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Design, Emotions, and Theories of Product Emotion. A Review

Gaurav Vaidya^a

^a Dhirubhai Ambani Institute of Information and Communication Technology, Gandhinagar, Gujarat, India

*Corresponding author e-mail: vaidyagaurav24@gmail.com

Abstract: In the design process, aspects of form and aesthetics are always thought of carefully, along with technical functionality. If only functionality were the requisite aspect of the design, there would be only one design of each product. People demand variation in product design to satisfy their emotional needs. Moreover, market research has shown that consumers who decide only based on pure facts are extremely small, and mostly they decide with their emotions. As consumers are becoming more and more aware, functionality and usability are more and more taken for granted in products, and consumers are eyeing for the attainment of higher-level needs, i.e., emotional needs. Therefore, the emotional aspect of design has gained significance in design education, practice, and research in the recent past. In this regard, it is essential to understand what emotions are and how design affects consumer emotional responses. This paper explores the fundamental terminologies in emotion research to understand and develop a perspective exploring relationships between design, emotion, and consumer responses. It involves reviewing and critically analyzing seminal studies, theories, and models previously proposed in this domain (viz. Emotional Design, Appraisal Theory, Pleasure Model, Technology as Experience Framework, and Product Personality Assignment). Based on the review insights, we enlist the advantages and limitations of each of the reviewed theories. It is expected that design practitioners, cognitive scientists, and ergonomists would find the insights drawn in the current study helpful while designing products that elicit the intended emotional response.

Keywords: Emotional Design, Product Form, Consumer Emotions, Design Education, Design Research

1. Introduction

Every product that is intended to be designed must fulfill the three basic requirements. First, the design must be useful. In other words, it should perform the intended task. Second, it should be usable and simple to understand. Finally, it should be desirable (Sanders, 1992). In the case of a new category of products, initially, the usefulness is exceptionally high. However, as the age of the category of product increases, the market becomes mature, and technically similar products co-exist.

In such situations, simple functionality becomes the norm (van Geel, 2011), and the desirability aspect becomes an important differentiator. The human desire for purchasing, owning, and using a product is an emotional need that is complex and multi-layered. Research shows that emotions dominate our decision-making (Reeves and Nass, 1998) as they stimulate behavior. Thus, designers must learn to identify and use the emotional considerations appropriate for the context (Vaidya & Kalita, 2022). Therefore, first, it is essential to understand the basic terminology used in emotion research and its connection with design. In this regard, the current study investigates the following fundamental questions through the literature review.

- What are the constructs in Emotion Research?
- How are Emotions and Design related?
- What are the existing theories, concepts, and models exploring the relationship between Emotion and Design?

2. Methodology of The Literature Review

A systematic search was conducted using online databases such as Scopus and Google scholar with search terms "consumer emotions", "emotional design", and "cognitive response". The research articles were then filtered based on specific criteria. The inclusion criteria were: (a) articles written in the English language, (b) the presence of search terms in article keywords or title, (c) availability of the full text, (d) relevancy of the article for the current context of the investigation. The shortlisted articles were analyzed comprehensively to answer the research questions proposed in the previous section.

3. Review of Constructs in Emotion Research

In emotion research, the terms 'affects' and 'emotions' are the most equivocal terms. Hayes-Roth et al. (1998) and Arnold (1960), in their articles, use the terms 'affect' and 'emotion' interchangeably. According to Calvo & D'Mello (2010), 'emotion research' and 'affective science' are identical. Keltner et al. (2014) also view affect and emotion as synonyms. However, they claim that 'affect phenomena' has now been used as a broad term inclusive of anything that deals with emotions, moods, character, and preferences.

Arnold (1960) defines emotion as the felt tendency toward anything intuitively appraised as good (beneficial) or away from anything intuitively appraised as bad (harmful). Additionally, the literature (Norman 2004; Lucas and Diener 2000) affirms that emotions alter the way humans contemplate and act as continuous guides to proper behavior. Desmet also agrees with this perspective and argues that everything humans do has a subconscious shade of emotion. Furthermore, he advances the argument that emotions produce quick bodily reactions arising according to the circumstances (Desmet 2003a). These bodily reactions are emotional responses that create biochemical reactions changing the physical condition of the body without conscious efforts or reflection (Carlson 1997) and giving the advantage of deciding what to do at the time of important events (Paul Ekman 1999). Emotional responses are physical such as eye movement, blood flow, facial expressions, body posture, respiration rate, etc.; hence they can be objectively measured (Hampton 2015). As emotions are coded in the genes, they are usually universal to humans (Dewey 1934).

