Integrating Affective Requirements in Car Design Methodologies

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ABSTRACT

This study aims to validate a product design model using the concept of pre-purchase affect in a case study of car design in the Philippines. It is hypothesized that car attributes related to form can explain the experience of intense emotion in the car buying process and that this experience influence purchase intention. A field study was conducted in car dealerships of four car companies in the Philippines. A total of 103 samples were gathered consisting mostly of expert car buyers. Results of the study indicated that affective responses of consumers are triggered by both product form and function. However, more variables related to product form can explain the intensity of PPA such as shape and dimension. Intense experience of affect triggered a greater chance of purchasing the product.

Keywords: affective product design, product design, discriminant analysis, multiple linear regression

1. Introduction

The capability of products to evoke emotions was discussed by Desmet (2003) through a “multilayered model” of product emotion. It proposes that emotional responses are brought about by an appraisal of the product in terms of novelty, motive compliance, intrinsic pleasantness, legitimacy and challenge. These appraisal criteria are generated by the concern of the individual for the product. Concern is defined as a point of reference in the appraisal process (Frijda, 1986). Products are judged according to their compliance to the concern. Another explanation of consumers’ emotional attachment to a product is the symbolism it provides (McDonagh et al., 2002). Consumers use products to indicate their personalities and value system which explains why marketers segment and position their products according to these variables (Howard & Sheth, 1969; Mahajan & Wind, 2002). The new Volkswagen for example uses retrospective associations to old models that previously appealed to the buyers (Mahajan & Wind, 2002). Its roof shape is very distinct and evokes a “cute” feeling on the part of the user. Hsiao & Chen (2006) asserted that shape is a critical attribute for product success and this can attract consumers and add value to a product.

Acknowledging the need for emotional attachment to the product, Nagamachi (1995) used Kansei Engineering to identify feelings that consumers desire to realize in a product. These feelings are translated into design attributes by breaking them down iteratively into more specific feelings that are useful in the design process (Nagamachi, Nishino, & Ishihara, 2001). The broken down feelings are transformed into product design elements such as color, shape, sounds, function, and so on. Automotive companies such as Mazda, Ford, Hyundai, Toyota, and Honda have used Kansei engineering in their design process (Nagamachi, 2002).

Lai, Chang, & Chang (2005), on the other hand, proposed a design approach to enhance consumers’ target feeling for a car. They asserted that feelings are quality characteristics that should be managed like other attributes of the product. They used a robust design approach to determine car characteristics that enhances “feeling quality”. Findings of the research suggest that car profiles redesigned using this approach is closer to the target feelings of the consumers. The method also enables the identification of optimal design parameters for the car according to the target feeling for the car.

Seva, Duh, & Helander (2007) related product design attributes of mobile phones to customers’ affective experience. The hypothesized relationships were based on the premise that perception triggers affect in consumers and the intensity of this affect influences their intention to buy the product.

Previous studies manifested the importance of considering users’ emotion when designing a product. The current study aims to relate car attributes to the intensity of affect experienced by car buyers and relate this affect intensity to their intention to buy. The research aims to address the following problems:
1. Which vehicle attributes can discriminate the intensity of pre-purchase affect experienced by car buyers?
2. How does affect intensity influence purchase intention?

The following hypotheses were posited:

\( H_1 \): Vehicle attributes related to form discriminate the intensity of pre-purchase affect.
\( H_2 \): A greater intensity of affect experienced drives purchase intention

These hypotheses were derived from the Pre-purchase Affect Model (PAM) proposed by Seva, Duh, & Helander (2006). This study replicated the method proposed by Seva, Duh, & Helander (2007) in their study of mobile phones.

### 2. Method

#### 2.1 Subjects

Participants in the field study were 103 car buyers with an average age of 41 years. Majority of the sample (88%) is male, married (89%) and 99% have finished college. Only 13% of the sample bought a car for the first time. The average number of cars owned by the sample is 4.

#### 2.2 Products evaluated

The products evaluated included sedans manufactured by three Japanese and one American car manufacturer. A total of 10 car models were evaluated in the study.

#### 2.3 Dependent variables

The dependent variables for the first hypothesis consist of the four emotions experienced by the participants when they evaluated the vehicles in the showroom. These four were amazed, content, encouraged to buy, and hopeful. The choice of these four were explained in detail in (Seva et al., 2007). Affect intensity was rated using a 5-point scale anchored at 5-Very much and 1-not at all.

The dependent variable for the second hypothesis is purchase intention rated using a 5-point rating scale anchored at 5-Definitely buy and 1-Definitely not buy.

#### 2.4 Independent variables

Independent variables for the first hypothesis are car attributes related to form and function. The attributes related to form are shown in Table 1. Shapes were measured using a semantic differential scale indicating curvature (5-curvy and 1-flat or 5-sleek and 1-functional). The author based on pictures taken of the vehicle models evaluated did rating of shapes. Angles were measured in degrees and dimensions were measured in centimeters. Measurements were either obtained from company brochures or directly measured from the vehicles.

Attributes related to function are engine maximum torque (kg-m/rpm), engine maximum output (PS/rpm), engine displacement (cc), number of airbags, entertainment system rating, vehicle interior rating. These functional attributes were chosen because car manufacturers publish them as reference for their customers.

