# STUDY OF AN AESTHETIC/ EMOTIONAL PREFERENCES ON THE PRODUCT DESIGN CHARACTERISTICS

This report is submitted in accordance with requirement of the UniversitI Teknikal Malaysia Melaka (UTeM) for Bachelor Degree of Manufacturing Engineering (Manufacturing Managememt) (Hons.)

by

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I hereby, declared this report entitled "Study of an Aesthetic / Emotional Preferences on the Product Design Characteristics" is the result of my own research except as cited in references.

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# APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirement for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) (Hons). The member of the supervisory committee is as follow:

……………………................................

**(DR.ZUHRIAH BINTI EBRAHIM)**

# ABSTRAK

Fungsi asas dan kualiti produk tidak mencukupi untuk memenuhi keperluan pelanggan dalam pasaran hari ini. Cabaran yang dihadapi oleh syarikat pembuatan hari ini ialah kesamaan fungsi dalam produk gagal untuk menjadi kriteria memenangi pasaran. Oleh itu, kajian ini bertujuan untuk mengenal pasti dan mengukur keutamaan produk estetik berdasarkan *Kansei Engineering (KE)* dan kaedah *Cognitive Style (i.e. CSI, Big 5 Theory dan KAI)*. Tiga objektif telah ditetapkan iaitu; (i) untuk mengenal pasti ciri-ciri reka bentuk produk yang berkaitan dengan afektif atau pilihan emosi berdasarkan Kansei Engineering; (ii) untuk menganalisis hubungan antara keperluan reka bentuk produk terhadap pilihan pelanggan dari segi nilai estetik berdasarkan kognitif dan personaliti; (iii) untuk menilai pilihan reka bentuk berdasarkan Fuzzy Kansei Cognitive Engineering. Temu bual dan kaji selidik dijalankan untuk menentukan ciri-ciri reka bentuk, pilihan reka bentuk, personaliti dan kognitif responden. Keputusan kajian menunjukkan bahawa; (i) lima perkataan Kansei dan sepuluh reka bentuk telah ditentukan daripada kajian awal dan akan digunakan untuk kajian utama; (ii) terdapat korelasi antara reka bentuk produk dengan kognitif dan personaliti dalam aspek pilihan pelanggan dari segi nilai estetik; (iii) Design-6 telah dipilih sebagai reka bentuk yang paling digemari, namun keputusan ini disokong dengan kaedah *Fuzzy*, bersepadu dengan kaedah *Cognitive Style*. Oleh itu, kajian ini menyimpulkan bahawa perasaan emosi dan kognitif pelanggan adalah penting untuk dipertimbangkan semasa mereka bentuk botol air yang digemari oleh pelanggan.

# ABSTRACT

Basic product's functionality and quality is insufficient to satisfy customer requirement in today's market. Challenge is faced by most of the manufacturing companies today as the similar function of products has failed to be the winning criteria in the industry. Therefore, this study aims for investigating and measuring the aesthetic product preferences based on Kansei Engineering (KE) and Cognitive Style Methods (i.e. CSI, Big 5 Theory and KAI). Three objectives have been set (i) to investigate and identify the characteristics of product design related to affective or emotional preferences based on Kansei Engineering; (ii) to analyze the correlation between the design requirements of product towards the customer preferences in terms of aesthetic value based on cognitive and personality style; (iii) to evaluate the design preferences based on Fuzzy Kansei Cognitive Engineering. Interview and surveys are conducted to determine the design attributes, design preferences, personality, and cognitive styles of the respondents. Results of the study show that; (i) five Kansei Words and ten designs are determined from preliminary survey which were used for main survey; (ii) correlation is found between the product design and cognitive and personality style in the aspect of customer preferences in terms of aesthetic value; (iii) Design-6 has been determined as the most preferred design that supported by Fuzzy approach integrated with the Cognitive Style Methods. Thus, this study concludes that customers' emotional feeling and cognitive style is important to be considered in designing customer preferred water bottle.

