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An Interactive System Based on Kansei Engineering to Support Clothing Design Process

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Abstract: Kansei Engineering was regarded as a technology to "translate a customer's feeling of the product to the design elements." In this study an interactive system was constructed on the base of Kansei Engineering to support clothing design process. As a core content and foundation, knowledge base is developed by varied methods such as Kansei engineering method and analytic hierarchy process. When the Kansei word is input, the image can be characterized and formalized by requirement process. The clothing in the proper fuzzy set can be selected and recommended. The designer can make evaluation and ranking and then input the results into the clothing recommendation model. In the end, an interactive system for men's suit was used as a case study to show the application.

Keywords: Clothing design, interactive system, Kansei Engineering

INTRODUCTION

Due to the rapid development of technology in recent years, the market is more ample and customers have more freedom and space before making the decision than ever before. They have preferences for the products which can express their own taste, style and status. The new challenge for designers and manufacturers is to understand what customers like which will help them to build more pleasurable products and stay ahead of the competition. Only if the customer's requirements and desirability are satisfied, the merchandise and development of products can be considered successful.

Clothing design process commonly includes two steps. Firstly, information is explored in orientation ideas concerning fashion, moods, themes, concepts and product types. Secondly, all gathered data is processed and transformed into product ideas combining silhouettes, materials and colors (Carr and Pomeroy, 1992). To improve the production efficiency of clothing, Computer-Aided Design (CAD) has been applied into the field of clothing industry (Wang and Yuen, 2005). Currently, almost all clothing CAD systems target at the modules such as pattern design grading, marking and fitting design. Because clothing design is used to be regarded as a black box and the success of design relies heavily on the desirability, imagination, inspiration and experience of the designer himself, it is very difficult to apply computer technology to assist clothing design. There are also a few researches on application of computer and information technology to fashion design (Santos and Rebelo, 2007).

Nowadays, the product development is changed from product-oriented to consumer-oriented; namely for manufacturers, the consumer’s feeling and needs are recognized more invaluable in product development than ever before. Kansei engineering is a comprehensive human-centered technology for developing new products and it has been widely used in automobile, construction machine, electric home appliance, house construction, costume, textile industries and so on. However, the application of Kansei engineering on clothing fields is at the primary stage and some research have been reported (Lu *et al*., 2008, 2011).

In the study, a new framework of interactive system based on Kansei engineering is advanced to support clothing design. The knowledge base is the foundation. When the Kansei word is input, the image can be characterized and formalized by the required process. The clothing in the proper fuzzy set can be selected and recommended. The designer can make

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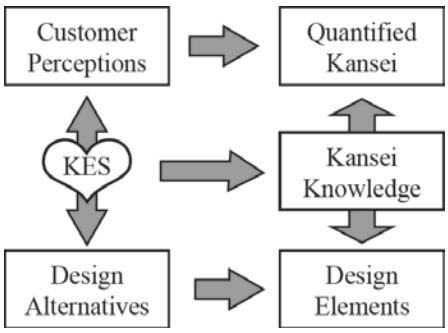

Fig. 1: The generalized kansei engineering system

evaluation and ranking and then input the results into the clothing recommendation model. In the end, an interactive system for men's suit was used as a case study to show the application.

KANSEI ENGINEERING

Kansei is a Japanese word which means a consumer's psychological feeling and image regarding a new product. Kansei Engineering focuses on sensory about a product and converts these ambiguous expressions of the product into detailed design (Nagamachi, 1996).

A generalized Kansei Engineering System (KES) is shown in Fig. 1 (Zhai *et al*., 2009). In the system, customers' perceptions about a product are represented in the form of Kansei words such as "comfort", "sporty" etc. and quantified by methods such as semantic scale ratings. On the other hand, the design alternatives of the product can be decomposed into a set of design elements. The Kansei knowledge (the relations between the quantified Kansei words and design elements) can be established by using appropriate mathematical tools and advanced computer technologies.

There are three kinds of techniques for Kansei Engineering (Matsubara and Nagamachi, 1997). The first is Forward KES (from Kansei to design element) which is utilized to support the consumer's decision in selecting the desired product. The second is Backward KES which is used to support the designer's creative work diagnosing the Kansei with regard to the designer's rough sketch. The final is hybrid KES which is the combined Forward KES and Backward KES and a more powerful supporting tool for both consumer and designer.

