

Cognition of Female Suits Silhouette Based on Sense of Fashion

Fang Qin, Binfei Gu and Guolian Liu

National Engineering Laboratory for Modern Silk (NELMS), College of Textile and Clothing
Engineering, Soochow University, Soochow 215021, China

Abstract: With competition increased in garment industry, fashion design has transformed from production-orientation to consumption-orientation. So it is important to study consumer's psychology and cognition processing. In this study, silhouette of female suits was studied, based on information process theory in cognitive psychology, praxiology experiment with E-Prime, a software applications suits for conducting psychological and neuroscientific experiments, was used to replace traditional questionnaires in Kansei Engineering to calculate the behavior data of subjects. There are three design elements (waist, length and hem) of female suits mentioned in the study. Stimulation samples were pictures of female suits combined with different levels of waist, length and hem size. Sensory word "fashion" was used to be representative one kind of style. The behavior results showed subjects' feeling of fashion are significant influenced and changed regularly with waist, length and hem opening size. The interactions effect of design elements also affected people's cognition in evaluating female suits. Characteristic design elements were confirmed after data analyzed. The results will provide behavior basis to study which design element affect cognition of female suits silhouette and to conclude cognitive neuroscience mechanism in further research. Data results may also provide basis research for evaluation or computer simulation system of fashion design, even product design in other area.

Keywords: Cognition, design element, female suits, silhouette

INTRODUCTION

Design process of product is becoming more and more complex with material and information science developed in recent years. At the same time, what consumers need is becoming personal, humanized and diverse with market competed. So function of product is not the only point, the design idea that cognitive process of customer is more and more impressed. Style is presented by a series of modeling elements consisted by different ways. In order to occupy consumption market, it is important for designer to master the style of product. If an evaluation system is established based on style of product, the process of design can be accelerated, effective and suitable. Style exists in art and design, for example fashion design, architecture design and so on Huang and Sun (2006).

Fashion is no longer the decision of designer, whether consumer like is the most important. Furthermore, consumers' emotional need is discussed to provide theoretical principle for evaluation system. Among great variety kind of clothing, suits takes a high place. Suits have played an important role in the development history of human clothing, which becomes the best choice of people when they take part in major occasion in the worldwide. In recent years, with the

development of fashion design, suits are very common and important in many ladies' wardrobe, especially for women in competitive career. In current fashion climate, traditional suits will be occupying a leading position in fashion market (Wei, 2008).

Every consumer has his own idea to each product. Especially female consumers have more rich feeling to fashion, it is necessary for apparel enterprise to consider how to design fashionable suits for women, because trend of fashion is important to make sustainable development of suits.

Silhouette of suits is more important to the other design elements in making female suits, it can not only modify figure of women, but can make stature prominent. In order to discuss how to design perfect suits for female consumer, firstly, silhouette is the emphasis analyzed in this study.

In this study, female suits were selected as objects and the consumers including male and female were targeted based on visual cognition.

RESEARCH METHOD

Theory of kansei engineering: At present, many product development theories based on consumer were described, of which is Kansei Engineering in Japan, or

called sensory evaluation in the other countries. Kansei Engineering is one of new research directions, beginning from late 70's in 20th century in Japanese and developing in 90's. The perceptual reflections, which are difficult to quantify can be quantified by using modern computer technology based on Kansei engineering to develop new products. In other words, it is both a product development technology based on customer and a technology which translates customers' experiences and intentions into design elements (Nagamachi, 2002).

Many researches in fashion design were based on theory of Kansei Engineering. In Taiwan, a fresh way of Kansei engineering theory called Miryoku Engineering which was applied in product design to emphases "attractiveness "of product (Ma *et al.*, 2012a; Shieh *et al.*, 2011; Ma and Li-Tan, 2012b).

In the theory of Kansei Engineering, the relation of design elements and image word is important and the element is drawn out from the product design to analyze, each element will be discussed.

