

Research on the Shape Design of Ice and Snow Intelligent Transport Vehicle Based on Perceptual Imagery

Yaqing Jin^{1,2,*}, Haojie Du², Subadrah Madhawa Nair³

¹ City Graduate School, City University, Malaysia

² School of Art & Design, Jilin Jianzhu University, Changchun, China

³ Faculty of Education and Liberal Studies, City University Malaysia, Selangor, Malaysia

Email Address

324814154@qq.com (Yaqing Jin), 1544965232@qq.com (Haojie Du),

csbadrah.nair@city.edu.my (Subadrah Madhawa Nair)

*Correspondence: 324814154@qq.com

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Abstract:

Based on the related theory of product perceptual image, this paper explores the use of morphological analysis method, perceptual image semantic evaluation method, and constructs factor analysis model to analyze the representative image semantic words of user perceptual image of ice and snow intelligent transport vehicle. Then, according to the Quantitative Class I theory, quantitatively analyze the perceptual image of the morphological design elements of the ice and snow intelligent transport vehicle, obtain the correlation research between the two, and propose to assist in the ice and snow by constructing a quantitative model between the product morphological elements and the user's perceptual image. The design method of the shape design of intelligent transportation equipment is expected to have certain guiding significance and application value for the shape design of ice and snow intelligent transportation equipment.

Keywords:

Perceptual Imagery, Product Form, Ice and Snow Intelligent Transport Vehicle, Factor Analysis, Quantitative Class I

1. Introduction

Intelligent transport vehicle belongs to the subdivision industry of equipment manufacturing industry. [1] Jilin Province is located in the world-class ice and snow gold latitude zone and North America and Europe as the "world's three major powder snow bases". [2] The ice and snow industry has huge potential and will promote the development of ice and snow equipment manufacturing industry. [3] However, the research of intelligent ice and snow transportation equipment is not deep enough, and most of them tend to the safety research of functional technology, lack of regional consideration. With the maturity of the transportation equipment market and the development of the ice and snow industry, the intelligent transport vehicles are facing more fierce competition. Product function safety has no advantage, appearance and

region become an important factor in selection. Keen enterprises pay attention to the application environment, improve the regional appearance to increase the added value. Design to meet the perceptual demand, mining the purchase tendency, to obtain the market. Based on the perceptual image, the form design of ice and snow intelligent transport vehicle is explored to improve its added value and the development of ice and snow industry.

2. Mordern analysis of ice and snow intelligent transport vehicle

In the form design of ice and snow intelligent transport vehicle, it is necessary to study the correspondence between morphological elements and perceptual image first, among which the analysis of morphological elements is the qualitative variable of quantitative analysis. [4] Snow and ice intelligent transport vehicle is suitable for snow and ice mountainous areas and tourist areas, increasing the characteristics of snow and ice intelligent transport vehicle to enhance the added value, but the overall form is similar to that of intelligent dump truck. Therefore, the elements of the intelligent dump truck can be referred to in the morphological analysis. The analysis of the form elements of the ice and snow intelligent transport vehicle can be divided into two stages.

2.1. Form part decomposition of ice and snow intelligent transport vehicle

The decomposition of the form parts of the snow and ice intelligent transport vehicles can be divided into two steps: quickly scan the appearance form, obtain the overall visual image, and gradually transfer to the details to form a new visual image. [5]The first step can analyze the overall form of the intelligent transport vehicle. Due to its function-oriented attribute, similar products have high form similarity, but the brand and market expansion bring improved appearance requirements, and the intelligent dump truck in the market shows a diversified development trend. Different styles of intelligent dump trucks are selected as an example to analyze the overall form. The second step is to divide the intelligent transport vehicle according to morphological analysis, and then analyze the characteristics of variable elements. The ice and snow intelligent transport vehicle can be decomposed into the control room (cab), air intake grille, cargo box, escalator, engineering tires, suspension system and other parts. In order to improve the design efficiency, the transportation equipment sample pictures can be compared through questionnaires, and the morphological parts of the participants that have the greatest influence on their own feelings can be recorded, and the important morphological parts of the ice and snow intelligent transportation equipment can be analyzed according to the experimental data.

