

Design DNA: Theory Reviewing Behind the Behavioral Aspect in the Levels of Design

Izzuddinazwan bin Misri

*Faculty of Art and Design, Universiti Teknologi Mara, Shah Alam, Selangor
izzuddinmisri@gmail.com*

Amer Shakir B.Zainol

*Faculty of Art and Design, Universiti Teknologi Mara, Puncak Alam, Selangor
Amers781@salam.uitm.edu.my*

Received Date: 10 January 2021

Accepted Date: 19 January 2021

Available Online: 30 June 2021

ABSTRACT

Behavioral was defined in various ways of perspective regarding lives such as humans, animals, and nature. Related to acting or behaving in general, the behavioral aspect in design is abbreviated to end in response, purposely to perceived stimulations that are linked to responses produced and the design that encourages the user to react. The design level was proposed and specified by Norman (2004) as the requirement, guideline, and characteristic aspects before design. This behavioral aspect is a vital component of design levels in every design that one desired to make. The function, usability, safety, operation, and user pleasure are the other definitions to the behavioral perspective in the design levels and, it is also the second level of design at consideration in designing things after the visceral level. As the design level is a fundamental subject in design, the theory reviewing here is exposing the formulation idea in the value for recognition, trademarking and, identical aspects for product criteria specified in the behavioral level in adding product value called the 'design DNA'.

Keywords: *Design DNA, Design level, Behavioral design, Product function*

INTRODUCTION

The sense of recognition and identification over products is referred to as brand identity in general understanding, and design DNA is basically the identical significance in design. Regarding design DNA, it derives from the theory of human beings as DNA, referring to blood and human characteristic from the combination of genetics. Thus, this concept was adopted widely in the design field to define an initial identity for design, brand, and products. Fundamentally, before design DNA was formed, it is necessary to understand the design criteria and the consideration that a designer should take before doing design. Norman (2004) proposed the design levels and revealed the three levels where one took as a level, criteria, and selection to remark as design DNA in this study. The level after the visceral level is the behavioral level, which is the second level. It is a new idea after the formulation of visceral design DNA, which derives from the particular algorithm between shapes and elements by Misri, I. (2015), was technically found. In the second level of design, the behavioral aspect or other common terminology that shares a similar meaning as 'the function' would be the aspect that is focused on in this study.

LITERATURE REVIEW

The Behavioral Aspect in Design Levels

Compared to the visceral, the complexion of this function or behavioral level is seen in finding the valid aspect as product function and technique for the design DNA formulation. The design level has three stages which are 1) Visceral, 2) behavioral, and 3) reflective as the second (2) level are adapted to form the design DNA, as the guideline shown in figure 1. The visceral or the visual aspect in design DNA was already founded with the criteria components is the shapes and elements. The point here is to fill the second-level criteria components on the behavioral level. Significantly, the function terminology was declared similar to behavioral in other systematic ways and, the proper term for the criteria components arrangement is shown next.