With the development of Kansei Engineering, the research is not only used in tangible products design, but in human-computer interaction interface and robotics engineering. The application layer involves from engineering to the mechanic of human brain, perceptive cognition and other area. Under this circumstance, cognitive psychology becomes a new theory orientation linked with Kansei Engineering tightly in study product design.

Cognitive psychology: Cognitive psychology is introduced to be the method in this study. The theory emerged in middle 50's 20th century in the Western countries, which studies people's high-level psychological processes, including cognitive processes, such as attention, perception, representation, memory, thinking and language and so on. "Cognitive psychology is one kind of study which study about how we get the information from the world, how to turn the information into knowledge and how the information to be stored up and used to guide our attention and behavior (Anderson, 2009). Modern psychological research shows that cognitive and emotional factors of subjects have close contact, emotions which can affect people's perception, thinking and behavior. More and more scholars who study psychology began to study human psychology from how behaviors affect emotion of human (Vernon, 2006; Auer *et al.*, 2005; Granlund, 1999).

At present, effect of design factors on female suits was discussed based visual cognition (Qin and Guo-Lian, 2009; Jiang and Liu, 2009).

From the cognitive psychology and information theory, product style recognition is a process of information; user compares his own observation with personal experience and psychology structure and then makes style decision after reasoning and thinking. So, if the psychological mechanism of product style recognition is achieved, the computing model and cognitive automation will be constructed. Kansei Engineering studied people's feeling and the relation between design elements and product design, as well as cognitive psychology studied how the feeling was formed, the deeper study in feeling that called psychological mechanism.

Method in the study: General speaking, the first step of Kansei Engineering is experiment, questionnaire is common and traditional method in the experiment, it is used to collect the image word. In this study, the difference among design elements and the levels of design element are important in fashion design. In fashion style, single element can be divided into so many levels, if these levels are all in one questionnaire, the scope of questionnaire will be very large and the data is collected inconvenient. If the details in questionnaire is too much, the attitude of investigator is hard to control and the data is not quite exact. Furthermore, in order to study cognitive neuroscience of product style recognition in further research, praxiology experiment was used in the study instead of questionnaires.

E-prime, psychology experiment software is employed based on visual cognition. It not only can show stimulus in the form of text, image or sound, but also can provide detailed time information and event details, including showing time, the details of reaction time. The time accuracy is optimized aiming at psychology experiment. Furthermore, the present stimulus is synchronous with the screen refresh which can accurate up to milliseconds and the experimental data can be automatically stored and preliminarily analyzed.

EXPERIMENT DESIGN

Subjects: Young people have a close sense on fashion and majority like suits when they go into formal working place. In this experiment, female suits were selected as objects. 64 undergraduates (junior students are going to work) were selected randomly from Nanjing Jingling Institute of Technology as subjects, who were volunteered to participate in this experiment without being forced or any boredom. The average age of these female students is 21.86 years.

The preparation of stimulus samples: Purchase behavior is driven by emotion, so some feeling can be representative style will be chosen. At common, when choosing suits, consumer concerned whether suits is in fashion will affect purchase, especially, now days, if clothing is out of fashion, people would not buy it. Many words were collected from questionnaire. After statistic, the word "fashionable" was used as emotional word (sensory word). Design elements of silhouette mainly involve waist, length, hem, shoulder breadth, shoulder slope and others. In this study, waist, length and hem were studied first, after the characteristic elements were definite, then the other elements will be analyzed. Then the visual stimulus samples were obtained by combining design factors of different waist, length and hem. In order to facilitate the processing of data, the pictures of female suits were coded.

CorelDraw graphics software was used to draw female suits images. Effect of silhouette design factors on female suits was the point in this study and to avoid the color influence the feeling of subjects, samples of female suits were not colored. 6 levels were divided in waist, 10 levels were divided in length based on measurement and 3 levels were divided in hem based on angle of hem opening.

