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Exploring the relationship between color and form in the design of women's Latin dance costumes

Istraživanje odnosa boja i oblika u dizajnu ženskih kostima za latino plesove

Scientific paper / Znanstveni rad

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Abstract

This article delves into the complex world of designing women's Latin dance costumes, highlighting the paramount importance of harmonizing current fashion trends with the essential requirements of comfort, flexibility, and the need to emphasize the dancer's graceful movements. The objective of this study was to create few models of Latin dance costumes. To forecast how the users and viewers would perceive Latin dance outfits, an on-line survey was conducted. A regression model was applied to analyze how color and shape interact in the creation of Latin dance costumes. The article focuses on key aspects of costume design, covering an in-depth study of silhouettes and colors and their perception by viewers. Designers are encouraged to focus their creative efforts on prioritizing the comfort and freedom of movement of the dancers, adapting to ever-evolving societal and cultural changes, and exploring innovative solutions to overcome the challenges and limitations inherent in costume creation. The regression model can be used to predict with enough accuracy users' and viewers' opinions on the use of Latin dance costumes. Embracing these results, designers are ready to produce remarkable, comfortable clothing patterns that authentically capture the splendor and diversity of Latin dance culture.

Keywords: Latin dance; costume design; color; form; regression model.

Sažetak

Ovaj članak zadire u složeni svijet dizajniranja ženskih kostima za latino plesove, ističući iznimnu važnost usklađivanja aktualnih modnih trendova s važnim zahtjevima udobnosti, fleksibilnosti i potrebe da se naglase graciozni pokreti plesačice. Cilj ovog istraživanja bio je izraditi nekoliko modela kostima za latino plesove. Da bi se predvidjelo kako bi korisnici i gledatelji percipirali odjeću za latino plesove, provedena je online anketa. Regresijski model primijenjen je za analizu interakcije boje i oblika u izradi kostima za latino plesove. Članak se usredotočuje na ključne aspekte kostimografije, pokrivajući dubinsko proučavanje silueta i boja te njihovu percepciju od strane gledatelja. Dizajneri se potiču da svoje kreativne napore usmjere na davanje prioriteta udobnosti i slobodi kretanja plesača, prilagodbu društvenim i kulturnim promjenama koje se neprestano razvijaju i istraživanje inovativnih rješenja za prevladavanje izazova i ograničenja svojstvenih stvaranju kostima. Regresijskim modelom moguće je s dovoljnom točnošću predvidjeti mišljenja korisnika i gledatelja o korištenju kostima za latino plesove. Prihvaćajući ove rezultate, dizajneri su spremni proizvesti izvanredne, udobne modele odjeće koji autentično prikazuju raskoš i raznolikost latino plesne kulture.

Ključne riječi: latino ples; kostimografija; boja; forma; regresijski model.

1. Introduction

Sports dance refers to a collection of dance forms that have been adapted into competitive sports. The discipline includes ten different dance styles, which are categorized into two groups: Latin American and standard. The Latin American group consists of five dances: the samba, cha-cha-cha, rumba, paso doble, and jive [1].

The constant evolution of Latin dance costumes is critical as it requires to keep the art form fresh, relevant, and engaging. It allows dancers to express themselves, adapt to ever eveling dance styles, and improve their overall performance. Furthermore, the creation of new Latin dance costumes maintains their cultural and artistic abundance while responding to market dynamics, making them a multifaceted and evolving aspect of the dance world.

According to Huh et al. [2], the appeal of sport dances lies, not only in the movements, but also in the elaborate and aesthetically attractive costumes worn by the performers. The costumes that are worn during these dances accentuate the dancers' movements and enhance their performance.

The design of women's Latin dance costumes is unique, often with bright colors, intricate details, and cuts. Costumes are usually made of light and stretchy materials that allow for ease of movement and often include fringes, sequins, and other decorations that help emphasize the dancers' movements. Suit designs often feature asymmetric cuts, bare shoulders, and short skirts that expose the legs to emphasize their work [3].

