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A TYPOLOGY OF DESIGN SKETCHES, DEFINED BY COMMUNICATION FACTORS; THE CASE STUDY OF THE THULE YEPP NEXXT CHILD BIKE SEAT

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ABSTRACT
Within the field of Industrial Design, sketches play a significant role for communication. Sketching represents a language for designers to explore options and support creativity, and to express visions and solutions to teams, clients and other stakeholders. Considering the many different goals and formats professional sketches (and visualizations in general) have in practice, this paper suggests to also explicitly distinguish and teach the various factors that should be taken into account for each specific type of sketch: uncover why sketches look the way the look. Several authors have in the past described classifications of design sketches and drawings, mostly assigned to specific design stages. However these scholars do not specifically describe the communication factors, nor do they provide clues or guidelines for implementation.
The case study on which the research was based was executed in close collaboration between University and Dutch design agency Vanderveer Designers, it concerned the Thule Yepp Nexxt child bike seat project they ran, which was awarded with the 'best of the best' Red Dot Award and the IF Gold award. The case study has helped to conclude that sketches vary along an extensive range of dimensional axes. Further, the visual database of sketches helped to uncover the various characteristics sketches could have.
Correlating (1) specific sketches with (2) the factors defining them and (3) the outcome characteristics together will help students and designers, agencies and clients to better understand and interpret each other.

Keywords: Sketching, drawing, communication factors, functions of sketching, Vanderveer Designers

1 INTRODUCTION

Within the field of Industrial Design, sketches play a significant role for communication within the various fields of design [1, 2]). Sketching represents a language for designers to explore options and support creativity ([3]), and to express visions and solutions to teams, clients and other stakeholders. The visual aspect is of great importance for communication in general [4, 5], all the more for design.
Since the design process is extensive, running from the early stages until final production and implementation, the discipline of design sketching covers a broad spectrum. For a designer, sketching is a necessary means to externalize thoughts for himself and for others: sketches are visual representations of not-yet-existing ideas and concepts. Moreover, sketches facilitate discussion, they facilitate thinking, negotiating, interaction and communication in general. This is why the discipline of sketching and visualizing is of such great value to design curricula. In design sketching education, much attention is spent on drawing didactics, and on the development of knowledge and sketching skills, in order to provide a solid learning situation.

2 UNCOVERING WHY SKETCHES LOOK THE WAY THEY LOOK

However, considering the many different goals and formats professional sketches (and visualizations in general) have in practice, this paper suggests to also explicitly distinguish and teach the various factors that should be taken into account for each specific type of sketch. 'What are you going to present to whom, when and why? These are the basic questions that professional designers ask

themselves before working towards a decision moment or milestone in a project. This paper seeks to uncover the communication factors of sketches; why they look the way the look.
Apart from the fact that the range of design sketch types has expanded these days (dimensions of design stages, design tools and design subjects), the factors that act upon them in general are numerous. The authors have in their practice noticed that for each sketch that is made for a project, different requirements and factors apply, sometimes unconsciously.
Several authors have in the past described classifications of design sketches and drawings, mostly assigned to specific design stages [6-8]. Although these classifications are very valuable, and stress the importance of the discipline, these scholars do not specifically describe their contextual background, nor the implementation characteristics that define those sketches in detail. They do not necessarily provide clues or guidelines for practicing designers, nor for educational purposes.
In order to help designers and students anticipate the various situations and the forthcoming communication challenges they could encounter in practice, this paper aims to unravel which factors could be decisive for a specific sketch, and how to characterize the sketch in detail.

