

The Effects of Consumer's Visual Cognition on the Feature Composition of Bicycle Frames

Tsu-Wu Hu* Yen-Ting Liao **

**Department of Industrial Design, Chaoyang University of Technology
Taichung, Taiwan, hutw@cyut.edu.tw*

*** Central Taiwan Teaching/Learning Resource Center, National Yunlin University of Science & Technology
Yunlin, Taiwan, liaoyt@yuntech.edu.tw*

Abstract

In modern times, product designs have been gradually oriented to consumer's perceptual demands. In the early stage of designing, if designers cannot sufficiently get hold of consumer's preference, attribute of consumers, and factors of their purchase behaviors, it will be difficult to design products preferred by the target consumer groups. Among the various bike models, City Bike are used by the majority of consumers. Features of bicycle frames account for 2/3 importance of a bike design in consumer's perceptions. As frame styles are diversified, consumers may have different judgments in the selection of bike styles.

Therefore, this study selected college consumers aged between 18~38 as research subjects to investigate their life attitude, attributes, and emotional consumption styles and cluster them by suitable bike frame styles. In model simulation and questionnaire survey, the image words for Kansei evaluation were used as the media, and the subjects were surveyed by random sampling. Bike models and consumer groups were clustered, and Kansei engineering, factor analysis, and two-step cluster analysis were employed as the main research methods. Finally, 25 bike models were extracted. Through model simulation and questionnaire survey, the consumer groups were clustered and analyzed for suitability.

Keywords: Urban recreational vehicle, Feature composition of bicycle frame, Consumers' visual cognition, Kansei words

1. Introduction

In this free society, consumer awareness has gradually risen. If financially allowed, people will certainly purchase favorable products and engage in all kinds of experiential consumptions. Such consumption model can not only satisfy consumers' physical needs but also enhance their psychological perceptions of comfort. With the prevalence of leisure sports and promotion of a healthy environment, bicycle has become one of the products that most people would prefer to use in their leisure time. Influenced by the need for riding comfort, bicycle has been

designed to offer riders with leisure experiences and help them live a healthy life through exercise. Therefore, this study aims to explore the urban recreational bike styles and use the image words for Kansei evaluation to classify and cluster bike styles. Consumers are also clustered through a questionnaire survey performed at random to achieve the research objective of “exploring and analyzing the bike style best suited for each consumer group”.

2. Research Methods

This study focused on mid/low-distance and mid/low-speed urban bicycles that are used for commuting and transportation of goods. Samples of bicycle frames were first collected from magazine and academic journals. The collected pictures were resized to 1/12 of the original size, with the background image, brands, and icons removed. Finally, the samples were presented in color-less images and also classified. Samples of bike frames in a tube-based structure were extensively collected. Experts in design and bike-riding were interviewed and asked to classify about 230 bicycle frames and select representative ones. Finally, a total of 25 bicycles with representative frame styles were extracted. These bicycles were presented in black-and-white images, where the original outlines of the styles were preserved and presented in 2D side-views. As to the image words, kansei words that could be used to describe bicycles were collected. A questionnaire survey was conducted. Participants were asked to evaluate the adequacy of the kansei words for describing bicycles. Therefore, suitable kansei words could be extracted through an objective and numerical approach. On the other hand, the bike frame samples were also clustered through kansei evaluations. 30 participants were invited to match kansei words to 25 bicycle frame samples. With these kansei words, factors of bike frame styles could be analyzed, and the 25 samples were also clustered. Finally, 100 consumers were invited to participate in a questionnaire survey with 3D simulations. These consumers were later clustered according to the survey results.

3. Analysis of Results

The extraction of kansei image words was based on the psychology of consumers, who were asked to select the words appropriate for describing the bike frame that they consider suitable for them. Through the analysis of the relationships between kansei words and consumer groups, the image factors affecting consumer’s selection of bike frames and what image words constitute the image factors can be explored. In this section, interviews were conducted to understand consumer’s image words and expectation of a bicycle product, and image words used in academic papers, newspapers, and magazines were also collected. All the positive and negative image words were organized into a total of 120 pairs. These words were placed in a questionnaire for consumers to reduce the sample of image words. Through this questionnaire, 120 pairs of words were effectively reduced to 60 pairs that consumers consider as suitable for describing bicycles. The 60 pairs of words were further placed in a questionnaire for consumers with a design background to condense the sample to only 16 pairs of words, include 1 technological—retro, 2 modern—traditional, 3 fashionable—retrospective, 4 light-weight—heavy, 5 leisure—work, 6 male—female, 7 cheap—expensive, 8 effort-saving—effort-taking, 9 professional—amateur 10 comfortable—uncomfortable, 11 safe—dangerous, 12 unique—ordinary, 13 new—old, 14 simple—complicated, 15 fast—slow and 16 popularized—individualized.

