INSPIRATIONAL CATEGORIES FOR PRODUCT DESIGN: A STUDY WITHIN THE CONJOINT TRENDS ANALYSIS METHOD

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ABSTRACT

The product user experience (UX) is essential in the design of innovative products. There are numerous methods to define the form of a product that best conveys an UX. One of these methods is the Conjoint Trend Board method (CTA) that is easy to use and inexpensive. Nevertheless, in some of CTA's instructions the user can introduce biases. Therefore, this publication is part of a study that seeks to increase the robustness of the method, increasing the accuracy of their results. This research seeks to define the criteria for choosing an image as inspiring, when one applies the CTA. One experiment with 6 designers (novel and experienced) is proposed in order to identify what the inspiring and non-inspiring elements are. Finally, some criteria, for use when selecting images as inspiring within the CTA method, are proposed.

Keywords: Inspiration, Conjoint Trend Analysis method, product aesthetics, user experience, product embodiment, product appearance, styling methods

1 INTRODUCTION

In the process of product embodiment [1], the designer must define three aspects: functionality, referred to the proper fulfilment of the function for which it was designed, usability that relates to the ease of use of the product and experience (user experience with the product, UX) that has to do with the emotions an feelings (emotional experience), perceptual sensations, including the degree to which all our senses are satisfied (aesthetic-perceptual experience) and meanings generated by the product in the user (semantic experience) [2][3]. When a designer defines the first two in a product, the first determines the physical embodiment of it, while the later refers to define the style of the product, or styling Cf. [4]. According to Chan [5] a style is identified by recognizable features (forms) that appear in certain products created by one person, by a group of persons, across some geographical area or through a period of time. Cagan et al. [6] argue that the aesthetic appearance of a product must convey the emotions and values needed to generate a UX desired by the user. The aesthetic appearance of a product is defined as the set of values that the product should have in all variables (properties) that define its aesthetics [3]: psycho-physical, organizational (perceptual) and semantic; besides, these properties are affected by cultural and individual differences and by universal conditions attached to biological evolution [3]. It's usual that most of the elements of the aesthetic appearance are defined through intuition. However there are some methods to support that task. The aesthetic appearance of the product encompasses the definition of the product style: a specific product style is a specific value of the product's aesthetic appearance, belonging to a specific point in history.

Following Pahl et al. [1], 11 of the most recognized methods for defining the aesthetic appearance of a product were classified [7]: intuitive, analytical, evaluative and global (discursive). The intuitive methods (Loewy's sixth sense, seeing magazines, Internet browsing) are short and fast but imprecise; the analytical (Kansei engineering 3 and 4, Conjoint Trend Analysis Method [8]) are accurate, they respect the complexity of the UX but take a long time, are expensive and require specialized knowledge (statistics); the evaluative (laddering, semantic differential) are relatively accurate but require the development of several models or prototypes, and are a long and expensive process; and global (Repertory Grid Technique, moodboards, ZMET, Conjoint Trend Analysis method or CTA) are relatively accurate but some require specialized knowledge in psychology and can be expensive. Many of the methods are not well adapted to the SMEs context that generally has limited resources. The CTA method could be adapted well to this context, as it doesn't require specialized or professional

knowledge, or high costs. The CTA is a semi-structured method which is based on the externalization and formalization of the cognitive activities of the designers in the early stages of product design Cf.[9]. It seeks to increase the accuracy in the definition of the aesthetic attributes of the product and the UX for this [7]. It has its origins in the fashion industry and has been developed, structured and used for over 10 years in automotive design in France among others [10][11]. There would be two versions of the method: 1) from the manual collection of images from different sources and use of some image editing software [10]; 2) through the use of software that automates some of the steps. The latter is the result of the European project *Trends*, which was performed to formalize some instructions of the manual method, in order to produce an automated computer system [12]. The result of applying the CTA is a Trend Board, TB, a visual composition of images from different sources of inspiration, which represents trends in styling which convey a UX for the user (aesthetic, emotional and semantic attributes) Cf. [13][14]. These images should form an organized set to obtain harmony and legibility Cf. [15]. A TB can be used as an inspirational tool in product embodiment sessions and to communicate an UX and the style that the product would have. In order to construct the TBs, the following steps are performed: 1) Establish influence sectors of the designed product. These are any sectors of human or natural activity that are related to the kind of product to be designed in any way and to the natural or artificial objects that exist in the sector. Magazines and websites that have images related to these sectors must be collected. 2) Identify whether an image will be inspirational or not in the design process. Inspirational ones should be selected until reaching a saturation point where no more inspirational images are found. 3) Classify images according to aesthetical, semantic or emotional criteria. 4) Debug the groups of images separating those that seem less coherent with the criteria. 5) Select only the most coherent and richer groups of images. A TB will be constructed from those groups. 6) Propose a harmonic composition of the images. Samples of colours and textures must be extracted in order to compose a palette to be placed alongside the composition. 7) Terms of the main features of the UX conveyed through the TB are identified and placed on the TB. The TB's name must be defined as well. This name should be evocative so as to fulfil the inspiring function of the TB. The TBs allows stimulation, enhance work for designers, communicate a desired product UX, also offer a visual and sensory channel of inspiration [13].

