

THE INTERACTION OF PRODUCT NOISE AND FORM DESIGN IN EVOKING USERS' RESPONSES

Abu Hanifa AB HAMID¹, Shahrman ZAINAL ABIDIN¹ and Mohamad Hariri ABDULLAH¹
¹Department of Industrial Design, Universiti Teknologi MARA (UiTM), Malaysia

ABSTRACT

The human mind automatically combines the two types of information received through different senses such as the sense of seeing and hearing. This combination creates new information that will influence the human mind before making the responses towards the encountered object. In product design, most of the products are designed to attract human attention through their external design such as form and colour. However, when the designed product emits undesired sound while functioning such as suck and blow air sound, this disturbing sound known as noise has been proven to be disturbing to the human hearing. Moreover, product noise also evokes a negative response from users such as to keep away from the product. In order to overcome this problem, the designers create an attractive design as a way to compensate the insufficiency of the product. Recently, in measuring the interaction between product appearances and noise, it was found that the contribution of visual appearance (colour and pattern design) of the product in interaction with the product noise is insignificant. However, measurement on the interaction between product form and product noise through users' response still remain unknown. Thus, in this paper, we intend to measure the significance of the users' response based on auditory and visual experience (form design) on noisy product.

Keywords: Noisy product, product form, users responses

1 INTRODUCTION

Over the years, the art of product design has been evolving, where the creative product design has been used by manufacturers as a strategy in the globalization of marketing [1][2]. It seems that a good form or design of a product will interact with the users. It attracts them to use the product and then provide quality usage experience for the user [3]. Recent product design studies show that the product design helps generate the users' emotion and illustrate ideas to improve their lives [4][5]. According to Creusen and Schoormans [6], the modern looks of product will motivate the users to appreciate the product through the visual appearance and aesthetics. However, the users' expectation on the product visual can be easily changed when they experience another sensory on the product when hearing the sound from the product. The sound is known as noise if the listener feels unpleasant and it is disturbing to the hearing, such as too loud and too harsh [7][8]. Based on the World Health Organization's (WHO) definition of health, Suter [9] describes noise as a major threat to human well being and their quality of life. It is because noise affects the mental well-being of humans.

In designing a product, sometimes the designer focuses more on the product appearance because it has been proven as a successful method to attract the consumers' attention. Yet, the sound of the product seems neglected as an unimportant property to be considered while designing. However, the sound of the product actually plays an important role while designing the product concept especially if the product produces sound when functioning [10]. It is because the sounds of the product may bring a negative response to the listener in some situation. Moreover, during the interaction between the users and the product, the users always use a combination of several senses to digest the information gained through the product such as sense of hearing, seeing and tactile. This gained information will influence the response of the users to the product and finally affecting their expectation and perception on the product. Furthermore, the designers will usually design products based on the information obtained from the users. All of this information will be used to design or redesign products to fulfil the users' needs and provide a better product interaction experience. Hence, many studies were done to

understand the user perception on a product, and it is important to investigate the perception of the users from the different approaches through the combination of various senses [10][11].

2 PRODUCT FORM AND USER RESPONSES

Basically, the word *form* can be defined as “the shape and structure of something as distinguished from its material” [7]. To be more specific, it also means a “shape or arrangement of parts or the visual aspect especially the shape of configuration of a thing or the shape of a body” and “an arrangement of parts or the outward aspect (apart from colour)”. Besides that, in design context, *form* means shaping or moulding a firmly model into a solid state or shape [12]. On the other hand, the word *shape* means “the external form” of a thing and “the form of outer edge of surface of something that has a particular form” [8][13]. Clearly, both these words are almost similar in their meaning and correlate to each other. However, to express the different meanings of these words, *shape* can be defined as the outline (close contour) of the object with two dimensions (2D) view; height and width. Otherwise, *form* represents the volume of the object in solid state in three dimensions (3D) view which includes height, width and depth (Figure 1).

