

IMPROVEMENT OF THE METHODOLOGY FOR ASSESSING THE CLOTHING PSYCHOLOGICAL COMFORT USING SEMANTIC DIFFERENTIAL

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Abstract: *The aim of the paper is to present the improvements of the methodology for assessing the clothing psychological comfort by using semantic differential. The differential allows one to achieve high quality of garments. It is assured by using the prototype expert system for selection of clothes according to the consumer's wishes on the basis of the methodology of Kansei engineering. The list of characteristics of the ideal clothing model was formed on the basis of theoretical research in the field of psychological comfort of clothing. The performed ranking of characteristics allows calculating of the coefficients of psychological comfort. A questionnaire for assessing the psychological comfort of clothing consists of semantic differential scales for each characteristic. The assessment based on the results of a survey has been performed by using the developed questionnaire. Improved process of the assessment of psychological comfort of sewing products allows one to form a new approach to the modern quality management system. Application of the presented methodology will further improve the process of developing an individual style in clothing.*

Keywords: *psychological comfort, psychographic segmentation, ideal clothing model, semantic differential, fashion dresses, harmonized dress.*

1 INTRODUCTION

Designing of sewing products has a number of specific features that distinguish it from the design of other technical objects. The problem of designing modern clothing is more complicated, because it is directly related to a person. That is why one of the specific features of clothing design is the importance of scientific reflection on the need to take into account the impression of clothing. Visual perception of models, collections, individual products and individual constructive elements by different groups of consumers must be taken into account [1].

The study and forecast of demand for projected models without the use of psychological methods, mainly sociological surveys, leads to unexplored system of consumer perception and, in the end, considerable economic losses in designing [2].

It is known that the first emotions of clothes received by a person during the first time seeing clothes and its elements. This usually happens when you meet a product in the process of testing. After that emotions are tested in the process of wearing clothes. Impressions of clothing may change. The difference in the sensual perception of clothing at the stages "seen - trying" can induce the purchase of clothes or refusal to buy. In this case, the designer affects the result of perceiving the product

of its activities at various stages [3]. Thus, the problems of the area of consumer quality of clothing can be formulated as follows:

- 1) the problems of studying and evaluating various aspects of the perception of clothing by consumers;
- 2) the problems of deepening the concept of comfort clothing to the level of psychological comfort in the senses.

It becomes apparent that the psychological comfort of a garment can only be achieved if the psychological characteristics of the individual are taken into account. It might be achieved by studying the peculiarities of the impression of clothing in consumer groups. The study will help to determine the overall quality of products for the consumer.

2 ANALYSIS OF PUBLISHED DATA AND STATING THE PROBLEM

The basic requirement of clothing is that it must not cause discomfort for the wearer. Modern consumers are interested in clothing that not only looks good but also feels good. It has been identified, by both natural and synthetic fiber markers, that consumers are increasingly involving more than their visual sense and are allowing touch, smell, intuition and emotion to influence their decisions.

As a result, greater importance being attributed to the shopping and wearing experience interest is growing in better feeling fabrics. Comfort is being reinforced a key parameter in clothing. Good health is a treasure. The textiles are making human life, a natural healthy life and making it comfortable.

Comfort has been identified by major fiber marketers as one of the key attributes for consumer's desirability on apparel products in all markets. Comfort as a pleasant state of physiological, psychological and physical harmony between a human being and the environment. Physiological comfort is related to the human body's ability to maintain life, psychological comfort to the mind's ability to keep it functioning satisfactorily with external help and physical comfort to the effect of the external environment on the body.

Clothing as a near environment of the human body plays a vital role in achieving human comfort and over the past few decades, extensive and systematic investigations of clothing comfort, function, and ergonomics have been conducted, specifically with protective clothing.

A great part of the researchers agrees that comfort is a multidimensional and subjective experience. The author [4] was one of the first ones to acknowledge the clothing comfort as a complex phenomenon, which comprises at least 3 dimensions: the physical, the physiological and the psychological. The mechanisms and underlying principles associated with human physiological needs, comfort attributes of clothing, and their interaction with a variety of environments have been formalized and established. The author does not propose a specific method of assessing psychological comfort. Parameters that should be considered when assessing this measure of comfort were not specified either.

The authors [5, 6] have proposed a clothing comfort concept and a clothing comfort model. According to them, the clothing comfort is "a state of satisfaction indicating physiological, social-psychological and physical balance among a person, his/her clothing, and his/her environment." The theoretical model proposed by [5, 6] is crucial to understanding the importance of the psychological aspect of comfort. However, authors intended that those attributes must be discussed and refined in the future works. Therefore, current work is aimed at becoming the next step in developing the concept of improving the psychological comfort of garments based on the emotional component in the perception of the clothing model. The main idea is to combine such approaches as semantic differential methods and methods of evaluation of the level of harmonization of clothes. The model proposed by [7] contains a list of the attributes associated with the social-psychological dimension that is divided according to the clothing comfort triad (person,

clothing, environment). Despite believing that all three components of the triad have a social-psychological dimension, all of these attributes are neither well agreed upon by researchers nor well elucidated in the literature.

