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FROM INSPIRATION TO SKETCHES (FITS) METHODOLOGY FOR STUDENTS OF PRODUCT DESIGN

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ABSTRACT
This paper presents an innovative design methodology for students of product design that can serve as a paramount methodology that can be utilized during the creative mental process, when students confront the "blank page" while developing a sketch concept. The FITS methodology was devised in order to leverage the creative thinking in the design process from inspiration to ideation of concept sketches.
The design process involves the need for development of a variety of sketches and forms, which design students often find difficult in terms of creating multiple options of shapes. The multiple options serve as a platform for solutions and assist in fostering the design process.
In this methodology, the source of inspiration is dismantled to categories of visual and textual units on cards that later are assembled to a new variety of shapes and forms representing different design concepts. The methodology brings more awareness to intuition towards shape designs and, practically, explores the complex process of emotional, mental and rational attributes that the process involves. A case study performed in a product design class demonstrates how students that implemented this model achieved creative visual strategic thinking that developed their sketching and visualization skills and their form ideation abilities. Thereupon, this model successfully assists in bridging the spectrum between the abstract and the concrete and provides design students with new opportunities for broadening the wealth of forms that they create.

Keywords: Product design education, inspiration, ideation, sketching, form generation.

1 PRELIMINARY DESIGN PROCESSES, STIMULUS AND FIXATION REVIEW

Most of the design processes that are conducted by design students, as well as by professional designers, begin with the fundamental phase of ideation sketches. Sketching is a crucial tool for designers that helps them in generation of ideas, visual concepts and problem solving. Moreover, sketches enable rapid development of diverse alternatives that ignites the design process [1]. De bono writes about the importance of generation of alternatives as the essence of creativity. Those alternatives can be rational options as well as provocative options. When we think that we have a final idea, we can nonetheless go on asking if there is another or an alternative for it [2]. Most of Design schools teach sketching as a major visualization technique [3]. Concept sketches are fundamental part of emergence and reinterpretation. Sketching enables the emergence of new thoughts and ideas that could not be thought prior to sketching. A research showed that students use verbal cognitive action when they dealing with sketches, it might reflect the way new thought emerge during the interaction with sketches [4]. Moreover, our minds cognitive abilities are limited, and sketching provides the assistance when confronting complex design problems [5].
Students use sketching tools in order to illustrate their ideas but some also struggle to generate sketches. Many of them do not know how to use sketches as a thinking tool, but see sketches just as a rendering tool. As a result, they skip some of the phases of the development process: doodling, researches, comparisons and estimations that help them refining the design intent into a mature design. Thinking while exploring is a process difficult to implement and in general, its intellectual dimension is neglected. For many students, iterations in the sketching phase, erasing and starting over are not well understood as an integral part of the design process. This phenomenon seems to result from the fear of approaching a blank page and starting doodling. Furthermore, when an idea is perceived as a

mature idea by the student, he would abandon the sketching process and would move to the next illustration phase, such as CAD [6]. The crucial time for igniting the creating process is attributed to the time in which the student sketches the first line on the blank page. Consequently, many teachers instruct their students by using sources of inspiration in order to promote and to stimulate the generation of concepts and sketches.

Most students gather diverse sources of inspiration for their development of concepts and for the styling of forms. They are guided to collect visual material and to use it as a source of inspiration for generation of alternatives. These materials are usually presented as collages and inspiration boards. Gonçalves, Badke-Schaub & Cardoso mention that while creatively solving problems, designers often meet a wide variety of visual representations when they browse and search for different sources of information. During this process, designers ascribe importance to existing concepts, competitive products, memory and prior knowledge that will be used for stimulating the creating process. The way those stimulators are perceived and transformed into sources of inspiration, has major influence on the emergence of innovative ideas during the design process [7]. Casakin, H., & Goldschmidt found that sources of imagery inspiration have positive influence on the concept creativity of students. Moreover, when specific directions to use images for analogy were given, the sketching creativity was even better. The researchers note that this study has shown cognitive efficiency when visual sources of inspiration were used as a stimulus and as the starting point for the creative process [8].

It seems that those sources of inspiration might create fixations in some cases, despite their advantages for creativity of students and for development of sketches. Gonçalves, Cardoso & Badke-Schaub note that when designers begin producing new ideas to solve design problems, sometimes they become attached to the examples that they see and, as a result, those sources of inspiration can create fixation and restriction [9]. Cheng, Mugge & Schoormans discuss that the possibility of the student fixations during ideation phase is a result of staying too close to the source of inspiration and the students are not moving far enough to new ideas [10].

