

AN EVALUATION CASE STUDY OF SUN HAT DESIGN FOR COLLEGE STUDENTS BASED ON KANSEI ENGINEERING

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ABSTRACT

This Paper puts forward a complete design thought based on the principle of Kansei Engineering, in the context of college students' demand for transformation and by combining with summer sun hat products and adopting questionnaire method. According to description of college students on sensory evaluation factor composition of sun hat and sensory evaluation characteristics of specific products; on the one hand, this Paper has analyzed relation between comprehensive sensory factors of sun hat and sensory mentality of college students; on the other hand, it tries to increase interestingness of design by characteristics of thermochromic materials for presenting different colors under different temperatures. According to experiment result, thermochromic material is applied to design process of sun hat and has obvious visual expressive force on color and surface texture effect, etc. and can endow texture with thermochromic characteristics. Research of this Paper aims at exploring a kind of new design thought for cloth design and development.

Keywords: *kansei engineering, demand of college students, sun hat, thermo chromic materials*

1. INTRODUCTION

Currently, the clothing market is in great demand of sun hats. There is no more innovation on design, which requires to change in the process of product design. The innovation of clothing

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products is to make a comprehensive evaluation for the product on the basis of the sensory organs of the wearer, which will indeed let the user enjoy practical and comfortable experience and improvement.

In academic, Moody, et al.,(2010) have studied female consumers' preference on clothing in the fitting process as well as the relation between customers' personality and emotion. The result shows that the wearer's emotion significantly relates to clothing preference, while the wearer's personality characteristics also relate to clothing preference. The expert knowledge base of costume design shall be established by using the fuzzy mathematical method to collect the data matching with consumers' preference. Example study shall be conducted for decomposition and description of clothing product's sensory data (Wang and Chen, 2008). Researchers (2014) have designed a style of sun hat that is inlaid with a flexible cable by sewing at the edge of the hat. The flexible cable turns the edge part upward through the sensor, which avoids the discomfort caused by the contact between the sweaty rear neck skin and sun hat.

In the fashion field, many brands also blend the assessment method of kansei engineering in product's R&D. Coolbit is comparatively representative. Its design philosophy is to add a rubber cooling patch at the back of the hat, which may cool the motor nerve of rear human brain through heat evaporation. Moreover, its design also has another highlight as it is detachable and convenient for cleaning. According to the evaluation of users, we can see that the wearers are satisfied for the sense of touch, color matching, and parent-child style that can enhance family interaction.

This paper changes sentimental appreciation into measurable data, considers the compatibility, novelty, and rationality of sun hat design and reflects contemporary college students' culture, character index, and epochal characteristics by taking heat discoloration as medium, basing on the evaluation method of kansei engineering and in accordance with research data; it uses new heat discoloration textile material as the innovation highlight, breaks the traditional simple and stiff image of sun hat and smoothly connects with clothing market.

2. RESEARCH PURPOSE

Main purpose of the research is to use the assessment method of kansei engineering in combination with new textile fabric to boost the development of sun hat that caters to college students. With coming of information and experience age, college students are taken as subjects of sensibility consumption. Product information received by users include rational information and kansei information. Product's rational information means its function, material, technology etc., which is the foundation for product existence, while kansei information means product's shape, color, usage mode etc., which embodies product's design culture and style (Du and Gao, 2007). Sensibility and rationality are usually relative. However, the rational information and kansei information conveyed by products are interactive.

Innovation in this paper lies in how to establish the communication channel between designers and users as well as the feeling, evaluation, demand exploitation of college students for new textile fabric and to optimize the rationality and the science of heat discoloration textile material design process so as to meet college students' aesthetic need and psychological need.

The paper regards kansei engineering as the experimental tool to set up the sensory evolution theory of heat discoloration textile material, in accordance with college students' evaluation and analysis method for heat discoloration textile material and explores college students' sensory evaluation and preference for sun hat.

3. HYPOTHESES

Heat discoloration costume design aims at allowing people to enjoy better experience. Good experience may occur when the wearer communicates with costume of new fabric. In consideration of costume getting closer to the wearer's thinking logicity and wearing ways, the change of costume color can embody the relation between color and psychology and boost the connection between people and product. The image quantification made by kansei engineering for sun hat provides rational basis for follow-up design.

H1. The possibility that kansei engineering can achieve image quantification of sun hat.

Currently, the research of kansei engineering in costume industry mainly focuses on women's wear and men's wear, and there is not too many researches are made on hat design. However, it is possible that the research method of kansei engineering can be applied to sun hat design.

H2. Kansei engineering can combine with heat discoloration textile material so as to establish the emotional relation between heat discoloration textile material and college student.

If college students face various kinds of sun hats, sensibility response of college students can be reflected by rational evaluation. College students' sensibility can be conveyed to costume design through heat discoloration textile material.