The technology [8] opens the possibilities for smart multifunctional clothing systems. This has led researchers to explore various approaches to improving wearing comfort and trying to understand thermo physiological processes. The wearing comfort itself is differentiated in four categories: thermo-physiological comfort, sensorial comfort, ergonomic comfort, psychological comfort as well as aesthetic appeal. The paper [9] describes the evaluation of thermal comfort through measurement of the physiological and psychological responses to changes in the microclimate surrounding the human body. But in the context of clothing, there has been a focus mainly from a physical-mechanical and/or physiological point of view. Little consideration was given for the more subjective aspects such as the aesthetic and emotional ones.

Psychological comfort is a positive evaluation of the product, which is made on the basis of the integration of the comfortable feelings of the various modalities and the individual acceptance of the product by the consumer [5]. In this manner the psychological comfort of clothing is still poorly studied, but it is a very valuable indicator, which in most cases determines the choice of the consumer. Its neglect can lead to significant economic losses in the implementation of clothing models, as the provision of optimal physiological indicators does not always contribute to the rapid implementation of products. The study of the effect obtained in the product allows one to withstand competition, which is especially important for small businesses in a saturated market. A method of determining psychological comfort might be used to study the requirements for clothing along with the results of targeted marketing.

This document presents a continuation of research [10, 11]. They were held with a purpose to develop a method to assess the clothing comfort with taking into account physical parameters such as temperature and humidity space between the fabric of garment and the human body. As a result of the research authors aim to develop the indices to select the garment, which would be advisable to wear in some environmental conditions by certain person, who is described by their psychological preferences and certain body type.

3 THE PURPOSE AND OBJECTIVES OF THE STUDY

The aim of this study is to improve the clothing design process by ensuring the consumer psychological comfort by creating a harmonious

image of garment visual perception. In order to achieve this goal it is necessary to solve the following tasks:

- theoretical and analytical research of consumers population segmentation by their relations to clothes;
- study of the emotional component of psychological comfort, the definition of its significant characteristics in the visual perception of the model of clothing;
- improving the methodology for assessing the clothing psychological comfort on the base of visual perception in the process of artistic design using semantic differential (SD) of the impression from outfit.

4 MATERIALS AND METHODS

4.1 Theoretical and analytical research of consumer segmentation by their relation to clothes

Companies make products in order to fulfil the needs and wants of a customer. There is a constant requirement for a customer for buying new products or services, and these wants keep on evolving and changing with age, income etc. This is directly related to the human psychology or psychographics of a customer. Thus, if a company is able to understand the customer's psychology, it can target them better with the products and services. In these cases, psychographic segmentation is extremely critical for a company [12].

Psychographic segmentation complements demographic and socioeconomic segmentation to explain and predict consumer behavior. Insights from psychographic segmentation enable marketers to understand consumers' decision-making processes better and more efficiently target audiences with highly-relevant messaging to influence their responses to marketing, brands, products or services [13, 14].

For urgent response to the needs of the fashion market we summarized consumer's psychographic

portraits. The results of the research described in [12-15] were taking into account while summarizing the portraits. The classification is basically segmentation of the total market by attributes of psychology, activities, interests, opinions, personality traits of people, lifestyle, values and attitudes. The proposed classification helps identify consumers based on how they think, focusing on customer psychology (Table 1).

The mathematical description of the connections in groups A, B, C (in the Table 1) is presented by following expression:

$$A \equiv CI \in \{CI^{ec}, CI^{cr}, CI^{ser}\} \quad (1)$$

where: CI – consumer class, CI^{ec} – economic class, CI^{cr} – creative class, CI^{ser} – serving class.

$$B \equiv Ps^p \supseteq Ps_{cl} \cup Pst_{cl} \cup Bv_{cl} \quad (2)$$

where: Ps^p – psychological portrait of a consumer; Ps_{cl} – psychological peculiarities of the personality of a class representative; Pst_{cl} – category of a psychotype of the class representative; Bv_{cl} – basic values of the class.

$$C \equiv Ps^b \supseteq L_{cl}^{sd} \cup L_{cl}^R \cup L_{cl}^F \cup L_{cl}^E \cup L_{cl}^V \quad (3)$$

where: Ps^b – psychological peculiarities of the consumer's behaviour; L_{cl}^{sd} – socio-demographic level of the class; L_{cl}^R – rational level of the class; L_{cl}^F – functional level of the class; L_{cl}^E – emotional level of the class; L_{cl}^V – value level of the class.

A set of characteristics of the group A, which describes elements of the groups B and C, is a cortege:

$$CI = \langle n_{ci} n_{cm1} b_{v1} r_1, \dots, n_{ci} n_{cmj} b_{vm} r_m \rangle \quad (4)$$

where: n_{ci} – psychological peculiarities of the person; i – the number of descriptive characteristics of the psychological characteristics of the individual; n_{cmj} – category of a psychotype; j – number of descriptive characteristics of the categories of a psychotype; b_v – basic values; n – number of descriptive characteristics of the basic values; r_m – consumer reaction when choosing a fashion product; m – number of descriptive characteristics of the reactions of a consumer.