In order to prevent this type of fixation from inspiration sources, Cheng, Mugge & Schoormans suggest to reduce the amount of visual elements by cropping images that serve as sources of inspiration, showing partial representations. Their study found that the level of abstraction of visual representation increased together with the designer's creative ability. Consequently, the sketches that produced were better in quantity and in creativity. Moreover, greater attention was given to details and to good design [10]. Leblanc offered a method to develop sketches from a single element by its duplication, transformation and especially by using gestalt theory principles. In her method, students doodle sketches and reach a point of wondering what else they can do. Only after this point is reached, the innovative, original and unexpected ideas begin to emerge [6]. Goldchmidt and Litan propose other stimuli for production of sketches from textual sources of inspiration. Their searches aroused the student’s inspiration with text related or not related to the subject of the design, in order to examine weather texts can inspire practical and original design ideas. It was thought that texts of the two types indeed can stimulate creative thinking [11].

According to Goldchmidth [11] humans remember colours, materials, shapes and insights about behaviour and connection of abstract and tangible details. The designer's expertise is using these pieces of knowledge to construct new entities. Furthermore, Gonçalves, Badke-Schaub Cardoso note that the most important properties of sources of inspiration are form, usability and materials [9]. Recent research showed the essential themes of exercises that are taught in design schools around the world during basic design courses, and are generally agreed on. The themes are line, space, materials, light, deformation, structure, contrast, colour, proportions, and geometry [12]. In general, most of the papers about sketches development describe the need for a starting point for creative thinking. Sketches that were produced from sources of inspiration demonstrate how the thinking process combines both cognition and intuition. In this process, sources of inspiration are transformed into new designs.

Studies surrounding the subject of this paper, have mostly examined so far *what* can cause inspiration. However, Sonneveld suggests examining the way of choosing inspiration, asking students questions that enhance the awareness to the process, such as: What ignite inspiration in the chosen source? What do you do that inspires you? The researcher notes that being inspired is not a passive state of mind but an active way of thinking. Sonneveld suggests developing pedagogical methodologies that deal with the inspiration phase as a process per se, and encourage students to examine what elements in their source of inspiration facilitate inspiration [13].

In my experience as a design educator, I have found that students choose their source of inspiration prior to sketching, but do not know *how* to use it and transform it into sketches. During the first phase of ideation, each student produces a small amount of sketches which are too close in their relation to the source of inspiration. The process of sketching development occurs from one presentation to another by the critique from the lecturer, rather than by profound pedagogical methodology. This process lasts for a while and many times students are locked-in into their first sketches. Thus, a need for a method that teaches how to transform sources of inspiration into diverse ideation sketches during a short period of time through creative thinking processes arises.

2 METHODOLOGY: FROM INSPIRATION TO SKETCHES (FITS)

The FITS methodology is applied in the early stages of the design process, following the design brief and the design research, and prior to sketches presentation. The methodology aims at promoting creative thinking and developing a wide variety of visual design ideas for the product concept that is designed. The FITS methodology broadens the range of options for visual and functional properties of the product. By using it, an innovative and fresh form development can be applied. The student finds a basis for the creation of starting points for visual ideation, thus eliminating the fixation that sometimes occurs in the early stages of the design process, especially with design students. Moreover, the FITS methodology nurtures the ability to present many design alternatives.

The methodology relies on thinking processes that encourage the development of creativity and creation. The methodology follows a thinking process of deconstruction and analysis of inspiration sources, classification into categories and random selection of elements from the categories, in order to ignite sparks of ideas and reconstruct the elements into visual sketches. The methodology contains development strategies of thinking processes and a concrete tool of card sorting and a technique for creation of new cards. Card sorting enables reconstruction and creation of multiple diverse options of new and innovative sketches. Using card sorting, students can construct their own tool. Each time a student chooses a source of inspiration, he can construct a new set of cards and use it to stimulate creativity. We can find references for the cognitive thinking process of the FITS methodology in Bloom's taxonomy. The cognitive domain in Bloom's taxonomy involves knowledge and the development of intellectual skills and includes six major categories of cognitive processes: knowledge, comprehension, application, analysis, synthesis, evaluation [14].

2.1 Model usage and its advantages

The FITS methodology contains the following phases:
Phase 1: Choosing- choosing a source of inspiration strategy.
Phase 2: Collection- collecting contextual and visual information strategy.
Phase 3: Inspiration Board- creating an inspiration board tactics.
Phase 4: Analysis- Creating cards by categories strategy.
Phase 5: Randomness- Random selection of cards to ignite sparks of ideas.
Phase 6: Synthesis- synthesis for sketching.
Phase 7: Assessment- advanced sketches development.

