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THE CHALLENGES OF DEVELOPING STYLING DNA DESIGN METHODOLOGIES FOR CAR DESIGN

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ABSTRACT
This paper discusses the challenges of developing 'Styling DNA' for car design. Existing theories, models and frameworks towards styling DNA are still fuzzy. Many car industries are still struggling with establishing a novel fact from styling DNA that can be used as a point of reference in supporting design concepts and specifications. There are two research directions towards styling DNA for car design in design methodologies; one is Algorithmic approach and the other is Manual approach. The example of Algorithmic approach is a Genetic Algorithm (GA). GA is an engineering analysis which is based on technology-driven direction. It evolved on the method of calculation which generates each item from some encoded form known as a chromosome that mutated to class new items. Meanwhile, the example of Manual approach is Human Visual Interaction (HVI). HVI refers to the design and implementation of product characters that people interact with. It is a study of design between people and products which are based on user-driven direction. For both approaches, either in academia or industries, it seems that the expectation is more on identifying the character traits and relative attributes of styling DNA a molecule that encodes the genetic instructions employed in the growth and aesthetics appealing of form that can be used as a unified point of reference.

Keywords: Algorithmic, car design, manual, design methodologies, styling DNA

1 INTRODUCTION

Recently, research on styling DNA has become important in car design. There is no clear definition about styling DNA which can be found in any English dictionaries. Here, a styling DNA is defined as a molecule that encodes the genetic instructions employed in the growth physical form or product. Even though, car design is being looked at as an innovative product and challenging discipline, it can be classified and positioning between the direction of technology-driven product and user-driven product [1]. Many researches on styling DNA towards car design have given focus on observing stylist in the design activities [2]. This is because stylist plays an important role in producing visual appearance towards aesthetics appealing of new products in the light of a general consideration of conceptual design [3]. Since aesthetics are common in the field of Art, it produces the reasons to gratify the concept such as: judgment, attitude, understanding, emotion, and value [4]. However, the most important part of styling is in the conceptual design phase, where there is a need to match the technical constraints or hard points such as identifying essential problems, establish function structures, search for principle solutions, combine and firm up into concept variants, and evaluate against technical and ergonomic criteria with the aesthetic intent of the stylist [5].
A common practice in car design, styling strategies consists: (1) Attention drawing: creation of visually appealing designs [3]; (2) Establishing recognition: brand and identity references [6]; and (3) Creation of symbolic meaning, e.g., metaphorical form [7].

2 ISSUES OF STYLING DNA

2.1 Genetic construction

The basic element of *Deoxyribonucleic acid* or DNA is the genome. In design, a genome is the "life form" whole set genes of DNA. In terms of definition, it is one haploid set of chromosomes with the

genes they contain. Broadly: the genetic material of an organism [8]. In the perspective of genetic terminology, the terms refer to a full set of chromosomes as well as all the inheritable traits of an organism. It contains all of the chromosomes in rank required to build and maintain that life form.
Most of the design research on genome explores the sequences, maps, chromosomes, assemblies and annotations. Even, the new car styling DNA shows potential disappearance from the current model and has the potential to bring us closer towards design aim [2]. Since, design is subjective in nature; there is a question about how can designers' establish the character traits of styling DNA for car design? Most exploratory research using experiments and analysis of data depended on syntax (structure) coding and pattern which derives from the studies. Since, the results can be too hypothetical, the researchers always argue in which context they should be explored in.

2.2 Contextual

Most of the research on styling DNA explores variables of studies either through natural resources or artificial intelligent information. However, in most cases, the studies focus varies dependent on what needs to be explored. Most car manufacturers refer to brand image and identity such as heritage and vehicle architecture (i.e., Volvo, Volkswagen, Range Rover, BMW, Mercedes, etc.). They maintain certain characters consistently in every production. Some car manufacturers imitate and reflects their vehicle architecture based on their competitors. This seems to be more market-driven in order to ensure the car is marketable.
Normally, in the context of marketing, there are several strategies which have been used by the car manufacturer as a strategic tool in order to establish brand image and identity. Among all: (1) Icon, Sign, and Symbol (i.e., Mini), (2) Object and Artifact (i.e., General Motor), (3) Furniture and Architecture (i.e., Volvo), (4) Art, Decoration, Culture, Heritage, and Costume (i.e., Alfa Romeo), and (5) Nature Resources (i.e., Volkswagen New Beetle). For example, in the development of company branding, Volvo claims that the Scandinavian elements embedded in cars designed by them [6]. This somehow evokes to the affective elements of styling DNA of the car between user and manufacturer.