# DEDICATION

Only

my beloved father,

my appreciated mother,

my adored sisters and brother,

for giving me moral support, money cooperation, encouragement and also understandings

Thank You So Much & Love You All Forever

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KE        -        Kansei Engineering

CSA       -        Cognitive Style Analysis

CSI        -        Cognitive Style Index

BFI        -        Big Five Inventory

KAI               Kirton Adaptation-Innovation

MFs       -        Membership Functions

FIS        -        Fuzzy Inference System

Mo               Modern

Con              Convenience

Dur              Durable

Ergo            Ergonomic

Sim              Simple

# CHAPTER 1

## INTRODUCTION

### 1.1 Project Background

In today's highly competitive marketplace, the evaluation approach towards the product development strategy should be transformed from a product-push type to a market-pull model (Tsai *et al.*, 2006:157). This is due to consumers' choice is as the customer main concerns to products are, nowadays, no longer based on functionality, quality, and usability (Wu *et al.*, 2011:61). However, based on the visual stimuli is as the first impression of product in the eyes of customer (Hsiao *et al.*, 2008:910; Tharangie *et al.*, 2009:744). They agreed that the high quality of products do not only satisfy the customer needs, but also will improve the functionality of the product.

Based on above reason, even though the functionality of product (such as physical appearance, material, shape and frame) can give the most immediate information related to the manufacturers as well as customers, according to Xu *et al.*, (2012:22), there were less concrete issues (such as psychological bonding of customers with products and social esteem frameworks) as valuable ideas for designers to understand customers' need beyond functionalities. In this context, the very important things that are required by the designer in designing the product is on how to translate consumers psychological feelings and impressions into perceptual design elements so that the product specifications fit to customers' affective needs (Xue *et al.*, 2011:97; Wu *et al.*, 2011:66). This is a reason on why the quality of the product should have to fulfill the customers' mental and emotional satisfaction.

In addition, since the products, nowadays, are commonly similar in technical characteristics, quality, and price, Desmet *et al.*, (2000:111) stated that the design of the product become a significant criteria to open a door for differential a favorable position in

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the marketplace. Thus, organizations that can convey a specific significance through the appearance of a product design will be able to make an upper hand in the market and increment the product's shot of accomplishment (Blijlevens *et al*., 2009:27). They also stated that the appearance of a product will help customers to evaluate the product on functional, aesthetic, typical or ergonomic thought processes. As an instance, a product that looks modern will eventually give a positive effect on product appraisal when customers are motivated to appraise a product on its aesthetics (Blijlevens *et al*., 2009:27). Besides, according to Tama *et al*., (2015:329), the attractiveness of a product can't be isolated from the appearance of the product itself because it is possibly the first sight that the customers captured. At the meanwhile, Desmet *et al*., (2000:111), also stated that the appearance of the products will strongly influence the emotions of the customer whether to buy, owned and use the products. Therefore, the design and aesthetic of the products are now contributing the major attributes in the decision and inclination of customer products (Reimann *et al*., 2010:431).

Viewing from this standpoint, Djatnaa *et al*., (2015:116) commented that the most challenging situation that designers facing nowadays is on how to design or develop a preferred product that will match the customers' perception and yet achieve customers' satisfaction. In addition, on how to improve the customers' acceptance of certain product, Djatnaa *et al*., (2015:116) argued that emotions feelings, creativity and innovative aspect are the keys for designers to design a customer's preferrable product. This is due to the consumers have plenty of products at home and they would like to have products more attractive which sensitive to their personality (Mamaghani *et al*., 2014:1487). Here, in order to achieve the satisfaction of customers' basic requirements, customer yearns not merely for products that satisfy their physical requirements but additionally those that would fulfil their psychological needs related to their feeling and emotion. Therefore, in order to cope with rapidly changing market situation, high level creativity and innovation should be implemented in product design (Brad, 2008:5980).

