band |
| 01.22 | Attach the band with a top seam |  | 301 | |
| 02.00 | BACK | | | |
| 02.01 | Sew the component pieces |  | 301 | Without bar-tack |
| 02.02 | Overedge the seam allowances |  | 504 | |
| 02.03 | Sew the back middle seam |  | 301 | With bar-tack |
| 02.04 | Sew the middle and the side part |  | 301 | With bar-tack |
| 02.05 | Overedge the seam allowancesca |  | 504 | |
| 02.06 | Making a decorative seam |  | 302 | |
| 02.07 | Unweave the seam allowance | | Handwork | 1 cm |
| 02.08 | Making a decorative seam |  | 213 | Put in a thread |
| 02.09 | Sew the back middle and back side part |  | 301 | With bar-tack |
| 02.10 | Overedge the seam allowances |  | 504 | |
| 02.11 | Pressing the 02. 10 |  | Steam iron | Towards the back middle |
| 02.12 | Make a decorative seam on the assembly seams |  | 302 | |
| 02.13 | Overedge the seam allowances |  | 504 | |

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|-------|--|---|------------|-----------------------------------|
| 02.14 | Sew the slit |  | 301 | With bar-tack |
| 02.15 | Press with a edge |  | Steam iron | |
| 02.16 | Sew the pieces of the bands |  | 301 | Without bar-tack |
| 02.17 | Assembly the bands |  | 301 | With bar-tack |
| 02.18 | Press with a edge |  | Steam iron | |
| 02.19 | Close the band with a top seam |  | 301 | |
| 03.00 | COLLAR | | | |
| 03.01 | Assembly the inner and upper collar |  | 301 | With bar-tack |
| 03.02 | Sew a reinforcing seam |  | 301 | |
| 03.03 | Cut the seam allowance |  | Handwork | Handwork |
| 03.04 | Turn the collar to the face side |  | Handwork | Handwork |
| 03.05 | Pressing the 03. 04 |  | Steam iron | The edge towards the inner collar |
| 04.00 | SLEEVES | | | |
| 04.01 | Sew the component pieces |  | 301 | Without bar-tack |
| 04.02 | Overedge the seam allowances |  | 504 | |
| 04.03 | Making a decorative seam |  | 302 | |
| 04.04 | Sew the elbow seam |  | 301 | With bar-tack |
| 04.05 | Overedge the seam allowances |  | 504 | |
| 04.06 | Lies on one side and press the ellbow seam |  | Steam iron | |
| 04.07 | Sew the inner seam of the sleeve |  | 301 | With bar-tack |
| 04.08 | Overedge the operation 04.07 |  | 504 | |
| 04.09 | Lies on one side and press the inner seam |  | Steam iron | |
| 04.10 | Assembly the inner and upper cuff |  | 301 | With bar-tack |
| 04.11 | Turn the cuff to the face side and press with a edge |  | Steam iron | towards the inner cuff |
| 04.12 | Sew the inner cuff and the sleeve |  | 301 | With bar-tack |
| 04.13 | Closing seam of the cuff |  | 302 | With bar-tack |
| 05.00 | ASSEMBLY | | | |
| 05.01 | Sew the shoulders and the side seams |  | 301 | Without bar-tack |
| 05.02 | Overedge the seam allowances |  | 504 | |
| 05.03 | Lies on one side and press the assembly seams |  | Steam iron | |
| 05.04 | Making a decorative seam of the shoulders |  | 302 | With bar-tack |
| 05.05 | Sew the front bottom pieces and the back |  | 301 | Without bar-tack |
| 05.06 | Overedge the seam allowances |  | 504 | |
| 05.07 | Lies on one side and press the assembly seams |  | Steam iron | |

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|-------|---|---|------------|------------------|
| 05.08 | Sew the top and bottom part |  | 301 | Without bar-tack |
| 05.09 | Overedge the seam allowances |  | 504 | |
| 05.10 | Lies on one side and press the assembly seams |  | Steam iron | |
| 05.11 | Sew the front and the pocket |  | 301 | decorative seam |
| 05.12 | Unweave the seam allowance of the pocket | | Handwork | 1 cm |
| 05.13 | Assembly the collar and the neck line |  | 301 | With bar-tack |
| 05.14 | Pressing the 05. 13 |  | Steam iron | |
| 05.15 | Assembly the sleeves and armhole |  | 301 | With bar-tack |
| 05.16 | Overedge the seam allowances |  | 504 | |
| 05.17 | Press the armhole |  | Steam iron | |
| 06.00 | Finishing | | | |
| 06.01 | Mark the place of the buttons | | Handwork | Handwork |
| 06.02 | Sew the buttons |  | Handwork | Handwork, 25p |
| 06.03 | Threads and chalk cleaning | | Handwork | Handwork |
| 06.04 | Final ironing | | Steam iron | |

3 Conclusions

The article proposes a creative method for reducing textile waste from the sewing industry. A women's skirt and a women's jacket of denim clothing has been created. A combination of three approaches is used: a concept for a boutique vision when creating the design of the models, as an attraction for each user; upcycling as an idea for reusing sewing products; moulage method in the development of the construction of clothing, based on a classic basic construction. The effect is also enhanced by the focus on denim products, whose production is one of the largest in the textile industry. To confirm the results, physical samples of the products were made.

The proposed approach opens a market niche with the possibility of Internet-based small business and is aimed towards developing of an active attitude to global environmental problems, both for designers and clothing users.

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