

## An Analysis to Determine the Priority Emotional Design in Kansei Engineering by using the AHP Approach in Product Development

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### ABSTRACT

The customer satisfaction is as the challenges on how they can deliver the quality of product for their success and survival in today's competitive environment. Based on this reason, this research is carried out to identify and investigate the satisfaction toward the customer requirement of the product development based on their emotional feeling and how deep we can interpret those meanings behind the quality attributes in product. This study highlights the integration study between Kansei Engineering (KE) and Analytical Hierachy Process (AHP) which in practice towards the product development. KE used to find, obtain and interpret emotional needs of consumers of a product, investigate what the customer requirement based on their emotional feeling articulated in Semantic Differential scale context. In order to support, the research is conducted among 100 respondents as a sample size towards car user in Klang Valley, Malaysia. Studies proved and showed that there an existing correlation appears and significant findings between the emotional design quality and product chosen. A daily life product will be used as case studies (car center stack), as a real situation feature to apply the idea. Results, by using the Analytical Hierachy Process (AHP) as a decision maker, the design No 2, is the best design selected among 4 final designs in concept generation. It gives the emotional feeling of Ideal (Kansei Word). The ideal design of the car center stack is the design that has practical arrangement and not too fancy and too crowded in the middle of the stack. This study found that and shows us that the perceived attributes or qualities is impacted or influenced against the emotional design.

**Keywords--** Kansei Engineering, AHP, Row Geometric Mean Method

In last two decades, the technology growth as fast as before, now it has attained a saturation level so in order to remain competitive, companies can expand their designs and produce a product for all users (generalization) because some companies are no totally being able to adequately satisfy the need of customers towards what is produced or provided. In positioning of the generalization and individualization (customization) in company, as example the others technique such as market segmentation and customer analysis has been developed (Juran, 1992, William and Soutar., 2009). The technique's goal is more to define the most effective set of consumers' classes so that companies can concentrate on customers' requirement in order to serve them better. The propose approach in this research will leads to discover on how the consumer experience, how to evaluate product performance as the challenges faced by companies to undertake the design and also a function and documentation of a product offering.

Above all, all elements aforementioned must be considered to satisfy the consumer in order to gain their satisfaction and exceeds their expectations. The most attractive element in order to relate product and satisfaction besides safety and functional, as suggested by Norman (2004), that the attractive things work better to influence the way human minds to solve the problem because the aesthetic value will influence the emotion. For that purpose, the research will be carried out to optimize the success in the developing the product, the functional and emotional considerations should be able to collaborate to ensure an overall good design (Jordan, 2000; Norman, 2004). Mainly, to study the relationship factor between product and person itself and how this correlation can be matched towards the customer satisfaction.

### I. INTRODUCTION

## II. THEORETICAL APPROACH

### 2.1 Kansei Engineering

Kansei engineering is a method for translating feelings and impressions into product parameters. The method was invented in the 1970 by Prof. Nagamachi at Kure University (now it calls by Hiroshima International University). Prof. Nagamachi recognized that companies often want to quantify the customer's impression of their products. Kansei Engineering can "measure" the feelings and shows the correlation to certain product properties. In consequence products can be designed in a way, which responds the intended feeling. Kansei Engineering's objective is to be able to capture and understand human's feelings and consideration, and translate those aspects into product design and development (Syaifoelida et al., 2013). Its main objective is towards customer's satisfaction in using the final product. For example, Sports cars can be described with the adjectives like sporty, powerful, and elegant but, which parameters influence these impressions? Kansei Engineering can show to what extent such as the gear ratio, suspension and the engine power, has an effect on these impressions (Lanzotti & Tarantino, 2000). Moreover, target values for the mentioned product properties can be derive.

There are some aspects and features in a product that customers are not aware of, but when they use it, they can feel it. It is difficult to be explained, but it's there. So, the goal of Kansei Engineering is to study those features and use it to create a designs and products. That is why the understanding of semantics is important in Kansei Engineering, throughout the process; we will be collecting Kansei words. Kansei words are words that describe the product. For example, when describing a car, adjectives such as fast, beautiful, and economical are used. Besides adjectives, verbs and nouns can also be used to express the Kansei words. Numbers of Kansei words can range from 80-600 words, (Nagamachi, 1997). Words with similar meanings are compiled to a bank of words. The human brain is able to translate with more than one information process that called Kansei process and the intelligence process.

