

THE COST-EFFECTIVE APPEAL OF CROSSOVER B-CAR INTERIORS TO CONSUMERS

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Abstract: The design of a crossover B-car interior was used to explore the relationship between marketing considerations, survey participants' emotional responses, and product design. Research methodology was based on Kansei Engineering. Seventeen experts with professional automotive knowledge, including editors of car magazines and experienced car users were interviewed using the Evaluation Grid Method (EGM) about their preferences and reactions to interior design schemes of crossover B-cars. Additionally, automobile consumers were surveyed through a questionnaire used to ascertain participants' preferences for pictures depicting design elements of crossover B-car interiors. The results of the questionnaire were analyzed using Quantification Theory Type I. According to the interviews of the experts, the two cost-effective, more appealing items relating to crossover B-car interior, as determined by the semantic structure of EGM, were "economical and practical" and "customized for consumers needs". In addition, the two interior items were related to particular reasons and detail design elements found in the analysis of the questionnaire using Quantification Theory Type I. The current study suggests that specific products in this case car interiors, and their design are related to consumers' motivations about cost-effectiveness, functionality, and form. Additionally, the study demonstrates that consumer preferences and motivations influence their responses to specific design schemes.

Keywords: Cost-effectiveness, Appeal, Car Interior Design, Consumer Psychology, Kansei Engineering, EGM, Quantification Theory Type I

1. BASIC SECTIONS OF A MANUSCRIPT

It has been found that a consumer's intention to buy a manufactured good is closely related to the potential purchaser's perception and emotional responses to the form, purpose, and design of the product. This phenomenon has been studied extensively through the investigation of purchased intention in relation to consumers' psychological responses via the Five-Factor Model, a model used to describe branded products using attributes of human personality (Guido et al., 2010). The different aspects of consumers' cognitive response to a product have also received recent attention, showing that consumers' reactions to the visual form of a product includes response characteristics that related to their aesthetic impression, semantic interpretation, and symbolic association of the manufactured good (Crilly, Moultrie, and Clarkson, 2004).

In 1995, Bloch introduced a conceptual model along with several propositions that describe how the form of a product might elicit a variety of psychological and behavioural responses from a consumer. As suggested by Bitner's (1992) work on architectural design, these psychological responses include both cognitive and affective components (Bloch, 1995).

For example, a product form that contains metal surfaces has been found to elicit a consumer impression of "durability". This association between product form and response characteristic is also applicable to car interiors (Leder and Carbo, 2005). Aspects of cognitive and affective psychological response are specifically relevant to the design of car interiors, as they are intentionally created to be functional, and to evoke positive emotional responses from consumers. In fact, Karlsson (2003) used the Semantic Environment Description (SMB) method to measure consumers' impressions of vehicle interiors and proposed suggestions for how design, engineering and marketing interact.

Consumers often buy into a product on the basis of their perceived economic benefits and have to goal of putting the least amount of money into a purchase with the greatest value. Saving motives of consumers often consist of two important factors: moderation and self control. From a psychological standpoint, such factors could lead consumers to regularly put away some resources in order to meet an end goal (Lewis, Webley, & Furnham, 1995; Wärneyd,1999). In other words, the decision to save involves complex psychological and socio-psychological processes (Furnham & Angyle, 1998). Therefore, deliberations on cost effectiveness can be considered motivations that can potentially change a consumer' behavior in terms of purchase incentive. These finding have several implications for marketing research in relation to psychology and could be advantageous for studying strategies that use motivation to modify a person's behavior. In fact, these strategies are already being used to study the effect of social marketing aimed at communicating the importance of safe driving through the forums of cognition, affect, and intention. In addition, cost effectiveness can also be viewed as goal attainment for consumers. This point is worth addressing since marketers spend considerable resources on motivating people to consume products and services as a means of goal achievement (Bagozzi & Dholakia, 1999)., which implies that consumers change their behavior based strongly on the fulfilment of a goal.