The design of women's Latin dance costumes plays an important role in the presentation of sports dances. Costumes not only enhance the dancers' move, but also contribute to the overall look of the performance [4].

In the women's Latin dance costume, the occurence of many colors is observed, both individually and in combination with each other. Their characteristic is to be in brighter and sparkling shades in order to be noticed on the dance floor and stand out. Thus, the movements of the

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dancers are more noticeable to the audience and the judges.

In addition to the brightness of the color, the material of the fabric the dress is made of is also important. It must be made of elastic material, very soft and stretchy, perfectly fit the body and emphasize individual elements of the move that need to be highlighted. This fabric is usually made with elastomeric threads with a high sheen. Elastic plush can also be used [5]. These elastomeric fabrics are preferred to better express the idea of the dress and the visual requirements of the dancer herself.

In the case of Latin dance costumes, a lot is relied on the decorative elements and the embellishment of the dress, and this is in line with the desired look of the dancer in the first place, but also with the peculiarities of her physique, because decorative elements can be used and decoration to cover up a given part of the body and also to emphasize it. Current fashion trends are also an important factor here [6].

In the making of the dress, there is also a mesh, which can be flesh-colored or the color of the elastomeric fabric: bright yellow, green, orange, cyclamen, or blue.

The mesh is also used to make fitted sleeves that follow the shape of the arm and thus emphasize the movements of the arms.

This mesh is noticed by the judges and points are awarded as it emphasizes the hand movement which becomes more elegant.

From the review of the available literature, it can be observed that there is a noticeable gap in research related to the interaction between the colors and shapes of Latin dance costumes. This specific aspect, which examines how color choices in costume design complement or enhance the overall shape and aesthetics of those costumes, remains largely unexplored in academic and practical research. Further research and analysis in this domain is needed to gain a deeper understanding of the nuanced relationship between color choice and the overall design of Latin dance costumes.

The goal of this research is to develop Latin dance costume patterns that seamlessly combine functionality, cultural authenticity, and aesthetic appeal, demonstrated through the interplay between color and form.

2. Experimental part
2.1. Concept design

Figure 1 shows the developed patterns of Latin dance dresses. All models are fitted at the waistline, the most feminine part of the figure, and the skirts are cut at the hemline, providing freedom in the movements of the legs.

| a) M1 | b) M2 | c) M3 | d) M4 |

Figure 1. Models of Latin dance dresses

The variant M1 features a Y-shaped inverted silhouette, a V-neckline, and body-revealing decorative openings. The top and sleeves are figure-hugging, emphasizing the graceful movements of the dance. Even more attention is drawn to the rich decorations adorning the front parts, the neckline, and the waistline. Lush curls framing the hemline are accentuated with dramatic feathers, and all this completes the dancer's sparkling and impressive look.

Variant M2 shows a developed model in a Y-shaped inverted silhouette. Highlights of the dress are the V-neckline ending with an opening at the waistline, forming curves, accentuated with decorative ribbons, and a decorative element. The top and sleeves are form-fitting, allowing movement to be seen, and the added feathers at the hem of the skirt and sleeves further accentuate them.

Variant M3 is in a close-fitting silhouette, shaped at the top with an embellished bustier, and finished with an asymmetric hemline. The emphasis is on the figure, with the shoulders, arms, and back exposed, and the movement of the legs is emphasized by the asymmetric hem of the dress, ending in a dancing fringe.

The variant M4 features an X-shaped silhouette with puff sleeves, a cinched waist, and a floor-length dress finished with an asymmetric hem. The neckline is open, revealing heart-shaped shoulders, while decorative openings and a decorative belt accentuate the waist.