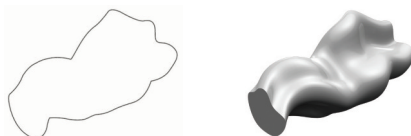


Figure 1. The difference meaning of shape (left) and form (right)

During the designing process, a few basic *visual elements* such as point, line, plane and volume is required before creating the form. These elements will be organized and assembled together until the form is created [12][14]. Meanwhile, the users' will form a snap judgment when accessing the physical properties of the object. Through this, they will make their decision which is whether to avoid or approach the object [15]. Therefore, the word *form* plays a clear explanation about the outward design of the product physical rather than *shape*. This is because the word *form* means the whole solid state or physical properties of the product.

In the product marketing, the change of users' expectation when evaluating the product is also influenced by the product appearance [6]. That is why creating the form of a product is the most challenging part in designing a successful product appearance [16]. However, some research has provided guidelines to create a pleasurable product form. According to study by Creusen and Schoormans [6], many respondents prefer objects with a more rounded and streamlined elements. They mentioned that rounded and streamlined elements provides a modern look and seem more technologically superior. Thus, they agreed that the modern design of the product appearance will elicit a positive response on the product. Besides, the design studies on car interiors also recommended that the curved form and design provides positive response to the user rather than the straight design [17]. Similarly, an analysis on the visual response of users discovered that, round shapes and curved polygons elicit a more positive response rather than angular hexagons and polygons. This is because people response to angular and sharp contour more to the sense of threat and elicit the negative judgment [18].



Figure 2. Creusen and Schoormans example of perception on product appearances

Creusen and Schoormans also identified that the appearance of the product plays an important role in helping the product evoke the users' response whether to approach the product or to avoid them. To describe the perception of the users' on the product appearance, they used two types of hair dryer as a

sample. Both of the hair dryers are 1875 Watts powered, and they describe a larger hair dryer's body as more powerful than smaller one (see Figure 2). It shows that, the little changes of the product form will affect the users' response to the product.

3 PRODUCT NOISE AND USER RESPONSES

Some products emit sounds while functioning. Product sounds can be divided into two types which are *intentional* and *consequential* sound. *Intentional* sounds are designed to send a message, provide convenience to the user and pleasingly attract the user's attention such as the microwave oven finish bell. On the contrary, *consequential* sound refers to undesired and uncontrolled sound that is emitted from the functioning of mechanical product system such as the rattling of product parts in vehicles engine and the loud suck and blow air sound of the vacuum cleaner [19]. Thus, as long the listener interacts with the product such as using it or getting around with the product, they are unable to avoid the occurrence of *consequential* sounds. Meanwhile, a loud, disturbing, uncountable and harsh sound that is undesired by the listeners and brings unpleasant feeling to the human auditory is known as *noise* [7][8][13]. In relation, the noise that is emitted from the product actually occurs when the sound become uncountable and uncontrolled. For example, vacuum cleaners produce an audible continuous sound. This uncountable sound could be perceived as a noise.

In the auditory context, every sound and noise that is encountered by the listener will automatically involved positive and negative emotional response of the listener to the source. The negative emotional response through unacceptable auditory experience will negatively influence the judgments of the users on the product [20]. In addition, in the product context, the noise emitted from the product is able to negatively influence the users' pleasantness on the product [21]. For instance, the alarm clock sound is useful but nonetheless, it can become annoying if it is too loud and sharp. The vacuum cleaner processing sound may bring negative impressions and it might also disturb our hearing. These examples portray the reflex of the human emotional response towards the product sound. These responses may affect the expectations of consumers on the product functionality and also their purchase decision [19]. In consequence, the consumer may distance themselves from the product form that elicits negative belief and response [3].

