Visual communication method of graphic language in industrial product design

Fang Wang*

School of Art and Design,
Bengbu University,
Bengbu 233030, China
Email: fangw@36haojie.com
*Corresponding author

Huaxi Chen

School of Science,
Bengbu University,
Bengbu 233030, China
Email: 6854127@qq.com

Abstract: In order to improve the ideality of product design effectively, enhance its market attraction and competitiveness and obtain greater economic benefits, the paper designs the visual communication method of graphic language in industrial product design. Through the analysis of industrial product design characteristics, principles and practical problems, the interview method and qualitative analysis method are used to explore the reasons for the low impact of product packaging. Then brainstorming method is used to quantitatively analyse the unique selling points of products, and select graphic language elements, and then construct industrial product packaging graphic language and its scene, to realise the visual communication design of industrial product graphic language. The experimental results show that the design satisfaction of this method is high, the competitiveness index of product packaging is 90%, the attractiveness index is 0.7, and it can obtain more economic benefits of industrial products.

Keywords: industrial products; visual communication; graphic language; qualitative analysis; brainstorming.

Reference to this paper should be made as follows: Wang, F. and Chen, H. (2022) 'Visual communication method of graphic language in industrial product design', *Int. J. Product Development*, Vol. 26, Nos. 1/2/3/4, pp.1–11.

Biographical notes: Fang Wang received her Master's in Arts from Anhui Normal University in 2011. Currently she is a professor in the School of Art and Design of Bengbu University. Her research interests include Visual Communication Design and Product Design.

Huaxi Chen received his Master degree from Yangzhou University in 2010. He is currently a professor in school of Science of Bengbu University. His research interests include algebra and mathematical modelling.

1 Introduction

At present, social information transmission is frequent and information exchange develops rapidly. People are more and more eager for unusual, flexible and novel and unique visual images. With the development of The Times, visual communication in the field of art and design will bring more challenges to people. Visual communication refers to the use of visual perception carrier, the use of forms of expression to convey information, visual communication is the most common way of information transmission in human history, and the use of visual image design, combined with graphic language, text expression, colour rendering and other basic elements is one of the artistic expressions of information transmission (Zhang et al., 2019).

Graphics, as a unique visual language symbol, has similarities with written language, and can even more prominent performance of human emotions, concepts and thoughts. Graphic language has great influence and appeal because of its easy to read, easy to understand and strong visual impact (Wang et al., 2019). If people want to use graphics to accurately convey information and feelings, then it is necessary to study the graphic language elements and coding process, grasp the characteristics of the graphic language, based on the current public aesthetic, combined with perceptual and rational creative thinking. For industrial product design, we must pay attention to graphic language design, in the form of industrial products, texture, etc., in order to strengthen and render the effect (Dey et al., 2019).

The shape, texture and visual perception of industrial products are important factors, and the use of visual perception of industrial products refers to the attraction effect of showing internal texture. All visual elements can be boiled down to a graphical language design. Reasonable graphic language design can not only attract consumers, make products more popular, but also can effectively bring great market attraction and competitiveness to industrial products, so as to produce greater economic benefits.

For this reason, this paper designs a visual communication method of graphic language in industrial product design. The method design idea is as follows:

1 Through the analysis of the characteristics, principles and practical problems of industrial product design, combined with the overview of image language in visual communication, the interview method and qualitative analysis method are adopted to study the reasons why packaging in industrial products does not have an impact.

2 Select the unique selling points of industrial product packaging. According to the positioning of industrial product packaging, brainstorming method is used to quantitatively analyse the number of keywords of unique selling points, select graphic language elements, create graphic language scenes of industrial product packaging, and realise the visual communication design of graphic language of industrial products.