Figure 2 shows an overview of the colors used and their numbers. In Latin dance, the colors of the dance costumes are chosen for aesthetic and performance purposes rather than having specific traditional or cultural meanings like some other dance styles.
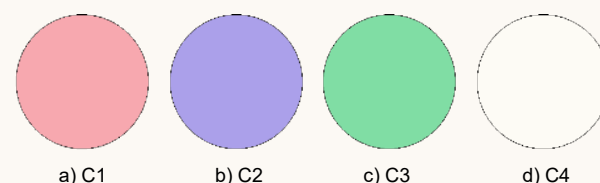

| a) C1 | b) C2 | c) C3 | d) C4 |

Figure 2. Colors of Latin dance dresses

In this designs, the colors more commonly used for dance costumes are: pink, violet, green, and light yellow.

Pink is associated with femininity, romance, and softness. Dancers can choose pink for a more delicate and elegant look or to convey a sense of passion and love.

Violet is a color that symbolizes creativity, individuality, and spirituality. It is used to create a unique and attractive appearance.

Green symbolizes nature, growth, and renewal. Dancers choose green to evoke a feeling of freshness and vitality.

Light yellow is associated with happiness, positivity, and warmth. Dancers choose bright yellow to convey a sense of joy and energy in their performance. Using the regionprops function in Matlab (The math works Inc.), the primary shape indices of the produced apparel models were ascertained from their digital photos [7-8]. The following are determined by this function: major axis D, minor axis D, area (A), and perimeter (P). The following formulas determine the remaining geometric properties and their corresponding particular coefficients:

Shape factor, K_f $\quad K_f = \dfrac{P^2}{A}$ $\qquad$ (1)

Eccentricity, K_1 $\quad K_1 = \dfrac{D}{d} \cdot 100, \%$ $\qquad$ (2)

Ovality, c $\quad c = \dfrac{P^2}{4\pi A}$ $\qquad$ (3)

Roundness, R $\quad R = \dfrac{1}{c}$ $\qquad$ (4)

Area ratio, K_A $\quad K_A = \dfrac{A}{A_{ideal}}$ $\qquad$ (5)

Area ratio, K_{AM} $\quad K_{AM} = \dfrac{A}{A_{mr}}$ $\qquad$ (6)

2.2. Design of on-line survey

Google Forms was chosen to conduct a survey because this tool offers an affordable, cost-effective, and efficient platform for creating, distributing, and analyzing surveys. The user-friendly interface and customization options make it a versatile tool suitable for a wide range of research tasks, from personal projects to large-scale business or research initiatives.

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Figure 3 shows an overview of the survey. At the beginning, the content of the survey is described and also the steps how to make the assessment.
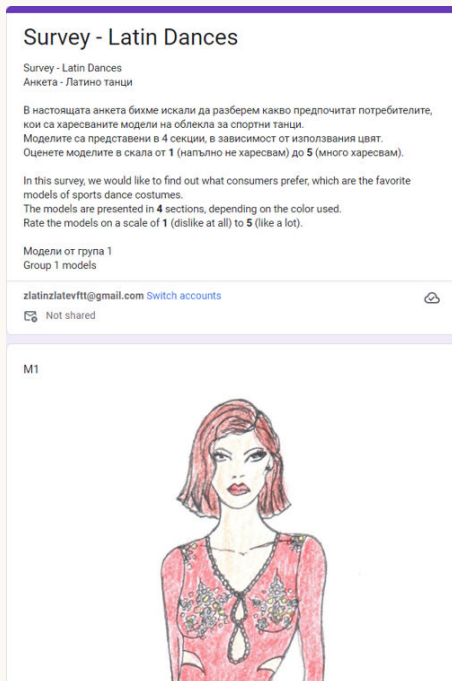

Figure 3. Survey form – general view

The survey is divided into four sections, depending on the color-shape combinations of the clothing models. The rating is from 1 (I don't like the model at all) to 5 (I really like the model).

A total of 70 respondents were surveyed. They are randomly selected without regard to educational level, workplace, or gender. All respondents are aware of the purpose of the study and the purpose of using the obtained data.

The ethical norms of Thrace University, Bulgaria, were observed when conducting the survey.

