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A CONCEPTUAL FRAMEWORK FOR IMPRESSIONS ELICITED IN HUMAN-PRODUCT INTERACTION.
DESIGN FOR MEANING AND DESIGN FOR EMOTION.

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ABSTRACT

Affective design and human-product interaction are multidisciplinary fields. They have been dealt from different approaches and, as a consequence, a variety of concepts and terms, aimed at different objectives, have emerged.

This article proposes a conceptual framework that establishes the main elements in human-product interaction, and relations that occur between them. Drawing a distinction between descriptors applied to the product (assignment of meaning) or the person (elicitation of emotions) provides a definition of the families that are emerging in design, namely, Design for Meaning and Design for Emotion. Some other aspects have also been taken into account, such as the consideration of the design process as a key moment for the study of impressions or the existence of different types of people, who may generate similar impressions inside a particular group, depending on their environment or reference criteria. The main purpose of the framework is to serve as a basis for developing a practical tool that can be used to study subjective impressions in product design.

Keywords: *Design for Meaning, Design for Emotion, Conceptual framework for Impressions in human-product interaction.*

1. INTRODUCTION

Product design is a multidisciplinary field, in which various disciplines, such as marketing, engineering or ergonomics converge. Particularly, the fields of affective design and human-product interaction have been dealt from different approaches, and this has produced the emergence of a variety of concepts and terms, aimed at different objectives.

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This article proposes a conceptual framework that establishes the main elements participating in human-product interaction, and relations that occur between them. It is pretended to obtain a theoretical basis for the application of design tools that take into account perceptions and emotions elicited by the product in the different stages of the product lifecycle, including design and development. Besides, the different stakeholders who decide about product design throughout the stages of the development process should be also taken into account. The conceptual framework proposed here adopts some concepts from previous works such as the Product Experience Framework [1], the Phenomena model of product emotion elicitation [2], the Framework for consumer response to the visual domain in product design [3], or the Framework for evaluation of affective design [4], [5]. It also tries to fulfil the requirements identified for our objective.

Next section discusses some relevant models from literature about subjective impressions in human-product interaction. In the third section the proposed conceptual framework is presented and the final section summarizes the main ideas of this work.

2. IMPRESSIONS IN HUMAN-PRODUCT INTERACTION

2.1. Meaning assigned to the product and emotions elicited

Application tools in the field of affective design such as the Semantic Differential technique [6] and Kansei Engineering [7], [8], seem to focus on the assignment of meanings to the product more than on the emotions elicited. Thus, tools have been proposed for the study of a variety of products [9], [10], [11]. Although tools focusing on emotions have also been proposed [12], only a few studies consider and differentiate between semantics (meaning) and emotions [13]. A revision about theories and measurement methods of affect and pleasure can be found in [4].

Emotions and the affective system in general, are intimately linked to the cognitive aspect of the interpretation of product design [14]. In fact, some theoretical models of human-product interaction focus solely on the elicitation of product emotions, without considering the assignment of meaning. This is the case of the *Product emotion elicitation* model [12], [15] or the *Phenomena model of product emotion elicitation* [2].

The first model is based on previous works such as those by Frijda [16], Lazarus [17] or Scherer [18] on emotions and on the Appraisal Theory. An appraisal is an automatic assessment of a stimulus (in this particular case, of a product) to determine whether it is beneficial or harmful for one's personal well-being. This assessment, which precedes the emotion, will vary from person to person and their concerns (which can be defined as more or less stable preferences for certain states of the world that serve as references for the appraisal). The combination of appraisal and concern will generate product emotions. Some appraisal patterns of emotions have also been proposed [19]. Fenech and Borg [2] claim that their model completes the previous one through the concept of *product life phase system* [20]: it will be necessary to consider that the product will meet a person in a particular environment. Although these meetings may take place throughout the entire product life cycle, the relevant human-product contact occurs for the authors during sales and use. Therefore, interaction during product development is not emphasized.