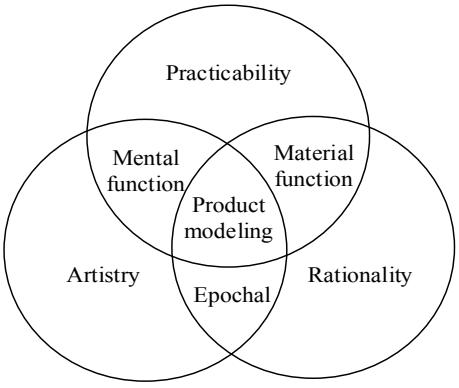
3 The empirical results show that the product design of this method has a high degree of satisfaction, which can effectively promote the salability of industrial products, enhance market attractiveness and competitiveness, and obtain greater economic benefits.

2 Design principles of industrial products and their existing problems

2.1 Characteristics and principles of industrial product design

The design and development of modern industrial products is to improve the current people's spiritual and cultural level, to meet the needs of People's Daily life, so as to realise people's pursuit of spirit and material. Therefore, industrial product design needs to have material and spiritual functions, as well as a certain degree of artistry, rationality and usability. The characteristics of industrial product design are shown in Figure 1.

Figure 1 Design characteristics of industrial products



The design of industrial products should not only design their functions, but also consider the appearance design of industrial products, and give certain cultural connotation to industrial products. At present, industrial product design needs to follow the following principles:

1 *Principle of rationality*: the main condition for industrial products to achieve circulation is to achieve a certain reasonable degree of industrial products. As each design of industrial products should have a corresponding design purpose, therefore, the rationality of industrial products is the primary consideration.

2 *The principle of economy*: because industrial products involve related circulation and sales, so, the current market economic benefits of industrial products are affected by the price of industrial products. Therefore, we should use high precision automatic processing equipment, adopt reasonable design technology to reduce the cost of industrial products, so as to provide market economic benefits.

3 *Artistic principle*: the outer packaging of industrial products directly determines the satisfaction and recognition of the market and consumers. Therefore, the design of industrial products must consider the artistic principle (Nicolás et al., 2020; Arun et al., 2020).

The above three industrial product design principles are complementary to each other, belong to the same time constitute the unified elements of industrial product design. The relationship of the three is summarised as follows: under the condition of rational use of

industrial products, pay attention to the economy of industrial products, and on this basis, consider the aesthetic packaging design of industrial products.

2.2 Industrial product design problems

In fact, the design of industrial products can be embodied by two basic elements: one is to take meeting the needs of human life as the design purpose of industrial products; the other is that the design of industrial products should not only take the material as the content, but should include the internal relations of industrial products. With the gradual improvement of people's quality of life, their artistic appreciation ability is also improved, and they are more fond of characteristic industrial products, especially those with strong artistic characteristics and charm. Modern industrial products mainly design its production packaging, so that its production mode with modern characteristics, designed industrial products can meet the needs of people's lives (Raju et al., 2019). To this end, industrial product design should pay attention to the following two aspects of the problem:

First, the materials and energy used must be economical. With the continuous development and progress of the society, the consciousness of the use of energy has been gradually updated to economic use at the present stage, and the available energy and materials will be integrated into the industrial product design scheme.

Second, increase the cultural connotation of industrial products. In the design of modern industrial products, the openness of the market promotes the rational use of industrial products, and at the same time contains rich culture, which can adapt to the harmonious concept of people-oriented in modern society.

Industrial products in addition to reflect its use function, but also have a certain value. Contemporary society is to realise the importance of industrial products consumers' aesthetic demand, industrial product design should consider the specific national conditions, inheritance of ethnic traditional culture at the same time, adhering to the modern industrial product design concept, will be in line with the national characteristics of industrial product design for new products, and can use modern technology, better meet the aesthetic need of modern people.

3 Image language in visual communication

Based on the above analysis of the characteristics and principles of industrial product design and the problems that should be paid attention to, the theory and definition of visual communication and graphic language are analysed to lay a foundation for the subsequent design.

In visual communication design, "vision" refers to things that can be seen and perceived by human eyes, "communication" refers to the transmission and communication of information, while visual communication design refers to the design of the transmission and communication of various information through perceptible visual symbols. The expression and transmission of information by visual language can overcome the barrier between language and culture, and realise the understanding and interaction of information through the consensus of information in the form of visual symbol transmission (Liu, 2019).