2.2. Analysis of the form elements of the ice and snow intelligent transport vehicle

The morphological design elements mainly include four elements: point, line, surface and body. Point elements are limited in describing the morphological characteristics of products, while surface elements and body elements can fully display the morphological information, but they are varied and difficult to define, while line elements carry almost all the morphological information and are easy to express. The line elements of extracting product forms are usually realized by extracting feature lines. The product sample maps are often presented as perspective charts. Designers need to play their professional ability to transform the feature lines into plane lines or outlines of face view, side view and top view, so as to define the morphological and characteristic attributes. According to the investigation results of

the morphological parts of the snow and ice intelligent transport vehicles, they were divided into independent morphological parts by morphological analysis method, and the morphological design elements and extraction characteristics were analyzed. Different form design elements and their characteristics as the design of “project” and “category”, focusing on the main product parts, select the general product form characteristics of design elements, with the cab side, container side, intake grille side, intake grille front face, roof side five product form design elements as the analysis object.

3. Research on the Morphological Design Method of Snow and Ice Intelligent Transport Vehicle Based on Perceptual Image

Users' perceptual image cognition of the product form depends on their subjective feelings. In order to judge whether the form design meets the perceptual needs of users, it is necessary to quantify the perceptual image through methods and theories, clarify the correlation with the product form elements, and help the designers to efficiently design the product form in line with the perceptual goals of users. The form design method framework of ice and snow intelligent transport vehicle based on perceptual image is constructed, the corresponding relationship between the form elements and the user's perceptual image is analyzed with the quantitative class I theory, and the form design suggestions of ice and snow intelligent transportation equipment that meet different perceptual images are generated.

3.1. The morphological design method framework of ice and snow intelligent transportation equipment based on perceptual image

The study on the perceptual image design of products is mainly realized by establishing the mapping relationship between design elements and perceptual image. Therefore, the analysis of product form elements and perceptual image semantics is the key to establish the mapping relationship. Based on the quantitative analysis method, the fuzzy perceptual image information of users is transformed into clear quantitative data, and the correlation between product form elements and users' perceptual image is established, so as to provide effective reference for morphological design. According to relevant theories, the morphological design method framework based on perceptual image quantification is combed, as shown in Figure 1.

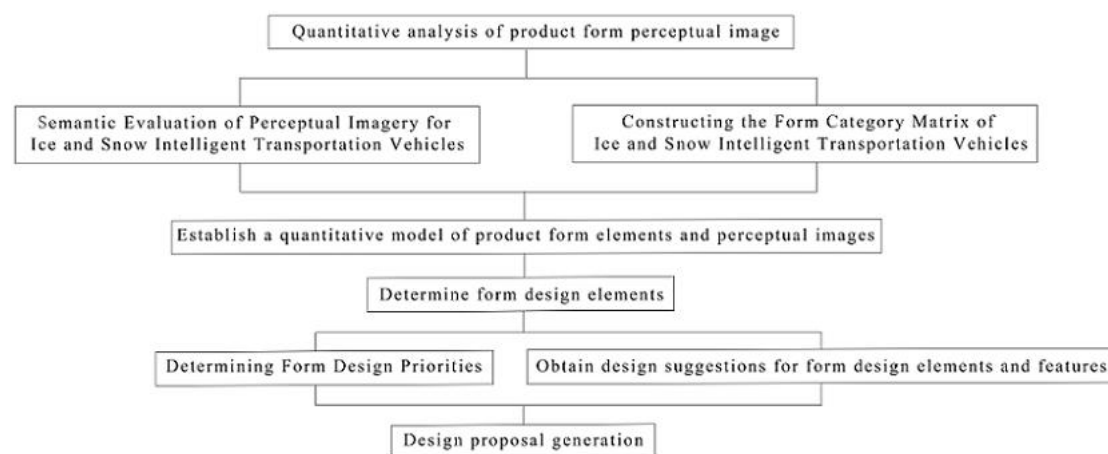


Figure 1. A form design methodology system based on perceptual image quantification.