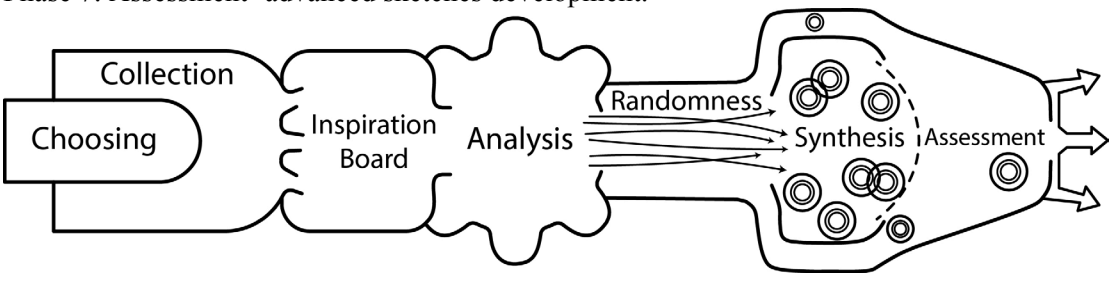

Figure 1. FITS Methodology

The choosing phase concludes the selection of inspiration sources according to its relation to the design task. The relation for this purpose can be based on contextual substance, contextual structural, contextual form etc.

The collection phase is based on the knowledge, according to Bloom's taxonomy. At this stage the student researches contextual and visual information that relates to the source of inspiration, such as; close-up images, distanced images, in group, as single, in motion, static, as newborn to grown-up, or

any relevant information that can enlighten the source of inspiration and provide data. At stages 3 and 4 these data are transformed into design elements.

Inspiration Board phase constitutes of the comprehension, according to Bloom's taxonomy. At this stage, the student organizes the relevant data as visual representations in an inspiration board. The student marks the important visual elements by his own opinion used to inspire sketching. This stage relies on the student's prior knowledge from design foundation courses. At this phase the student mainly implements his knowledge.

At the **Analysis phase** the student analyses and deconstructs the data from the inspiration board and converts it into textual and visual representations in the contexts of design and technology, which constitutes the application phase, according to Bloom's taxonomy. The student categorizes those representations into basic 'building blocks' and distilled product properties: colour, shape, line, proportions, motion, joints, material etc. These are abstractions of the data and their transformations into visual and textual prototypes, arranged in a matrix (Figure 2), which constitutes the analysis phase, according to Bloom's taxonomy. This stage is realization of a process that is usually executed in the designer's mind and memory. Realizing the thinking process brings to the awareness of the student ways of thinking, thus provoke his attention to details and to different design solutions. At this phase, the student creates his own inspiration tool, he cuts the matrix and creates his own *FITS cards* that relates to his selected source of inspiration.

At the phase of randomness, the student pulls out random *FITS cards* in order to spark ideation. The student **flips** the *FITS cards* **facing downwards** and then pulls out one card from each category. The student spreads the pulled-out cards in front of him. The combination of the randomly selected cards stimulates new ideas for ideation sketches. The combination ignites starting points for a thinking process with form sketching. De-Bono describes random input as a key method for immediate provisions, in any condition, of starting points for creative thinking. The random input gives different thinking directions and, consequently, those can be changed at the moment of appearance and new directions can be proposed [1].

At the phase of **synthesis**, which is based on the synthesis, according to Bloom's taxonomy, the combinations of the pulled-out *FITS cards* stimulate creative thinking to design new shapes. Each combination includes different elements that beforehand were not imagined together. Replacing any element can stimulate the creation of a totally new sketch. Combining a word, a shape and a material provokes creative thinking, visual and concrete altogether, and enriches ideation. The pulled-out cards create ideation boundaries but at the same time encourage creative thinking by establishing anchor points for the thinking process (Figure 3). The synthesis phase can be executed in multiple sessions, in order to extract a wide variety of combinations and connections between the categories of elements. It is possible to ignite a creative spark by pulling out one card from each category and by adding cards as needed. Each card can constitute a starting point to develop a new idea. The combinations of cards can evoke sketches of innovative forms. While sketching, the student constructs a new body of design know-how: different connections between parts and materials, new types of joints, relations between forms and colours, alternative proportions, inter alia. The student can implement his insights in the designed product, as well as in future designs. This phase leads to the **assessment** phase, which is parallel to evaluation, according to Bloom's taxonomy. The student assesses his sketches for further development and detailing. There can be cases when assessment of sketches sends the student back to the synthesis phase and so on to re-assessment.