Mass customization is the ability to provide individually designed products and services to every customer through high process flexibility and integration at reasonably low cost (Silveria, 2001). In this study, we subdivided mass customization into: "customized for the needs of a specific population" and "customized for individual preference". In addition, mass customization can be further categorized into different levels by degrees of involvement.

Japanese scholar, Mitsuo Nagamachi, founded a new consumer-oriented technology of product development- called Kansei Engineering. Defined as the technology of transforming consumers' feelings and impressions of products into the elements of functionality and design, the technology aims to link the vague physiological and psychological demands of consumers to

the development of a vehicle based on users' evaluation and preferences with regard to form (Nagamachi, 2002). Consequently, this technology allows for the design of a product aimed at reflecting an induced feeling. After completing the necessary stages in the Kansei methodology, the final steps of validation remain, where subjective evaluations are carried out by semantic differential methods, and then analyzed using multivariate analyses. To summarize, "Kansei Engineering" is designed to realize human affections and preferences by leading a consumer-centered study. This type of methodological framework is growing in popularity and has been implemented by such companies as Nissan, Mazda, and Mitsubishi (Nagamachi, 1995).

In the current study, we argue that crossover B-Car interiors are particularly attractive to consumers because of certain particular elements that we have named "appeal factors". In the automobile industry, a "crossover" refers to a vehicle built on a car platform that combines, in highly variable degree, features from a sedan with features of a sport utility vehicle (SUV), a multi-purpose vehicle (MPV) or a recreational vehicle (RV). A crossover vehicle aims to combine multiple functionalities into one form including cross-country capabilities, comfort and controllability. According to the definition of the Commission of The European Communities, the crossover type of B-Car belongs to the "small cars" subgroup.

Lastly, according to Barron's Accounting Dictionary, cost-effectiveness is defined as being, among decision alternatives, the one in which cost is lower than its benefit. The current study probes consumers' cost-effective needs for the interior of a vehicle. We hypothesize that the popularity of crossover B-cars can be of assistance to designers of car interiors by enabling them to target the cost-effective psychological preferences of consumers.

2. METHODS

Kansei Engineering was applied to evaluate and analyze consumers' impressions of crossover B-car interiors in order to develop a survey and analysis system. The purpose of this survey and analysis system was to appeal to consumers' cognition and perceptions of car interiors in order to provide necessary insight and assistance for designers and evaluation groups. In this study, we applied both qualitative and quantitative research methodology; consequently, we adopted a two step approach that consisted of both expert and consumer evaluations.

2.1. Participants

In-depth interviews were held with people having expertise in the automobile industry such as auto professionals, car owners, editors of automotive magazines and veteran car mechanics. Participants were asked to provide their preferences for the crossover B-car interior design and functionality, listing the details of, and reasoning behind, their preferences. In order to understand the appeal of car interiors, the interviews were conducted using the Evaluation Grid Method (EGM). Five male experts with ages between 37 and 55 years old were interviewed. In addition, 12 crossover B-car owners were interviewed: including six male and six female car owners with ages ranging between 29 and 48. A comprehensive list of the appeal factors of a crossover B-car interior was provided for the 17 interviews and the saturation point was attained.

A questionnaire was then used, out of a total 1100 questionnaires, 1003 were returned, producing a 91.1% response rate. After eliminating the questionnaires that contained incomplete or invalid answers, 931 valid questionnaires were taken into account, resulting in a 92.8% rate of effective returns. Among these valid respondents, there were 520 males and 411 females, with the ages ranging from 31 to 55.

2.2. Measures

Preparation for interviews involved the initial gathering of data for collecting information related to the interior design and variations in functionality for crossover B-car in Taiwan. We collected data from all types of crossover B-car in the market in Taiwanese market and then focused on the information regarding interior space and design functionality. In compiling the questionnaire, we gathered 521 adjectives related to interior space and design functionality design of crossover B-car through specialized media such as automotive magazines or web sites. In addition, 27 sample cards made by the car manufacturers were selected for the interviews. These sample card contained pictures and names of 27 crossover B-car interiors.

