

METHOD OF ANALYZING IMAGES OF CLOTHES BASED ON KANSEI ENGINEERING

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Abstract: Fashion, in contemporary world is becoming more sophisticated day by day. Its implications on general public are dramatically increasing in the cultural level that divides community into different subcultures. Hence, the emotional aspect of people towards 'Fashion Industry' is rising at a rapid rate. The most important component of customer's impression must be considered in terms of garment design in order to maintain leadership on the market.

This paper aims to evaluate the emotional component of the garment with semantic differential. The process of evaluating consumer's emotional experience consists of steps that provide an ability to classify the Kansei attribute of clothes. They are considered as key issues for the concept of recognition of images, and particularly emotions.

Method based on Kansei Engineering model is used to develop the full range of emotional keywords and their affinity cluster. The result shows that this method will be a good reference to design studies that involved with user's personal emotional experience in the field of clothing design.

This research intends to seek the psychological and emotional parameters that influence the selection of a particular dress and colour for female. The research involves the results of a designed survey.

Keywords: fashion, Kansei, visual images, semantic differential.

1. INTRODUCTION

Nowadays, the product development is changed from product-oriented to consumer-oriented; namely for manufacturers, the consumer's feeling and needs are recognized more valuable in product development than ever before.

Fashion in contemporary world is becoming more sophisticated day by day. Its implications on general public are dramatically increasing in the cultural level that divides community into different subcultures. Hence, the emotional aspect of people towards "Fashion Industry" is rising at a rapid rate.

The most important component of customer's impression must be considered in terms of garment design in order to maintain leadership on the market.

Although clothing design could be considered as united process, it includes at least two steps. Firstly, information about fashion trends, end use of clothing styles, image clothing, etc., must be explored. Next step includes selection of the specific information about silhouettes, materials and colours that would be recommended for specific groups of consumers.

Such information can be gathered with means of Kansei Engineering (KE) that develops methods of translating and embedding perceptual and emotional qualities into the features of product design [6, 7]. In terms of clothing design, emotion could be considered as a means for achieving the aesthetic quality of the garment. KE is a comprehensive human-centered technology for developing new products. It has been widely used in different fields of research and industry sectors [9-12]. However, at the time, the application of KE on clothing design is at the primary stage and little research has been reported yet.



This research intends to seek the psychological and emotional parameters that influence the selection of a particular dress and colour for female consumer.

There are several well-known methods and tools, which are used to assist the process of evaluating user's emotional experience with products [11, 12]. However, the basic method of image analysis in KE is the method of semantic differential (SD) in the classification of Kansei attributes [6-8]. The method is the most popular way of the assessment of consumers' emotional impressions. Therefore, it is chosen to be applied in current research.

2. METHODS

The method of SD includes research of words that express the emotions of consumers from clothing, formation of word pairs that form the semantic differential, and scaling of SD [8].

Collection of Kansei words (KW) – typical emotional keywords that reflect physiological impression from any models of clothes – is a database of KW [2, 3, 5]. Grouping of the typical keywords forms a new database of KW that is represented in the table 1.

Table 1. Grouping of words - Database of formed Kansei words to match clothes style with a basic colour

		Base colour							
		Red	Orange	Yellow	Green	Blue	Violet	Achromatic	
Clothing style	Classic	Respectable Severely Practical Elegant	Ruling Bold Luxurious Solid	Bohemian Exquisite Natural Strong	Gullible Calm Attractive Energetic	Creative Elegant Emancipated Businesslike	Energetic Practical Luxurious Costly	Classic Chic Luxurious Refined	Restrained Intellectual Cold Decisive
	Romantic	Female Fine Exquisite Delicate	Charming Flirtatious Touching	Delicate Calm Fresh	Luxurious Spectacular Relaxed	Open Carefree Benevolent	Female Playful Relaxed	Creative Elegant Fine	Enigmatic Intangible Mysterious
	Sports	Practical Functional Comfortable Dynamic	Direct Youthful Flirtatious	Emotional Excitable Active	Carefree Female Energetic	Strong Hard Aggressive	Stylish Free Energetic	Sport Chic Luxurious Practical	Strong Decisive Sturdy
	Folk	Ethnic Natural Ecological Native	Restrained Mature Reliable	Youthful Fresh Traditional	Worthful Decorative Ethnic	Relaxed Careless Youthful	Cheerful Active Decisive	Natural Striking Original	Clean Fresh Cool
	Avant-garde	Outrageous Creative Unusual Extraordinary	Exotic Dramatic Innovations	Emotional Excitable Active	Beautiful Luxurious Spectacular	Spectacular Bright Dynamical	Costly Majestic Splendid	Notable Provoking Intriguing	Radical Informal Free