4 CASE EXAMPLE: THE RELATIONSHIP BETWEEN THE AUDITORY AND VISUAL PERCEPTION

Perception to sound seems to be a simple sense and impression process, but actually the changes of this perception will also be affected by various other sensory including the visual aspects of the object [22]. The earlier study has also identified the relationship between hearing and visual sense. The McGurk effect theory explains how the human mind processes the two types of information received. In their study, most respondents thought they heard 'da' when seeing the video of lip movements saying 'ga' with recording of the sound 'ba'. However, they can correctly heard 'ba' with their eyes closed [23]. It is also discovered that the human brain will automatically combine the two types of information received and conclude them into single information. Sekuler and Blake [24] state that auditory and vision are known as a 'distant sense, because without requiring a direct contact to the object, these two senses are able to identify and understand the object. But, this ability also requires knowledge on the object [25]. As an example, when including the knowledge in our response, our mind still accepts the roaring sound of a Harley Davidson motorbike although it is very loud and rough because it shows the quality of the motorbike [26]. In another example, when designing a sports car, designers have to make sure the fittingness of the engine sound and the visual design. As the sports car is usually known as a speedy car, the sound should be loud, furious, vigorous and able to attract the users' hearing. This character of the sound is important to maximize the user's satisfaction when experiencing the 'sporty' experience of the car [10]. Thus, it is important to the designers to ensure that the sound of the product fits together with the visual character of the product [27]. This is different with Fenko, Schifferstein and Hekkert's [21] finding, their intention is to measure the significance between the two (2) sensory of the product which is based on the visual and auditory sensory. By using visual appearances (pattern design) of the product as an attraction material, they measured the attraction over the noise of the product (whistle kettle and alarm clock) to understand the noisy product context. In consequences, the noisy context in product design is more of product sound rather than the product pattern and colour. However, the contribution of product pattern and colour

does exist in this auditory-visual interaction, but it does not significantly influence the mind's expectation on the product.

5 DISCUSSION

Product sound has been distinguished as an important property of the products especially the products that requires the user to directly interact with it. Mostly, the product sounds are designed to advance the product communication with the user. On the other side, product sounds also communicate with the user conversely. Noise emitted from the product may provide an inconvenient situation to the user rather than provide information to them. Parallel with this, the visual of the product plays an important role in providing a convenient situation through the visual appearances of the product.

5.1 Product communication through different sensory

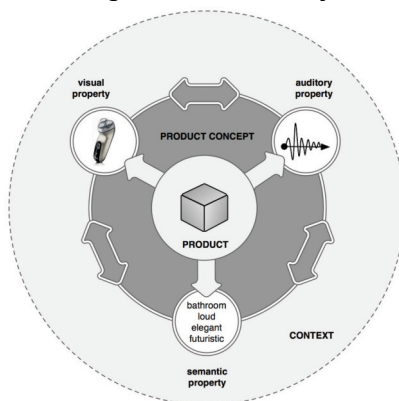


Figure 3. Özcan's model of interaction of three product properties

In the product design context, Özcan [26] has proposed that the product concept should include three basic properties which are the auditory property, visual property and semantic property (see Figure 3). Accordingly, these three properties are always processed and connected to each other when the mind is trying to evaluate the product based on the product concept. When the user evaluates the sound property of the product while seeing the visual characteristics and at the same time considered the semantic properties of the product, the mind's response to the sound will change. They will accept the lack of design when they feel satisfied with other characteristics of the product. Thus, the matching of the product properties such as the sound of the product and the visual characteristics will contribute to a successful product experience [28]. They agreed that to achieve the congruity of these properties, a detail explanation of interaction between the visual properties and the sound of product is needed [10]. Indeed, our mind has the ability to synchronize all the information received into a single thought. This ability also requires a wide range of the respondents' knowledge on the object. Furthermore, every human mind intends to access the physical of the object through few difference senses. When a person encounters the object but is unable to access it directly, their mind will automatically access the object from a distance through various aspects using distance senses such as hearing and visual to gain maximum possible information. Our mind will select the most dominant information gained then generated assumption through the other information such as from visual on a physical properties and environment context of the objects [22].