Six levels of waist, 10 levels of length and 3 levels of hem were established according to the practical female measurement and clothing structure rule. Before drawing, a body model which can be adapted to practical human body was set up, 300 body measurements of female who are in 1.65 meter high are chosen from database. All measurements were collected from statistical data from 2D graphic measured by 3D Body Scanner (Su and Liu, 2009) and the size of female suits in picture was strictly conformed to the practical female suits.

- As shown in Fig. 1, there are 3 levels in hem measurement, each level in one picture.
- As shown in Fig. 2, there are 6 levels in waist measurements, each level in one picture.
- As shown in Fig. 3, there are 10 levels in length measurements, each level in one picture.

Experiment process: The picture of stimulus was shown in the center of the 17-inch computer screen with natural light. Before the experiment, the subjects were asked to be familiar the process of trial and button operation and were informed to make the first feel assessment as soon as possible.

Before the formal experiments, the subjects were required to do preparative test in several units. The whole experiment consists of 180 trials, picture and

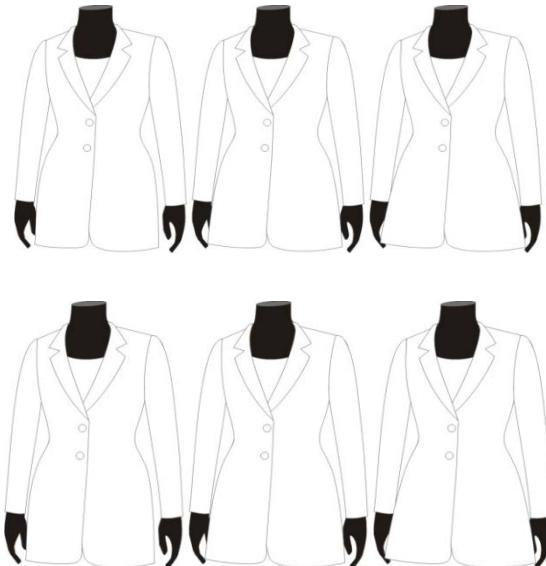


Fig. 1: Female suits with 3 levels of hem



Fig. 2: Female suits with 6 levels of waist

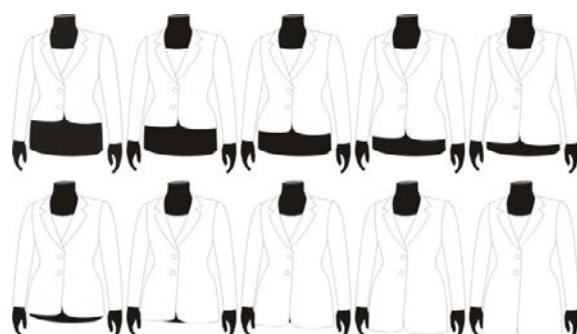


Fig. 3: Female suits with 10 levels of length

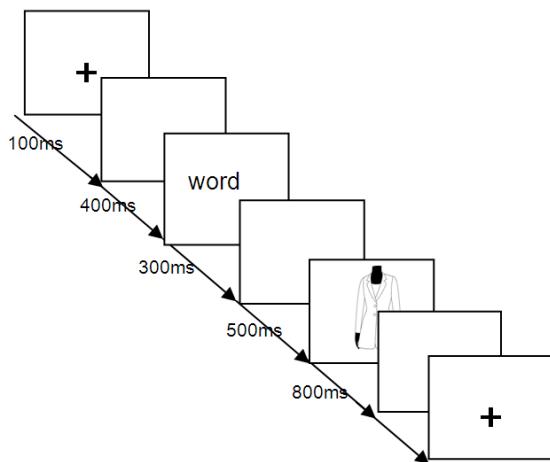


Fig. 4: Task: A schematic illustration of trial presented

word were presented randomly and the show time is limited. Subjects were required to make an exact decision whether their first feeling when seeing female suits in image coincide with the sensory word. If the feeling coincide with the word, subjects press a key in the keyboard, otherwise, press another key. Data can be collected by E-prime to show reaction time, choice and code of image. The experiment process was shown in Fig. 4. + indicates shield before experiment.

