Consistency Study between Female Preferences for SUV Shape Design and Designer Comprehension of These Preferences for the Chinese Market

Wen-Jie Li\textsuperscript{1, a} and Shi-Jian Luo\textsuperscript{2, b,*}

\textsuperscript{1, 2}Department of Industrial Design, Yuquan Campus, Zhejiang University, Hangzhou, China

\textsuperscript{a}jawen_id@163.com, \textsuperscript{b}sjluo@zju.edu.cn

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Abstract. Proportion of female consumers in Chinese Sports Utility Vehicle (SUV) market is rapidly growing, and appearance is the most important factor that affects their purchasing decision. However, little study about their preferences has been conducted. If traits and demands of target female consumers were not clearly understood, inconsistencies and deviation between consumer preferences and proposed designs for them might exist. In this study, traits, demands and preferences for SUV shape design of 630 Chinese female were studied, then they were clustered into five typical groups. Then, 10 professional designers were invited to match SUVs for five groups, after that, a correlation analysis was conducted between the preferred SUVs of the five groups and the matched SUVs for them. Analysis results of two groups were negative correlations, which proved the real existence of misunderstanding of designers about traits and demands of female consumers. Finally, for a reference, feasible design solutions were provided for these two groups through a conjoint analysis based on their preference scores. The methods and final results could be incorporated into the SUV design process and provide references for the automobile industry.

Introduction

The Rapid Growth of the SUV in the Chinese Automobile Market

In recent years, the Chinese SUV (sport utility vehicle) market has experienced rapid growth. In 2015, the Chinese passenger vehicle market experienced more than 20 million sales, Chinese automobile output and consumption have experienced seven consecutive years ranked first in the world. Among all passenger car types, the year-on-year growth of SUV models is the most obvious [1]. Also, a growing number of car enterprises set foot in this market segment, and keeps launching new SUV products [2]. These all indicates that the Chinese SUV market actually has enormous potential.

The Potential for the Female Chinese Automobile Market

Among family car owners in China, there are more female owners (51.4\%) than male owners for the first time in 2012 [3]. The proportion of females buying cars rose to 36\% in 2014 [4], and females has increasingly become the majority of the Chinese automobile consumption [5]. Additionally, the decision power and ownership of the second family car mostly belongs to women (as high as 80\% [6]). Also, more and more females prefer SUVs for family use or expression of self-individuality and status. [7,8].

Shape Design is Crucial for Female Perceptions

It is well known that product appearance is significant for consumer perceptions and preferences, and subsequently for successful sales [9, 10, 11, 12, 13]. Especially in the mature and competitive automotive industry, visual aesthetics has become an important factor for determining success of a vehicle in the market [14, 15]. According to Audi, up to 60\% of a consumer’s vehicle purchasing decision is based on styles [16]. Generally, males are more concerned with technical parameters,
function, capability and price. However, females are more emotional, their final decisions are more dependent on their perceived feelings[17,18].

For vehicle purchasing, many females claim that they would ask for recommendations from friends and salesmen, also refer to ads and information on the internet for comparison; however, in real life, good-looking appearance comes first, and they often choose the one that is the “the best looking” at first glance[19,20,21]. The phenomenon indicates that female consumer perceptions and preferences are crucial factors for their purchasing decisions in the highly competitive automobile market [22].

**Understanding Female Consumers Is Necessary**

To attract females, designers need to have a thorough awareness and understanding of female aesthetic desires and preferences for SUV shape design. For designers, if the targeted consumers are not reasonably classified, the diversity of consumer preferences would be ignored, which may lead to a misunderstanding [23] or inconsistency between consumer preferences and design proposals. To avoid this, clear and reasonable classification of consumer groups according to their different traits, demands and preferences is necessary.

Meanwhile, the SUV is relatively new in the Chinese automobile market, few guidelines with academic backgrounds have been introduced to assist SUV designers and enterprises. Existing literature mostly studied passenger cars [24] or specific vehicle brands[25]. Few academic SUV studies have been performed, let alone studies concerning the perception and preferences of female consumers for SUV shape design. There is also not a clear subdivision of female SUV consumers.