4. EXPERIMENT METHOD

The research is divided into two experiments. The procedure of finished sun hat design and producing is the first experiment. Firstly, extract semantic words group in questionnaire form and extract design element of prototypical sun hat according to ten pairs of words group. Implement design experiment based on variance analysis. The second experiment is comparative evaluation, which compares prototype hats with other typical sun hats.

4.1. Trial group



Figure 1: The selection the of experimental samples

4.2. Experiment method

Questionnaire consists of 10 pairs of words group constituting sensible image of hat (see Table 1). The Experiment adopts Richter scale and evaluates sensible image of hat by adopting 5 score evaluation method. At the same time, issuance of questionnaire has implemented initial statistics analysis on consumption behavior and preference degree of college students.

Table 1: Ten selected pairs of opposite adjective used to assess the perception of the sun hat

No.	1	2	3	4	5
Phrase	Concise	Modern	Colorful	Fashionable	Edgy
	Changeable	Conservative	Solid	Traditional	Dull
No.	6	7	8	9	10
Phrase	Common	Smooth	Novel	Uninhibited	Technological
	Exaggerated	Rough	Plain	Prim	Handmade

Table 2: VARIANCE analysis

	Cluster		Error		F	P.
	Mean Square	df	Mean Square	df		
Concise/ Changeable	9.750	2	.532	17	18.315	.000
Conservative/ Modern	3.750	2	.768	17	4.885	.021
Novelty/ Plain	.942	2	.580	17	1.622	.227
Elegant/ Hyperbolic	.842	2	.404	17	2.084	.155
Edgy/ Dull	2.267	2	.557	17	4.070	.036
Tradition/ Fashionable	.375	2	.532	17	.704	.508
Technology/ Handmade	.750	2	.791	17	9.948	.407
Smooth/ Rough	10.875	2	.438	17	24.815	.000
Uninhibited/ Prim	4.208	2	.399	17	10.547	.001
Colorful/ Solid	4.442	2	.451	17	9.849	.001

Table 2 is variance analysis table and it can be seen from analysis result that 6 P-value variances have obvious relevance to establishment of sensibility intention space of sun hat. Extracted factors include changeable-concise, conservative-modern, colorful-solid, edgy-dull, smooth-rough, and uninhibited-Prim factors. Extract design element to factor by semantic words. Sensible images of sun hat can be divided into 6 factors, such as temperament factor, function factor, eye-catching factor, leisure factor, concise factor, and youth factor.

5. PROTOTYPE PRODUCTION SCHEME OF SUN HAT

5.1. Design feature of heat discoloration sun hat

At the present market development stage, heat discoloration material is less used in hat design. The sensory characteristics of such material is that its fiber is short and differs in length,

with hard hand feeling and smooth surface. The style features of such fabric is natural, comfortable, warm, breathable, moisture absorption, with gentle luster, and the sense of warmth. Therefore, we need to research and develop the application of such emerging and less used material in sun hat design. This paper combines heat discoloration material with kansei engineering and deeply analyzes it, which has great practical significance and theoretical significance for the development trend of hat industry. Structural design of sun hat shall include a cap peak with proper width, sweatband, tail buckle or Velcro tape. On design of hat brim width, by referring to test result of Diffey research and Kansei Engineering, it is proper that hat brim width does not exceed 7.5cm, so that it will not influence sight and can prevent nose and face from direct sun exposure(Diffey and Cheeseman, 1992). The crown is entirely open, which can avoid ruining the wearer's hair style. The tail buckle part of the hat shall use Velcro tape, which not only ensures that the hat will not separate itself from the head when the wearer lowers head or raises head, but also allows the wearer to adjust the size of hat at any time according to his/her need. Wind strings are added at the both sides of hat, which can be removed at any time. It functions identically and is suitable for people who work outdoors for a long time and make sure that their hats are not blown away in case of strong, windy days or rainy days (Stone, 2003) .

5.2. Sun hat pattern Figureure

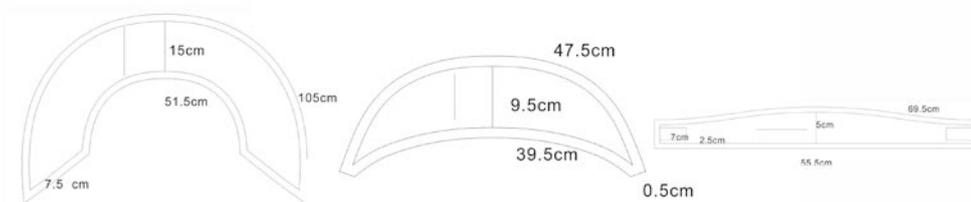


Figure 2: Sun hat pattern

5.3. Material selection

Hat material selection is one of the important factors that decides the quality of hat. Heat discoloration textile is used for outer material of the hat. Safe textile that is not harmful to human takes precedence. For example, heat discoloration or photosensitive discoloration reaches to ideal effect through fiber addition, coating, and other methods. The design principle of heat discoloration clothing is to cause fabric's internal structure change discoloration ability, which results in color change. When temperature reduces, the color recovers as before. In the process of design, it refers to Schütte (2005) and Lee et al (2002) research for the relation between function technology and emotion expression and blends heat discoloration fabric in clothing research and development, which makes sun hat design get closer to college student's emotional need--seeking different clothing experience.