3 METHOD AND STARTING POINTS: THE YEPP NEXXT CASE

As the goal of this paper is to gain and share knowledge about sketch factors and characteristics, a thorough analysis has taken place of a specific range of design sketches. Of a specific case, nearly all sketches that were made along the conception process, both analogue and digital, were collected and added to the database used for this study. All sketches, factors and output characteristics were enlisted separately. This subsequently helped to objectively characterize a limited range of selected sketches, by considering all of those aspects. When design sketching, those are the characteristics and factors designers and students might need to take into account.
In order to empirically uncover a representational range of sketched output, data was collected from the professional case of the Thule Yepp Nexxt child bike seat, which was awarded with the 'best of the best' Red Dot Award and the IF Gold award. The case study was executed in close collaboration between University and Dutch design agency Van der Veer Designers.
Firstly, the pile of sketches was thoroughly analysed. Although the authors anticipated a broad range of multilevel factors that would apply to design sketches, a standard design process model of was taken as a first reference [9-12], refering to design stages from analysis to approval. Accordingly, the time axis (stages) was taken as a single dimension starting point for initially arranging all drawings used in the Yepp Nexxt project (Figure 1). The various design steps and materials were analysed and categorized, and compared to recent literature of sketch taxonomies. Secondly, all circumstantial influences; functions and factors, that played a part when the design sketch was made were identified and noted. This was done from a design agency's point of view, in random order, to find out in retrospect which - mostly unconscious - factors had had an impact on the sketches. Then, the characteristics which define the appearance of the various sketches were deduced from the database of sketches in the studio of Vanderveer's: what choices were consciously or unconsciously made when making them? For the documentation of output characteristics (or sketch-characteristics), a genuine sketching vocabulary was used.

Figure 1. Study set up

4 RESULTS

Unlike Schenks subdivision [7], which categorized drawings based on use, types and capability, this paper claims that all product design sketches are aimed at communicating information, and all – not some of them - must therefore include: 3d information, visualization, representation, indication, lay out and a varying level of specification and e.g. rendering, which is the case for the Yepp Sketches. It is a continuous range. Given the continuous character of the range of sketches, of which characteristics and defining factors gradually differ, this paper gently questions Pei and Campbell's taxonomic classification [6] which distinguishes 'personal', 'shared', 'persuasive' and 'handover' sketches; in the Yepp case, the boundaries were not so clear. Moreover, sometimes a sketch that was meant for informal use only, might suddenly be presented to a client, as was the case for Vanderveer's 'epiphany' sketch, as will be referred to in the results section.

4.1 Sketches

This paper proposes a typology of a different kind, based on the findings of the case study. The typology that is proposed distinguishes the different kinds of communication anticipated for each sketch by Vanderveer Designers, as shown in Figure 2 and Figure 3. It is important to stress that the analysed design sketches represent a rather continuous range, not very well suited to be subdivided and denominated, since any given name would fail to do justice to its many defining elements and characteristics. Although each and every sketch is different and has its own and unique 'reason-to-be', this study strived to document a manageable and therefore limited range of sketches for further study. To achieve this, the enormous amount of sketches was divided and filed in specific representational groups: 'key' design sketches. In Figure 3 these are enlisted, next to their determining type of communication circumstances.

Figure 2. Typology uncovered from the Thule Yepp Nexxt case, and three selected sketches (green frames) for further analysis

4.2 Factors

The case study has helped to conclude that sketches, apart from the stage dimension, vary along an extensive range of dimensional axes. For each of the sketches that were spread on the ground, the story behind the sketch was recollected and shared by Vanderveer Designers. These stories brought about the factors that were decisive for the appearance of the sketches. Some of the factors that were concluded from the case are project communication goals, time available, rank of negotiating partner, designer ambition, etc. The factors could be categorized in terms of 'why', 'for whom', 'how' and 'what', as was documented in Figure 3.

4.3 Characteristics

Each sketch has a certain appearance that is characterized by many variables. The sketch might for example look sketchy, or colourful, or accurate, or realistic, is made from a specific point of view, or includes context information, etc. These are some of the deduced variables of characteristics of the sketches that were part of the case study. In Figure 3 the characteristics that were found are enlisted. Figure 3 displays in the centre the types of sketches retrieved from the case study, categorized by its

communication purpose. On the left, the factors that were recollected are shown, and on the right the variables of sketch characteristics. As each sketch has a unique character, even within a certain category, each of them needs to be studied separately to find the defining factors and appearance aspects which define it.