Next step of the method includes the selection of words from a common database of KW with the opposite meaning and interpretation. Each pair of KW is the SD poles for a particular attribute of an investigated fashion model: style, shape, colour, material and so on. Search is performed in order to achieve the positive correlation between each word from the SD (column 2 and 3 of Table 2) and words that express the emotions of consumers from clothing (column 6 and 7 of Table 2). The KWs are coded by using the first letters of words with opposite meaning [4].

Table 2. Consolidated results for semantic differential impressions from clothes

Pair code	KW		Meaning		Positively correlated to	
	KW 1	KW 2	KW 1	KW 2	KW 1	KW 2
1	2	3	4	5	6	7
CS	Casual clothes	Smart clothes	Practical and comfortable clothes	Clothes for special occasions	Comfortable Practical Rational	Exquisite Charming Excellent
RS	Romantic style	Sports style	The style creates a feminine image with exquisite detail	Style that adapts sportswear for everyday wear	Female Elegant Exquisite	Functional Comfortable Dynamic
CA	Classic style	Avant-garde style	The traditional forms of various clothing types	Impressive style that uses unusual fashion ahead of time	Respectable Austere Elegant	Epatage Creative Extravagant
FM	Folk clothes	Modern clothes	Clothes are shaped by the national costumes	Style is not sustainable within the long period of time	Ethnic Natural Ecological	Trendy Modern Actual
RO	Rectangular shape	Oval shape	The geometric symbol of clothes shape is rectangle	The geometric symbol of clothes shape is oval	Practical Dynamic Persistent	Female Calm Gullible
TdTu	Trapezoid shape (long base down)	Trapezoid shape (long base up)	The geometric symbol of clothes shape is trapezoid with long base down	The geometric symbol of clothes shape is trapezoid with long base up	Creative Starry-eyed Impulsive	Pragmatic Decisive Energetic
MP	Mono colour	Poly colours	Simple colour palette within a different hue	Sophisticated colour palette: two-, three - four-, colours and more	Monotonous Clean Stable	Complex Fantasy Individual
BS	Bright	Soft	Pure colour	Colour with a black hue	Solemn Refreshing Dynamic	Matte Hazy Still
LD	Light	Deep	Colour contains 70 % of the white hue	Colour contains 70 % of the black hue	Light Transparent Delicate	Heavy Classic Traditional
WC	Warm	Cool	Colour with a golden hue	Colour with a blue hue	Blinding Cheerful Resilient	Cool Fresh Romantic
MtPt	Mono texture	Poly texture clothes	One texture	Many textures	Classic Elegant Traditional	Luxurious Rough Avant-garde
MS	Matte texture	Shiny texture	The fabric absorbs light	The fabric reflecting light	Moderate Neutral Simple	Smooth Polished Bright
TN	Transparent texture	Non-transparent texture	The fabric is freely pass through itself light shines through	Fabric that does not pass through a beam of light	Light Delicate Elegant	Sturdy Thin Stable
SA	Symmetry	Asymmetry	The garment is composed of equal parts	The garment is composed of unequal parts	Static Equal Balanced	Expressive Dynamic Exclusive

3. EXPERIMENTAL

For the study the material of fashion mega-portal "first VIEW" [1] was used which makes it possible to work with digitized photographs the whole collection show.

The size of samples is 12 most frequently appearing outfits over the investigated period in press releases of designers and fashion houses namely Alexander McQueen (UK), Elie

Saab (Lebanon), Oscar de la Renta (USA), Roberto Cavalli (Italy), Valentino (Italy), Emanuel Ungaro (France), Jason Wu (USA).