Word indicates the feeling, in this study, word is "fashionable". Image is target. The next picture will not be shown until subject make judgment by press keyboard.

During the process of experiment, subjects can be given time to rest. Make sure everyone can participate in the experiment once in the same experiment to prevent memory mechanic disturb subjects' cognitive process.

STATISTICAL ANALYSIS AND DISCUSSION

In this study, if the feeling coincide with word "fashion", that means subjects judging female suits fashionable. Percentage of feeling coinciding with word was the focus in the study. Three design elements which have the influence on silhouette design of female suits were considered. There are 3 levels in hem measurement, 6 levels in waist measurements and 10 levels in length measurement defined in the study.

Comparison in percentage of participant judging female suits fashionable with 3 levels of hem opening: Repeated Measures ANOVA was applied in discussing data, percentages of subjects judging female suits in pictures as fashion differed significantly ($F = 7.054$, $p < 0.005$). The behavior results showed

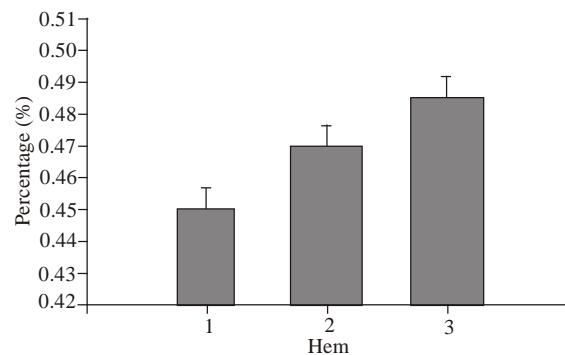


Fig. 5: Percentage of subjects judging female suits fashionable with 3 levels hem. Vertical line 1+SE

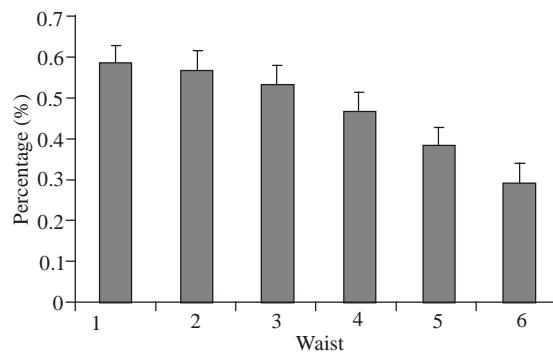


Fig. 6: Percentage of subjects judging female suits fashionable with 6 level waist. Vertical line 1+SE

hem opening size affects people judging suits fashionable, percentage which is highest in level 3 and increased from level 1 to level 3. So results showed hem opening affects people judging suits fashionable. So, it is important for design element of hem to be considered in design process. As shown in Fig. 5.

Comparison in percentage of participant judging female suits fashionable with 6 levels of waist:

Repeated Measures ANOVA was applied in discussing data, percentages of subjects judging female suits in pictures fashionable differed significantly ($F = 29.879$, $p < 0.001$), percentage in level 1 is highest, then they decreased from level 1 to level 6. As shown in Fig. 6. The behavior results showed waist measurement affect people judging female suits fashionable significantly. With waist measurement increased, fewer subjects judged female suits fashionable.