Goleman (1995) argues that the emotional and rational part of the brain typically works in unison. Emotion informs the rational mind, and the rational mind processes the inputs from the emotional feed. The dissimilarity between emotion and reason is that emotion results in responsive action, and reason results in a conclusion. Moreover, emotion succeeds over reason every time in a conflict

situation between the two (Roberts 2004). According to Desmet, emotions have an expressive or physiological component and a subjective experience component (Desmet, 2003a). The mechanism of triggering emotion and its components are presented in Figure 1.

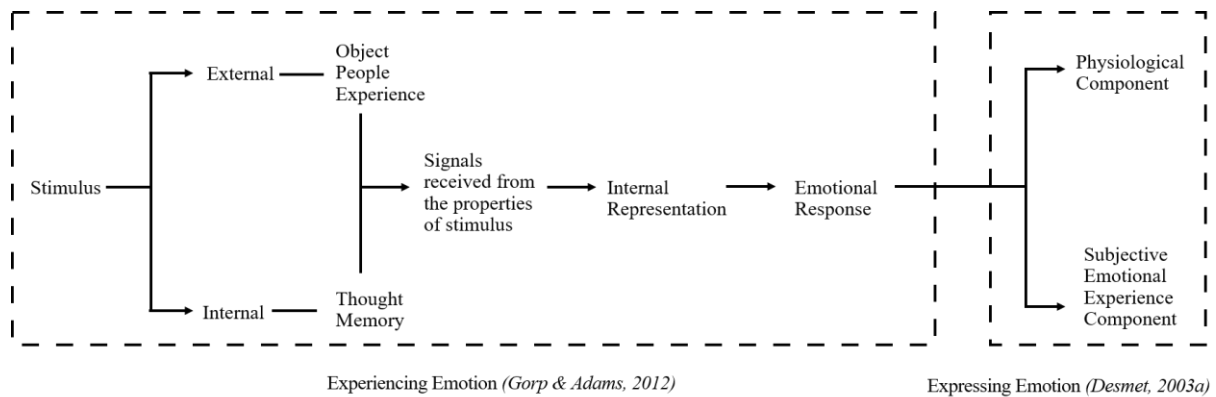


Figure 1. Experiencing and Expressing Emotions. Gorp & Adams, 2012; Desmet, 2003a.

4. Relation Between Emotion and Design

According to Luckman, the process of design is nothing but the transformation of gathered and processed data in the form of needs, limitations, and knowledge into possible solutions according to the designer's considerations to achieve necessary capability features (Luckman, 1967). In literature (Schön 1984), design is termed as a 'reflective practice', a form of knowledge creation by 'reflecting-on-action' and 'reflecting-in-action'. Since every decision defines the next action taken, each phase of design is given high significance (Schön 1984). Furthermore, product design is creating a new product that consists of 'functional' and 'emotional' attributes. Consequently, in the design of a product, function, and appearance both have great importance.

According to Ashby & Johnson (2003), functionality and usability tend to come at the lower part of 'the requirements pyramid', and consumer satisfaction (emotional need) comes at the top portion of the pyramid. As the consumer is becoming more and more aware, functionality and usability are more and more taken for granted in products, and consumers are eyeing for the attainment of higher-level needs, i.e., emotional needs (Demirbilek and Sener 2003).