As the object of study is women's dresses, from the collection of hits models by these houses in the period of spring-summer 2016 all models of women's dresses were picked up. Thus, a general collection was formed which amounted to 66 photos of fashion dresses for subsequent questionnaire.

The expert group consisted of 10 experts and 16 consumers. In a survey, photos of clothes were valued using valuation factors in bipolar scales defined by verbal antonyms of KW from each end of the scale (Fig. 1, Table 3).

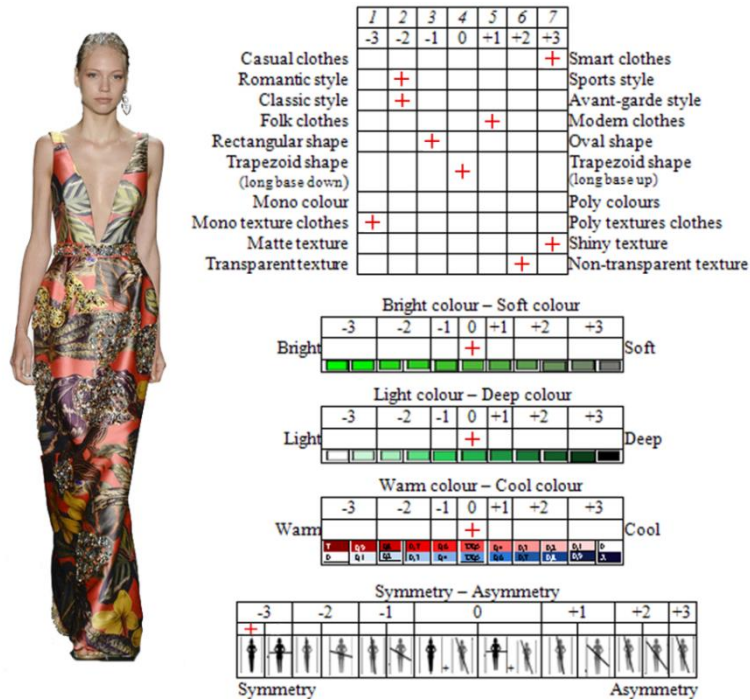


Figure 1. Example of answers for the questionnaire (outfit 28, expert 1 within group of professionals)

Table 3. Example of filling the form of evaluating consumer's impression with SD (outfit 28)

Code	Professionals – 10 people										Kp	Consumers – 16 people																Kc	K
	1	2	3	4	5	6	7	8	9	10		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
CS	3	2	3	2	3	2	2	2	3	3	2.5	2	3	2	3	3	3	2	2	2	2	3	3	2	3	2	2	2.4	2.45
RS	-2	-1	-2	-2	-3	-1	-2	-3	-3	-3	-2.2	-2	-1	-1	-2	-2	-3	-3	-2	-3	-3	-3	-2	-2	-2	-3	-2	-2.3	-2.22
CA	-2	-1	-1	-1	-2	-1	-2	-2	-2	-3	-1.7	-2	-1	-2	-2	-1	-1	-1	-2	-2	-2	-1	-2	-1	-2	-2	-2	-1.6	-1.66
FM	1	-1	-1	-1	1	-1	-1	1	1	-3	-0.4	1	1	1	1	1	-1	-1	1	-1	-1	1	1	1	1	1	1	0.5	0.45
RO	-1	1	-1	-1	-1	-1	1	-1	1	0	-0.3	-1	-1	-1	0	-1	-1	-1	-1	-1	1	1	-1	1	-1	1	1	-0.3	-0.30
TdTu	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.00
MP	3	3	3	3	3	3	3	3	3	3	3.0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3.0	3.00
BS	0	1	1	1	0	1	1	1	1	1	0.8	0	1	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0.8	0.80
LD	0	1	1	1	3	1	2	2	2	2	1.5	0	1	3	1	1	1	2	2	2	1	0	1	1	0	1	1	1.1	1.31
WC	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.00
MtPt	-3	-3	-3	-1	-3	-3	-3	-3	-3	-3	-2.8	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3.0	-2.90
MS	3	3	2	2	3	2	3	2	3	3	2.6	3	2	2	3	3	2	2	3	2	3	2	3	3	2	3	2	2.5	2.55
TN	2	3	3	3	3	3	3	3	3	3	2.9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3.0	2.95
SA	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3.0	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3.0	-3.00



4. RESULTS

The consistency degree of photo evaluation results by experts using SD scales is confirmed by concordance coefficients and Pearson criteria. Table 4 presents the consolidated results of the evaluation level coordination of expert opinions of the 66 models.