2.3. Regression model

A regression model was applied [9]. It describes the relationship between independent and dependent variables and has the form:

$$z = b_0 + b_1 x + b_2 y + b_3 x^2 + b_4 xy + b_5 y^2 \qquad (7)$$

in which the dependent variable is z. The model's coefficients are represented by the letters b, and the independent variables are x and y.

Based on the coefficient of determination (R^2), model coefficients, standard error (SE), t-statistic (tStat), p-value, and Fisher's test (F), the model was evaluated. A residuals analysis was conducted.

Based on the p-level value in relation to the significance level α, each model coefficient was examined. The coefficients where p>α was found the Student's test was used to determine the coefficients' significance, and the Fisher test was used to determine their adequacy.

3. Results and discussion
3.1. Results

Data about the colors used is displayed in Table 1. Color models RGB and Lab are referred to as data. RGB values, which range from 0 to 255, showing how intense the red, green, and blue components of each hue are. For the L*a*b* color model standard CIE 1976 has been used In the L*a*b* values, the luminance (L*) ranges from 0 to 100 and the range for the opposite color, which are "a*" (green-red) and "b*" (blue-yellow) is -128 t0 127. Standard Illuminant D65 is used and observer 2o.

The symbol "*" is used to separate CIE 1976 standard from clear Lab (without *) which is from 1931 color space.
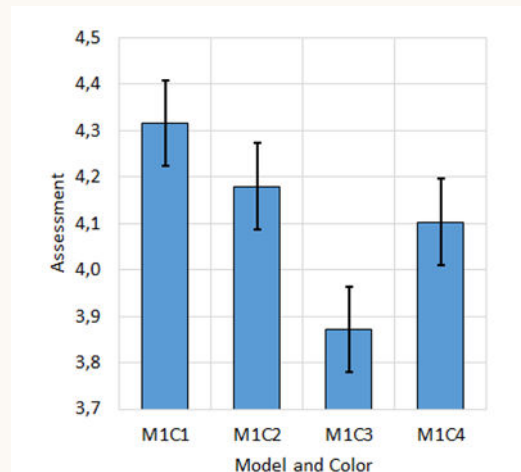
Table 1. RGB and Lab values of the colors

Color Component	C1	C2	C3	C4
R	247	171	128	253
G	168	160	221	251
B	175	234	164	245
L*	76.61	69.28	81.28	98.62
a*	30.00	19.81	-40.1	-0.37
b*	8.30	-35.78	19.51	3.10

Table 2 shows shape index data for the suggested models of Latin dance dresses. The M3 and M4 models have the highest form factor values, and the M1 and M2 models have the lowest values. The roundness is more pronounced in the first two models and lower in the M3 and M4.
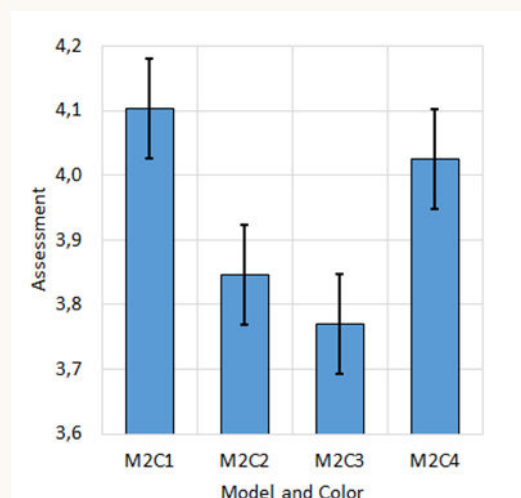
Table 2. Values of form indices

Model	K_f	K_1	c_1	R_1	K_A	K_{AM}
M1	17.76	217.02	1.41	0.71	0.95	0.75
M2	19.00	256.19	1.51	0.66	0.95	0.75
M3	19.92	284.25	1.59	0.63	0.95	0.75
M4	19.19	262.07	1.53	0.65	0.95	0.75

After conducting the survey, the results were established and presented in Figure 4.

