THE COMPILATION OF EMOTIONAL EVALUATION PARAMETERS

FOR TAIWAN PLUMING, FURNITURE AND MACHINE TOOLS INDUSTRY

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ABSTRACT

In the recent years, many Taiwan's companies attempt to make the transition from OEM to ODM manufacturing. Responding to the need of industry to evaluate or measure design execution in product development, this research develops evaluation parameters to perceive design and give efficient and effective product feedback. This research is based on the 70 design indexes from Human design technology (Yamaoka, 2012), and aims to develop a design evaluation index to measure design quality and discover the challenges from Kansei perspectives for industries in Taiwan. Therefore, focus group and KJ method were used to reanalyze then simplify the 70 design items into 50 parameters. With the parameters been gradually established, seven facets were extracted as the "Seven Emotional (kansei) Elements", included happiness, heart-warming, relaxing, convenience, stability and reliability, safeness and environment-friendly. The Kansei evaluation parameters were tested in Taiwan industry for verification. Finally, each parameter was designed into a card, and the validation has discussed for modification.

Keywords: Kansei Engineering, Emotion, Evaluation Parameters, Design, Product Development

1. MOTIVATION

This research was initiated with a grand vision to facilitate Taiwan's economic growth through the implementation of design methodologies. Historically Taiwan's economic growth came from OEM manufacturing. In the recent years, many companies attempt to make the transition from OEM to ODM. This research responds to the need of industry to evaluate or measure design

execution in product development. Emotional (Kansei) evaluation parameter assesses products based on emotional perspective to perceive design and give efficient and effective product feedback in product development.

Existing methodologies, such as Kansei methodologies, revolved around market survey, analysis and categorization. Often times are too theoretical, too complex, or too abstract, and rarely focuses on a technique to evaluate design. This research is based on Human design technology 70 design indexes (Yamaoka, 2012) to develop the product evaluation parameters for Taiwanese industries.

2. PURPOSE

The goal of this research is to develop a design evaluation index to measure the design quality and discover the challenges from emotional (Kansei) perspectives for the industries in Taiwan. There are three phases in the research: (1) Aggregation of emotional design parameters; (2) Design of emotional evaluation parameter; (3) Industry test and validation.

3. LITERATURE REVIEW

Kansei Engineering has been developed to deal with customers' subjective feeling or emotions of a product (Nagamachi, 1996) Yet Kansei terms are normally abstract, fuzzy, or conceptual terms, leaving space for vague assumptions and implicit inference. (Jiao, 2006)

Enforced hierarchical structure(Saaty,1980) or AND/Or tree structure for the articulation of customer needs, for example the requirement taxonomy (Hauge & Stauffer, 1993), the customer attribute hierarchy, (Yan, et al., 2001) and the functional requirement topology (Jiao & Tseng, 1998). Some methods strengthen hierarchical structure to better convey users' needs, for example Hauge & Stauffer (1993) requirements taxonomy structured in AND/Or tree or Tseng & Jaio (1998) functional requirement topology. Some methods customer needs with semantics. Sedgwik et al (2003) uses semantic differential techniques for packaging surface characteristics, similarly Kawakita Jiro (KJ) method (Kawakita, 1991) and multi-pickup method (MPM) also analyzes from the semantic level.

Many methods focus on analysis, understanding and projection of customer needs. Ofuji's method, assists in finding customer needs, it is difficult to translate these needs into design requirements. Information customers, marketing employee, and design engineers do not have a common language. (Jaio et al. 2006)

This research attempts to bring both semantic and hierarchical structure into variables understandable by all parties, including customers, marketing, design, and engineers for a company's product development process.

4. APPROACH/METHODOLOGY

This research begun with T. Yamaokas' "Human design technology and construction principles" derived 70 design items which evokes Kansei reaction. Two methods; focus group method and KJ methodology were used to reanalyze then simplify the 70 design items into 50 parameters fit for Taiwanese industries. A list of parameters has little value when applied into industry design, this project took the abstract parameters to create tangible design evaluation card set. These cards are validated with local industries for practical feedback. The validation process is recorded. The emotional evaluation parameters are optimized according to feedback and observations. This session will elaborate on methodologies and steps used.

4.1. Aggregation of emotional design indexes

The assembly of emotional evaluation parameters consists of two steps: deconstruction and reorganization of design parameters (section 4.1.1), and deriving the emotional elements (section 4.1.2).