FRAMEWORK OF THE CLOTHING INTERACTIVE SYSTEM

Although subjectivity lies in the clothes design process and the consumer's sensory to clothing is changeable and various, there are some theory and rule to be followed during the design. It is a trend to set up a computer-aided system to support clothing design which can reduce the reliance of the designer's inspiration imagination. The difficulty in the process is how to correctly understand rules of clothing design and consumers' sensory requirements. In current work, a new interactive system to support clothing design is developed. The topic object of the work is to develop a consumer-oriented clothing design system and to help designer to develop new clothing which meet consumer' requirements. The framework of the system is shown in Fig. 2. It consists of user interface and four parts-requirement process, clothing recommendation, knowledge base and clothing evaluation and ranking.

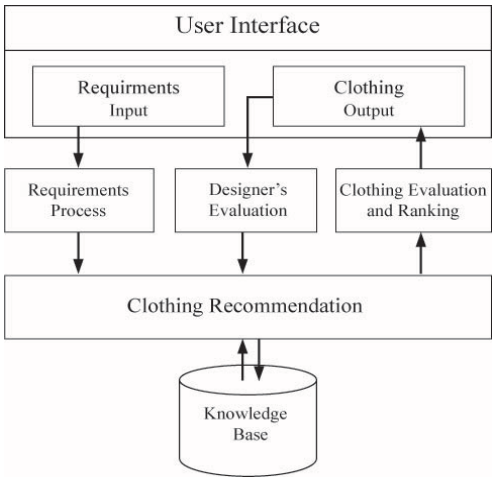

Fig. 2: Framework of the clothing interactive system

Requirements process: Functions of the model are to translate designer's image (requirements) about new clothing to formal description. The input of image may use discrete Kansei words or natural language. Natural language is easy for user, but the translation is relatively difficult and commonly performed by text mining (Zhang and Jiao, 2007). In current work, the designer's image is described by using some discrete Kansei words. Each of these Kansei words is corresponding to a real number which is used to weigh the importance of the Kansei word. Finally, a n-dimensional vector is obtained to characterize the formalization of designer's image.

Clothing recommendation: In the system, there are plenty of clothing by combining different clothing components. Each clothing has its Kansei descriptions and the clothing with the same description are gathered in a set. On the basis of formal description of designer's image, some fuzzy set can be selected and clothing in it can be recommended by intimating degree of relationship between Kansei with clothing design elements (Matsubara and Nagamachi, 1997).

Knowledge base: Knowledge base for clothing sensory design is defined as four parts: the clothing design

elements, semantic expression, reflection between the former two and design rules. It's useful not only to the style design, color matching and material choice but also to the application of TPO. Methods of interviewing, laddering, card sorting, Analytic Hierarchy Process (AHP), Hierarchy structure, triangle fuzzy numbers, literature reviewing etc. are chosen for the knowledge elicitation and representation (Nagamachi, 1996).

Clothing evaluation and ranking: After clothing is selected, system can automatically rank on the similarity between selected clothing with designer's formal description and output these clothing in interface. The clothing designer can score these clothing on his own Kansei understanding and obtain new requirement and then put it into clothing construction model. This task can improve cognition consistency between the experts' system and the designer himself and provide reference to the succeeding application of the system.

CASE STUDY

For diversity of clothing, it is impossible to develop uniform knowledge base. In order to solve the problem, the knowledge bases can be developed according to the different style such as men's suit, women's overcoat, blouse, shirt and etc.

Based on the above idea, an interactive system for men's suit is developed. Fashion designer's requirements are described by using four Kansei word-pairs (formal- casual, classical- modern, gorgeous-simple and elegant- masculine). The interface of program is shown in Fig. 3. Then the requirement is analyzed and distinguished to be sole or multi demands. Then, the clothing recommendation procedure begins with different methods on the basis of fuzzy theory.

Figure 4 is the interface of clothing recommendation. The garments in the appropriate fuzzy set are recommended which can all satisfy the consumer's demands and personal situation. The initial choice can be displayed in the right column temporarily for convenience of comparison, choice and determination. If the customer can't choose the preference, the Kansei to the whole recommendation garments can be given and the system can adjust the fuzzy clothing set and start the recommendation procedure again. During the commendation, the special condition can be limited to reduce the number of garments and the time of choice.

