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HOLISTIC PRODUCT DESIGN FOR THE FUR FABRIC INDUSTRY: A FLOOR LAMP DESIGN APROACH ACCORDING TO BRAND PRINCIPLES

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Abstract: *Design thinking and design procedure are two essential approaches to the holistic design strategy. Design thinking is focused on user-centered innovation and creative problem-solving, on the other hand, the design process strategy involves the technical aspects of designing a product. The combination of the aforementioned design approaches leads to successful product design outcomes of products that are user-centered, aesthetically pleasing, functional, and sustainable. In recent years, there has been a great interest in the use of natural organic materials to ensure sustainability in product design, as they have a unique aesthetic appeal. Furthermore, the semiology of natural organic materials is a crucial aspect of the branding identity of the final products. The proposed paper is exploring a user-centered design approach (e.g., empathy maps, digital sketches, CAD models, and physical prototypes with a focus on selecting the appropriate materials). Finally, this design strategy highlights the importance of collaboration between designers, engineers, and manufacturers throughout the design process.*
Keywords: *Holistic Product Design, Design Thinking, Natural Organic Fabrics, CAD, Prototyping.*

1. INTRODUCTION

A holistic product design approach can offer significant emphasis on a variety of issues and considerable advantages to the industry [1]. The brand-based direction can drastically increase the product value perceived when its acquisition is completed. According to the branded product identity strategy the holistic approach of product design increase competitiveness through marketing and promotional tools [2]. Furthermore, the user is able not only to receive the satisfaction offered but at the same time to build a specific brand identity for the product. According to Efer (2017) the unique role of the product branding is actually related to the values, services, functions, and aesthetic design attributes of the final product [3]. The aforementioned approach offers the advantage of bringing the customer back to enjoy the whole experience again in the future, thus a special connection is created [4, 5, 6].

Several researchers have used modern digital tools (i.e., CAD-based free hand tools, 3D CAD modelling softwares, renders, etc.) to differentiate the design process traditionally followed and by offering a unique experience to their users, build a special bond between the users and the products [7]. In those cases, prototyping and manufacturing using 3D printing proved essential [8].

2. LITERATURE SURVEY

Spahiu et al. (2020) designed a series of fashion-related products aiming to emphasize the use of 3D printing technology and its introduction as a mainstream manufacturing process. The proposed products can be related to the material used when 3D printed, and the customers realize that a newly proposed approach is applied. Fashion-related accessories with shoe design, and clothing design and manufacturing are presented, while families of products are available [9].

Manavis et al. (2020) applied design thinking principles to design innovative wearable products

and their success is based on the holistic approach followed, while the customers were heavily involved in all the steps of the product development period [10]. Manavis et al. (2019) used a nature-inspired approach to design a series of in-store displays. This approach led to a unique approach that transferred highly innovative concepts to be designed with the use of modern CAD (Computer Aided Design) and rendering pieces of software [11]. The term *natural materials* is used several issues are presented. The first question that should be answered is: what does this term *natural materials* mean? Apart from the basic material categories (i.e., metal, wood, stone) that easily relate to manufacturing and product design, other fabric materials can be key players when designing products (i.e., silk, wool, leather). The second question is: how do users perceive these materials? Vision and feeling are the two basic sensations that allow them to have a spatial and more intimate perception of the texture. Regarding vision, the most important element is light, which influences color and shape perception [12, 13, 14]. The present paper aims to propose a holistic product design approach based on both design thinking and design processing. A series of methodological and technological tools are used and presented. That influences the user towards creating a unique experience and creates a great deal of attachment to the product and the exceptional materials used.

3. METHODOLOGY AND APPLICATION

Design methodologies are used either to spark creativity or to structure the design procedures to deliver the best possible outcome. At the same time, they help designers to stay focused, control the design target and intervene with the necessary iterations between the steps. These methodologies are not always following a linear way, in the sense that the designer could, or better should, return to previous steps and re-evaluate the work as it proceeds and correct any mistakes if necessary. As the project evolves, the designer is referred to as the main stakeholder. At the same time, these methodologies find great application also on design teams.

3.1. Methodology framework

The methodology consisted of four steps. The first step included the application of mind-map and mood board. Two powerful tools that allowed to transform thoughts into words and shapes. The second step was based on a design protocol specifically built for this purpose. It is a document that summarized the design work. Step three was about the design process, and it consisted of four stages and is the most crucial step because it delivered the final design solution. The fourth step was based on digitalization; thus Computer-Aided Design and photorealistic rendering were used for completing the 3D models required. The geometry and dimensions were evaluated, via 3D rendering and prototyping with the use of proper materials and in a realistic environment.

