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BASIC SKILLS IN THE STUDY OF FORM - GENERATING DIFFERENT STYLING PROPOSALS BASED ON VARIATIONS IN SURFACE ORIENTATION

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ABSTRACT
How professional designers create form and study form alternatives is often a personal issue and is difficult to analyse. It mainly depends on his or her creative skills, educational background or experience. Because a company that hires a designer expects that he/she is able to present a number of alternatives of equal value, generating a number of form alternatives is an important design skill.
When freshman students without design experience get an assignment to generate form alternatives for a monovolume-based beamlike product (for instance a personal balance, computer hard disk, cell phone, toaster...), the majority of them draw volumes based on planar elevations (extrusions of a front-, side- or top view). And thus, based on the students' personal experience, a number of possible form alternatives remain unexplored.
This paper describes a methodological approach to improve student's ability to create different styling proposals, characterised by an increase of the amount of form alternatives and larger variation. Understanding and implementing this design method enforces the designer to explore new surface orientations in order to strengthen the visual identity of a product or a range of products. The underlying foundation of this study of form is a step-by-step approach. The design process is divided into consecutive and comprehensive manipulations of a geometric volume. The results of these manipulations can be defined as designs of the first and the second generation.

Keywords: design education, study of form, modeling, form generation,

1 INTRODUCTION
In the complex process of product development, the product developer masters and integrates different skills: such as management skills, engineering skills, skills in the study of form…
The importance of the study of form in the integrated product development process is supported by the fact that several researcher report on this topic in open literature. Crilly et al. concluded after an extensive literature study that the visual appearance of products plays a significant role in determining consumer response [2]. Chang and Van studied the form characteristics of existing printers in order to get an evolutionary overview. Based on their findings they were able to make projections towards the future [3]. Semantic aspects of form are often subject of research, as well (Hsu et al [4]). Amongst others, Lewalski [6] investigated the importance and the impact of aesthetic aspects of form. Norman (2004)

[7] and Lebbon and McDonagh-Philp (2000) [5] reported on the emotional aspects of form.

Only few research projects focus on methodological approaches in form generation, yet a well-described methodological approach in creating different styling proposals would allow students to generate a higher amount and a larger variation of form alternatives. Training these design skills can be taught early in the educational program. Even students with relatively few experiences in drawing techniques can learn to apply this technique. However, abilities in spatial thinking, combined with basic skills in perspective drawing, are a good starting point to learn the basics of generating form alternatives.

It has to be mentioned that styling and form study cover more aspects than considered in the approach described in this paper. Semantics, meaning of form, emotional connotations, aesthetic proportions, harmony, color and materials are only a few examples of form related issues that are extremely relevant to design. However, this approach of teaching students new insights in creating more form alternatives, characterized by an increased variation, has a significant value in the training of students in product development.

2 BASIC SKILLS IN THE STUDY OF FORM, A STEP BY STEP APPROACH

The methodology presented below is applied as a starting point for developing basic skills in the study of form. Although these basic skills may seem obvious to qualified designers, our teaching experience has taught us that many starting students struggle with the ability to create valuable form alternatives.

The foundation of this methodology is a step-by-step approach (fig 1). The design process is divided into consecutive and comprehensive manipulations of a basis geometric mono volume [1], resulting in a design of the first and the second generation.

Figure 1 Scheme of the step-by-step approach

This systematic design method helps the students to keep a clear overview over the different steps of the form-giving process, and provides them insight into the composition of more complex designed objects.

2.1 First step: Design of the First generation

2.1.1 Design principle: replacing edges by a radius

The design principle of unifying surfaces by replacing edges by a radius can already generate a large number of form variations. Depending on which edges are being eliminated, results can vary from extruded volumes to more three-dimensional surface orientations.

To illustrate the first step, a simple rectangular block is used as a starting point. This block is composed of six planes or surfaces; the borders between these surfaces are called edges.

By eliminating edges and replacing them by a radius, the initial six surface volume will be turned into a five, four, three, two or one surface volume (figure 2). Composing as many different possible solutions for eg. a four or three surface volume, stimulates the spatial thinking skills, the latter will automatically result in a variation of surface orientations.

The objective of the first step in the manipulation process is the generation of the understanding in students that a geometrical mono volume is composed out of a number of surfaces.

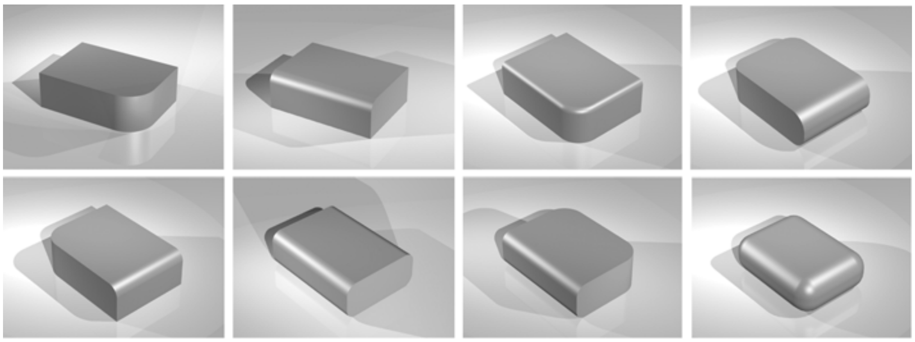

Figure 2 A number of volumes of the first generation based on variations in surface orientation.