Maya et al [7] evaluated the use of CTA in the design of a plastic organizer for the home, and found that the CTA is suitable for use in SMEs, but it has some unstructured instructions in which the subjectivity of users may interfere, e.g. to decide whether an image is inspiring or not. The CTA can be improved in many areas [7]. This publication is part of a study that aims to increase the robustness of the CTA, to better define its instructions and make its concepts more explicit. It seeks to make the method less sensitive to external changes (e.g. changes in the mood of the person performing the TBs). The final goal of the research is to consolidate the CTA to increase the accuracy of their results. According to Maya et al [7], one of the questions corresponding to the implementation and evaluation areas of the CTA is: which are the criteria for choosing an image as inspiring to develop a TB in the CTA context? It is important to define what inspires the designer to include inspiring elements in the composition of a TB and what are the requirements to pick up an inspiring element. Bouchard et al (2009) say that "there is little understanding of the requirements for information retrieval in the context of a creative process such as industrial design" [16]. This paper presents the research that seeks to answer the previous question, to avoid the subjectivity of those doing the TB alter the results of this, and focuses on the process of inspiration for designers when they're gathering material concerning the product to be designed.

In everyday life, inspiration is defined as "*The process of being mentally stimulated to do or feel something, especially to do something creative*" [17]. Especially in design, finding inspiration and capturing information, is a frequent and continuous part of the job of designers to increase their creativity [18], this one is characterized by Kostler as ''*the sudden interlocking of two previously unrelated skills, or matrices of thought*'' [19]. For this, the designers look to different sources of inspiration, a term used for all conscious applications of previous designs, other objects, images, art, literature, photography, objects and natural phenomena and everyday life, from which elements of different types to apply in a new product can be obtained Cf. [20]. So, in this article we define inspiration for a designer as the process by which they gather information from various sources to create new connections and apply them in the creative process of product design Cf. [20][21][17][19]. The structure of the inspiration process seems complex and unstructured Cf. [22][23][24]. The remainder of the paper is organized as follows: Section 2 describes the experiment used to answer the

research question, Section 3 presents the results obtained in that experiment and Sections 4 and 5 present the discussion and conclusions respectively.

2   METHODOLOGY

In order to answer the research question, an experiment was conducted which aims to identify the criteria for defining an image as inspiring. The following paragraphs demonstrate the systematical development of different alternatives for the experiment, the selection, and the final development. The results of this experiment will contribute to establish the characteristics and requirement of an inspiring image. There were two alternatives proposed: a) Participants (i.e. product designers) are asked to browse through a selected design magazine, and single out the inspiring images for a set of simulated design situations. The identification of the conditions for selecting an image as inspiring will be carried out through the use of a protocol analysis method; the process will be recorded. This method allows the verbalization of the participant's thoughts while executing a task, and thus preserving the sequence and the content of these Cf. [25]; b) Select and organize numerous groups of images, including products, natural objects and people performing actions, on sheets. Have participants select one of the images considered inspiring for a specific simulated design situation. During this activity the protocol analysis method will be conserved. The first proposal was selected due to the data richness that the magazine contains for the objective of the experiment. First, the images are numerated; consequently a simulated product design task is proposed. Each participant is asked to leaf through the magazine and determine for each image: is this image inspiring for the product design proposed in the task? Then, the individual images that are inspiring for a selected product design are classified. This activity is repeated until the end of the magazine. This experiment is carried out by two groups of product designers: experienced and novice [26]. In the experiment, one exemplar of the Italian magazine Domus (February 2012, latest volume available till the completion date of the activity) was used. Two groups were chosen as samples: Group a) An industrial designer (design chief) and two product design engineers (design manager 1 and 2), who were in charge of product design in a home appliances company. All but one of the design managers knew about the CTA, the people within this group had more than 4 years of experience. b) Three 3rd semester students of the Product Design Engineering program at EAFIT University (Colombia) who were taking the Product Aesthetics course in which CTA is taught. These students were the novice designers of the group. To analyse the transcriptions of the protocols, the use of the thematic analysis [27] is proposed. The thematic analysis initially rises to read all the information until one becomes familiar with the data; second, generate initial codes of interest features in the data; third, search for potential themes for the analysis; fourth, review the themes to ensure these work in relation to the codes extracts and the entire data set, generating a thematic map of the analysis, and finally define and name the themes for the analysis.