3.2. Creativity tools

The mind-map was the first tool to be used as it helped to organize the thoughts using words and images. It helped to turn the concepts into optical communication. At the same time, any word that was selected aiming to generate more areas for exploration was encouraged. Every feeling or thought was recorded, without questioning its relevance at that stage. Finally, the words that related the most to the design assignment were separated and colored. Figure 1 depicts the mind-map used, whereas the main directions followed are presented in blue and the selection of the relevant words are marked in purple.

The subject - research question- was positioned at the center of the tool and was kept as generic as possible, in order not to narrow the thinking from the start. Around it, the areas that needed to be explored were placed. These areas were set at this stage and they could be altered if needed. On the mood board that follows (Figure 2), the previously selected words were used and translated into images. For this reason, they included stock images or vector images that best described the words transferred from the mind-map.

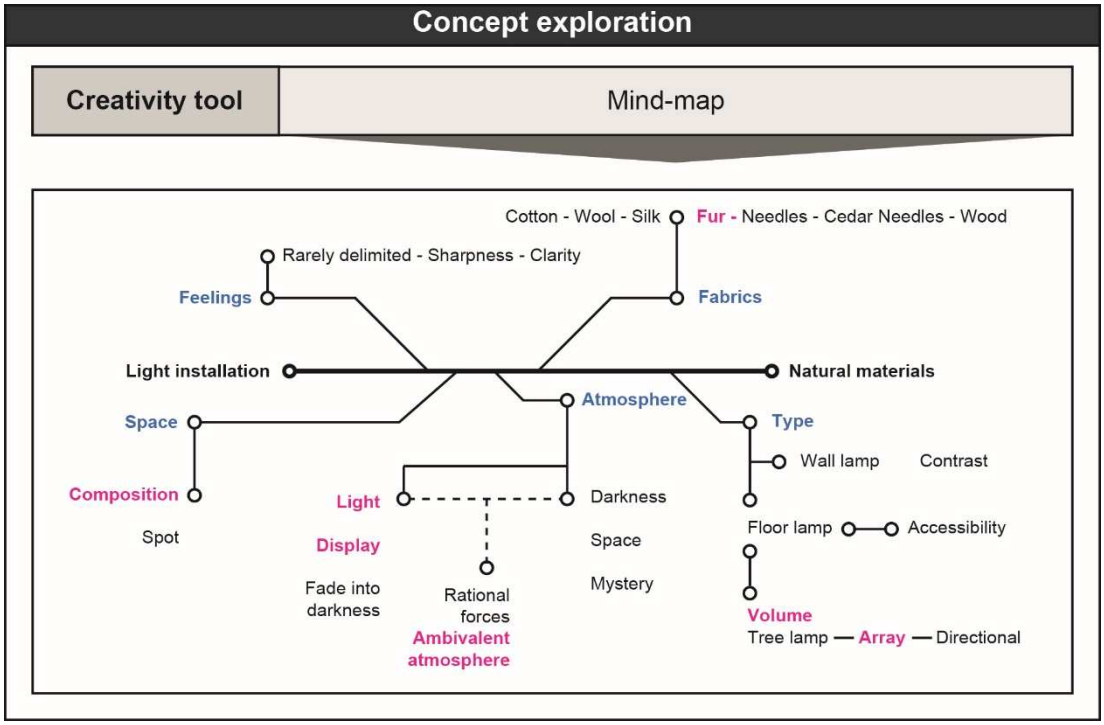

Fig.1. Mind-map transforms abstract thoughts into specific concept

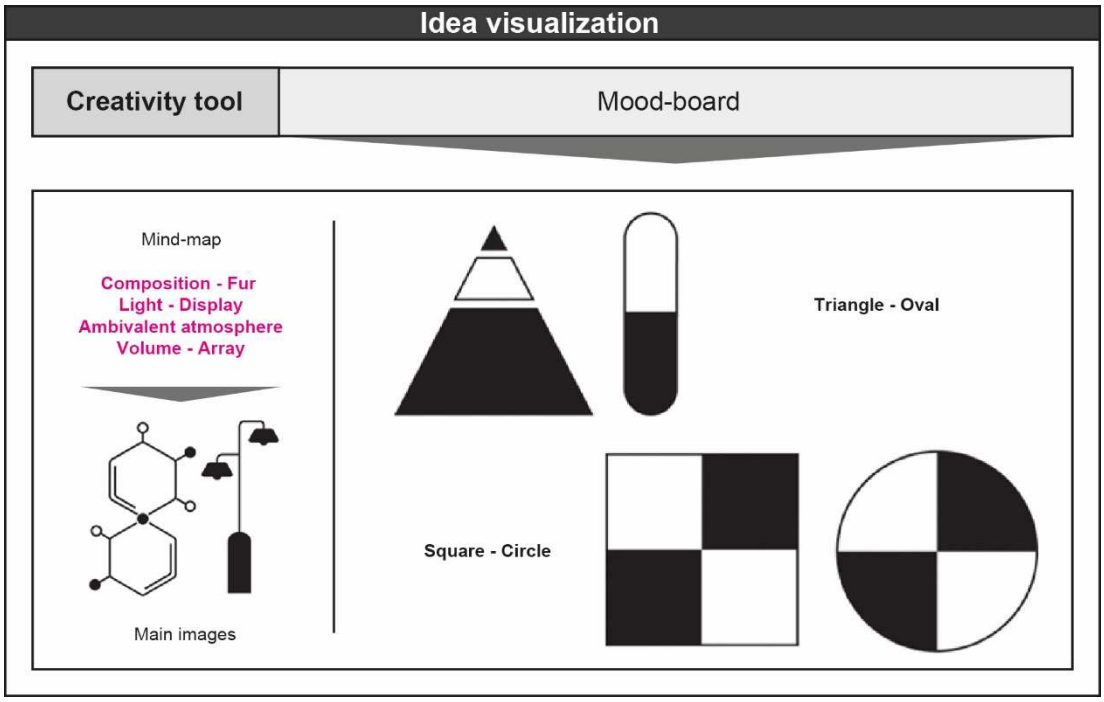

Fig.2. Mood board provides images and shapes

3.3. Procedural design document

The procedural design document is a technical roadmap in product design. It was used as a summary of the design targets, the requirements, the restrictions, and the stakeholder's involvement (Figure 3). It also contained other useful information and it was a guide to be consulted in every step of the process. It secured that the design procedure remained within the requirements, and the result met the requirements. There was no

specific template for the design protocol, as it could be adapted to every design project and its demands. The design protocol should be revised often, and extra info can be added as they become available during product development. It was an excellent way to communicate pieces of information and design procedures with all the stakeholders.

