# SUCCESSFUL POINTS OF KANSEI PRODUCT DEVELOPMENT

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**ABSTRACT**

The author founded "Kansei Engineering" in 1970, which is a child of Ergonomics. The ergonomics is a science that aims to build a good system between Human and Machines. Kansei Engineering stands much more on human orientation to develop a product, working system, social system as well as service system. Kansei Engineering or (KE) has developed a technological process from the survey of human emotions in relation to attain well-designed products or systems that are able to satisfy the people. The author has developed more than 60 different Kansei products from brassiere (Wacoal), refrigerator (Sharp), sports car (Mazda) and so forth, as well as Kansei Artificial Intelligence system such kitchen design AI, Brand name decision system and others. In this article, three examples of Kansei development are described for understanding how the Kansei Engineering process results in successful designs.

**Keywords:** Kansei engineering, brassiere, sports car, car dashboard design

## 1 Introduction

Nagamachi started Kansei Engineering (KE) in 1970 and published his first article related to KE in 1974[1]. Since then he has developed more than 60 Kansei products. Table 1[2] describes his main Kansei products, which are Refrigerator (Sharp), Brassiere (Wacoal), Shovel car (Komatsu), Bus tab, Toilet (Panasonic), Cosmetic (Milbon), Bedsore preventing mattress (Panasonic), Sports car (Mazda), Aircraft (Boeing) and so forth. Nagamachi and his group has developed many Kansei AI & VR such Shovel car Cockpit (Komatsu), Car room design(Isuzu), Kitchen design (Panasonic), Brand Name Consultation system (IKD), House design (HausMall) and so forth. Those products have been popular in Japan and their copies are sold in East Asia. Nagamachi has never had any unsuccessful experience using Kansei product development. This could be due to the fact that

KE has both psychological and ergonomic procedures. Anyone can be successful in Kansei development, if the person has skills to conduct surveys pertaining to people's Kansei or emotion, and knowledge of statistical techniques.

The article will iterate (1) Good-Up Bra (brassiere, Wacoal), (2) Nissan CIMA, (3) Miata MX5 (Mazda), and (4) Car dashboard (Hyundai), and finally the overall success of Kansei Engineering Method is explained.

Table 1. The list of new main Kansei products developed using Kansei Engineering since 1974[2].

| YEAR | COMPANY NAME | PRODUCT NAME (BRAND NAME) |
|---|---|---|
| 1974 | Fukuoka Interior | House Living System (House interior) |
| 1979 | Sharp | New refrigerator |
| 1980 | Sharp | Liquid Crystal Viewcam |
| | Kao | Biore-U (Body shampoo) |
| 1984 | Mazda | Persona (passenger car) |
| 1985 | Panasonic EW | Twin lamp (four-folded fluorescent lamp) |
| 1985-87 | Mazda | Eunos Roadster (Miata, MX5) |
| 1992 | Komatsu | Shovel car (digger) Avance 45t: Government Good Design Award |
| | Wacoal | Brassiere (Good-Up Bra) |
| 1993 | Komatsu | Avance 200t, Government Good Design Award |
| | Wacoal | Brassiere (2nd Good-Up Bra) |
| | | AI & VR |
| | | WIDAS (Brand system) |
| | | ViVA (Kitchen design), |
| 1995 | Hyundai (Korea) | Sonata-2 (Compact car) |
| 1996 | LG (Korea) | Dish washer machine |
| | Panasonic EW | Roof / Roof gutter / Siding (Wall) / Gate |
| | | Bath tab / Stair case /Washbowl / Closet |
| | | Floor Heating System |
| | | Kitchen design AI-VR system (ViVA) |
| | | New shaver (Smooser) |
| | | VeJEAR (Isuzu) |
| 1997 | | HKES (Wheel) |
| 1999 | | HousMall |
| 2000 | Panasonic | Sitting shower (The shower) |
| 2003 | Milbon | Shampoo & Hair Treatment (Deesse's) |
| | Panasonic EW | Toilet (TRES) |
| | | Bed sore preventing Mattress |
| 2008 | Boeing (USA) | Boeing 787 Interior design |
| 2008 | Kounan | Apricot energy jelly (Activo) |
| 2014 | Vf Lee | Urban Rider Jeans |

## 2. Development of the new brassiere, Good-Up Bra (Wacoal)

The KE procedure is the followings.