Furthermore, since consumers' aesthetic appraisal of products depends on the presence of certain product design properties in the product design (*e.g*., colour, shape), there were the properties and characteristics of different cognitive and affective processes need to be recognized towards an aesthetic appraisal. First, the typicality of perception related to a cognitive process (Veryzer and Hutchinson, 1998). Second, the experience arousal is as an affective process (Berlyne, 1960:109). Since the people may consciously search for a typical

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product designs, therefore the people consider a typical product designs as more attractive than highly typical designs (Baumgartner and Homberg, 1996; Schoormans and Robben, 1997). In this context, according to Armstrong and Detweiler-Bedell (2008), a typical product designs are positively appraised as a result of successfully expanding knowledge. Therefore, to know who the customer is and what the customer wants, the company need to know what and why the customer wants that depends on the product attributes identified and how its importance to them. This is as what emphasized by Dickson (1996) related to market segmentation and product positioning as a deal attention in marketing research.

Moreover, together with the development of living standard of the people and the way of the consumer spending nowadays, Liu (2009), commented that the economic attributes of present consumption has become weakened while its social emotional attributes has become more significant. Customers turn their consideration not merely to logical and rational aspects of the product, however progressively symbolic and emotional factors that have gained an essential role in making choices when purchasing products (Razza *et al*., 2015:6229). Based on this reason, companies have to reformulate their product and development strategies (Hartono and Chuan, 2011), especially by shifting their difference efforts from the tangible product attributes towards less tangible characteristics, such as aesthetics (Reimann *et al*., 2010:431). From this point of view, customers are gradually shifting their interest focus from functionality aspect to aesthetic aspect. Hence, since the perception of customers are very important to the successful product launched in the market, to stay competitive in today's worldwide market is therefore necessary to identify the sense of aesthetic feelings and yet transfers them as the requirements constructed into the product (Steinberg *et al*., 2015:77). In this perspective, Nagamachi (1995) defined it through Kansei Engineering which translates the technology of consumer feeling towards the products that are "able to touch the heart of customers' emotions and capture the culture and reason of expectations. By integrating of the customer and designer into the process for design and evaluation required, Tscuchiya *et al.,* (1996:135) stated about the neccesaary of communication interacted occurs between designer and customer in which the customer will involve to support the selection of products, while the designer concern will be focused on the evaluation of product design.

In addition, since the improvement required towards the new products is not just to fulfill the necessities of physical quality aspects, therefore the manufacturers have to center their approach to the customer through enhancing the appeal of produtcs, especially by

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adding the subjective factors that related to the customers' mental needs (Huynh *et al.*, 2010:575). Bakhare (2012:21) said that the statement of 'Customer is King' do really conveys significant truth in it. He also mentioned, in order to achieve customers' satisfaction towards the product, the company should know about the behavior of the customers. Also, according to Vani *et al.*, (2011:2), the customer behavior should be interpreted as individual customer behavior when they are looking for the product; purchasing, using, assessing and disposing of products. However, due to the rapidly changing technology and innovation, Bakhare, (2012:36) commented that to understand customers' behavior is, unfortunately, becoming an extremely tough task for manufacturers. In this case, towards the market of products, the designers must frequently consider numerous combinations of product shapes by taking into account the customer tastes in order to reduce the risk of their products being rejected in the market (Hsiao *et al.*, 2010:237).

In conclusion, since the changes of customer needs plays an important roles in developing a good product in competitive market, the product development perspectives should, therefore, not only be focused on the benefit value of product based on its functionalities (Wu *et al.,* 2011:61). This meant that the companies need to concern in various ways where the design of product should more accurate and fit to customers need based on the design requirement (Lokman, 2010:1), and also on how design changes will affect the environmental performance of product concepts in design process (Sousa *et al.,* 2006). In addition, since the main challenge of effective design is to take the customer's effective needs accurately and subsequently to the design of products (Jiao *et al.,* 2006), therefore it necessary to know how to measure and analyze human reactions to affective design and to assess the corresponding affective design features (Reimann *et al.,*2010).  On how they evaluate, Tanoue *et al.,* (1997) suggested about the sensibility and the expertise of the designers involved.  This meant that the design and aesthetics are said to be major differentiating attributes in the choice and preference of consumer goods (Zolli, 2004), where the designers need to deal carefully with possible interaction problem between customers and product interfaces that should be reflected on the customers' emotional requirements (Huang *et al.,* 2012: 418).

