IMPLEMENTATION AND ASSESSMENT OF THE TREND BOARDS METHOD IN A PRODUCT DESIGN ENGINEERING PROGRAM

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ABSTRACT

The User Experience, UX, with a product can be fundamental to design innovative products nowadays [1]. There is a large variety of methods that are meant to design this experience [2]. However, the methods that relate the UX with the aesthetic aspect most appropriate for the product are scarce and imprecise. Usually the designer makes this relation intuitively, after reading magazines and searching the web [3][4]. The Trend Boards Method, TBM, [5] was created to remedy this shortcoming. Its goal is to solve the problem of selecting and defining the products aesthetic attributes (form, color, texture, etc.)[3][5]. The result of applying the TBM is a board where, through structured imagery, the values, attributes and characteristics of a desired UX are conveyed. Despite the frequent use of the TBM, its evaluation in the academic context is rare. This paper evaluates the use of the TBM, and it was part of the graduation project by two product design-engineers. The aim was to design a plastic product for home organization. The methodology of the design process applied was complemented with the TBM to define the aesthetic attributes of the product. Five trend boards, TB, were obtained by using the TBM. Two TBs were selected as the most suitable to vehicle the desired UX. After this, the designers proceeded towards the product embodiment process using the selected TBs. A prototype of the product was constructed. Through a semantic differential test, a validation was carried out to determine if the product's potential users perceived the prototype's attributes conveyed on the two TBs. The results were completely coincident with the TBs. The relationship between the TBs and the product was also assessed qualitatively. First, the extent to which the image of the product was consistent with the imagery of the two TBs was determined by introducing the image of the prototype on them. Then, potential users were asked to define if they found any incoherent elements in the two TBs. This assessment revealed that there are some parts where the TBM is less structured. Finally, quantitative studies on the validity of TBM are required.

Keywords: Trend boards, product design, product design methods, design methods assessment, user experience.

1 INTRODUCTION

Nowadays the user's experience with the product can be fundamental to obtain innovative products [1][9]. Three interrelated components constitute the experience of the user with the product, UX: emotional ("it´s fun! "), semantics ("it´s modern") and aesthetical ("it´s beautiful") [1]. By definition this UX is subjective. Nevertheless, in the product design process the user requirements in terms of the desired experience with the product may not always be identified clearly [2]. It is also difficult to translate with precision these needs into concrete product attributes.

The program of Product Design Engineering, PDE, in the Universidad EAFIT located in Medellin, Colombia was created in 1999 as an answer to the growing necessity of increasing added value to products manufactured in the local industry (particularly in textile products, plastic products, furniture, and vehicles). This program trains its students in ethnographic methods, focus groups and other instruments of survey that allow them to determine the needs and requirements of the user in terms of the UX. However this determination occurs partially guided by the subjectivity of the student, which can be a disadvantage in the product design process. The problem with the methods mentioned above is that to capture the user requirements regarding the UX they are mainly based on verbal requirements [10]. In order to capture the requirements associated with the UX the students have been trained in the creation of collages since their first year in the program. Some of the boards most used by the students in their collages are the lifestyle, mood and theme boards [11]. Even though it is commonly used in

both the academic and the professional worlds, these have shown limitations in terms of the precision demanded for the process. These methods emphasize on verbal requirements, which do not favour a precise definition of which would be the concrete aesthetic attributes of the product (form, size, material, colour, texture) [12] associated to the desired UX. However, these boards facilitate the communication, inside and outside the design team, in terms of the UX desired. The need for a method that relates directly and structurally the UX to the concrete aesthetic attributes of the product became important in the PDE program.

Literature shows different methods for this process, for example: laddering [13]. Other more sophisticated methods allow users to represent their thoughts and feelings about a product in a nonverbal form, for example the Zaltman Metaphor Elicitation Technique, ZMET [14]. These techniques have not been applied in the program for reasons like: the lack of knowledge on them and the training of the students would make it relatively complex. Similarly, in Kansei Engineering, precise methods for this task exist, but the implementation would be difficult because it would demand special mathematical and statistical knowledge and it would require large population samples (500 or more users) [15].

It is common among undergraduate students to make their decisions about concrete aesthetic attributes based by intuition and subjectivity. This can result in a product that does not have the suitable aesthetic attributes to respond to the UX. Schifferstein and Hekkert [1] argue that the aesthetic elements of the product must be coherent with the experience sought to generate to the person. Ulrich and Eppinger [7] state that a necessary condition for the success of a product is to offer benefits that can be perceived by the client, which can derive from aesthetics [9].

