UNIVERSITI TEKNIKAL MALAYSIA MELAKA

STUDY AND ANALYSIS OF THE ENGINEERING QUALITY FEELINGS BASED ON AFFECTIVE RESPONSE TO DIMENSIONAL INTEGRATION OF PRODUCT SHAPES DESIGN CASE STUDY [Product: Spectacles]

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering (Manufacturing Management) with Honours.

by

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” is the result of my own research except as cited in the references.

Signature	:	
Author’s Name	:	Muhammad Hannan Bin Kamarzaman
Date	:	3 June 2013

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) with Honors. The members of the supervisory committee are as follow:

……………………………………………
H.H.IP [XV:[illegible]]
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(PSM Supervisor)

ABSTRAK

Tujuan kajian ini adalah untuk mengenal pasti dan menilai ciri-ciri reka bentuk produk yang berkaitan dengan nilai-nilai afektif / emosi (perasaan kualiti) berdasarkan perspektif Kansei Kejuruteraan. Kajian ini juga melihat dan menganalisa keperluan reka bentuk ke arah membentuk asas kepada sesebuah produk (reka bentuk cermin mata) berdasarkan pandangan 1000 responden (pelajar di negeri Melaka). Di sini, manipulasi data menggunakan kaedah logik kabur untuk menganalisis keutamaan yang diperluan terhadap ciri-ciri reka bentuk produk berdasarkan keputusan membuat pendekatan menggunakan Proses Hierarki Analisis (AHP). Perisian yang diperlukan untuk membuat keputusan yang dijalankan terhadap keutamaan reka bentuk Expert Choice, manakala untuk memanipulasi data ke dalam Logik Kabur adalah perisian MATLAB. Statistik pengiraan dan pendekatan yang diperlukan untuk menentukan korelasi antara bentuk produk dan ciri-ciri produk dengan menggunakan SPSS V16 perisian. Berdasarkan pilihan setiap bahagian telah digabungkan ke dalam 3 reka bentuk untuk kajian ujian semu;, di mana reka bentuk 1 (rim penuh, kanta segi empat tepat, lengan tebal) adalah yang paling digemari oleh responden. Kebanyakan responden dinyatakan reka bentuk ini sebagai "Rapuh-Teguh", manakala reka bentuk tidak. Reka bentuk 2 dan 3 lebih dirasai sebagai "Tidak Selesa-Selesa". Ujian pos dijalankan, kajian ini mendapati bahawa yang paling disukai ialah reka bentuk 3 berdasarkan kualiti emosi telah dinyatakan sebagai "Tidak Selesa-Selesa". Kebanyakan perkataan Kansei berdasarkan reka bentuk bersepadu berbanding reka bentuk bahagian-bahagian adalah sedikit berbeza kerana apabila mereka bersepadu atau digabungkan, ia akan menyebabkan keutamaan kepada reka bentuk produk yang mudah dikenal pasti mengenai apa perbezaan atau persamaan mereka. Sebabnya ialah kerana emosi manusia yang semulajadi cendurung kepada persamaan dan / atau kelainan reka bentuk.

ABSTRACT

The purpose of this study is to identify and evaluate the characteristics of product design related to affective/ emotional values (quality feelings) based on Kansei Engineering perspective. This study reviews and analyze the design requirements towards the product shape basis of the product (spectacles design), through the survey conducted towards 1000 higher education students as the respondents in Melaka. The analysis conducted in this study was using the Analytical Hierarchy Process (AHP) and manipulation data based on Fuzzy Logic method; in order to find the priorities required to the characteristics of product design. The software used for the decision making carried out in this study was Expert Choice, while to manipulate the data into Fuzzy Logic was MatLab software. The analysis carried out through statistical calculation was using SPSS v16 in order to determine the correlation among the product shapes and the characteristics of product based on Kansei words. This study found that the most preferred of Rim design was Type-1 and 6, where the overall of Kansei word preference was “Beautiful-Attractive”. While to the Lens shape (that is Type-1) and Arm type (that are Type-1 and 3), the overall Kansei words preferences were “Lame-Cool”. Here, the spectacle construction of integrated designs based on such preferences of each parts were combined into 3 designs for Post Test survey, where the Design no. 1 (full rim, rectangular lens, thick arm) is the most preferred by the respondents. Most of the respondents articulated this design as “Fragile-Robust”, while Design no. 2 and Design no 3 as “Lame-Cool” respectively. Through the resurvey by post test carried out, this study found that the most preferences of 3 integrated design based on the emotional quality were articulated as “Lame-Cool”. This most preference of Kansei words based on the integrated designs versus the parts design is slightly different due to when they were integrated or combined, the most preferences result to the design product is easily identified on what their differences or similarities. This is due to the humans emotional are naturally triggered on what the most of similarity and/or incongruity appearances of design. In this study, “Lame-Cool” word is the articulation of the lens and arm design.