factors retrieved in case study	cat.
ambition of agency	why
ambition of designer	why
communication direction	why
audience	for whom
rank of negotiating partner	for whom
repeatability	for whom
time available	how
stage in process	what
exploring v deciding	what
concent: technical v aesthetic	what

types of sketches observed in case study	cat.	
metaphoric concept sketches (design direction)	(2) imagine, pull	<
interpretation of the brief	(1) inspire, push	>
re-briefing sketch	(2) imagine, pull	<
evaluation sketches	(3) discuss	0
epiphany sketch	(1) inspire, push	>
explorative sketches	(4) iterate	>
sketch for translation of inspiration	(4) iterate	>
technical materialization sketch	(5) document	0
form detailling sketch	(6) verify	0
aesthetic options sketch	(2) imagine, pull	<
sketch for CAD transfer	(7) transfer	>
interaction sketches	(6) verify	0
technical lay out sketch	(3) discuss	0
engineering sketches	(3) discuss	0
feature sketches	(4) iterate	>
3d sketch on model	(4) iterate	>

sketch characteristics observed
geometry accuracy
surface appearance realism
graphic use of color
concreteness of solution
medium
use of underlay
additional notes
amount of sketches of options
sketching lines
attention value
artistic quality of sketch
information in sketch
point of view (3d info)
context

Figure 3. Factors, 'key' sketches and sketch characteristics, retrieved from the case study

4.4 Correlations

Of the numerous amounts of key sketches, three of them were selected that had fulfilled a major and distinguishable role in the design process. These three, (1) the interpretation sketch of the brief, (2) the 'epiphany' sketch and (3) the technical lay-out sketch are noted in 'bold' in Figure 3 and indicated by the green frames in Figure 2. By thoroughly examining these three sketches, as representatives for a future extensive typology, the relevant factors and characteristics for each sketch were defined and documented.

The 'characters' (factors and characteristics) of the three examined sketches were plotted in the radar charts below (Figure 4, Figure 5). The type of sketch that is required in a certain situation always depends on a combination of factors, not on a range of individual factors.