## 1.2    Problem Statements

Currently, business globalization, complex customers' requirements, and high technology development have prompted to vigorous business competition and market vulnerability (Lin and Luh, 2009:191). With the advancement of production technology, customers are no more extended hunting down products which fulfill physical requirements (such as function and quality), but they will also to those that meet their emotional requirements (like feeling and emotion) (Razzaa and Paschoarellib, 2015:6229). This has forced the manufacturers to change their production strategy from the production-oriented perspective to a more market-centered strategy (Razzaa and Paschoarellib, 2015:6229). For anstance, as to be successful in the competitive marketplace, giving radical innovations turns out to be progressively critical to any company (Lin and Luh, 2009:199). Based on that reason, companies nowadays are concentrating on the accomplishment of new and innovative products for sustainable growth and benefits (Xie, 2008:235). Therefore, the creativity and maturity play a greater role in designing a product (Hsu *et al.*, 2000:375). However, the real key to the success of the new products is, in facts, by distinguishing the customers who are the potential first buyers in the market (Xie, 2008:235). This is why innovative customers are playing an essential part in the success of the new product.

Moreover, since the product image plays a significant role in consumers' preferences and choice of the product, according to Lai *et al.,* (2006:254), the way of the customers look at the product image is generally not the same as the way that designers look at product characteristics. The designers usually will design a product by considering the basic functions which is product quality, capacity, and performance. However, customers will choose the products that are more required, attractive and exceptionally delicate to their identities (Mamaghani *et al.,* 2014:1487). In extent to the satisfaction of basic requirements, they stated that consumers do not just look for the products that fulfill their physical requirements, but also to those which are carving their emotional needs as valuable factor to them. Therefore, from the design perspectives, the physical characteristics of the product is necessary to be connected to the customers' perception of the product in order to best address customers' requirement of a product (Lai *et al.,* 2006:254).

Viewing from the above standpoint, the feelings and emotions have been perceived as essential factors in recent consumption and customer decision making. In facts, the role of feelings and the character of psychological response are the complicated concerns where

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the feelings were assumed by the capacity of causes, impacts, mediators and moderators. They were not just positive or negative side, but also they can even be merged. According to Desmet (2012:1), since the nature of product is bringing out an extensive variety of feeling; both negative and positive, there were the complicated interface may stimulate the feeling of dissatisfaction or irritation as the negative side. Whiles, for the positive side, the similar complexity might bring out fascination or satisfaction (Desmet, 2012:1).

Based on reason above, since good design and good quality in today's market are insufficient to meet customers' requirements (and this made designers have to deal very carefully with the conceivable interaction issue amongst product and customers), Kachitvichyanukul (2012) suggested that the designers have to capture the customers' feelings with respect to the product and translate them into design parameters. Here, the objective is to obtain maximum satisfaction level of customers. First, this is because of, in terms of behavioral effect, the positive and negative feelings are fundamentally different. The negative feelings evoke people to reject or to pull back from the product, while the positive feelings invigorate prople to accept or approach to the product (Desmet, 2012:1). However, the questions inherented to this situation is on how to measure and distiguish it as a reflection of customer preferences.

Second, since the Kansei adjectives are clustered based on the customers' voices/opinions (Huang *et al.,* 2012:418), there were current design methodologies for design have been seeking new methods that allow the generation of innovative ideas (Marghani, 2011). This conceptual framework extends Kansei Engineering from pure product design to working backward to design specifications. To integrate the consumer and designer into the process for design and evaluation, therefore it requires the semantic differential (SD) experiment conducted by asking consumers to evaluate product samples using chosen adjectives (Han *et al.,* 2007). Also, to observe and analyze human mental activities, there were appropriate tools required towards cognitive psychologists. In this context, Kim *et al.,* (2009) in their research focused specifically on design as an information cycle which includes informative, generative and decision-making phases (evaluation-selection) whose outcomes are intermediate representations (IRs) and iterates evolutionarily. In this perspective, Goggin (2009) stated about 'customization' towards product design that bring these to bear on the cultural adaptation framework is as a fruitful process. However, to discover the mapping pattern between consumer affections and product design elements

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(from raw design data) there are, in facts, the challenging issue of affective design that is usually characterized by non-linearity and uncertainty (Zhai *et al.,* 2009).