3.1 Visual graphics language

Graphic language is one of the important expressive elements in visual communication design. It is not only a way of recording, transmitting and expressing information, but also a medium of human emotional exchange and communication (Frutiger et al., 2019; Wrona et al., 2020).

3.1.1 Visual graphic language elements

Graphic language includes: point, line, surface, volume, texture, colour and other elements. These elements change and recombine to form different graphic languages. Among them, the role of the point can represent the position, different points have different meanings, while the line has length, direction, position, located in the plane space turning point and edge position. Straight lines are hard and straight, conveying a message of toughness and masculinity; vertical lines represent rising; horizontal lines represent stillness and stability; The slanted lines represent a sense of direction; soft curves represent soft beauty; complex lines represent a combination of hardness and softness. In addition to the expressiveness of the points and lines, the surface can also represent the design connotation of graphics and words, showing a richer and more specific strength and beauty. The body is composed of planes, representing the expression ability of points, lines and planes. Different volume structures create different visual effects. Texture refers to the visual or tactile form of the material surface, which can truly reflect the material's internal physical structure and external visual form. Colour is a major visual aesthetic language, colour can effectively affect people's psychological feelings.

3.1.2 Visual graphic language features

Graphic language not only represents schematic symbols and body elements, but also represents pointing or conceptual information that can be obtained through various ways. Graphic symbols refer to specific substances and clearly interpret information. Graphic languages are based on rational thinking, observe and analyse the current life and world through specific thoughts and connotations, and realise the superposition of a variety of ideas, covering philosophical graphic expression (Gautam et al., 2019; Kyriakos et al., 2020).

At present, the graphic language has undergone an obvious transformation, from the graphic expression form imitating the natural order to the structural graphic expression form, that is, after logical thinking, using each symbol element to reconstruct the graphic. Graphic image power is greater than the text, it contains a variety of images, can make people intuitively understand the image and feeling of the objective world. A variety of graphics language combination and expression, with intuitive, rich characteristics. Graphic language is different from text, and it has metaphorical nature. In people's brain consciousness, the real meaning of different people has different values, and the interpretation of image information will also produce different effects. Metaphor in graphic language belongs to the public concept, which is generated by social consciousness. It can effectively reflect people's psychology in both structure and expression, thus effectively enriching the connotation of graphic language. Image

metaphor is derived from reality, from life, and higher than reality and living environment, and to convey a kind of information and spirit.

To sum up, this paper analyses the elements and characteristics of the visual graphic language, based on which the visual communication of the graphic language is realised.

4 Visual communication method of graphic language

4.1 Select unique selling points of products

In this paper, through the research on the visual design of packaging of common industrial products on the market, to determine the reasons why packaging in industrial products did not have an impact, and on this basis, to select the appropriate unique selling points.

If the unique selling point does not have an effective impact, the use of the unique selling point can be avoided in the visual design process of industrial product packaging, but a new unique selling point should be selected to achieve its desired effect (Li and Pan, 2019). Therefore, the visual communication method of graphic language in industrial product design should first determine the reasons why the visual design of industrial product packaging has not had an impact, and then select the appropriate unique selling points.

The reasons why packaging has no influence on industrial products are studied and summarised by interviews and qualitative analysis. The interview design of the reasons why packaging has no influence in industrial products is shown in Table 1.

Table 1 Interview design for reasons why packaging has no influence on industrial products

Project	*Content*
To achieve purpose	On the basis of interviewing the interviewees, the author determined the interviewees' views on the reasons why packaging in industrial products has no influence, and obtained the data of the reasons why packaging in industrial products has no influence
Research methods	Face to face
Interview object	15 market consumers
Interview environment	Open and free interview environment
Interview	Manual recording and voice recording are used
Involves the content	Basic information of the interviewees, their consumption habits and their views on the reasons why packaging in industrial products does not have an impact
Important content	Personal information of interviewees, including name, age, occupation, income, consumption motivation and demand, and opinions and suggestions on the reasons why packaging in industrial products has no influence