Unlike the models discussed so far, which only focus on product emotions, the *Product experience framework* [1] proposes three interrelated levels in what the authors call the "product experience", i.e. the aesthetic experience, linked to the information from the sensory level; the meaning experience, where the cognitive system comes into play and meaning is assigned to the product; and the emotional experience, where emotions are elicited from the appraisal of the stimulus and from the situation. The authors compare the first two levels to those proposed by Crilly et al. [3] for the cognitive response of their *Framework for consumer response to the visual domain in product design*. According to this framework, the cognitive response is made up of the aesthetic impression (as a result of a visual perception), the semantic interpretation (linked to what a product says about its functionality) and the symbolic association (personal and social significance attached). These three levels correspond, according to Crilly et al. [3], with Norman's visceral, behavioral and reflective levels of design [14].

These levels of design proposed by Norman are considered in the Framework for evaluation of affective design [4], [5], from the view of the designer. The designer should also consider the context of use and trends and norms from society. They are related to the type of user/ customer of the product (see next section). The affective user experience considers the affective and the cognitive systems.

Therefore, different types of subjective impressions can be identified. First of all, we can distinguish between the meaning assigned to the product, and emotions elicited, which refer to the person. Furthermore, different levels for the attribution of meaning have also been distinguished: the level corresponding to the aesthetics of the product, another one linked to its use and functionality, and a third one related to the symbolic (personal, social, etc.) meaning assigned to it. These levels are related to the concept of roles of product appearance [21].

Next we will see that users are not the only type of people designers should be focused in. Other stakeholders can decide about products along their lifecycle.

2.2. Beyond the user: types of people interacting with the product

Related literature uses terms such as *user*, *customer* or *purchaser*. The term *customer* implies some generality and, according to Schütte [22] two different aspects can be distinguished: the economic one, related to the purchase process (in this case the *customer* would be the *purchaser*), and the functional aspect, linked to the use of the product (then the *customer* becomes the *user*). But the purchaser and the user are not always the same person. Moreover, the purchaser, or whoever makes the purchasing decision, does not apply only economic criteria; instead, many other factors may also exert an influence. As regards the user, different types can be distinguished for the same product, since there are often different types of use. Janhager [23] reviews and classifies different types of users, noting that several methods can be employed to make a distinction, such as according to the purpose of the use of the product, the user experience or the involvement in the purchase. That is, the generic term *user* is not always being applied to the person who really uses the product. In fact, marketing is interested in the person who decides to purchase or acquire the product, in addition to the end user.

Fenech and Borg [2] avoid adopting the term *user* and apply the more generic *stakeholder*, taking into account not only those who use the product, but also the purchasers. However, this distinction allows for even greater specification. Besides the different types of users and purchasers, other possibilities may also be considered, such as those who select or filter the product on its way to the target group of customers, i.e. dealers, distributors, and so forth. The study of the impressions in designers can also be included, because designers and users interpret products in a different way and they express different aesthetic preferences [24].

2.3. Conclusions

Models about affective design and human-product interaction usually focus on the meaning associated to the product or on the emotional response elicited, but they do not usually present a holistic and complete view of the process. In addition, most of them are designed for their implementation in the last stages of the product lifecycle, like purchase or use, so that the person considered for the interaction with the product coincides with a purchaser or an end-user.

A complete model should include different types of environments and consider interaction with different types of stakeholders, from earlier stages, namely, during product design and development. Thus, in many cases it will be necessary to analyse an intermediate product, which has not yet been fully developed, such as a prototype. In this case, the representation of the product should allow an evaluation to be carried out in a way that is as similar to reality as possible, because the type of representation can influence the perception and cognitive analysis [25].

As indicated by Fenech and Borg [2], there is no a clearly defined framework for product designers that is capable of lending support to the supra-functional aspect in the interaction between product and user. The authors argue that these supra-functional criteria must be studied in order to support a new emerging member of the DFX family, namely, Design for Emotion, or DFE. However, with the model described below this view is expected to be extended, since this framework for impressions in human-product interaction includes DFE, but as only one of its components.

