

Research on the Bionics Design of Automobile Styling Based on the Form Gene

Zhao Aili¹ and Jiang Long²

¹Department of Industrial Design, Heilongjiang Bayi Agricultural University, Daqing, 163000, CN

²Department of Product Design, Panzhihua University, Panzhihua, 617000, CN

aili_fiona@126.com

Abstract. From the heritage of form gene point of view, this thesis has analyzed the gene make-up, cultural inheritance and aesthetic features in the evolution and development of forms of brand automobiles and proposed the bionic design concept and methods in the automobile styling design. And this innovative method must be based on the form gene, and the consistency and combination of form element must be maintained during the design. Taking the design of Maserati as an example, the thesis will show you the design method and philosophy in the aspects of form gene expression and bionic design innovation for the future automobile styling.

1. Form Gene and Orientation Guidance of Automobile Design

Product form gene is an expression of the hereditary knowledge about the basic vocabulary of a product and the rules of its shaping rules[1]. It is the most basic genetic element of concrete expression and constraint of object shape. And the form gene of automobile design is the combination of technology and art, which is based on the extraction of brand genes. Its special characteristics have oriented guidance to the construction of brand culture and consumer sentiment. The form gene of automobile design has similarity with the construction of its brand value. The exploration of the automobile form gene will not only enable us to trace the source and form good cultural accumulation, but also focus on the future and establish a good sustainable development context. The research and exploration of the automobile form design genes can help designers and design enterprises to accumulate and innovate their design and form unique form characteristics under the same cultural background and evolution rule. Automobile form gene is the root of the design, and the law of development is the basis for the design of adaptation, rational cognition and perceptual knowledge formed on the basis of it will be the strong guidance for the next design part. In the design, through the parts of arrangement, analysis and excavation, reconstruction and innovation of automobile shape modeling are achieved, and the final practical results will continue to be integrated into the gene chain and become an important part of the law of development. (Fig. 1)



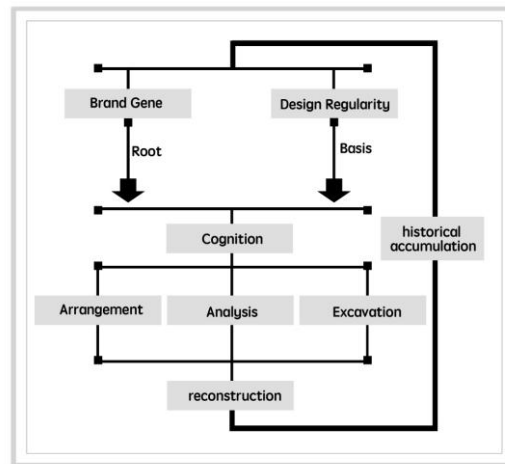


Figure 1. Automobile Modeling Gene Refining Procedure

The extraction of form characteristics of automobile brand is the arrangement and excavation of brand itself, which is also the process of self-cognition of the comprehensive system and used to accumulate brand identity elements and construct brand identity image. In 1991, professor David A. Aaker proposed the concept of brand identity, he believed that the essence of brand identity is a series of brand associations which enterprises want to form, and he expressed brand's permission and commitment for consumers[2]. Brand form gene is a collection of brand culture in the context of healthy development circulation of enterprises. It is a complex brand identity system. We will continue to design and innovate the enterprise's form genes by collecting and arranging business process assets, trend analysis and concept screening. Besides, we make the design and innovation establish emotional ties with consumers.

2. Bionics design concept and breakthrough attempt of automobile modeling

Bionics design is the external form of the existence of objects and natural substances and their symbolic meaning, and applies them to the design through the corresponding artistic treatment methods[3]. The development space of bionics design is very huge because of its infinite research objects. We carry on analysis and understanding of "goodwill" through the "revelation" of nature and use the methods and thinking of combining art with science. From the angle of humanization, we use biological structure and functional principles to design, aiming at achieving the integration of nature and science and fusion of technology and art. In the process of automobile exterior design, designers often seek design inspiration from nature, extract the form symbols or functional models from the natural species, and convert them into a practical and intimate form. This kind of natural imitation of products is in line with people's natural association and value orientation, which is a design concept with good experience and good external form.