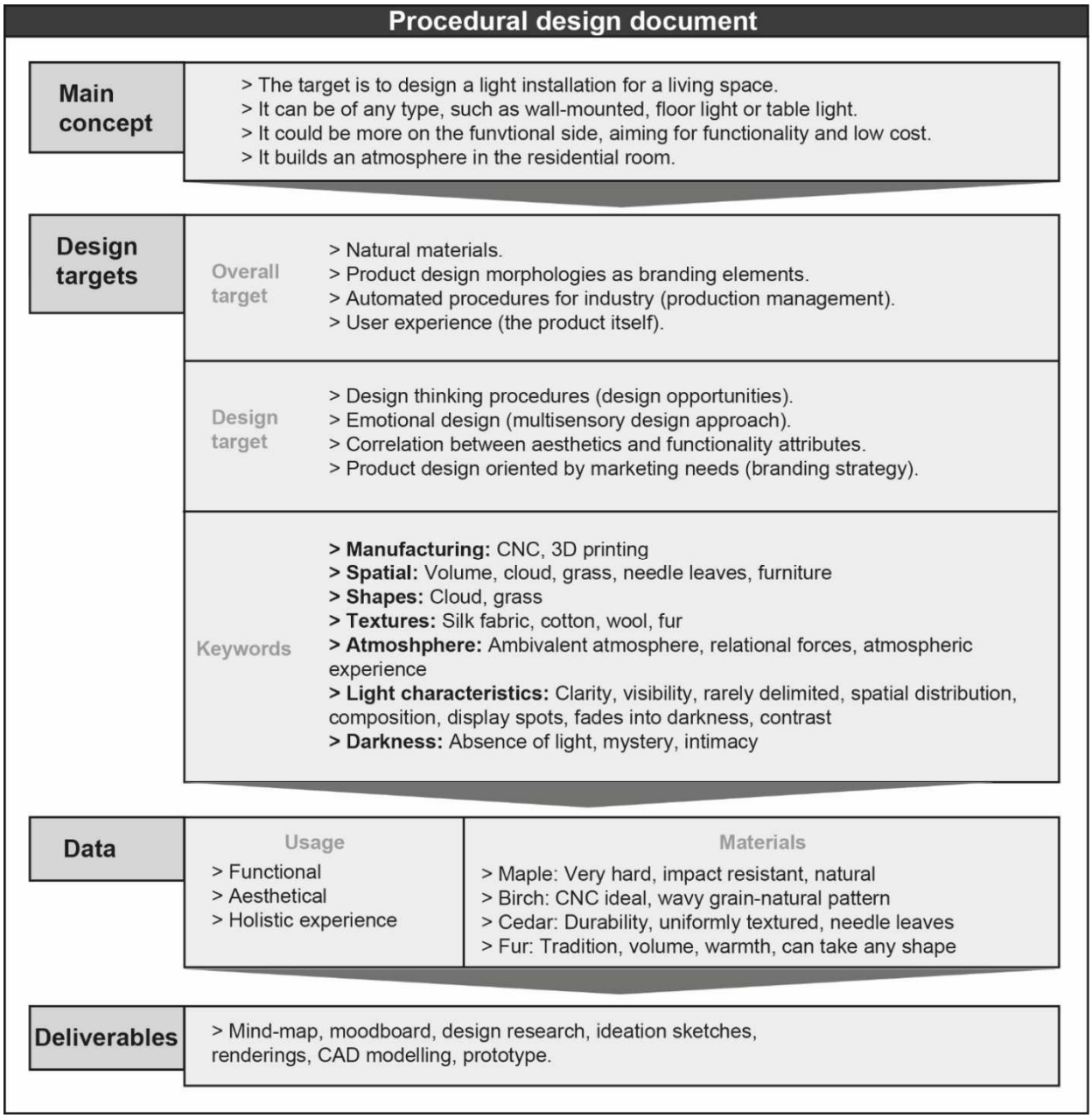

Fig.3. Procedural design document

3.4. Design procedure

It was the main design phase, and it consisted of four steps: procedural sketches, ideation, final solution, and color rendering. In this phase, the sketching work could be done by using physical means such as paper, pens, ink, and markers, or by digitally using a pen display and appropriate software. For our purpose, we choose the digital path and we used a Wacom™ Cintiq 22” and Autodesk Sketchbook Pro™.

3.4.1. Procedural sketches

This first stage was more of an information collection period and not a sketching procedure application as the title suggests. The input was collected from the previous steps, establishing the foundation for the ideation to follow.

This stage was more a mixture of design directions i.e., what to take into consideration, a description of the shapes, the users, and the experience to be met (Figure 4).

