



## NATURE-INSPIRED COLORS AND SHAPES IN CLOTHING DESIGN

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**Abstract:** *Nature is an inexhaustible source of inspiration for fashion designers when it comes to colours, materials, textures and pattern of garments or accessories. Its suggestive potential, the infinite imaginative resources that nature forms generates and reveals always remain relevant, continuously feeding the creative imagination.*

*The flexibility of shapes, angles, overlays of volumes, all these we find in clothes, in prints, in the search of cutouts, in the way that many designers chose to put their mark on their fashion creations in order to harness the expressive language of human body.*

*The purpose of this article is to offer models of clothing based on combinations of colors and shapes inspired by natural sources. The colors used from natural sources and their values in the RGB color model were presented. Also, the procedure for obtaining a four-color wheel and the method for creating "rose" curves were described. Different geometric shapes based on the rose curve were defined. Based on the selected colors and the defined shapes, the design of 3 models of nature-inspired dresses was made in order to visualize how the proposed colors and shapes will look in a completed garment. Discussion and a comparative analysis have been made with the results obtained by other authors.*

**Keywords:** *eco-clothing, eco-fashion, identity construction, apparel design, flower colors, rose figure*

### 1. INTRODUCTION

Nature has always been a source of inspiration for artists; it has been and is being approached by various themes and motives, by different ways of expression: paintings, decorations, clothing and textiles, etc. The varieties of plants, flowers and animals are highlighted by artists precisely through their chromatic dynamics. Natural colors have a great impact on art and design, especially in garments design.

Colors in nature are often less saturated and more pleasing to the eye than their artificial substitutes [1]. İşmal [2] proposes to use natural colors derived from waste products, biomass, when staining fabrics. After a number of studies, the author concludes that the color obtained on the textile material depends to a large extent on the type of material to be applied. This thesis is confirmed and supplemented by Samanta [3]. According to the author, research is needed regarding the stability of the colors obtained, standardization of the methods by which they are extracted, also the microbiological action and last but not least the education and training of specialists in the application of natural colors.



Starting with the premise that colours influence our behaviour due to the fact that we are constantly surrounded by colours and that we are taught to associate each color with certain values, characteristics and feelings, fashion designers explore how colours/colours combinations influence a design, pattern or detail.

The shape [4] and arrangement of geometric elements is another important factor in design. The diversity of natural forms, their bizare combinations and often their unexpected manifestations were also a model for those who formed the elements of the environment Marfo [5] proposes the use of mathematical relationships and methods for generating elements that can be used in textile design, jewelry and decoration of buildings.

The compositional shape of the clothing elements takes into account the commonalities between geometry, the human body and clothing. When designing clothing, it is necessary to strike a balance between functionality and aesthetics in geometry, the human body and clothing.

The purpose of the article is to offer models of clothing based on combinations of colors and shapes inspired by natural sources.

## 2. MATERIAL AND METHODS

A description of the colors used and their values in the RGB color model is made. The procedure for obtaining a four-color circle is described. The method for creating rose curves is presented. The software products used are described.

Colors used by manufacturers of food coloring agents: Kalsec (Kalsec Inc., USA); Kanegrade Ltd. (United Kingdom); NATCOL (NATCOL AISBL, Brussels, Belgium). Colors with their RGB values and their natural sources are summarized in Table 1.

*Table 1: Colors obtained from natural sources*

Color	RGB values			Natural source
	R	G	B	
Yellow	248	229	23	Eggs, milk, yeast
Yellow-orange	255	120	0	Carrots, oranges, red peppers, saffron, tomatoes
Pink-red	218	0	17	Hibiscus
Blue	0	159	223	Indigo Flower
Green	92	121	29	Alfalfa, nettles, parsley, spinach
Brown	205	79	0	Caramel
Red-blue	141	27	225	Black grapes, black currants, elderberry, strawberries
Red-pink	182	91	113	Beetroot
Black	0	0	0	Carbonized plant material

The colors are represented in the Lab four-color wheel. The color wheel is a clear and effective scheme designed to represent the concepts and terminology of color theory. There are many different color patterns, but there is hardly a color wheel that can fully describe the complexity and the way we perceive color from light. Obtaining polar coordinates in the four-color circle is based on their chroma and Hue.

