

A study on the semantic gap between designer and user in automobile design

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Abstract: It is argued the semantic gap between the automobile designer and the user is one of the key factors to the business success of automobile design. In order to bridge the gap, the designer must understand the user's psychological feelings and feedbacks on the styling aesthetics; we propose the so-called perceptual archetype based on two surveys. The first survey was a questionnaire about the user's semantic expression of automobile styling, 16 major brands' compact sedans were and 50 subjects selected, 277 semantic words were extracted from the questionnaire. Meanwhile another survey on the designers' intention was undertaken. 15 senior automobile designers were selected, and 131 semantic words were extracted. A hierarchical forest perceptual archetype with 3 semantic folders and 7 semantic types based on the Eakins's semantic theory was built. At last an analogy analysis was carried out to bridge the semantic gap.

Key words: *Automobile design, Semantic gap, Perceptual Archetype*

1. Introduction

Design is not only making things but also fundamentally about making sense of things especially in the automobile design process [1]. Design inherently involves aesthetic and the communication of aesthetics. The Aesthetic aspects of a product are a potential source of pleasure that contribute a lot to the business success [2]. Most approaches focus on the use of technical expertise to identify key interactions between engineering characteristics, but it doesn't address the issue of perceptual interactions. In fact, this is a classic problem in conjoint analysis, and most applications ignore the interactive effects of product attributes on consumer preferences [3]. Besides, it is argued the semantic gap between the automobile designer and the user is one of the key factors to the business success of automobile design. In order to bridge the gap, the designer must understand the user's psychological feelings and feedbacks on the styling aesthetics.

2. Aesthetic response

As we know, aesthetic response depends on a number of factors. Many researchers in the field of art, marketing, fashion, and psychology have done many works to figure out what we see and how we perceive [4, 5]. They used the empirical and experimental methods to evaluate the novelty and distinctiveness. From the perspective of cognitive psychology, aesthetic response is a perceptual framework based on information processing [6]. In design

research, it acts as a agent for the form generating process based on user needs understanding, design concept proposing and form sense making to set a linkage between the semiotics and semantics. The argument is “Form Follows Meaning” [7]. In automotive design, this means that design is to transplant the “right sense” in design to user.

The previous research approaches were mainly from the designers’ aspect on the perceptual framework, little has been done on users’ aspect, and the gap between them. So a research focuses on both the designers’ intention and the users’ understanding on the car styling was carried out to establish a perceptual archetype that could define the automobile aesthetic perceptual framework.

3. Perceptual Archetype

Robert (2001) proposed the perceptual archetype based on the structure of mental category that he described as the prototypicality and the unity [8]. “Prototypicality” is the core of a mental category which could be used to show the degree which an object is representative of a category and “Unity” refers to a congruity among the elements of a design such that they look as though they belong together or as though there is some visual connection beyond mere chance that has caused them to come together [9, 10].

Robert (2001) also proposed a semantic based prototypicality and the unity on aesthetic perception [8]. So In order to figure out the aesthetic response of designer and user, the questionnaire was taken in the survey to collect the semantic expression on automobile styling in order to define the perceptual archetype.