The Trend Boards Method, TBM, is a structured approach that seeks to increase the accuracy in positioning product, in terms of aesthetic attributes specific to its use and in terms of the UX expected. The TBM has its origins in the fashion design industry and it has been developed and structured for over 10 years [5][6][16]. On the last decade, the TBM has been applied in the car industry in France [6]. The needs covered with the TBM led to the European project, Trends Project [6], where several steps of the method were formalized and automated. The result of applying the TBM is a board (composition of images) through which not only the desired aesthetic attributes of the product are conveyed, but also the emotional and semantic attributes (values) wished for the UX [4][5]. The TBM would then transmit the desired UX with the product. In addition to that, it is well known that, visual aids encourage creativity in design [4][16].

In spite of the extensive use of the TBM in the industry, the structured evaluations of its use and its possible applications in product design are rare. Responding to these needs, the implementation and evaluation of the method was put in to context on the PDE program at Universidad EAFIT. Two undergraduate students applied the TBM as a part of their graduation project. The students had only previously used mood, theme and lifestyle boards. On this project, the TBM was evaluated to design a plastic home organization device for the company IMUSA. IMUSA is a manufacturing and trading company of plastic products for home and businesses, with presence in over 10 countries from South America, Central America, North America and Europe. This product was also meant to complement the product portfolio of the company, aimed at a segment of average income users (around U$1500/month by family). The company supported the design team, and helped them in the taking of the important decisions during development.

2 METHOD

This section is divided in to two parts: the first presents the method used for the product design. The method followed was that of Ulrich and Eppinger [7] for the development of the concepts; this method was adapted to the particularities of the project. Additionally, functional analysis tools were used (Pahl et Beitz)[8] for the development of the practical functional elements and architecture of the product. In addition to that, perceptual maps were used to specify and analyse the attributes present in competing products and to have an insight about the positioning of the product towards them. This design process was complemented with the elaboration of TBs before generating the formal concepts of the product. Figure 1 shows the overall development process used. The second part of this section presents the method followed in the evaluation stage of the implementation of the TBM.
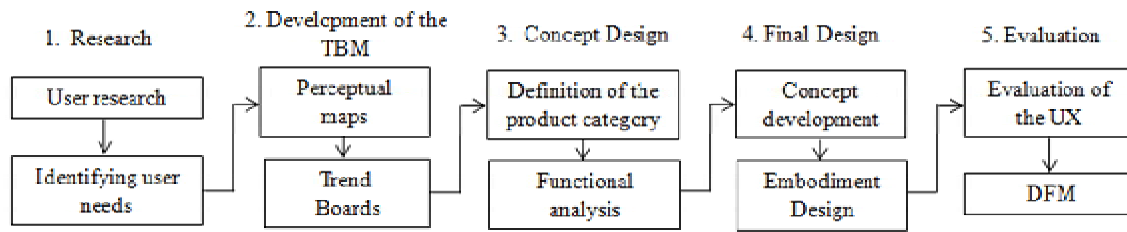
Figure 1. Process of product design

2.1 Product Design Method

In this study the design process is divided in two stages, which are explained below. First, visits to households of users were made to know in detail their needs. Ethnographic observations along with unstructured research interviews were conducted. They sought to identify specifications for these products. The results thrown by the visits showed that people already own a lot of products for home organization. Products they use in different places such as bedrooms, bathrooms and living rooms. However, they also showed how there is a lot of unused space in people's closet racks most of the time. Then a product perceptual map of home organizers, present in the international market, was developed [15][16][17]. Perceptual maps are meant to show how a group of people relatively perceive product. The images contained in the product maps were grouped, by similar characteristics and attributes perceived, in a plane divided by two perpendicular axes. The maps can be made quantitatively. However this approach is applied when the degree of precision required is high. This project had an interest in the relative perception of aesthetic attributes, but not the exact proportion of presence in the market, so the map was made qualitatively. This map identified which groups of products share certain attributes, which attributes are relatively rare in the offer and what gaps exist in the market. For an in depth explanation of the maps see [15]. Once the perceptual maps were ready, the company chose the strategic location in the perceptual map of the product that was to be designed. This location must submit the functional attributes, usability and UX what they wanted for the product. Then the TBM was implanted as it sought to increase the accuracy in positioning the product in terms of aesthetic attributes to be used in terms of the experience proposed to the user. Figure 2 shows the overall development of the TBM.
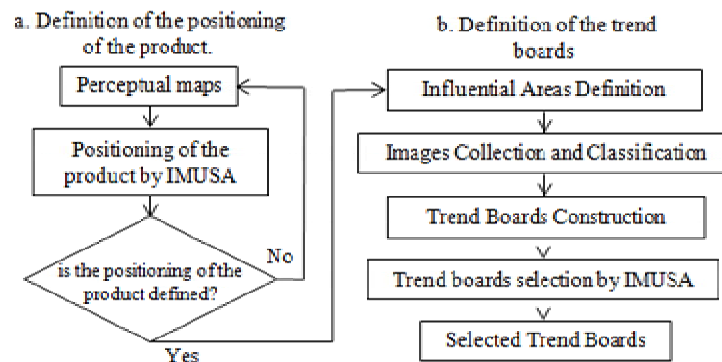