a) M1

b) M2

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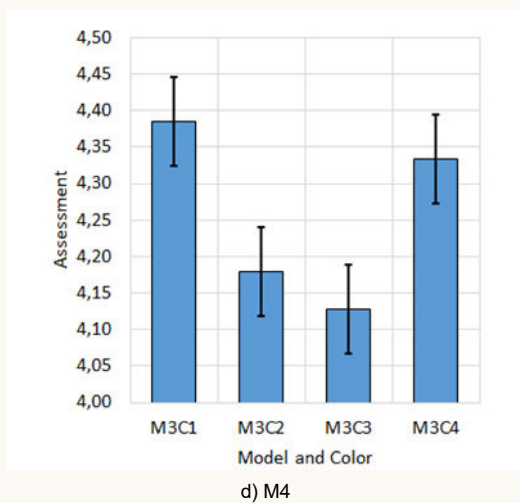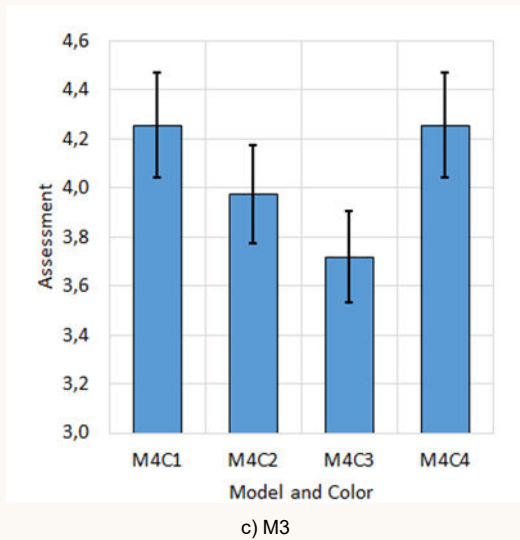KOŽA & OBUĆA

c) M3

d) M4

Figure 4. Survey results for combinations between models and colors

Models M1, M2, and M3 are most preferred with color C1 and least with color C3. For the M4 model, users preferred it equally to the C1 and C4 colors. As with the previous models, the C3 color variant is not preferred. In terms of the average model preference score, model M1 has a score of 4.12; model M2 is slightly preferred and has a rating of 3.94; model M3 is the most preferred with a rating of 4.26; and model M4 has a rating of 4.05. In terms of color preference, color C1 is the most preferred and has a score of 4.26; color C2 is at 4.04; color C3 has the lowest score of 3.87; and color C4 is at 4.18.

Before processing with the PCA method, the data were normalized to the interval [0;1]. Table 3 shows the standardized data for the color and pattern of Latin dance costumes.

Table 3. Normative data of information assessment for combination model and color

Model Color	M1	M2	M3	M4
C1	0.10	0.08	0.06	0.13
C2	0.07	0.02	0.01	0.06
C3	0.00	0.00	0.00	0.00
C4	0.05	0.06	0.05	0.13

Since the number of rows and columns is 4 each, It follows that the data can be reduced to three principal components by rows and columns. The number of components required was determined under the condition that the sum of the principal components should describe more than 95% of the variance in the data.

Figure 5 shows the results of a PCA analysis of the relationship between pattern and color of the dance dresses. Two main components are used. As it can be seen from the graph, they describe over 95% of the variance in the data. According to these results, model M1 is

preferred in color C2. Models M2 and M3 are preferred in color C1, and model M4 in color C4.
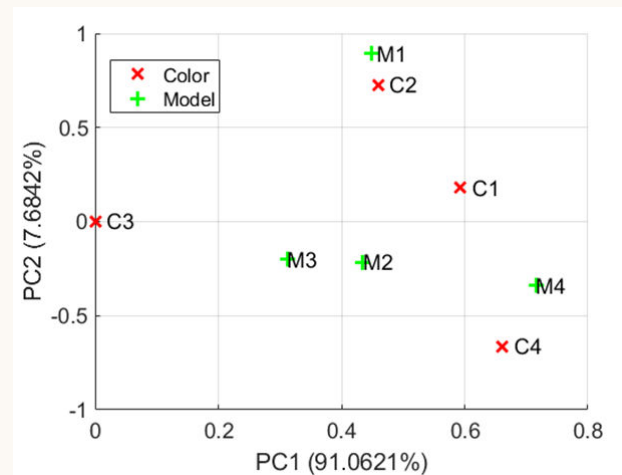