### 2.2 Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) is a theory of estimation through pairwise correlations and depends on the judgments of specialists to induce require scales. It a multi criteria decision method because its advantage and this method has been use in many fields (Koc and Burhan,2015). These scales that measure intangibles in relative terms. The correlations are made utilizing a size of supreme judgments that speaks to, the amount more, one component rules another as for guaranteed characteristic (Saaty, 2008). To make decisions we need to separate the decision into several steps.

- Define the problem and decide the sort of information looked for.

- Structure the decision hierarchy of leadership from the top with the goal of the decision, then the goals from a broad perspective, through the widely appealing levels.
- Develop an arrangement of pairwise correlation systems. Every component in an upper level is utilized to look at the components in the level instantly underneath with regard to it.
- Use the priority obtained from the correlations with measure the needs in the level quickly underneath. Do this for each component. At that point for every component in the level underneath include its measured values and get its overall or overall need. Proceed with this procedure of weighing and including until the last needs of the options in the base most level are acquired.

### 2.3 Concept Selection and Concept Generation

Okudan & Shirwaiker (2006) claimed that this is the process toward surveying thoughts with respect to customer needs and other criteria, differentiating the relative qualities and weaknesses of the ideas, and selecting at least one ideas for further examination, testing, or improvement. Hence, the method presented is also useful in the development process when their must select subsystem concepts, components, and production processes. Methods vary in effectiveness and include the following:

- i. External decision – customer, client and some external entity makes the decision
- ii. Product chosen – choose concept based on personal preference
- iii. Intuition – chosen.by feel
- iv. Multivoting – team votes for several concepts
- v. Pros and Cons – strength and weakness are listed and makes a choice
- vi. Prototypes and test – build and tests prototypes, making decision based
- vii. On the test data
- viii. Decision matrices - The team rates each concept against pre specified selection criteria, which may be weighted.

Idea determination is regularly performed in two phases as an approach to deal with the many-sided quality of assessing many item ideas. The two phases is Screening and Scoring (Chinkatham and Cavallucci, 2015). As example, the idea screening is created by Stuart Pugh in the 1980s and is frequently called Pugh concept selection. Purposes behind existing are to constrain the amount of thoughts quickly and to enhance the ideas (Liu and Yu, 2014). For idea scoring is utilized when expanded determination will better separate among contending ideas. The group measures the relative significance of the choice criteria and spotlights on more refined examinations with respect to each establishment in concept.

## III. METHODOLOGY

Kansei Engineering’s purpose is to improve quality. Product development can be thought as the process to transform market demands and opportunity into a product for sale. It requires knowledge not only from engineering but also from economics, art, and others. The whole process can be roughly divided into investigation of the market, development of product design specification, concept design, detailed design, manufacture and selling. The main attributes came from method of Kansei Engineering from the product that be chosen. On the scope of studies, a car center stack is chosen as a product (Figure 1) domain in order to apply a qualitative measurement in the real situation. Next, the data has taken from 100 respondents based on the population in Klang Valley area. It was selected based on the designs and the current trend. These car center stacks are divided into few parts such as conditioner button shape, position of radio button and

compartment.



Figure 1. Car Center Stack

Based on the analysis part towards the existing product in market, the concept generation is applied and the final design is obtained as listed in Table 1. While in Table 2 is the listed of Kansei words, the words that represent the emotional feeling respondent against the product chosen. Kansei words used with the semantic differential (SD) to articulate the design characteristics in

terms of emotional or quality affective. These word banks example will be a final Kansei words for the final survey of the product. Only one word from collected word banks will be choosing to be a main word or grouping leader. Table 3 below shown the word banks and their main word for each word banks to be evaluated SD Kansei words in Likert scale (Table 4).