4. Building the Perceptual Archetype

4.1 User Survey and analysis

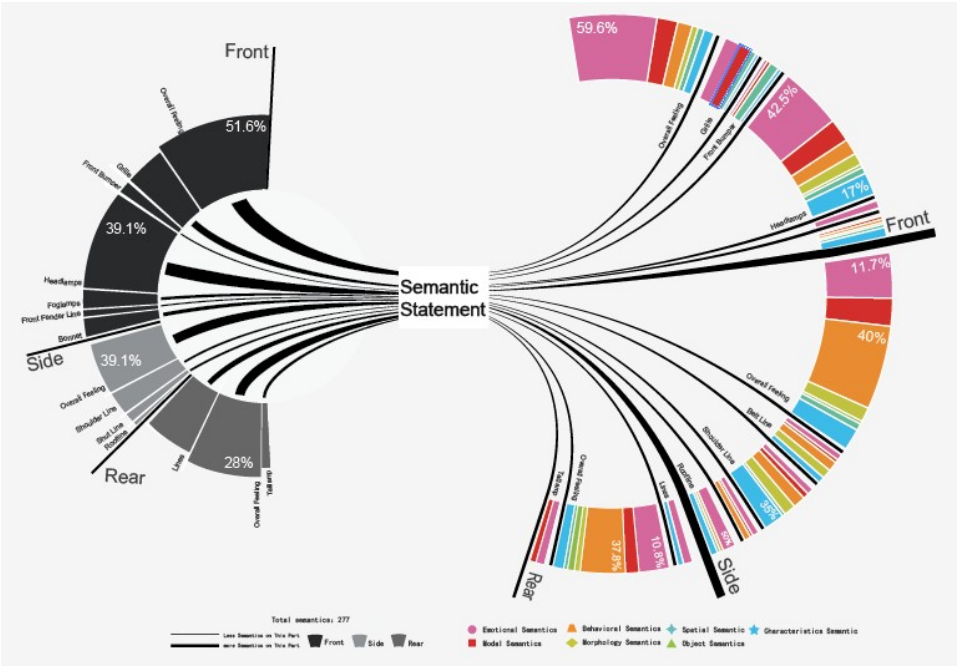


Fig. 1 The Semantic Statement

The first survey was a questionnaire on the user's semantic expression of automobile styling. 50 users participated in this survey, they were asked to tell what they like and why they like on the given 16 typical compact sedans from major brands. According to the natural language extracting processing, the sentences were striped layer by layer, and then the independent words were extracted [12][13], 277 semantic words were extracted. Thus, a semantics database was illustrated as Fig. 1.

In Fig. 1, the semantic words and the related form element are illustrated in two-folder information. One folder is the purely semantic words, and the other folder is the visual and styling elements. These two folders information

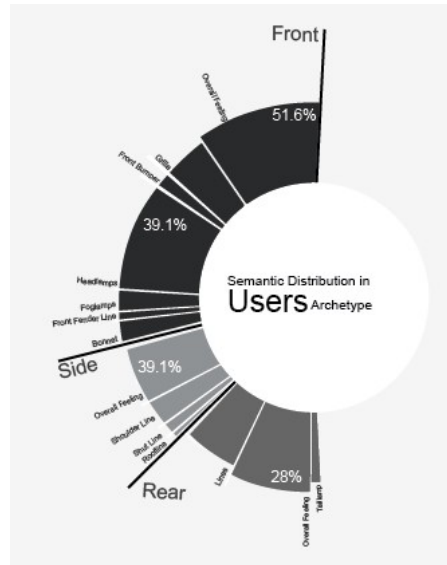


Fig. 2 The Semantic Statement

were matched according to the survey in the database.

Fig. 2 shows, there are 51.6% words that users use to show their overall feelings and about 39.1% words are related with the form elements, such as front bumper, grill, head lamp and so on. But the words describing the side and the rear are all about the overall feelings on the style, there is less words or nearly nothing talking about the design details. That could be the evidences that the main users' aesthetic response on a car is basically from the front of a car rather than from the side and the rear. The result also shows that the users' perception is built on overall perception instead of added detail feeling when facing a car.

4.2 Design Intention and analysis

The knowledge of automobile styling and form shows significant signs of hard to capture and represent because it is mainly composed of the implicit knowledge of designers, so called situated knowledge. Tovey argued that the skills that car stylists owned are developed over times with practice [15]. Even experienced designers are not sure what kind of expertise they use in designing and how, the design knowledge acquiring and representing is still a challenge research problem [16, 17].

Thus, another investigation on the designers' intention and design knowledge was undertaking. 20 senior automotive designers were engaged in the investigation, they were experienced and renowned automobile stylist working for more than 10 years in well-known design businesses and corporations of the automobile industry in China. Through the interviews, the designers described the way that they thought and worked during the design

process, and what intention they expected to transmit to the users. Then the data was arranged with the same method we mentioned above.