Comparison in percentage of participant judging female suits fashionable with 10 levels of length:

Repeated Measures ANOVA was applied in discussing data, percentages of subjects judging female suits in pictures fashionable differed significantly

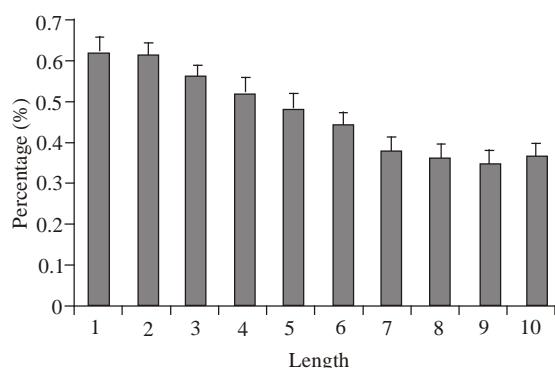


Fig. 7: Percentage of subjects who judged female suits fashionable with 10 levels length. Vertical line 1+SE

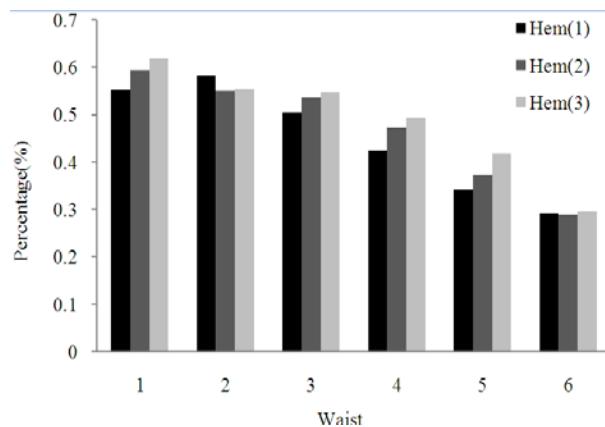


Fig. 8: Interaction effect of waist and hem

Table 1: Interaction of hem and waist

	Vaist (level)	F	Sig
Hem	1	4.78	0.100
	4	4.34	0.015
	5	4.81	0.010

Table 2: Interaction of waist, length and hem

	Vaist (level)	Length (level)	F	Sig
Hem	1	2	5.04	0.008
				0.052
	2	2	4.07	(marginal significant)
	3	6	3.25	0.042
	4	6	5.81	0.004
	5	4	3.13	0.047
				0.068
	6	6	2.75	(marginal significant)

($F = 18.687$, $p < 0.001$), the percentage decreased from level 1 to level 10. As shown in Fig. 7.

The percentage is highest in level 1, level 2 and level 3 and they decreased from level 1 to level 10. The behavior results showed length measurement affects people judging female suits as fashion.

Interaction Effect of silhouette design factors:

Analyzing percentage of judging female suits in image as fashion, a $3 \times 6 \times 10$ repeated measures ANOVA was calculated with three within-subjects factors, there was a main effect of waist, length and hem on coincidence percentage. Furthermore there was a significant interaction between waist and hem ($F = 1.982$, $p = 0.033 < 0.05$). The interaction indicated when people judging female suits; silhouette design elements of waist and hem not only were important but also interdependent. Interactions were shown in Fig. 8.

There is also an interaction effect among waist, length and hem when subjects make decision in judging process whether female suits are fashionable ($F = 1.328$, $p = 0.021 < 0.05$). Simple Main Effect test was done to make data further discussed in levels, effect of waist on people judging female suits fashionable differed significantly in each level of hem, while effect of hem only differed significantly in level 1, level 4 and level 5 of waist, as shown in Table 1. So hem only matched particular waist size will produce fashionable emotion for subjects.

On each level of waist and hem, effect of length was significant, also on each level of length and waist, effect of waist was significant too. But, effect of hem differed significantly only on few levels of waist and length. So Simple Effect was done to hem opening on levels of waist and length, the result was shown in Table 2. The data results showed effect of hem was less essential than design element of waist and length.

CONCLUSION

In the experiment of this study, when judging female suits fashionable, design element of waist, length and hem opening can be considered as characteristic elements in cognition of female suits silhouette. Each element can be considered alone, but hem opening should be matched with design element of length, waist in design female suits, because its effect to make people judging suits fashionable is not significant on every level of waist and length. Effect of hem is opposite to that of waist and length to affect subjects judging female suits fashionable.