Table 2: Propose Design

| DESIGNPROPOSED | DESIGNCHARACTERISTIC   |
|----------------|--|
| Design 1       | LCD screen, rectangular shapes for the air conditioner, roundness adjustable air conditioner, storage compartment and USB socket.  |
| Design 2       | Rectangular base on LCD screen, rectangular shapes for the air conditioner, roundness adjustable air conditioner, storage compartment, USB socket and also has the compartment for drinking water. |
| Design 3       | LCD screen, roundness shapes for the air conditioner, roundness adjustable air conditioner, storage compartment and USB socket.  |
| Design 4       | Rectangular base on LCD screen, rectangular shapes for the air conditioner, roundness adjustable air conditioner, storage compartment, USB socket and also has the compartment for drinking water. |

Finally, four designs concept were created through concept generation and selection technique that adopted. CREO software was used in designing process and have been developed in neutral (standard) color analysis. The

adaptation of neutral color is important to implement because to avoid the psycholocial influence in mind among respondent during interview and survey. Hence, as a one of validation technique.

Table 3: Kansei Words Grouping

| Atractive  | Glamorous   | Ideal       | Simple  | Futuristic    |
|------------|-------------|-------------|---------|---------------|
| Beautiful  | Fashionable | Comfortable | Compact | High Tech     |
| Luxurious  | Style       | Presentable | Precise | Intellectual  |
| Refreshing | Modern      | Friendly    | Solid   | Understanding |
|            | Smart       | Safely      | Smooth  | Innovation    |
|            | Unique      |             | Shapely |               |
|            | Youthful    |             |         |               |

Table 4: SD Kansei Words

|             |   |   |   |   |   |   |   |            |     |
|-------------|---|---|---|---|---|---|---|------------|-----|
| Offensive   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Attractive | O/A |
| Inelegant   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Glamorous  | I/G |
| Impractical | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Ideal      | I/I |
| Complex     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Simple     | C/S |
| Traditional | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Futuristic | T/F |

#### IV. RESULT AND DISCUSSION

The total 100 respondents in Klang Valley is chosen as a sample size of the population, the majority of respondents are male with percentage of 54%. For the age, the percent for 18 to 25 years is 33%. But the highest or the most age survey come from 26 years to 35 years, that is 45%. Furthermore, the design will be analyzed through

AHP as a decision maker by using the 7-points of Likerts scale.

##### 4.1 Kansei Words Preference

Figure 2 depicted the Kansei words preference, which is the Futuristic word gain the highest voted compared to the other Kansei words. Respondent felt that the element that has on the Design No 1. looks Futuristic (T/F) base on LCD screen, rectangular shapes for the air conditioner, roundness adjustable air conditioner, storage compartment and USB socket.