Table 1 Class stratification of consumer's psychographic portraits

Consumer characteristics groups			
A	B		C
Class characteristic	Categories of psychotypes	Basic values	Behaviour (criteria for choosing a fashion product)
Economic class: participates in the creation and circulation of capital	Careerists (purposeful pragmatists)	Material success Social status	Status (limited reach) Aesthetics (stylishness)
	Imitators	Career, achievement	Prestige (a high quality)
Creative class: creates new ideas, products, technologies, a new creative sense	Independent - Innovators	Self-development Interesting job, freedom of choice	Individuality Novelty (originality)
	Hedonists		Expressiveness (conceptuality)
Serving class: provides support for the creation of economic and creative values	Intellectuals (traditionalists)	Stable work Decent wage Satisfactory vacation	Availability (moderate prices) Familiarity (widespread) Acceptability (adaptability)

On the vertical of the triad model, the process of forming the type of consumer based on psychological characteristics (C^{PS}) describes the cross sections of subsets of characteristic groups:

$$C^{PS} \supset Cl \cap Psp^p \cap Ps^b \quad (5)$$

The obtained connections provide an opportunity to understand the behavior, attitude and personality of the consumer. Besides, it might provide the means to offer psychological correction with help of elements of the shape and color of the fashion garment.

Information about the psychological characteristics of the consumer is a starting point for solving the problem of achieving the psychological comfort of clothing.

4.2 Study of the emotional component of psychological comfort, the definition of its significant characteristics in the visual perception of the model of clothing

Claims of a consumer to the aesthetic quality of the product are determined by external and internal factors [16]. The external factors (F_{EX}) are basic because they contain all information about consumers and their impressions of clothing. Such factors form criteria of claims for aesthetic quality that is of external origin. They meet the requirements of human psychological comfort (Ps^{cf}):

$$F_{EX} = Ps^{cf} \supset Ev^{pos} \cup Fl_{PPH}^{cf} \cup P_{PPH} \quad (6)$$

where: Ev^{pos} – positive self-estimation in the clothing.

$$Fl_{PPH_i}^{cf} = \{Fl_V^{cf}, Fl_T^{cf}, Fl_S^{cf}, Fl_{Sm_i}^{cf}, Fl_{Ts_i}^{cf}\} \quad (7)$$

$$St = \{St_i\}; i=1...3,$$

where: $Fl_{PPH_i}^{cf}$ – comfortable psychophysiological feelings: visual impression (Fl_V^{cf}), tactile feelings (Fl_T^{cf}), sound (Fl_S^{cf}), smell ($Fl_{Sm_i}^{cf}$), taste ($Fl_{Ts_i}^{cf}$) in the situation St_1 – first impression, St_2 – fitting, St_3 – wearing clothes.

$$P_{PPH} = \{n_{PPH}^1, n_{PPH}^2, n_{PPH}^3, n_{PPH}^4, n_{PPH}^5\} \quad (8)$$

where P_{PPH} – psychophysiological perception; n_{PPH}^1 – emotional experiences; n_{PPH}^2 – emotional reactions; n_{PPH}^3 – perception of an image according to experience; n_{PPH}^4 – intuition; n_{PPH}^5 – mental reflection.

$$P_{PPH} \subset AP_{SB} \quad (9)$$

$$AP_{SB} = \sum A_{SB} + \sum G_{SB} + \sum V_{SB} + \sum N_{SB} + \sum I_{SB} + \sum S_{SB} \quad (10)$$

where: AP_{SB} – subjective attitude of the person to clothes.

In accordance to the psychographic portraits of consumers (see Table 1), the AP_{SB} system includes:

ΣA_{SB} – total index of compliance with age characteristics of a consumer;

ΣG_{SB} – total index of compliance with the gender characteristics of a consumer;

ΣV_{SB} – total index of "value" of clothing in the system of consumer's values;

ΣN_{SB} – total index of clothing compliance with the system of consumer's needs;

ΣI_{SB} – total index of compliance with consumer's settings;

ΣS_{SB} – total index of compliance with socially desirable stereotypes of a consumer.

These dependencies describe characteristics of the emotional components of psychological comfort. Thus, the psychological comfort of the consumer is formed with a positive subjective attitude of the individual to the chosen clothing model. A positive self-assessment of appearance in this product and a comfortable psychophysiological perception are vital for the psychological comfort of the consumer.

4.3 Ranking of characteristics of the ideal clothing model

Improved diagnostics of the psychological comfort of clothing at visual perception is carried out according to such an algorithm:

1. Investigation of the characteristics of an ideal model of clothing by means of questionnaires.
2. Selection of garments photos.
3. Estimation of outfits while locating the images of them on the photo of a particular consumer.
4. Analysis of evaluation data.

Eighteen models of women's dresses were selected from 66 images those comprise a dataset of the expert system described in [17, 18]. The selection was performed by way of the dialogue between a user and the expert system. These models were used for experimental estimation of psychological comfort of the model of clothes.

The list of characteristics of the ideal clothing model for women's dresses was compiled based on the results of the literature review [17-21]. Depending on the specific conditions such as range, purpose, materials, as well as the psychographic characteristics of the consumer, the list of characteristics of the ideal clothing model might be supplemented. Characteristics of the ideal model of the women's dress are given in the Table 2.