2.1.2 Training the first step: design of the first generation

To practise this first step, students are asked in an assignment to sketch as many different surface orientations as possible. These sketches show that some students have difficulties in imagining 3D shapes, and that, sometimes, they draw impossible configurations, mixing sharp edges with a radius. In the second stage of the assignment, students produce foam models of the different generated forms in the first phase of the assignment, and they study the impact of different sizes of radius.

2.1.3 Conclusion of the first step

The results of the first step can be described as a design of the first generation: the original volume is still easily recognizable, the newly generated surfaces stay flat, edges between radius run straight, radius are circular.

Looking at design history, one will notice that a lot of the industrial design products from the 1960s and 1970s, refer to this design of the first generation. This rational form approach was one of the cornerstones of the Ulm School. The 'exact mathematical geometry' design principle became very popular and influenced a lot of European designers at that time. Products of this generation had a recognizable styling language, they were simple and geometric, and were characterised by mutual uniformity. Under the influence of Braun (an electronic appliances company) and the Ulm High school, the German Design standard became that widely spread, that even today products with a strictly geometrical styling (design of the first generation) are referred to as having a German styling.

2.2 Second step: Design of the second generation

Looking at contemporary products, and analysing their styling, one can conclude that the surface composition of most of the monovolume products can be described as one of the basic surface orientations from the first phase: a five, four, three, two or one surface volume. The objective of the second step in the process is to gain the insight that the results from the first step are not an endpoint. On the contrary, they can be used as a starting point for further manipulation. A few simple techniques are introduced to refine the generated volumes from the first generation.

2.2.1 Replacing the straight edges and surfaces by curves

By curving some or all of the remaining edges and surfaces, and by varying these curves, the overall character of the initial surface composition can be changed dramatically. An edge can obtain more tension; a plane can obtain, literally, an extra dimension by curving, or double curving it (see figure 3).

2.2.2 Adding surfaces by replacing edges by a chamfer.

Starting from the original basic geometrical volume one can upgrade a form by replacing an edge (or several) by a chamfer instead of replacing an edge by a radius. Replacing one edge leads to a seven-surface volume, replacing more ribs can lead to complex faceted volumes.

The chamfer technique can also be applied to the results of a first generation design. In this case, the new surface (chamfer) will replace a remaining edge after the fist manipulation of the basic volume (figure 3).

2.2.3 Adding surfaces by making cuts (principle of subtraction of volume).

Although chamfering an edge can strictly be considered as a cut as well, this technique is based on making cuts in other parts of the volume besides the edges, or by making non-parallel cuts. Depending on the number of cuts made, or the shape of the cut, one or more surfaces are added. Also double-curved cuts are possible. The results of this manipulation can be totally different than the results obtained when using the former techniques.

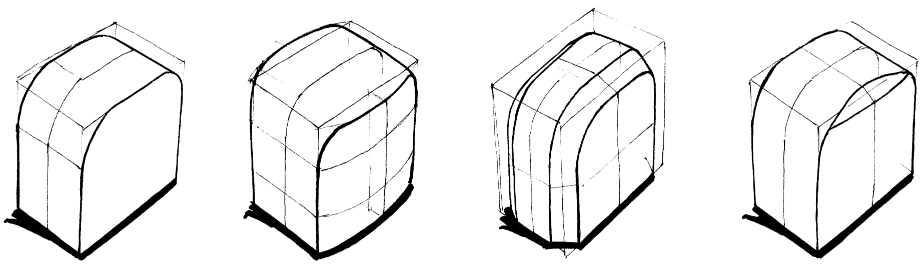

Figure 3 Left: design of the first generation, then: second generation by replacing straight edges by a curve, by adding surfaces by replacing edges by a chamfer, by adding a surface by making a cut

2.2.4 Adding surfaces by adding volumes (principle of addition of volume)

Another possibility to add surfaces is by adding and joining entire volumes. Depending on the size of the added volumes, the original mono volume can no longer be considered as a mono volume, but is now turned into a multi volume. Although the global surface orientation can be studied in the same way, the study of form of multi volumes is more complex and goes beyond the basic skills explained is this paper,

2.2.5 Training the second step: design of the second generation.

The design of the second generation is trained after the learning experience of the design of the first generation. The insight in the planer composition of the styling proposals of the first generation should be established.

To gain insight in the second-generation design, the different manipulation possibilities are first explained theoretically, and then illustrated using case studies. Existing products are then analysed by breaking down the shaping scenario into consecutive steps (figure 4). (Reversed design exercises are used to reconstruct the shaping scenario).

In this training session, students are first assigned to sketch volumes of the second generation, based upon the first generation volumes produced in the previous session. Subsequently students are should apply their insights on a mono volume based product like e.g. a toaster, a remote control or a computer hard disk.