Table 4. The consolidated results of the evaluation degree of coordination of expert opinions (professionals – 10 people)

No	ω	χ^2_p	No	ω	χ^2_p	No	ω	χ^2_p	No	ω	χ^2_p	No	ω	χ^2_p	No	ω	χ^2_p
1	0.734	95.42	12	0.849	110.41	23	0.853	110.84	34	0.792	102.96	45	0.853	110.91	56	0.953	123.96
2	0.600	77.37	13	0.847	110.07	24	0.804	104.47	35	0.932	121.12	46	0.856	111.23	57	0.974	126.66
3	0.884	114.92	14	0.732	95.12	25	0.911	118.43	36	0.962	125.04	47	0.928	120.70	58	0.830	107.95
4	0.653	84.92	15	0.826	107.44	26	0.942	196.01	37	0.897	116.55	48	0.969	125.93	59	0.894	116.26
5	0.828	107.65	16	0.771	100.17	27	0.931	120.97	38	0.880	114.38	49	0.834	108.44	60	0.920	119.65
6	0.705	91.71	17	0.817	106.21	28	0.930	120.90	39	0.973	126.54	50	0.928	120.60	61	0.881	114.56
7	0.678	79.28	18	0.827	107.54	29	0.893	116.04	40	0.970	126.12	51	0.929	120.82	62	0.959	124.63
8	0.675	87.78	19	0.950	123.47	30	0.963	125.17	41	0.960	124.75	52	0.860	111.76	63	0.877	114.04
9	0.851	110.65	20	0.898	116.76	31	0.942	122.40	42	0.927	120.48	53	0.885	114.99	64	0.794	103.24
10	0.864	112.37	21	0.885	110.45	32	0.948	123.25	43	0.745	96.88	54	0.861	111.97	65	0.901	117.08
11	0.789	102.60	22	0.930	120.89	33	0.929	120.79	44	0.833	108.32	55	0.855	111.11	66	0.890	115.70

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. Therefore, it is possible to state with 95-percent probability that the frequency of evaluation ratios of KW pairs in different experts is coordinated in accordance with the calculated rate of concordance. Thus, each clothes model can be described with the help of the rating pairs of KW that were described in the Table 2.

As the results of the factor analysis that was described in previously published work [5], six factors (components) were highlighted, which can combine all pairs of words of SD that reflect consumer's impressions from clothes. That is why the number of descriptors of SD that must be considered for any outfit can be restricted to 6 pairs of words.

Since these evaluations are subjective, as a result of the survey psychographic profile of one dress pattern was constructed (Fig. 2). This profile reflects the average amount of evaluation coefficients for each pair of KW.