**Aim and Plan**

In this study, female subjects were selected to explore their preferences for SUVs shape design. Also, the consistency between their real preferences and understanding of designers to these preferences were explored, to provide guidelines for designers and manufactures.

The study is divided into three sections. First, female consumers in the Chinese SUV market were clustered into different groups based on their preferences to SUV shape design, and each group was defined based on common consumer traits in the same group. Second, car designers were invited to match SUV design samples for different consumer groups according to their different traits. Finally, the consistency was verified between matching proposals by designers and real preferences of consumers through correlation analysis. The outline of this paper is illustrated in Fig.1.

![Figure 1. The working procedure of this study.](image-url)
Stage 1: Investigating the Preferences, Traits and Demands of Female Consumers

In this stage, quantitative and qualitative information about female subjects were obtained to classify them into typical groups. A preference test was conducted to collect consumer preference data. Interviews and a questionnaire survey were implemented to obtain behavior traits and demands of consumers.

**Methods**

**Subjects**

First, invitations for experimental subjects were posted on the Internet, especially on the SUV BBS and SUV club websites in China. The requirements for the subjects were that they be female, 20-50 years old (females within this age range have great influence on purchasing activities, accounting for more than 21% of the total population (Wang, 2007; Psychology, 2015)), have SUVs or buying demands, and have good communication skills. Simultaneously, field studies were conducted in Hangzhou, Shanghai and Beijing. Finally, 630 female subjects were selected for later study.

**Stimuli**

32 typical SUV products (imported and domestic) with different shape design in the Chinese market were selected by 10 invited professional car designers. The 32 SUVs were marked with SUV ID, Sn. Images of each SUV were printed on one card, including the front perspective view, side view and back perspective view. The images were all in black and white. Brand logos were erased to eliminate unnecessary influences.

**Procedure**

1. Preference test
   - 630 subjects were invited to conduct a SD (Semantic Differential) evaluation for the 32 SUV samples, based on a 10-level Likert scale in which “10” represents the most preferred and “1” represents the least. Scores were collected for later analysis.
2. Questionnaire survey and interview
   - Each subject was asked to finish a questionnaire and a short interview contained questions about their demographic and behavioral traits (the contents included their daily life, working condition, lifestyle, SUV usage, SUV purchase, SUV design, goals and aspirations) to reveal an explicit consumer image.

**Results of Stage 1**

**Results of the Cluster Analysis based on Consumer Preference Scores**

Based on preference scores (32×630) determined from the SD test, a Hierarchical Cluster in SPSS were conducted to classify these consumers into groups. According to the recorded subject information, and multivariate analysis of variance to the clustering results, the 630 consumers were finally classified into 5 groups, named from G1 to G5. The numbers of subjects in G1-G5 were respectively 76, 227, 189, 75 and 63.

**Different Female Consumer Groups in the Chinese SUV Market**

From the questionnaires and interviews, information of each subject was collected. For defining each group, a focus group was built. It included 2 experienced salesmen at Auto 4S shops, 2 SUV dealers, and 1 market researcher. Based on the collected subject information, the focus group compared and summarized similarities and differences from the demographic information and various behavior traits within the same group and among different groups, then identified certain distinct traits of each group to describe this group, finally formed a comparison chart (Table 1) to present and compare important characteristics of each group to better understand their differences.
Table 1. Comparison of important characteristics among the five groups.

<table>
<thead>
<tr>
<th>Basic traits</th>
<th>G1: Family type</th>
<th>G2: Fashion type</th>
<th>G3: Career type</th>
<th>G4: Practical use type</th>
<th>G5: Athletic type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUV usage related</td>
<td>Picking up children, shopping, going to beauty salon with friends.</td>
<td>Transportation tools for work and travel.</td>
<td>Represents status, working and commercial activities.</td>
<td>Transporting goods or passengers (including families).</td>
<td>Outdoor off-road activities.</td>
</tr>
<tr>
<td>SUV purchase requirements</td>
<td>Large, comfortable, opinions are changeable with suggestions and always follow the majority opinion.</td>
<td>Appearance, quality and details. Preferring distinct and strong styles. Do not like moderation.</td>
<td>Concerned with brand, design quality, performance and level of luxury. Brief and elegant appearance.</td>
<td>Concerned with practical use, such as emissions, reputation, multi-functionality, and fuel consumption.</td>
<td>Cross-country performance, handling quality and high technology.</td>
</tr>
</tbody>
</table>