The FITS methodology equips students with a tool of creative thinking strategy. The student himself creates the tool using cards. With every source of inspiration a new cards tool is created in order to increase the student's creativity.

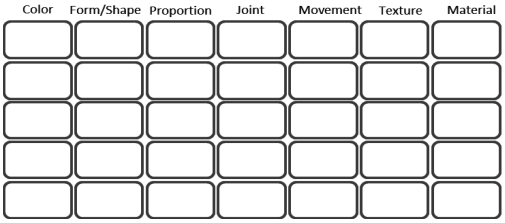

Figure 2. analysis and creating FITS cards

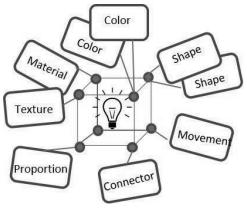

Figure 3. Randomness to ignite spark of ideas

3 CASE STUDY

An experiment aiming at validating the use of the FITS methodology was conducted with a second year class of product design. The experiment conducted a 3 hour workshop, as a part of a design and technology course. 18 students participated in the experiment and were given a task to design a lampshade. The students were told to begin sketching with a source of inspiration (from nature) without acquaintance with the FITS methodology. The students managed to create 2-4 ideation sketches. Most of the students' sketches were visually closer to the source of inspiration image. The students answered a questionnaire, in which they explained this phenomenon by mentioning their **difficulties to transfer ideas** from thoughts to actual sketches. Moreover, they pointed the **lack of time** when they intended to sketch many ideas and sometimes did not have enough ideas for many sketches. The purpose of the experiment was to encourage the students to create a variety of sketches at a specified time. Consequently, the students were asked to ideate with the FITS methodology and to follow its phases. The students conducted the process up to the randomness phase. Only 30 minutes were given at that point, in order to complete the experiment and to synthesize ideation sketches. The results were impressively good. It appeared that in the given short time, the students accomplished an average of 10 product sketches. Most of the sketches showed idea development that relied on the source of inspiration, but nonetheless showed a significant visual distance from the source of inspiration and an explicit self-developed ideation process.

Sequentially, the students reported in a questionnaire that the pulled-out cards and the relations between the represented elements caused them stimuli for ideation of new ideas that otherwise would not have been thought of. The students reported clear breakthroughs in comparison to just looking at inspiration imagery. Moreover, students reported about new connections that they ideated and the sketches showed greater form innovation and looser unrestricted ways of sketching. The participating students argued that the randomness of pulling out cards generated connections and relations that seemed impossible and would not have been consciously chosen. Therefore, the FITS methodology enabled them to create new ideation sketches, by moving them out of their 'comfort zone'. Additionally, students reported about a clear advantage of the FITS methodology that is found especially in the actions of deconstruction and analysis that ignites them to research the source of inspiration deeper and to search for more details. Students reported that categorizing elements enabled them to propose more properties for product design. The students described the use of FITS methodology as a stimulus for creative thinking during sketching, which made them develop new ways of thinking for design ideation. This was especially mentioned in comparison to prior experiences in which they relied solely on their memory and viewing the source of inspiration.

