

Kansei Database System For Emotional Interface Design Of E-Commerce Website

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Abstract - *This paper discusses results of the study of emotional values in web design through the methodology of Kansei Engineering. An evaluation of visitor's kansei towards clothing e-Commerce websites were conducted using pre-selected 35 e-Commerce websites, 40 Kansei Words as descriptors of emotional sensation organized in a 5-point Semantic Differential scale, rated by 120 participants. Factor Analysis, and Partial Least Square Analysis were then performed to uncover factors, Kansei Word's structure and the relationship between Kansei and website design elements. The result enables the establishment of a design guideline presented in the form of Kansei Database System for emotional website interface. Additionally, the study proposed the construction of KanseiExpertWeb, KanseiCollaborativeWeb and KanseiHybridWeb. The database inspires the construction of computer systems as a design tool for Kansei e-Commerce website design, which enables researchers, users, designers, e-Commerce and other stakeholders to benefit the database in the production of emotional interface design of e-Commerce website. Additionally, the study presented a reference table, which revealed associations between consumer's kansei and specimen.*

Keywords: Emotion, e-Commerce, Kansei Database System, Kansei Engineering, Interface design.

1 Introduction

The discipline of design science emphasizes the integration of cognitive, semantic and affective elements in the conception and development of designed products. Designers have begun to address affective or emotional elements in their products and significant amount of work is seen in the design of tangible products such as automobiles and electronic home appliances. However, the literature does not exhibit significant work on artifacts such as websites. In this paper, we report our research in the production of design guideline to the emotional interface design of e-Commerce website, which also referred to as Kansei e-Commerce website. Here, we demonstrate the use of Kansei Engineering (KE) to identify the emotional signature of websites and presents our empirical findings in supporting the use of KE as a means to incorporate the affective or emotional appeal into websites. The context of web application chosen for this work is the design of online clothing e-commerce websites where emotional appeal is assumed to be significant. Based on the result, we established a design guideline and present Kansei Database System (KDS) for emotional design of website interface. The study also introduce the deployment of KDS into KanseiExpertWeb, KanseiColaborativeWeb and KanseiHybridWeb database system. The database inspires the construction of computer systems for Kansei e-Commerce website design, which enables researchers, users, designers, e-Commerce and other stakeholders to benefit the database in the production of emotional interface design of e-Commerce website.

2 Emotional interface design of e-commerce websites

HCI issues related to e-commerce applications were formerly focused on cognitive aspects of websites. Since the early work of Nielsen in the 1990s, the emphasis was on the qualities of usefulness and usability in producing good website design. Na Li and Ping Zhang [1] cited that most studies dedicated to e-Commerce website evaluation are based on two assumptions. The first assumption is that target customers spend at least a few minutes on a website and the second assumption is that good website features usually elicit positive cognitive evaluations and shopping experience. These assumptions have ignored the primary affective reaction or primary emotional responses towards the website. Echoing this concern, Na Li and Ping Zhang [1] stressed that online shopping behavior is a complex phenomena and recognized that affective reaction has been cited to be a factor that promotes online shopping. This is because e-commerce websites have gone beyond the function of conveying information to the extent of providing persuasive engagement with website visitors through the

lively process of perception, judgment and action. Affect has also been discussed in literatures as a factor found to influence decision-making, perception, attention, performance, cognition and etc [2, 3].

Align with these claims, we argue that e-Commerce websites should induce desirable consumer experience and emotion that influences users' perception of the websites, to enhance visitor's stickiness that promotes consumer conversions and retentions. This is ultimately targets to extend the outreach potential of the online business. Hence, we need to consider the emergence of the dimension of desirability in e-commerce website design.

Desirability emerged from the realization of the need to have new measures of users' experience driven by emotional factors [4, 5]. Donald Norman, an advocator of emotional design discussed the notion of emotional design through elements of visceral, behavioral and reflective factors [6]. His views, parallels the view of Englested (1989, as cited in Aboulafia and Bannon [7]) who discussed three temporal categories of emotions, namely affect, emotion, and sentiment. We argue that in terms of website emotional design for desirability, visceral factors or affect that is the emotional state that results from a response to the external stimuli is more pertinent.

Mahlke and Thüring [8] studied affect and emotion as important parts of the users' experience with interactive systems, aiming to consider emotional aspects in the interactive system design process. While admitting that emotion cannot be designed, they assert the importance of deriving a method for recognizing users' emotion from emotional evaluation procedures.

Despite the gained recognition, the subject of emotional appeal of websites or desirability is often neglected as designers tend to pay more attention to issues of usefulness and usability [9] due to the availability of established design methodology that addresses aspects of usefulness and usability. The design method that enables the incorporation of emotional design requirements is lacking. In addition, numerous studies conducted on emotional design tends to look at minimizing irrelevant emotions related to usability such as confusion, anger, anxiety and frustration [2]. Therefore, it is necessary to seek for a suitable design method to handle design requirements based on emotional signatures of websites.

3 Kansei Engineering

Kansei is a Japanese term that is used to express one's impression towards artifact, situation and surrounding. Deeply rooted in the Japanese culture, direct translation of kansei is difficult but means the mental state where knowledge, feeling, and sentiment are harmonized [10, 11]. When adopted by other culture, kansei is simply described as the sense and sensitivity that evoked subjective pleasurable feelings from the interaction with an artefact [11, 12].