3   RESULTS AND DISCUSSION

The results from the experiment were 6 transcripts of talk-aloud protocols, 3 from the professional designers (140 minutes, 43 pages) and 3 from the students (101 minutes, 22 pages). Each participant from both groups had their transcripts analyzed, and then a comparison was made between the results of the two to obtain information about the standards for selecting a picture as inspirational. In this study, the analysis of the information began with dividing the quotes that had more than 5 lines in small parts, looking for phrases with sense, between followed or suspended points. These parts were called ideas. Then, a code was assigned to each idea in the transcription. This was done to have a control of the amount of quotes and ideas and for fast identification of the information. Each protocol was read and some notes were made in front of each idea about different topics. Then some recurring patterns in all transcripts were identified and coded initially. The annotations were grouped into initial codes and were reviewed to determine if these belonged to each code or needed relocation. The definitions and relevance of the initial codes were reviewed and modified. With the initial codes, a preliminary thematic map was created, where the initial codes may form main themes, sub-themes or may be discarded. The map (see figure 1) shows the relation between codes, themes and different levels of themes [27]. The themes should be reviewed to ensure if these form a coherent pattern between them, also a review of the validity of each theme with the entire data set and if the preliminary thematic map accurately reflects the meaning evident in the data set as a whole has to be done too [27]. With these reviews a satisfactory thematic map resulted. The following were defined as final themes and sub-themes of the thematic map:

- Product, brand and company strategy: it refers to the strategies defined by a company to position itself, its brands and/or products on the market. The sub-themes are: context (of a particular product), user and other products or objects (e.g. food, electrical appliances).
- Product design strategy: refers to strategies to design the product. The sub-themes are: 1) Product aspects that fill peoples needs (user needs with a product [2]): functionality, usability and experience (UX); the later has the follow sub-themes: emotional, semantic and aesthetic (components of the UX). 2) Design process aspects: related to the stages of the product design process [28]: planning, concept development, system-level design, detail design, testing and refinement and production ramp-up.

The strategies (product, brand and company and product design) where defined as themes because in the analysis it was found that gathering images during the inspirational process, could affect the design process because the images might suggest to the designer how to position the product, the brand or the company in the market (product, brand and company strategy), or how to design the product (e.g. modularity, use bright colours – design strategy).
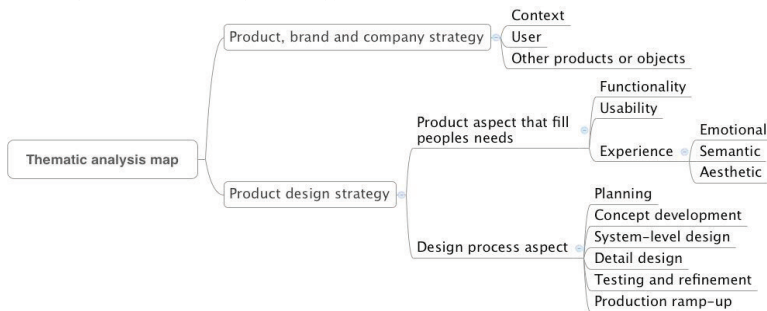

Figure 1. Thematic analysis map

In each category, participants mentioned elements that they considered inspiring and non-inspiring of the images seen, and a count of elements by category and type was conducted (inspired or non-inspiring) for each group of participants. The experienced designers mentioned 222 inspirational aspects and the novice 77 respectively. The chief designer mentioned these aspects the most. Therefore, presumably the experimented designers are able to take advantage from different sources of inspiration or sectors of influence, near (e.g. other electric home appliances) or distant (e.g. nature and animal) from the product to be designed, to adopt and integrate different points of view from the suggested sources Cf. [29], possibly due to their experience and creativity: *"No, it is that all of them seem inspiring to me ... ",* said the design chief, referring to the images. Whereas novices consider aspects closer the object (e.g. food) or low level aspects that can be included in the new design (e.g. colours, forms, textures, etc.): *"The 45, also inspires me, because due to the colours, the greens that are like freshness, could be used for the part where it would be dispensed, we say to green- blue"* (from protocol of student 2). Also the experienced designers cited more aspects that belong to product, brand and company strategies than the novice. The first refers to aspects such as eco design, BoP (Bottom of the Pyramid), user lifestyle, market trends, etc. that the latter do not take into account, also mentioned aspects of the context (e.g. where the refrigerator could be located) and user (e.g. user lifestyle, user needs) that were mentioned to a great extent by the design chief and design manager. The students mentioned aspects like low cost product, efficiency, minimalism, etc., only mentioned two aspects of context and didn't mention aspects related to market segment. This could be due to the mental process of linking the content of an image with the product, brand or company strategy could require a high-level education, knowledge and experience, and related to the user and context elements, the designers may consider that some images allowed constructing an imaginary context or lifestyle of a certain user (imaginary: existing only in the imagination [17]); although the novices mentioned elements like the identification of the user and context where the refrigerator could be located, that show that although they are in the beginning of their formation process, they keep in mind the user and his context. They didn't mention non-inspiring elements in this theme.