5.2 Relevance to design education

A product can elicit a variety of different emotions whether in a positive or a negative way. These positive and negative emotions will provide a different response and action, where the positive emotions will encourage the individual to approach and alternatively reject the product that evokes a negative emotion [29]. In other words, the user will buy products that elicit positive emotions more often rather than the negative one. They will also feel pleasure and more likely to use the product frequently. Thus, it is worthy to design products that will elicit positive emotions; which encourage the users to appreciate them more [30]. In order to understand the users' expectation, the product

developers must be aware on how their products will communicate with the users and also to the market. The product does not only have to be attractive in design, but it also needs to be able to communicate well with the users [31]. Moreover, rather than the design, product sound also communicates with the user through its sound both in a positive or a negative way. Hence, as an important part of the product, designers should understand that if the product emits noise rather than sound while functioning, does this noise affect the users' expectation on product or not even despite the attractive design. Besides that, Creusen [32] states that there are five (5) opportunities in investigating the information regarding the users' response on product design, which one of them is to investigate the relationship between form and function in triggering the users' response when evaluating the product. It shows that this topic will be important information in understanding the characteristic of product appearances that will influence the user in evaluating the product form and function.

6 CONCLUSION

Assuredly, pleasurable product should be considered in the product concept if it is strongly desired to achieve a successful marketing over the other products [33]. Also, pleasurable product frequently gains point in the process of attracting consumer to approach them. This first approach of the users may indulge them to explore the whole product personally. However, the success of a pleasurable product requires congruity between the whole product characteristics including the integral property of the product such as its sound and noise. This is because the product sound or product noise is able to negatively affect the changes towards consumer response on the product.

Overall, based on the case example explained earlier, there are opportunities to found positive conclusion about interaction between sense of auditory and visual of the users when evaluating the noisy product. As mentioned, *consequential* product sound can be defined as product noise, and also able to evoke the wide range of users' responses especially the negative response when hearing them [13][19][20]. On the other hand, the modern and attractive design especially the design with streamlined and curved shape can attract the users to positively response to them [6][17][18]. Although the result of Fenko, Schifferstein and Hekkert's studies found that auditory-visual interaction of the product are dominated by product sound, there are a few other characteristics of product appearances that can be measured through this interaction. They also further suggested that it might be helpful if a future study is conducted to explore the interaction between product shape (form) and product sound (noise) towards the users' response. This suggestion implies that the research on the role of product appearance on the users' response is important [32]. Thus, our study will be conducted on the respondents' response regarding the interaction between product sounds (noise) through the visual appearance of the product. We are interested in evaluating the vacuum cleaner sound because it is has the characteristic of *consequential* sound and it also has an attractive form design. Generally, we will identify the interaction of existence and measure the interaction. Finally, we also hope to confirm if the characteristic of the mentioned product form is able to evoke the positive response over the noise.

ACKNOWLEDGEMENT

This research was financially supported by the Ministry of Higher Education, Malaysia and the Universiti Teknologi MARA, Malaysia. This support is gracefully acknowledged.

REFERENCES

- [1] Berkowitz M. Product Shape as a Design Innovation Strategy. *Journal of Product Innovation Management*, 1987, 4 (12), 274-28.
- [2] Nussbaum B. Smart Design: Quality is The New Style. *Business Week*, 1988, 11(April), pp. 102-117.
- [3] Bloch, P. H. Seeking the Ideal Form: Product Design and Consumer Response. *Journal of Marketing*, 1995, pp.16-29.
- [4] Jensen R. *The Dream Society: How the coming shift from information to imagination will transform your business*, 1999 (McGraw-Hill, New York).
- [5] Alessi A. *The Dream Factory*, 2000 (Electa-Alessi, Milan).
- [6] Creusen M. E. H. and Schoormans J. P. L. The Different Roles of Product Appearance in Consumer Choice. *Journal of Product Innovation Management*, 2005, 22(1), pp.63-81.