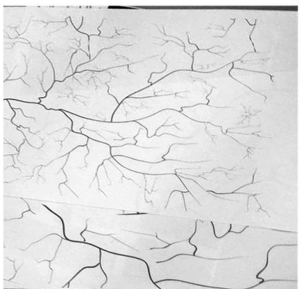

Figure 4. Initial sketches prior to FITS workshop

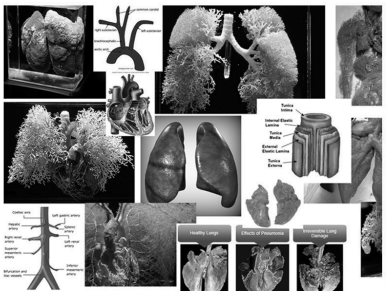

Figure 5. Inspiration board

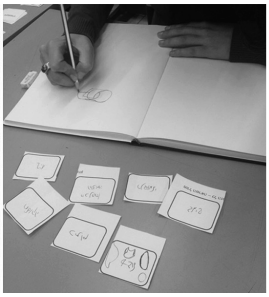

Figure 6. Sketching with pulled-out FITS cards

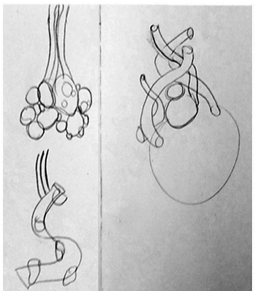

Figure 7. Newly generated concept sketches

The students found difficulty in the verbalization of the elements of the inspiration source, although they reported that the textual written cards contributed to generation of forms. Without the written verbs those formal sketches would not have been thought of. Further, the students mentioned an advantage in the limited number of cards that were pulled out from each category that forced them to focus on particular starting points without confusing them with a large amount of options of the inspiration imagery. Another difficulty that the students described as a delaying factor in the process was the need for production readiness of the design sketch. They created sketches that they could produce and did not want "to waste time" on sketches they did not know how to produce or did not recognize with the materials.

4 CONCLUSIONS AND SUGGESTIONS FOR FUTURE WORK

The FITS methodology serves as a structured process for using sources of inspiration and for constructing knowledge with know-how from prior courses, especially with design foundations represented in textual and visual ways. The experiment shows that the FITS methodology causes students to pay more attention to elements and to details of sources of inspiration. The FITS methodology conducts a systematic understanding of shape and form development techniques and sketches generation processes that are based on visual inspiration. It was developed out of a need to ignite many idea sketches, not from intuitive approach to ideation only, but from a systematic pedagogical approach. It gives an innovation toolbox that employs inspiration sources in a visual thinking process and combines cognitive thinking of choosing, collecting, analysis and synthesis with random elements that cause the magic of the creative thinking. The methodology can be used by students of product design in the early stage of the design process. Analysis of visual and textual elements and classification to categories assist students with a starting point for a new idea. We conclude from the case study that there is a need for a pool of words for choices, or for the analogy from the inspiration source to the analysis categories. Likewise, the students need prior knowledge of technologies and materials. Nonetheless, the methodology can be used to develop creative thinking without referring to the manufacturability of the design idea at this stage.

4.1 Future Work

The methodology should be examined in other fields, such as jewellery design, graphic design, and engineering. Categorizing elements can be broadened by verbalization of product properties into a list of relevant verbs. A list of manufacturing materials, production methods and possible joints can be added in order to decrease the stress of students.

REFERENCES

[1] Tovey, M. (1997). Styling and design: intuition and analysis in industrial design. *Design Studies*, *18*(1), 5-31.

[2] De Bono, E. (1992). *Serious creativity: Using the power of lateral thinking to create new ideas*. HarperCollins.

[3] Boucharenc, C. G. (2006). Research on basic design education: an international survey. *International Journal of Technology and Design Education*,*16*(1), 1-30.

[4] Menezes, A., & Lawson, B.(2006). How designers perceive sketches. *Design Studies*, *27*(5),571-585.

[5] McGlynn, M. Thinking It Through: The Importance of Study Sketches and the Implications for Design Education. *EAEA11 2013. Envisioning Architecture: Design, Communication*, 465-472.

[6] Leblanc, T. (2015). Sketching as a thinking process. In *DS82: Proceedings of the 17th International Conference on Engineering and Product Design Education (E&PDE15), Great Expectations: Design Teaching, Research & Enterprise*.

[7] Gonçalves, M., Badke-Schaub, P., & Cardoso, C. (2011). Searching for inspiration during idea generation. In *IASDR2011, the 4th world conference on Design Research*.

[8] Casakin, H., & Goldschmidt, G. (1999). Expertise and the use of visual analogy: Implications for design education. *Design Studies*, *20*(2), 153-175.

[9] Gonçalves, M., Cardoso, C., & Badke-Schaub, P. (2013). Inspiration peak: Exploring the semantic distance between design problem and textual inspirational stimuli. *International Journal of Design*

[10] Cheng, P., Mugge, R., & Schoormans, J. P. (2014). A new strategy to reduce design fixation: Presenting partial photographs to designers. *Design Studies*,*35*(4), 374-391.

[11] Goldschmidt, G., & Sever, A. L. (2011). Inspiring design ideas with texts. *Design Studies*, 32(2), 139-155.

[12] Boucharenc, C. G. (2006). Research on basic design education: an international survey. *International Journal of Technology and Design Education*,*16*(1), 1-30. *Creativity and Innovation*,*1*(4), 215-232.

[13] Sonneveld, M. H. (2011). Creating Inspiration in Design Education. In *DS 69: Proceedings of E&PDE 2011, the 13th International Conference on Engineering and Product Design Education, London, UK, 08.-09.09. 2011*.

[14] Bloom's, T. M. E. (1965). *Bloom's taxonomy of educational objectives*. Longman.