(1) One thousand ladies were invited to the Wacoal's Ergonomic Research Centre, where they expressed their Kansei to a brassier in general; The question is "how do you want to feel when wearing a brassiere?". A total of 80% of these ladies have answered that "we want to be *beautiful* and *elegant*" (the italics are Kansei words).

(2) Two hundred ladies were re-invited to cooperate with a new brassiere research. Hence, Wacoal have prepared all kinds of brassieres produced by Wacoal as well as rival companies with a S, M and L size. A participant selects a sample with her size and stands before a miller while wearing the selected one, and evaluates it on a given five scale of Kansei words that are "Beautiful and Elegant". This is continued for all samples.

(3) High scoring samples are examined and all items like material, size, cup design etc are surveyed. Several staff of the Research Institute are required to wear the selected samples and an investigation on Moire images is conducted in order to obtain the principles of realising a "beautiful and elegant brassier".

i. Both breasts should be inside between two body lines.
ii. Both breasts should be aligned parallel and face somewhat upward.

(4) A new brassiere that is based on these two principles "beauty" and "elegance" is launched and is named as "Good-Up Bra". The new product was in the market for a long period of time that profited Wacoal since ladies enjoyed the new product range and are extremely satisfied with it. In addition to that, the 2nd Good-Up Bra and Hip-Up pants were launched as the new product range which became very popular all over Japan.

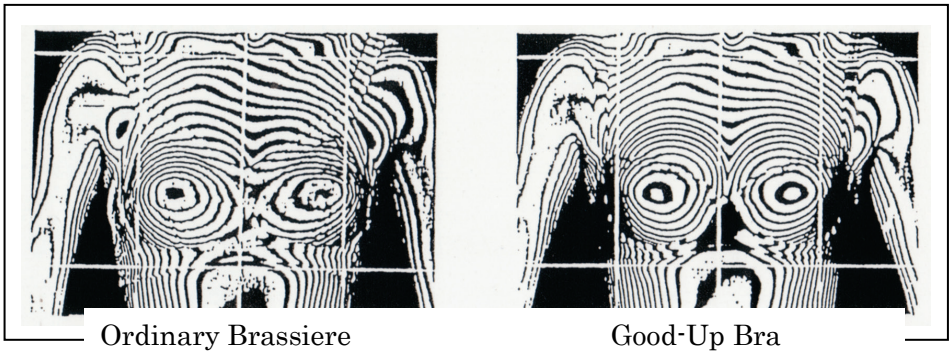



Fig. 1: Kansei brassiere named "Good-Up Bra" (Wacoal). Moire image (each 1cm high)[3]

## 3. New design of a passenger-car brake lamp (Nissan CIMA)

The Hiroshima University collaborated with Nissan Motors for a car design from the viewpoint of Kansei Engineering in 1987. A number of 20 passenger cars were rented from a car rental company which includes cars manufactured by Japanese, United States, Europe manufacturers. 20 Kansei words were selected for the survey to describe the exterior design of these selected cars from car magazines as well as discussions with sales people. A 5-scale evaluation sheet using 20 Kansei words is developed, and 20 male and female students participated to explain their emotions (Kansei) towards the exterior design of the car after being trained by using a Kansei evaluation.

In this article, only the taillights' design is being detailed. This is because the Nissan CIMA's taillight design was evaluated by students as being "very ugly". Their opinion on the design was that it is not smart and elegant, because it has wide red colour area although it will be easily perceived by driver (see Figure 2).


Fig. 2. Kansei design of taillights of the New Nissan CIMA, 1989.

Another experiment using students is conducted to find a beautiful taillight design that is more feminine by using a quasi-triangle that is better than a rectangle design. As the Nikkei News Paper printed such a good comment that the CIMA's taillight looks like "when the car passes by and when we turned to look at it, it looks like a very beautiful and elegant lady". Then, the New CIMA became very popular in the market which leads to trend among other makes to duplicate the same taillight into their models.

## 4. Mazda Sports Car, Miata, MX-5

Mr Nagamachi was contacted by the CEO of Mazda, Mr. Kenichi Yamamoto in 1987 where he is required to teach KE to Mazda's designers group as well as a lecture on KE to the people of Mazda. But after then, Mazda has made no request to help design a new car. However, a year passed and Mr Nagamachi was invited to Mazda to take a look at Mazda's new car that has used Kansei Engineering in its design. Mr Nagamachi accepted the invitation and with further investigation, he concluded that the new car is not properly designed using KE and it is anticipated that the car will stop being manufactured after only one year.