2.3 Affective elements

Since car design is mapped and positioning between the parameter of user-driven product and technology-driven product, the elements of affective such as growth in feelings or emotional areas cannot be neglected. An affective element consists: attitudes, emotion and feelings that reflect product preferences [4]. There are several domain stages exist in affective models. This includes a domain of receiving, responding, valuing, organization, and characterization [9]. However, since design is subjective in nature, design is always being looked as private and individual. Therefore, the way designers' reason about form and the strategies employed in designing a "form" differs from designer to designer in the organization. It can be structured as well as emergent. From this parameter, we can see that, design can derive as problem solving (The problem-solving process considers the design activity as a problem to be defined and solved), normative (Normative rationales for action are based on evaluative judgments which justify beliefs, attitudes or actions regarding matters of knowledge, aesthetics or morality), synthesis-analysis (Synthesis-analysis is considered here as a compound activity, as it involves searching, exploration and discovery of design solutions, and composition and integration of these solutions), reflective (It is characterized as a reflective conversation with the materials whose basic structure-seeing-moving-seeing- is an interaction between designing and discovery), and hermeneutics (A hermeneutic model for designing is based on interpretative and intuitive processes, which are, firstly, driven by the inherent knowledge, past experiences, and prevailing assumptions of designers, and, secondly, stimulated by the designer's interaction with the material in its context). In current designing practice, the approaches of identifying styling DNA can be done through algorithmic and manual.

3 CASE EXAMPLE ON ALGORITHMIC AND MANUAL APPROACHES

3.1 Algorithmic approach - Genetic Algorithm (Technology-driven)

The genetic algorithm is an evolutionary technique under the area of artificial intelligence. The use of computer is common to find and establish principle solution. Most of the existing research has given emphasis on developing brand image and identity of the car using genetic algorithm. The instrument used depends on computer technologies. For example, research on Changan Benben (Figure 1) tries to

capture brand elements with integrated means through feature lines derived from designer experience [10]. They explore styling DNA by using an interactive generative design method to build up vehicle styling brand elements. From there, on the basis of the parameters, the chromosome of the lateral contour feature line can be represented mathematically.

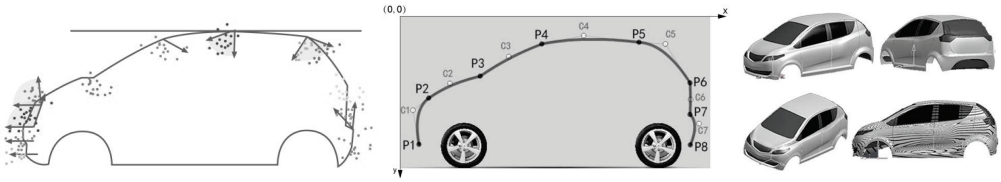


Figure 1. Genetic Algorithm [10]

Furthermore, in the understanding on vehicle styling and brand shape grammar through styling brand elements, they investigate rules to generate results on features lines and the brand identity. In their research, they claimed that the generations of styling brand feature lines were successfully applied in new Changan Benben design practice. Their experiment was based on Takagi's genetic algorithm theory [11], the interactive generative design of lateral contour feature lines consisted of four steps: coding initial population, setting up threshold, designing the operator, interactive generation and evaluation. However, there is no concrete evidence that genetic algorithms in genome construction can match with the aesthetical quality of the form attach with user perceive in design. This is differing with manual approach.

3.2 Manual approach - Human Visual Interaction (User-driven)

The manual approach is the way designer creating form reflects to natural resources as a source of inspiration. Many researches on manual approach regard affective elements in the studies. Several models of experience have been used to fit the human preferences into car design. According to Hiort af Ornäs [12], among all (1) Kansei Engineering, (2) Basic model of product emotions, (3) Framework of product experience, (4) The emotional design framework, (5) The four pleasures framework, and (6) Model of user experience.