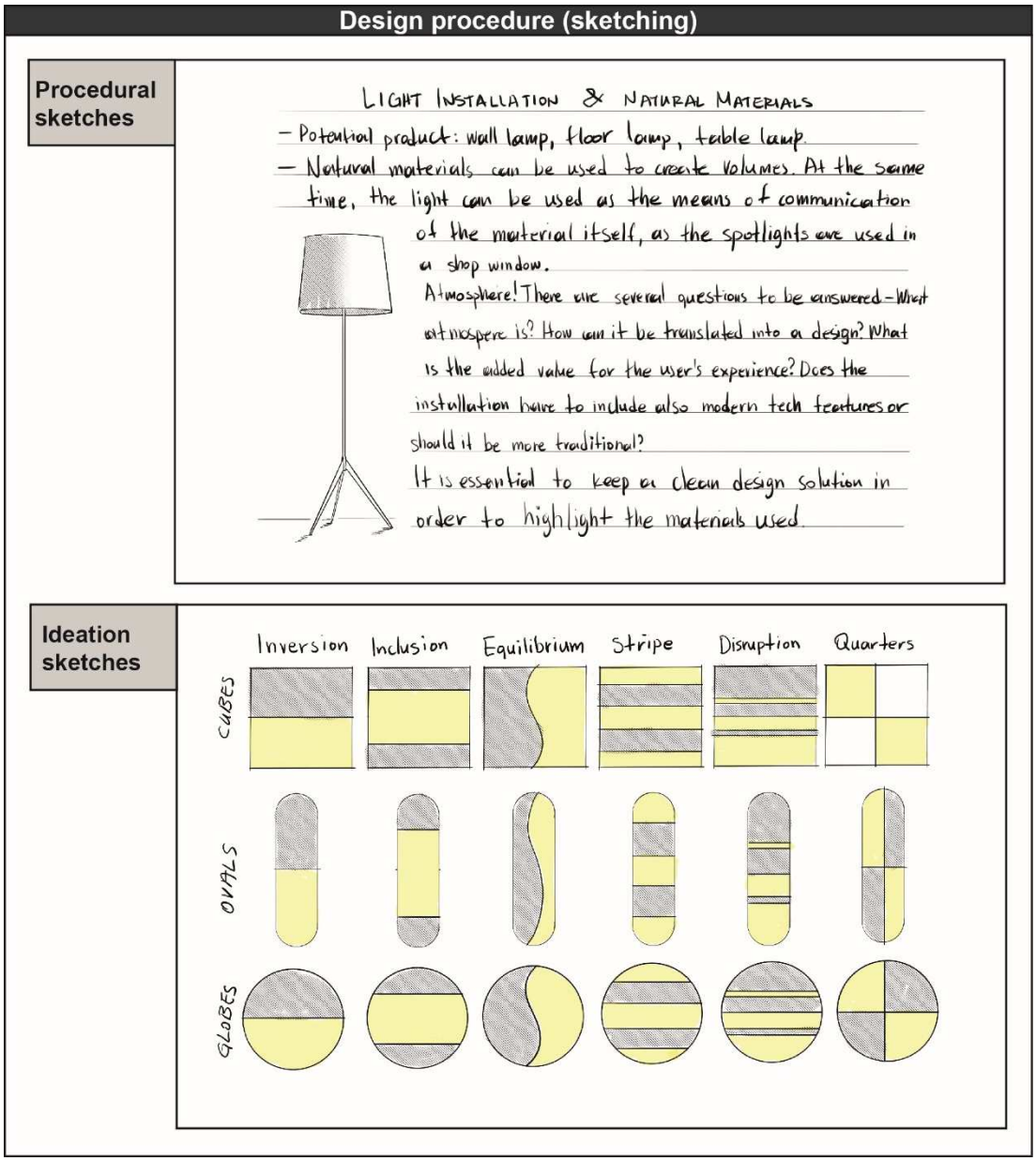

Fig.4. Procedural (main concept) and ideation sketches (form exploration)

3.4.2. Ideation

The ideation was the brainstorming part of the procedure, as in this stage all efforts were put into sketching. The result was to generate as many as possible ideas for the product and discover potential design opportunities that led to the final solution. As Figure 4 demonstrates, ideation contained both abstract sketches and more

elaborate ones, while Figure 5 includes colors and explanations. The shapes and forms exploration ended up with descriptions of the product functionality and creativity.