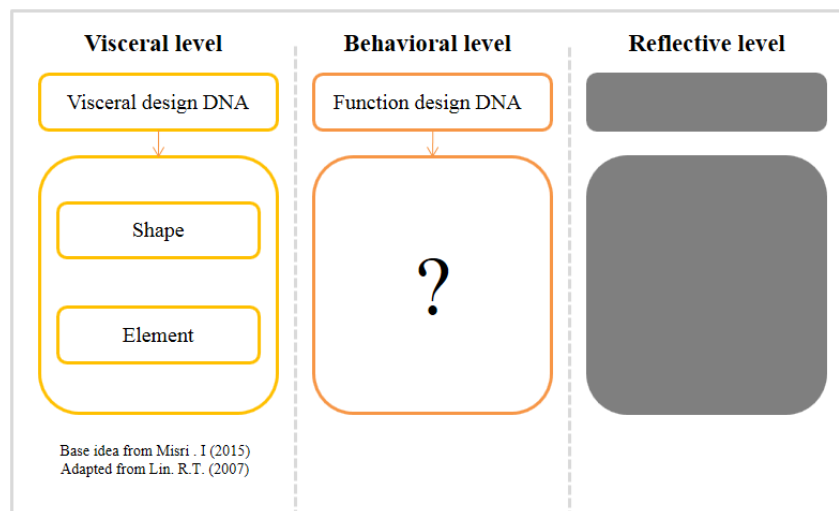


Figure 1: The Design DNA Pre-Guidelines

According to figure 1, the component for the behavioral / function design DNA will be searched, and before it started all over, the criteria component, which is the core aspects in each design DNA must be explained and understood. The criteria component derives from the combination of the 'gene' in DNA term or formally known as the subject, and this process is called the 'genetic algorithm'. The gene itself has two kinds: the genotype and phenotype (Lee and Tang, 2004). Subjectively, based on the components, it could be more than one genetic algorithm instead of each. Back to the gene, the appearance either in genotype and phenotype initially referred to the best selection amongst the list of genes and known as the fittest gene to survive as the part of component's straightly to the desired design DNA. Hence, if the fittest appearance is single, the kind of gene is the genotype, and if the appearance were attached or firmly in two or more, it goes to the phenotype kind. For example, for the visceral design DNA study (refer to Misri, I., 2015), the shape is the criteria component with the fittest gene is 'the circle' (genotype) was founded using the sample of cultural products features. Another component in this DNA is 'the element' which in the study found three particular kinds of flowers pattern by races, and these features were evaluated to find the fittest genes and references in merging to produce balance at gene determined as the phenotype. For this study, the set of criteria components' has been formed. The components were formulated to achieve the design DNA status, which in the combination of the components' called the 'Evolutionary Algorithm'. These terms are defined as the combination of two or more different types of segments of fittest genes to overcome the new evolution for design DNA. Most likely, this could be understood in the human occurrence when males and female who have different gender producing a child with cross genes between male and female; hence, a new genetic (child) is formed.

The Function Is the Behavioral

The function is also the other word for the behavioral. Other than Norman's definition, the function is also known as the relation between a human user's goal and a system's behavior (Bobrow, 1984: p 2). From the design perspective, this level refers to the purpose of a product being made, probably, to solve daily life issues and seek a better living and make life easier with the product's assistance. Hence, this function encourages the innovators or designers to elaborate and connect the function to a user through artefact or product. Whereas the designers work to produce a product or artefact specification which perform certain functions (refer Roozenburg & Eekels, 1995: p 53; Suh, 1990: pp 25-26). Generally, the function is more into what the product could do and how it can help solve problems, but technically, it has more than just the function. From Preston (1998) and redefined by Crilly (2010), the fundamental study of 'the function' was drawn from the numerous academic disciplinary within the intention of the function aspect. The function was divided into two categories: 1) Categorization referring to Purpose, Effect or Means and 2) Categorization referring to Selection, Intention, and Recognition. It has seven functions in each category. The reason for separating the category is that the function has been made to the artefact (term of the things before the product functionality was produced purposely and the function selected or alternate to the other exact function. For example, a car's basic function is for transporting people or things from one point of place to another point, which is the categorization of Purpose, Effect, and Means (PEM). In other ways, the car could be the barricade for blocking the road for certain intentions, and by changing the main purpose of the car, the function also changes categorized in the Selection, Intention, and Recognition (SIR) level.

Classification according to purpose, effect or means	Physical functions
	Status functions
	Technical functions
	Social functions
	Ideological functions
	Aesthetic functions
	Non-aesthetic functions
Classification according to selection, intention and recognition	Proper functions
	System functions
	Design functions
	Use functions
	Service functions
	Manifest functions
	Latent functions