3.2. Quantitative analysis of perceptual image of ice and ice intelligent transport vehicle

The quantitative analysis of the perceptual image of snow and ice intelligent transportation equipment, the purpose is to obtain the quantitative data between the form elements and the perceptual image of users, and to determine their correlation. First, according to the analysis table of morphological elements, the coding information of the morphological category of the ice and snow intelligent transport vehicle sample is obtained. Then, the perceptual image evaluation data of the snow and ice intelligent transport vehicle is collected through the questionnaire survey. Finally, the quantitative analysis means are used to establish the connection between morphological elements and users' perceptual image.

(1) constructing the category code list of ice and snow intelligent transportation equipment

Based on the quantitative class I theory, before the multiple regression analysis of the relationship between the morphological elements and the perceptual images of the ice and snow intelligent transport vehicles, the morphological design elements of the sample should be expressed in a quantitative form, and the morphological category coding table should be constructed. For example, using the coding information in the analysis table of the design, A14 in sample 1 is A11=0, A12=0, A13=0, A14=1; A23 (rounded), and it is A21=0, A22=0, A23=1, A24=0. The characteristic distribution of morphological elements of ice and ice intelligent transportation equipment is summarized, and the coding table of morphology of ice and ice intelligent transportation equipment is constructed, as shown in Table 1.

Table 1. Classification codes of intelligent transport vehicles.

samp le	A1 1	A1 2	A1 3	A1 4	A2 1	A2 2	A2 3	A2 4	A3 1	A3 2	A3 3	A3 4	A4 1	A4 2	A4 3	A4 4
Sam ple 1	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0
Sam ple 2	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0
Sam ple 3	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0
Sam ple 4	0	0	0	1	0	1	0	0	1	0	0	0	1	0	0	0
Sam ple 5	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0
Sam ple 6	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Sam ple 7	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0
Sam ple 8	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0
Sam ple 9	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0
Sam ple 10	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0

(2) The perceptual image quantification method of ice and snow intelligent transportation equipment

At present, there are many methods of perceptual image quantification. The method adopted in this paper is quantitative class I theory. Quantitative class I theory uses multiple regression analysis to construct a mathematical model of design elements and perceptual imagery to reveal the correlation between them. Because the snow and ice intelligent transport vehicle is a complex mechanical product, with many complex morphological parts, and the change of morphological characteristics is relatively small, so it is easy to summarize. The relationship between the form design elements and the method of quantitative class I theory. When obtaining the quantitative data of the perceptual image of the ice and snow intelligent transport vehicle, it is necessary to import the mean value of the morphological category coding table and the semantic evaluation of the perceptual image into SPSS software for multiple regression statistical analysis, so as to obtain the values of the category score, partial correlation coefficient, complex correlation coefficient and determination coefficient of the morphological design elements. The complex correlation coefficient or determination coefficient indicates the accuracy of the mathematical model, greater than 0.8 or 0.7 means the model is ideal; the partial correlation coefficient indicates the contribution of the morphological design item to the perceptual image; the greater the value, the greater the contribution of the category score; the influence of the morphological design element on the perceptual image. Based on the results of the quantitative analysis, specific morphological design recommendations can be generated.

4. Conclusions

Ice and snow intelligent transport vehicles play an important role in ice and snow areas, used for loading and unloading and transporting ice and snow raw materials and equipment. Its demand has driven the expansion of ice and snow intelligent transportation equipment production capacity. As a high-end complex engineering equipment, snow and snow intelligent transportation equipment is composed of multiple morphological design elements. Different morphological design elements have different effects on user perception. This study proposes a morphological design method of snow and ice intelligent transportation equipment based on user perceptual imagery to connect user needs with specific morphological elements. In this way, more emotional meaning can be transmitted on the basis of function and regional characteristics on the basis of function and use, and enhance the added value and market competitiveness of products.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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