In the process of the questionnaire production, major evaluative items were generalized from content found in the EGM. The survey aimed to target vehicle consumers or people with the financial means to be considered potential vehicle consumers. In addition, the personal information of the survey participants' sex, age, education level, marital status, family, and average monthly income were collected. Moreover, the content of the questionnaire was aimed at understanding, from the const effective side, consumers' general needs and their reasoning for preferences of crossover B-car interior design and variations in functionality.

We were able to create the questionnaire using the evaluation items in relation to specific aspects of each item. The original evaluation items, chosen in accordance with the focus of this paper, were "economical and practical" and "customized for customers' needs". Hence, consumers were asked to select their inclinations with regard to aspects of car interiors under the original evaluation item. The following are examples of the questions asked in the questionnaire under the general evaluation item of "economical and practical" in relation to varying features: 1. How do you rate the importance of "economical and practical" with the following items: durability, worth more than its cost, and safety and stability? Participants were asked to evaluate the different aspects by importance, scoring the most important as a "5" and the least important as "1". 2. In the category of "economical and practical", to which trait do you feel "durability" should be applied? In this type of question, participants were asked to select one from the following list of features: leather, metal surfaces, and integrated storage.

2.3. Procedures

To make a qualitative assessment, we collected data from authoritative articles, analyzed crossover B-car interiors, and interviewed car buyers. We applied the EGM to determine the structural appeal of crossover B-car interiors, and vehicle descriptions given by consumers were used in the construction of the questionnaire. The procedure for conducting the EGM is as follows: (a) The 27 sample cards were grouped into three stacks according to the participants' preferences from high to low. (b) the original evaluation items were obtained by asking the participants about the images and their reasons for grouping them in each of the three stacks; each original evaluation was then processed to form its corresponding "upper-level" and "lower-level" concepts (see Table 2). "Upper-level" corresponded to words that were more abstract in the hierarchical structure of semantics, while "lower-level" related to the words in the evaluation that were more specific.

Table2: The best 2 original image selections from the hierarchical diagram as determined by the number of times they appeared

Classified	Original images	Reasons (upper level)
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First	Economical and practical 9	Worth more than its cost 19 Safety and stability 15 Durable 9
Second	Customized for consumers' needs 6	Customized for individual preference 20 Customized for the needs of a specific population 14

For the quantitative assessment, we conducted a survey using the questionnaires and analyzed the data. In order to measure the weight of the features in the importance of crossover B-car interiors, the aspect that was most closely related to cost-effectiveness issues was chosen. The study then adopted snowball sampling, now-probability sampling technique where existing study subjects were asked to recruit future subjects from among their acquaintances who belonged to the population of interest. People who had no automotive experience were excluded from the study. Further stringency was obtained by only enrolling participants in the study, who had used crossover B-cars for at least 3 months.

The Quantification Theory Type I method was used for the analysis of the questionnaires as a tool to evaluate the importance of the appeal factors of a crossover B-Car interiors. In addition, the different weights of the original evaluation, upper-level, and lower-level items were measured and quantified. The Quantification Theory Type I method was transferred to a mathematic formula and was run through Excel Macro for statistical analysis.

3. ANALYSIS

The EGM aimed to extract consumer language with the goal of understanding the evaluation items within the interviews and the structure of the network of factors. This was also a method used to determine how consumers evaluated product value using an in-depth investigation for each individual. Through this process, consumer perception and level of economic value were analyzed. Using the structure of the semantic hierarchy, from abstract to specific, we were able to visualize and solidify the structure of consumer values through the original evaluation composed of upper-level and lower-level items. Additionally, the repertory grid method developed by Kelly (1955) was used in the interview in order to gain an understanding of each participant's ability to report on the similarities and differences between two objects. This method is standard when attempting to gauge the extent of people's understanding and recognition of their surroundings.