Figure 2: The Functions List in the Categories

The list of functions in categorization is also called classification by Preston (1998), which describes that the PEM and SIR have their specific role in segregating every function from what is basically defined. Referring to figure 2, it starts with PEM top-line definition, 1) Physical functions: this is a general function assigned to, where this function depends on the artefact or physical product features, behavior, and properties. 2) Status functions: this refers to the function that is attained by the symbolic status consequences instead of their capacities of physical (Searle, 1995: pp 39-41; p 12). Hence, three major functions seem continuous and related within, which are 3) Technical, 4) Social and, 5) Ideological functions. The technical function refers to the functions over artefact or product that works in environment and physical surrounding, the social functions that work in regard of the social system and ideological is a reverence to the component aspect of

culture (Rathje & Shiffer, 1982: pp 65-67; Schiffer, 1992: pp 10-12; Schiffer & Skibo, 1987: p 596; Skibo & Shiffer, 2008: p 110). Continuously, 6) aesthetic functions and 7) non-aesthetic functions that gather in a group related to the circumstances and more into art practice-based. The aesthetic in the point is the function of embracing or sustaining aesthetic value such as beauty and daintiness, and non-aesthetic is opposite as it is unnecessary to make an object an artwork but intangibly seen in revelation (of certain truth), representation (of a certain object), and provocation (of certain action) (Stecker, 1994: p 260; also see Hansson, 2006; Zangwill, 2001: p 141).

In the next category, SIR has seven functions types, starting with 1) Proper functions as the start. It describes the presence of the product in the context of its selection background. Compared to in the same group but in discrete intention, 2) system functions are generally defined by the product's capacity to execute a function in a certain context. For example, the hammer's proper function to drive in a nail in the wood and system function is utilized when the hammer was used as paperweight instead, without any reproduced concern to a new product. In the other functions, kindly in the group with more consideration for the designer and user at intentional behavior, there are three types of functions, 3) design functions, 4) use function and 5) service functions which described what purpose is product designed, what it is used for, what is the product can serve in the aspect of beneficial (Achinstein, 1977). Next, this set of group functions considers the intensity and extent of acknowledged and recognized (distinguished 6) manifest and 7) latent functions. The manifest functions refer to those objectives implications that the participant in the system intends and acknowledges while the latent functions are those function that works oppositely which non-intended and nor acknowledges by the participant (Merton, 1957: p 51; Mahner & Bunge, 2001: p 90; Searle, 1995: p22). For example, the expensive and luxury products (manifest) are unappointed to the performance and quality, but to expose the owners' affordance, social status, and wealth (latent), outwardly, the latent functions may well be the reason some product or artefact keep surviving and produced (Almquist & Lupton, 2010).

The Formulation of Design DNA in the Behavioral Aspect Level

The major part of design DNA and the function details described are compulsory tools before including the formulation in the process. In finding desired DNA, the sample of respective concerns or subjects essentially must be specified. The acquired product must have identical aspects of brand development with the intrinsic aspect of design DNA. Determining similar characteristics was done through the communication among the designer and user, and product or artefact as the platform. Berlo (1960) suggested some characteristics such as 'culture', 'communication skills', 'attitudes', 'knowledge', and social system as important roles relating to the sender (designer) and receiver (user). These characteristics are considered subjects of communicating non-purposely for the design DNA but still beneficial as a guideline to ease the process of formulating design DNA, as seen in the 'Sample Base' in Figure 3. Before it is further developed, the framework for the function design DNA is essential to look to stimulate the understanding process.

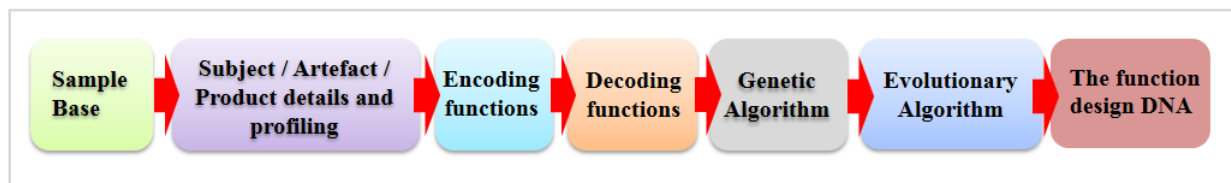


Figure 3: The Function Design DNA Formulation Framework

Initially, it aims to extract the details of the subject or sample as the core for the DNA formulation, such as culture. Lin proposed the Cultural Product Measurement table (CPM). R.T (2007) to elaborate cultural product specifications detail (Refer to Subject / Artefact / Product details and profiling in Figure 3).