<table>
<thead>
<tr>
<th>Table 1. Vehicle attributes related to form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of roof</td>
</tr>
<tr>
<td>Shape of tail light</td>
</tr>
<tr>
<td>Front shape</td>
</tr>
<tr>
<td>Back shape</td>
</tr>
<tr>
<td>Side shape</td>
</tr>
<tr>
<td>Angle of front windshield</td>
</tr>
<tr>
<td>Angle of rear windshield</td>
</tr>
<tr>
<td>Shape of headlight</td>
</tr>
</tbody>
</table>

#### 2.5 Procedure

The field study was conducted in showrooms four car manufacturers in the Philippines. Interviewers asked walk-in customers for their permission to be interviewed, after which, they were briefed regarding the objectives of the study.

A standard interview form was used to obtain data from the participants. The form was divided into four parts, namely: personal data, pre-purchase affect (PPA), purchase intention (PI) and environment evaluation parts. The first part aims to gather demographic data from the participants while the second part aims to determine their affective experience when inspecting products that attracted them in the showroom.

Participants were asked to identify one vehicle that positively attracted them and another one that negatively attracted them. Two extreme products were asked to be evaluated to enable within subject comparison of preferences. The model, type, and color
of the two vehicles were noted in the questionnaire. For each of the two vehicles, participants were asked to indicate the intensity of affect they experienced while inspecting or looking at the product.

2.6 Outline of statistical analysis

Data gathered from the survey were analyzed using discriminant analysis. This is a statistical technique that differentiates between two groups with respect to several variables simultaneously (Klecka, 1980). In this study, it is desired to identify which product features are capable of classifying the intensity of emotional experience when evaluating vehicles. Ratings of 4 and 5 using a five-point Likert scale were classified as intense emotional experience while ratings of 1 to 3 were classified as not intense. Intense emotional experience was coded “0” and less intense as “1”. The categorical variables were recoded, as discriminant analysis is a technique that requires the dependent variables to be dichotomous. A Likert scale was used instead of a dichotomous scale at the first instance because the verbal descriptors in the scale used accurately captures the possible intensities of pre-purchase affect that subjects can possibly experience. The intensities can then be recoded to indicate intense and less intense experiences.

Group means for phone attributes were analyzed to determine if significant differences could be observed across emotion intensities. Variables were checked for collinearity by analyzing the correlation coefficients between the independent variables (Schroeder, Sjoquist, & Stephan, 1986).

3. Results

3.1 Car buyers’ behavior

Price is the primary consideration of car buyers interviewed. They want to get the best value for money. This is closely followed by efficiency, capacity and brand of the car. Majority of the participants (88%) considered function as more important than aesthetics in their choice of cars.

3.2 Discriminant analysis of product features

After screening for multicollinearity, a total of 17 functional and aesthetic attributes were included in the analysis. Test of means was conducted to identify which features have different means between intense and non-intense emotional experience and it can be seen in Table 2 that discriminant variables or those with significant mean differences are related to both function and aesthetics disconfirming the first hypothesis that only aesthetic attributes matter to car buyers.

<table>
<thead>
<tr>
<th>Product Features</th>
<th>Amazed</th>
<th>Content</th>
<th>Encour</th>
<th>Hopeful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of headlight</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape of roof</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape of tail lights</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape of front</td>
<td>**</td>
<td>**</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Shape of back</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Entertainment</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Airbag</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>Engine displacement</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td></td>
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<tr>
<td>Engine torque</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>**</td>
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</table>

The coefficients of the canonical discriminant functions are shown in Table 3 that indicate the relative importance of a variable in the discriminant score. A higher coefficient indicates a higher contribution. Attributes related to form such as shape of the roof, back, and front have higher standardized coefficients. As the shape of the headlight, front, and roof becomes sleek and curvy the more the PPA becomes intense. A different trend was observed in the shape of the back. A more functional or flatter design elicits intense PPA.

There is only one discriminant model derived for each of the PPA. Each discriminant function is a linear combination of discriminating variables shown in Table 3 (Klecka, 1980). All the models obtained were significant at p<0.001 except for encouraged at p<0.05.
3.3 Regression of pre-purchase affect with purchase intention

Multiple regression was used to analyze the relationship of PPA and purchase intention. The model obtained is significant at 0.001 with an R equal to 0.7. This indicates that the regression equation obtained explains much of the variation in data. The parameter estimates and their corresponding significance are shown in Table 4. As can be seen in the table, the most significant PPA predictors are encouraged and amazed. This result validates the second hypothesis that as the intensity of emotion increases purchase intention also increases.

Table 4 Parameter estimates for affect-purchase intention model

<table>
<thead>
<tr>
<th>Pre-purchase Affect</th>
<th>Standardized Coeff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazed</td>
<td>0.266</td>
</tr>
<tr>
<td>Content</td>
<td>-0.144</td>
</tr>
<tr>
<td>Encouraged</td>
<td>0.566</td>
</tr>
<tr>
<td>Hopeful</td>
<td>0.175</td>
</tr>
</tbody>
</table>

4. Conclusion

Affective responses of consumers are triggered by both product form and function. However, more variables related to product form can explain the intensity of PPA such as shape and dimension. The most important functional attribute is related to engine displacement while those related to form include shape of the headlight, roof, taillight, front, back, and length. Important functional attributes are directly related to the primary need of the consumer, which is to drive the engine and the vehicle.

Intense experience of affect triggered a greater chance of purchasing the product. Intense feelings of encouragement and amazement determine purchase intention.

Acknowledgements

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References