5.4. College students' emotional design factor

College students' psychological activities include two aspects, i.e., sensory feeling and rational evaluation. Sensory feeling refers to the process that college students conduct comprehensive reflection for the property and all aspects of the sun hat through their feeling, intuition, memory, image, thought and other activities; emotion refers to the influence of all aspects' features of the sun hat on college students' mental emotion. Rational evaluation is made by college students through trying to exclude the influence of external interference factors (Chen ,2007). For product design, traditional cognitive approaches have tended to underestimate the user emotions which acts as a critical component of artifact sense making(Spillers,2004). Figure. 3 is the structure of college students' mental activity.

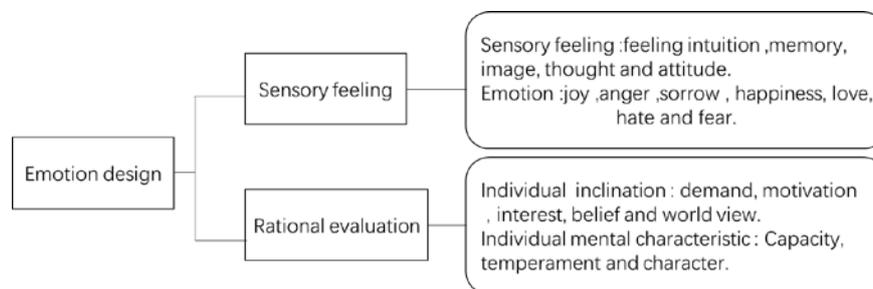


Figure 3: The structure of college students' mental activity

6. COLLEGE STUDENTS' EMOTIONAL DESIGN FACTOR

Figure. 4is a finished sun hat picture. Figure. 5 shows heat discoloration effect. When the cloth cover temperature is at room temperature, the fabric is shown as pink(a); when it is shone by sunlight for 30min, the color of cloth cover changes from pink to white(b); when it is directly shone by sunlight after 1 hour, the color of cloth cover is pure white (c). Breathable mesh yarn is chosen for lining, which absorbs more sweat and prevents sweat stain from immersing in fabric. The adjustable Velcro tape is added at the back of hat, which makes it more comfortable.

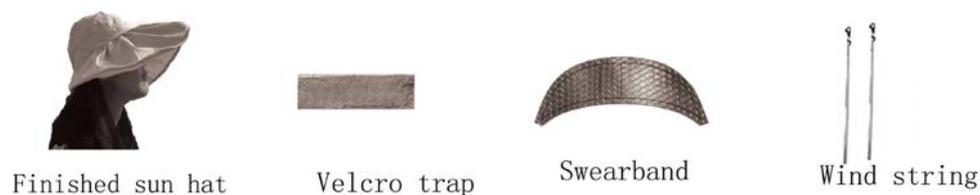


Figure 4: Finished sun hat picture

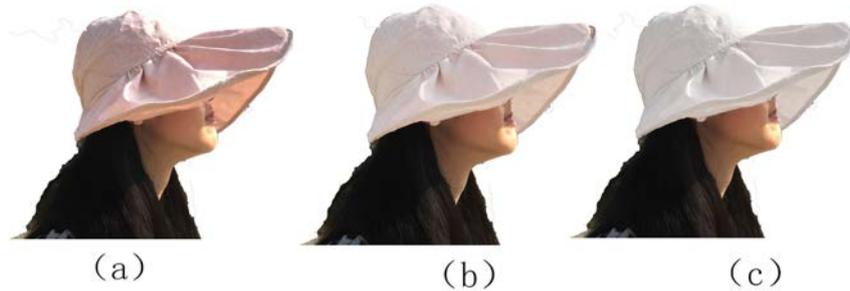


Figure 5: Heat discoloration effect

6.1. Kansei evaluation I

Semantic words have analyzed influence of thermochromic sun hat on mental reaction of college students for established sensibility intention space. The research result shows: (1) it is taken as design element for sun hat according to 6 factors extracted from results of variance analysis.

(2) Fabric is the only objective part of the product that can be seen and touched by people. As fabric is with unique vision and touch semantics and has a comprehensive effect on college students' physiology and psychology, it gradually becomes one of the communication media used by designers to express product image and to indirectly "communicate" with college students.