Hayashi's Quantification Theory Type I can statistically predict the relationship between a response value and its categorical values (Hayashi, 1950). In product design, Hayashi's Quantification Theory Type I can also be used to evaluate the weight of factors that stem from consumers' preferences (Iwabuchi et. al., 2001)(Sugiyama et al., 1996). In addition, this technique can be used to examine the relationship between quantitative and qualitative data. For example, Jindo (1997) used Quantification Theory Type I method to analyze the relationship between subjective evaluation scores and the elements of the design of car interiors. In 2008, Nagamachi introduced the idea that, using Quantification Theory Type I, it is feasible to construct the relationships between emotional images and design elements.

The current study employed Quantification Theory Type I in order to determine the different weights among appeal factors and the critical elements of the images presented of interior designs of crossover B-cars. In addition, the relationship between the appeal factors and features of the interior of crossover B-cars were also explored. The most meaningful responses

were found to be dependent on image composition. The partial correlation coefficients indicate the extent to which each design element contributes as an explanation of the evaluation adjective. (Jindo, 1997)

4. RESULTS

Appeal factors of crossover B-car interiors were determined according to the preferences obtained from the 17 experts interviewed using the EGM. Figure 1 shows the hierarchical diagram of the crossover B-car interior preference of one participant. In Figure 2, numbers to the right of the letters indicate the frequency with which the same opinion appeared more than once. For example, “economical and practical 9” indicates that “economical and practical” was listed 9 times from the 17 participants. Table 1 also shows the statistical results of the rankings from the hierarchical diagram as measured by the number of times the descriptions appeared.

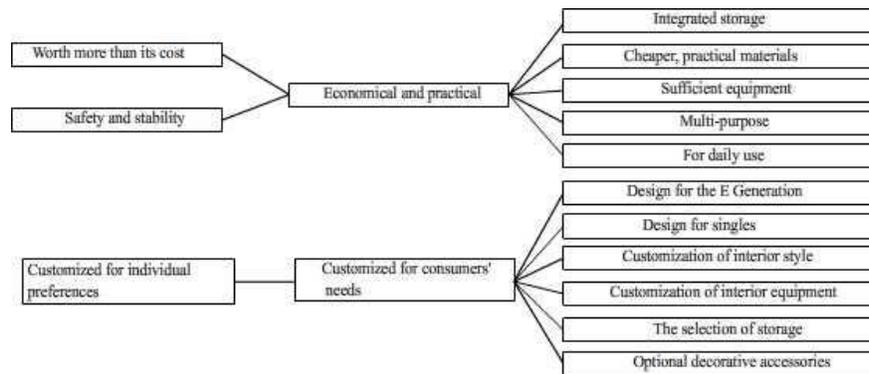


Figure 1: The hierarchical diagram of Crossover B-Car interior preference of one participant by means of the EGM

