SKETCHING AS A THINKING PROCESS

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ABSTRACT
Sketching is a form of communication and as such particularly effective for illustrating ideas or sharing thoughts. For designers, sketching is an indispensable tool that helps them externalize concepts, explore ideas and solve problems. However, the underlying principles of the cognitive creative process appear to be difficult to grasp. Students use sketching to visualise ideas, yet many do not know how to use it as a thinking tool. As a result, they tend to skip parts of the development process: the doodling, exploring, comparing and assessing that help them refine the initial intent into a mature design. To address this shortfall, a methodical approach to structuring exploratory thinking was introduced into a classroom and studio setting of the 3rd year industrial design program. The exercise described in details was initially developed for a theory course as a means of assessing students' ability to assimilate theoretical notions and apply them to design. In fact, the approach proved to be useful far beyond its initial scope. Students learned to externalize their thoughts, methodically explore creative options, as well as distinguish between common and unique. Many recognized how generating ideas in quantity enables the less interesting ideas to be discarded, paving the way for the emergence of creativity. This paper describes in greater detail de exercise developed for this purpose, observes and examines the challenges students face in transitioning from visualization to creative thinking mode, and comments the obtained outcome.

Keywords: Sketching, creativity, design development, Gestalt psychology, principles of perceptual organisation.

1 INTRODUCTION

Over the years, we continually observe students struggle with the creative process, especially with sketching, exploring and developing ideas into mature designs. Many see sketching only as a means of visualization and rarely know how to use it as a creative thinking tool. The proverbial 'fear of the blank page' seems to amplify this phenomenon.

Although, students are taught that doodling and sketching help them not only to "… think differently, generate a variety of ideas quickly, explore alternatives with less risk, and encourage constructive discussions" [1], only few actually develop these skills sufficiently. As Brown explains: sketching and doodling "can serve a myriad of functions that result in thinking, albeit in disguise" [2], he also suggests that they help enhance focus; increase information retention and recall; activate the 'mind's eye'; enhance access to creative problem-solving, and unify three major learning modalities: visual, auditory, and kinaesthetic [2]. In fact, sketching, when used to explore and materialize ideas as well as externalize thoughts, is critical to a designer's reflective practice [3].

Yet, thinking while exploring is a process difficult to instil and its intellectual dimension is widely ignored. The simple notion of trying, discarding and starting over seems to many students abnormal or a sign of failure, and not always readily accepted as a part of designing. Consequently, as soon as a sound idea emerges, students abandon sketching and hasten to the next visualization mode. In so doing, they neglect to explore variations and nuances, imagine new functions and features or envision the product in a different material or under a different manufacturing process. The developmental stages that include assessing and refining the initial idea are thus shortened or even disregarded, leading to ideas that are immature and less substantial.

With a wide variety of methods and tools at their disposal, students should be better equipped than ever to tackle design problems. Digital tools in particular have added a new dimension to designing.

However, in changing design practices, digital tools have adversely affected education. Firstly, each new tool needs to be taught and mastered, and as their complexity increases, so too does the effort of mastery. Given that sketching alone can already be a challenge, adding a technological component

only complexifies the task. Furthermore, the growing spectrum of tools adds to the teacher's responsibilities. To incorporate these tools into the program, existing content must be adjusted, replaced or dropped altogether. In the case of sketching, students grasp the required notions only superficially, finishing their schooling with an inadequate skill set and a sense of ineptitude. Those with high ambitions and strong self-motivation manage to overcome the deficit; others learn to mask their lack of skills in one area by developing others. In our experience, the more gratifying digital tools gradually replace the doodling, sketching and physical mock-ups that are so fundamental to the development of a design and the decision-making process.

The second notable trend is that less and less time is committed to imagining, exploring or developing ideas and more time to visually enhancing or embellishing them. Powerful imaging software helps transform rudimentary visions into something polished, giving the false impression of a 'finished' design. Consequently, the outcomes tend to be either without depth, ordinary, and sometimes naïf.

Our observations indicated a third dilemma. Students have difficulty transitioning from the unrestrictive ideation mode into the discriminatory concept-development mode, proving that the development process is widely misunderstood or inaccessible. Indeed, students frequently stagnate between these stages and, in the end, habitually produce only cleaned-up versions of their initial ideas instead of mature and thoroughly considered concepts.