3. A CONCEPTUAL FRAMEWORK FOR HUMAN-PRODUCT INTERACTION

Following on from the previous ideas, the proposal in this work divides the interaction under study into two levels. The first one is the objective level of interaction between the product and the person (and more specifically, through the sensory organs). This will result in a **physical sensation** (generic to any type of person, culture, etc.). Another level of interaction, this time between the person and the environment, will lead to subjective **reference criteria** (see figure 1). Reference criteria include moral values and personal beliefs, learned rules, personal goals and future expectations, memories and results from past experiences, innate tendencies and instincts, and so on. They are inherent to the person or perhaps they have been formed throughout his or her life, and may change and evolve with new experiences.

The environment to be considered includes both the general environment and also the particular context in which the interaction occurs. Aspects such as the kind of relationship

with the product, or the time spent interacting with it (at work or outside), play a leading role in reference criteria. Thus, we should know the main features and attitudes of the stakeholders in order to analyze their product impressions and preferences.

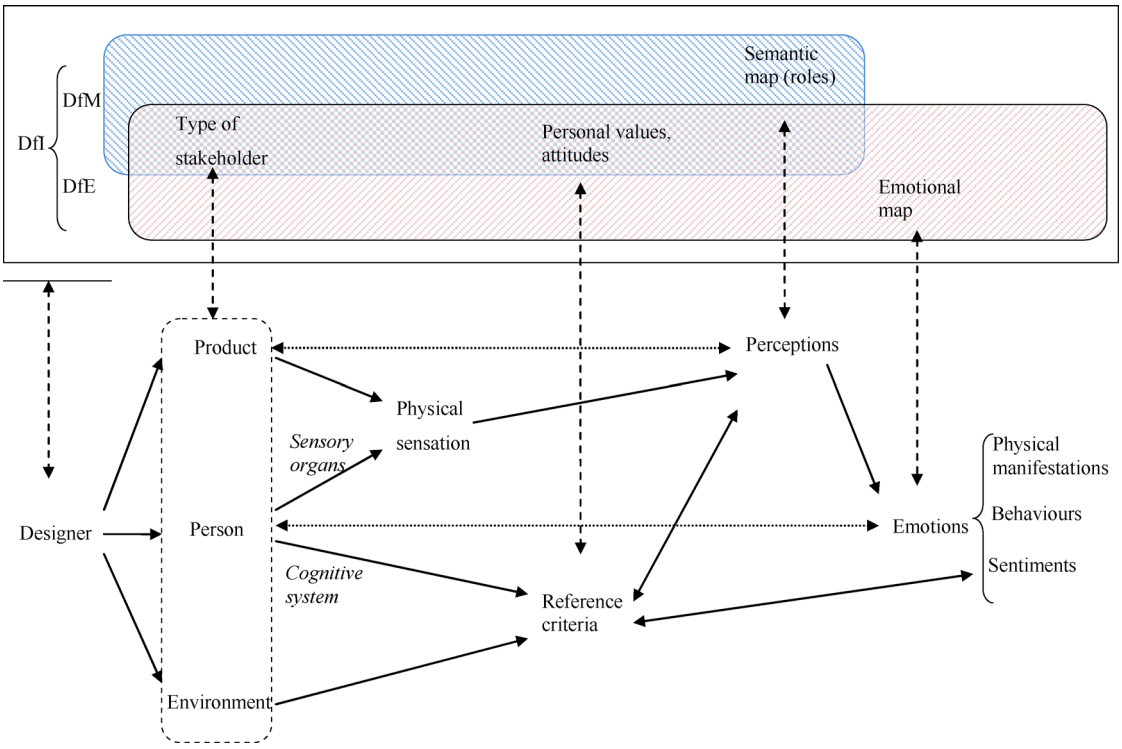

Figure 1: Conceptual framework about impressions in human-product interaction

The cognitive system acts evaluating and interpreting the physical sensations produced in the human-product interaction, with the support and influence of the reference criteria and the environment conditions. Thus, the cognitive system allocates features and meaning to the product, giving rise to the **perception** of its properties. Perceptions are therefore located within the field of subjectivity. The perception or attribution of meaning to the product may be expressed verbally and measured by means of semantics. The **semantic map** of the product is made up of a set of adjectives or descriptors that qualify it. For example, for a given ceramic tile product, potential semantic descriptors such as *minimalist*, *feminine*, or *cosy* could be considered. Hence, we associate the perception and the semantic map with what we call "**Design for meaning**" **(DFM)**.