4.1.1. Deconstruct and reconstruction of parameters

During the construction of emotional evaluation parameters, a total of three focus groups studies were conducted for validation and modification. Each focus group session includes 9 design master graduates, familiar with product design process and with design related background. As the target end user for the emotional evaluation tool are for Taiwanese industries, thus the main language used was Mandarin Chinese, terminologies were adjusted into habitual vocabulary. Below depicts two of the focus group sessions.

With the intention to increase productivity during analysis of design parameters, the research begun with providing participants human design technology's 70 design items original terminology and Chinese translation, as a reference for discussion. Additionally, the Kawakita Jiro (KJ) method (i.e. affinity diagram) was applied. All participants focused on discussing one item at a time. This increased focus and assisted documentation of results, preventing participants affected by fatigue. This research contained three round of focus group discussion, each consisting with two hours of categorization.

As a result, 50 "emotional evaluation parameters" were compiled through the use of three focus group method, from 70 human design technology design items. The documentation of three focus group meetings is shown on Table 1.

Table 1: Emotional evaluation parameters and definitions

No.	Emotional Evaluation Parameters	Definition of Emotional Evaluation Parameters
1	Aesthetics	Simplicity or harmony of form allowing one to appreciate it's beauty
2	Good texture	Consists of quality material allowing the user to enjoy the product
3	Fitting color	colors used fits its design image or scenario
4	Simple graphic display	The operator panel layout is fit its position and proportions

5	Clear precise style	clearly communicates product style and image
6	Easy to operate	Great experience is created when being used
7	Fits scenario	fits in the environment and cohesive to the scenario
8	Innovative combination	a new or Innovative combination giving users a fresh experience
9	Excellent function	has good functions allowing user satisfaction beyond expectations
10	Builds satisfaction	Through progressively building towards a goal, users accumulate the feeling of satisfaction
11	Customizable setting	user can adjust the structure and order of the product
12	Power of choice	allows users to proceed based on their own choices
13	Substitution	When parts do not function correctly, there are still means to achieve the desired actions
14	Assistance	provides users with effective problem solving support
15	Kind reminders	Provides additional and unexpected feedback allowing users to feel touched.
16	Considers user background	Puts in consideration the cultural fit
17	Guidance	Simplicity or harmony of form allowing one to appreciate it's beauty
18	Operation instructions	Provides clear instruction for novice users to easily follow operation procedures
19	Strengthening of main points	Communicating through highlighting information in a way users can accept
20	Smooth process flow	Providing a smooth flowing operation
21	Reduce physical burden	Minimize burden or work the user physically requires
22	Ergonomics	Fits human ergonomic design
23	Intuitive	Provides users an operation experience which can be understood upon seeing it the first time
24	Consistency in operation methods	The logic behind operation is consistent
25	Effective operation	Minimize the number of steps required to improve efficiency
26	Easy to retrieve information	Allowing users easily access to specific information
27	Understandable	Provides visual aid or icons to understand signal or message conveyed, allowing users judge and correctly react upon information
28	Readability	Allowing users to easily read information provided
29	Providing necessary information	Provides user enough important information to correctly judge systems state
30	Overview	Provides a complete overview of message and signals
31	Easily maintain or repair	Can be efficiently repaired or provides replaceable parts
32	Common parts	Specification of components are commonly used
33	Selection of material	According to user scenario, applying fit material on products ensure stability during use
34	Strengthen external form	Strengthen regional parts to product against external forces
35	Strengthening of internal	Strengthening of internal structure to insure product's stability

	structure	
36	Dispersion of impact	When receiving pressure from outside, product has the ability to separate impact equally
37	Durability /Length of life cycle	Ability to lengthen product lifespan
38	Form-fitting design	The use of form to insure correct usage
39	Tolerance to mistakes	The system allows common and expectable mistakes to occur
40	Prevention of misuse	Ability to prevent users from incorrectly forms of contact or use.
41	Automatic protection	The application of physical principles to provide a self-protection mechanism and insure safety
42	Chained protection	Forces user to follow correct operation methods to proceed for correct use
43	Elimination of danger	The elimination of dangerous parts
44	Isolation of danger	A protective mechanism to product users from danger through separation
45	Warning sign	Display of warning signal, informing users of the system or products dangerous aspects
46	Recycle to reuse	Ability to recycle and reuse
47	Minimal material	The use of minimal manufacturing material to achieve the same results
48	Harmless material	The selection of material with minimal impact on environment or human body
49	Regional replacement	The ability to replace specific parts
50	Shortening manufacturing process	Affectively shortening production time while increasing product rates