Understandably, initial ideas tend to be naive, unoriginal and lacking in depth. To stimulate the imagination and open the mind requires playful exploration. Given time, a critical approach and liberal doses of imagination, ideas can evolve into mature concepts that meet the established design objectives. Yet when absorbed in the creative process, students tend to lose track of the design goals. Sketching is also easier said than done. Whenever an idea is challenged, students simply change direction instead of creatively resolving its weak points. Many simply don't know what to do with the feedback or how to explore options and variations. Advice to develop an idea further is usually interpreted as 'continue searching for another'. Thus, when students encounter a problem, they simply abandon one idea for another.

The key role of doodling and sketching is insufficiently emphasized; similarly, the constructive thinking mechanisms that could help students approach the process methodically are often overlooked. Creative exploration needs to be structured to allow students to assess and discard initial ideas before advancing onto the next. This avoids the random accumulation of unjustifiable concepts, thus giving students a sense of how the design develops.

A vast amount of literature debates design methods and the role of visualization tools in design. This paper adopts a didactic perspective by presenting sketching as a thinking tool and examining how a structural approach can be used to guide the creative process. We will look at the learning challenges and propose a pedagogical approach to help overcome them.

Our structured approach was part of a theory course entitled *Semiotics and Design*, which explores Gestalt theory [4], and the laws of perceptual organization [5]. In the following sections, we will describe the framework of the exercise and its goals in greater details, explain the process, present the results and comment on its pedagogical value.

To ensure a shared understanding in reference to sketching and creative exploration, we will include modes of visualization that help externalize ideas (including formal and informal, physical and virtual, and two- and three-dimensional representations), provided they have been considered and used as a creative thinking tool and that their mode neither limits nor dictates the outcome.

2 THEORETICAL CONSIDERATIONS

Many consider the act of designing as a form of communication whereby the designer constructs meaning by defining the product's features (intended meaning), and the user perceives and interprets meaning when interacting with the product [6], [7]. Human-oriented design in particular focuses on the intuitive use of products, systems, spaces or interfaces. Accordingly, some design schools see the need for teaching the theoretical foundations of cognitive processes, semiotics and product semantics [7]. Gestalt theory and the principles of perceptual organization [8], [9] are already fundamental teachings in art and visual communication. Engaging users on a cognitive level, these principles are used to construct meaning, hierarchize messages, and emphasize or de-emphasize certain features. Gestalt theory emerged in the early 20th century in the course of research on human perception conducted by Wertheimer, Köhler, Koffka, and Gibson, [4], [8], [9], [10]. The theory explains that objects in an environment are not perceived as individual parts but rather as global constructs and

meaningful arrangements. Thus, the mental and physical act of *gestalten* (German for *form giving*) produces what is referred to as a *Gestalt* or a 'whole' with an internal structure. According to this theory, the stronger and distinguishable the Gestalt, the more memorable the whole. According to the research, innate perceptual laws govern the perceptual process and help people to interpret sensory experience [9], [10]. Grouping is indeed a mental strategy that helps simplify complex sensory experiences (sight, smell, taste, sound, touch, behaviour, etc.) into cognitively digestible portions in order to minimize cognitive effort (cognitive economy) [11]. Among the most representative Gestalt laws are those of simplicity (*prägnanz*), proximity, similarity, closure, figure and ground, good continuation and common fate. For example, the law of simplicity explains the human inclination to perceive complex and irregular shapes in the simplest manner possible by cognitively simplifying them as identifiable patterns (minimal, geometric, symmetric); the law of closure refers to the human ability to recognize and mentally complete a Gestalt (shape, poem, melody) with only fragments of information [4], [5], [6].

While these laws apply to all types of sensory stimuli, they are typically associated with visual perception. Nevertheless, it should be remembered that multi-sensory experiences (flavours, scents, textures, sounds, tastes) as well as thoughts and behaviours can be complex and are thus perceived and interpreted according to the same principles [4]. In design, this awareness can help designers become more conscious of their decisions, justify their design choices and assess their ideas in terms of visual organization, simplicity, complexity, ambiguity, etc. By exploiting perceptual grouping concepts, designers can create intuitive products that users can more readily appreciate and manipulate.

3 STRUCTURAL APPROACH TO SKETCHING

The exercise described below was designed with three objectives in mind: 1) to methodically explore design concepts through a conceptual framework and thus develop a sketching approach; 2) to assess and build on a concept's visual quality, thus showing how a concept can evolve; and 3) to grasp and apply theoretical notions to design. In this sense, understanding Gestalt theory and its laws and assimilating them into the design process was helpful to the students.