4.3 Analogy analysis and the findings

(1) Forest Perceptual Archetype:

Semantics is hierarchical, it can be said semantic has granularity, different levels of semantic granularity differ from each other, thus the multi-layer structure can be used to carry out the analysis [18]. According to the semantic hierarchical model of Eakinsl [19] and Wang Huifeng [20], the semantics are in different layers, they were arranged in succession from the bottom to the top: feature semantics, object semantics, spatial relationships, scene semantics, behavioral semantics, as well as emotional semantic.

Based on their theories, the 277 user aesthetic semantic words, a perceptual archetype of user is illustrated like a perceptual tree (Fig. 3) with 3 layers, the Characteristics Layer (the higher semantic layer), the Scene Layer (the intermediate semantic layer) and the Psychological Layer (the lower semantic layer) as the main branches of the perceptual tree. 7 types of semantics are treated as the basic leaf-nodes that indicated the different semantics of the aesthetic response of the subjects on the sedans.

The Characteristics Layer contains the Characteristics Semantics and Object Semantics. The Characteristics

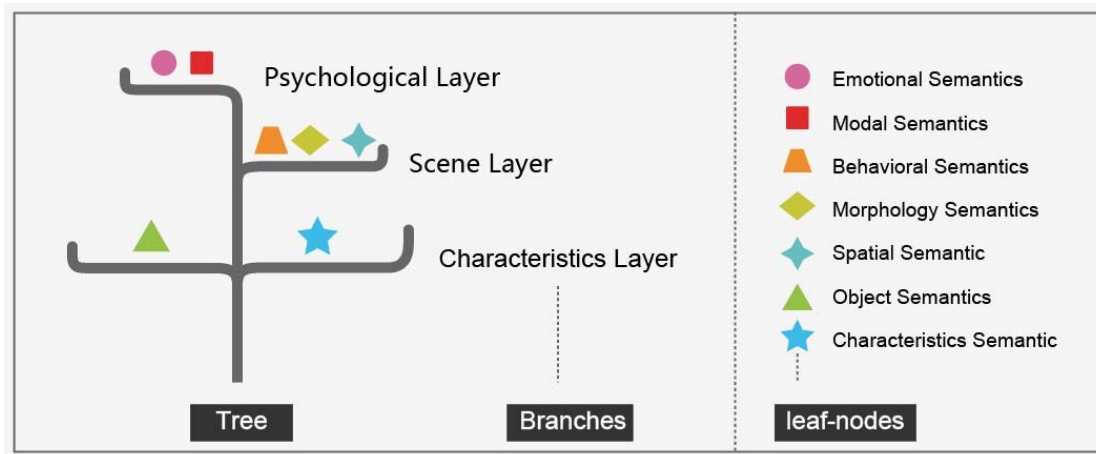


Fig. 3 The Tree Perceptual Archetype

semantics indicate the underlying visual features, such as shape, color, size, texture. The object semantics indicate the symbolic and metaphor pattern, like blade, willow, eyes of an owl presented by form element.

The Scene Layer includes behavioral Semantics, Morphology Semantics and Spatial Semantics. The behavioral semantics indicate the behavior of form features, such as straightness, tilt. The morphology semantics indicate the gesture and status the object manifested, such as tough, sleek. The Spatial Semantics show the spatial relationship between objects, such as low, high, cross.

The Psychological Layer includes modal semantics and emotional semantics. The modal semantics indicate the demeanor and spirit the object manifested, like: sporty, powerful. The emotional semantics indicate subjective feelings to the image, like elegant, stylish.

Later, another perceptual archetype tree was formed based on the investigation of designer semantic statement in the design intention survey, so call the designer intention archetype. Those two surveys provide evident that both users and designers have structural perceptual archetype that is of format of a forest. Fig. 4 shows the forest perceptual archetype, each perceptual archetype is as a tree of the forest, such as archetypes relating to automobile design process, like engineers, decision makers, etc.

