CHAPTER 7

CONCLUSIONS AND FUTURE WORK

7.1 Overview

This research has explored the potential of Kansei Engineering (K.E.) implementation in website design. Literature in product emotion has described the need to design product that capture user's attention by captivating emotional connectivity with the interface of the product. Many products that were designed geared to user's emotion have been successful in the market (Nagamachi, 2003). In this research, it seeks possibility to embed user's emotion in website design, so that website that cultivates emotional connectivity to the users could be designed.

To date, the literature on website evaluation and use have been centralised to the aspect of functionality and usability (Backlund 2001; Garret, 2003; Ivory & Hearst, 2001; Krug, 2000; Lederer et al., 1998; Lam, 2001; Lee et al., 2003; Marcus & Gould, 2001; Nielsen, 2000; Powell, 2002; van Welie et al., 1999; Zhang et al., 1999; Veen, 2001), which resulted the production of numbers of guide or design requirement to develop website that based on functionality and usability. Although recent research have paid increasing interest to the emotional aspect of website design (Dillon, 2001; Egger, 2001; Kimet al., 2003; Lee et al., 2001; Li & Zhang, 2005; Okada & Tejima, 2003; Overbekee et al., 2004; Schenkman & Jönsson, 2001; Siu & Ho, 2005; Thielsch, 2005; Wong, 2004; Yoon & Lee, 2003; Zhang et al., 2000), the literature shows a gap in terms of determining design requirement based on the aspect of emotion.

Consequently, the design paradigm remains including the emotional aspect based on designer's interpretation and inspiration per se (Kim et al., 2003; Norman, 2002).

Unfortunately, this kind of website design does not carefully include user's implicit needs and emotions in design process, whereas to successfully design product emotion, users must be included in the process of requirement generation (Bouchard et al., 2003; Nagamachi, 2003). Thus, this research was performed to investigate the potential of engineer user's emotion in website design to fill in the gap of the absence of design requirements geared to user's emotion. For the purpose, this research began with literature review on the issues in web design, the theory of psychology and emotion, the design science and available method in evaluating user experience including emotional experience.

This chapter summarizes the phases that involved in the process of the investigation of evidence of the possibility of engineering emotion in web design, the developed goals and objectives and related findings. The chapter ends with suggestions of future work.

7.2 Discussions

Nowadays, most our daily activities have become more and more dependent to the internet. Everyday people surf the website with various purpose to accomplish their respective goals. Internet shopping for instance, have resulted a tremendous growth in online sales (Forrester Research Inc., 2005). In doing businesses, e-Stores are highly reliant to their website to get consumers attentions, as this is their only medium of interaction with consumers. This is similar to the physical stores, where they need to capture visitor's attention at first sight, and persuade them to enter their store. Over the Internet, visitor's evaluation of website design significantly influences their shopping decisions and behaviours (Bhattacherjee, 2001; Dougherty, Li & Biocca, 2002; Lee & Benbasat, 2003; Shedroff, 1999).

However, literature involving website evaluation and use were grounded to the assumption that visitors will spend time on the website to find aspect of attractiveness and positive cognitive experience is evoked by enjoyable features on

the website (Bhattacherjee, 2001; Li & Zhang, 2005). Unfortunately, this does not reflect the reality. Today, with the vast choices visitors are offered over the internet, they will jump from one store to another if the website does not capture their attention. This indicates that if a website can not attract visitors at the first sight, it will be out of business even if it's highly helpful and convenient to use (Li & Zhang, 2005).

In the verity that emotion influences decision making, perception, attention, performance, and cognition (Norman, 2002; Russell 2003; Tractinsky et al., 2000), visitors primary emotional responses to a website is seen as the first step to the success of e-businesses (Li & Zhang, 2005). Functionality and usability aspect have become old school of thoughts, and people are now discussing the aspect of emotion in web design (Dillon, 2001; Egger, 2001; Kim et al., 2003; Lee et al., 2001; Li & Zhang, 2005; Okada & Tejima, 2003; Overbekee et al., 2004; Schenkman & Jönsson, 2001; Siu & Ho, 2005; Thielsch, 2005; Wong, 2004; Yoon & Lee, 2003, Zhang et al., 2000).