The assignment entailed having students gradually transform an abstract element such as a line, circle or symbol, using a conceptual framework to guide their exploration. Students were asked to choose a simple element and 'play with it' by progressively creating patterns and configurations, then disposing them as shown in Figure 1. Students were allowed to use any form of visualization: sketching, collage, physical artefacts such as nuts, bolts or noodles (with photos taken each step of the way), digital tools such as Illustrator and so on. They typically began with a single element that they subsequently multiplied, arranged and transformed. To foster creativity and avoid predictability, the exercise required a significant number of configurations over a minimum of twelve pages.

During earlier iterations of the exercise, only two pages showing the most unique configurations were required; consequently, only a few students took the time to explore variations before compiling the two mandatory pages. The results were unimpressive, lacking originality and intellectual effort. Furthermore, many (whether intentionally or not) only reproduced the examples seen in class using their chosen element. By imposing a 12-page exploration with 9 to 12 configurations per page, students sooner or later managed to overcome the stage of mimicking patterns and eventually transitioned into a more methodical creative thinking mode. Some theoreticians refer to this phenomenon as creative 'emergence' [13].

To help organize and structure the exploratory process, students were asked to use strategies. For example, it was suggested to follow bi-polar concepts such as singular to multiple (progressively transforming an element by multiplying and grouping, thus create visual interesting structures). Other suggested concepts were: geometric to organic, orderly to chaotic, linear to surface, positive to negative, etc. Unaccustomed to such a structured and concept-driven approach, many struggled initially and jumped from one configuration to another. Others missed the point of the exercise by trying to take shortcuts. Those using digital tools tried to gain time by copying/pasting entire pages and modifying certain arrangements, thus neglecting the reflective component of the experience altogether.

Nevertheless, our observations reveal that only when students reached the point of wondering what else to do did they actually start experimenting, exploring and producing unexpected results. This 'tipping point' is precisely the aim of the exercise. Figure 1 shows a number of predictable configurations in the early stages, whereas further down the line, patterns materialize that cannot be

easily imagined. The results produced by a methodical concept-driven approach as opposed to random illustrations are thus easily spotted.

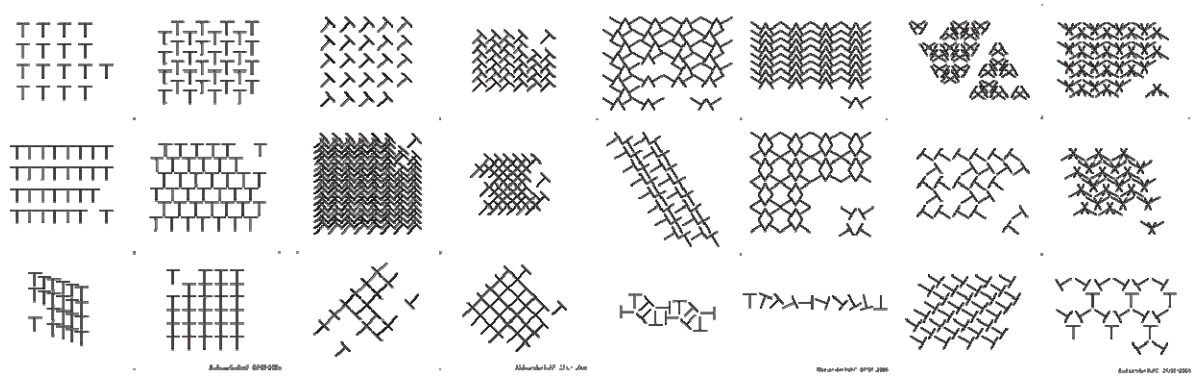

Figure 1. Example of a sequence (pages 11 and 12), by A. Pohl

Ideally, each new formation should be a refinement of the previous one, which implies drawing conclusions from a previous idea to inspire the next. To give a configuration more interest, one could exploit the visual phenomena of *dominance* or *emphasis*—for example, by isolating one of the elements, exaggerating its proportions, varying the spacing or simply adding contrast or an accent colour. The principles of figure/ground, simplicity, closure, proximity, isolation and so on were also used to assess the Gestalt quality of the proposed solutions or search for alternatives and nuances while refining and comparing the obtained results.