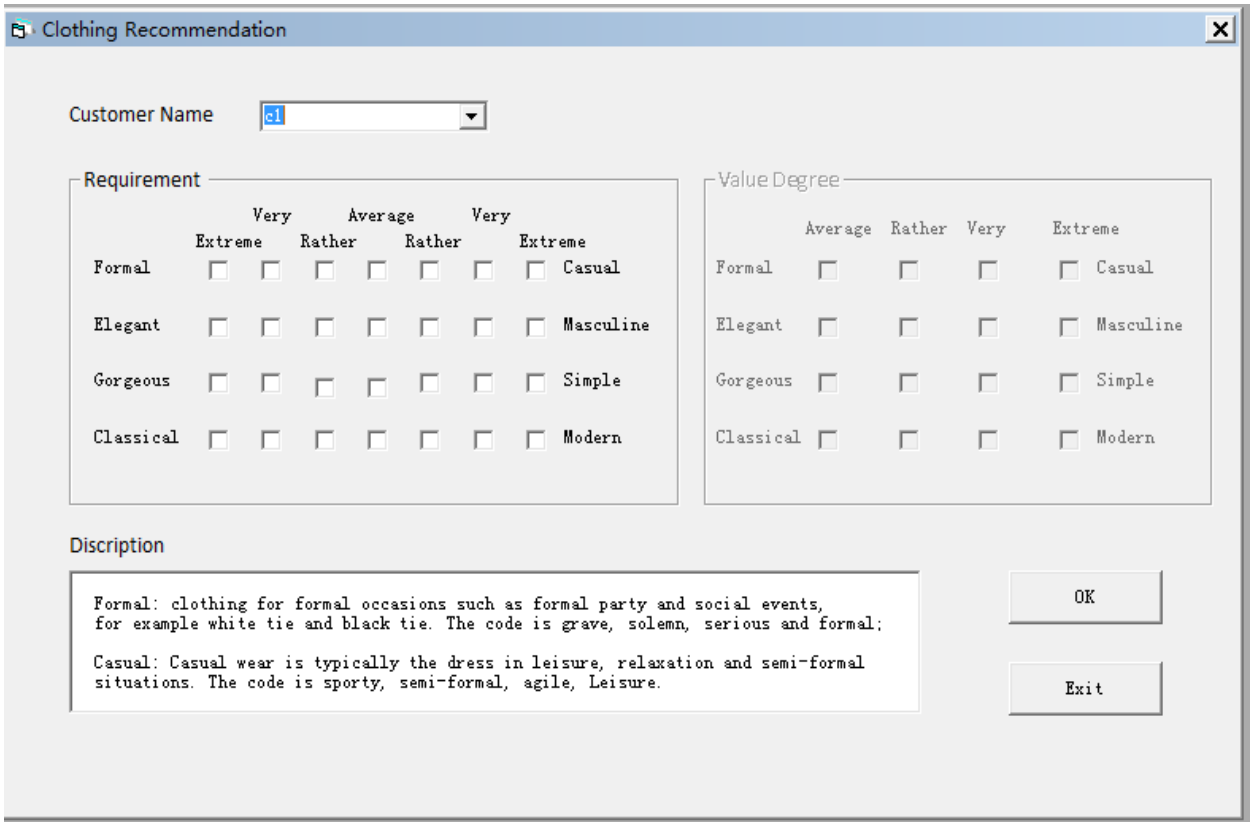

Fig. 3: The interface of clothing recommendation

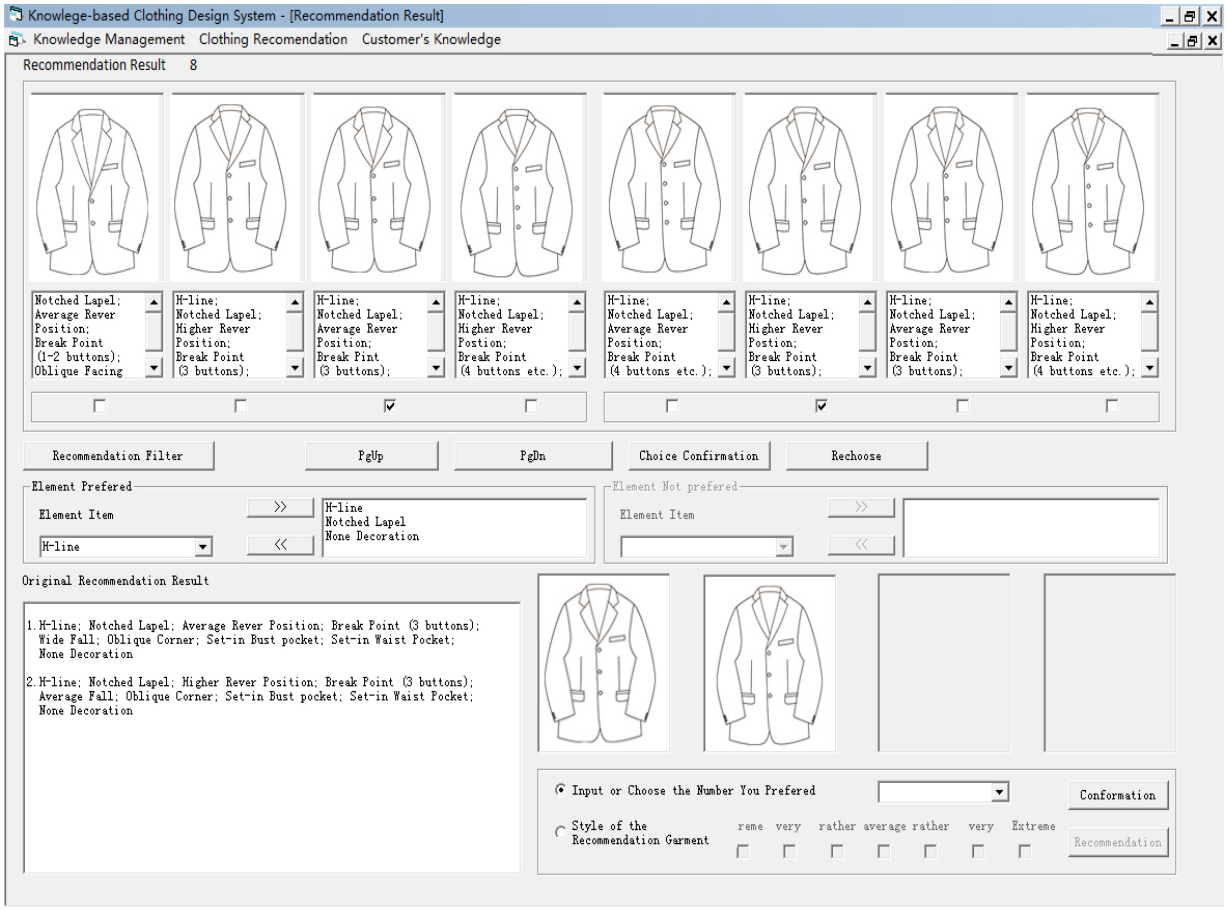

Fig. 4: The clothing recommendation interface

CONCLUSION

Although subjectivity lies in the clothes design process and the consumer's sensory to clothing is changeable and various, there are some theory and rule to be followed during the design. In the study, an interactive system is developed to support clothing design process which will improve efficiency of clothing design and quickly respond to consumer's needs. As one of the core technology in the system, the knowledge base is set up by using Kansei engineering method. The clothing recommendation process is performed on the basis of fuzzy theory. The clothing satisfied with the requirements can be recommended and the designer can evaluate these clothing by scoring. Then a new requirement is formed and input into clothing recommendation model and new recommendation begins. The satisfied clothing can be obtained through these repeating processes.

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REFERENCES

Carr, H. and J. Pomeroy, 1992. Fashion Design and Product Development. Blackwell Scientific Publications, Oxford.