Past effect of silhouette design element of waist, length and hem on subjects judging female suits fashionable was studied (Qin et al., 2012). Base on the past research, style can be analyzed to some sensory word including professional, favorite and fashionable. To compare this effect of different representative word, how design element can be affect style of female suits will be achieved. The results can be modeling and put into software by computer to achieve new design.

Because female suits in the study was based on practical measurement and real clothing structure, if maximum and minimum measurement is decided (only for ready-to-wear clothing, not for exaggerated fashion design), silhouette of female suits in fashion trend will be shown. These behavior results can be the basis of evaluation system. With the research going on, the other design elements will be discussed parried with sensory word in style system.

Furthermore, reaction time will be measured in further research; the behavior results provide the theoretical basis for evaluation or computer simulation system of fashion design.

ACKNOWLEDGMENT

This study is funded by the First Phase of Jiangsu Universities' Distinctive Discipline Development Program for Textile Science and Engineering of Soochow University.

REFERENCES

- Anderson, J.R., 2009. Cognitive Psychology and its Implications. Worth Publishers, America.
- Auer, P., I. Bloch, H. Buxton, P. Courtney, S. Dickinson *et al.*, 2005. A Research Roadmap of Cognitive Vision. ECVision: European Network for Research in Cognitive Vision Systems. IST Project IST-2001-35454.
- Granlund, G.H., 1999. Does vision inevitably have to be active? Proceeding of the Scandinavian Conference on Image Analysis (SCIA 99). Kangerlussuaq, Greenland.
- Huang, Q. and S.Q. Sun, 2006. State-of-the-art of research on product style computation. *J. Comp-Aided Design Comp. Graph.*, 18: 1629-1635.
- Jiang, X.F. and G.L. Liu, 2009. The influence of color brightness on the perception of clothes gorgeousness. Proceeding of IEEE 10th International Conference, 2: 1273-1276.
- Ma, M.Y., Y.T. Li-Tan, W. Yu-Ting, T. Yi-Lin and R. Tsai-Ci, 2012a. Evaluation attractiveness of wedding dresses: Qualitative to quantitative. *J. Converg. Inform. Technol.*, 7: 263-272.
- Ma, M.Y. and Y.T. Li-Tan, 2012b. Applying miryoku (Attractiveness) engineering for evaluation of festival industry. *Adv. Inform. Sci. Serv. Sci.*, 4: 1- 9.
- Nagamachi, M., 2002. Kansei engineering as a powerful consumer-oriented technology for product development. *Appl. Ergonom.*, 33(3): 289-294.
- Qin, F. and L. Guo-Lian, 2009. Study on influences of collar types towards women's t-shirt fashionable design based on visual cognition. Proceeding of the IEEE 10th International Conference, pp: 1579-1583.
- Qin, F., X.F. Jiang and G.L. Liu, 2012. Cognition f female suits silhouette based on characteristic design elements. *Adv. Inform. Sci. Serv. Sci.*, 21: 525-532.
- Shieh, M.D., W. Tsung-Hsing and Y. Chih-Chieh, 2011. A clustering approach to affective response dimension selection for product design. *J. Converg. Inform. Technol.*, 6: 197-2006.
- Su, J.Q. and G.L. Liu, 2009. Techniques of efficient 3D human body modeling and feature measurements extraction based on reverse engineering. World Cong. Bioeng. Hongkong, pp: 645-648.
- Vernon, D., 2006. The Space of Cognitive Vision. In: Christensen, H.I. and H.H. Nagel (Eds.), *Cognitive Vision Systems: Sampling the Spectrum of Approaches*. Springer, Berlin, pp: 365, ISBN: 354033971X.
- Wei, Z.Q., 2008. Fashion-orientation of western suits: A new perspective of industry development. *J. Nantong Textile Vocat. Technol. Coll.*, 19: 51-53.