Figure 5. PCA results for connection between model and color

Table 4 shows the results of the regression analysis. According to Fisher's test, $F_{(2, 13)} = 88.08$ is much larger than $F_{cr} = 3.81$. Also, the standard error value is 0.06 and $p<0.00$, which is much less than the accepted significance level of 0.05. The value of the coefficient of determination, 0.93, is high. These results show that the obtained model describes the experimental data with sufficient accuracy.

Table 4. Regression results

N=80	R^2= 0.93; F(2, 13)=88.08					
	p<0.00 Std.Error of estimate: 0,06					
	b*	SE of b*	b	SE of b	t(13)	p
Intercept	-	-	4.1	0	178	0
x*y	1	0.1	3.6	0.3	13	0
y^2	-0.3	0.1	-1.3	0.3	-4.5	0

The resulting model showing the relationship between the evaluation of Latin dance dresses and the first two principal components has the form:

$$A = 4.06 - 1.31PC_2{}^2 + 3.62PC_1PC_2 \qquad (8)$$

Figure 6 shows the resulting model in the general graphical form. The two main components are plotted on the horizontal axis, and the dress ratings are plotted on the vertical axis. It can be seen that the highest score for Latin dance dresses is obtained when the two principal components are at their highest levels. Analysis of the residuals for this regression model found that they closely fit the normal probability plot and have a near-normal distribution.
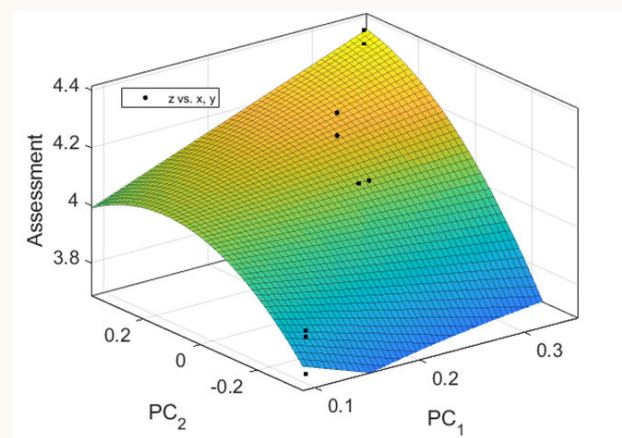

Figure 6. Regression model A=f(PC1, PC2) – general view

3.2. Dicussions

The Latin dance costumes proposed in this work complement the research of Huh et al. [2], according to which the appeal of sport dance

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lies not only in the movements but also in the elaborate and aesthetically attractive costumes worn by the performers. These studies are further developed by objectively proving the relationship between shape and color in the creation of Latin dance costumes.

According to Jun et al. [3], the design of women's Latin dance costumes is unique, often with bright colors, intricate details, and revealing cuts. This statement is supplemented by proving the interrelationship between the mentioned elements of the suit. This connection has been proven through user evaluation.

Costumes not only enhance the dancers' movements but also contribute to the overall look of the performance, as Roberts [4] points out. Viewership also matters, as demonstrated in the present study.

4. Conclusions

Latin dance costume patterns have been developed and researched to seamlessly combine functionality, cultural authenticity, and aesthetic appeal, as demonstrated through the interplay between color and form.

As a result of the conducted research, the possibility of forming a complex assessment of the interrelationship between color and shape in the design of Latin dance costumes has been revealed. This relationship is proven by the reduced data on the color and shape of these garments.

A regression model was developed to predict the evaluation of users and viewers when using Latin dance costumes. Reduced color and shape data on these garments were used to create this model. These results complement and refine those presented in the available literature.

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