The color components of the RGB color model (RGB [0 255]) were converted to Lab (L [0 100], a [-86.18 98.23], b [-107.86 94.47]), according to [6]. The chroma (C) and hue (h) values are determined by:

$$C = \sqrt{a^2 + b^2} \quad h^\circ = \text{atan} \left( \frac{b}{a} \right) \quad (1)$$

Forms of the shape "rose" shapes are used, which can be described in a Cartesian coordinate system, by the following mathematical formula:

$$\begin{aligned} x &= r \cdot \cos(\theta) \\ y &= r \cdot \sin(\theta) \end{aligned} \qquad \begin{aligned} r &= \cos(n \cdot \theta) \\ \theta &= 0, \frac{\pi}{64}, 10^2 \cdot \pi \end{aligned} \qquad (2)$$

If  $n$  is odd, the rose has an  $n$ -leaf. If  $n$  is even, then the rose has  $2 \cdot n$  leaves. If  $n$  is a rational number, then the curve closes at an angle in the polar coordinate system  $\pi \cdot s \cdot p$ , where  $p=1$  if  $n$  is odd and  $p=2$  if  $n$  is even. If  $n$  is irrational, then the rose has an infinite number of leaves. The rose type curve was chosen because it has the shape of a flower. It was proposed by the Italian mathematician Guido Grande between 1723 and 1728 because it looks like a rose [7].

The following software products were used in the present work:










- ✓ Image processing with PhotoFiltre ver.6 software (<http://www.photofiltre.com>, Houilles, France).
- ✓ Vector processing was done with Inkscape ver.0.92 software (<https://inkscape.org>).
- ✓ The models were developed with the help of the online tool Art of Where Design Lab (<https://artofwhere.com>).

All data were processed at a level of significance  $\alpha=0,05$ .

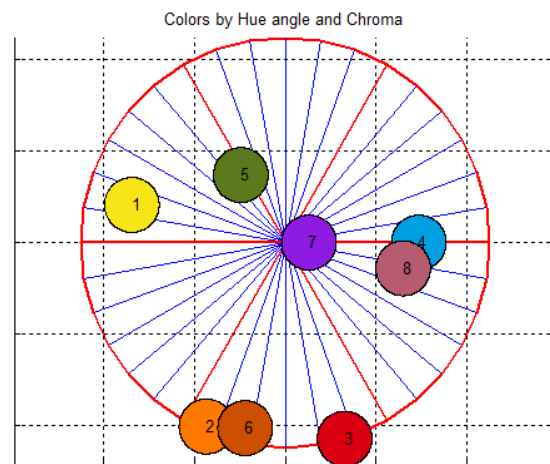
### 3. RESULTS AND DISCUSSION

The work presents the colors of natural sources in a four-color wheel, as well as their general appearance. Shapes based on a curve of the "rose" type are defined. Design models of clothing, representing the resulting figures and selected colors, were presented. Discussion and a comparative analysis have been made based on the results obtained by other authors.

Figure 1 shows a general view of the natural colors used and their location on the Lab color wheel.

RGB Values of the colors	
9@ 0 0 0	
8@ 182 91 113	
7@ 141 27 225	
6@ 205 79 0	
5@ 92 121 29	
4@ 0 159 223	
3@ 218 0 17	
2@ 255 120 0	
1@ 248 229 23	