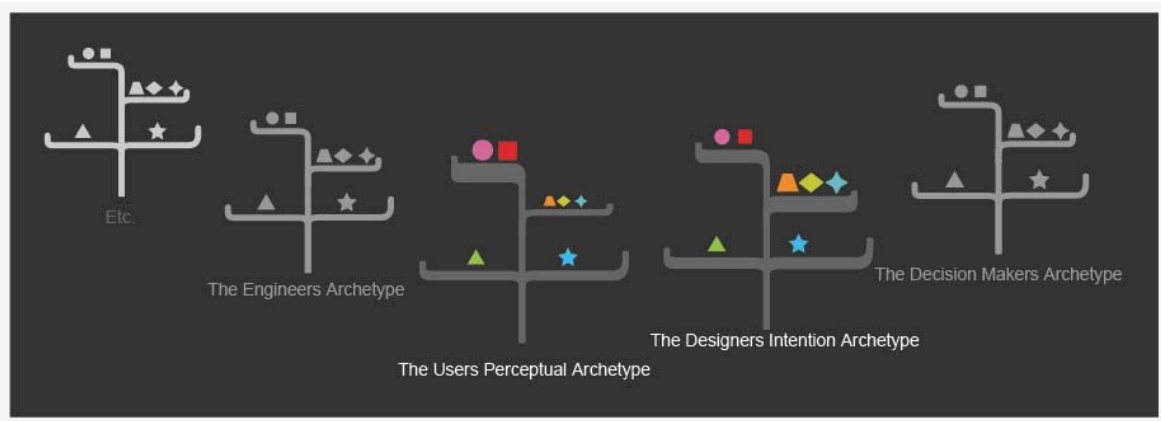


Fig. 4 The Forest Perceptual Archetype

(2) The Similarities between the designer and user perceptual archetype

The designers and users' semantics are both hierarchical. There are several similarities on those two archetype trees based on the survey. First, words describing the Psychological Layer, higher-layer semantics, are mainly adjective-based (95%), such as sporty, elegant, fashionable, reflecting the user psychological needs and design intention (Fig. 5).

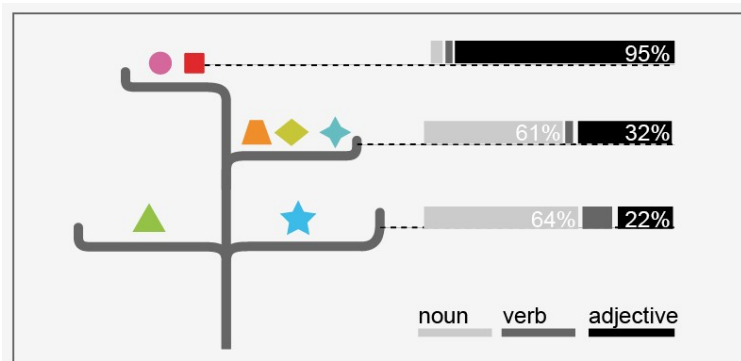


Fig. 5 The Percentages of different types of words in each branch

Second, when describing one specific visual element, like the lights, grill, most words are on the Characteristics Layer, the low-layer semantics, and mainly noun-based (64%), such as blade, willow. Those characteristics can be recognized in automobile design as features, feature-lines, patterns, etc.

Last but not the least, for the Scene Layer, majority on this layer are verbs and adjectives (61%, 32% respectively), verbs such as down, tilt, adj. such as tough, sleek. Words of those types are mainly used to describe two phenomenon: Firstly, the spatial variation of the visual elements; Secondly the interactive relationship between the visual elements, which means how the visual elements connecting and matching with each other. In other words, through this semantic layer, the two-dimensional feature on the lower layer becomes spatial, three-

dimensional and full of volume, which means making the feature has more potentials and possibilities to express the psychological needs and intention.

(3) The differences between the designer and user perceptual archetype

Through the designer and user have the same pattern of perceptual archetype based on the survey. There is several distinctions on the two archetype trees.