4.1.2. **Relative emotional facets**

In the step, the new categorizations were discussed through applying KJ method (reference to Figure 1) with reference to the 8 original facets (山岡俊樹, 2003) (see table 2), seven new facets were extracted to create the “Seven Emotional Elements”; “Happiness”, “heart-warming”, “Relaxing”, “Convenient”, “Stability and reliable “, “Safeness”, “environmentally-friendly “. Each aspect is relative to more than one emotional evaluation parameter.

Figure 1: Extracting emotional facets by applying KJ method

Table 2: 8 original facets (山岡俊樹, 2003)

No.	8 original facets (山岡俊樹, 2003)	
1	ユーザインタフェースデザイン関係 (29 項目)	User Interface Design
2	ユニバーサルデザイン設計項目(9 項目)	Universal Design
3	感性デザイン項目(9 項目)	Kansei Design
4	安全性(PL)項目(6 項目)	Safety-related Design (PL)
5	ロバストデザイン項目(5 項目)	Eco-Friendly and Sustainable Design
6	メンテナンス(保守性)項目(2 項目)	Robust design
7	エコロジーデザイン項目(5 項目)	Maintenance
8	その他（HMI の 5 側面他）(5 項目)	Others (Human Machine Interface)

4.2. Emotional evaluation card

The emotional evaluation parameters were tested in Taiwan industry to verify if the content for each parameter are communicated effectively, whether the parameters are unclearly defined parameter, repetitive or unevaluable. During this phase, each parameter was made into a card. Design examples were found to explain each parameter.

To further assist industry easy in use and understanding of each parameter, specific procedure was designed for the parameters and named the emotional evaluation toolkit. To increase user involvement and make the evaluation procedure more interesting, each card includes: (A) a parameter number; (B) parameter name; (C) parameter definition; (D) visual example; and (E) description of example; on the back of the card includes (F) emotional facet(s) of each design parameter. The example can be seen in Figure 2.

Figure 2: Example of one emotional evaluation card

4.3. Industry validation

The validation of emotional evaluation parameters was conducted by inviting company from the pluming industry, furniture industry and machines tool industry to participate. The following

pictures in Figure 3 shows the scenario where an engineer from the machine tool industry is guided through the series of validation procedures.

Figure 3: Validation of emotional evaluation tool with Machine tool industry

A total of five companies participated in the validation. Each session was conducted using the same cards and designed procedures to evaluate the company's product. While the researching facilitator guides the company in evaluation of the company product using emotional evaluation cards, another researcher records the interaction and understanding for each parameter. Recorded content includes; understanding of participant, hesitation, readability, repetitive explanation, and modification of each parameter. Feedback and modifications made are recorded in section 5, results and conclusion.

5. RESULTS AND CONCLUSION

In continuation to the last section where the research process is described, the emotional evaluation cards as a tool is described in section 5.1, the actual feedback and modification are described in section 5.2.

5.1. Emotional evaluation module

Using T. Yamaokas' 70 design items "Human design technology and construction principles" as a basis to develop the 50 emotional evaluation parameters, KJ Method was applied to derive the 7 main emotional elements, together creates the emotional evaluation module.

Emotional evaluation tool is the collection of the emotional evaluation parameters, where each parameter corresponds to one or more emotional element. Using card number 11 as "Customizable setting" as an example: Its definition is "user can adjust the structure and order of the product", reflecting the user's control and personalize on the content, corresponds to both elements "heart-warming" and "convenient". The diagram below shows the correlation between parameter and elements.