Until today, designers have enough reference in designing website that offers good functionality and usability due to the availability of method to develop such website (Backlund 2001; Garret, 2003; Ivory & Hearst, 2001; Krug, 2000; Laderer et al., 1998; Lam, 2001; Lee et al., 2003; Marcus & Gould, 2001; Nielsen, 2000; Powell, 2002; Zhang et al., 1999; van Welie et al., 1999; Veen, 2001), for instance the renown Nielsen's Heuristic (Nielsen, 1993), a three-phase model for website evaluation (Sutcliffe, 2002), and IBM's design principles (IBM Design, 2008).

However, a method to develop such website that captures visitor's attention at first sight is absent. Support by the needs theory posited by Maslow (1943), web designers need to learn to identify user's internal needs, structuring them into the website design to satisfy the needs in order to motivate user's attention. Therefore, designers need to study the experience of website users, and include this knowledge into the design requirements of website. While there are massive discussions addressing emotional aspect of web design (Dillon, 2001; Egger, 2001; Kim et al.,

2003; Lee et al., 2001; Li & Zhang, 2005; Okada & Tejima, 2003; Overbekee et al., 2004; Schenkman & Jönsson, 2001; Siu & Ho, 2005; Thielsch, 2005; Wong, 2004; Yoon & Lee, 2003; Zhang et al., 2000), a guide to design such website is lacking.

Hence, this research was performed to fill in the gap of the absence of the design requirement for website that embeds user's emotion in its design. It has investigated the primary emotional user experience towards Website UID, analysed the underlying influential design elements, and composed a guideline to the design of website that embeds target emotion. This research named the guideline as Kansei Web Design Guideline©, where the term Kansei in the guideline is referred to the target emotion. Although by its current form the guideline is seen to be specific to the case study domain, it offers a basis to the extension of existing scheme on website design such as the renown Nielsen's Heuristic (Nielsen, 1993), IBM's design principles (IBM Design, 2008), a three-phase model for website evaluation (Sutcliffe, 2002), and design factors for emotional homepages (Kim et al., 2003). The first two are heavily focused on functionality and usability aspect. The latter two are although looking into arousal aspect of website design and emotional aspect of homepages, it limits users involvement in evaluation phase and does not include users input in its requirement analysis phase. The guideline established in this research is a result of experiential approach and participatory design philosophy, involving users in requirement analysis phase and designers in design phase. This guideline can be used either as design clue or evaluation criteria rather than design principle, since the experiential and participatory approach is an evolutionary process.

Also, supported by the evidence of the success of engineering emotion in website design through its empirical studies, this research established a systematic method to engineer emotion Website UID. This research named the method as Method to Engineer Kansei Website, where Kansei Website refers to website that embeds target emotion in its design. The method could be used to review the developed guideline in timely basis. This research also established Method of Emotion Detection, which could be used to evaluate website in terms of its emotional appeal.

This research was performed adopting K.E. methodology in its research framework. With the proven success of the implementation of the developed guideline in designing several prototypes, this research justified its claim that K.E. can be used to engineer emotion in Website UID. K.E. has been implemented successfully in the measurement of users emotional responses to Website UID, conceptualise emotion in web design, and produce design requirement for website that embeds target emotion. This kind of website design is targeted to offer emotional connectivity and motivate user's attention in order to enhance stickiness in the effort to promote consumer conversions and retentions to online businesses.

7.3 Implications of Research

This research was performed to investigate evidence of the possibility to engineer emotion in Website UID. The findings that the research has provided, has implication in the design paradigm of website, where the proof that emotional design requirement could be determined and website that embeds target emotion could be designed, educates designers and users in terms of Website Emotion. Designers could have ways to understand how users perceive emotionally of their website design, and could use the knowledge to devise strategies to improve positive emotional appeal of their website. This is seen to result a paradigm shift from the concentration on functionality and usability aspect to fulfilling user's implicit need and emotion which influence emotional connectivity to the website.