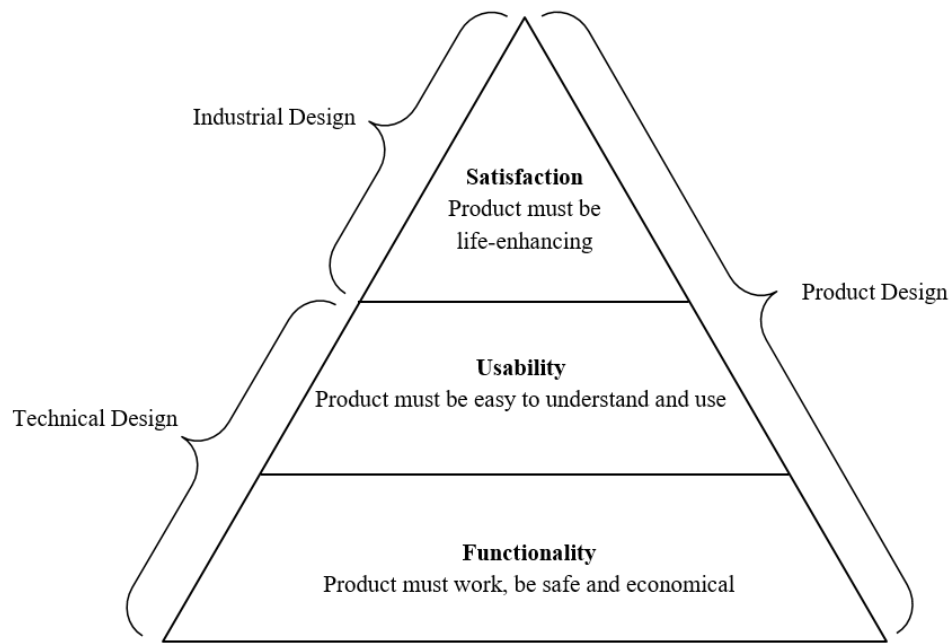


Figure 2. *The Requirements Pyramid. Ashby and Johnson, 2003.*

Thus, to cater to consumers' emotional needs, a designer must have a prior understanding of how design decisions affect consumer emotional responses (Vaidya & Kalita, 2021). Previous research in product design and emotion has resulted in the development of various theories of product emotions. A comparative study of these theories of product emotions would be beneficial for comprehending this complex phenomenon of product emotion. Therefore, through this study, we attempt to review seminal theories of product emotion and list the advantages and limitations of each approach

5. Theories of Product Emotion

The analysis of five seminal theories of product emotions is presented in this section. Though many theories are available in the literature, in total, the following five theories of product emotions have been identified and examined: (a) Emotional Design, (b) Appraisal Theory, (c) Pleasure Model, (d) Technology as Experience Framework and (d) Product Personality Assignment. These theories are relevant for the current context, first, because all five have explored the complex phenomenon of layered emotional responses, and, second because they all have in different ways attempted to establish links between sources of product emotions and their relevance to product design. Each theory mentioned above has its own positives. It is essential to study these theories to get an improved understanding of the phenomenon of emotional response to design for better emotional product design.

5.1 Emotional Design

Product appearance (i.e., the visual design of the product) is a communication channel between the designer and the user. Product appearance is the key that governs the consumer interpretation of the product. Crilly and colleagues propose a framework for design as a process of communication that consists of five elements, namely design team (source), product (transmitter), environment (channel), senses (receiver), and response (destination) (Crilly, Moultrie, and Clarkson 2004). In this process, the design and manufacturing of the product is the producer's responsibility. The design team codes the intended message into the product by manipulating its geometry, measurements, surface quality, materials, colors, visuals, details, etc. The consumer interacts with the product in a

specific environment, which can be termed as a channel. Consumer senses receive the message transmitted by the product, and the product perception is formed, which results in consumer cognitive response.

Although all human senses impact consumer reaction to the design, it is accepted that visual sense contributes the most in the process (Schroeder 2002; Postrel 2004), and product style usually refers to visual style (Baxter 1995). Monö suggests that the product form that the eye sees generates the viewer's expectation of what other senses will ascertain (Monö 1997). Thus, product appearance has to strike a chord that makes conformity with other human senses (Smets and Overbeeke 1995).

Norman (2004) categorized the human attributes of response in three emotional levels according to the processing that is carried out inside the brain. The levels are visceral, behavioral, and reflective. He further mapped these three levels to product characteristics forming three elements of emotional design: Visceral Design, Behavioural Design, and Reflective Design.