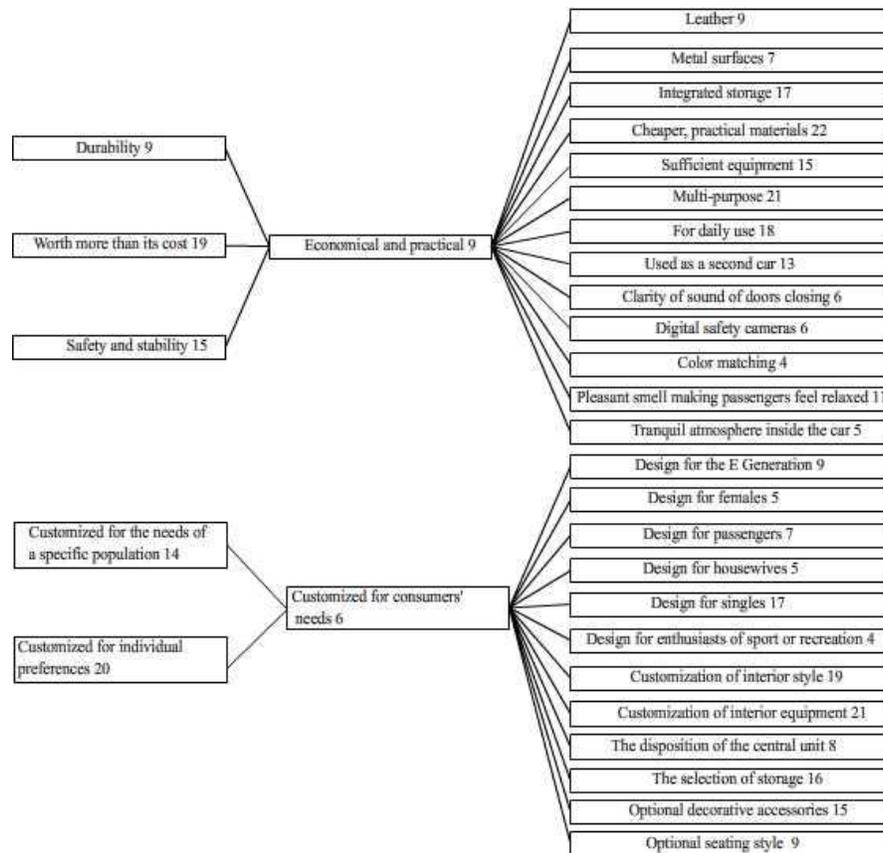


Figure 2: The hierarchical diagram of Crossover B-Car interior preference by the EGM

Table 1: Title of the table

Original images	Upper Level (reasons)	Lower Level (specific attributes)
Economical and practical 9	Customized for individual preference 20	Cheaper, practical material 22
Customized for consumers' needs 6	Worth more than its const 19	Multi-purpose 21

The first evaluation factor was “customized for consumers’ needs”, which included sub-classifications of “customized for the needs of a specific population” and “customized for individual preference” in the upper-level assessment. In this study, the coefficient of determination, $R^2=0.617$, which was determined based on the results of the Quantification Theory Type I method, indicated that our surveys were reliable. The highest partial correlation coefficient was “customized for the needs of a specific population” (see Table 3), which contributed most to the “customized for consumers’ needs” evaluation factor. The specific aspects included under this sub-classification of the general evaluation factor were the designs for E Generation, females, passengers, housewives, singles, and enthusiasts of sport or recreation vehicle.

Table 3: The category scores for the general item of “customized for consumers’ needs”

Items	Categories	Category Scores	Partial Correlation Coefficients
Customized for the needs of a specific population	Design for E Generation	0.141	*0.816
	Design for females	0.019	
	Design for passengers	-0.141	
	Design for housewives	-0.282	
	Design for singles	-0.181	
	Design for enthusiasts of sport or recreation vehicle	*0.230	
Customized for individual preference	Customization of interior style	-0.007	0.519
	Customization of interior equipment	0.037	
	The disposition of the central unit	0.036	
	The selection of storage	-0.099	
	Optional decorative accessories	0.047	
	Optional seating style	0.158	
C		0.625	
R = 0.848			
R Square = 0.720			

As shown in the category scores in Table 3, “changeable interior style” (See Figure 3) had a stronger effect on “design for enthusiasts of sport or recreation” than the others. In addition, “design for singles” had a stronger negative effect on this factor than the others did.



Figure 3: “Changeable interior style”

The second evaluation factor classified was “economical and practical”, which included sub-features related to durability, worth more than its cost, and safety and stability” in the upper-level assessment. A crossover B-car interior was classified as “economical and practical” if it gave the consumers this impression because one of the three above-mentioned descriptors. The coefficient of determination, $R^2=0.601$, which was determined based on the results of the Quantification Theory Type I method, indicated standard reliability for our survey instrument.