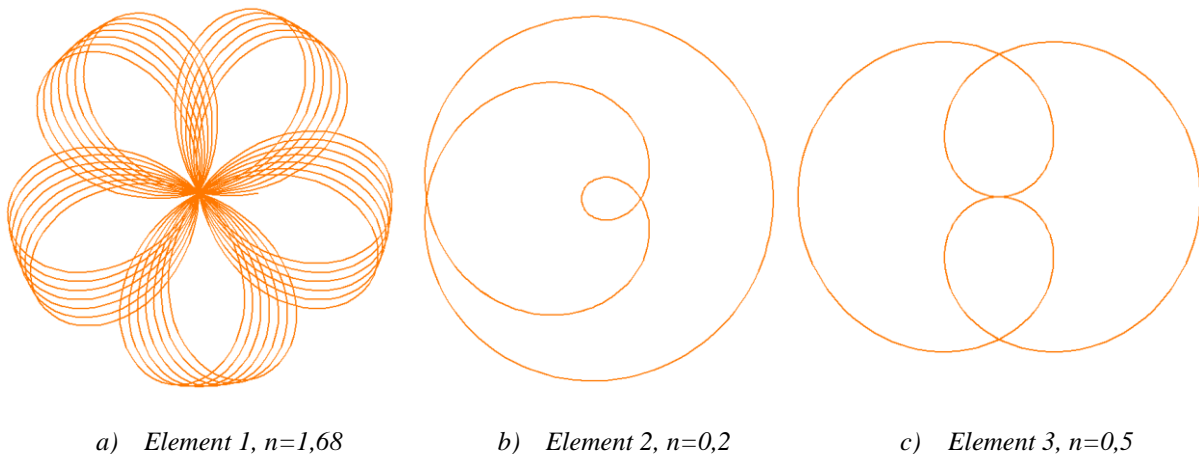
a) General view of the colors



b) Colors on Lab color wheel

**Fig. 1.** Natural colors

Figure 2 shows the resulting shapes, depending on the coefficient "n". The motifs presented can be directly used in textile and fashion design. For the sake of greater model variety and convenience in the design of the patterns, different geometric shapes were used, based on the cow "rose".



*Fig. 2. Forms used*

Figure 3 shows the designed dress models. The models consist of three basic elements – a mannequin, a wig and dress. The models represent a dress of the cut style. It has an A-shaped silhouette. The neckline is round, sleeveless but with straps. It is cut in the waist and there are busts to form a bundle in the waist and to form a bust. For Model 1 Element 1 is used, the colors are 1 and 4 (blue and yellow). A 90 degree rotation of the element is applied. The colors 1, 3 and 4 (yellow, red and blue) were used in Model 2 in conjunction with Element 2. The repeat is reflection+glide reflection. Model 3, created by Element 3, consists of the three colors 7, 8 and 9 (pink-red, pink-blue and black). The repeat is the same as in Model 1 - 90 degree rotation.

The choice of colors in this paper confirms Baycheva's findings [6] that color is a major indicator that influences consumers when choosing a product.

The results presented in this paper complement and confirm those of Yueming [8]. The author points out that more and more clothing manufacturers are developing applications of geometric shapes in clothing. According to the author, the application of geometric shapes in a three-dimensional way is the key to success for contemporary designers. Research is also needed on the impact of geometric elements used on consumer desires and searches. The results of such studies could be used to create new garments. On the other hand, the way of combining forms is also a major aspect in the design of clothing, as stated by Kazlacheva [9]. According to the author, the use of the Fibonacci order and the gold section in the arrangement can be used to create beautiful and harmonious shapes directly or with the help of geometric shapes.



*Fig. 3. Designed models*

Curves are a proven effective geometric element for creating spectacular shapes [10]. The results obtained in the work confirm Kazlacheva's statement that the round shapes can be applied in the fashion design in different rhythms, different combinations of colors and in different proportions and directions according to the clothes.

#### 4. CONCLUSIONS

Theoretical studies highlight that one of the main trends in the development of fashion in the future - the increasing penetration of eco-fashion. Another trend in fashion is the use of colors from natural sources in the field of textile production, focusing on their rationality and uniqueness.

Clothing models based on combinations of colors and shapes inspired by natural sources were proposed in this article. The researches made give the basic directions for the application of the selected eco-colors in the modern textiles. There are possibilities for their interpretation in accordance with the contemporary cultural-aesthetic, material-technical, scientific, ergonomic, ecological factors of the modern society. The software products used have the advantage of providing greater visibility into the results obtained, which are also presented graphically for better visualization of the results.



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