Table 2 Characteristics of the ideal clothing model

Code	Characteristic definition
X1	Concordance of colours and consumers appearances
X2	Concordance of colours to the fashion trends
X3	Concordance of colours and usage circumstances
X4	Harmonious colour design of the clothing model
X5	Ratio of the garment parts measurements to the consumer's height
X6	Concordance of the garment size and human body size
X7	Proportional allocation of the construction lines
X8	Proportion and concordance of the parts sizes to the garment size

Experts evaluated each characteristic on the list. The expert groups consisted of experts in the garment industry (20 experts) and consumers (20 experts). Two questionnaires were conducted simultaneously. The degree of coherence of the results of evaluating the characteristics of the ideal style is confirmed by the coefficient of concordance and Pearson's criteria (Table 3).

Table 3 The consolidated results of the evaluation degree of coordination of expert opinions

ω for the expert group			χ^2_p for the expert group		
professionals (20 people)	consumers (20 people)	total	professionals	consumers	total
0.955	0.967	0.937	133.77	135.42	262.41

Figure 1 shows the a priori charts of the ranks of the characteristics of the ideal clothing model.

As one can see from the Figure 1, the characteristic X1 is the most important one for all groups of experts. On the other hand, the X4 parameter is the least valued characteristic on the list. The summary of the ranks of the characteristics of the ideal clothing model are shown in Table 4. The coding in the Table 4 refers to the one in the Table 2 and in the Figure 1.

Table 4 Consolidated results of ranking the characteristics

Code	Rank of the characteristic by expert group		
	professionals (20 people)	consumers (20 people)	total group
X1	1	1	1
X2	7	5	6
X3	6	7	7
X4	8	8	8
X5	4	4	4
X6	3	3	3
X7	2	2	2
X8	5	6	5

The final rank of each characteristic is calculated as an average mean of the ranks those were determined separately by groups of experts.

Table 5 Clothing model's characteristics described according to the method of semantic differential

Pair code	KW	Code	Correlated to KW	
			positive	negative
UI	Unimpressive - Impressive	X1	bright, expressive, attractive	pale, indecent, inconspicuous
UF	Unfashionable colours - Fashionable colours	X2	actual, modern, fashionable	simple, outdated, boring
IS	Inappropriate - Suitable	X3	appropriate, attractive, refined	inappropriate, aggressive, provoking
DH	Disharmonious - Harmonious	X4	harmonious, exquisite, elegant	disharmonious, provocative
IP	Impractical - Practical	X5	practical, comfortable, functional	impractical, uncomfortable
UC	Uncomfortable - Comfortable	X6	comfortable self-confidence charming	uncomfortable, not practical, vulgar
UN	Unfit - Nice fit	X7	nice look, holistic, organic	too noticeable, tastelessness, not organic
DP	Disproportionate - Proportionate	X8	balanced, agreed, no frills	unbalanced, uncoordinated, overloaded

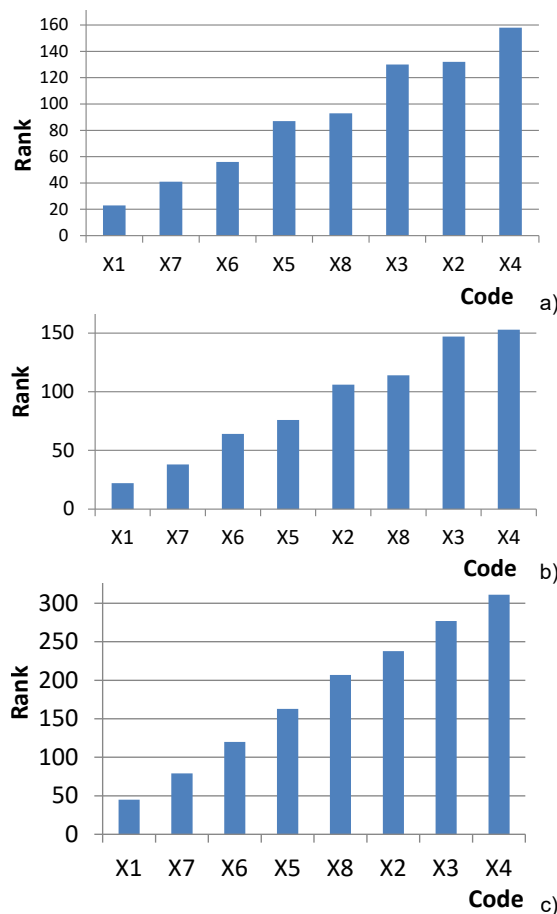


Figure 1 Charts of ranks of the ideal clothing model characteristics: a) experts are professionals; b) experts are consumers; c) total results

4.4 Assessment of the psychological comfort of clothing

Assessment of the psychological comfort of a fashion model might be performed by applying a scale of semantic differential to describe the characteristics of the ideal fashion model and sequential comparing them to characteristics of actual outfit. This allows measuring the perception of the fashion outfit by a particular consumer.

Since psychological comfort is usually achieved through harmonization of garment colours, form, fabric and proportions with the appearance of consumer the consumer's impression of clothing, which are reflected by typical key emotional words, are collected in the Table 5 [17, 20].