Distinct traits of each group were concluded as follows:

G1:
- Most of women in this group are full-time wives or have limited work between 28 and 47 years old. Most of them are married. Their main work involves caring for family or children.
- Their main reason for choosing SUVs is for picking up children, going shopping and meeting with friends. Their SUV choices can be easily manipulated with suggestions. Most of these women are attracted to visually appealing and popular styles.
- Life is relaxing, free and enjoyable for most of them.

G2:
- This group pursues the extraordinary. They have strong brand awareness and personality needs. This is a relatively young group, mostly between 22 and 34 years old. Most of them are involved in jobs related to creative industries, literature and art, white collar position, or elite members of foreign companies. Some are married, but few have children.
- The majority of this group has a higher education degree and a strong economic position. So, to reflect their sense of achievement and superiority, they consider quality and details when choosing SUVs. The vast majority of them prefer distinct and strong style. Thus, fashion and special appearances are attractive to this group.
- These women are independent and passionate. Most of them care about certain quality of life, emphasize quality of goods and unique styles, and they trust brand products and imports.

G3:
- Most of this group are successful middle-aged women, and more than half are aged 35-45 years old. This group includes advanced white-collar workers, small business bosses, entrepreneurs, and business women. Most of them are married with at least one child.
- This group chooses SUVs as a status symbol and for commercial uses. Thus, they are most concerned with brand, design quality, performance and level of luxury. The majority of them prefer a brief and elegant appearance.
- This group values quality of life and is career oriented, striving for a more successful career.

G4:
- Seventy-five percent of them selected SUVs for carrying passengers or goods. Most of them are small private business owners or self-employed. Women in this group are between 30 and 45

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years old. More than half of them are married and have at least one child. Their overall cultural level is not high.

- More than half of them consider practical uses when purchasing SUVs, such as multi-functional abilities, fuel consumption, reputation and cost performance. Compact SUVs are common choices for them.
- Business is not the only motivation for the majority of this group. They consider business and family. Almost half of this group plays Mahjong during their leisure time and enjoys making friends.

G5:

- Most of this group are cross-country enthusiasts, between 30 and 39 years old, but some 20-30 years olds are also interested in off-road activities. Regardless of whether they have a job, they enjoy freedom and excitement.
- For SUVs, they are most concerned with cross-country performance, handling quality and high technology.
- These women are passionate, like to experience and conquer limits, and enjoy driving.

A global Summary of Chinese female SUV consumers

Through data summarization, meaningful information was extracted about all of the female consumers that may benefit the automobile industry in its understanding of the current Chinese females SUV market.

- Female consumers between 30 and 40 years old comprised almost 60% of the female consumers from 20 to 49 years old.
- Married female consumers comprised a larger proportion of the overall market (approximately 70%). More than half of these married women have at least one child.
- Most mature married consumers choose an SUV for the space, safety and multi-functionality, while the majority of young and single consumers select SUVs for appearance and fashion.
- High-income and well-educated consumers are more concerned with SUV appearance, design, brand and details.
- Private owners and white collar workers are economically strong and have potential demands for SUVs. These two groups may lead the future Chinese female SUV market.

Stage 2: Designer Shape Matching for Female Consumer Groups

Subjects

10 car designers (7 males and 3 females), each had at least three years of experiment with car design, were invited to perform matching experiments.

Stimuli

- Printed images of the 32 SUV samples used in stage 1.
- Five determined consumer groups (G1-G5) from Stage 1. Each consumer group was represented with a printed card with minimal text to describe traits of this group in the comparison chart. The cards were marked with the group ID: Gn.