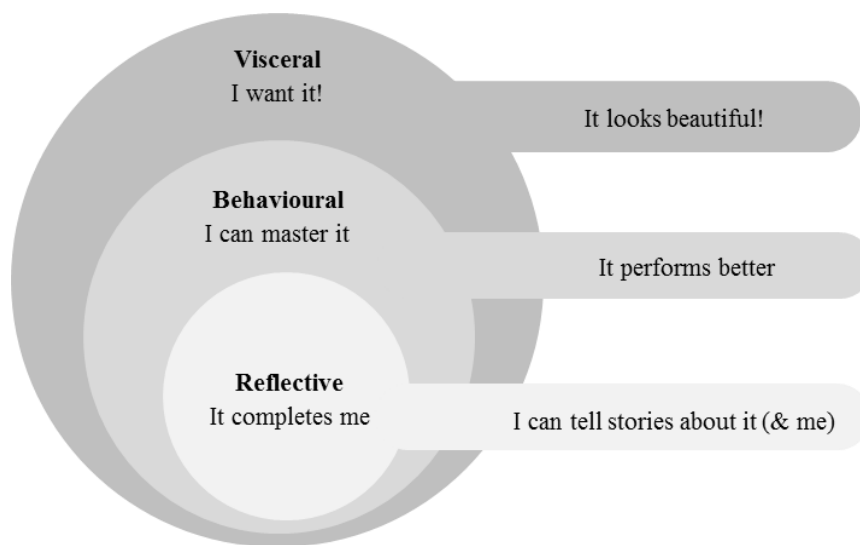


Figure 3. Three Elements of Emotional Design. Norman, 2004.

Norman further explained Visceral Design deals with appearance (i.e., visual design) and how consumers evaluate product appearance through their senses. Human response to objects that offer food, warmth, and protection is usually positive, as humans are genetically programmed through evolution. Behavioural Design refers to the pleasure and effectiveness relating to the usage of a product that consumers find easy to use or gives them a sense of satisfaction. Such products are generally liked more than those having usability issues. Finally, Reflective Design has to do with interpretation, understanding, and reasoning. The consumer may appreciate even a useless product if it has the ability to elicit memories, tell stories or enhance consumer self-image.

5.2 Appraisal Theory

Different from the concept of Norman's three levels of emotional design, Hekkert & Desmet (2002) proposed the appraisal theory. According to this theory, the consumer's appraisal is the factor that governs emotion elicited by the design outcome. In the experimental model, Hekkert and Desmet divided product emotions into five categories: surprise emotions, instrumental emotions, aesthetic emotions, social emotions, and interest emotions. The model showed that although a product might evoke several emotions, the underlying process that induces emotion in consumers is universal.

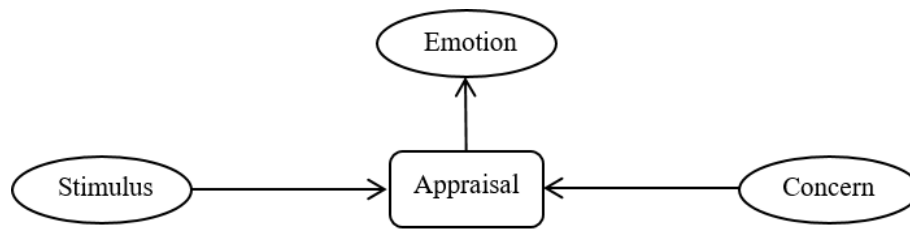


Figure 4. Model of Product Emotions. Hekkert and Desmet, 2002.

This theory resembles Lazarus Theory of Emotion which states that the experience of emotion depends on how an individual cognitively appraises or labels the experience. The appraisal of an event depends upon previous experience, current circumstances, and cultural background (Lazarus 1991). Though the proposed model highlights the cognitive process of emotion generation through appraisal, it does not provide much empirical evidence verifying the connection between design and emotional responses.

5.3 PLEASURE MODEL

Jordan (2005) proposed the pleasure model. He argued that designers need to move beyond the functionality and usability approach to design. He proposed a pleasure-based approach in which the focus is on the pleasure aspect in designing product experience. His model classified four different types of pleasure, (a) Physio-pleasure; (b) Socio-pleasure; (c) Psycho-pleasure and (d) Ideo-pleasure. Physio-pleasure is associated with pleasure obtained from interaction with products through our senses, e.g., the tactile pleasure of holding a remote control, the olfactory pleasure of smelling hot coffee. Socio-pleasure is related to joy obtained from our relationship with other people. Sometimes products encourage social interactions, and the pleasure derived from these interactions facilitated by products is termed socio-pleasure. For example, a bakery shop owner may provide a service that facilitates a small public get-together – 'An evening with Cake'. Psycho-pleasure is to do with the cognitive and emotional responses. In order to use a product, it may be essential to have a certain level of cognitive ability, and product experience may elicit some emotional reactions. Ideo-pleasure is related to peoples' values. For example, a product manufactured from biodegradable material pertains to the value of environmental responsibilities of the consumer. Although the pleasure model encourages designers to consider product attributes that can exhibit pleasurable experiences in consumers, it does not deal with the biological process of pleasure. Moreover, the model proposes a structured approach to the issue of product pleasure experience and product acceptance based on pleasure. Still, the other dimensions of emotion (e.g., boredom, pride, fascination) remain unexplored.