This research was performed adopting the K.E. methodology in its research framework of engineering emotion in Website UID. In system design methodology, K.E. is possible to be adopted in the requirement analysis phase. The use either physiological or psychological technique could facilitate generation of design requirements especially in terms of non-functional requirements such as when addressing the look and feel of a user interface design. Although the approach of involving users in generating requirements is seen to be more non-functional, the

combination of the technical specification from the expert based on user's point of view could also contribute to generation of functional requirement of a system. Also, K.E. methodology can be effectively use in design philosophy of participatory design that supports the direct participation of users and other stakeholders in system analysis and design work.

This research had developed several prototypes according to the proposed guideline. Result from empirical studies had shown that the prototype had successfully elicited the target emotion. The findings are inline with other studies involving the adoption of K.E. that the use of K.E. could improve the structure of product emotion and thus capture consumer's attention. Although the successful adoption of K.E. in many industrial and household products has been proven, this is the first attempt of K.E. adoption to e-Commerce website design, and it is proven successful. Thus, this result could be used as a benchmark in the HCI discipline looking into emotional aspect of system design.

As shown in many literature and previous implementation on K.E. in numerous product and environment domains including service domain, many developed country especially its origin, Japan, followed by Korea and several European countries have paid high interest in K.E. in order to develop innovative and market-success products and services. Although the implementation of K.E. in this research was in the domain of website design, this research would propose the extension of the technology of K.E. in other domain such as clothing, furniture, fashion, vehicle, interior design, home appliances and many more by developing countries such as Malaysia, to outreach its potential and become the next leader of a particular product invention in the world. The use of K.E. is also seen to enable the enculturation of every kind of product design for the market in Malaysia and other part of the world.

As proven by this research findings that Website Emotion can be designed, web developers especially in Malaysia should look into emotional aspect of their website design, so that they could become leader in producing website that captures visitors

attention, cultivate emotional engagement so that visitors will go to further actions and judgements.

7.4 Summary of Findings

This research performed empirical studies in order to find evidence to support the research claims, which path to find the answers were guided by the formulated research questions.

Empirical studies were conducted and analyses performed to the gathered data by the means of Cronbach's Alpha, Correlation Coefficient Analysis, Principal Component analysis, Factor Analysis, Partial Least Square Analysis and Cluster Analysis. Results form the entire empirical studies, which are the pilot, exploratory and confirmatory studies, have successfully answered all the research questions which lead to the achievement of all its objectives. The summary of research objectives and its respective outcome is shown Table 7.1. The detail description of all empirical studies and its result is provided in Chapter 5 and 6.

Table 7.1: Summary of Findings.

Objective	Outcome
1. To propose a methodology to measure and engineer emotion in Website UID.	- Method to Engineer Kansei Website - Method of Emotion Detection
2. To provide evidence that emotional signature exists in Website UID through empirical study.	- Empirical evidence that emotional signature exist
3. To investigate the structure of emotion in Website UID, the significant factors, and the influence of design elements to emotion.	- 5 Concepts of Emotion - 23 Elements of Emotion - Influential Design Elements to each Elements of Emotion
4. To develop a design guideline that enables the incorporation of target emotion in Website UID.	- Kansei Web Design Guideline© - Kansei Website Taxonomy - Periodic Table of Kansei Web Design Elements©

7.5 Research Challenges

With the implementation of the formulated research framework, this research has successfully provided answers to all research questions and achieved all the research goals. Nonetheless, during the research endeavours, it encountered several challenges that require careful attention to ensure its success. The challenges were encountered due to the big specimen size, multicollinearity in design elements and the discovered large amount of data. This has consequences and emerged several challenges that need to be overcome during the research endeavour. The identified challenges are:

1. The complexity due to the large number of design elements during empirical investigation in each specimen, and screening activity during identification of valid specimen.