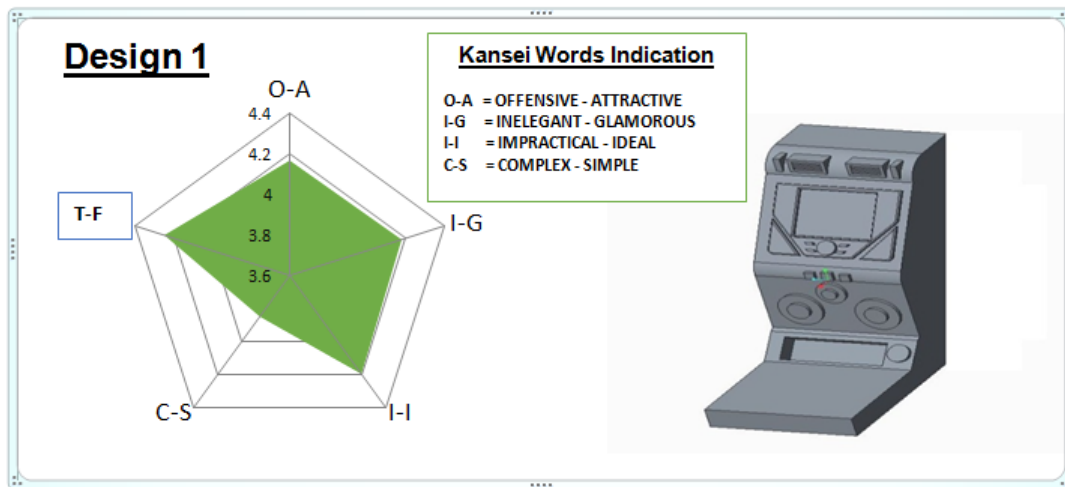


Figure 2. Kansei word Result for Design No. 1

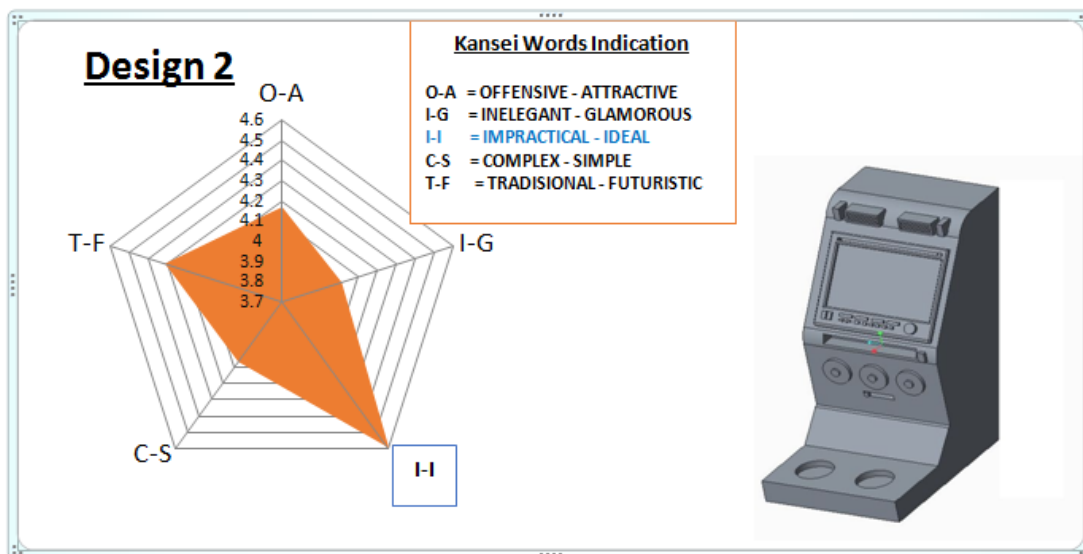


Figure 3. Kansei word Result for Design No. 2

From the graph on figure 3, can see that the Ideal (I/I) Kansei Word gain the highest rated. Respondent see and felt that the Design No.2 is more ideal with the elements of rectangular base on LCD screen, rectangular

shapes for the air conditioner, roundness adjustable air conditioner, storage compartment, USB socket and also has the compartment for drinking water.

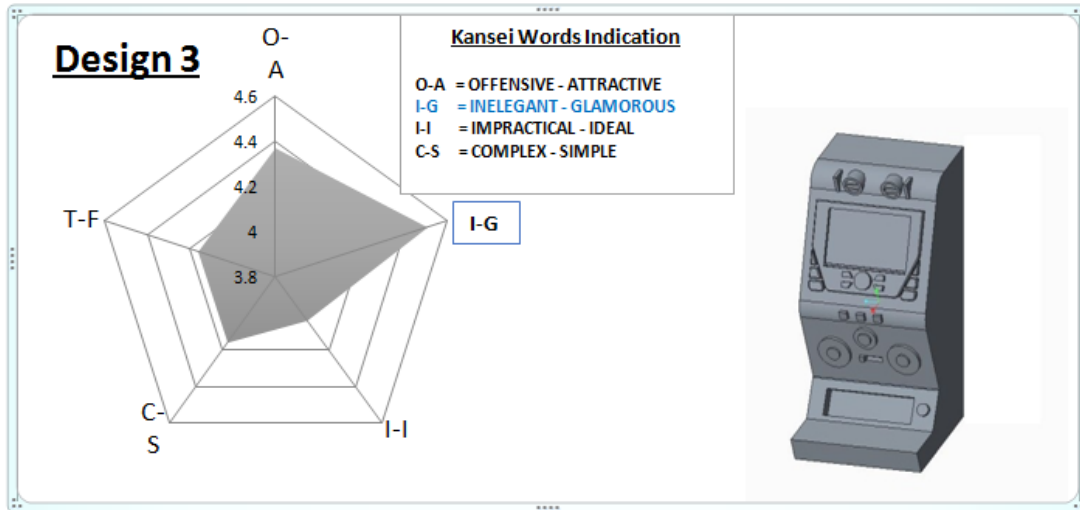


Figure 4. Kansei word Result for Design No. 3

Kansei word of ‘Glamorous’ is chosen among respondent that felt the Design no 3 (Figure 4) looks Glamorous (I/G) with the element of LCD screen, roundness shapes for the air conditioner, roundness adjustable air conditioner, storage compartment and USB socket.