Procedure: Matching Experiment

The experiments were individually performed so that each designer was allowed to proceed at their own pace. First, through referring to the provided content and further verbal description from the experiment executor, a designer was asked to choose 10 of the 32 SUV samples that were suitable for one group, also provide reasons for the choices. IDs of the selected SUVs and the reasons were recorded by the experiment executor. Then, the designer matching for other groups according to the same process. Designers performed the experiments in random order and were allowed to repeat SUV samples for different groups.
Results and Discussion

According to the real preference data of consumers from stage 1 and the matching results of designers from stage 2, a correlation analysis was conducted to verify the consistency between designer and consumer data.

Comparison between Matching Results of Designers and Real Preferences of Consumers

Data Processing and Charting

To performing correlation analysis, the data from the subjects and designers were processed. The data from G1 are used here as an example of data processing:

1. For the designer data, rearranging the order of SUVs based on the total number of selected times for each SUV in G1 by the 10 designers, in descending order. The SUVs that were selected at the same times were considered a group.
2. For the preference scores of G1, the mean preference score for each SUV was calculated.
3. For each SUV group generated in step 1, the mean preference score of the SUVs were the new score of G1 for this SUV group. Based on this, rearranging the SUV groups in descending order, and the corresponding selection times (from step 1) of each SUV group were also rearranged.

Finally, a correlation analysis was conducted based on the two orders of SUV groups represented by their corresponding selected times.

Figure 2. Results of correlation analysis.
Before correlation analysis, a scatter diagram was constructed to inspect the linear relationship between the two orders. The X axis represented SUV groups and the Y axis represented the corresponding data from the designers and consumers. Data points from the designers and consumer groups were connected separately with red and blue lines to form the line graphs, to present the consistency between the two groups (Fig.2).

Then, a correlation analysis was performed between the consumer and designer data. Based on the Pearson correlation coefficients and Sig values, the consistency was defined.

**Results from the Correlation Analysis**

The results from the correlation analysis were presented in Fig.2. The correlation coefficient \( r, -1 \leq r \leq 1 \) reflects the consistency between the preferred SUVs of consumers and matching proposals by designers. A correlation greater than 0.8 is generally described as strong, whereas a correlation less than 0.5 is generally described as weak (e.g., Das et al., 2009). So, the analysis conclusions are as follows:

- **For G3** \( (r = 0.909) \) and **G5** \( (r = 0.842) \), a strong correlation, showed that the designers understand the demands of G3 and G5 better. The SUVs that these groups preferred and the SUVs that designers matched were relatively consistent.

- **For G2** \( (r = 0.779) \), the correlation was still high, but there were differences between consumer real preferences and understanding of designers.

- **For G1** \( (r = 0.283) \) and **G4** \( (r = 0.152) \), there was a comparatively weak correlation, which revealed that significant differences existed between understanding of designers and consumer needs and preferences.

1. **G1**

<table>
<thead>
<tr>
<th>Designers</th>
<th>Ranking by Selected times</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>S15 &gt; S16 &gt; S21 &gt; S27 &gt; S22 &gt; S29 &gt; S24 &gt; S23 &gt; S19 &gt; S10 &gt; S11 &gt; S17 &gt; S26 &gt; S13 &gt; S14 &gt; S21 &gt; S18 &gt; S19 &gt; S20 &gt; S21 &gt; S22 &gt; S23 &gt; S24 &gt; S25 &gt; S26 &gt; S27 &gt; S31 &gt; S15</td>
</tr>
</tbody>
</table>

Due to the weak correlation, from the Table 2, there are clearly differences between the consumer preferred SUVs and matched samples by designers. The top ten preferred SUVs of G1 tended to be mellow, elegant styles, such as S12, S6 and S32, also cross-country styles such as S1, S2 and S20. However, designers did not match a cross-country style SUV. Predictions of designers for this group were too conservative. Aesthetics and values of full time wives are changing, and there were a significant number of young females in this group. Designers should understand demands and preferences of this group from an overall perspective.