DEDICATION

For my beloved parents who are always supported me:

Kamarzaman bin Latip

Fauziah binti Omar

And

for My Supervisor,

H.H.IP [XV:[illegible]]
@Haeryip Sihombing

My Co-Supervisor,

Mr Saifuddin Hafiz Yahaya,

For my families, and my friends thank for their loves and caring

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First and foremost, all praise is due to **Allah Subhana-Wa-Ta'ala** for bestowing me with health, knowledge and patience to complete this work. The Almighty, who made this accomplishment possible. I seek his mercy, favor and forgiveness.

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LIST of ABBREVIATIONS

EO	**-**	**Enterprise Organization**
HOQ	**-**	**House of Quality**
GA	**-**	**Genetic Algorithm**
FAHP	**-**	**Fuzzy AHP**
AHP	**-**	**Analytical Hierarchy Process**

CHAPTER 1
INTRODUCTION

Nowadays, by increasingly competitive market condition, the providers and/or manufacturers have to carry out a customer-focused approach to their product development (design and process) as an articulation of what the expectation of customers. By increasing the complexity and variety of products to satisfy increasingly sophisticated customers, they ultimately require the knowledge and expertise in developing products (Ameri & Dutta, 2005:577). On this, Shen *et al.*, (2000:91)

χομμεντεδ τηατ χυστομερσ νεεδσ ανδ εξπεχτατιονσ σηουλδ βε μετ ανδ εξχεεδεδ τ ηρουγη προδυχτ ινноωατιον σινχε σατισφψινγ χυστομερ ρεθυιρεμεντσ τηρουγη τηε υσε οφ ορδιναρψ προδυχτσ ισ οφτεν νοτ ενουγη το χαπτυρε ανδ ρεταιν μαρκετ σηα ρε. Ιν φαχτσ, εωεν τηουγη ινноωατιον ηασ αλωαψσ βεεν ατ τηε χεντρεπιεχε οφ χομ πετιτιωενεσσ (Δεντον, 1999:82) ανδ ασ α δομιναντ φαχτορ ιν maintaining worldwide competitiveness (Lin & Chen, 2007:115), innovation frightens the organizations because it inevitably linked to risk (Ahmed, 1998:30).

Viewing on this standpoint, Su *et al.*, (2006:784) commented about technological innovation that allows the company to cope the challenges from a rapidly changing market situation with intensive competition. In order to make the implementations of such initiatives are successful, the product innovation of a company must link to technological competence, such as engineering and process know-how, with customer competence such as knowledge of customer needs (Patel & Pavitt, 1997;

Hansen & Løvås, 2004)[1]. The quality characteristics of this case should be prioritized from the customer's perspective and target values (or preliminary specifications) for the desired level of performance are selected based on competitive benchmarking (Cristiano *et al.*, 2000:289), besides by adopting flexible and multi-tasking technology which can be used to fabricate a wide range of products in order a company more able to meet its costumers' demand against a given capacity level (Jung, 2003:2).

On the other side, by fulfilling the requirements related to physical quality and consumers'[2] psychological needs, according to Van-Nam *et al.*, (2010: 575), the development and improvement made need to be focusing on the attractiveness of products developed. Even though the attempts to produce goods with attractive forms are nothing new (Bloch 1995:16) and difficult (especially in new product development), this is significantly critical in the design stage (Yung *et al.*, 2006:257). On this, due to a key success of business organizations in the current global χομπετιτιϖε ενϖιρονμεντ ισ τηε σατισφαχτιον οφ τηε χυστομερ (σομε οφ τηεμ τηρο υγη τηε τεχηνολογιχαλ ινναϖατιον), τηεν τηε συχχεσσ ανδ συρϖιϖαλ οφ νεω προδυ χτ δεϖελοπμεντ (ΝΠΔ) ισ ασ α χρυχιαλ φαχτορ ιν μαινταινινγ τηειρ χομπετιτιϖε αδ ϖανταγε. Χονσεθυεντλψ, τηισ λεδ τηε προδυχτ δεϖελοπμεντ to a more knowledge-intensive activities than ever which is not only requires the tremendous expert knowledge, but also on how effectively the analysis carried out based on design information.