5.4 Technology as Experience Framework

This model was established by McCarthy and Wright (2004), and it analyses elements of consumers' experience with technology in different phases of engagement with it. The model talks about four threads of overall consumer experience: 'sensual thread', 'emotional thread', 'compositional thread', and 'Spatio-temporal thread'. The 'sensual thread' is associated with the consumer's sensory organs and their affiliation with a situation. This is comparable to the visceral level described in Norman's model. For example, children get intensely engrossed in mobile games with all their senses to the extent they cannot be attentive to any activity around them. The 'emotional thread' is related to the impact of product use on consumer emotions. For example, irritation caused due to an unresponsive computer. The 'compositional thread' involves the relationship between the whole experience and its elements as the consumer makes sense out of it. For example, a mechanic is working on an

engine with his passion and commitment to his own handiwork. Each passing moment while working gives him joy and shapes the overall experience in the way of expressing himself. The 'Spatio-temporal thread' relates to the effect of space and time on consumer experience. For example, some people choose a quiet place to experience the joy of reading an exciting novel. The framework gives a holistic perspective about consumer experience and its threads. However, the threads mentioned in the framework are not mutually exclusive, and they have a considerable overlapping. For example, both the sensual and the emotional thread deal with the emotional impact of the product use, and one can be unclear of categorizing such consumer experiences based on the threads mentioned. Moreover, the role of human senses in each thread is not described with clarity.

5.5 Product Personality Assignment

Phillips Design originally developed the approach of 'Product Personality Assignment' (PPA). In a pleasure-based approach, the products are seen as 'living objects'. PPA forms an extension to this idea and proposes that products possess traits that make their personalities. The proposed idea seems over-imaginative as, in a true psychological sense, the products do not have their personalities. However, people may assign personalities to products such as unhelpful, funny, calm etc. based on their reflection of human qualities on to products. For example, an earlier study by Joran reports that one of the participants referred to his radio as an 'old friend'. Another participant in the same study revealed that she punishes her stereo by thumping it for ruining cassette tapes. The approach demonstrated that different individuals are likely to allocate equivalent personality attributes to the same product, but it falls short in linking personality attributes to product preferences. Moreover, designers having no psychological background may find it challenging to understand the model of personalities proposed by PPA.

6. Conclusion and Discussion

The present paper covers fundamental terminologies in emotion research and a review of five seminal theories for emotional product design. The first two theories (viz. Emotional Design and Appraisal theory) outlined in this paper are effective in lifting the layers of elementary cognitive and emotional processing that is carried out inside the brain, whereas 'Pleasure Model', 'Technology as Experience Framework' and 'Product Personality Assignment' are mainly related to categorization of consumer emotional experience with the product. For better comprehension, table 1 given below describes the benefits and drawbacks of the studied theories.

Table 1. Benefits and Drawbacks of Five Theories of Product Emotion.

Theory	Benefits	Drawbacks
Emotional Design	Clarifies cognitive processing that is carried out inside the brain at different levels.	Unable to establish empirical methods to evaluate emotional responses validating the model.
Appraisal Theory	Explains the underlying process of emotion generation through appraisal.	It does not provide much empirical confirmation verifying the connection of design and emotional responses
Pleasure Model	Describes a systematic approach to the issue of product pleasure experience. Explains product acceptance based on pleasure.	Not able to explain cognitive information processing and multiple dimensions of emotion.

Technology as Experience Framework	Explains consumer experience in different phases of engagement with technology.	Unable to explain emotion generation process and the role of human senses in each phase.
Product Personality Assignment	Effectively relates visual design of a product with individual personalities and emotions.	Not able to establish a link between personality attributes and product preferences.

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About the Authors:

Gaurav Vaidya is currently working as an Assistant professor at DAIICT, Gandhinagar. He has a background as an industrial designer and obtained a Ph.D. Degree from Indian Institute of Technology Guwahati, India, with research focused on emotional product design. His main research interest is in the question of why and how consumer products evoke emotions. In addition, he develops tools and methods that facilitate an approach to emotion-driven design. Besides his research initiatives, he has successfully completed projects in the areas of handicrafts, toy design, and design for play and learning.