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Kansei engineering for e-commerce sunglasses selection in Malaysia

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Abstract

In sunglasses e-commerce shopping experience, consumers are unable to touch or feel the product. Thus, the product physical appearance becomes more important in their buying decision. Increasing the emotional appeal or Kansei generated from the product appearance would encourage sunglasses sales. This paper reports the implementation of Kansei Engineering Type 1 to identify sunglasses design elements that are emotionally appealing to 18 to 34 age demographic in Malaysia. Multivariate analysis is performed on the Kansei survey data to discover the influential Kansei words and the corresponding design elements. Finally, sample sunglasses that contain these design elements are selected as recommendation.

Keywords: sunglasses design; Kansei Engineering; e-commerce; recommender system; statistical kansei analysis

1. Introduction

E-commerce and Internet-based sales transaction for sunglasses is increasingly becoming popular [1, 2]. Tangible benefits for shopping sunglasses online include convenience, time and cost savings, and greater choices without geographical constraints [3].

The experience of online shopping for sunglasses online is different than that of shopping at conventional brick-and-mortar retail outlet. During conventional shopping, the consumer is able to wear and feel a product before purchasing it. This enables the consumer to make a quick decision on whether to buy the product or find another product that the consumer would be more satisfied with. There is also interaction between the consumer and the product seller during conventional shopping that could build trust and would normally enhance the success rate of sales transaction [4].

During online shopping of sunglasses, a consumer is limited to selecting products based on pictures, prices, and brands. Occasionally, some website provides visualization tools such as superimposition of the product on the consumer’s face. Nevertheless, the consumer cannot wear and feel the products. This makes the physical design of the sunglasses more crucial as a key feature in selling sunglasses in the internet [5].

Images of sunglasses in e-commerce web pages need to provide emotional appeal so that consumers would want
to buy the displayed products [6]. Emotional appeal based design could be derive from Kansei Engineering (KE), a product development method pioneered by Nagamachi [7] that converts feelings and impressions (Kansei) into product parameters and design specification. Nagamachi founded Kansei Engineering in 1970’s at Hiroshima University as a technology that facilitates the development of product that delights and satisfies human physiologically. Since then, Kansei Engineering has been successfully used to develop products in a wide range of industry such as automotive, construction machines, home appliance, costume, and cosmetic [8].

Kansei Engineering has also been used to evaluate e-commerce website design [9, 10]. Further, Lokman [11] had applied Kansei Engineering in e-commerce children clothing design to identify design concept and characteristic that appeals to consumers’ emotion and proposed Kansei Engineering for use in others e-commerce markets.

In our study, we use Kansei Engineering for sunglasses selection for e-commerce website. Our objective is to implement a Kansei system to recognize design trends that would appeal to the local population. The knowledge gain could be used by online sunglasses retailers to showcase and better promote emotionally appealing and relevant sunglasses design in their main web page and website search results. This would increase customer satisfaction and consequently would attract more sales [12].

2. Kansei Engineering Method

We use a popular type of Kansei Engineering called Kansei Engineering Type I [13] which is capable of relating emotional appeal in the form of Kansei Words to physical design characteristics using item/category classification. Our target demographic group is Malaysian consumers with age between 18-44 years. The general flow for our Kansei Engineering implementation is as below:

1. Collection of Kansei words
2. Structuring semantic differential (SD) scale for the Kansei words
3. Collection of specimens
4. Classification of item/category:
5. Evaluation experiment
6. Statistical analysis
7. Interpretation of the analyzed data
8. Identification of influential design elements

2.1. Collection of Kansei Words

We constructed the 5-point SD Scale with 30 Kansei words as shown in Figure 1. The words are sourced from sunglasses adverts and promotional articles [1]. In addition to that, we also verified the suitability of Kansei words with an Optometrist from the National University of Malaysia before conducting the evaluation experiment[14].

![Fig. 1. The Kansei words [1,14].](image-url)
2.2. Collection of Specimens

20 specimens is obtained with the help of staffs from Optometry and Vision Science Programme of the National University of Malaysia [14], based on the distinctiveness of shape, style, and color.