Mr. Yamamoto contacted Mr Nagamachi for the second time seeking the support and assist in designing Mazda's new car. The discussion leads to a new sports car as the domain and young drivers as targeted buyers. Hence, the Kansei Engineering method is used to reach the successful conclusion.

Then, an observation of young driver's manoeuvres from the inside as well as from the outside is conducted. In order to gauge the driver's experience, someone sits on the seat next to the driver and takes a picture of the driver's driving. Another man stands on the intersection and starts a video camera when a young driver car comes. Therefore, discussions are held to analyse young drivers' emotion (kansei) while driving. The video is analysed by writing down Kansei words on a card. Finally, the KE method is followed by using the *Category Classification Method* as one of KE methods[4].

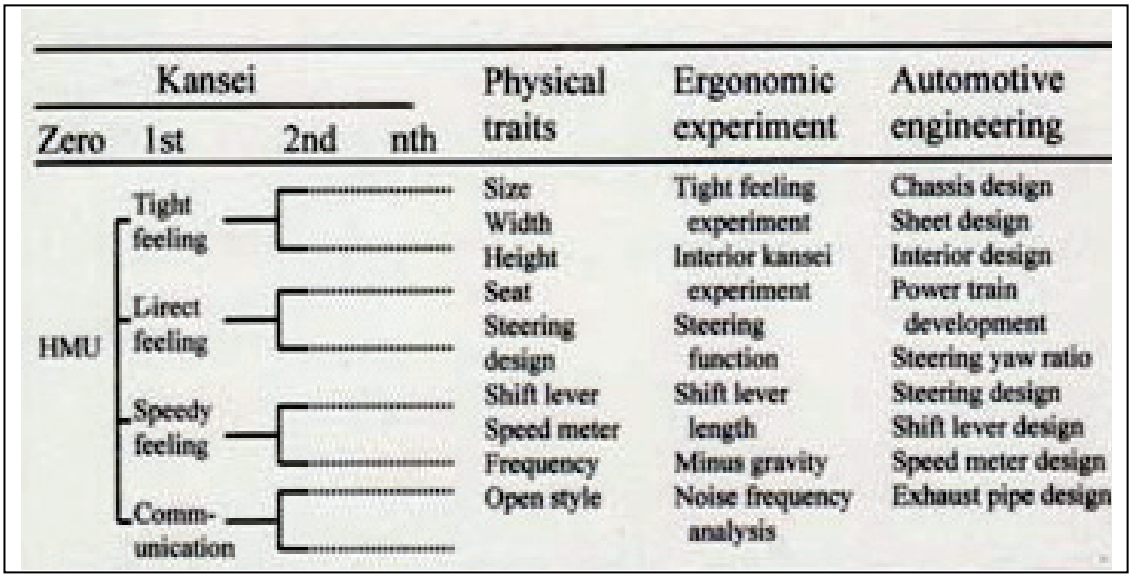



Fig. 3. The Category Classification Method.

The designer group classifies each card into the same category. Then, these categories are arranged in a tree structure shown in Figure 3 and each branch transfers the car's physical trait and extend the item into the automotive engineering world. Some of the physical trait is treated in an ergonomic experiment in order to attain clearer design specifications. The total design specification gained from the Kansei words are utilised into the total car design.


Fig. 4. The first generation, MX 5 (Miata), Mazda.

The first generation of the MX5 had obtained the Car of the Year Award in Japan. This model became immensely popular in just a short period of time since the launch among young and middle aged people in the world. The second and third MX5s were also produced from Mazda. The fourth generation of the MX5 was decided to be produced in 2014. However, Mr. Yamamoto who is the R&D manager has asked his designer group to inspect the 1st,2nd, and the 3rd Miata from the view point of KE, because of the fear of altering the fundamentals of KE. Thus, all of the MX5s are re-evaluated using a 5-scale Kansei Method that revealed that the 1st generation of Miata was the best.

The design of the 1st generation Miata that was designed by Nagamachi has brought the feeling of a more "*Joyful Driving*". Hence, by reapplying the same Kansei Method to boost the design, the 4th Miata succeeded to attain Japan's Car of the Year Award, 2015 and The Europe Award in 2015.