Lu, H., Y. Chen and Y. Wang, 2008. Knowledge-based customers. Desirability acquisition of clothing. 4th International Conference on Natural Computation (ICNC), Jinan, China, pp: 94-98.

Lu, H., Y. Chen Y. and H.Q. Dai, 2011. Construction of knowledge base for clothing sensory design. Adv. Mater. Res., 811(16): 175-176.

Matsubara, Y. and M. Nagamachi, 1997. Hybrid Kansei Engineering system and design support. Int. J. Ind. Ergonom., 19(2): 81-92.

Nagamachi, M., 1996. Introduction of Kansei Engineering. Standard Association. Tokyo, Japan.

Santos, M. and F. Rebelo, 2007. An expert system to support clothing design process. ergonomics and health aspects of work with computers. Lect. Notes Comput. Sci., 4566: 284-289.

Wang, L. and M.M.F. Yuen, 2005. CAD methods in garment design. Comput. Aided Design, 37(6): 583-584.

Zhai, L.Y., L.P. Khoo and W.Z. Zhao, 2009. A Dominance-based rough set approach to Kansei Engineering in product development. Expert Syst. Appl., 6: 393-402.

Zhang, Y. and J. Jiao, 2007. An associative classification-based recommendation system for personalization in B2C E-commerce applications. Expert Syst. Appl., 33(2): 357-367.