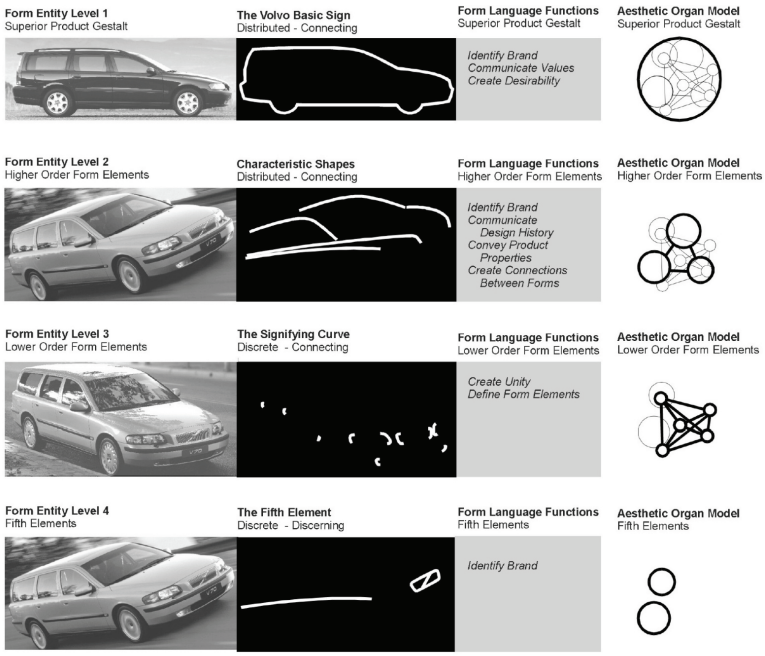


Figure 2. Human Visual Interaction [9]

Figure 2 provides an example of design syntactic (structure establishment) reasoning, including a coherent design format, and examples of form entities, aesthetic organs, and form elements for styling DNA of Volvo V70 Station Wagon. Warell [9] states there are four form entity levels in describing

form entities, characteristics form elements, communicative functions and superimposed aesthetic organ models for Volvo V70. It can be identified through: 1) *The superior gestalt* consists of form entities and form elements of the highest hierarchical (global) level of the product form; 2) *Characteristic shapes:* Significant form elements are the pronounced shoulders running from the front of the car along its sides all the way to the taillights; 3) *A signifying curve* is found as a form ingredient in distributed across the car body: in the door handles, in the front lights, and in the grille, among other locations; and 4) *The fifth element:* The grille of the car featuring the distinctive diagonal cross member is a typical example of a 'fifth element,' a symbol for the Volvo brand of cars, which over the years has been seen in many different variations. It shows that the assessment of form focuses the element of consistency, selectively, and completeness [13]. The pattern of syntactic was embedded and the semantic (meaning carrying) language revealed based on the familiarities.

4 DISCUSSION

4.1 Challenges on Styling Strategies: Structured versus Emergent approaches

In this paper, we can see the strategies of form embodiment using algorithmic approach and manual approach are different. For algorithmic approach, it was structured. A form has been developed within the context of problem solving, normative, and synthesis-analysis. Meanwhile, for manual approach, it was emergent and seems more reflective and hermeneutics. The main challenges are that to match the aesthetical quality of form through an algorithm. Recently, research on Kansei Engineering (KE) tries to explore this kind of knowledge as a contribution to design methodology. KE focuses on product attributes and their relation to affective meaning [14]. KE explores the methodologies in measuring and tried to develop a model. KE systems have been applied in research and in the development of the car industries as a numerical tool to define affective response in relation to design features. However, the successful result derived from the study seems support Japan design market only. The methodologies are still fallacious and cannot be generalized to be used by other countries since it involve an issue of cultural (i.e., Ethnography and Demography) differences. The example was a Mazda Miata car which is successful in sales in Japan but not receive a similar feedback on sales in United States of America. After all, this effort was one of the attempts on identifying character traits of styling DNA for car design.

4.2 Styling DNA related to Car Design (Proton Prevé as an example)

In order to investigate styling DNA through the focal point/area of the car that contributes to brand image and identity of the organization, we have carried out a Design workshop among 30 designers at Proton. The purpose is to identify which elements designers' perceive most when looking at car design. Proton Prevé has been chosen as a case for this study. If we look at the popular choices among Proton designers', the item that represents local identity through nature resources by using Malayan tiger metaphor seems given a promising properties/attributes to the characteristics of styling DNA for car design (see Figure 3). The Malayan tiger (*Panthera tigris jacksoni*) is a tiger subspecies that inhabits the southern and central parts of the Malaysian Peninsula. Here, it shows how form elements positively correlated with shape character traits through syntactic and semantic properties of selected item. Furthermore, the item uses as a source of reference embodied agent makes styling DNA interpretations stand substantial from ambiguity. However, the connections between shape character traits, item and form language functions only can be seen at the three quarter front view through façade and side view of the car.