- [7] Webster M. Merriam-Webster.com. Available: <http://www.merriam-webster.com/dictionary/form>; <http://www.merriam-webster.com/dictionary/noise> [Assessed on 2013, 4 Feb].
- [8] Fowler H. W., Fowler F. G. and Thompson D. *The Concise Oxford Dictionary, 9th Edition*, 1995 (Clarendon University Press, Oxford).
- [9] Suter A. H. *Noise and Its Effects*, 1991 (Administrative Conference, United States).
- [10] Özcan E. and van Egmond R. Audio-Visual Interactions in Product Sound Design. In *Human Vision and Electronic Imaging XV: SPIE-IS&T Electronic Imaging, SPIE Vol. 7527 75270P*, March 2010.
- [11] Thompson V. A. and Paivio A. Memory for Pictures and Sounds: Independence of Auditory and Visual Codes. *Canadian Journal of Experimental Psychology*, 1994, pp.380-398.
- [12] Abidin S. Z., Sigurjónsson J., Liem A., and Keitsch M. On The Role of Formgiving in Design. In *International Conference on Engineering and Product Design Education 2008*, EPDE08, September 2008, pp.365-370.
- [13] Hornby A. S. and Turnbull J. *Oxford Advanced Learner's Dictionary, 8th Edition*, 2010 (Clarendon University Press, Oxford).
- [14] Akner-Koler C. *Three-dimensional visual analysis*, 2000 (Reproprint, Stockholm).
- [15] Bar M., Neta M. and Linz H. Very First Impressions. *American Psychological Association*, 2006, pp.269-278.
- [16] Pahl G. and Beitz W. *Engineering Design: Systematic Approach, 2nd Edition*, 1996, (Springer).
- [17] Leder H. and Carbon C. Dimensions in Appreciation of Car Interior Design. In *Applied Cognitive Psychology*, 2005, 19, pp.603– 618.
- [18] Silvia P. J. and Barona C. M. *Empirical Studies of the Art. Do people prefer curved objects? Angularity, expertise, and aesthetic preference*, 2009 (Baywood Publishing Co., New York).
- [19] Özcan E. and van Egmond R. Product Sound Design: An Inter- Disciplinary Approach?. In *Undisciplined! Design Research Society Conference 08*, 2009, pp.306/1-306/14.
- [20] Lyon R. H. *Designing for Product Sound Quality*, 2000 (Marcel Dekker Inc., New York).
- [21] Fenko A., Schifferstein H. N. J., and Hekkert P. Noisy Products: Does Appearance Matter?. *International Journal of Design*, 2011, 5(3), pp.77-87.
- [22] Haverkamp M. Look at That Sound! Visual Aspects of Auditory Perception. In *III Congreso Intyernacional de Sinestesia, Granada*. 2009.
- [23] McGurk H. and MacDonald J. Hearing lips and seeing voices. *Nature*, 1976, 264, pp.746-748.
- [24] Sekuler R. and Blake R. *Perception, 3rd Edition*, 1994 (McGraw-Hill, New York).
- [25] Sweetser E. *From Etymology to Pragmatics: Metaphorical and Cultural Aspects of Semantic Structure*. 1990 (Cambridge University Press, Cambridge).
- [26] Özcan E. *Product sound: Fundamental and application*, 2008 (Doctoral dissertation, Delft University of Technology).
- [27] Blauert J. and Jekosch U. Sound Quality Evaluation – A multi-layered problem. *Acustica United with Acta Acustica*, 1997, 83(5), pp.747-753.
- [28] Ludden G. *Sensory incongruity and surprise in product design*, 2008 (Spinhex & industrie, Amsterdam).
- [29] Frijda N.H., Kuipers P. and Schure E. Relations among emotion, appraisal, and emotional action readiness. *Journal of Personality and Social Psychology*, 1989, 57, pp.212- 228.
- [30] Desmet P. M. A. Faces of product pleasure: 25 positive emotions in human-product interactions. *International Journal of Design*, 2012, 6(2), pp.1-29.
- [31] Monö R. *Designing for Product Understanding: The Semiotic of Design from a Semiotic Approach*, 1997 (Skogs Boltryckeri AB, Sweden).
- [32] Creusen M. E. H. Research Opportunities Related to Consumer Response to Product Design. *Journal of Product Innovation Management*, 2011, 28, pp. 405-408.
- [33] Chang W.C. and Wu T.Y. Exploring Types and Characteristics of Product Forms. *International Journal of Design*, 2007, 1(1), pp.3-14.