Figure 2. General development of the TBM

To build a trend board one must first establish what are the areas of influence of the home organizers. The areas of influence are defined as all the different sectors related to the product design segments. These sectors sum up shapes, colours, textures and material attributes in terms of the UX. Additionally these attributes may also relate to the usability and functionality of the product [16][17]. The French and Italian automobile design industry have influential sectors, which go in the following order [16]: automotive design, furniture, fashion, boats, planes, sport products, product design, film, nature, city, other means of transport, music, art, luxury goods, brands, animals, packaging and advertising, among others. All influential sectors must be aligned with both the company and product strategies [7][16].

For the development of the TBM the following steps were followed. First, the list of sectors was adapted to the desired product category, seeking to replace cars and other means of transportation for home products and organizational products. Then, magazines and websites, which might contain useful visual aids, were selected. The magazines must be one year old as maximum. Second,

identifying images in magazines and websites that can inspire the design process took place. Images should be selected until reaching a saturation point, where new images are found seem redundant towards those already selected. The TBM is composed of three types of images: high level of abstraction, including atmospheres and people, middle level, including products and low level, which mainly includes specific aesthetic attributes. Third, these images are classified according to criteria of similarity, which can be very broad. Usually the classification is done by aesthetic attributes (shapes, colours, textures, materials) and by some more abstract aesthetic attributes (i.e. organic forms) or in semantic and emotional aspects of the UX (for example, values such as ecological, or feelings as happiness). Fourth, each group of images must be purged, by separating the images that seem less consistent in the group. Then, only the most consistent and more informative ones are selected. A TB will be built from every group determined. Fifth, come up with a harmonic composition of the images. This composition is the central element of the board. From the selected images, samples of colours and textures are extracted; this will form a pallet that will be positioned along side the image composition. Sixth, key words that represent the main attributes of the images are placed on the board. Leaving for the end the conception of the board´s name, which should be inspirational for the board's role.

The 5 resulting TBs were presented to the company, so they could select the most consistent boards with the desired UX. In addition to that, the boards should be relatively consistent with the formal style of the company's products. Once chosen, the selected TB were used as a communication and inspirational element for the two students who work in the conceptualization and formalization of the product. Once the company chose the boards, the definition of the practical-functional specifications of the product was concluded. Once these were defined, a functional analysis was conducted to find alternative solutions for its functions (positioning the system in the closet, positioning the load, store charge, order load, unload, remove the system). After having defined the functional characteristics of the product, the formal aesthetic attributes of the product were defined, by using the information conveyed in the board. A prototype of the final chosen design was constructed and later validated by several tests.

2.2 Method of Evaluation of the Implementation of the TBs

To assess whether the TB helped generate the desired UX, a semantic differential test of the product´s prototype was conducted. A semantic differential test is a quantitative technique for obtaining a connotative meaning of an object, which examines the degree to which the semantic oppositions of the product (for example: pretty-ugly, ordinary-fine) are present in the product [18]. 25 attributes of the product were listed regarding the practical, usability and experience functions. 15 of these were consistent with the TB. Regarding how the opposites list in the semantic differential was made: The opposite terms show aspects of the product concerning its evaluation , its power and its activity [18], which must be present in the semantic differentials of the product. Below, the terms extracted from the board are in bold characters and they are beside their respective opposite term: aesthetic (**simple**-complex, **beautiful**-ugly, **colourful**-colourless), emotional (**happy**-sad, **positive**-negative, **fun**-boring) and semantic (**dynamic**-static, **modern**-classic, **good**-bad, **original**-common, **multiuse** – single use, **light**-dark, **light**-heavy, **comfortable**-uncomfortable, **useful**-useless). The remaining 10 attributes were not extracted from the TBs: active-passive, individual-family, same-different, male-female, adult-child, stable-unstable, neat- messy, strong- weak, bad-good, contemporary-classical. These oppositions were located on opposite ends of a scale, which was numbered between -3 and 3. 10 students of the PDE program were chosen according to target user profile. They were six men and four women, all Colombian, aged between 22 and 25 years old. These users had no prior knowledge of the project or what the TBM is all about. They were asked to state, to what extent the product was transmitting the element of the UX queried on the scale.

In addition to that, another evaluation was conducted; it consisted in showing the product and the TB to 8 PDE students. First they were told what a TB was. Then the prototype was showed to them so they could manipulate it. The use of the product, which is to optimize empty spaces on closets, was then explained to them. They were then asked in which of the 5 TB would they place the product. This way, the study tried to verify if the UX felt with the prototype was consistent or not with the one intended on the TB.