These words are selected in order to obtain an objective assessment of the feelings and impressions of experts from the given dress. The key words (KW) are components of the semantic differential (SD) that is described in [17]. Each pair of KW is the SD poles for a particular attribute of an investigated fashion model. The common practice of coding the KW pairs that is to use the first letters of words with opposite meaning has been used in current work as well. Positive and negative correlations between each word from the SD with words, which express the emotions of consumers from clothing, are given in the columns 4 and 5 of Table 5.

Photos of outfits, which are shown in the Figure 2, were selected out of fashion collections [17] and assessed by experts using the questionnaire, which is shown in the Table 6.



Figure 2 Fragment of database of women's dresses: a) ideal clothing model; b) photos of outfits combined with consumer's photo

In a survey, photos of clothes were valued using evaluation factors in bipolar scales defined by verbal antonyms of KW from each end of the scale.

The expert group consisted of 10 experts and 10 consumers. The degree of coherence of the results of evaluation of the photographic material by experts using the semantic differential scales is confirmed

by the coefficients of concordance and the Pearson criteria. Tabular value of Pearson criterion for 5 percent of the weight level and the corresponding number of freedom degrees ($\chi^2_{\text{tabl}} = 22.36$) is less than the estimated value criterion. Table 7 presents the consolidated results of the degree of harmonization of expert opinions for 18 photos of consumers in clothing models. Number of degrees of freedom is 7.

Table 6 Example of the questionnaire

Negative	1	2	3	4	5	6	7	Positive
	-3	-2	-1	0	+1	+2	+3	
Unimpressive							+	Impressive
Unfashionable colours						+		Fashionable colours
Inappropriate						+		Suitable
Disharmonious						+		Harmonious
Impractical							+	Practical
Uncomfortable							+	Comfortable
Unfit							+	Nice fit
Disproportionate							+	Proportionate

Table 7 The consolidated results of the evaluation degree of coordination of expert opinions

Number of an outfit	ω for the expert group		χ^2_p for the expert group	
	consumers (10 people)	professionals (10 people)	consumers	professionals
1	0.61	0.68	42.10	48.10
2	0.68	0.69	48.10	48.59
3	0.63	0.75	43.86	52.25
4	0.88	0.83	61.44	57.94
5	0.83	0.82	57.94	56.83
6	0.74	0.64	51.91	44.71
7	0.71	0.78	49.42	54.42
8	0.61	0.62	42.10	43.25
9	0.78	0.86	55.23	60.39
10	0.79	0.92	55.45	64.94
11	0.77	0.69	53.96	48.59
12	0.68	0.61	48.10	42.10
13	0.61	0.63	42.10	43.86
14	0.74	0.75	51.91	52.25
15	0.81	0.84	56.78	58.49
16	0.79	0.81	55.45	56.78
17	0.91	0.91	63.65	63.65
18	0.86	0.86	60.48	60.48

Therefore, it is possible to state with 95% probability that the frequency of evaluation ratios of KW pairs in different experts is coordinated in accordance with the calculated rate of concordance.

Mathematical processing of data reduces to the calculation of the Spearman's rank correlation coefficient that is a nonparametric measure of rank correlation (statistical dependence between the rankings of two variables) [23]:

$$r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)} \quad (11)$$

where: d_i is the difference between the two ranks of each observation; n – number of observations.

The obtained values of correlation coefficients are checked for statistical significance. Then data

processing was carried out to assess psychological comfort of clothing. The value of each indicator is counted as the difference between the ranks of perfect clothing and the photo of actual outfit for each characteristic. Thus, for each photo model - the idea of dress characteristics is assigned a certain rank in accordance with the methodology for determining the index of psychological comfort. The coefficients of psychological comfort (PC) are calculated according to the expression 1. They are evaluated as follows:

- 1) $r_s \geq 0.79$ - high level PC;
- 2) $0.64 < r_s \leq 0.79$ - middle level PC;
- 3) $0 < r_s \leq 0.64$ - low level PC;
- 4) $r_s < 0$ - complete rejection of the proposed style.

Calculated coefficients of psychological comfort (PC) are shown in the Table 8.

Table 8 Results of calculating

Level	Outfit	Coefficient
High	1	0.917
	3	1.00
	6	0.82
	8	0.88
	13	0.976
Middle	2	0.76
	10	0.72
	11	0.74
	12	0.66
	14	0.64
Low	5	0.52
	7	0.60
	9	0.47
	15	0.45
	18	0.48
Complete rejection	4	-0.56
	16	-0.47
	17	-0.30

As one can see in the Table 8, four dresses have high-level PCs. They do not need any improvements. Three dresses were rejected completely (outfits 4, 16, and 17 in the Table 8). For further work the model of dress 18, which

received a low level of PC and highlighted in the Table 8 by colour, was chosen by the consumer.

5 GARMENT STYLE ALTERATION

The next stage of the study is the adaptation and harmonization of the artistic and constructive parameters of the product to the individual characteristics of the consumer. It is done in order to increase the psychological comfort of the model specifically in visual perception. The method we used to do so is the one that was described in the previous study [21].