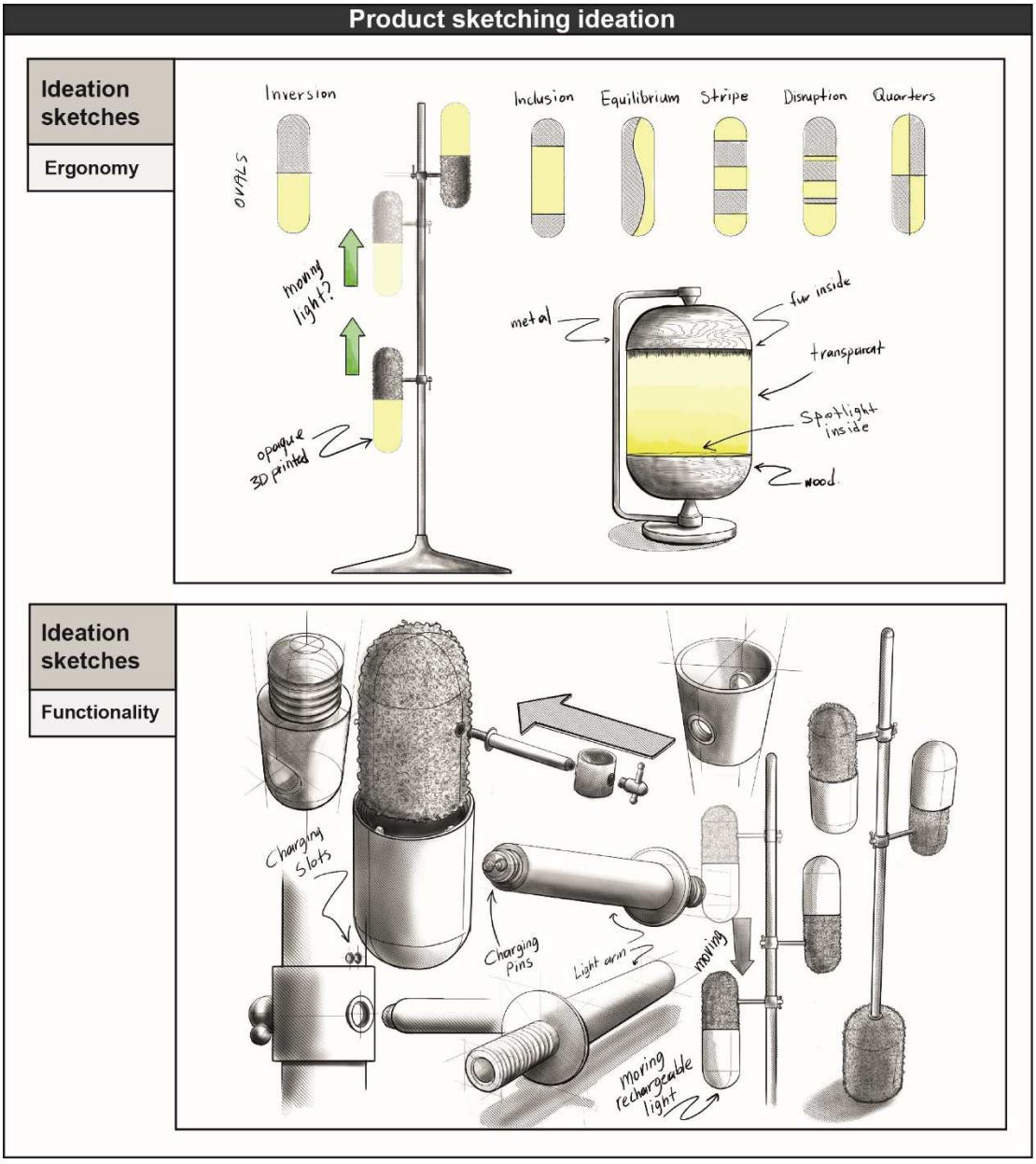

Fig.5. Product sketching ideation

3.4.3. Final concept adaptation

At this stage, the proposed design got a more tangible form and it described how it works, and what the details were.

It was an accurate way that the stakeholders could easily and without doubt understand the output (**Figure 6).**

3.4.4. Color rendering of sketches

This last stage of the sketching procedure aimed in giving a more realistic view of the product to communicate the idea to the stakeholders. For that purpose, textures, colors, and shadows were used aiming to create a product as close to reality as possible (**Figure 6**).

It was very important to achieve great optical communication because this was the moment where the first decision to continue was taken so sketch rendering was used for applying colors and textures and making the design proposal more realistic.