2. The difficulty in analysing the data. In many K.E. implementations, the number of independent variables, the design elements, is rather small in relative to number of specimens. Treatment of data can be done rather effortlessly with the widely used QT1 (Hayashi, 1952) analysis. Some bigger number of design elements can still be treated into groups before performing QT1. However, when there are heavy interactions between these variables, calculation will fail and result will be distorted (Ishihara, 2007).

3. The difficulty in delivering the knowledge due to the discovered huge amount of data, so that it can be easily accessible by the intended audience.

The first challenge that was encountered is the extensive work during empirical investigation of design elements in each specimen, and screening activity during identification of valid specimen. The challenge surfaced when the research needs to process the numerous amounts of design elements, i.e. 77 Item and 249 Category, over 163 specimens. The research provides solution to this challenging procedure by

introducing matrix of specimen vs. design elements. Although the matrix does not substantially reduce the amount of work, it offers easy management of the data by providing orderly data organization.

Secondly, in this research case where the number of variables largely exceeds the number specimens, the challenge is seen in the possibly heavy interaction between variables. It should be noted that in K.E., relationships between emotion and design elements are quantified by regression model (see Chapter 3, section3.6.4). In K.E. where interaction between design elements exists, and classified into two levels, the resulting linear regression model for the category variable becomes,

$$Y_i = \sum_{j=1}^{R} \sum_{k=1}^{Cj} \beta_{jk} X_{i(jk)}$$

Where,

i = 1,…, n (n = number of specimens)

j = 1,…, R (R = number of Item)

k = 1,…, C_j (C_j = number of Category for item j)

Y_i represents the semantic differential evaluation value of emotion. β_{jk} is called the coefficient value of the dummy variable X, indicating the relation of the design elements X and the rated emotion Y_i.

In many K.E. implementations, the number of design elements is rather small in relative to number of specimens. Treatment of data can be done rather effortlessly

with the widely used QT1 (Hayashi, 1952) analysis. Some bigger number of design selements can still be treated into groups before performing QT1.

However, in the case of this research where there are heavy interactions between these variables, treatment of data is highly challenging. The research describes how it overcomes this challenge, with the use of Partial Least Square analysis in Chapter 5.

The third challenge is regarding how to interpret the huge amount of the gathered data, so that it can be easily accessible by the intended audience. The adoption of K.E. in website design has discovered a big number of design elements and associations to emotion become complex. The resulting huge volume of information demanded one to read and interpret the knowledge for it to be used. The research requires way to deliver this interpretation of knowledge effectively and easily to the audience. The research describes how it overcomes this challenge, with the introduction of periodic table, in Chapter 6.

With the formulation of matrix, the use of PLS analysis and formulation of periodic table, this research have overcome all the emerged challenges. The detail of the challenges and each of the solutions are provided in Chapter 5 and 6.

7.6 Research Limitations

This section describes limitation intentionally place within the scope the research. The research investigates website visitor's primary emotional responses when visiting e-Commerce website. The ultimate target is to establish design guideline to produce website that cultivate emotional engagement, capture visitor's attention at first sight and persuade them to stay longer on the website, in the effort to promote consumer conversions and retentions.

While there are so many classification of emotional dimension described by scholars and philosophers in the emotional research domain, and several other domain such as

psychology and social sciences (Aristotle, 350 B.C.E.; Damásio, 1980; de Sousa, 1980; Ekman, 1999; Frijda, 1986; Griffiths, 2002; Leighton, 1982; Russell, 1980; Russell, 2003; Scherer, 1994; Tractinsky, 2004), the emotional dimension addressed in the research refers to valence (pleasure-displeasure) and arousal (sleep-arousal) dimension explicated by Russell in his circumplex model of affect (Russell, 2003). This is based on the findings that both valence and arousal formed fundamental components of affective constructs in e-commerce website evaluation studies (Li & Zhang, 2005). It is also align with the concept of emotion which covers overall emotional responses elicited by external stimuli.

The notion of emotion investigated in this research of e-Commerce website evaluation is confined to the visceral factor (Norman, 2004) or affect (Englelsted, 1989 as in Aboulafia & Bannon, 2004) that is a brief emotional state that results from a response to the external stimuli. This is aligned with the research that targets to capture the primary emotional response to e-Commerce website. Temporal notion of emotion is not covered.