In recent years, there have been breakthroughs of exploration and attempts in the bionics design of automobile shape modeling, aiming at enhancing the aesthetic degree of design and meanwhile increasing the emotional emotions, visual effects, characteristics of the times and interactive experience conveyed by automobile shape modeling. For instance, in the book of *My world is Round* written by Luigi Colani, a famous German industrial design master, he summed up his design ideas that, "when we talk about bionics design, we need to accept a simple fact that the structure of the spider web has much more unbelievable advantages than the large number of structures made by mankind, and we should be able to find solutions from the advantages of nature" [4]. His design emphasizes the integration of man and nature and thinks that the beauty of design is reflected in the return to nature and the product should serve the people[5]. His design made for Ferrari, Porsche, Mercedes-Benz, BMW and other companies well interpreted the concept and connotation of bionics

design. (Fig. 2-3)

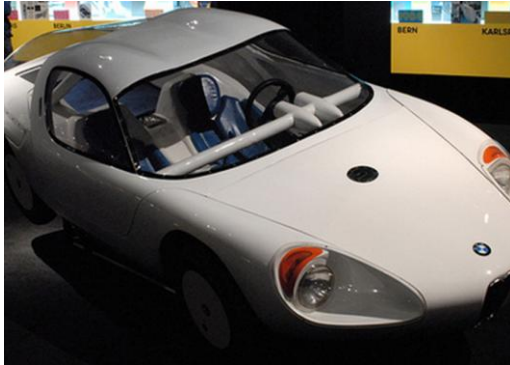


Figure 2. BMW design



Figure 3. Ferrari design

3. Bionics design trends and design errors of automobile shape modeling

In the current study, bionics design is generally divided into form bionics, texture bionics, body bionics, structure bionics, function bionics, color bionics and intention bionics[6]. Therefore, in the future design study, we can extend from the above aspects, and use the design method of “insight - analysis - divergence - reconstruction”, aiming at seeking for the best balance between nature and design. Insight and analysis can help us establish a good cognitive system and form a clear design research context. The divergent way of thinking can expand the design ideas and let us re-examine the connection and link between natural elements and automobile exterior shape. Finally, we finish the final design through reframing way and achieve good design results. In this process, we can well integrate the concept of bionics design into automobile modeling design in the flow of “understanding - innovation - achievement”.

However, some automobile companies still have some design errors in the design and development process: they blindly pursue innovation and only consider the modeling divergence way of this automobile and automobiles with same brand. Although, new automobiles have wholly new modeling forms, they lack inheritance of brand gene. Therefore, in the design process, one the one hand, we achieve bionics design by drawing inspiration from nature. On the other hand, we comb the brand gene context of enterprises, so that the final design results integrate and reconstruct original characteristic and bionic elements and achieve true evolution of exterior modeling design.

4. Automobile modeling bionics design flow, methods and application cases based on form genes

Bionics design inherits the corporate brand genes and includes the following steps(Fig. 4): firstly, the brand cultural materials are summarized to form from genes (shape features, traditional colors and cultural contexts). And we extract bionic elements (image form, color semantics , cultural representation, etc.) from natural objects. And then, we integrate and transform form genes and bionic symbols by using divergent and subversive thinking way. We carry out design positioning, determine design keywords, draw scheme sketches, achieve innovative design results, perfect the arrangement and form the final exterior design modeling form. The whole process fully embodies the effective combination of design genes and bionic concepts, and the design should not be separated from the actual design ideas and methods.

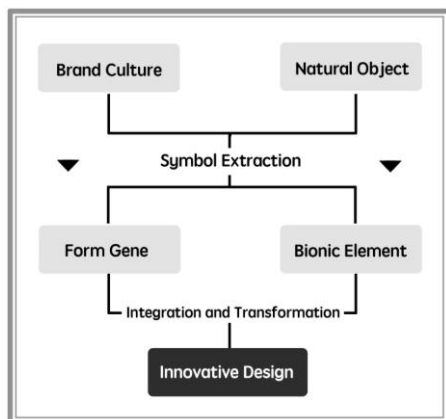


Figure4. Automobile Modeling Bionics Design Flow Based on Form Gene

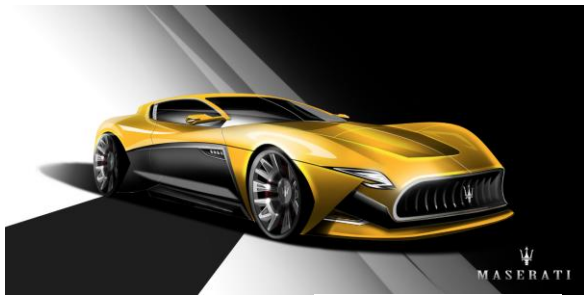


Figure5. Bionic prototype - crane

We Integrate and explore form genes and bionic symbols in Maserati – crane design. Maserati is known as the classic and eternal representation of flowing sculpture, which is designed for those who seek the ultimate quality of life and pure driving pleasure and has its own unique cultural connotation. It is an indispensable part of Italy in the long and glorious history. Therefore, We focus on the analysis and exploration of existing products in the design of Maserati - crane, so as to seek for new breakthroughs.