Through in-depth interviews with the interviewees, according to different packaging design languages of industrial products, it can be seen that the interviewees have no influence on packaging of industrial products mainly focus on the following issues: similar packaging of industrial products, incomplete operation mode and function display of industrial products, strong interest display and so on. In the qualitative analysis of the

same kind of industrial products and the visual design of packaging, the reasons for the packaging not having an impact on the visual design of industrial products are divided into three parts: the homogenisation of the instinctive layer, the ambiguity of the behaviour layer and the hardening of the reflection layer. For the next step to select the appropriate unique selling points to provide a reference.

Before the selection of unique selling points, industrial product packaging positioning should be carried out, and the appropriate unique selling points should be selected according to the positioning situation. In the selection of unique selling points, we should first determine a proposition, that is, positioning of industrial products and packaging, and positioning the visual design of industrial products packaging through qualitative analysis of the reasons why packaging does not have an impact on industrial products. In order to solve the problem of homogenisation of the instinctive layer, the differentiation positioning of the product should be determined in the similar industrial products (Pradhan et al., 2019; Qammar et al., 2019), and the unique selling point of appropriate packaging should be selected from the aspects of acceptability and reputation.

4.2 Select graphic language elements

The unique selling point of industrial product packaging is a relatively vague and abstract concept. Only by summarising the key words of the unique selling point of industrial product can we ensure the precision of the selection of graphic language elements. Therefore, according to the industrial product packaging positioning, select the appropriate unique selling points, using brainstorming method to quantitatively analyse the unique selling points (Lu et al., 2019), Then summarise the number of keywords of unique selling points can be expressed as:

$$Q = \frac{1}{2}WE \tag{1}$$

In Formula (1), W represents the number of indicators of unique selling points, and E represents the keyword area of unique selling points. Because image description behaviour can vividly explain the design image of industrial products, and make it different from similar products in the market. So, when applying graphic language in industrial product packaging design, we must summarise the key words of industrial product packaging unique selling point. Taking the key words of unique selling points as the constraint condition, the graphic language elements suitable for packaging unique selling points can be expressed as follows:

$$A = \frac{Q(T+U)^2}{E} \tag{2}$$

In Formula (2), T represents graphic expression language and U represents graphic metadata.

4.3 Graphic language scene creation

Through the selection of the above industrial product packaging graphic language elements, build a rough industrial product packaging graphic language, and then refine the industrial product packaging graphic language, so as to create industrial product

packaging graphic language scene, and finally achieve the visual design of industrial product packaging. For example, the package design and visual graphics of the wheel bearing kit are shown in Figure 2.

Figure 2 Package design and visual graphics of wheel bearing kit

Its packaging unique selling point for "wheel bearing kits", the unique selling point for image descriptive graphic language to express, by the combined single car wheel bearings and suite is most appropriate, therefore, its graphics language scene is the car wheels and a single bearing and suite this graphic language to create, elaborating on the graphics language scene description, you can get the complete industrial products packaging graphics language scene, finally realises the industrial product graphics language of visual communication design.

5 Summary and empirical analysis

In summary, the visual communication design process of industrial product graphic language designed in this study is summarised as follows:

Step 1: The interview method and qualitative analysis method were adopted to study the reasons why the packaging of industrial products did not have an impact and to select the appropriate unique selling points of the packaging of industrial products.

Step 2: After selecting the appropriate unique selling points according to the packaging positioning of industrial products, brainstorming method is adopted to quantitatively analyse the unique selling points, summarise the number of keywords of the unique selling points, and select graphic language elements.

Step 3: Through the selection of graphic language elements of industrial product packaging, build a rough graphic language of industrial product packaging, and then refine it, create graphic language scenes of industrial product packaging, and realise the visual communication design of graphic language of industrial product.

In order to verify the effectiveness of the visual communication process of industrial product graphic language, an industrial product was selected as the visual communication design object of graphic language, and the target consumer groups were set as employees and white-collar workers of the company. This paper adopts the graphic language visual communication method to carry out the industrial product graphic language visual communication design.