The process of harmonizing the dress is proposed to be performed in the following sequence:

1. To carry out the identification of the consumer, taking into account the psychological characteristics of the individual and the characteristics of the appearance.
2. To make a decision on the need to adapt the chosen form of the product and artistic and constructive parameters, in accordance with the appearance of the consumer.
3. Place the photo of the consumer with the product into a grid of harmonious arrangements.
4. Perform artistic and constructive analysis and harmonization of the garment.

The harmonization of the garment must be performed in accordance to the following order. We put the consumer's photo and the sketch of the dress into the grid of harmonic segmentations as it shown in the Figure 4a. After that, the design parameters of the dress were altered according to the grid limits.

Foremost it is necessary to begin with alteration of the garment length. Then the width parameters would be changed: the shoulders line as well as the hem line. These alterations are shown on the Figure 4c. We can also adjust the degree of fit at the waistline. Finally we have to change a form of the neckline, and the specifics of the decorative parts.

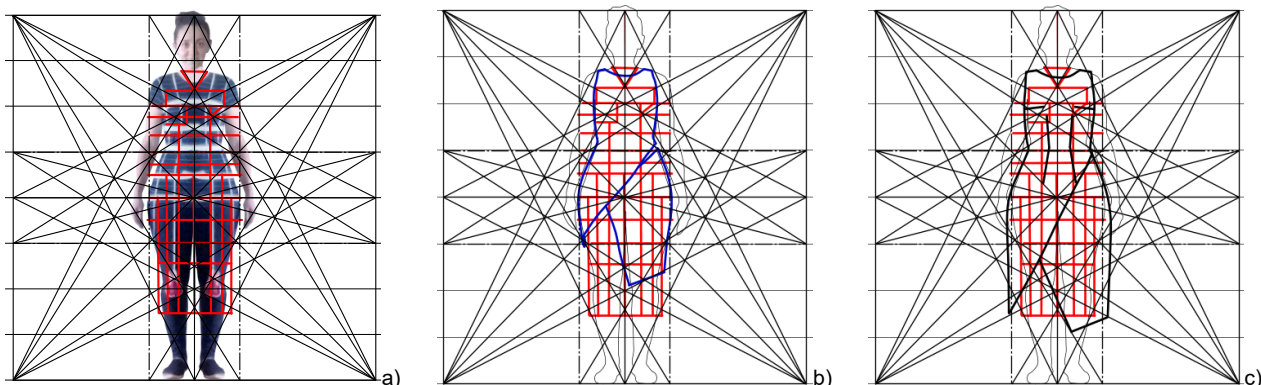


Figure 4 Harmonization of the dress style (outfit 18), a) preferred limits of the harmonic segmentations, b) original dress, c) harmonized dress

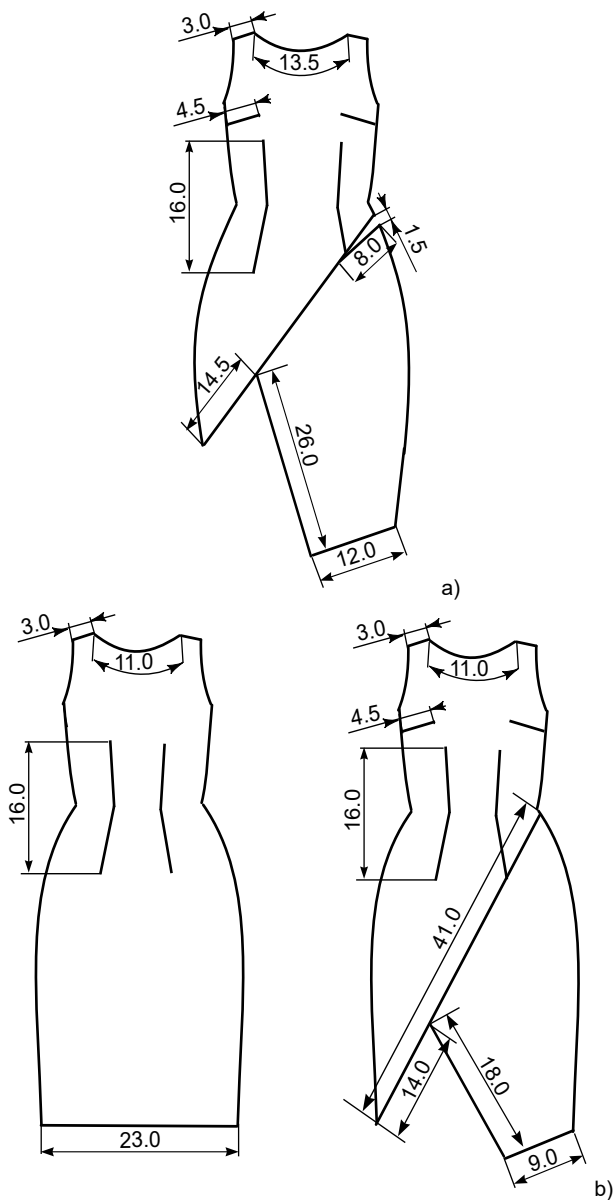


Figure 5 Real and harmonized parameters of composition segmentations of light women dress, a) original dress, b) harmonized dress

In the Figure 5 one can see the differences between the harmonized dress style and the real outfit. As a result of the harmonization, the following characteristics of the dress style have been improved: X5 (ratio of the garment parts measurements to the consumer's height); X6 (concordance of the garment size and human body size); X7 (proportional allocation of the construction lines); X8 (proportion and concordance of the parts sizes to the garment size).