2. **G2**

<table>
<thead>
<tr>
<th>Designers</th>
<th>Ranking by Selected times</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2</td>
<td>S29 &gt; S31 &gt; S30 &gt; S20 &gt; S26 &gt; S23 &gt; S12 &gt; S27 &gt; S16 &gt; S25 &gt; S7 &gt; S24 &gt; S17 &gt; S5 &gt; S18 &gt; S4 &gt; S6 &gt; S13 &gt; S1 &gt; S2 &gt; S19 &gt; S22 &gt; S9 &gt; S8 &gt; S28 &gt; S32 &gt; S31 &gt; S11 &gt; S14 &gt; S21 &gt; S3 &gt; S10</td>
</tr>
</tbody>
</table>

This group prefer young, energetic and distinct SUVs. They prefer boxy and straight-lined styles, such as S29, S30, S20, S23 and S25. When the SUV is round, massive dimensional feelings are also required (as in S15, S26 and S27). From Table 3, the top ten SUVs from the designers and consumers
were nearly the same. The distinct personality of this group might improve the understanding of designers.

3. G3

Table 4. Data of G3 and matching proposals for them.

<table>
<thead>
<tr>
<th>Designers</th>
<th>Ranking by Selected times</th>
<th>S16&gt;S31&gt;S26&gt;S30&gt;S24&gt;S23&gt;S20&gt;S29&gt;S28&gt;S26&gt;S30&gt;S24&gt;S23&gt;S20&gt;S29&gt;S28</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3</td>
<td>Ranking by preference scores</td>
<td>S30&gt;S16&gt;S32&gt;S23&gt;S25&gt;S31&gt;S29&gt;S27&gt;S24&gt;S26&gt;S20&gt;S12&gt;S15&gt;S14&gt;S13&gt;S17&gt;S80&gt;S28&gt;S11&gt;S19&gt;S15</td>
</tr>
</tbody>
</table>

Business use is the dominant requirement for this group, so moderate and solemn appearances are important for representing their status. From the data of designers in Table 4, the top ten SUVs are consistent with the preferred SUVs of the consumers. From the data for G3, whether the SUVs are boxy and straight-lined, such as S30, S23, S29, S25 and S27, or rounded and streamlined, such as S16, S32 and S24, their appearances are all modest, elegant and brief.

4. G4

Table 5. Data of G4 and matching proposals for them.

<table>
<thead>
<tr>
<th>Designers</th>
<th>Ranking by Selected times</th>
<th>S6&gt;S9&gt;S13&gt;S14&gt;S8&gt;S7&gt;S28&gt;S10&gt;S11=S12&gt;S2=S21=S22=S3=S27=S15=S18=S24=S31</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4</td>
<td>Ranking by preference scores</td>
<td>S16&gt;S32&gt;S12&gt;S6&gt;S5&gt;S7&gt;S24&gt;S15&gt;S29&gt;S8&gt;S27&gt;S30&gt;S26&gt;S31&gt;S25&gt;S4&gt;S28&gt;S30&gt;S13&gt;S10&gt;S11&gt;S12&gt;S2&gt;S11&gt;S18&gt;S8&gt;S22&gt;S19&gt;S19</td>
</tr>
</tbody>
</table>

The choices for this group are mostly based on practical needs for transport and cost performance, such as S13, S14, S28, S10, S6, S8, S11 and S12, rather than SUV appearances. However, the preferred SUVs for this group have strong female characteristics, such as S16, S32, S12, S6 and S24, and there were also other selected SUVs, such as S5, S7 and S29. The uncertainty of a preferred style and unclear personalities may have caused the weak correlation.

5. G5

Table 6. Data of G5 and matching proposals for them.

<table>
<thead>
<tr>
<th>Designers</th>
<th>Ranking by Selected times</th>
<th>S1=S20&gt;S23&gt;S8&gt;S26&gt;S29&gt;S32=S21&gt;S20&gt;S23&gt;S25&gt;S26&gt;S8&gt;S13&gt;S27&gt;S26&gt;S29&gt;S4&gt;S5&gt;S6&gt;S8&gt;S12&gt;S15&gt;S31&gt;S16&gt;S14&gt;S28&gt;S4&gt;S5&gt;S17&gt;S11&gt;S10&gt;S18&gt;S8&gt;S3&gt;S32&gt;S19=S21</th>
</tr>
</thead>
</table>

The two data groups in Table 6 were consistent. For this group, the cross-country appearance is necessary (S1, 20, S2, S23). The boxy and straight-lined appearances represent their passion and sense of adventure.