Maserati has entered China since 2004, its fashionable and elegant atmosphere quickly got the recognition and favor of Chinese consumers. Currently, China has become the country that has the highest growth rate in the Maserati market. It can be seen that it has huge sales potential in China. However, with the awakening of traditional Chinese cultural awareness, consumers are more looking forward to the birth of the automobile shape with national consciousness. So in the design, we take into account consumer demand and its development trend in Chinese market and integrate Chinese traditional culture elements into the design, which not only inherits the Maserati gene semantics, but also uses bionic way to achieve the Chinese traditional culture connotation.

Maserati models interpret centuries of elegance, luxury, sports and passion of the brand together. Maserati perfectly fuses luxury with unrestrained sports nature, pays equal attention to comfortable and passionate driving pleasure. Besides, the elegance and refinement conveyed by Maserati are also genes that need to be inherited in the design and important elements of design expression. Therefore, in the body design, in addition to the inheritance of the original modeling elements of Maserati - crane, it also integrates bionic elements. Maserati's iconic grille and dynamic outline modeling become the focus of achieving reconstruction of design genes. Besides, Maserati - crane fuses the image characteristics of crane. Crane has a lofty position in Chinese culture, which represents the longevity, luck and elegance. And its flying speed and endurance are also quite amazing, which is in line with Maserati's concept of elegance, luxury, sports and passion (Fig.5). In the modeling design, bionics design is used. The perfect arc shape of crane from its neck to the tail is extracted and fused into the waist line design of the body. So that the body has natural mobility. The beautiful arc extends from the grille to the side of the body and then to the taillight, which is in line with the aerodynamic requirements. And the waist is more aesthetic. In addition, the wrapped form of the bottom of the body makes the whole body be surrounded by plump wings. The whole automobile shape looks more stable and heavy, and the proportion of the body also takes the shape of flying crane as a reference, which achieves flexible and fashionable flavor of the body and shows its elegant and unique aristocratic temperament (Fig.6-7).

**Figure6.** Front face design of Maserati – crane**Figure7.** Tail design of Maserati - crane

The wheel is designed in concert with the overall body temperament. large wheels can show Maserati's eternal pursuit of passion, talent and perfection. The wheels add some embossed line decorations that are extracted from the crane's feather shape on the surface of the multiple spokes, which increased the flexible feeling of design elements. Therefore, the whole wheel does not seem too serious, yet elegant and sporty, coupled with a smooth silver effect. And the unique Maserati design genes and bionic elements are combined together(Fig.8).

**Figure8.** Wheel hub design**Figure9.** Automobile light design

As an important head component, headlight is the representation of the charm of the front and constitutes important facial features with other components of the front together. Headlight modeling element takes “flying and dancing crane” as the bionic prototype, which brought more dynamic visual effects for the design of automobile front face. Meanwhile, the automobile light tries a new proportional relationship, stretches the light modeling to long and narrow shape and divides it into main/subsidiary parts. Therefore, headlights effect is more discriminating, and the front face of the body is more moderate than and that of the existing sports cars. It is connected with the atmospheric grille, which effectively enhances the visual tension and looks very confident(Fig.9).

Through the practices and study of bionics design based on form design gene, the author carries out innovative fusion of Maserati brand culture gene and morphological characteristics of crane, which is an important link in the development of brand culture.

5.Conclusion

In this paper, the author studies automobile modeling bionics design based on morphological gene, summarizes the design methods and design flow of this process, and carries out practical interpretation of the Maserati - crane design plan. Through the analysis and research, the author wants to remind designers that they can not view design issues superficially in the design process, they should continue and upgrade the brand culture and use design concept of bionics to conduct breakthroughs and exploration. This kind of bionic design research that can convey the brand gene takes nature as the teacher, stimulates creative ideas and eventually acquires more innovative design results, which not only help enterprises get rid of plagiarism or design disjointed state, but also enable enterprises to start down the developing road of independent innovation.

References

- [1] Sun Shouqian, Bao Enwei & Pan Yunhe 1999 China. Component Feature Model Oriented to Product Layout Design. *Computer-Aided Design & Computer Graphics*.**11**.
- [2] David A. Aaker 1995. Building Strong Brands. *Big Apple Tuttle-Mori Literary Agency Inc*
- [3] Chen Wei 2010 China. Bionic Design and Application of Product Form. *Packaging Engineering*.**8**.
- [4] Huo Yuhua, Dai Junjie & Dong Zhaohui 2005 China. My World Is Round. *Aviation Industry Press*.
- [5] Tian Jun 2013 China. Nature: Source and Direction - Luji Colani's Bionic Design *Decoration*.**4**.
- [6] Ren Luquan & Liang Yunhong 2012 China. Coupling Bionics. *Science Press*.