Kansei Engineering (KE) is a technology that combines kansei and the engineering realms to assimilate human kansei into product design with the target of producing of products that consumer will enjoy and be satisfied with. The focus of KE is to identify the kansei value of products that trigger and mediate emotional response. The KE process implements different techniques to link product emotions with product properties. In the process, the chosen product domain is mapped from both a semantic and physical perspective. In terms of a design methodology, the approach of KE is to organize design requirements around the emotions that embody users' expectations and interaction [10, 11, 12]. Since it was first introduced by one of the author, Nagamachi, in the seventies, KE has been successfully used to incorporate the emotional appeal in the product design ranging from physical consumer products to IT artifacts. Due to its success in making the connection between designers and consumers of products, KE is a well accepted industrial design method in Japan and Korea. In Europe KE is gaining acceptance but is better known as emotional design.

4 Kansei Measurement

Based on the underlying concept of Kansei Engineering and literatures involving the adoption of Kansei Engineering, we present a model of Kansei Engineering implementation in e-Commerce website as shown Figure 1.

Conforming to the model, to perform Kansei Engineering in e-Commerce website, one should begin with selecting a specific evaluation domain. This is because different domain will induce different Kansei respectively. Failing which will lead to confusion during measurement and classification of design element, which will cause an invalid result. The domain addressed in Kansei Engineering does not refer to a particular industrial field, such as car or electronic appliance, but a more specific group of product that have same design

viewpoint [11]. Similarly for websites, one must carefully control and narrow down their investigation to a specific domain.

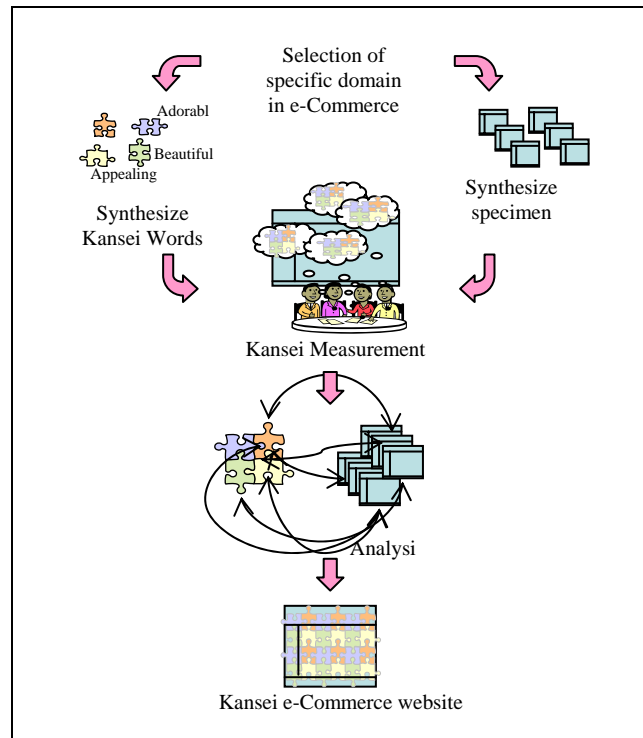


Figure 1: Model of Kansei Engineering implementation in e-Commerce website

Since Kansei is the state of consumer's internal sensation, the measurement process can be very challenging. Kansei Engineering provides diverse method to measure consumer's sensation, namely brain waves by electroencephalogram (EEG), muscular loads measurement by electromyography (EMG), eye movement and self-reporting system such as Different Emotional Scale (DES), Semantic Differential (SD) scale or free labeling system.

In the measurement of visitor's Kansei in e-Commerce website, measurements are psychological which deals with human emotional state. Hence, the most suitable measurement method is by self-reporting system. This is done by using words that describe the emotional expression associated to e-Commerce website. In Kansei Engineering, this expression is called Kansei Word (KW) [11]. Possible sources of KW can be of any or all but not restricted to; Web developer / designer, pertinent literature, experienced website user, the expert, related study, technical magazine or journal. For the quantification of subjective consumer's emotion, the Osgood Semantic Differential scale is recommended.

On the other hand, to enable interpretation of Kansei responses, one need to identify the e-Commerce website detail design element. Compilation of these design elements can be done through self-investigation system.

Once the KWs are set and the design elements are compiled, evaluation can be performed to find association between the KW and design elements. The expected result will not be as one to one association, but most probably one KW is associated with few design elements. For example, the word elegant may be associated with elements of background color, typography, and image size. The synthesized result will provide guidelines on how to induce Kansei into website design.

Before the evaluation, subjects must be carefully selected in order to obtain accurate input in the Kansei measurement process. Correspondingly, the most appropriate subject group for e-Commerce website evaluation is web users. This is inline with Kansei Engineering principle to investigate and induce specific end-user's Kansei into product design.

4.1 Research Method

We conducted two studies: the identification of detail design elements and measurement of visitors' emotional feelings (kansei) towards online clothing websites. For the kansei measurement, we adopted the Kansei Engineering method described in earlier section. The visitors kansei and website specimen were then analyzed to identify associations between kansei and web design elements. Subsequently, kansei and the website samples are mapped to determine the kansei cluster.

4.2 Research Instrument

Initially, one hundred and sixty three online clothing websites were selected based on their visible differences in design such as in colors, layouts, page orientations, and typography. An investigation was conducted to identify detail design elements in all websites in the context of what consumer's see in the external feature of a website. As a result, the study has identified 77 categories in design element, and 249 items as specified values in each design category identifiable from all websites. Table 1 shows instance from the result of design elements study.