2.2.6 Conclusion of the second step

The results of the second step can be described as designs of the second generation.
Based upon the different surface orientations of the first generation designs, the forms are brought to a higher level. By replacing straight edges by curves, or by judiciously adding surfaces, the overall perception of the forms can become more refined and sophisticated. Trained designers will automatically combine the different techniques in one design.

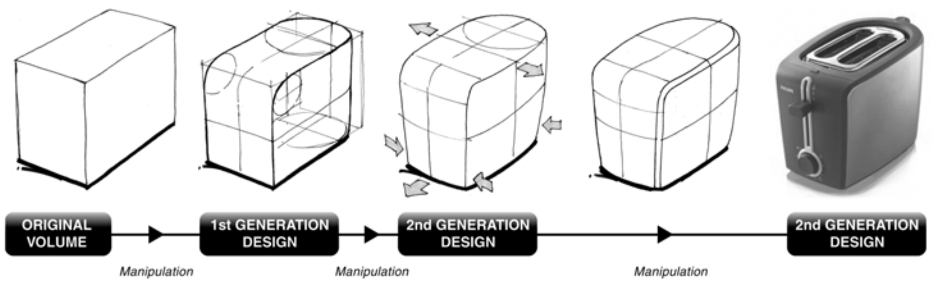

Figure 4 Combination of different techniques of the second generation

Merely applying the different techniques does not guarantee the creation of aesthetical objects, therefore insight into composition, harmony, mutual relations in dimensions and an aesthetic ‘sense’ are required. Good design in terms of a beautiful shape is also more than an equilibrated planar orientation with well-balanced curves. Integration of formal details, general interface layout, or the choice of materials and colours are only a few of the additional aspects that are of great importance to the overall perception of a product.

3 TEACHING EXPERIMENT

To evaluate the effectiveness of the methodological approach, students had to perform two design evaluation sessions. The topic of this design evaluation session was to design a personal balance. Students were asked to draw as much as possible different styling proposals within the limited period of time of 4 hours. The first design evaluation session (M1) was situated at the start of the design program, based in the personal experience of the students (figure 5.1), a second design evaluation (M2) was held after learning the step-by-step approach (figure5.2).
The results confirmed the hypothesis that design students with only little knowledge about the methodology, spontaneously draw basic geometrical volumes: cubes, rectangular blocks, cylinders, pyramids, or in a second stage planar elevations of a curved top or side view. Those ‘extruded volumes’ could be described as ‘two dimensional volumes’ (figure 5.1).
The results of the second design evaluation session indicated that the students actually applied the methodology in order to improve their results: more form alternatives, and more variation in planar orientation was created. Different techniques of designs of the second generation were integrated.

4 GENERAL CONCLUSIONS

The experiment indicates that the methodology presented above is effective. The differences in results between the first and the second measurement, show that the basic skills in generating different form proposals based on variations in surface orientation has significantly improved. The freshmen involved produce more designs and with more variation: more 3-dimensional surface orientations, less “extruded volumes”, or “planar elevations”. By applying the second step of the methodology, the final results show a higher level of quality.

The study of form covers more aspects than considered in the presented methodology, therefore controlling this basic skills is only one step on a long road to become a fully-fledged designer. Courses in the educational program in industrial design, focussing on other aspects of form, remain important.

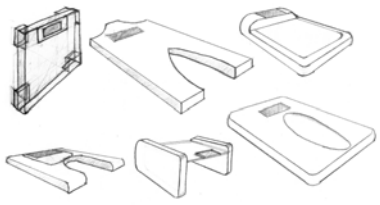

Figure 5.1 Results of the first design session

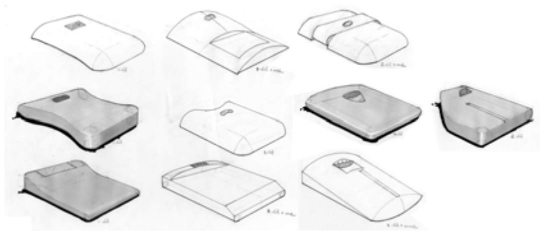

Figure 5.2 Results of the second design session

REFERENCES

[1] Corremans, J., *Basisvaardigheden voor de productvormgever*; (Lemma, Den Haag, 2008)

[2] Crilly N., Moultrie J. and Clarkson P.J., *Seeing things: consumer response to the visual domain in product design*, Design Studies, 25(6), 2004

[3] Chang W. C and Van Y. T, *Researching design trends for the redesign of product form*, Design Studies, 24(2), 2003

[4] Hsu, S. H., Chuang, M. C. and Chang, C. C.‘*A semantic differential study of designers’ and users’ product form perception*, International Journal of Industrial Ergonomics, 25, 2000, 375-391

[5] Lebbon C. and McDonagh-Philp D., *Exploring the emotional relationship between users and products*, Proceedings of designing for the 21st century. An International Conference on Universal design, 2000, Federal University of Rio de Janeiro, Brazil

[6] Lewalski Z.M, *Product aesthetics: an interpretation for designers*, Design & Development Engineering Press, Carson City, NV, 1989

[7] Norman D., *Emotional design: why we love (or hate) everyday things*; Basic Books New York, 2004

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