**Analysis of the Existing Misunderstanding between Designers and Consumers**

Reasons for the misunderstanding between designer and consumer perceptions and preferences may be explained as follows:

- Initial and deep studies and analysis of consumer preferences and demands were weak, resulting in an unclear definition of the target consumers and inexplicit design directions.
- Designers might integrate personal perceptions according to personal experiences.
- The diversity of the consumer needs, their unpredictable changing values and roles in modern society also make understandings difficult.
Design Solution

For the inconsistency of G1 and G4, feasible solutions were provided as a design reference.

SUV Design Features

The side view of SUVs, which has a considerable numbers of important design features, was selected for defining and classifying the design features. Based on former research [5] and existing vehicle shape design literature, such as Lai et al., 2005, with the help of car designers, SUV design features and levels of each feature were finally defined from the 32 SUV products (shown in Table 7).

Table 7. Design factors and feature levels of SUV.

<table>
<thead>
<tr>
<th>ID</th>
<th>Factors</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Size</td>
<td>Level1 Small 4000 1600</td>
</tr>
<tr>
<td>B</td>
<td>Outline</td>
<td>Level1 Boxy</td>
</tr>
<tr>
<td>C</td>
<td>Stereoscopy</td>
<td>Level1 Flat</td>
</tr>
<tr>
<td>D</td>
<td>The ratio of head’s length to body’s length</td>
<td>Level1 0.25</td>
</tr>
<tr>
<td>E</td>
<td>Vertical angle of windshield</td>
<td>Level1 30°</td>
</tr>
<tr>
<td>F</td>
<td>Front mask angle</td>
<td>Level1 0°</td>
</tr>
<tr>
<td>G</td>
<td>Horizontal angle of hood</td>
<td>Level1 2°</td>
</tr>
<tr>
<td>H</td>
<td>Angle of roofline</td>
<td>Level1 0°</td>
</tr>
<tr>
<td>I</td>
<td>Vertical angle of rear window</td>
<td>Level1 10°</td>
</tr>
<tr>
<td>J</td>
<td>Beltline</td>
<td>Level1 Horizontal</td>
</tr>
<tr>
<td>K</td>
<td>Shape of window</td>
<td>Level1 Party trapezoid</td>
</tr>
<tr>
<td>L</td>
<td>Wheel archs’ shape</td>
<td>Level1</td>
</tr>
<tr>
<td>M</td>
<td>Fenders’ height (shape change with L)</td>
<td>Level1</td>
</tr>
</tbody>
</table>

Conjoint Analysis

Based on Table 7, different design feature levels were listed in a table in an orthogonal pattern. Then, a conjoint analysis was conducted based on the preference scores of G1 and G4 separately.
1. G1

The result of the conjoint analysis for G1 is shown in Table 8.

Table 8. The results of conjoint analysis for G1.

<table>
<thead>
<tr>
<th>Components</th>
<th>Design feature levels</th>
<th>(u)</th>
<th>q(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Size</td>
<td>a1: 4000/1600mm</td>
<td>0.847</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a2: 4400/1660mm</td>
<td>3.096</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a3: 4800/1780mm</td>
<td>-7.965</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a4: 5200/1860mm</td>
<td>4.022</td>
<td></td>
</tr>
<tr>
<td>B: Outline</td>
<td>b1: Boxy</td>
<td>-4.447</td>
<td>5.892</td>
</tr>
<tr>
<td></td>
<td>b2: Rounded</td>
<td>4.447</td>
<td></td>
</tr>
<tr>
<td>C: Stereoscopy</td>
<td>c1: Flat</td>
<td>2.061</td>
<td>3.848</td>
</tr>
<tr>
<td></td>
<td>c2: Solid</td>
<td>-2.061</td>
<td></td>
</tr>
<tr>
<td>D: The ratio of head’s</td>
<td>d1: 0.25</td>
<td>-3.054</td>
<td>5.225</td>
</tr>
<tr>
<td>length to body’s length</td>
<td>d2: 0.3</td>
<td>3.054</td>
<td></td>
</tr>
<tr>
<td>E: Vertical angle of</td>
<td>e1: 30°</td>
<td>-3.635</td>
<td>5.373</td>
</tr>
<tr>
<td>windshield</td>
<td>e2: 45°</td>
<td>3.229</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e3: 60°</td>
<td>0.405</td>
<td></td>
</tr>
<tr>
<td>F: Front mask angle</td>
<td>f1: 0°</td>
<td>1.107</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f2: 10°</td>
<td>2.978</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f3: 15°</td>
<td>0.339</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f4: 30°</td>
<td>-4.425</td>
<td></td>
</tr>
<tr>
<td>G: Horizontal angle of</td>
<td>g1: 2°</td>
<td>7.76</td>
<td>13.237</td>
</tr>
<tr>
<td>hood</td>
<td>g2: 6°</td>
<td>1.347</td>
<td></td>
</tr>
<tr>
<td></td>
<td>g3: 10°</td>
<td>-9.107</td>
<td></td>
</tr>
</tbody>
</table>