Table 2: Correlation between evaluation parameters and emotional elements

Emotional Elements	Emotional Evaluation Parameters (Number)
Happiness	Aesthetics(1), Good texture(2), Fitting color(3), Simple graphic display(4), Clear precise style(5), Easy to operate(6), Fits scenario(7), Innovative combination(8), Excellent function(9), Builds satisfaction(10)
Heart-warming	Good function(9), Customizable setting(11), Power of choice of the user(12), Substitution(13), Assistance(14), Kind reminders(15), Considers user background(16), Guidance(17), Operation instructions(18), Strengthening of main points(19), Automatic protection(41)
Relaxing	Guidance(17), Operation instructions(18), Strengthening of main points(19), Smooth process flow(20), Reduce physical burden(21), Ergonomics(22), Intuitive(23), Consistency in operation methods(24), Effective operation(25), Easy to retrieve information(26), Understandable(27), Readability(28), Providing necessary information(29)
Convenience	Customizable setting(11), Smooth process flow(20), Easy to retrieve information(26), Providing necessary information(29), Overview(30), Easily maintain or repair(31), Common parts(32), Regional replacement(49)
Stability and Reliability	Substitution(13), Selection of material(33), Strengthen external form(34), Strengthening of internal structure(35), Dispersion of impact(36), Durability (Length of life cycle)(37), Form-fitting design(38), Tolerance to mistakes(39)
Safeness	Selection of material(33), Strengthen external form(34), Strengthening of internal structure(35), Dispersion of impact(36), Tolerance to mistakes(39), Prevention of misuse(40), Automatic protection(41), Chained protection(42), Elimination of danger(43), Isolation of danger(44), Warning sign(45), Harmless material(48)
Environment-friendly	Length of life cycle(37), Recycle to reuse(46), Minimal material(47), Harmless material(48), Regional replacement(49), Shortening manufacturing process(50)

5.2. Validation and modification

After validating parameters with Taiwanese companies in the three main industries, feedback and observation forms were analyzed. Optimization for the emotional evaluation module, the 7 emotional elements, and emotional evaluation parameters are analyzed in the following sections. The validation process was not limited to participants' role or responsibilities. The validation session includes opinions and understanding from managers, designers, engineers…etc.

5.2.1. Seven emotional elements modification sugestions

When industry representatives used the seven emotional elements, a few participants had different understanding for each definition. Thus a definition was given to the seven elements. Of the seven elements, relaxing and convenient were easily confused. Thus relaxing was modified to specifically refer to whether "information communicated" was easily received, while convenient focuses on the interaction level, if the process was conducted smoothly and efficiently. Definitions for the other seven elements are translated as below.

Table 3: Definitions of the seven elements

Emotional Elements	Definitions of Emotional Elements
Happiness	Product and product interaction allows users a feeling of happiness
Heart-warming	Product provides feedback or assistance allowing users experience to surpass expectations
Relaxing	Ease to receive information, or the product alleviates user's burden
Convenience	Product allows affective work flow during use and repair
Stable and Reliable	Structure or system of product is stable or reliable
Safeness	Product considers dangerous situations or emergency precautions
Environment-friendly	Material or manufacturing process is environmentally friendly and reduces harm

5.2.2. Emotional evaluation parameter selection and modification sugestions

Our validation results proves effective in evaluating product from various perspectives, to affectively guide, stimulate discussion, and initiate reflection. Each parameter was tested and modified to fit Taiwan industry understanding. During the process of industry validation, two cards within the emotional evaluation parameter, customizable setting (card 11) and Power of choice (card 12) were easily confused. For example, the name "users power of control was modified into "users power of choice (card 12)". As design parameter were translated into emotional evaluation parameters applicable by the industry, each parameter was given a description. After validation, parameters and were found to be unclear or confusing, and were modified respectively. Through validation, the picture was modified to highlight the doors of separation, further strengthening the definition.

6. FUTURE WORK

In continuation to the pervious section, industry validation feedback and suggestions for modification resulted in future research direction based on "evaluator (user)" and "industry differences", the two directions are evaluated below to elaborate on:

1. consideration for user

The emotional evaluation parameters itself are a qualitative measurement, it becomes difficult to separate subjective variables such as the user background, experience or values. Different industry background or different rank and roles within a corporation could easily result in different results. Secondly, the research suggests further studies for "product developer" and "user" to have separate sets of evaluation process; or to develop a method for evaluators cross analyze and manage data evaluated for the same product; create more objective process decipher data, the implications behind parameters results.

2. Differences across industry

In different industries, product development and markets vary greatly. When emotional evaluation parameters were applied, features for each industry were not put in consideration. More validation for industry products are needed to further optimize the emotional evaluation parameter module. The goals and target users for each industrial product are different, not all emotional evaluation parameters are applicable to each industry. To increase emotional evaluation parameter reliability, this research suggests further studies regarding how to adjust modify parameters when used on specific industrial products.

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