(3) College students widely consider that sun hat shall be comfortable, pretty, and durable as well as make the wearer look refreshed and vigorous, while they pay less attention to gorgeous and luxury degree and do not like grotesque and exaggeration. Only comfortable, fashionable, pretty sun hat that makes the wearer look refreshed and vigorous can meet the wearing and aesthetic needs of college students and be well received by them.

6.2. Head Kansei evaluation II

Cluster analysis method is used to conduct cluster analysis in accordance with different sentimental demands of college students for sun hat image, and further analysis is made for all kinds of college students' different recognition degrees for sentimental demands through multiple comparison of means. The design in this paper is partial to female sun hat from style to color. However, the color for male sun hat is designed to use cool tone to highlight the handsome and mature male image. In comparison with female hat design, multifunction becomes the central point of design. The feature of sun hat obtained from analysis blends in design so as to make designers pay more attention to functionality, fissionability, and collectability of sun hat in the design process, which is more in line with the aesthetic demand of college students.

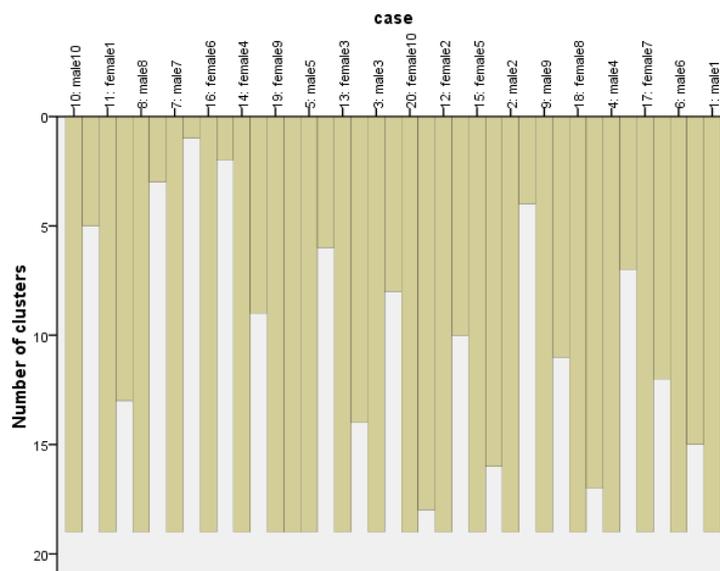


Figure 6: Evaluations of different genders on the image of sun hats

The following results are obtained by utilizing SPSS software and according to different demands of college students on sun hat functions. Figure. 6 is icicle Figure and tested group can be divided into 3 kinds of groups: comfortable type, leisure type and fashion type. Right icicle length of male 7 is less than 3, so male 7 and female 6 are in the same group; because right icicle length of male 8 is less than 3, he is in the same group with female 1, male 10, and female 4 and others are in the same group; three kinds in total. Analysis result shows that different-type sun hat appearance has aesthetic difference and there is obvious difference on evaluation and preference of different-gender college students.

7. CONCLUSION

On the basis of kansei engineering, this paper explores and evaluates the sensible image of college students for sun hat by using cluster analysis method, tries applying kansei engineering to sun hat design and explores to apply appropriate and specific design method and step of kansei engineering theory to costume design. By taking sun hat as the entry point, the previous exploration method is concretely applied to set up a kansei word database of sun hat and a sensory evaluation scale. Then through the college students' sensory evaluation for sun hat product, it sorts and analyzes a sun hat style represented by each sensation. The relationship between sun hat design factors and heat discoloration is established through adopting variance analysis method, factor analysis, and other statistical analysis methods, which realizes multi-dimensional evaluation and system analysis for sun hat.

(1) This paper puts forward the concept, acquisition, and analysis method of sensible image quantification of sun hat in summer and provides the approach for evaluating and analyzing aesthetic feeling of heat discoloration fabric. This Paper explores and evaluates sensible image of college students group on sun hat by adopting variance analysis method

based on Kansei Engineering and evaluates experiment by Richter Table and quantifies experiment by data analysis method. The experimental process and analysis method of heat discoloration fabric's aesthetic feeling evaluation are demonstrated by means of example study, while the relation between sun hat design factor and kansei engineering is established. The design result demonstrates that heat discoloration fabric can be applied to the research and development of sun hat industry as well as other clothing products' evaluation and design.

(2) The relation between heat discoloration fabric and college students' feeling evaluation is established; the aesthetic feeling of different materials is defined; the relation between college student' preference and aesthetic image is analyzed. Representative product sample and image words are selected to conduct sensory evaluation experiment on the basis of kansei engineering and new textile fabric and to conduct quantitative analysis for aesthetic evaluation data. Evaluation factor of sun hat is concluded, while the feature of heat discoloration fabric as well as the aesthetic evaluation and preference of college students between different genders for sun hats are explored.

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