Finally, stating if the image of the product was aesthetically consistent with the images on the boards took place. For this, a photo taken at 30 degrees was placed in the TB, as shown in figure 3 right. 10 PDE students, with the same profile mentioned already, were gathered to determine if they saw an aesthetically incoherent element in the TB chosen. The product was then made part of the TB, as shown below, highlighted with a circle.

3 RESULTS

The user research showed that there are many product organizers available on the market. However, the shelf space of the closet is not fully exploited by these products because the contents of the shelves could not be stacked to a certain height. The product to be designed should be able to use the empty or unusable spaces on the shelves. Moreover, when studying the perceptual maps, the company defined two groups of products that had attributes that they identified to be important in home organization products. Finally, the functional analysis led to defining the architecture and construction elements of the product, especially a metal hook attachment that allowed the fixation of the product to the shelf.

In the application of the TBM, over 300 pictures of the three levels of abstraction were gathered. These images were obtained from over 50 magazines and 30 websites, related to the areas of influence. This led to 8 groups relatively coherent. By selecting the most consistent groups, 5 TBs were constructed. These were named, Happy Colours (with explicit attributes like joy, positive, fun, energy, family), Black and White (contrast, elegance, independence, stability, security), Dark Acid (mystery night, alter ego, pleasure, urban, eccentric), Space Futurism (versatile, able, transparent, order, resistant) and Retro-Chic (creative, sweet, dreams, delicate, quiet). Figure 3 shows two of them, Happy Colours and Black and White. The names of the two first TBs were given in English, but the remaining names of the TB were in Spanish. All the terms inside the TBs were also given in Spanish. The TB were presented to IMUSA so they could select those that best conveyed the UX intended: Happy Colours and Black and White. These TBs allowed having aesthetic elements characteristic of the IMUSA brand on the product design (for example, circle grids on the product's wall).

Figure 3. TBs Black and White and Happy Colors. In the Happy Colors TB is shown the designed product inside a circle

The TBs were then used in three creative sessions, which were meant to solve the product concepts and its formal aesthetic elements. Thirty ideas were created from which four were made into product concepts. Finally the authors, based on the functional criteria of usability and quality of the UX, selected the product shown in figure 4.
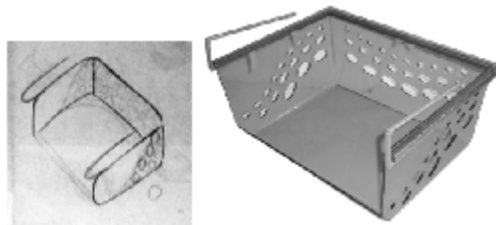

Figure 4. Original sketch of the product and prototype's photo

The semantic differential result of the attributes taken from the two TB, which is reported only in terms of positive, negative or neutral, was quite positive. However in the remaining oppositions (single-family, to child-adult, limited-unlimited) the responses were neutral. Nevertheless these neutral values met the product requirements, such as being directed at a person or family with a wide age range. The neutral values, from limited-unlimited, can be interpreted as the result of the product being large enough but not stackable. Only the stable-unstable opposition resulted as a negative expectation about the product. This may be due to the fact that the product was not installed under real conditions; it was done on a table instead. Yet, the value of instability was only -1, which in a larger group of

people could bring this perception closer to neutral. The result of evaluating the coherence between the TBs and the product by the user was completely coincident with the expectations, because the product was found to have a coherent design, although this was not systematically collected.

4   CONCLUSIONS

The TBs served as an inspiration in the design process. The TBs conveyed positive aesthetics that helped in generating the UX. From the TBs, the students could identify with relative ease which aesthetic attributes were most suitable for the product. The overall result of the application of TBM, fully complied the desired objective, by implementing such tool in the design process of a plastic product, it was possible to represent a trend in its UX. This trend specifies a relatively well-defined aesthetic design. The aesthetic elements allowed generating a UX through the formal elements applied to the product. These aesthetic elements could be used in IMUSA's future products in order to create a similar UX. However, the fact that the UX was judged from the observation and manipulation of the product on a table, making it important to replicate these experiments with the product loaded and installed on a shelf inside a closet. By using the TBM, a much more objective and structured decision-making, regarding the desired UX and aesthetics of a product, takes place. However, this evaluative work reveals points where the methodology is less structured and where the subjectivity of those who conceived the board can occur (for example, when deciding whether an image is inspiring or not) More research is needed to determine the general validity of the TBM: the construct validity (the TB show a real UX?), internal (to what extent the method will give similar results using similar conditions) and external (the extent one TB could convey a similar UX for different user groups?). More studies are needed in order to obtain the replication of results. Although the results are not conclusive, they sure look promising. Currently the PDE program is training its students in the TBM as of the second year of studies.

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