The highest partial correlation coefficient was for the feature “safety and stability” (see Table 4), which contributed the most to the evaluation factor of “economical and practical”. The specific items included under this sub-classification of the general evaluation factor were the designs for the following: clarity of sound of doors closing, digital safety cameras, color matching, pleasant smell inside the car leading to the relaxation of passengers, and a tranquil atmosphere inside the car.

Table 4: Category scores for the general “economical and practical” evaluation item

Items	Categories	Category Scores	Partial Correlation Coefficients
Durability	Leather	0.011	0.137
	Metal surfaces	0.010	
	Integrated storage	-0.011	
Worth more than its cost	Cheaper, practical materials	0.129	0.652
	Enough equipment	0.022	
	Multi-purposes	-0.052	
	For daily use	*0.174	
	Used as a second car	0.084	
Safety and stability	Clarity of sound of doors closing	-0.004	*0.781
	Digital safety cameras	-0.015	
	Color matching	-0.295	
	Pleasant smell making passengers feel relaxed	-0.127	
	Tranquil atmosphere inside the car	0.103	
C		0.823	
R = 0.839			
R Square = 0.703			

As shown in the category scores in Table 4, “daily use” had a stronger effect on “cost-effectiveness” than the other items. In addition, “color matching” had a stronger negative effect on “safety and stability” than the other design features.

5. DISCUSSION

The current study probed consumers’ cost-effective needs for the interior of a vehicle. The results of the study, shown in a hierarchical diagram of crossover B-car interiors, were determined using the Evaluation Grid Method (EGM) (see Figure 2). When questions related to automobile interior design, were examined, evaluation items determined that greatest cost-effective appeal of car interiors included factors to “customization for consumers’ needs” and “economic and practical”. More specifically, the current study suggests that consumers choose car interiors because of one or more of the following characteristics: customized for the

needs of a specific population, customized for individual preference, durability, worth more than it cost, and/or safety and stability.

In addition, the weights of the varying features of car interiors were analyzed using Quantification Theory Type I, and the appeal of car interiors was determined for the following two appeal factors: “economical and practical” and “customized for consumers’ needs”. Among these factors, “customized for consumers’ needs” had the highest R square value (0.720). In addition, the results demonstrated that participants in the current study tended to identify more with the “customized for consumers’ needs” than they did with other factors.

Typically, consumers attempt to decrease unit cost by increasing the rate of the use of crossover B-car interiors. This also reflects consumers’ decision making while in the purchasing process. Furthermore, consumers are inclined to pay lower costs for the maximum functionality and usability that the crossover B-car interior has to offer. Based on these points, “economical and practical” has become a marketing strategy aimed to appeal to the cost-effective psychology of consumers who select crossover B-Car interiors. The “economical and practical” quality can be broken down into three aspects. The first of these is “durability”, including specific design features such as leather, metal surfaces, and integrated storage (Figure 4). The second characteristic is “worth more than its cost”, and includes specific factors such as the use of relatively cheap but practical materials” (Figure 5), being sufficiently equipped, having equipment with multi-purpose functions, and being a vehicle interior that is optimal for daily use, and one that is suitable for a second car (Figure 5). The third aspect is “safety and stability”. There is often concern shown for the safety of small cars, which is a consumer basic need. Therefore, the question of how to deliver the idea of “safety and stability” through a car’s interior design should not be overlooked. This has been accomplished through inclusion of several design features such as clarity of sound of doors closing, digital safety cameras, color matching, a pleasant-smelling interior to put passengers at ease, and a tranquil environment inside the car.