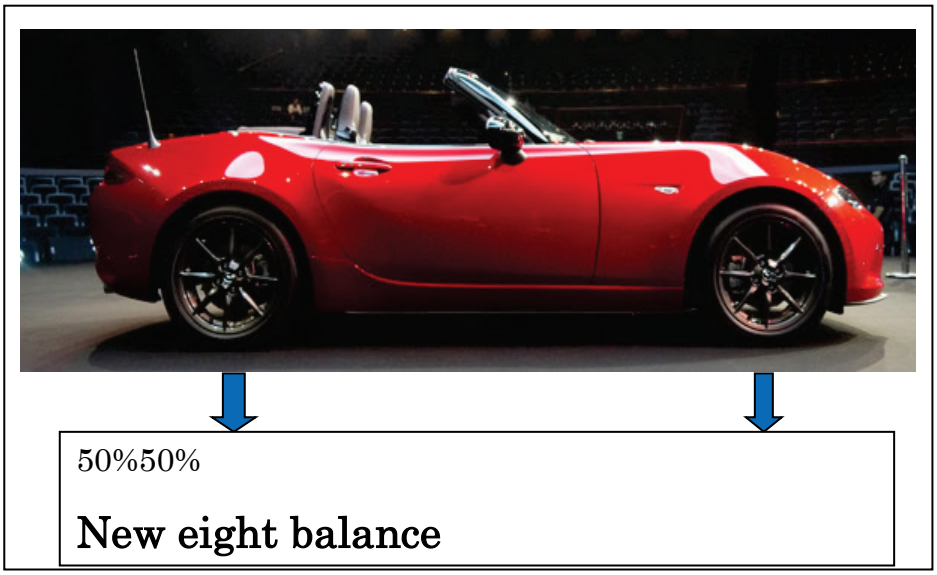



Fig. 5. The 4th Miata (The Car of the Year Japan & Europe Car of the Year 2015).

## 5. New dashboard and instrumental panel design (Hyundai).

In 2008, Nagamachi was requested by Hyundai Car Company to implement the KE into the dashboard design. The research procedure is as the following.

(1) A discussion was held with Hyundai's R&D department, Korea concerning the new dashboard design project. The Kansei Engineering theory needs to be introduced into the dashboard design of the next compact car.

(2) Ten compact cars were rented that includes cars made in Japan and Europe like Mitsubishi, Toyota, Honda, Nissan, Suzuki, Volkswagen, and Hyundai were parked in the Hiroshima International University parking area.

(3) A number of 80 male and female students who are trained in conducting the Kansei Method took part in the experiment.

(4) All of the participants sat inside each car in front of the dashboard with a 77 kansei question sheet, which consist of 6 different categories, such as 1) front view to dashboard, 2) the instrument panel design, 3) air-out hole design, 4) meters design, 5) centre console design, 6) shift lever design, 7) steering wheel design, and 8) the feeling of the front broad view.

Fig, 6. The experimental scene at HIU car parking area.

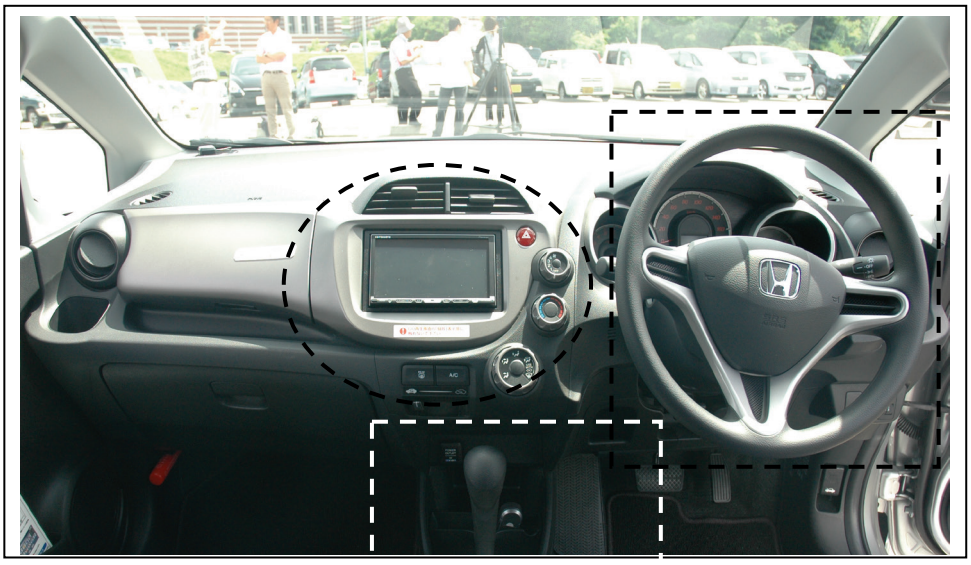


Fig. 7. The area inside a car for Kansei evaluation.