Firstly, designers tend to use more words on description of automobile proportions, such as the proportion

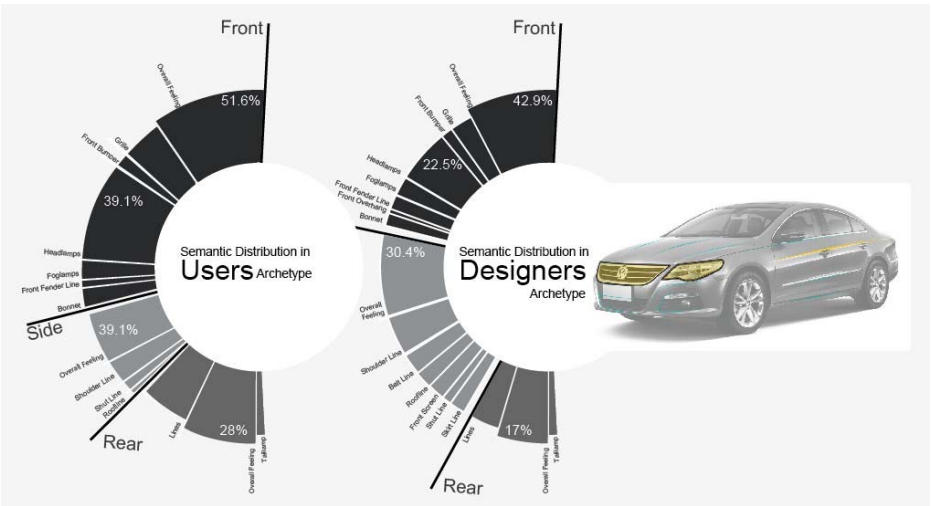


Fig. 6 The Comparing of Semantic Distribution in Users and Designers Archetype between length, width, height and wheelbase. On the contrary, the users use more words on the visual elements, such as the shape of lights, grill. Fig. 6 shows that most user attentions are on the front cars styling (59.7%), especially focusing more on the style of lights (39.1%).

Secondly, the statistical data shows (Fig. 7), the users used more higher-layer semantics (57.5%) and lower-layer semantics (25.4%). However, designers use more intermediate-layer semantics (40%) to illustrate their design intention and the spatial relationships between visual elements (Fig. 7).

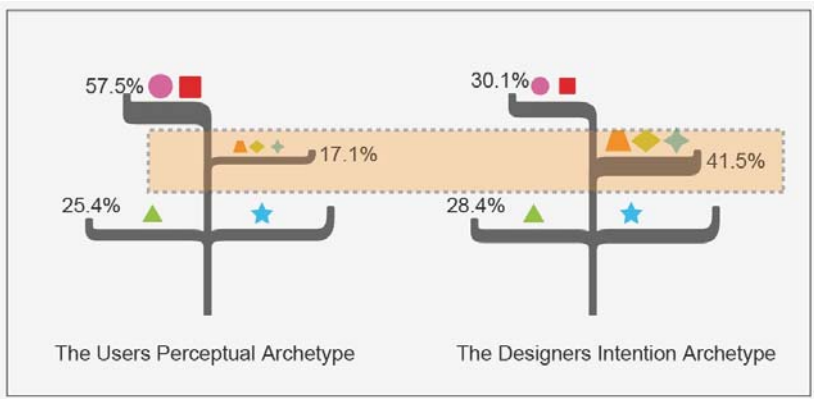


Fig. 7 The Comparing of Users and Designers Archetype

Users and designer have more common perceptual cognition in the higher-layer and lower-layer semantics, indicating that the two layers are the foundational language they communicate with each other. Thus, it can be assumed that the intermediate-layer semantics is the main cognition gap between user perceptual archetype and designer intension archetype. It could be concluded that the Scene Layer, the intermediate semantic layer, is

playing an important role in terms of bridging the low-layer and higher-layer semantics, or as one kind of syntax interpreting the other two semantics semantic layers.

5. Conclusions

Based on two surveys and data analysis, a tree perceptual archetype with 3 semantic layers as the tree branch and 7 types of semantics as the leaf-nodes are proposed. A Forest Perceptual Archetype is conceptualized to illustrate the whole design satiation. The result also shows there are similarities between the designer and user perceptual archetype in the Psychological Layer, higher-layer semantics, and the Characteristics Layer, the low-layer semantics. But the intermediate-layer semantics, the Scene Layer, is the main cognition gap between user perceptual archetype and designer intension archetype. This would layout the basic foundation for the future study in bridging the semantic gaps between the user and the automobile designer. Of course our research were facing the Chinese users, there might be some limitations in terms of culture differences.

6. Acknowledgement

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