Table 1: The Cultural Product Measurement Table

Object	(1)
Type	(2)
Tribe	(3)
Picture	(4)
Material	(5)
Colour	(6)
Pattern	(7)
Principle of formation	(8)
Classification	(9)
Operation	(10)
Using scenario	(11)
Cultural content	(12)

Generally, CPM defines product profiles in detail. However, optionally, it could be the platform to extract details for any data related to the expecting content for the design DNA formulation, including some adaptation without any abuse on the basic CPM structure. As the starting point to the process, the respective subjects' population is required to be found, collected, and filled in CPM (see figure 4) to identify which specification and details that possess the type of function in PEM and SIR. In figure 3, it is shown that all columns are organized, and these rows are expected to be filled with product or artefact profiles. The sampling process is shown in figure 5.

Picture		
Object	Keris (Kris)	
Type	Weapon for Malay self-defense and martial art.	
Race / Tribe	Malay	
Material	Steel, cooper, wood (handle and case) gold, silver, gems detailing	
Color	Natural-wood color, painted, nature base	
Pattern / Shape	Prosperously implemented with floral patterns and Mujarad style.	
Principle of formation	<ul style="list-style-type: none"> - Flat back and upward edge and handle form of pistol grip shape. - The accuracy of workmanship helps it to stand on the edge of form. 	
Classification	<ul style="list-style-type: none"> - Classified with its own motive by the style, the materials, the wavy blades and the holster. - The wavy blade, holster and other feature details have their own characteristics to validate the identification and distinctive meaning that specifies the status of the holder. 	
Cultural content	<ul style="list-style-type: none"> - The royal sovereignty sign and the array of valued pieces of art. - The piece of art represents the finest level of workmanships. - Believed to have the divine capacity and determination to shield the person from physical injury. - The old claims that Kris or Keris seems to have its own 'spirit' tied to it should stand on its own feet, but in the modern paradigm, logically, this could balance on its own feet if it builds with the correct methods and efficiency. 	

	CATEGORIZATION REFERRING TO PURPOSE, EFFECT OR MEANS (artefact's Function is- or should serve)	Physical functions (Phy)	/
		Status Functions (Sta)	/
	CATEGORIZATION REFERRING TO SELECTION, INTENTION AND RECOGNITION. (artefact's Function as- or intention / selection)	Technical Functions (Tec)	/
		Social Functions (Soc)	/
		Ideological Functions (Ide)	/
		Aesthetic Functions (Aes)	/
		Non-aesthetic Functions (Noa)	/
		Proper Functions (Pro)	/
		System Functions (Sys)	/
		Design Function (Des)	/
		Use Function (Use)	/
		Service Function (Sev)	/
		Manifest Functions (Man)	/
		Latent Functions (Lat)	/

Figure 5: Sample Product Specification and the Functions Encoding

A sample of the process is shown in Figure 5, accompanied by two partial tables on the right and left. The specification details are explained on the left table and, the 'Encoding function' process in at the right figure with remarks on which type of functions specified in each categorization of product or artefact. Each type of functions are coded into specific capital for ease segregations between functions from the encoding table. Moreover, this process would continue in terms of the population's scales and depending on the most preferred subject, which is vital to the desired DNA searching.

Table 2: table list for total result by each subject according to categorization

	Subject	Total
Categorization referring to Purpose, Effect or Means	Phy	
	Sta	
	Tec	
	Soc	
	Ide	
	Aes	
	Noa	
Categorization referring to Selection, Intention and Recognition.	Pro	
	Sys	
	Des	
	Use	
	Sev	
	Man	
	Lat	

The decoding process shows the results of the population base from the selected subject based on initial consideration. From here, the search for the compatible functions or genes would start. The decoding is pulling off the frail functions known as the unfit gene type in DNA terminology. In the population, the unavailable number would appear by functions. By categorizing the Genetic Algorithm (refer Lee and Tang, 2004; also Misri. I, 2015), which the gene numeration, the fittest gene are identified in total top number available among the scaled population, and this was done in each categorization of PEM and SIR and the others were decoded for reference in future. As seen in figure 7, the compatibility of functions or genes within the categorization observed some of the issues identified at the top. The total number has similar functions or genes in the same categorization. As this happens, the fittest function in the categorization with more than one function was meant to be suitable within the categorization in gene or functions combination, especially in PEM. The possibility of having the compatible combination is in the categorization of SIR if the fittest number total appears in two kinds of functions or gene. In this phase, PEM is seemingly categorized without any compatible match between functions and stands firmly to have a productive combination, known as The Evolutionary Algorithm (EA) (refer Lee and Tang, 2004; Misri. I, 2015) take the role.