From the result, through combining the most preferred design features (which influence preferences most) of G1, a design solution was obtained for the frame image of the side view, shown in Fig.3.

![Design proposal through conjoint analysis for G1.](168)

The preferred design feature combination for G1 was \([a4, b2, c1, d2, e2, f2, g1, h3, i3, j2, k2, l3, m2]\). From the utility criterion, G1 prefers a large size (a4) SUV, corresponding with their needs for shopping, travelling, picking up children and families. The rounded appearance (b2) can decrease the intimidation of the large size, providing a more amiable appearance that corresponds with the temperament of mothers. This group is expected to be traditional, which corresponds with the stable and safe appearance of the moderate vertical angle of the windshield (e2) and horizontal angle of the hood (g1). However, the rising curved beltline (j2) reveals a pursuit of speed and vigor. L3 and m2 always appear in cross-country vehicles, while i3 is regularly applied to sports or elegant vehicles. Thus, consumers in this group were contradictory. They are fond of elegant, stable and rounded SUV design, while disliking mediocre appearance. Instead, they prefer masculine design features. Thus, design proposals for this female group should balance stability with dynamics and cross-country appearance.

2. G4

For G4, the same conjoint analysis was conducted, design solution by combining their most preferred design features \([a2, b2, c1, d2, e1, f2, g1, h3, i3, j2, k2, l3, m3]\) was shown in Fig.4.
This group preferred a compact (a2), rounded (b2) and flat (c1) SUV. This corresponds with their practical and economical consumption view. Their vigor and passion are revealed from the rising curved beltline (j2). Additionally, they preferred I3, e1, m3, l3 and h3. These five factors are all extreme-levels of the features that strongly influence the style and temperament of an SUV. These show that this group potentially has a spirit of adventure, which supports the strong career development.

There were several common features between the final design proposals for G1 and G4, which may reflect common traits. Most women in G1 and G4 are married and mothers. B2, c1, and g1 all reveal their demands for a stable and mild appearance, which corresponds with the female gender, while j2, i3 and l3 suggest certain sporty and masculine appearance, showing their passion and superiority. These contradictory preferences for SUV shape design indicate that values of Chinese females are changing.

Summary
In this study, explicit definition of five typical female consumer groups in the Chinese market can help designers and manufacturers understand female behavioral traits and demands, and aid clear design direction during design process. Additionally, these five consumer groups can be directly employed as targets for the design process.

Also, consistency between female preferences and understanding of designers was explored, and found two groups showed weak correlations. Finally, recommended design proposals were provided for the two groups, to provide guidelines for designers and manufactures.

However, these definitions do not aim to formulate absolute rules because there are numerous methods to collect consumer information and satisfy demands of the target consumers. Also, the suggested design solutions just provide a reference, and are presented the side views by main design features, not rules for final concrete designs. Substantial design work is still needed for designers to transform concepts into actual products. For the potential SUV market in the further study, the authors would try to corporate with specific automobile enterprise, perfect the results and use them in the actual design and development process.

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