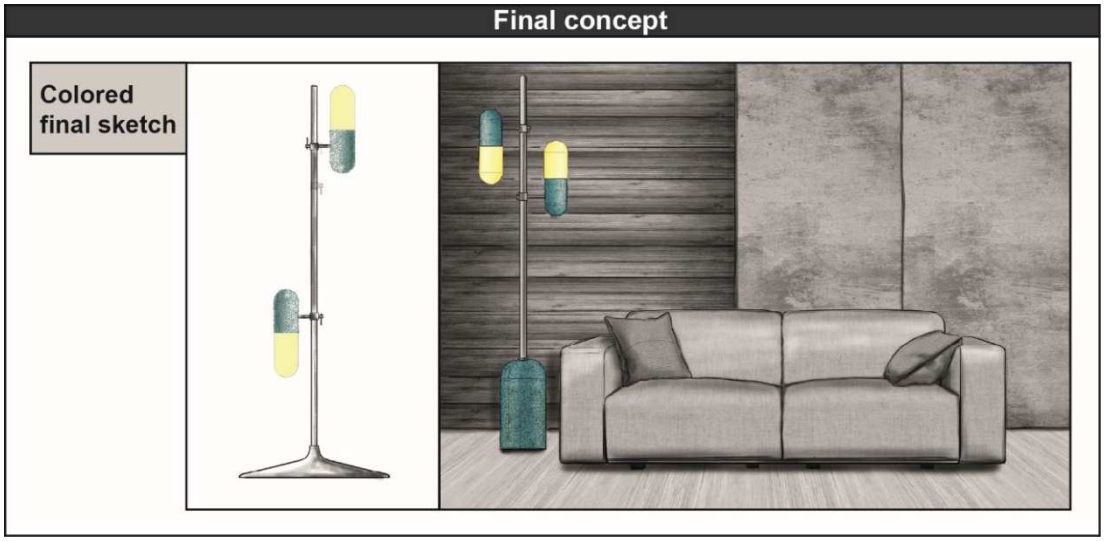

Fig.6. Final solution (colored rendering sketches)

3.5. CAD modeling and prototyping

After the final solution was approved, CAD tools were used to design the model of the product in 3D and provide its exact geometry together with its dimensions. For that purpose, Autodesk Inventor™ was used. Every part of the product was designed separately, and all the parts were assembled into the final product. Parametric design principles were used to control all the possible design changes. This was true at both the parts and assembly levels and increased the design flexibility offered by the use of advanced CAD systems. At the same time, a family of products can be created thus making the whole procedure more cost effective and efficient.

Having the latest CAD models completed, Luxion™ Keyshot™ piece of software addressed the need for a high-quality render facility. Not only the metallic, plastic, and wooden parts were defined very well but the parts including a great deal of fur material were extremely well presented. At this stage, a series of difficulties faced, when rendering the fur-based geometries, should be stressed. The challenge was great because the use of this material was from the beginning one of the key aspects of building the brand-based approach. Figure 7 depicts a realistic image of the designed lamp inside its environment of use. All the material properties were introduced together with the lighting properties and provided a very realistic view of the final lamp design, including the fur material properties as well.

The final stage aimed in providing a 1:1 scaled prototype for an early evaluation of the lamp. The prototyping helped examine the geometry, the analogy of the dimensions, the ergonomics, and the functionality. It was one of the most important parts as this was the first test of the difficulties that might occur during production. Creating a series of prototypes is very common, as many times corrections and changes are needed. That included iterations and changes within the design processes followed, from the start to the end. In addition, it was important to create high-quality material i.e., photos, renders, and sketches, for promotion and marketing purposes.

A number of parts and components were built via 3D printing technology. This approach offered an additional advantage when the fur material was used as a cover, the process was easily completed. First, the simulation and all the appropriate calculations were completed and then transferred

to the physical prototype. For production purposes, extensive use of 3D printing is required to create a considerable number of parts and match a customized production or a production of a small size. The fur parts were traditionally made by hand, and it shows how these techniques can successfully be combined with modern technology.