The design element addressed in this research focused to content and layout aspects as described in web design literature (Garret, 2002; Powell, 2002; Veen 2001). They cover product presentation style, placement of buttons, tabs, images, and the visual design such as background, colour, and typography. This research did not cover elements such as navigation and functionality.

In terms of research instruments, first, all the empirical studies were performed using e-Clothing websites as evaluation specimen. Second, subjects employed to provide input in the evaluation were chosen from specific target consumer group, which were 120 young consumers recruited form the researcher's university. Third, the emotional keywords used for the measurement purposes were limited to forty words. These limitations may affect the overall generalization of the outcome. Also, the checklist used was in the form of paper checklist. This could complicate the data entrance into computer systems when the population is huge. Although the research

has successfully validated the data input, it was time consuming and challenging process.

This research has produced Kansei Web Design Guideline©, and Kansei Website Taxonomy. Although the validity of both articles was confirmed by a confirmatory study, they fit as a benchmark in its scope and specific to this case study domain.

This research has also introduced Periodic Table of Kansei Web Design Elements©, as a solution to provide easy access to the design guideline. Although the periodic table smartly manage and store the large data, apart form becoming greatly useful, the effectiveness of the tool has not been tested.

The development and testing phases described in this research were meant for confirmatory purposes in validating the proposed guideline. It does not cover actual implementation of the guideline in real world. Thus, the resulting Kansei Web Design Guideline©, and Kansei Website Taxonomy, and Periodic Table of Kansei Web Design Elements© could only be used as a reference to engineer emotion in Website UID. Also, the confirmatory results could be used to lend some hypothetical credence that the implementation of the proposed guideline have made it possible to engineer emotion in the developed prototypes. Also, they serve results that applicable to the research scope and specific to this research domain.

7.7 Future Work

All the empirical studies were performed using e-Clothing websites as evaluation domain. Although this research have focused on e-Clothing websites, the theoretical assumptions, methodological recommendations and even most of the empirical results should be transferable to other domains. To support this claims, similar work could be suggested to be performed to other website domains, such as e-Learning, e-Governance and e-Community. A comparison of emotional responses could be used to confirm the transferability of the method used and the guideline constructed.

Subjects employed to provide input in the evaluation were chosen from specific target consumer group. In the interest of cultural effect shaped by indigenous characteristics of the different cultural races, evaluations using different cultural background can be performed. Results could be useful to contribute to the generalization of the constructed guideline.

The checklist used was in the form of paper checklist. The Emotion Measurement procedure in this research had resulted a huge data population. This had complicated the data entrance into computer systems and it was error-prone. Although the research has successfully validated the data input, it was time consuming and challenging process. A computerize input system where participant could input their responds directly into computer system is desirable. Therefore, this research could suggest a future work to develop a computerize system to handle participant's input. Additionally, it would be great idea to establish ample facilities that conducive to the research environment prior to performing further research.

As the developed Kansei Web Design Guideline©, Kansei Website Taxonomy, and Table of Kansei Web Design Elements© were developed under certain limitation, future work could be performed to enhance its applicability with extension of work using wider scope of participants, higher number of emotional keywords and using other domain of website stimuli, addressing cultural and universal aspects of emotion. Future work could also be performed to test the practicability and success of the guideline, taxonomy and periodic table in actual case or with expert designers.

Also, this research was performed using a limited number of specimen, test subjects and emotion variables. Given the nature of these limitation, the results cannot be used to represent the generally acceptable knowledge, but only applicable to the study domain and the selected target group of market segment. Further testing of the experiments in a larger and more diverse population and variables are needed to provide support of internal validity for the research claims of the internal validity of Kansei Design Model and method to engineer emotion in Website UID.

Transferability of the established methods and models from this research could also be investigated with the future work addressing its implementation to other application domains as well as different user domains. Results could contribute to the universally accepted method in the design of product that embeds target emotion.