Figure 2 shows our approach modelled with the technique IDEF0 [26], widely known and used in activity modelling. This standard makes it possible to represent activities and flows between them. Activities (in boxes) modify some inputs (arrows that come from the left), are influenced by controls (on the top of the box) and mechanisms (bottom), and some outputs are generated (arrows leaving boxes on the right-hand side).

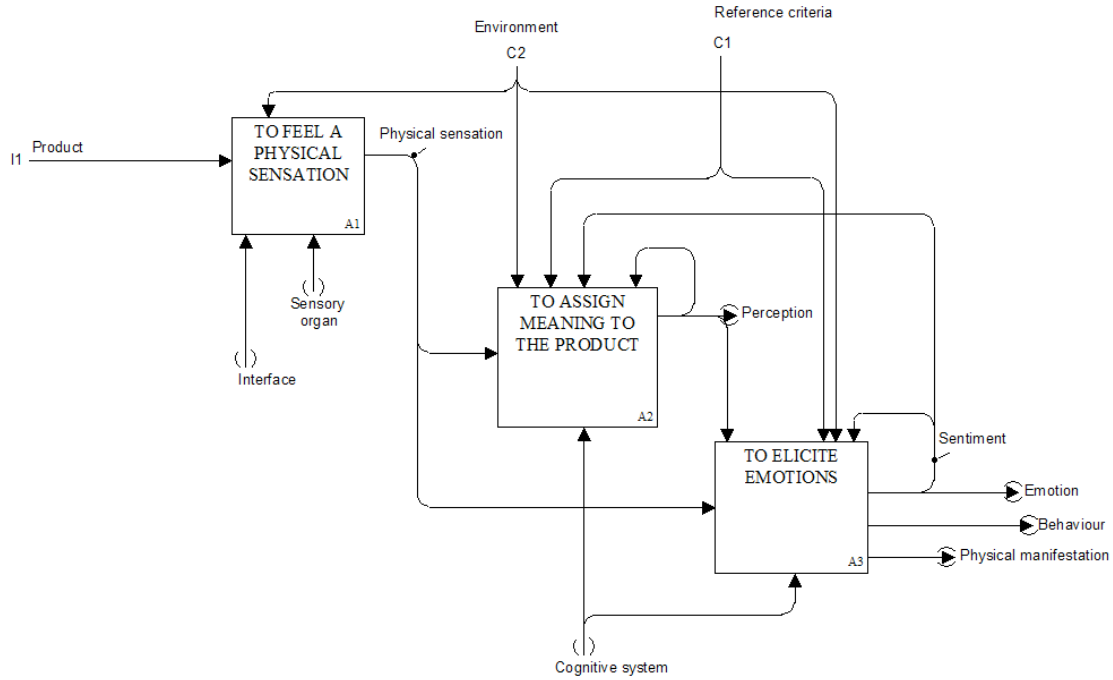

Figure 2: Activities and flows of the conceptual framework about impressions in human-product interaction

In our proposed model the term "perception" encompasses the different meanings which may be given to the product. Some of these descriptors will refer to the aesthetic communication produced by the appearance of the product (*pretty, provocative*). Others will refer to functional, ergonomic information (*Design for Usability*) obtained from the product appearance (this is linked with the concept of *affordances* [27]), or from a more intensive interaction with the product, such as touching it or using it (*comfortable, easy to clean, cosy*). A third level corresponds to the assignation of a symbolic value to the product, such as an *avant-garde character* or a *ridiculous product*. Therefore, in the descriptors of the semantic map it will be interesting to distinguish the different *roles* (using the terminology of Creusen and Schoormans [21]) that the product can communicate. Besides, the possible relation between these roles and emotions could also be studied.