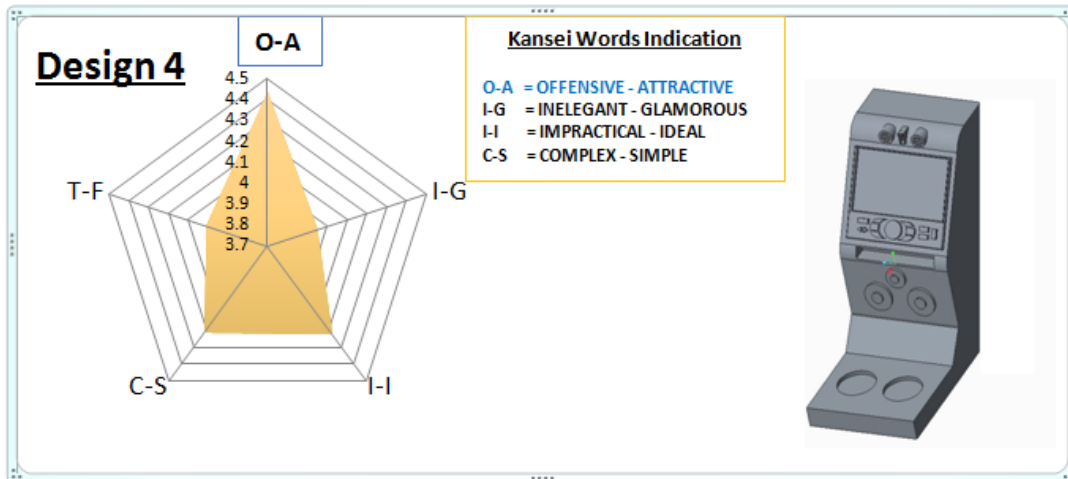


Figure 5. Kansei word Result for Design No. 4

Graph 5 shows that the ‘Attractive’ (O/A) is the highest rated compared to the others. Respondent chose that this design looks ‘Attractive’ than the words of glamorous, ideal, simple and futuristic. The element that has on this design is rectangular base on LCD screen, rectangular shapes for the air conditioner, roundness adjustable air conditioner, storage compartment, USB socket and also has the compartment for drinking water.

**4.2 Design Preferences**

AHP is a multi-criteria decision-making technique which combines the quantitative and qualitative factors to sort the needs, status, and assessment of options. In order to determine the design preferences, the Row Geometric Mean Method (RGMM) approach is adopted and the results is depicted on Table 5 below and Figure 6 below.



Table 5: Results for Design Preference

| DESIGN   | PREFERENCE |
|----------|------------|
| Design 1 | 4.220      |
| Design 2 | 4.800      |
| Design 3 | 4.215      |
| Design 4 | 4.195      |

From the AHP analysis, Design No. 2 is best design preference with result tendency of 4.80 in scale, that comes with characteristic of compartment for drinking water, adjustable button for air conditioner, USB port and the rectangle LCD screen. Table 5 and Figure 6 shows the preference for the final design. Respondent felt that this



Figure 6: Preference final Design (Design No 2)

design consist of emotional feeling of 'Ideal' when look at. It shows that the tendency rated is more towards the technical subject for their car center stack. The ideal design of the car center stack is the design that has practical arrangement and not too fancy and too crowded in the middle of the stack.

## V. CONCLUSION

Based on the results, the determination of customer satisfaction towards the qualitative measurement through the Kansei word is done. The characteristic of the product design is identifying on this study using the concept of Kansei Engineering. The word of Kansei is classified based on the feeling respondent towards the product domain. Hence, the data collected is analysed through the AHP process, as a decision maker and also as

the design priority guide for the characteristic of the car center stack (product). The results show the best features of feeling in design ideal. The arrangement for car center stack is choose by the customer that focus on the shape and what items that want to have in the car center stack besides with the nicely arrangement on the product. With the engineering design knowledge, it guides to develop more ideal concept for the car center stack.

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