Website	Body Bg Color						Page Style			Dominant Item			Picture Size				Picture Focus		
	White	Black	Brown	Lt	Grey	Lt	Frame	Table	None	Picture	Ads.	Text	Small	Medium	Large	Mix	Breast	Hip	Full
1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0
2	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1
3	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0
4	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0
5	1	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0
6	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1
7	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0
8	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0
9	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1
10	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0
11	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
12	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0
13	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1
14	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0

Table 1: Detail design elements

All websites were then analyzed following a set of predefined rules in the study. From the analysis, 35 website specimens were finally used. The specimen are coded numerically from one to thirty-five, and snapshot of the specimen are shown in table 2.

ID	Specimen	ID	Specimen	ID	Specimen	ID	Specimen	ID	Specimen
1		8		15		22		29	
2		9		16		23		30	
3		10		17		24		31	
4		11		18		25		32	
5		12		19		26		33	
6		13		20		27		34	
7		14		21		28		35	

Table 2: Specimen and code.

Kansei Words, which are used to represent emotional responses were synthesized according to web design guidebook, experts and pertinent literatures. 40 Kansei Words were then selected according to their suitability to describe website. Among the synthesized words are adorable, professional, impressive and etc. These Kansei Words were used to developed checklist to rate websites. The kansei checklist developed was organized in a 5-point Semantic Differential (SD) scale.

4.3 Participants

One hundred and twenty undergraduate students from the Faculty of Information Technology and Quantitative Science, Faculty of Architecture, Building, Planning and Survey, Faculty of Business and Management and Faculty of Electrical Engineering from the researchers' university participated in the kansei evaluation. From each faculty, exactly thirty students consisting of fifteen males and fifteen females were recruited. All of them have prior experience as web users.

4.4 Procedure

The participants were grouped according to their faculties. Four kansei evaluation sessions were held separately for each group. During each session a briefing was given before the participants began their evaluation exercise. The thirty five website specimens were shown one by one in a large white screen to all participants in a systematic and controlled manner. Participants were asked to rate their feelings into the checklist according to the given scale. Participants were given three minutes to rate their feelings towards each specimen. They were given a break after the fifteenth website specimen, to refresh their minds. The order of checklist was also change to avoid bias. Each kansei evaluation session took approximately 2 hours to complete.

5 Results

Factor Analysis and Partial Least Square Analysis were performed using the average evaluation results between subjects, to identify associations between Kansei and design elements, and determine specimen's kansei.

5.1 Factor Analysis (FA)

FA is a statistical data reduction technique used to explain variability among observed random variables in terms of fewer unobserved random variables called factors. FA assumes that all the rating data on different attributes can be reduced down to a few important dimensions. This reduction is possible because the attributes are related. The rating given to any one attribute is partially the result of the influence of other attributes.

In this research, FA is used to find psychological structure of Kansei space, and detail result on weighted axes. The detail of Kansei space were investigated using the average value of evaluation results. Table 2 shows result of Factor Analysis after varimax rotation. Varimax, which was developed by Kaiser (1958), is the most popular rotation method that simplifies the interpretation of variables. This is because, after a varimax rotation, each original variable tends to be associated with one (or a small number) of factors, and each factor represents only a small number of variables. In addition, the factors can often be interpreted from the opposition of few variables with positive loadings to few variables with negative loadings.

Factors	Variance	Contribution	Cummulative Contribution
1	16.09262	40.23%	40.23%
2	12.29421	30.74%	70.97%
3	3.427578	8.57%	79.54%
4	1.856272	4.64%	84.18%
5	1.810882	4.53%	88.70%
6	0.923415	2.31%	91.01%
7	0.370649	0.93%	91.94%
8	0.250962	0.63%	92.57%

Table 3: Contribution and cumulative contribution table

In table 3, it is evident that the first factor explains 40.23% of the data and the second factor explains 30.74% of the data. Both factors represents majority of factor contributions. This shows that Factor1 and Factor2 have

dominant effect on Kansei Words. The first two factors together represent 70.97% of the variability while three factors explain 79.54% of the variability. Inclusion of the third factor is deemed considerable, and therefore the first three factors could explain most of the data. The proportion of variability explained by the fourth factor and above is minimal (4.64, 4.53, 2.31, etc respectively) and they can be eliminated as being insignificant.

The following table shows partial result of factor analysis after varimax rotation. The table shows factor results in ascending order.