Figure 4: “Leather” and “integrated storage”



Figure 5: “Cheaper, practical materials”

Mass customization, i.e., catering to consumers’ needs, can be used as a way to achieve the cost-effective goal of purchasing. More specifically, the ability of consumers to choose which design elements should be implemented for targeted products without spending money for

unnecessary features could be an invaluable marketing tool. In fact, the current study, showing the preference for “customization for consumers’ needs” indicates that the functionality and usability of crossover B-car interiors reflect not only consumers’ preferences but also their motive to save money. “Customized for consumers’ needs” can be further broken down into two aspects: the first aspect is “customization for the needs of a specific population”, meaning that interior equipment should be designed according to a specific populations’ needs. Thus, specific items include designs for the E Generation (Figure 6), females, housewives, passengers, singles, and designs for consumers that show a preference for sport or recreation vehicles. The second “customized for consumers’ needs aspect is “customization for individual preference”. Therefore, specific design aspects should include customization of interior style, interior equipment, the disposition of the central unit, and the selection of storage. In addition, optional decorative accessories and seating styles of should also be included.



Figure 6: “Customized for the needs of the E Generation”

6. CONCLUSIONS

The design of the crossover vehicle, allows a small car to have a maximum interior space and functionality, and no longer offers just a style of body but also constitutes a new generation of type. In fact, consumers choose crossover B-car interiors because of cost-effective considerations relating to their social and cultural backgrounds, as discussed in the beginning of this study. Hence, social and cultural factors have a big influence on consumers’ decision-making preferences when choosing crossover B-car interiors. These factors indicate a consumer’s financial behaviour, which is greatly affected by culture and society. Based on this study, the semantic structure of the cost-effective appeal derived from interviews of experts showed hierarchical relationships between the type of appeal factors, reasons for consumers’ preferences, and specific desirable characteristics of crossover B-car interiors. In addition, overall statistical analysis on the cost-effective appeal of crossover B-car interiors was performed through consumer evaluations.

From the perspective of consumer psychology, the average prices of cars are higher than other marketable good; therefore, purchasing automobiles involve a high level of decision-making. This means that a consumer has to weigh the risks while he or she decides to purchase a car; thus, the cognitive process of purchasing a car is more complicated than the process of buying general goods manufactured for basic living. It also means that a consumer will exert a higher degree of mental and physical effort to gather information on the intended vehicle for purchase, and will consult with friends or relatives and consider comprehensive comparisons of vehicles before actually making a definitive purchase decision.

The design of car interiors is a potential area for academic research because a person’s emotional response to, and perception of, car interiors is a complicated and significant factor,

one that requires more research and further exploration. In the current study, we investigated the design of car interiors using a preference-based approach, as it was appropriate to reveal the appeal of car interiors, as articulated by the experts used in qualitative aspect of the study. In addition, it has been shown that product design integrated with marketing considerations is necessary in the current market because consumers can be motivated to change their consumption behavior. Since consumer behavior is deeply influenced both by consumer preference and motivation research, the findings of the current study should add to the literature in these two fields.

One limitation of, the current study could be that the samples collected from the specific institutions in Taiwan might not be representative of wider populations in other countries or areas, due to differences in culture and custom; therefore, a future research study could be focused on personal motivations with regard to financial considerations of other types of car interiors. To this goal, we will accumulate impression data on important factors constituting other types of car interiors, as was attempted by Jindo (1997).

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BIOGRAPHY

Short biography of author 1 (100 words max) (leave blank for reviewing)

Kai-Shuan taught in the Department of Digital Fashion Design in TOKO University. During the period of teaching, he was enthusiastically engaged in teaching and research relative to multimedia and industrial design. From 2009-2010, he served as Project Co-Manager for Green-Technology Interdisciplinary Value-Added Innovation (98-2218-E-006-246-) and Sub-Project Manager for Green Dockers, which is elected for the award of feasibility evaluation prospectus. Kai-Shuan Shen is the corresponding author and can be contacted at: creativekevin2001@hotmail.com

Kuo-Hsiang Chen also enthusiastically participated in the Kansei Engineering research group and co-instructed graduate students to proceed to relative study of the application of Kansei Engineering Design. From 2001 to present, he has published critical papers relative to Kansei Engineering. Due to approved academic and research achievements, he was elected as the President of the Taiwan Institute of Kansei.