Third, as manufacturing technology advances, it is hard to differentiate products by quality. Thus, to improve the competitiveness of product, one of the best solutions is by changing the product's image through the variation of the product color (Hsiao *et al.,* 2008:910). They commented that the aesthetic measurement is thought to be affected by the color environments, color areas, component colors and display angles of the item. Whiles, external shapes of the product currently also contribute more and more to the appeal of products (Yokoyama *et al.,* 2011:25). Tsai *et al.,* (2006:157) previously commented that the sensation of a product is formed by totaling the general perceptions of shape, color, texture and so forth. In this perspective (related to the shape and color factors that would control the visual perception of the product), Hsiao *et al.,* (2008:910) commented that customers will usually obtain their first impression based on the appearance of the product, including shape, color and material. Therefore, in order to increase the preferences of product, pleasure and satisfaction of consumers, companies are therefore looking at the development of new products that emphasize on a product's apparent style (Djatna and Kurniati, 2015:116; Hsiao *et al.,* 2008:910). However, the questions on this perspective then on how to formulate the customer requirement articulated through their expression onto product development that fir to customer feelings. This is due to, in the new product development (NPD), the quality of a product just isn't determined by means of its functional aspects.

Based on aforementioned problems, since product's basic functionality and quality are insufficient to meet customers' requirements. Challenge is faced by the companies today as the similar function of products has failed to be the winning criteria in the industry. The product development nowadays relies on consumers' preferences, opinion and evaluation (Huang *et al.,* 2012:416; Tharangie *et al.,* 2009:744), therefore, this study will conduct and carry out the investigation related to customer preferences against the water bottles. According to the European Commission (2011) the use of plastic water bottle is increasing in volume. But, the demands of plastic water bottle have caused pollution due to people will just dispose it after consuming the water. Therefore, manufacturer should produce water bottle products that can tackle customers' emotional feeling so that they are willing to own water bottle products instead of using plastic water bottle which will caused pollution. To do so, it is important to understand the customer emotional feeling toward the water bottle products so that they can be used for long term. This is due to customers are, nowadays,

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making their buying decision with the aid of tremendously subjective criteria (Mohais *et al.,* 2007:441). Since the most importance on this reason is due to consumers' affective or emotional values should be considered in the process of product design, this study will not only to investigate the product preferences based on function and performance of products (Hsu *et al.,* 2000: 375, but also towards their cognitive and personality identities refers to the big five inventory and brain dominant approach. Whiles, about on how the articulation of customer voices need to be translated into technical and design specifications (especially due to randomness, vagueness, ambiguousness, impreciseness and inexactness of human language) (Hsu *et al.,* 2000:375), there were manipulation process is necessary to transform the human expression articulated. This is due to customers' preferences and expectations are hardly to be determined in exact numerical values. Therefore, this study will construct the approach to manipulate on what there no obvious boundaries were existed (*i.e.,* like in distinguishing heavy from very heavy or blue from purple. Also, this study will carry out the manipulation process towards the customer satisfaction level using a fuzzy model (Mamdani – Tsukamoto) which will be formulated to determine the satisfaction level based on the linguistic used to convey a more accurate expression in human thought and cognition.

## 1.3   Objectives of the Study

The objectives of this study are as follows:

a) To investigate and identify the characteristics of product design related to affective or emotional preferences based on Kansei Engineering.

b) To analyze the correlation between the design requirements of product towards the customer preferences in terms of aesthetic value based on cognitive and personality style.

c) To evaluate the design preferences based on Fuzzy Kansei Cognitive Engineering.