VAR	F1	VAR	F2	VAR	F3	VAR	F4	VAR	F5	VAR	F6
Cute	0.4961	Creative	0.3969	Feminine	0.0012	Calm	0.0467	Fun	0.0539	Lovely	-0.0503
Refreshng	0.5314	Surreal	0.4037	Childish	0.0311	Neat	0.0586	Gorgeous	0.0593	Charming	-0.0477
Relaxing	0.5420	Profesnal	0.4220	Adorable	0.0506	Lovely	0.0723	Impressiv	0.0703	Relaxing	-0.0436
Fun	0.5845	Calm	0.4323	Cool	0.0506	Beautiful	0.0794	Adorable	0.0735	Neat	-0.0265
Charming	0.6085	Cool	0.4529	Cute	0.0523	Charming	0.0996	Cute	0.0799	Feminine	-0.0251
Lively	0.6090	Sophisti	0.4544	Charming	0.0531	Natural	0.1035	Appealing	0.0806	Refreshng	-0.0210
Adorable	0.6346	Fun	0.4850	Appealing	0.0706	Gorgeous	0.1147	Masculine	0.0809	Mystic	-0.0184
Pretty	0.6449	Impressiv	0.4991	Stylish	0.0751	Creative	0.1174	Charming	0.0865	Impressiv	-0.0107
Comfort	0.6518	Light	0.5166	Elegant	0.0763	Stylish	0.1185	Luxury	0.0897	Comfort	-0.0059
Elegant	0.6543	Comforta	0.5178	Pretty	0.0781	Pretty	0.1220	Elegant	0.1111	Lively	-0.0044
Lovely	0.6707	Gorgeous	0.5353	Interesting	0.0806	Cute	0.1223	Simple	0.1203	Appealing	0.0037
Appealing	0.6847	Interesting	0.5751	Profesnal	0.1017	Chic	0.1316	Classic	0.1387	Interesting	0.0092
Interesting	0.7156	Stylish	0.5933	Mystic	0.1446	Futuristic	0.1426	Old-fash	0.1632	Surreal	0.0151
Calm	0.7464	Refreshng	0.6014	Surreal	0.1524	Surreal	0.1444	Interesting	0.1662	Cool	0.0179
Stylish	0.7599	Relaxing	0.6598	Old-fash	0.1730	Profesnal	0.1516	Pretty	0.1834	Simple	0.0297
Creative	0.7773	Lively	0.6778	Comfort	0.1943	Appealing	0.1678	Profesnal	0.1914	Boring	0.0326
Classic	0.7943	Appealing	0.6825	Refreshng	0.2042	Relaxing	0.1949	Plain	0.1980	Crowded	0.0405
Profesnal	0.8058	Pretty	0.6895	Sexy	0.2729	Impressiv	0.2029	Lively	0.2016	Adorable	0.0461
Cool	0.8113	Lovely	0.6900	Classic	0.2754	Masculine	0.2114	Lovely	0.2079	Creative	0.0551
Gorgeous	0.8128	Elegant	0.7034	Boring	0.3086	Adorable	0.2118	Beautiful	0.2394	Classic	0.0631
Impressiv	0.8227	Adorable	0.7130	Light	0.3138	Cool	0.2842	Relaxing	0.2474	Light	0.0664
Surreal	0.8464	Charming	0.7637	Neat	0.3193	Interesting	0.3081	Light	0.2747	Plain	0.0667
Sophisti	0.8484	Sexy	0.7876	Calm	0.3392	Comfort	0.3204	Calm	0.3026	Chic	0.1311
Luxury	0.8788	Cute	0.7941	Relaxing	0.3485	Lively	0.3285	Comfort	0.3286	Old-fash	0.1441
Masculin	0.8991	Beautiful	0.8170	Natural	0.4249	Refreshng	0.3909	Refreshng	0.3548	Fun	0.2227
Futuristic	0.9132	Chic	0.9392	Plain	0.8390	Fun	0.5000	Natural	0.6050	Cute	0.2767

Table 4: Factor Analysis result for Kansei Words

The structure of Kansei Words are observable in the analysis result. It is evident from the table that sample websites Kansei are structured by 5 factors. The first factor consists of professional, cool, gorgeous, impressive, surreal, sophisticated, luxury, masculine, futuristic and mystic. This Kansei space could be represented as 'sophisticated'. The second factor consists of elegant, adorable, charming, sexy, cute, beautiful, chic and feminine. This Kansei space could be represented as 'elegant-beauty'. The third factor consists of plain and simple, and therefore it could be represented as 'simplicity' Kansei space. The fourth factor consists of light, and therefore could be represented as 'richness' Kansei space. The fifth factor consist of natural and neat, and could be represented as 'comfy' Kansei space. The result demonstrates that website samples are structured by five factors; sophisticated, elegant-beauty, simplicity, richness and comfy. These five factors altogether explains 88.70% of the total data.

Factor Analysis demonstrates that the first, second and third factors explain most of data, i.e. sophisticated, elegant-beauty and simplicity, represent 79.54% of data. This means that this first three factors are very important Kansei space. It suggests that all websites should have these three factors in order to gain good business appeal. The fourth and fifth factors, richness and comfy, are also important but have weak influence. Therefore, these two factors are suggested to be used as background / supporting features in good website design.

5.2 Partial Least Squares (PLS) Analysis

PLS is a method for constructing predictive models when the factors are many and highly collinear, and the interactions between x variables are heavy. The nature of this study best suited this analysis method, and PLS analysis were performed to identify associations between Kansei and web design element.

The following describes partial results of PLS analysis.