6 RESULTS AND DISCUSSION

In order to confirm the results of the current research the virtual 3D-model of a dress was developed by using pattern design system (PDS) "Julivi". The model is displayed in the Figures 6, 7.

Virtual model of the dress is connected to its patterns. Thus, the alteration of the visual characteristics of the garment was performed by altering the patterns (Figure 6a) and simultaneous visualization (Figure 6b). The alterations continued till the dress style reached the parameters shown in the Figure 5.

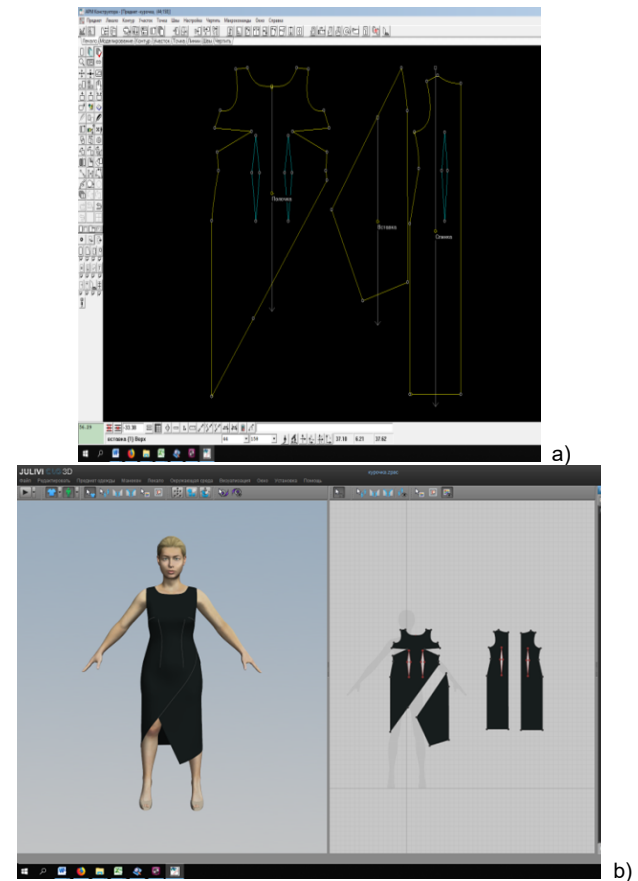


Figure 6 Virtual model of the dress in PDS Julivi: a) patterns, b) visualization process

In order to ensure that the incorrect fit of the garment does not impede the results of the followed PC evaluation the virtual model was assessed in the mesh mode (Figure 7).

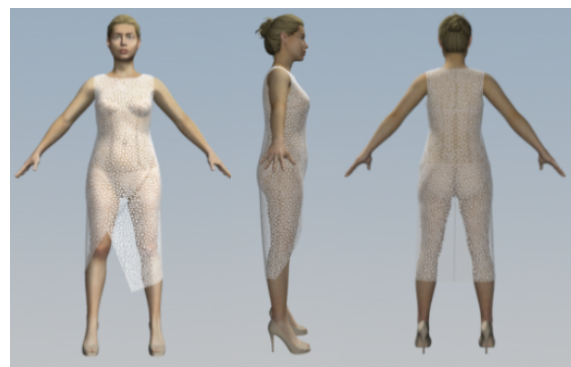


Figure 7 Virtual model of the dress in PDS Julivi to assess static compliance of mesh model

According to the work [22] the data obtained are within the permissible range. Thus, the patterns were used to sew the real garment sample. The image of the consumer that is wearing the real sample of the outfit 18 is displayed in the Figure 8.

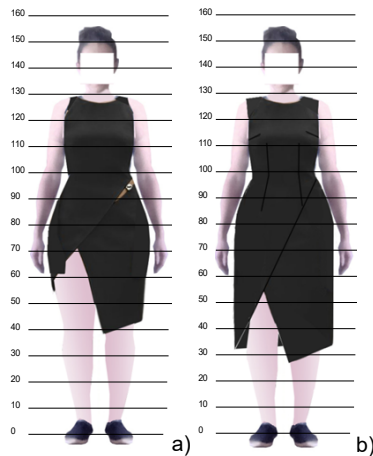


Figure 8 Photos of women's dresses 18: a) original dress, b) harmonized dress

The consumer chose a harmonized dress that is displayed in the Figure 8b. It is evident, that after alterations it is hiding the shortcomings and emphasizes the advantages of the body. Comparison of the harmonized dress to the original one was performed by comparing the results of two separately conducted surveys. In the Table 9 one can see the results of the first survey that was conducted using the questionnaire in the Table 6.