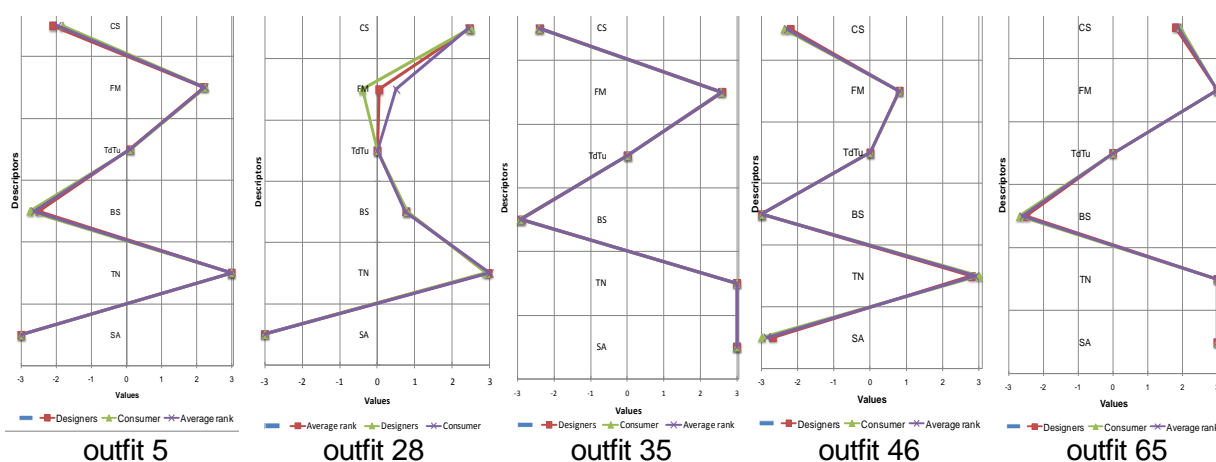


Figure 2. Examples of psychographic profiles



As shown in Figure 2 psychographic profile of an outfit visually practically does not differ for different groups of experts. That is why a two-sample location test of the null hypothesis such that the means of two populations are equal, was performed. Each population was represented by values of the same number of rating pairs of KW, but obtained by different groups of experts those are designers and consumers.

The results of the T-test that are shown in the table 5 confirm the null hypothesis. Therefore, in order to evaluate the consumer's impression with semantic differential only one group of experts is needed. Moreover, the group may consists of designers as well as consumers. The number of experts was determined as the maximum value of sample size for each descriptor of SD given that the sample size was calculated for each outfit (Table 5).

Table 5. Sample size determination

Outfit	Sample size for the descriptor						T-test	Outfit	Sample size for the descriptor						T-test
	CS	FM	TdTu	BS	TN	SA			CS	FM	TdTu	BS	TN	SA	
1	10	21	1	12	2	1	0.633	34	17	19	19	9	21	28	0.644
2	8	1	1	41	9	1	0.199	35	21	24	1	30	1	1	0.204
3	1	23	1	23	1	1	0.567	36	1	21	24	1	1	30	0.339
4	1	2	7	28	1	1	0.881	37	5	21	1	24	3	1	0.836
5	16	17	1	28	1	1	0.721	38	1	21	1	17	1	19	0.063
6	17	14	1	6	1	1	0.243	39	4	21	24	1	1	1	0.086
7	7	21	1	21	7	5	0.810	40	10	14	1	1	26	26	0.982
8	1	16	1	19	13	24	0.539	41	14	14	1	1	21	28	0.046
9	6	8	1	1	14	1	0.306	42	83	9	1	58	1	1	0.378
10	4	8	1	30	14	1	0.214	43	7	12	1	28	12	1	0.059
11	26	14	24	17	13	28	0.885	44	26	1	1	16	30	1	0.027
12	1	2	8	21	2	1	0.138	45	10	8	26	26	26	1	0.743
13	9	21	17	16	10	28	0.816	46	17	2	1	1	28	26	0.641
14	4	14	1	14	2	30	0.156	47	24	14	1	24	3	1	0.046
15	16	10	1	1	2	1	0.754	48	14	23	13	1	1	1	0.151
16	1	4	1	26	21	1	0.771	49	21	21	1	7	1	1	0.638
17	16	16	1	10	14	1	0.638	50	1	21	1	28	1	1	0.433
18	17	10	1	24	16	1	0.788	51	21	24	9	1	24	6	0.053
19	24	12	1	1	12	1	0.283	52	14	13	2	28	24	24	0.181
20	7	13	3	13	26	24	0.666	53	5	12	1	1	2	26	0.170
21	24	17	23	17	6	30	0.882	54	24	9	24	23	10	1	0.539
22	6	5	1	1	30	1	0.585	55	10	10	28	2	10	1	0.234
23	24	10	1	26	16	21	0.174	56	23	5	1	1	1	1	0.243
24	1	1	26	26	10	5	0.557	57	21	17	16	1	1	1	0.608
25	17	1	1	19	1	1	0.008	58	6	21	23	24	8	1	0.039
26	13	1	1	30	24	1	0.734	59	13	12	1	1	1	1	0.102
27	2	21	1	17	26	30	0.879	60	21	16	1	13	1	1	0.543
28	23	1	1	2	30	1	0.833	61	30	13	1	24	23	10	0.804
29	28	24	8	3	1	28	0.463	62	10	14	4	1	1	24	0.551
30	5	8	16	19	1	28	0.648	63	10	21	1	24	21	1	0.589
31	1	10	1	1	1	1	0.869	64	1	16	1	21	24	1	0.839
32	28	10	24	1	1	30	0.329	65	12	1	1	24	1	1	0.308
33	23	7	16	1	19	1	0.843	66	7	30	1	23	1	1	0.454