Among the 120 to 140 arrangements, students were to select the six most unique ones that they felt possessed the strongest visual qualities (Gestalt). Each was subsequently examined with respect to perceptible phenomena. By gauging each configuration in terms of its visual impact, originality, aesthetic quality, etc., students could reinforce their grasp of theory and demonstrate their understanding of the principles of visual grouping.

The exercise described above can be also applied in a more tangible fashion: for example, simulated perforations on a surface, textures and reliefs, printed elements and logos, spatial configurations or even arranging the buttons on physical or digital user interfaces to help identify and group functions and features according to a certain logic (menus, links, action buttons, etc.). However, while the tangible option was offered, students clearly preferred its abstract form. In any case, the exercise can be considered successful when students recognize a) the importance of following the conceptual framework; b) the need to produce in large quantities; and c) when they shift from visualization into the reflexive, experimental mode.

4 APPLICABILITY TO OTHER FIELDS

An exercise is only valuable when students grasp its purpose and learn to use the newly gained skills in their respective fields. Yet many tend to compartmentalize the knowledge and move on as soon a course or an exercise is completed. A systematic enforcement of newly acquired skills is needed to improve assimilation of the knowledge and help turn it into competencies. In this respect, some schools either link studio courses to their theoretical counterparts, thus making it possible for students to apply theory to design problems, or inject theoretical elements at specific stages in a given design project.

In our case, a 3rd-year studio class teaching *Product Semantics* was paired with the above mentioned theory course *Semiotics and Design*. The 16-weeks class allows students to apply the theoretical notions taught previously by learning to conduct a semiotic analyses of a user context, identifying and interpreting signs, defining the product language, categorizing existing products and analyzing their semantic qualities, and later applying Gestalt principles to design.

The given topic was ‘time’. Using a justifiable form language, students were to come up with playful interpretations while focusing on the communicative aspect of design. Figure 2 shows a design exploration of an infant sleep timer, interpreted as a ‘play-and-sleep buddy’. Figure 3 shows a kitchen timer that includes sound cues to signal duration, progression, etc.

In both cases, students began by studying the user context to extract information helpful for establishing design criteria, identifying relevant signs and analogies and so on. The ideation phase began with typical hesitations and random doodling as ideas were put to paper.

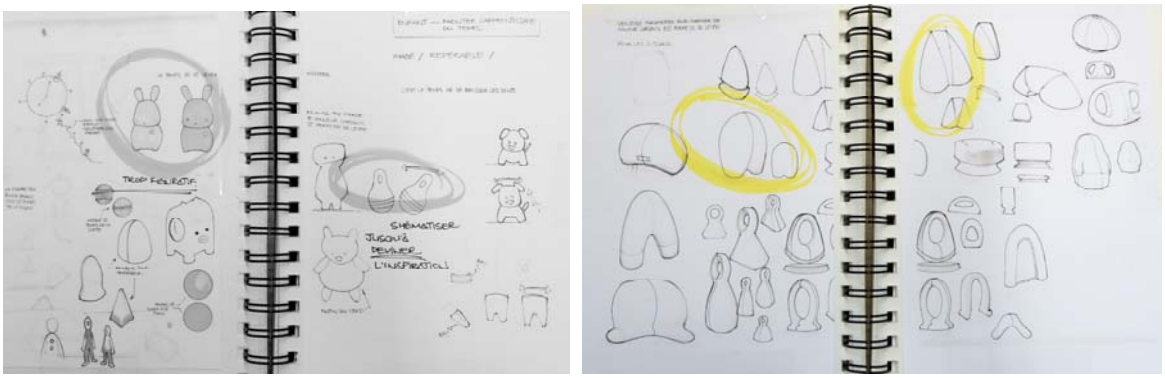

Figure 2. Random exploration turning into methodical evolution of an idea, by E. Perras

The goal of this exploratory and concept development stage was to seek viable solutions through sketching. As Cross explains: "The solution is not simply lying there among the data, like the dog among the spots in the well-known perceptual puzzle; it has to be actively constructed by the designer's own efforts" [14].

Once the first two or three ideas were critiqued, students tended to change subjects, leaping from a shower timer to a USB-plugged computer timer, to detecting time in the wilderness, etc. To counteract this tendency, students were instructed to use the methodical approach without discarding their initial idea but rather learning from and building on the feedback. The goal was to understand the potential of sketching as a creative thinking tool.