Perceptions have a bidirectional relationship with the cognitive system, since they provide it with feedback, thus setting preferences, criteria and experiences for subsequent interactions. Besides, the cognitive system takes part in an appraisal about perceptions, again with the support of the reference criteria. **Emotions** are therefore generated, this time with the focus on the person. They are related to the **emotional map**, i.e. a set of adjectives referring to emotions experienced by the person that interacts with the product. Following on from the previous example of ceramic tile products, someone who imagines the decoration of a room with a specific model might feel *proud* or *surprised*. The emotional process consists then, of a subjective appraisal and of the subsequent **emotional response**, which may produce behaviours related to the assessment, in addition to physical manifestations of changes in physiological arousal (such as sweating, increased heart rate, facial expressions, etc.). In the case of products, experts in marketing often classify the behaviours in terms of approaching or avoiding the product [3]. For example, impressions produced from an interaction can trigger a behaviour that was not previously planned, like buying a product.

Other external aspects that can influence on the product decision (like price) are left out of consideration in this approach.

In this case, as with perceptions, the reference criteria are also fed back through the cognitive system, so that they will influence future experiences. The feedback occurs with the residual subjective emotion, a feeling called **sentiment** by some authors [28]. The emotional process configures the part of the design for the interaction that we call **Design for Emotion**. Thus, the cognitive system plays a crucial role, acting both in the generation of perceptions and emotions in a specific human-product interaction and in the storage of experiences and memories that will condition future interactions.

Table 1 lists the types of objective and subjective impressions taken into account in human-product interaction, and the field of the "Design for" family that they belong to.

Table 1: Types of impressions in the proposed conceptual framework

Type of impression	**Description**	**Field**	**Levels**	**Family**	
Physical sensation	Produced by sensory organs.	Objective			
Perception	Descriptors relating to the meaning given to the product (referring to its aesthetics, symbolism, functionality, usability, etc.)	Subjective	Aesthetic communication		Design for meaning, DFM
			Functional and ergonomic information, usability (from the appearance or use of the product)	*Design for usability, DFU*	
			Symbolic value or meaning		
Emotion	Descriptors referring to the person in his/her interaction with the product.	Subjective		*Design for emotion, DFE*	

4. CONCLUSIONS

This article proposes a conceptual framework that establishes the main elements participating in a human-product interaction, where different objective and subjective effects take place. In the subjective field, our proposed framework distinguishes between the assessment that a person makes about a product (referring to it) and the emotions that this product may cause in the person (referring to her/him). This distinction between descriptors applied to the product or the person, barely dealt with in the literature to date, allows us to study the semantic and emotional fields of the product separately, therefore making it

possible to distinguish new emerging families in design, such as Design for Meaning (DFM), or Design for Emotion (DFE).

On the other hand, models of human-product interaction usually describe it within a particular context, such as the purchase or the use of the product, and they do not consider the design process. Our proposal can be applied at any stage of the interaction, including the development stages. In addition, there is a need to distinguish among types of customers or other people who are involved and their concerns; proposals from the literature usually talk about the user or the customer, but these concepts do not always refer to the same person. Furthermore, other figures have an influence on the purchase decision by acting as a filter and selecting products or their characteristics, not necessarily in the purchase phase but in other phases of design and development process. This is the case of distributors, the purchasing staff of a construction company, or an architect or interior designer, for example.

The conceptual framework proposed here attempts to fill these gaps identified in previous models such as the Product Experience Framework [1], the Phenomena model of product emotion elicitation [2], or the Framework for consumer response to the visual domain in product design [3], taking from each one interesting aspects for the intended objectives. The main aim of this model is to obtain a theoretical basis for the application of design tools that take into account meanings and emotions elicited by the product (and the possible relations among them) in the different stages of the development of a new product. They should be applicable for different types of stakeholders throughout the phases of design and development.

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