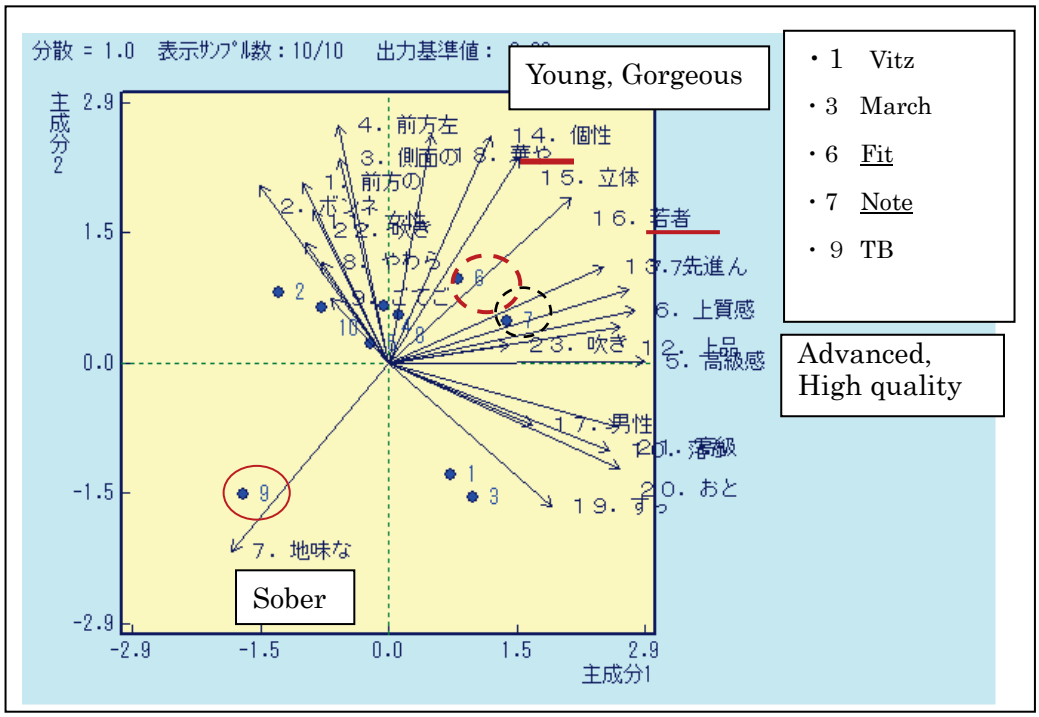



Fig. 8. Principal Component Analysis for ten cars. Each arrow means kansei word.

(5) Statistical analysis

The Factor Analysis were calculated from Kansei words and several Principal Component Analysis (Fig.8) and finally a Quantification Theory Type 1 ( similar to PLS) were calculated, which shows the most important design specification items. This data suggests the most important Kansei design direction. Two dashboard designs were produced by computer graphics which Creation A and B, referred to Mitsubishi Fit and Nissan Note, based on the data of the quantification theory type 1, as shown in Figure 8.