The assignment was evaluated based on the following: the evolution of the idea, justification of the design choices, discrimination and refinement, the pertinence of the signs, visual cues and analogies used to express and communicate design features, etc. Figure 2 shows how a naive depiction of a children's toy transitioned into a sophisticated interpretation, while Figure 3 shows how the idea for a kitchen timer matured into a design concept that communicates its sound features using visual cues.

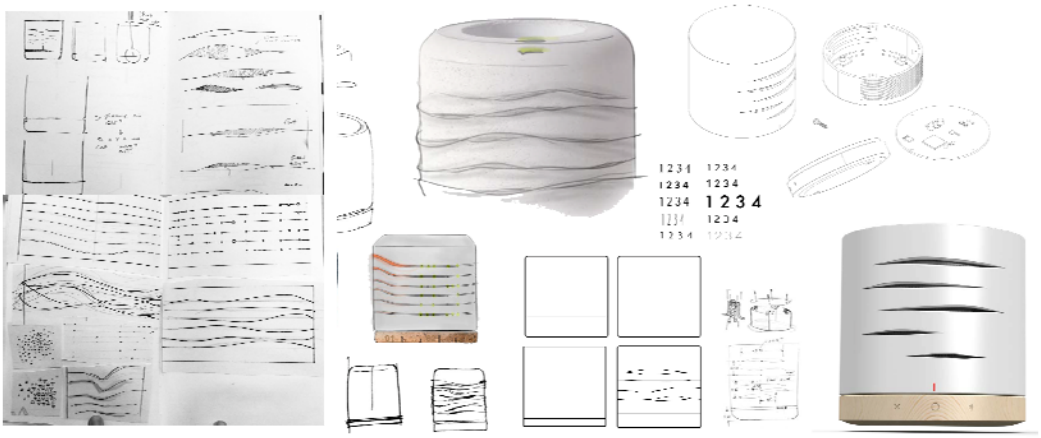

Figure 3. Methodical concept exploration of a timer design, by J. Croteau

5 CONCLUSION

Digital visualization techniques play a significant role in design—to the extent that, when entering professional practice, students are judged by their skills with these tools rather than their creativity or problem-solving ability. This unfortunately nurtures the misconception of design as an aesthetic gesture rather than an intellectual, creative thought process that helps solve problems and drive innovation. Many argue that there is little difference between drawing with a pencil on paper, a stick in the sand, or using a finger on a digital surface. Yet they tend to ignore the importance of visually comparing and assessing ideas side by side. When using digital tools, this aspect of the design process is easily overlooked unless the progression is systematically documented and digitally or physically

compiled. Too many important issues come into play when assessing works-in-progress: concordance with design objectives, respect of functional, ergonomic, technical design criteria, visual impact and so on. Yet in the interests of efficiency, economy or ecology, these intermediate steps are being progressively eroded. In addition, it is a paradox to see students physically together in class yet working in isolation, completely absorbed in their individual screens.

Sharing, observing, critiquing and collaborating would appear to be less and less possible. The information that drives a student's thinking process is filtered and only the final realizations are presented. Digital tools allow ideas or concepts to be viewed only sequentially unless prints of every stage of the process are made. Even than, the process leading up to the final design is rarely documented. Digital sketching and presentation tools make it thus difficult to follow the design process of multiple students concurrently. Learning from one another and measuring one's own performance by comparing it with others are important to education; accordingly, these practices need to be valued.

For all of these reasons, design educators need to reassess the pedagogic relevance of certain tools to ensuring adequate design skills. Each tool must play its role at the appropriate time. The relevance of some should be questioned, while others may need reviving. Ultimately, it is vital that the adequacy of each be recognized within the design process, based on the tasks at hand. If tools embellish irrelevant ideas, camouflage problems and give students a false sense of accomplishment—or worse, are mistaken for 'good design'—then they may need to be called into question.

This paper set out to underscore sketching (including other forms of prototyping) as a tool for methodical exploration that can support the creative thinking process. By demonstrating some of the mechanisms involved, we have shown how a creative process can be structured, particularly when using a conceptual framework. Furthermore, the paper has shown how theoretical notions about cognitive processes, semiotics and Gestalt phenomena provide not only a solid basis when assessing the communicative value and Gestalt qualities of a design concept, but also a framework for structured thinking during the search for creative solutions.

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