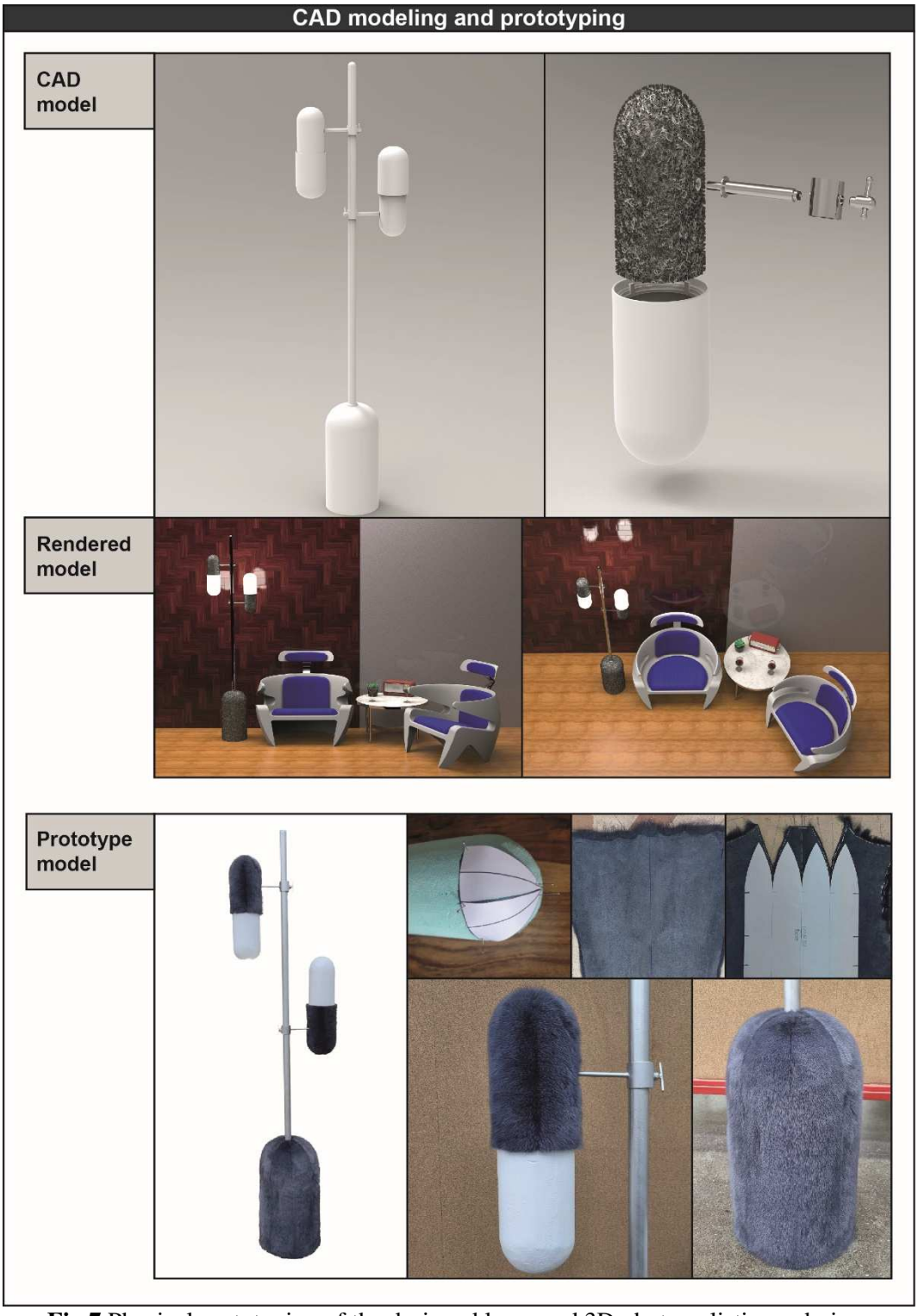

Fig.7 Physical prototyping of the designed lamp and 3D photorealistic renderings

4. CONCLUSION

The proposed methodology was used as a roadmap in product design following a combination of design thinking and design process. It begins with a very abstract concept and by using certain methodologies and modern technological tools.

The outcome was introduced to CAD and rendering facilities to get very realistic representations of the lamp itself and within the work environment. In the end, a 1:1 prototype was used as a guide for future production possibilities.

Finally, this paper combines the use of the creativity design (holistic design approach) and the visual aspects of the brand DNA of the fur materials (i.e., eco-friendly) for developing innovative everyday products for home decorations. Furthermore, the combination between product design attributes with unusual or/and unique textiles is a great area for research and innovation.

All the aforementioned procedure was based on the branding theory which is a crucial element to nowadays market of commercial industrial products.

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Proiectarea holistică de produse din blană pentru industria țesăturilor: o abordare bazată pe branduri

Procesul și procedura de proiectare sunt două abordări esențiale ale strategiei de proiectare holistică. Procesul de proiectare se concentrează pe inovația centrată pe beneficiar și pe rezolvarea creativă a problemelor, pe de altă parte, procedura de proiectare implică aspectele tehnice ale proiectării unui produs. Combinația dintre abordările de proiectare menționate mai sus duce la rezultate de succes de proiectare a produselor care sunt centrate pe beneficiar, plăcute din punct de vedere estetic, funcționale și durabile. În ultimii ani, a existat un mare interes pentru utilizarea materialelor organice naturale pentru a asigura durabilitatea în designul produselor, deoarece acestea au un caracter estetic unic și atrăgător. În plus, semiologia materialelor organice naturale este un aspect crucial în identitatea de branding a produselor finale. Lucrarea propusă explorează o abordare de proiectare centrată pe beneficiar (de exemplu, hărți de empatie, schițe digitale, modele CAD și prototipuri fizice, cu accent pe selectarea materialelor adecvate). În cele din urmă, această strategie de proiectare evidențiază importanța colaborării dintre designeri, ingineri și producători pe tot parcursul procesului de proiectare.

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