Category	Item	Adorable	Range	Appealing	Range	Beautiful	Range	Boring	Range	
Body Bg Color	White	-0.03649	0.10015	-0.03670	0.10574	-0.01732	0.06569	0.02740	0.06968	
	Black	0.00605		0.01114		-0.01314		-0.00356		
	Dk Brown	0.06366		0.06904		0.02000		-0.04228		
	Lt Brown	0.01247		0.00987		-0.00432		0.00348		
	Grey	0.02467		0.03151		0.04837		-0.03951		
	Lt Blue	0.02520	0.00995	0.01758	-0.01612					
Body Bg Style	Picture	-0.00504	0.03755	-0.00972	0.03096	-0.00153	0.02760	-0.01272	0.05540	
	Texture	0.03251		0.02066		0.01801		-0.06811		
	Color Tone	0.00881		0.02123		0.02607		-0.03242		
Page Shape	Sharp	0.02780	0.05560	0.02998	0.05997	0.02159	0.04319	-0.02046	0.04093	
	N/S	-0.02780		-0.02998		-0.02159		0.02046		
Page Menu Shape	Curve	0.00398	0.04094	-0.00686	0.02953	0.00807	0.06454	-0.00940	0.06019	
	Sharp	-0.01401		-0.00420		-0.02303		0.02247		
	Mix	0.02693		0.02267		0.04151		-0.03773		
Page Style	Frame	0.03191	0.07782	0.02432	0.07020	0.02631	0.04929	-0.03636	0.07783	
	Table	-0.04161		-0.03566		-0.02298		0.04147		
	None	0.03621		0.03455		0.00991		-0.03082		
Page Orientation	Banner-Content	-0.04047	0.07705	-0.03718	0.09182	-0.02923	0.06176	0.02751	0.07709	
	Content	-0.00748		-0.01118		-0.01759		0.04718		
	Header	-0.05149		-0.05402		-0.03114		0.03572		
	Footer	0.01230		0.01128		0.02339		-0.01381		
	Horizontal-Split	0.01914		0.01751		0.00314		-0.01527		
	Vertical-Split	0.02281		0.03780		0.03062		-0.02991		
	Plain	0.02556		0.02030		0.01075		-0.01720		
Dominant Item	Picture	0.04672	0.09980	0.04769	0.09141	0.03111	0.05634	-0.04436	0.09126	
	Advertisement	-0.03070		-0.03236		-0.01779		0.02500		
	Text	-0.05308		-0.04371		-0.02523		0.04690		
	N/S	-0.01924		-0.02637		-0.02191		0.02371		
Page Color	White	-0.07098	0.11488	-0.06051	0.10091	-0.05233	0.08049	0.08195	0.12061	
	Blue	0.03249		0.02742		0.02478		-0.02271		
	Black	0.00149		0.00389		-0.01037		0.01080		
	Pink	-0.00044		0.00531		0.02094		-0.03851		
	Grey	0.04368		0.03846		0.02816		-0.03155		
	Colorfull	0.01369		0.00798		0.02084		-0.03866		
	Brown	0.04391		0.04041		0.01276		-0.02166		
		N/S		0.00240		-0.00353		0.01213		-0.02476

Legend: : Highest value : Lowest

Table 5: PLS result for design element and kansei

Table 5 shows part of PLS analysis result shown in terms best of scores for design elements in respective kansei. The first column lists design 'Category', which are the design elements of specimen identified in the preliminary study. The second column lists design 'Item', which are the value of the identified elements. The third column shows the score of each 'Item'. In each 'Item', largest positive PLS score indicates elements leading to good design, and largest negative value indicates elements leading to bad design.

In the table, each of maximum and minimum values is highlighted in purple and pink respectively. This translates most appropriate design value for a particular Kansei. For instance, best body background color that leads to the Kansei 'Adorable', is 'Dark Brown', and color that must be avoided is 'White'. Best dominant element to include in targeting 'Adorable' website is 'Picture', and element to avoid is 'Text'. The rest of the results follow accordingly.

The column 'RANGE' lists range value for each design category in each Kansei. Range is calculated using maximum and minimum value, where

$$Range = PLS_{Max} - |PLS_{Min}|$$

Mean of range is calculated, where

$$\overline{Range} = \frac{1}{n} \sum_{i=1}^n Range_i$$

Each Kansei has means of Range, and if the mean score of an ‘Item’ is larger than \overline{Range} , the item will have influence as the good design. From the result, Range for every ‘Category’ having value bigger than \overline{Range} , implies the appropriate ‘Design Element’ which influence consumer’s Kansei in website design. The rest of Kansei follows accordingly.