![Specimens](image)

Fig. 2. Specimens used for Kansei survey [13,18]

2.3. Classification of Item/Category

Due to the nature of our study on e-commerce merchandise visual emotional appeal, our item/category classification is limited to the physical trait that can be view in our specimen images. Table 1 shows the partial list of the 48 item/category classification that we used:

| Physical Trait | Item | Category |
|----------------|------|----------|
| Overall        | Color Count | One, Two, Three or more |
| Frame          | Color | Red, Black, Orange, Metallic, Blue, Yellow, Gold, Purple, White |
|                | Shape | Round, Square, Sharp |
|                | Color Intensity | Light, Dark |
|                | Design | Full, Half, Frameless, Thin |
| Lens           | Lens color | Black, Orange, Purple, Brown, Green, Red, Yellow |
|                | Colour tint | Mono color, Dual color |
|                | Colour intensity | Light, Dark |
|                | Colour matches frame | Yes, No |
| Hinge          | Thickness | Thick, Medium, Thin, None |
| Arm            | Thickness | Thick, Medium, Thin, Strap |
|                | Pattern | Printed, Crafted, None |
|                | Tip | Obvious, Not obvious, Strap |
2.4. Evaluation Experiment Survey

To conduct the evaluation experiment, we created a survey website using the URANUS system and invited seventy five subjects (aged between 18 and 34) to evaluate Kansei words appeal for each of our twenty specimens on a 5-point SD scale. URANUS is an established research gathering tool widely used for user research in industrial ergonomics [15] and website assessment [4,16,17]. This is the first study whereby URANUS was used in an optometry and health science field to gather survey feedback from respondents. The subjects are recruited from UKM student population and MIMOS Berhad personnel. This number of subjects is more that the recommended twenty to thirty persons [13].

![Screen-shot of survey website used to evaluate the appeal of Kansei words on 5-point SD scale](image.png)

3. Statistical Analysis and Interpretation

3.1. Factor Analysis

We start with the use of Factor Analysis to find a small number of factors that will contribute significantly more weight. We calculated the biggest five factors as shown in the table 2:

|   | F1  | F2  | F3  | F4  | F5  |
|---|-----|-----|-----|-----|-----|
| Eigenvalue | 14.508 | 7.141 | 2.368 | 1.091 | 0.821 |
| Variability (%) | 48.361 | 22.802 | 7.892 | 3.638 | 2.736 |
| Cumulative % | 48.361 | 80.054 | 80.054 | 83.692 | 86.428 |

The five factors in in Table 2 have a cumulative contribution of 86.43%. Factor 1 has a contribution of 48.36% and factor 2 have a contribution of 22.80%. Meanwhile, the rest of the factors are significantly smaller. Therefore, we can confidently use factor 1 and factor 2 to construct the principal component sphere of Kansei words.
Table 3. Factor loading table

|       | F1  | F2  |
|-------|-----|-----|
| Trendy| 0.921 | 0.959 |
| Beautiful | 0.920 | 0.885 |
| Gorgeous | 0.917 | 0.784 |
| Stylish | 0.891 | 0.770 |
| Designer | 0.884 | 0.572 |
| Glamorous | 0.882 | 0.448 |
| Premium | 0.869 | 0.384 |
| Hot | 0.863 | 0.337 |
| Bold | 0.848 | 0.323 |
| Sophisticated | 0.830 | 0.310 |

Table 3 list the top ten Kansei words with the highest weight for factor 1 and factor 2. From here, we can see that Kansei words associated with factor 1 such as “trendy”, “beautiful”, “gorgeous”, and “stylish” can be grouped together as “Visual Attraction”. As for Factor 2, words such as “sporty”, “cool”, “safety”, and “practical” lead us to name factor 2 as “Everyday Use”. Note that the word “cool” in factor 2 may have an ultirian meaning of keeping a sunglasses wearer cool in the Malaysia tropical weather.

3.2. Principal Component Analysis

Principal Component Analysis is applied to the experiment data and the relationship between Kansei words and specimens is obtained. The cumulative contribution of PCA is almost the same as the results of our Factor Analysis. Fig. 4 shows Kansei words vectors which indicate the strength and directions of each Kansei words. The specimens relative positioning are overlay as dots. The figure illustrates the position of the specimens relative to the Kansei words direction.