Descriptive statistic was calculated for the dataset of sample sizes. Statistical parameters for each descriptor of SD are shown in the table 6.

Table 6. Descriptive statistic

Parameter	CS	FM	TdTu	BS	TN	SA
Mean	12.43	13.14	6.55	15.15	10.42	9.22
Standard Error	1.09	0.92	1.12	1.52	1.25	1.48
Median	10.00	14.00	1.00	17.00	8.00	1.00
Mode	1.00	21.00	1.00	1.00	1.00	1.00
Standard Deviation	8.77	7.43	9.01	12.34	10.09	11.89
Sample Variance	76.84	55.25	81.22	152.16	101.75	141.33
Kurtosis	-1.20	-0.85	0.00	0.55	-1.15	-1.15
Skewness	0.26	-0.11	1.29	0.56	0.60	0.88
Range	29.00	29.00	27.00	57.00	29.00	29.00
Minimum	1.00	1.00	1.00	1.00	1.00	1.00
Maximum	30.00	30.00	28.00	58.00	30.00	30.00
Sum	808.00	854.00	426.00	1000.00	677.00	599.00
Count	66.00	66.00	66.00	66.00	66.00	66.00

As a result of the calculation, it was determined that the number of experts in the group is the maximum value in the range. The descriptor BS has the maximum value that is 58. However, it is not advisable to increase the sample size to such an extent. The descriptor BS is the pair of KW that is the description of the colour characteristics. Such characteristics must be estimated with software such as GIMP or Photoshop. Therefore, the descriptor was deleted from the overview and the number of experts is 30.

In the figure 3 the improved version of questionnaire is shown. The descriptor BS must be evaluated according to the value of brightness that is provided with tools of chosen software. In the figure 3 it is presumed to be Colour Picker of Adobe Photoshop.