Relating to the product design strategy, novices didn't mention any element about the design process aspects; designers mentioned 4. So this kind of aspect may not be the most inspiring for them. The products aspects that fill peoples needs, are the most mentioned in both groups, designers mentioned

115 and novices 44. In the functionality and in the usability aspects, the designers mentioned aspects that suggest a new way of operation of the refrigerator and dynamic system of food stored. The novices mentioned aspects of the functionality that currently exist in the refrigerator: store water and ice, and mentioned only one aspect that has to do with the order of the food in the fridge. The students didn't mention any emotional aspects; the designers mentioned 4 elements that where related to the objects or people in the image: "cool" or "great". On the semantic, both groups agreed in mentioning cleanliness, sobriety and tranquillity (inspiring elements), and disorder (chaos) and darkness (non-inspiring elements). This could mean that these are elements that may have the same meaning for all the participants and can be applied (inspiring) and should be avoid (non-inspiring) in the design of a refrigerator. In the two groups the most mentioned aspects were the aesthetics. Here are included colours, materials, forms and textures (aesthetic-perceptual elements). Then, in the context of this experiment, that seeks to gather inspiring images for the design of a electric home appliance, the designers, without concerning their level of experience are inspired mainly by images which stimulate their senses, especially the vision, for example organic forms, accents and combination of materials. With respect to the shapes, designers consider that some aspects of the forms seen in the images are inspiring: symmetry and straight lines. If these elements are included in the design of a new refrigerator, a different form could be obtained. Regarding non-inspiring element, for the students the planes, the triangle and traditional forms in refrigerators are non-inspiring. Are still very present the images that enable them to generate new forms; different forms are more inspiring for both groups. There was another theme that the two groups of participants mentioned but is not on the map because it has to do with the content or the characteristics of the images. In the experimented group, this subject was mentioned more, mentioning similar inspiring images of good quality, of a size in which the objects or people present can be identified, that represents attributes (e.g. cleanliness, natural) and that shows products on flat colour background and detailed views of products, nature, architecture and landscapes. Also, similar non inspiring abstract images were mentioned, small images where the objects or the people are not identifiable and those that have text, aside from the images full of small details, which were not selected Cf. [30]. Then, it seems that the quality as far as the resolution of the image (a low resolution was considered unsuitable) and the size of the image could be important aspects at the time of deciding if an image is inspiring or not. In addition, taking into consideration the definition of inspiration and the use of inspiration-sources, if the designer has all the information and the tools necessary to initiate the design, they could access the inspiration "more easily". The designer is in a "flow" state, in which she feels happy and calm, immersed in the activity that is developing, in a state of intrinsic motivation characterized by a feeling of commitment and satisfaction Cf. [31]. The designer creates the conditions so that this flow occurs when consulting diverse sources of inspiration.

4   CONCLUSIONS

The images that inspire the designers during the inspirational process may suggest them how to position the company, the brand or the product in the market and define how to design a product (shapes, materials, textures, colours). In this way, if an image suggests a designer a strategy mentioned above, the image could be inspiring. However, might appear some images that are inconsistent with the product sector to design (e.g. for an electrical appliances an image showing school suppliers) or are not familiar to the designer. If such images appear but it suggests to him a strategy, the images could be inspiring. In experienced designers the inspiration process encompasses the totality of the structure proposed in figure 1. In novel designers the information process covers mostly the aspects that fulfil peoples' needs. Images should be extracted until the designer achieves the flow state. Other criteria for the selection of inspiring images are aesthetic-perceptual (low level like colour, forms, texture, materials and finishes), semantic (high level like simplicity, cleaning, freshness, naturalness, etc.), new ways of functioning (like different ways of cooling and illuminate), images that show people considered being the objective user and the context of them (the space and the objects that they could use). Regarding the requirements of images, large images should be selected, of more than average letter size, and with good quality, where not too many objects or people are simultaneously present, also images without text and images that show unfamiliar objects should be use. Then, inspiring elements as functional, semantic, etc., allow new and different ways for integrating functions, meanings, contexts, forms, etc. to the design of a new product. Finally, it could be said that for experienced and novel designers almost all the information have a strategic value concerning the direction of the future product design conceptualization process. Consequently, the inspiration process is a metacognitive ability, rather than being only a simple pick-up images process. "Broadly defined,

metacognition is any knowledge or cognitive process that refers to, monitors, or controls any aspect of cognition." [32].

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