Table 9 Results of the survey for the original dress (outfit 18)

Experts	Pair code								
	UI	UF	IS	DH	IP	UC	UN	DP	
professionals	1	-2	2	2	2	-3	-3	-3	-3
	2	0	0	0	0	-2	-2	-2	-2
	3	-1	3	3	3	-3	-3	-3	-3
	4	-3	1	1	0	-2	-2	-2	-2
	5	-2	2	2	2	-2	-3	-3	-3
	6	-2	2	2	2	-3	-3	-3	-3
	7	-1	1	0	2	-1	-1	-3	-3
	8	-2	0	2	0	-3	-3	-3	-2
	9	0	0	1	2	-3	-3	-3	-3
	10	-1	1	1	0	-1	-2	-3	-1
Kp	-1.40	1.20	1.40	1.30	-2.30	-2.50	-2.80	-2.50	
consumers	1	-1	2	3	3	-3	-1	-2	-1
	2	1	3	3	3	-1	-1	-1	-1
	3	1	3	3	2	-2	-3	-3	-2
	4	-1	3	2	3	-2	-2	-2	-3
	5	0	0	1	2	-2	-2	-2	-2
	6	-1	3	3	3	-1	-2	-3	-2
	7	-2	3	3	2	-2	-3	-3	-2
	8	-2	1	1	0	-1	-2	-3	-1
	9	-1	1	1	0	-1	-1	-1	-1
	10	-2	1	1	1	-2	-2	-3	-2
Kc	-0.80	2.00	2.10	1.90	-1.70	-1.90	-2.30	-1.70	
K	-1.10	1.60	1.75	1.60	-2.00	-2.20	-2.55	-2.10	

The aim of the second survey was to assess psychological comfort of the outfit 18, which has been already harmonized (as one can see in the Figures 5 and 8). The same group of experts evaluated the harmonized dress using the same questionnaire. The results of the assessment are displayed in the Table 10.

Table 10 Results of the survey for the harmonized dress (outfit 18)

Experts	Pair code								
	UI	UF	IS	DH	IP	UC	UN	DP	
professionals	1	2	2	2	1	2	3	3	2
	2	2	2	1	1	3	2	3	2
	3	3	2	2	1	2	2	3	2
	4	2	2	1	1	3	3	2	2
	5	2	2	2	1	2	2	3	2
	6	3	2	2	1	3	3	3	2
	7	2	2	2	1	2	3	3	2
	8	3	2	2	1	3	2	2	2
	9	2	2	2	1	2	3	2	2
	10	2	2	2	1	3	2	3	2
Kp	2.30	2.00	1.80	1.00	2.50	2.50	2.70	2.00	
consumers	1	3	2	1	2	2	3	3	2
	2	3	2	2	2	3	2	2	2
	3	3	2	2	2	3	3	3	2
	4	3	2	2	2	2	3	2	2
	5	3	2	1	2	2	3	3	2
	6	3	2	2	2	3	2	3	2
	7	3	2	2	2	2	3	2	2
	8	3	3	2	2	3	3	3	2
	9	3	2	2	2	2	3	3	2
	10	3	2	2	2	3	2	3	2
Kc	3.00	2.10	1.80	2.00	2.50	2.70	2.70	2.00	
K	2.65	2.05	1.80	1.50	2.50	2.60	2.70	2.00	

The results of the data processing are displayed in the Table 11. The columns 3 to 5 refer to the first survey (Table 9), which was carried out before the alterations of the models. The columns 6 to 8 refer to the second survey, which was carried out after the harmonization (Table 10).

Table 11 Example of data processing

No	IC (rank)	Ph _{18o} (rank)	K _{18o}	d _{18o}	Ph _{18g} (rank)	K _{18g}	d _{18g}
1	2	3	4	5	6	7	8
1	8	5	-1.10	3	7	2.65	1
2	4	6	1.60	-2	4	2.05	0
3	2	8	1.75	-6	2	1.80	0
4	1	7	1.60	-6	1	1.50	0
5	5	4	-2.00	1	5	2.50	0
6	6	2	-2.20	4	6	2.60	0
7	7	1	-2.55	6	8	2.70	-1
8	3	3	-2.10	0	3	2.00	0

Code: IC – ideal clothing model; Ph_i – photo; K_i – the average value of expert assessments; d_i – difference of ranks; o – original dress; g – harmonized dress.

The results of mathematical processing of evaluation data and qualitative analysis of the results of evaluation of psychological comfort of the dress model 18 showed an increase in the PC ratio from $r_{S18o} = 0.48$ (low level) to $r_{S18g} = 0.98$ - high PC level.

As one can see in the Table 11 the coefficient of the psychological comfort has increased to 0.98 that refers to the high level of the comfort.

7 CONCLUSIONS

In the current work the task of studying and assessing of psychological aspects of quality and comfort is solved by creating a harmonious image of a garment.

As a result of theoretical and analytical studies of consumer segmentation in relation to clothing, a conceptual model of class stratification of consumers is proposed. The obtained connections provide an opportunity to trace the consumer's attitude to clothing. They might be used as source information for solving the problem of ensuring the psychological comfort of garments.

The emotional component of psychological comfort is studied and its characteristics at visual perception of model of clothes are defined.

The methodology for assessing the clothing psychological comfort was improved based on visual perception of the garment. The results of the assessment are confirmed by designing the experimental garment sample for the specific consumer.

The ability to assess the psychological comfort on a virtual mannequin before and after the patterns' alterations and harmonization of visual characteristics of the outfit gives one the opportunity to correct the work of a designer before the garment is sewn.

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