Moreover, since the technology cannot stand alone and how to maximise the affective appeals of consumer products to improve the likelihood of transfer from the shelf impact to the purchase intent in today's consumer-oriented market (Barnes & Lillford, 2007:135), they must, therefore, dealt with various fields related to the

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[1] According to Patel and Pavitt (1997:141), the typical and the characteristics of technological competence companies are such as follows:

- *Multi-field,* and becoming more so over time, with competencies ranging beyond their product range, in technical fields outside their 'distinctive core'.
- *Highly stable* and *differentiated,* with both the *technology profile* and the *directions* of localised search strongly influenced by firms' *principal products.*
- The *rate* of search is influenced by both the firm's *principal products,* and the conditions in its *home county.* However, *considerable unexplained variance* suggests *scope for managerial choice.*

[2] The term "consumer" is used throughout this study for its specific reference to the context of consumer purchasing decisions. It relates to the customer's choice and preference when first exposed to a range of products, before significant interaction occurs or a purchase is made.

issues in the human and social sciences (Shiizuka, 2007:203), the concept of technology that should be consistent with the consideration of the innovation process as a learning process (a process for the creation of new knowledge or for the development of new routines from the perspective of core competencies and dynamic capabilities (Nieto, 2004:316), and throughout the products entire lifecycle through flexibility of design that thus allowing speedy and inexpensive modifications, together with cost-effective service and other downstream activities (Baard & Watts, 2006:3). On this perspective, according to Lai *et al.*,(2005) , the customer satisfaction is, in facts, need to be seen as a key differentiator. Even though the customer satisfaction is an ambiguous and abstract concept since the actual manifestation of the satisfaction was vary from person to person and also against the products or services, as a key element of business strategy in order to satisfy consumers toward product design and development, according to Huanga *et al.*, (2010:113), customer satisfaction need to be emphasized on product functional requirements to user experiences that gained from the interaction with the products. This means that companies should actively involve their customers in the design since their customers not only have an impact on the quality of their own experiences, but also influences the satisfaction of other customers (Tax *et al.*, 2006:39). Therefore, according to Jiao *et al.*, (2006: 658), by engaging customers' emotions or attention, it is imperative to design the products. This is due to emotions always implying and involving a ρελατιονσηιπ βετωεεν ινδιϖιδυαλ εξπεριενχεσ ον α παρτιχυλαρ οβφεχτ (Δεσμετ, 20 03) ωηερε τηειρ ϖαλυεσ, αχχορδινγ το Αψασ *ετ αλ.*, (2008:39), αρε ασ τηε ιντεραχτι ϖε ρελατιϖιστιχ οφ πρεφερενχε εξπεριενχεσ ρεφερ το the evaluation of some object or goods, service, and environment.

First, in addressing such issues , Yang (2011: 382) argues that how to develop the product design which satisfies consumers' affective responses (CARs) effectively is of great importance of business since the way of a product looks is one of the most important factors affecting a consumer's purchasing decision. On this point of view, according to Shieh *et al.*, (2011: 197), the consumers' preferences and cognition will strongly affect their acceptance of a product. Due to the achievement of quality attributes does not always mean the improvement of customer satisfactions and

equally are important to them, manufacturers need, however, to understand the effects of the different quality attributes to increase customer satisfaction or minimize dissatisfaction based on the non-linear relationship between the performances of quality attributes and overall customer satisfaction. For an example, Dahl *et al.*, (1999:18) view about the incorporation of the customer in the imagery invoked, and examine its effects on the usefulness, originality, and customer appeal of the resulting design. Based on a theoretical perspective, Childers and Houstan (1983) stated that by showing this different type of imagery can have a very different impact

ον τηε δεσιγν ουτχομε. Τηισ μεανσ τηατ ιφ μανυφαχτυρερσ χαν υνδερστανδ τηε χο νσυμερσ' πσψχηολογιχαλ φεελινγσ τοωαρδσ α προδυχτ, τηειρ προδυχτ δεσιγν σηου λδ, τηερεφορε, μεετ το τηε νεεδσ οφ χονσυμερσ ασ τηε ιντερπρετατιον οφ ηυμαν σεν σιβιλιτιεσ τηατ ισ τηε μοστ διρεχτ ωαψ οφ εξπρεσσινγ φεελινγσ τοωαρδσ ουτσιδε στ ιμυλι. Ον τηισ ματτερ, εωεν τηουγη Ησιαο *ετ αλ.*, (2006) στατεδ τηατ τηε ρελατιονσ ηιπ βετωεεν α προδυχτ δεσιγν ανδ αφφεχτιωε ρεσπονσε οφτεν ρεμαινσ α βλαχκ βοξ σινχε τηε χυστομερ ρεθυιρεμεντσ οφ νεω προδυχτ ισ υσυαλλψ ινχονχειωαβλε, accurately and completely acquired, to be successfully marketed, according to Yung *et al.*, (2006:257), the products must, however, fulfil the customer needs and even bring a higher satisfaction than expected.