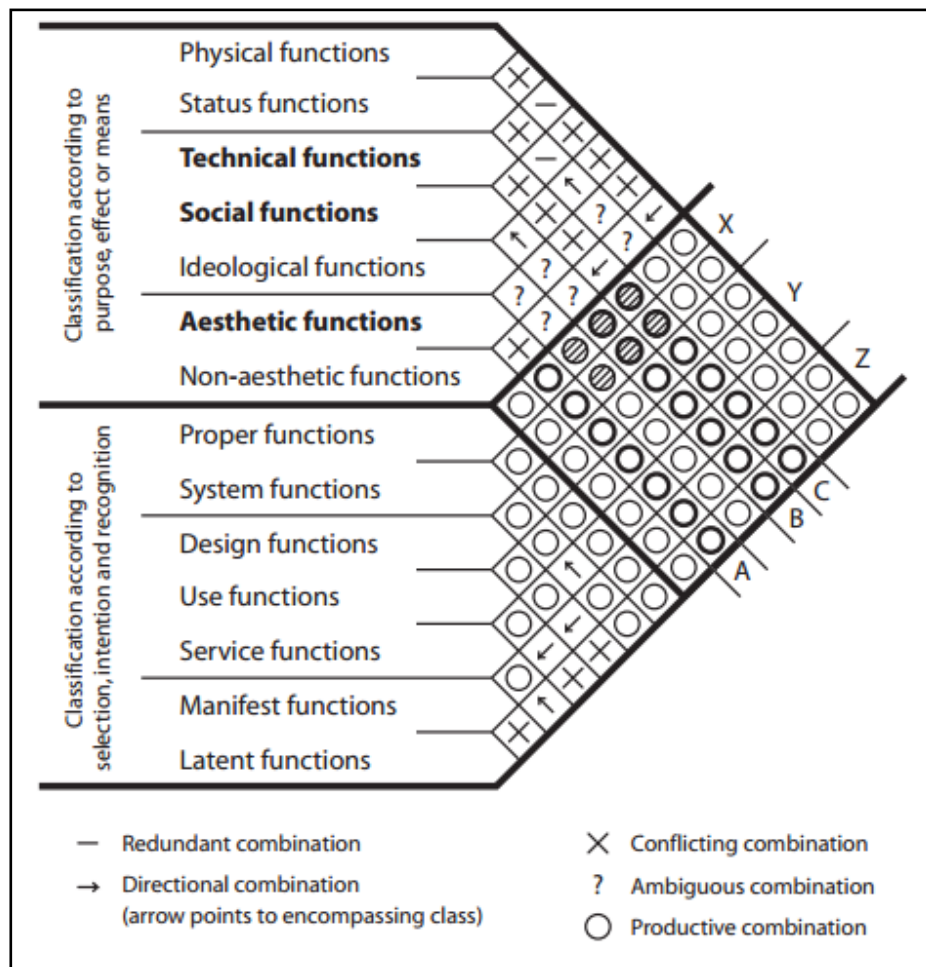


Figure 6: The Categorization (Classification) Of PEM and SIR Functions' Combination Framework

EA is simplified as a crossover combination between two categories as the idea was taken from the human combination DNA. In this role, the EA has all productive combinations when functions' categorization are merged, as shown in figure 7 and the perfect combination is the desired function DNA for the respective subject study. At some point of issue, the PEM without any compatible match within categorization as seen in the Genetic Algorithm (GA) process. Suppose the possibility of fittest functions or gene that appear more than

once, considering pulling up all function availability as the top in population for the DNA required, will be made. For example, technical and social functions (PEM), which incompatible within but still be the fittest in categorization, will be combined with the design function (SIR), which compulsory as the fittest in the total population. This step will still produce a perfect combination for the function design DNA. Therefore, this is the identity reference in the perspective of functions of design DNA.