Kansei Infl. No.	Adorable		Appealing		Beautiful		Boring	
	Design Element	Range	Design Element	Range	Design Element	Range	Design Element	Range
1	Page Color	0.11488	Header Bg Color	0.12338	Picture Existence	0.09660	Picture Existence	0.14714
2	Product Disp. Style	0.10644	Face Expression	0.12216	Header Bg Color	0.08531	Fter Menu Font Clr	0.14382
3	Hdr Menu Bg Clr	0.10612	Hdr Menu Bg Clr	0.12077	Page Color	0.08049	Product view angle	0.13200
4	Lft Menu Font Clr	0.10370	Product Display Style	0.10646	Left Menu Link St	0.07868	Header Bg Color	0.12532
5	Header Bg Color	0.10218	Body Bg Color	0.10574	Main Font Size	0.07780	Page Color	0.12061
6	Face Expression	0.10024	Page Color	0.10091	Main Font Style	0.07307	Left Menu Font Clr	0.11534
7	Body Bg Color	0.10015	Left Menu Font Color	0.10085	Product view angle	0.06714	Product Display Style	0.11351
8	Dominant Item	0.09980	Picture Style	0.09771	Product Display St	0.06624	Picture Style	0.10189
9	Header Font Size	0.09651	Page Orientation	0.09182	Body Bg Color	0.06569	Top Menu Bg Color	0.09507
10	Main Txt Existence	0.08813	Dominant Item	0.09141	Page Menu Shape	0.06454	Main Text Existence	0.09380
11	Main Bg Color	0.08587	Main Text Existence	0.08811	Fter Menu Font Clr	0.06441	Main Font Style	0.09253
12	Main Font Style	0.08582	Main Font Size	0.08397	Lft Menu Font Clr	0.06422	Dominant Item	0.09126
13	Main Font Size	0.08324	Header Font Size	0.08359	Page Orientation	0.06176	Empty Space?	0.08926
14	Right Menu Link St	0.07868	Logo Location	0.08352	Picture Dimension	0.05774	Main Font Size	0.08588
15	Picture Arrangemnt	0.07865	Picture Existence	0.08208	Dominant Item	0.05634	Face Expression	0.08456
16	Picture Existence	0.07838	Main Bg Color	0.08194	Body Representation	0.05582	Main Bg Color	0.08322
17	Page Style	0.07782	Main Font Style	0.08092	Face Expression	0.05531	Hder Menu Bg Clr	0.08016
18	Picture Style	0.07776	Main Font Color	0.07968	Main Text Alignmnt	0.05309	Page Style	0.07783
19	Page Orientation	0.07705	Footer Menu Bg Clr	0.07852	Main Bg Color	0.05260	Page Orientation	0.07709
20	Picture Focus	0.07658	Picture Arrangement	0.07785	Page Style	0.04929	Left Menu Link St	0.07530
21	Page Size	0.07572	Image of?	0.07743	Hdr Menu Link St	0.04898	Face facing?	0.07418
22	Top Menu Bg Color	0.07260	Picture Focus	0.07635	Other Images?	0.04886	Left Menu Bg Color	0.07222
23	Top Menu Location	0.07131	Left Menu Link St	0.07471	Picture Focus	0.04868	Fter Menu Bg Color	0.07166
24	Hdr Menu Link St	0.06990	No of people in pict	0.07193	Page Size	0.04832	Body Bg Color	0.06968
25	Main Font Color	0.06945	Page Size	0.07095	Fter Menu Bg Clr	0.04548	Main Font Face	0.06838
26	Image of?	0.06919	Top Menu Bg Color	0.07025	Main Text Existnce	0.04539	Left Menu Font Size	0.06794
27	Fter Menu Bg Color	0.06871	Page Style	0.07020	Right Menu Link St	0.04470	Main Font Color	0.06594
28	Artistic Menu?	0.06774	Artistic Menu?	0.06968	Picture Arrangement	0.04428	Artistic Menu?	0.06432
29	Left Menu Link St	0.06719	Fter Menu Font Clr	0.06814	Face facing?	0.04412	Top Menu Link Type	0.06283
30	No of people in pict	0.06478	Top Menu Location	0.06789	Artistic Menu?	0.04370	Hdr Menu Link St	0.06223
31	Product view angle	0.06422	Empty Space?	0.06459	Page Shape	0.04319	Top Menu Font Style	0.06058
32	Logo Location	0.06360	Header Menu Link St	0.06221	Image of?	0.04175	Page Menu Shape	0.06019
33	Empty Space?	0.06176	Product view angle	0.06136	Picture Style	0.04135	Page Size	0.05958
34	Other Images?	0.06093	Page Shape	0.05997	Logo Location	0.04011	Right Menu Link St	0.05953
35	Fter Menu Font Clr	0.05864	Right Menu Link St	0.05895	Left Menu Bg Color	0.04007	Header Font Size	0.05937

Table 6: Dominant design elements in each kansei

Table 6 shows part of the result of the selected ‘Design Element’, which Range value is bigger than \overline{Range} , for each Kansei. The results are sorted in descending order to demonstrate dominant design element from highest to lowest for each Kansei.

The following table 7 illustrates part of the result of PLS score for each Kansei in relation to each sample website. In the table, largest positive value indicates website sample that best fit to the Kansei. On the other hand, largest negative value indicates most unfit website sample to the Kansei. In the table, both values are indicated in purple and pink color respectively. The result has made it possible for the study to discover and visualize which specimen highly induces what kind of consumer’s kansei.

ID	Adorable	Beautiful	Boring	Calm	Charming	Chic	Childish	Classic	Comfortable
1	3.23352	3.14276	2.39434	2.77595	2.93343	3.41967	2.06980	2.01726	3.02852
2	2.72056	2.94337	2.84746	2.70364	2.81997	2.82017	1.94619	2.08152	2.97260
3	3.68517	3.30493	2.66730	3.52251	3.55746	3.07788	2.11046	3.84500	3.60832
4	2.52333	2.92539	3.32273	2.83322	2.56347	2.45115	2.19049	2.20374	3.06234
5	3.06786	2.98098	2.83406	2.67317	2.66387	3.11172	3.12506	2.18806	3.00666
6	2.34030	2.58091	3.56973	2.66560	2.25456	2.12376	1.94987	2.79467	2.88071
7	3.16084	3.25413	2.58095	2.77491	2.90715	2.73127	1.85056	2.39251	3.20750
8	3.49967	3.35909	2.30261	3.32644	3.33457	2.66034	1.77639	2.57945	3.62130
9	2.65392	2.84483	3.31682	2.74922	2.23772	2.26767	2.05169	2.76947	2.95566
10	3.31305	3.00556	2.72732	3.49567	3.19025	2.33509	2.16910	3.48942	3.37944
11	2.96722	2.96223	3.08820	2.88259	2.68545	2.74939	2.23403	2.38529	3.61080
12	3.26369	3.43048	2.40299	3.16667	3.22916	2.85788	2.20716	3.31311	3.32008
13	2.87722	2.95498	3.19583	2.87777	2.57862	2.40100	2.45270	2.52575	3.25847
14	2.12599	2.69230	3.72111	2.68575	1.95756	2.04703	2.54259	2.33220	2.90018
15	3.32669	3.54718	2.44541	3.02450	3.12673	3.17880	2.07064	2.29411	3.16920
16	4.00896	3.66163	1.97005	3.56817	3.69670	3.20662	2.12679	3.40523	3.98117
17	3.88432	3.43218	2.31150	3.66133	3.69804	2.95288	2.11578	3.47594	3.96854
18	3.57208	3.21562	2.83233	3.49431	3.50153	2.81826	2.28145	3.95078	3.74056
19	3.62704	3.34410	2.34575	3.41167	3.44553	2.91245	2.44160	3.32148	3.73072
20	3.29579	3.24288	2.64988	3.37847	3.00881	2.60645	2.02792	2.62835	3.80632
21	2.89860	3.03359	3.17416	2.86390	2.75191	2.60149	2.01186	2.63597	3.02998
22	2.70295	2.65321	3.16572	2.75098	2.36060	2.01275	1.87660	2.45218	2.90928
23	2.82689	2.61171	3.50018	3.25762	2.20954	1.99025	2.26757	3.19859	3.21850
24	2.48816	2.48702	3.52643	2.66128	2.20659	2.01739	2.06610	2.45412	2.82323
25	3.79941	3.55885	2.37384	3.49784	3.70739	3.10873	2.10398	3.21922	3.79387
26	2.93272	3.22082	2.86249	2.62266	2.74952	3.03113	2.13778	2.42942	3.09308