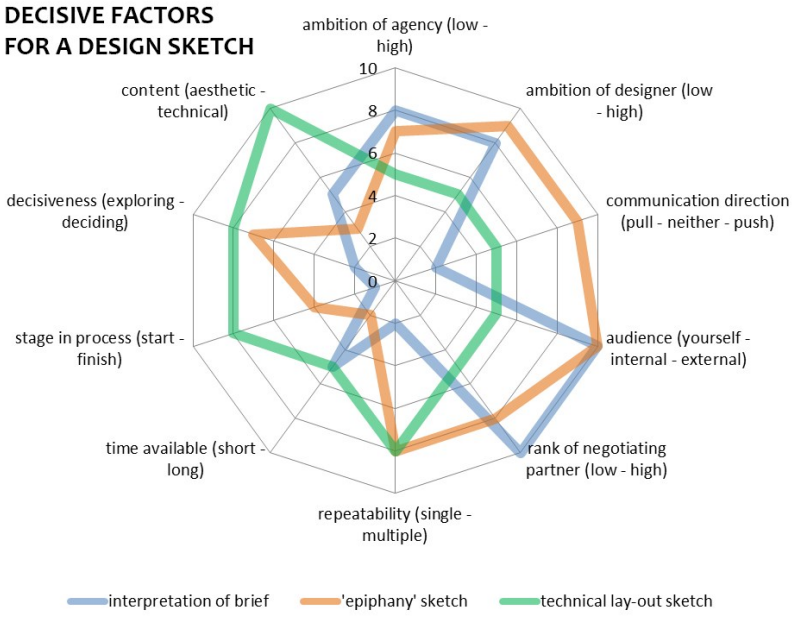

Figure 4. Plotted factors for three types of sketches

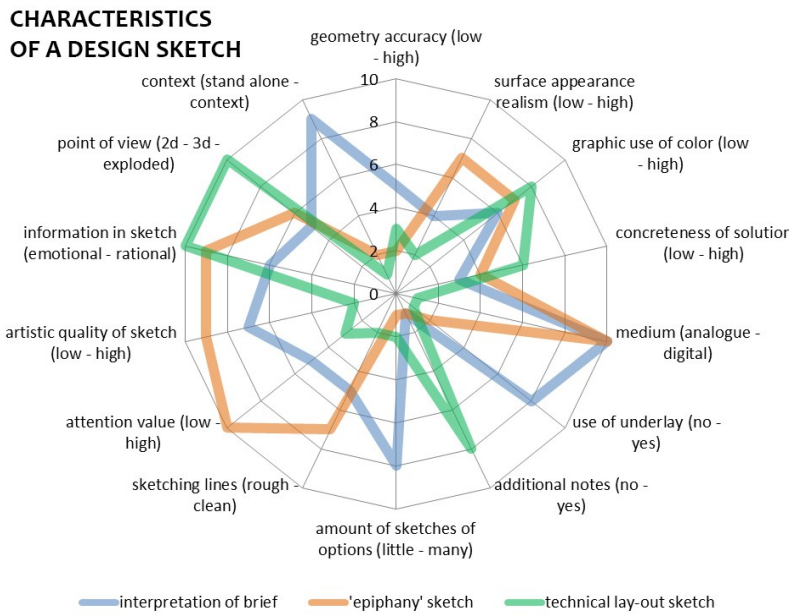

Figure 5. Plotted characteristics of three types of sketches

Apart from project information (the contents of a sketch), the study clearly brought about that each sketch has a certain 'intention'. This 'intention' strongly correlates to specific factors that apply to a sketch. And, as emerged from the study, this intention highly influences the forthcoming sketch characteristics, as shown in Figure 4 and Figure 5. The plotted characters of the three sketches comprise a large amount of information. Some interesting findings from studying the three sketches in detail are as follows:

Interpretation of the brief: Because these sketches were made to provoke a discussion on the things the agency wanted to know more about, the designer sketcher did not want to let surface appearance to interfere with concepts. The surface appearance element was not emphasized, in order to avoid any unanticipated reactions.

'Epiphany' sketch: (Figure 6**)** Recognizable to many designers was the major role played by the so-called 'epiphany' sketch: representing an intuitive design step not planned for, but - in retrospect - very decisive and important for the following stages of the project. The characteristics of the sketch therefor include a high level of attention value and artistic quality. However, geometry accuracy was not very important in this situation.

Figure 6: The so-called 'epiphany' sketch

Technical lay-out sketch: This sketch, in preparing assembly, served as a way to internally discuss options. In the radar charts (Figure 4, Figure 5) it is made clear that providing rational assembly information was the main purpose. The format of an exploded view, the sketch included no surface appearance, though made use of graphic colour indication of the different product parts.

5 CONCLUSIONS AND DISCUSSION

The case of Yepp revealed a slightly different sequence of steps that were addressed, in comparison to the standard Roozenberg and Eekels process. In fact, some interesting non-linear process steps occurred, in retrospect. For example, the project sometimes concerned more than one design process at the time, the reason why the expected sequence was somewhat disrupted. And, as the project progressed, the client considered certain aspects of the entire project of higher importance than other aspects.

This case was specifically chosen not only because it covers a large part of the design process, but also due to the fact that the decision making process was rather transparent. No decisions were influenced in layers of bureaucracy outside the reach of the designers. This was desirable as it would be difficult to determine the influence of this aspect on the effect of the presentations on the decision making process. However, in many other cases the course of a project can be influenced by such hidden factors, out of reach for the designer.

In design practice, a designer will develop the awareness of the communication impact of design sketches by means of trial and error, or by learning the do's do not's from senior designers. Sharing these insights with novices, however, would definitely increase students' consciousness of and thinking about designing in practice. Though each situation is different, and not always suitable to be captured by a model or denomination. The line is thin between (1) convincing a client and (2) not promising too much, and (3) anticipating the knowledge of a client.

The result of this study provides the first building blocks for the establishment of a multidimensional typology of design sketches. All the expected output will help to define the various ways of sketching required when approaching a client, depending on the various types of designer-client interaction.

In near future research, a further study of correlations between factors, while examining other product design cases will help to uncover even more information and guidelines for design sketching.

For design education, this study has brought about the knowledge that sketches could represent all kinds of communicative purposes as part of design process. The results, and the future multidimensional typology, will help to align taught exercises and the assessment of students' work to practice situations. The inclusion of the consideration for which audience to sketch, for what purpose and function, will help preparing student for designing in practice.

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