Based on the 25 bike samples and the 16 pairs of image words, a kansei evaluation questionnaire was designed and given to the subject to evaluate each bike sample with available image words. Later, Principal Component Analysis was performed to induce the image words that were mapped to the 25 bike frame samples. Through

orthogonal varimax rotation, the factor loading of each image word could be derived, and factors with an eigenvalue greater than 1 were extracted. Finally, three dimensions of image words were extracted, and the variance explained was 86.842%. The three dimensions were (1) Evaluative consideration: adjectives in this dimension are used in the evaluation or judgment of a purchase decision; they allow consumers to make subjective evaluations. (2) Experience-based consideration: adjectives in this dimension are used to describe consumer perceptions of experience; consumers use them to describe the experience they imagine when purchasing the product or service. (3) Consideration of needs: adjectives in this dimension are used to describe the basic requirement of a product or service, such as “comfortable” and “safe”.

From the above factor analysis, it could be discovered that the image words for bicycles were explained by three dimensions of considerations. Thus, according to the factor loading of the image words, cluster analysis of the 25 bike frame samples was conducted. According to the significant difference of consumer considerations for each cluster of bicycles, bicycles in Cluster 1 are given more evaluative considerations, followed by experience-based considerations, so they are named as “Modern Style”. It can be discovered that in the modern consumption model, evaluative considerations are essential, and experiential perceptions in life are also valued. However, novel and fashionable frame designs are pursued. In the evaluation, kansei words such as modern, professional, fast, and effort-saving are used, and the frame designs are more technological and avant-garde. Bicycles in Cluster 2 have a higher value in the dimension of experience-based consideration, so they are named as “Leisure Style”. In this consumption model, simple and light-weight frames and a sense of leisure are pursued. For bicycles in Cluster 3, the dimension of consideration of needs has the highest value, followed by the dimension of experience-based consideration. It can be inferred that consumers of this type of bicycles tend to be more rational. In addition to safety and comfort, they also seek leisure experience in life, so bicycles in this cluster are named as “Rational Style”. For bicycles in Cluster 4, evaluative consideration has the highest value followed by the consideration of needs. The bike styles in this cluster are significantly different and more individualized, so they are called “Individual Style”. Consumers of this cluster of bikes clearly know their individual needs. The bike styles in this cluster are more differentiated, but the need for riding comfort is also considered.

Later, consumers were clustered through evaluation of simulated 3D bike styles with 16 pairs of image words. Two-stage cluster analysis was also adopted. First of all, hierarchical cluster analysis was performed to determine the number of clusters. Through k-mean clustering, the representative bike frame of each consumer cluster could be derived. The analysis showed that customers could be classified into three groups, including (1) Hedonic Group: consumers in this group tend to have more ideas in the selection of bike frames and prefer designs that feature comfort and safety; they make rational evaluations of the quota allowed for a bike, and select the product based on a reasonable and acceptable price. (2) Fashion-leading Group: consumers in this group have a certain taste for bike styles, tend to receive more information about bike fashions, and have higher purchasing power for novel and trendy products; they have strong awareness of self selection, disregard less about bike price, and care more about whether the product can fulfill personal needs and offer expected riding experiences. (3) Passive and Compliant Group: consumers in this group have little opinion in the selection of bike styles and demand for only simple, easy-to-ride products. They are more compliant with the fashion, given more flexibility of the allowance for a bike, and also easily affected by peers.

The relationships between consumer groups and bike styles are explained as follows: The “Hedonic Group” of consumers tend to live an easier life, maintain personal lifestyles, have a certain philosophy of value, and clearly know what they really need. In their choice of bike styles, they would purchase comfortable and highly

recreational styles that they can afford. Therefore, the “Reasonable Style” of bikes is more suitable for this group. Consumers in the “Fashion-leading Group” tend to follow fashion, get hold of fashionable and new products, have sufficient consumption knowledge, and have a certain taste of life. They care about leisure experience, personal styles, and pursue the quality of product packaging, internal and external. However, their purchase decisions usually arrive too fast and without thorough consideration. They have certain demands for any product they intend to purchase, so they are clever and relatively loyal to certain products. This kind of consumers usually gets extreme results. They will either get the right product or get lost. In general, “Modern Style” of bikes is more suitable for this group. Consumers in the “Passive and Compliant Group” have little personal opinion in the choice of bike styles. They demands only comfortable and recreational styles. They are likely to blindly follow the fashion of each season and have little idea about fashion. In general, they also have a wider range of product choices, and “Leisure Style” bikes may be more suitable for them.

4. Conclusion

In this paper, kansei words were applied to explore consumer's evaluation of bike styles and analyze the attitude, consideration, and choice models of each consumer group. Through clustering of consumers, consumers would be able to understand the group they belong to, their philosophy of consumption, and self-position. Moreover, the inference with these kansei words can also help them find the bike style that best suits their needs.

Based on the attributes of kansei words and dimensions of consumer considerations, consumers and bike styles were clustered. The clustering of consumers could demonstrate the consumption patterns in the contemporary society. Previous literatures have pointed out the characteristic difference between contemporary consumers and traditional consumers. In this study, through cognitive recognition of bike styles, consumers were properly clustered. Contemporary consumers are not necessarily seekers of fashion. Some of them enjoy living a hedonic life, and others are blind followers who may be over-compliant. The inference of the bike styles best suited for each customer group in this study could help consumers who may be confused when purchasing a bicycle identify their consumption model, orientation, and position, and pick a suitable urban bike frame style.

5. References

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