Table 7: Specimen's kansei

As evident from the table, specimen design that best fit to evoke the Kansei 'Adorable' is specimen no. 16. The most not 'Adorable' specimen is specimen no. 14. The best fit sample that induced the kansei 'Calm' is specimen no.17. The most not 'Clam' specimen is specimen no. 26. Table 8 illustrates 10 results for specimen and it's kansei.











No.	Specimen	Kansei	No.	Specimen	Kansei
1		Chic	6		Classic
2		Crowded	7		Sexy , Elegant, Feminine
3		Boring, old-fashion	8		Childish
4		Cool, Masculine, Calm	9		Relaxing, Charming
5		Stylish, Refreshing, Comfortable	10		Simple, Plain

Table 8: Specimen's kansei reference table

5.3 Design Guideline

Factor Analysis has shown that the first three factors contribute ample score representing the whole variables. Despite the weak influence, the study has also suggested to include the following two factors as supporting features. Thus, the total factors decided to be included in the construction of design guideline is 5. The implicated factors consist of the kansei professional, cool, gorgeous, impressive, surreal, sophisticated, luxury, masculine, futuristic, mystic, elegant, adorable, charming, sexy, cute, beautiful, chic, feminine, plain, simple, light, natural and neat. Accordingly, the identified design elements and Kansei from PLS analysis is used to form the guideline to the emotional interface design of e-Commerce website. The following table shows partial result of the constructed guideline.

KANSEI	Design Element							
	Body Bg Color	Body Bg Style	Page Style	Page Orientation	Dominant Item	Page Color	Page Size	Logo Existence
ADORABLE	Dark Brown	Texture	None	Plain	Picture	Brown	Small	No
BEAUTIFUL	Grey	Color Tone	Frame	V. Split	Picture	Grey	Small	No
CHARMING	Dk Brown	Color Tone	None	V. Split	Picture	Grey	Small	No
LIGHT	Dark Brown	Texture	Frame	Content	N/S	Blue	Small	No
LUXURY	Black	Color Tone	None	Vertical Split	Picture	Black	Small	No
MASCULINE	Black	Color Tone	None	Header	Picture	Blue	Medium	No
MYSTIC	Black	Color Tone	None	Plain	Picture	Black	Medium	No
NATURAL	Dark Brown	Color Tone	None	Vertical Split	Text	Brown	Medium	Yes
NEAT	Light Blue	Color Tone	Frame	Footer	Text	Blue	Small	Yes
PLAIN	Dark Brown	Picture	Table	Content	Text	Brown	Medium	No
PROFESSIONAL	Dark Brown	Color Tone	None	Vertical Split	Picture	Blue	Small	No
SEXY	Dark Brown	Color Tone	None	Content	Picture	Grey	Small	Yes
SIMPLE	Dark Brown	Picture	None	Content	N/S	Brown	Medium	No
SOPHISTICATED	Grey	Texture	None	Vertical Split	Picture	Grey	Small	No
SURREAL	Dark Brown	Texture	None	Vertical Split	Picture	Grey	Small	No

Table 9: Kansei e-Commerce interface design guideline

5.4 Database Construction

Results from the study enable the paper to construct Kansei Database System (KDS) to streamline the Kansei e-Commerce interface design guideline. The presented KDS consists of Kansei Word Database (KW DB), web Design Element Database (DEDB), LOGIC and Kansei Design Database (KDDB). The result of Kansei space identified from Factor Analysis is to be stored in KWDB. The result of design elements identified in the study of detail design elements are to be stored in DEDB. The result from dominant design elements and design guideline identified from both FA and PLS analysis is to be stored in LOGIC. Finally, as an underpinning guide to designing the intended Kansei website design, the PLS result for specimen's Kansei is to be stored in KDDB.

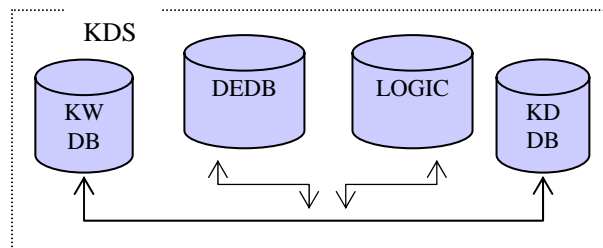


Figure 2: Kansei Database System (KDS)

In terms of deployment, this KDS enables the set-off of computer systems for e-Commerce web design. The proposed systems are Expert Kansei Web Design (KanseiExpertWeb), Collaborative Kansei Web Design (KanseiCollaborativeWeb) and Hybrid Kansei Web Design (KanseiHybridWeb).