The study illustrates that this is the way of the normative and the reflective strategies thinking in design and designers' understanding of form character traits in relation to car styling DNA. The character traits of styling DNA are selective embedded at certain focal point/area and a portion of the car. The character embedded as a metaphorical form through line and curvature in motion as directional force, etc. Most Proton designers' believed that the uses of an algorithmic approach and manual approaches are equally important for car design. For them, it could generate an item from some encoded styling DNA known as a chromosome that mutated to class new items.

Other strategies of reasoning such as problem solving and synthesis-analysis using an algorithmic approach could provide variations of the findings. Hermeneutics is another way of establishing uniqueness of form on styling DNA since it involves an individual designer's interpretative and intuitive processes.

The next questions could be explored is on the perceived quality such as effective impacts on public perception, visual identity and corporate branding. This can give advantages to the research on styling DNA design methodology in both industry and education.

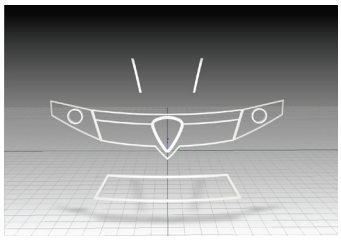
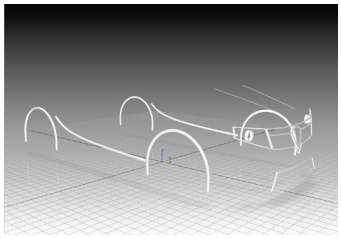
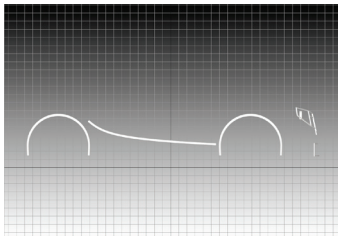
Form elements	Shape character traits	Item – Nature resources (i.e., Malayan tiger metaphor)	Form language functions
 Front View			Convey product properties *i.e.,* *(a) Tiger stare indicates aggression;* *(b) Nose symbolizes power;* *(c) Single graphic creates brand image;* *(d) Horizontal elements create wider perception;* *(e) Mouth expresses the sense of arousing desire.*
 Three Quarter Front View			Convey product properties *i.e.,* *(a) Belly line shows the dynamic character;* *(b) Wheel arch trims shows the muscles;* Create connections between forms *i.e.,* *(c) Façade and side view**
 Side View			Convey product properties *i.e.,* *(a) Belly line shows the dynamic character;* *(b) Muscles represents masculine.*

Figure 3. Form Elements in relation to Shape Character Traits, Item – Nature Resources, and Form Language Functions

4.3 Advantages of Research on Styling DNA Design Methodologies in Education

Since styling DNA has become important in many car industries, the higher institution or design school should consider this as a part of special curriculum in the education. This can be done by setting up an appropriate parameter and weight age of design curriculum learning domain in education through the elements of mental skills (cognitive), growth in feelings or emotional areas (affective) and manual or physical skills (psychomotor) [15]. The curriculum should emphasize on giving understanding about styling DNA as a molecule that encodes the genetic instructions employed in the growth physical form or product. By doing that, students' reasoning ability on design thinking such as creative, critical and analytical could be increased. At the same time, the designs produced by students can be more promising and attach both user and technology requirements.

For industry, focuses on the styling DNA of the car are always with the reason for establishing the "State-of-the-Art" especially when it relates to the creation of brand image and identity of the company. Research on styling DNA both academic and industrial should address issues on genetic construction, contextual, and affective elements. Now, the challenges are how to create car character traits that can remain consistent in every production? Also, by establishing the fundamental fact about the uniqueness of the car, can it make the organizations or industries appear with their own originality?

5 CONCLUSION

This paper drew a major conclusion that styling DNA is important in determining the brand image and identity of the car and the organization. Even though, Algorithmic approach - Genetic Algorithm (Technology-driven) and Manual approach - Human Visual Interaction (User-driven) were the possible way to find the solutions, however, for both approaches, either in academia or industries, it seems that the expectation is more on identifying the character traits and relative attributes of styling DNA a molecule that encodes the genetic instructions employed in the growth and aesthetics appealing of form that can be used as a unified point of reference.

In future research, the combination of these two approaches that emphasize the complexity and addressing number of factors affecting a successful design outcome such as quality, cost, time, and capability might give better solutions in the creation of the brand image and identity building; and verifying could be extended to a larger setting, including facts or actual occurrences on practice. Such a setting could offer a structured approach to analyze value-based design cues of the organization through the model of styling DNA design methodologies for car design.

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