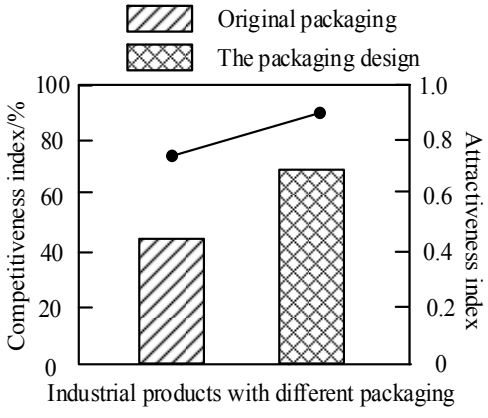
Through the above steps, the industrial product graphic language visual communication design is completed. On this basis, the original packaging design of industrial products is adopted to analyse the satisfaction degree of target consumer groups on packaging of different industrial products. The comparative results are shown in Table 2.

Table 2 Comparison of satisfaction degree of target consumer groups on packaging of different industrial products

Project	*Original industrial product packaging*		*Design of industrial product packaging*	
	Unit worker	*Company white-collar*	*Unit worker*	*Company white-collar*
Visual cognition	No	No	Fuzzy	Clear
Visual appeal	Don't attract	Don't attract	Attract	Attract
Purchase reason	Price	Others recommend	Brand	Advertising
Satisfaction	General	Not satisfied	Satisfied	Satisfied

According to the data in Table 2, the employees of the original industrial product packaging unit think that the industrial product has no visual perception and no visual attraction, and the reason for buying it is due to the price, and the overall satisfaction level is average. For the white-collar workers of the original industrial product packaging company, they thought that the industrial product had no visual cognition and no visual attraction, and the reason for buying it was recommended by others, and the overall satisfaction level was not satisfied. And for the design of industrial product packaging unit employees think that the industrial product visual cognition is fuzzy, with visual appeal, the reason for the purchase is because of the brand, the overall degree of satisfaction is satisfied. For the design of industrial product packaging, the company's white-collar workers think that the industrial product visual cognition is clear, with visual appeal, the reason for the purchase is because of advertising, the overall degree of satisfaction is satisfied. It can be seen that the overall satisfaction of the design of industrial product packaging is higher. On this basis, the competitiveness index and attractiveness index of industrial products are taken as evaluation indexes, the greater the competitiveness index of the industrial products, the stronger the competitiveness, otherwise, the weaker the competitiveness. The greater the attractiveness index, the greater the attractiveness of an industrial product. The competitiveness index of industrial products of different packages was further verified, and the comparative results were shown in Figure 3.

Figure 3 Comparative results of competitiveness and attractiveness index of industrial products with different packages



According to Figure 3, the original competitiveness index of industrial product packaging is 75% and the attractiveness index is 0.45, while the competitiveness index of the designed industrial product packaging is 90% and the attractiveness index is 0.7. Therefore, the design of industrial product packaging competitiveness index and attractiveness index is larger, can effectively enhance the market attractiveness and competitiveness, to obtain greater economic benefits.

6 Conclusion

1 This paper presents a method of visual communication of graphic language in industrial product design. Firstly, the interview method and qualitative analysis method were used to analyse the reasons why the packaging of industrial products did not have an impact, so as to select the unique selling points of the packaging of industrial products. Then, brainstorming method was used to quantitatively analyse the number of keywords of unique selling points, select graphic language elements, construct graphic language scenes of industrial product packaging, and realise the visual communication design of graphic language of industrial products.

2 This method can effectively improve product design satisfaction, enhance market attractiveness and competitiveness, and obtain greater economic benefits. However, due to limited experimental conditions and resources, the accuracy of this method cannot be completely guaranteed. Therefore, in the following research, more resources and research equipment will be used to improve the accuracy of the research results.