5.4.1 Expert Kansei Web Design (KanseiExpertWeb)

The give an illustration of the proposed deployment, the paper describes KanseiExpertWeb. In this expert system, web design acquirer will input a KW via selection form a list of existing Kansei words into the Client Interface (CI). The KW will be processed to identify the semantic taxonomy in reference to the KW DB. Inference Engine will then handle the associated design with the KW, extract the design elements with the detail attributes from DDB and LOGIC, and send a design example to be displayed on CI. Further enhancement to the example can be proposed to the system in the form of design template. This template can later be saved for end use.

The system structure of KanseiExpertWeb is illustrated as the following.

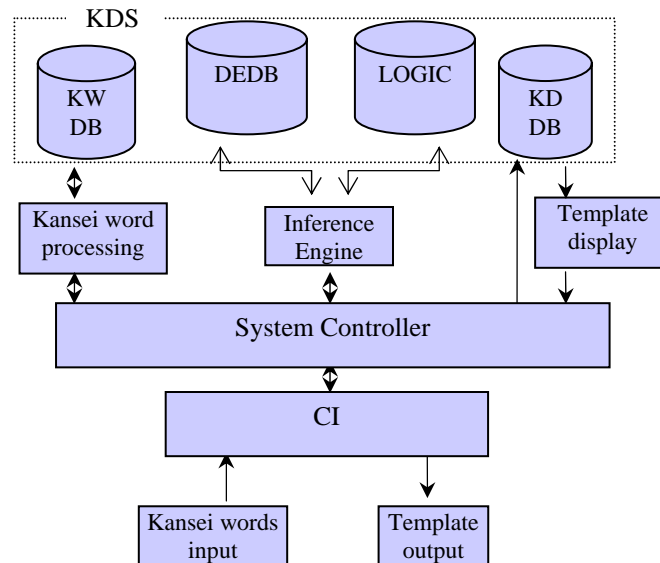


Figure 3: System Structure for ExpertWeb

5.4.2 Collaborative Kansei Web Design (KanseiCollaborativeWeb)

The main objective of Kansei Engineering is to reach optimum understanding between end-user's requirements (emotion) and product design specification by designers. Hence, results from the study are proposed to be utilized as a basis in this KanseiCollaborativeWeb. The result can be used as a bench-mark to enhance mutual understanding between parties. A system can be structured so as to provide medium for client and web designers located in separate places to collaborate in the process of designing a website.

In this system, a client input a KW by key input or via selection form a list of existing KW into web client interface. The system will check existence of KW. If it exists, then the KW will be processed to identify the semantic KW in reference to the KWDB. Inference Engine will then handle the associated design elements with the KW, extract the design elements with the detail attributes from DEDB and LOGIC, and send a proposed design to be displayed on the client browser. Client can then choose to accept the design or participate in examining the web design and express his kansei. Same process happens when a designer designs a new website. The new design will be sent to client, and client will examine and express his kansei against the web design. The process repeats until agreement can be achieved. Next, web designer must classify each design elements of the accepted website design and store them to the system. Later, the system will process and analyse data generated by both client and designer, and finalize the kansei web design which induces the client Kansei. As a result, not only KWDB will be updated, but also the web design will always be updated as accuracy of kansei advances.

5.4.3 Hybrid Kansei Web Design (KanseiHybridWeb)

A system can also be structured in assisting web designers during the process of designing a website. As semantic KW, design elements and attributes are identified from the experiment and stored in the databases, designers can extract design element and attribute from the system as a basis in sketching his idea of a web

design. To help examine whether the targeted kansei is induced in his design, the designer can use the system to examine the web design through the means of e.g. image recognition system. The system will auto-examine the new web design and conclude the associated Kansei in reference to the KWDB, DEDB and LOGIC. This will help web designers identify his achievement of targeted kansei design. This kind of system is possible for use in training programs and evaluation process to certify a competent kansei web designer.

6 Conclusions

Many studies have proven that Kansei Engineering works very well in the engineering field. However, in the web space, Kansei Engineering is still in its infancy. Isolated work has shown the possibility of incorporating emotional usability in the design of websites which draws on the new paradigm of producing desirable websites as opposed to common concentration on website functional usability and performance.

The research explores the implementation of Kansei Engineering in the effort of embedding emotional signature in e-Commerce website design. Factor Analysis and Partial Least Squares analysis were performed to identify factors, Kansei Word's structure, association between Kansei responses and design elements, and determine specimen's kansei. The results from both analysis have made it possible for the study to produce a guideline for emotional interface design of e-Commerce website. The constructed guideline is then systematized into Kansei Database System (KDS). The presented KDS could be deployed to form different kind of stand-alone and distributed systems, providing knowledge sharing and easy access to the guideline. From the KDS, three system structure for kansei web design, i.e. the KanseiExpertWeb, KanseiCollaborativeWeb and KanseiHybridWeb were proposed, which form a decent contribution as a design tool in the production of emotional interface design of e-Commerce website. The study has also produced a table of reference into specimen's kansei, which delivers significant contribution to the design of Kansei e-Commerce website.

Nonetheless, this study were performed exclusively to the domain of clothing website, and subjects employed were young age group. Thus, the result may not represent the whole population of e-Commerce website and target market segment. We also perceive that the adoption of Kansei Engineering is not risk free. Since Kansei is highly dependent on the indigenous characteristics of cultural races, this study of engineering kansei into e-Commerce websites may not produce globally accepted features. Consideration on the universal context of kansei will be considered in our future work.

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