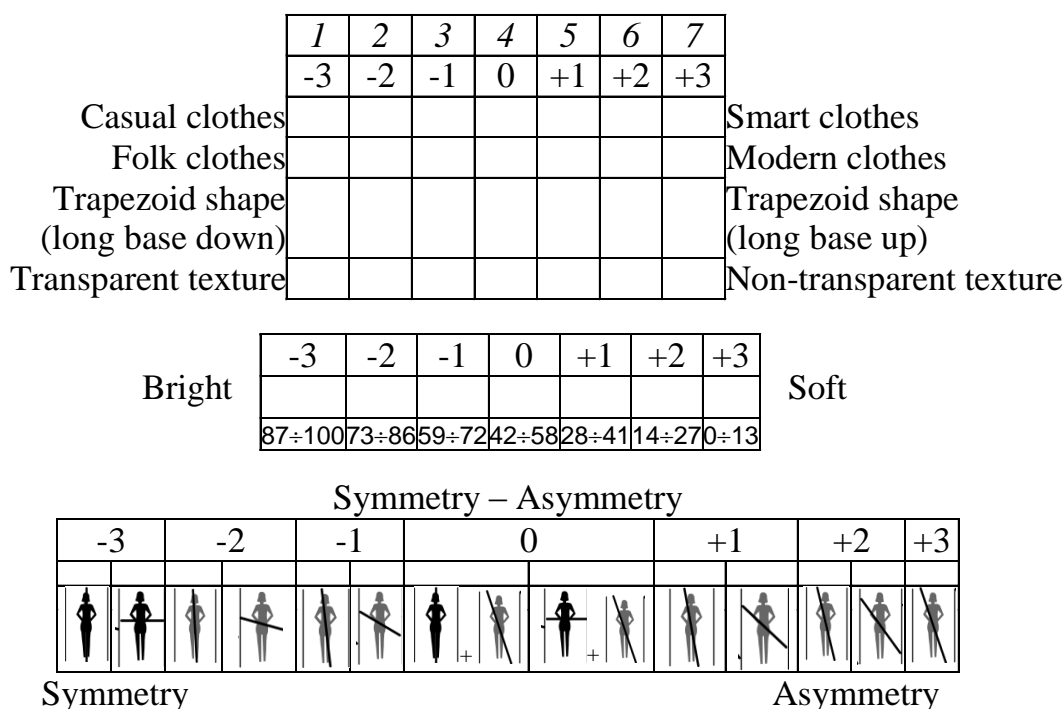


Figure 3. Example of the improved questionnaire
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5. CONCLUSIONS

As a result of the current research, analysis of photographs from clothes' collection shows by 12 famous Fashion Houses was conducted and photographic images of women's dresses were selected. The selected material was sampled for the next general assessment of impressions that are caused by outfits.

With the help of the developed bipolar scales of SD the description of artistic and design solutions of clothes in the form of psychographic profiles was made. Each profile is a list of the average meanings of the estimated coefficients of SD for six pairs of KW: SA, BS, CS, TN, FM, TdTu.

It was determined that only one group of experts is needed and the number of experts that can be designers as well as consumers was determined. The descriptor BS was removed from the original survey in order to decrease the number of experts in the group. Therefore, the number of experts is 30 and evaluation of the colour characteristics of outfit must be performed with tools of raster graphics editors.

6. REFERENCES

- [1] First VIEW. [Online]. Available: <http://www.firstview.com/> [2016-September-15].
- [2] Kuleshova S. G. (2016). Colour in the art of designing clothes: study guide. Khmelnytskyi: KhNU, Ukraine, (2016).
- [3] Kuleshova S. G., Zakharkevich O. V. & Shvets G. S. (2016). Image clothing as a component of the professional designer's education. Proceeding of International Conference on Research in Education and Science, Bodrum, Turkey: Gaziantep University, May 19-22, (2016), pp. 641-650.
- [4] Kuleshova S.G. & Kurochka S. B. (2016). Emotional component in the clothing design with semantic differential. Resource-saving technologies of light, textile and food industry: proceedings of Ukrainian scientific-practical Internet-conference of young scientists and students, Khmelnytskyi: KhNU November 17-18 2016, pp. 56-57. [Online]. Available: http://tksv.khnu.km.ua/inetconf/2016/kuleshova_kurochka.pdf
- [5] Kuleshova S.G., Zakharkevich O. V., Koshevko J.V. & Ditkovska O.A. (2017). Development of expert system based on Kansei Engineering to support clothing design process. *Vlakna a Textil*, No 4, (2017), pp.30-41.
- [6] Nagamachi M. (2008). Perspectives and the new trend of Kansei. *Affective engineering. The TQM Journal*, Vol. 20, No. 4, (2008), pp. 290-298.
- [7] Nagamachi M. (2011). *Kansei / Affective Engineering*. Taylor & Francis Group, United States of America, (2011).
- [8] Osgood C. E. (1968). *Method and Theory in Experimental Psychology*. Hardcover: Import, Germany, (1968).
- [9] Qiao X., Wang P., Li Y. & Hu Z. (2014). Study on a correlation model between the Kansei image and the texture harmony. *International Journal of Signal Processing, Image Processing and Pattern Recognition*, Vol. 7, No. 4, (2014), pp. 73-84.
- [10] Rajasekera J. & Karunasena H. (2015). Apparel design optimization for global market: Kansei Engineering preference model. *International Journal of Affective Engineering*, Vol. 14, No. 2, (2015), pp. 119-126.
- [11] Schutte S. (2005). Engineering emotional values in product design. *Kansei Engineering in development*. Linköping University Institute of technology, Sweden, (2005).
- [12] Shaari N. (2013). Methods of analysing images based on Kansei Engineering. *International Journal of Computer Science and Electronics Engineering*, Vol. 1, No. 3, (2013), pp. 417-421.