CONCLUSION

The behavioral or the function in design is an important criterion in design to answer the purpose of a product to be produced. Hence, for the idea to find a sample of design DNA at this behavioral aspect can be referred to Berol's theory for the best solution. Other theories reviewed such CPM's table are purposely to extracting kinds of the function that available in the selected product and continued with the Preston's function matrix to organized the available kinds of function into specific categorization as shows earlier. To finalize, the productive combination as shown in the functions matrix explained the fittest kind and capable type of function to be design DNA at the behavioral aspect. At these theory reviewing points, any product without purpose is ineffectual to be made and would not improve life quality. This process is an initiative for an idea to the designer and innovator as a reference for identity and trademarking idea to be realized. This review provides a more reliable track to improve product identity and branding. The search for an identical function aspect is the second obligation after the visual aspect. Its purpose is to make a product to be straight to the point of what the user wanted and desired. Also, it prevents the product from having any additional futile function that can increase the cost of production and losses.

REFERENCES

- Achinstein, P. (1977), Function statements. *Philosophy of Science*, 44 (3): 341- 367.
- Almquist, J., & Lupton, J. (2010), affording meaning: design-oriented research from the humanities and social sciences. *Design Issues*, 26(1): 3- 14.
- Barrow G.H. (1984), *Verify: A Program for Proving Correctness of Digital Hardware*. *Artificial Intelligence* 24, 437-491,
- Berlo, David (1960). *The process of communication*. New York. New York: Rinehart, & Winston.
- Crilly, N. (2010). The roles that artefacts play: technical, social and aesthetic functions. *Design Studies*, 31(4), 311–344. doi:10.1016/j.destud.2010.04.002
- Hansson, S. O. (2006), Defining technical function. *Studies in History and Philosophy of Science*, 37 (1): 19-22.
- H.C. Lee and M.X. Tang, Evolutionary Shape Grammars for Product Design. On Generative Art, Politecnico di Milano University, (2004) 309-322.
- Lin, R. T. (2007). Transforming Taiwan aboriginal cultural features into modern product design: A case study of a cross- cultural product design model. *International Journal of Design*, 1(2), 45-53.
- Mahner, M., & Bunge, M. (2001), Function and functionalism: a synthetic perspective. *Philosophy of Science*, 68 (1): 75-94.
- Merton, R. K. (1957), *Social theory and social structure (revised and enlarged edition)*. Glencoe, IL: Free Press.

Misri, Izzuddinazwan (2015) *Evolutionary genetic algorithm as a generative tools in identifying Malay, Chinese and Indian cultural product DNA / Izzuddinazwan Misri*. Master's thesis, Universiti Teknologi MARA.

Norman, D. A. (2004). *Emotional design: Why we love (or hate) everyday things*. Basic Civitas Books.

Preston, B. (1998), Why is a wing like a spoon? A pluralist theory of function. *The journal of philosophy*, 95 (5): 215-254.

Rathje, W. L., & Schiffer, M. B. (1982), *Archaeology*. New York, NY: Harcourt Brace Jovanovich, Inc.

Roizenburg, N. F. M., & Eekels, J. (1995), *Product Design: Fundamentals and Methods*. Chichester, UK: John Wiley and Sons. [Originally published (1991) as *Productontwerpen; Structuur en Methoden*, Utrecht, The Netherlands: Lemma.]

Searle, J. R. (1995), *the construction of social reality*. London, UK: Allen Lane.

Schiffer, M. B. (1992), *Technological perspectives on behavioural change*. Tucson, AZ: University of Arizona Press.

Skibo, J. M., & Schiffer, M. B. (2008), *People and things: a behavioral approach to material culture*. New York, NY: Springer.

Stecker, R. (1994), Historical functionalism or the four factor theory. *The British Journal of Aesthetics*, 34 (3): 255-265.

Zangwill, N. (2001), *Aesthetic Functionalism*. In Brady, E., & Levinson, J. (Eds.) *Aesthetic concepts: essays after Sibley* (pp. 123-148). Oxford, UK: Clarendon Press.