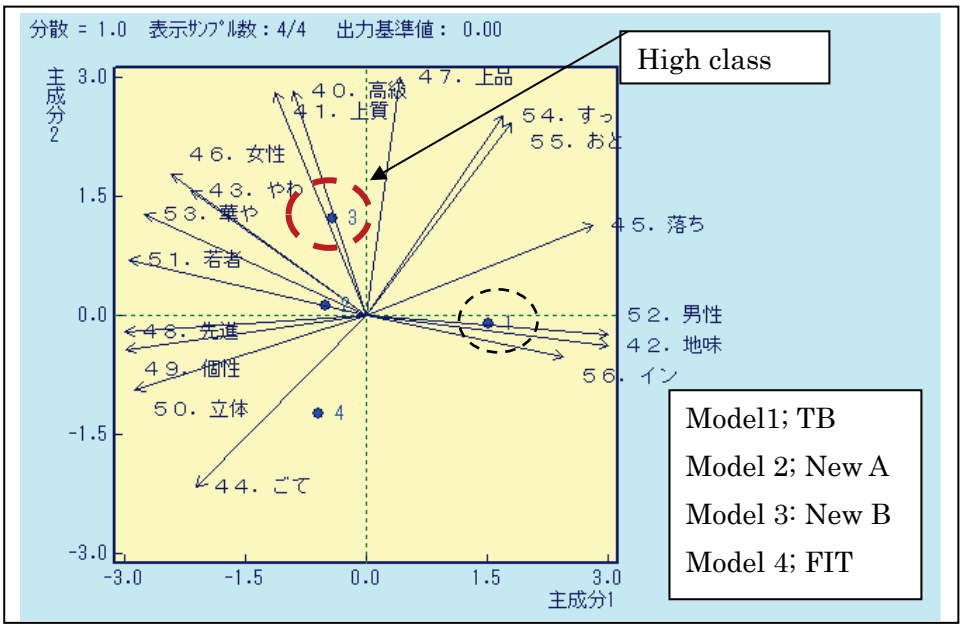


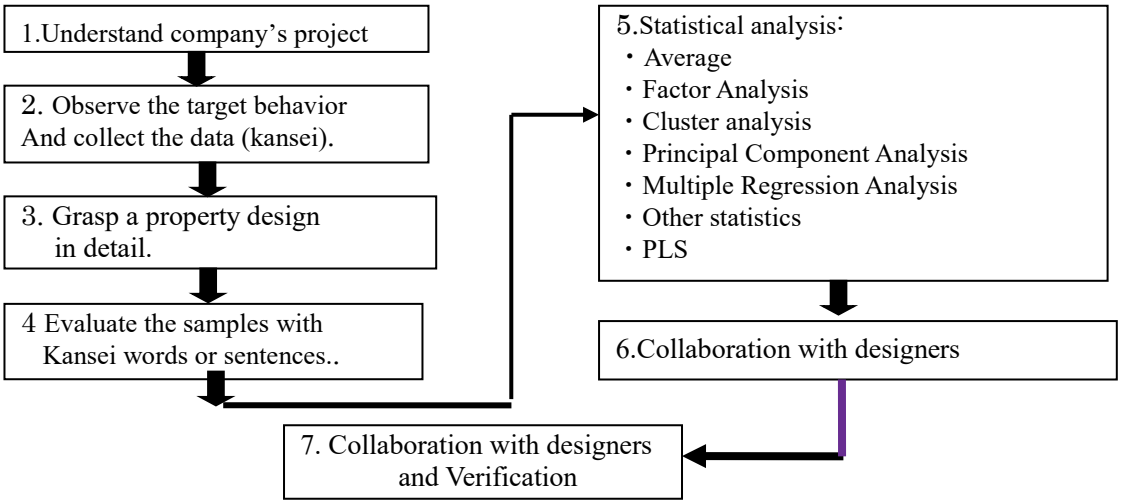

Fig. 9. Principal; Component Analysis using two new designs A & B, Fit, TB data.

## Remarks: Summary of the research

The dashboard designs of 20 compact cars were surveyed where participants sit inside each car and evaluate the dashboard designs using the 5-pont scale with Kansei Words (sentences). These data are analysed and found that the Fit design was the best design. Therefore, using the data calculated by the Quantification Theory Type 1, two types of new dashboard designs were produced by computer graphics, and we calculated the Principal Component Analysis using the two new designs with Fit and TB data. It was very clear that the new design B represents “high class design” and better than Fit, and that TB was still in the low level with Kansei “sober”. This step verifies the result of the research.

The Kansei Engineering procedure to analyse the present 20 compact cars as the samples and analysed the obtained design data using the statistical analysis and where it is found two Japanese cars had very good dashboard designs. After making two new dashboards by a computer graphics, three candidates of good dashboard designs as well as Hyundai’s design were re-analysed in order to attain the new best dashboard design, Candidate B. Finally, it is hoped that Hyundai would refer to the power of the Kansei Engineering function and results to continue to produce excellent car designs. Hence, it is possible that the KE matches very well with Artificial Intelligence and Virtual Reality system[5.6.7].

**Kansei Engineering POINTS＆ Procedures[4]**

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