Acknowledgements

This work was supported by the Academic Program Foundation for Outstanding Talents in Subject or Major Fields of Higher Education of Anhui Province in the Year of 2020 under grant no. gxbjZD2020021.

References

Arun, B., Suresh, B. and Michael, A. (2020) 'Quality-by-design in hot melt extrusion based amorphous solid dispersions: an industrial perspective on product development', *European Journal of Pharmaceutical Sciences*, Vol. 15, No. 8, pp.105–115.

Dey, K., Roy, S. and Saha, S. (2019) 'The impact of strategic inventory and procurement strategies on green product design in a two-period supply chain', *International Journal of Production Research*, Vol. 57, Nos. 7/8, pp.1915–1948.

Frutiger, J., Cignitti, S., Abildskov, J., Woodley, J. and Sin, G. (2019) 'Computer-aided molecular product-process design under property uncertainties – a Monte Carlo based optimization strategy', *Computers & Chemical Engineering*, Vol. 12, No. 4, pp.247–257.

Gautam, A.K., Farhan, M., Agrawal, N. and Rambabu, K. (2019) 'Design and packaging of a compact circularly polarised planar antenna for 2.45-GHz RFID mobile readers', *IET Microwaves Antennas & Propagation*, Vol. 13, No. 18, pp.2310–2314.

Kyriakos, C.N., Pete, D., Charis, G. and Hitchman, S.C. (2020) 'Awareness and correlates of noticing changes to cigarette packaging design after implementation of the European Tobacco Products Directive: findings from the EUREST-PLUS ITC Europe Surveys', *European Journal of Public Health*, Vol. 30, No. 3, pp.98–107.

Li, W. and Pan, D.Z. (2019) 'A new paradigm for FPGA placement without explicit packing', *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, Vol. 38, No. 11, pp.2113–2126.

Liu, M. (2019) 'Optimization of plane visual communication effect simulation based on graphic beautification technology', *Computer Simulation*, Vol. 36, No. 9, pp.426–429.

Lu, K., Qiao, X. and Hao, N. (2019) 'Praising or keeping silent on partner's ideas: leading brainstorming in particular ways', *Neuropsychologia*, Vol. 12, No. 4, pp.19–30.

Nicolás, M.C., Felissia, E.F., María, C.A. and María, E.V. (2020) 'Design of nano and micro fibrillated cellulose production processes from forest industrial wastes in a multiproduct biorefinery', *Chemical Engineering Research and Design*, Vol. 16, No. 7, pp.1–14.

Pradhan, S., Kumar, S. and Barai, S.V. (2019) 'Impact of particle packing mix design method on fracture properties of natural and recycled aggregate concrete', *Fatigue & Fracture of Engineering Materials & Structures*, Vol. 42, No. 4, pp.943–958.

Qammar, H., Gladyszewski, K. and Skiborowski, M. (2019) 'Towards the development of advanced packing design for distillation in rotating packed beds', *Chemie Ingenieur Technik*, Vol. 91, No. 8, pp.53–65.

Raju, N.N., Muthukumar, P., Selvan, P.V. and Malleswararao, K. (2019) 'Design methodology and thermal modelling of industrial scale reactor for solid state hydrogen storage', *International Journal of Hydrogen Energy*, Vol. 44, No. 36, pp.20278–20292.

Wang, C., Wang, N., Ho, S.C., Chen, X. and Song, G. (2019) 'Design of a new vision-based method for the bolts looseness detection in flange connections', *IEEE Transactions on Industrial Electronics*, Vol. 67, No. 2, pp.1366–1375.

Wrona, M., Silva, F., Salafranca, J., Nerín, C. and Caballero, M.N. (2020) 'Design of new natural antioxidant active packaging: screening flowsheet from pure essential oils and vegetable oils to ex vivo testing in meat samples', *Food Control*, Vol. 12, No. 1, pp.107–116.

Zhang, C., Huang, H., Zhang, L. and Liu, Z. (2019) 'Semi-quantitative method for task planning in product eco-design', *International Journal of Production Research*, Vol. 57, Nos. 7/8, pp.2263–2280.