3.3. Interpretation of the Analyzed Data

In this phase of Kansei Engineering, the suitable Kansei words that could describe the emotional appeal of our target consumers are determined. Good product design could be reach if we choose to transfer design element associated with the Kansei words that contributes positively to both “Visual Attraction” and “Everyday Use” component. The Kansei words located in the shaded region in Figure 4: “modern”, “intellectual”, “premium”, “youthful”, “edgy”, “sleek”, and “hot” fulfills this criterion. From the region, we picked four candidates Kansei words: “modern”, “intellectual”, “premium”, and “youthful” that we think will best describes the two components simultaneously.

3.4. Identification of Influential Design Elements

Partial Least Square (PLS) Analysis is used to identify the influential design elements. PLS is done using the data from Kansei words survey and the Item/Category Classification. Relationship between the four chosen Kansei words and the design element describe in the item/category is obtained. Table 4 shows some of the PLS analysis results.
Fig. 4. Positioning of 20 specimens relative to psychological sphere of the 30 Kansei words

Table 4. Partial PLS results for strategic Kansei words

| Item - Category          | Modern | Intellectual | Premium | Youthful |
|--------------------------|--------|--------------|---------|----------|
| Intercept                | 2.5624 | 3.1067       | 2.5627  | 2.7351   |
| Color Intensity-Dark     | 0.0185 | 0.0597       | 0.0339  | -0.0037  |
| Color Intensity-Light    | 0.0848 | 0.0589       | 0.0965  | 0.0550   |
| Color count-One          | -0.0149| -0.0351      | 0.0232  | 0.0619   |
| Color count -Two         | 0.0245 | 0.0376       | 0.0441  | -0.0197  |
| Color count -Three or more| -0.0146| -0.0142      | -0.0596 | -0.0215  |
| Frame Color-Blue         | 0.4826 | 0.2931       | 0.4630  | 0.1604   |
| Frame Color-Orange       | 0.2361 | 0.1819       | 0.2947  | 0.1325   |
| Frame Color-Yellow       | 0.1541 | 0.0843       | 0.1432  | 0.0169   |
| Frame design-Half frame  | 0.1001 | 0.0686       | 0.1029  | 0.0228   |
| Frame design-Round frame | 0.0550 | 0.0366       | 0.0602  | 0.0354   |
| Frame design-Thin frame  | 0.1259 | 0.0275       | 0.0971  | 0.0547   |
From our PLS analysis, we picked the design elements that have the highest influence to the Kansei words as our recommended design requirements list. Some of the design elements (i.e., lens color and intensity) were not included in the list because doing so would severely restrict the number of products we can recommend later. In the end, the design element list becomes:

- Overall color: Two.
- Frame: Blue, orange, or yellow. Half or thin frame. Light colors.

Example of sunglasses design that could contain our recommended design elements are shown in the Fig. 5:

![Fig.5. Proposed sunglasses that based on recommended design elements](image_url)

4. Conclusion

We use a systematic application of Kansei Engineering to discover the design element that could generate emotional appeal for e-commerce consumer based on limited physical visual design. By implementing Kansei Engineering Type I procedure, thirty Kansei words related to the sunglasses advert descriptions with twenty sample products (specimens) was analyzed using multivariate statistical analysis. The important Kansei Words have been chosen by using FA and PCA while the influential design elements that correlates to the chosen Kansei words is determined by PLS analysis.

In our study, we targeted Malaysian in the age group of 18 to 34. We found sunglasses with light colored thing or half frame with overall color count of two to be the most emotionally appealing design. Also, the color blue, orange, and yellow are statistically more attractive.

Overall, the most significant contribution of this research is that we’ve shown that Kansei Engineering could be used in the sunglasses e-commerce industry as an added-value tool to facilitate the understating of consumers’ desires in an objective matter. We also realized that performing a Kansei Engineering study of this nature is tedious and time consuming when performed manually. Hence, we propose using an automated tool such as URANUS. By the means of this study, we have incorporated the survey instrument in URANUS [16,17,18], which will facilitate future researcher in this area. We recommend that in the future online retailers and researchers could do similar studies for other demographic in order to gain better insights on the user’s Kansei and design for the target demography accordingly.

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