Second, since the loyalty of customers is an important strategic purpose of worldwide managers, Bell (2002) found that customer loyalty and retention is as the most important challenges of the business to make the quality of products and services are recognized. Based on this reason, the customer satisfaction improvement will, therefore, increasing the competitiveness of companies (Chang, 2008; Hansemark & Albinsson 2004; Herrmann *et al.*, 2000; Paulson & Slotnick, 2004; Shamdasani *et al.*, 2008). On the other hand, they were also assumed to lead the attitudinal loyalty (Lovelock *et al.*, 2001) as an interpretation of the intention to make future purchases (Oliver, 1980; Patterson *et al.*, 1997; Bolton, 1998; Page & Eddy, 1999; Jones & Suh, 2000). Since the satisfaction is as an emotional post-consumption response that may occur as the result of comparing expected and actual performance (Oliver 1996), the satisfaction as a result of the disconfirmation of expectations can be labelled evaluative satisfaction, then satisfaction as an outcome

of non rational processes can be labelled as emotion-label (Cronin *et al.*, 2000). On this, the functional and affective needs have to be recognized as a primary ιμπορτανχε φορ χυστομερ σατισφαχτιον (Κηαλιδ, 2001) ωηερε τηε πηψσιχαλ φορμ ο φ α προδυχτ πλαψσ α ϖερψ χρυχιαλ ρολε ιν ενσυρινγ τηε συχχεσσ οφ τηε μαρκετ (Ησιαο *ετ αλ.*, 2006). Ον τηισ, ϑιαο *ετ αλ.*, (2006:658) δισχυσσεδ αβουτ how to measure and analyse human reactions to affective design and how to assess the corresponding affective design features.

Third, since the design quality is the degree to which a product design (specification) fits to customer needs and expectations, and conformance quality is the degree of match between the features of a specific product and its specification (Meirovich *et al.*, 2007:242-243), the characteristics related that determine its value in the market place and its performance of the function for which it was designed should be defined and justified (Adam *et al.*, 1981). On this, the design information transformed and accumulated is as very important in the developing a good product that has a stronger market competence (Huang *et al.*, 2006:87). On the other hand, the development process which led to a deeper understanding of how to gather and use

ινφορματιον αβουτ τηε χυστομερ ιν τηε δεσιγν, τεστινγ, λαυνχη, ανδ μαναγεμεντ οφ νεω προδυχτσ χαν βε οπτιμιζεδ, ανδ τηε ιμπροϖεμεντ οφ τηε χονχυρρεντ δεγρεε, πρ οδυχτ θυαλιτψ ανδ χυτ δεϖελοπμεντ χοστ ανδ τιμε χαν βε χαρριεδ ουτ ιν αν εφφεχτ υαλ μαννερ (Δαηαν & Ηαυσερ, 2001:179). Φορ αν εξαμπλε, Χλαρκ ανδ Φυφιμοτο (1 991:22) σεε τηατ τηε αππλιχατιον οφ ινφορματιον βεψονδ δεσιγν ανδ ενγινεερινγ το οτηερ φυνχτιονσ συχη ασ προδυχτιον ανδ μαρκετινγ, ανδ το τηε βενεφιτσ οφ χον συμερσ –

φρομ προδυχτ δεϖελοπμεντ το προδυχτιον, μαρκετινγ, χονσυμερσ ανδ βαχκ το προ δυχτ δεϖελοπμεντ– ωηιχη βρινγ τηε προδυχτ δεϖελοπμεντ το τηε φορε. Αχχορδινγ τ ο ϑιαο ανδ Τσενγ (2004:745), τηισ ωιλλ εναβλε τηε χομπανψ το τηε ηιγηερ profit margins, better and improved customer satisfaction, as well as high-value added business opportunities due to a maximum of customer-perceived value while exploiting the potential of design that generate a huge amount of variety.