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A TAXONOMY FOR THREE-DIMENSIONAL SKETCHES

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A TAXONOMY FOR THREE-DIMENSIONAL SKETCHES

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ABSTRACT

In form generation aimed at creating aesthetic expressions a number of sketches is produced, it can be difficult to decode directions and acknowledge the need to seek inspiration. A solution to these problems could be to carry out a taxonomic division of the sketches, and to name the groups according to Carl Linnaeus's method. This creates an analogy between the characteristics of each group and its name. Such a naming ensures that sketches can be recalled and allows for replication of new ideas. A taxonomy designed this way also has a didactic function as it communicates something characteristic of the forms that points towards possible aesthetic expressions and conceptualizes these.

Keywords: taxonomy, aesthetic, three-dimensional sketches, inspiration, design

1 INTRODUCTION

In form generation aimed at creating aesthetic expressions a considerable number of sketches are produced from which it can be difficult to both decode the direction of the sketch and put into words the perception the sketch gives. One way to solve that problem is to divide the sketches into categories based on characteristics and give each category a name, which describes the essence of the sketch. Therefore, the purpose is to develop a classification system for a form generation, a taxonomy, which creates narrative and perceptual relationships between the sketches and knowledge communicated through the names of the categories, classes and their order. The idea comes from Carl Linnaeus's method of botanical classification that captures the essence of the biology of plants through genus naming. Linnaeus developed a naming method which created an analogy that allows botanists and other readers to conceptualize, recall, and replicate new ideas. The plant names hold a didactic function, as Linnaeus's taxonomic names communicate some characteristic of the plants [Powell, 1995]. Similarly, the purpose of naming in taxonomy for three-dimensional sketches is to communicate something characteristic about the forms pointing towards a possible aesthetic expression.

Chucholowski et al. attempt to systematize and categorize the relationship between activities (practices) and research (theories) in design processes by establishing a taxonomy that link together activity and research in engineering design [Chucholowski et al. 2013]. Their taxonomy does not thematising subjects in the aesthetic fields, but it is open to development and the present taxonomy for three-dimensional sketching can be seen as a new class, focusing on the creative practices associated with the aesthetic research field. Pei, Campbell and Evans have developed taxonomy for sketches and prototypes in the design process to communicate how they support product development [Pei Mf. 2011]. Such taxonomy not only arranges dissemination objects, but also provides a hint about which categories of dissemination objects are most suitable for moving the process forward in the given phase. Similarly, taxonomy for three-dimensional sketches can provide a hint for inspirational searches, and the naming contains a conceptual explanation for the description of forms. Such taxonomy for three-dimensional sketches constitutes a supplement to the Design Heuristics' proposals to development of design concepts [Yilmaz et al. 2013].

2 BACKGROUND

A collection of more than 100 three-dimensional sketches in heavy weight drawing paper created by the artist and architect Erik Lyngé (1919-1998) represents the basis for this study. KUNSTEN - Museum of Modern Art Aalborg has given Aalborg University the opportunity to use their collection in the education of architecture and design students. Lyngé's sketches have provided incentives for the students' form creating. In doing so, the sketches have helped solve the problems of creating aesthetic wholes that simultaneously constitute functional buildings or products. This is the reason why it has been interesting to study Lyngé's three-dimensional sketches. Another reason is that these sketches led to the sculptures that gave Lyngé his recognition as a form researcher and artist. Most of Lyngé's sketches and sculptures (137) are

3 METHODOLOGY

A tentative taxonomy was established on the basis of the phenomena / inspiration sources / techniques that could be traced in Lyngé's collection of three-dimensional sketches. The taxonomic names were chosen according to Carl Linnaeus's method so that the reader from conclusion by analogy forms an idea of what is essential in this category or the aesthetic expressions the category deals with. For example, the term 'weightlessness' names the category of sketches that tries to emphasize the phenomenon that a form can be experienced as floating when the impact of gravity seems to be nearly eliminated by invisible supports. 'Organic forms' names the category of sketches inspired by living beings or by nature or clearly shows perceptual mimesis. Another example is the term 'pieces' which names the categories where Lyngé has cut a piece off a form in order to highlight a particular feature at the form.

The study is limited to Lyngé's three-dimensional sketches or forms which are created from a continuous plane of paper folded over straight and curved lines. The connection between form, technology and inspiration sources has been clarified by use of Lyngé's collection of inspirational materials

stored in the KØS Museum of Art in Public Spaces - Køge Collection of sketches. Taxonomic systems also form a basis for museum registration, for example the ITIS - the Integrated Taxonomic Information System. Neither KØS nor Kunsten have made a taxonomic registration of Lyngé's sketches, and currently their state is an obstacle for using the sketches as inspiration. A selection of Lyngé's sculptures is shown in the catalog from the memorial exhibition, but the images and comments are too sparse to replace the access to the sketches and the experience of aesthetic qualities that would give [Saghaug et al. 1998]. The above realization raised the question: Can exclusion of taxonomic groups in such a collection give direction to the inspiration search and thus a more systematic form development?

and references about his approach to inspirational searching as well as recognizable forms such as the platonic bodies.

Geometrical basic forms such as the cube, sphere, pyramid, cone, ellipsoid, tetrahedron etc. are so common in many combinations and cuttings in Lyngé's sketches that they will not individually form taxonomic groups, although the basic forms would obvious make taxonomic groups in other contexts. Too few sketches have been preserved to decide if Lyngé systematic changed from one basic form to another in order to investigate whether a better solution could be achieved using this form rather than first. In addition to the geometric basic forms, the categories of 'folding' and 'material experiments' form some preliminary groupings, which indicate that Lyngé stuck only to the flat materials and technology associated with these materials. These limitations mean that this study only produces a tentative taxonomy, but provides a structure and organization that can provide an overview and identify a direction in future form generation. The following sections present the categories identified in Lyngé's posthumous sketches / incentives and forms.

3.1 Organic Forms

The organic forms are characterized by their steering lines – parts – decoded from naturally occurring forms and their cross sections, which have been obtained as abstractions of cross sections recorded perpendicular to the tangent of steering lines. Lyngé both collected natural forms and searched for photographic motives in nature. Whether Lyngé consciously worked with abstraction or strived to achieve the best approximations with the given techniques that is unknown. As seen in figure 1, the folding lines follow the steering lines, although the subdivision along the back softens the form.



Figure 1: The material and the fold technique united in the organic form

3.2 Weightlessness

The phenomena "weighted" and "balance" are physically two sides of the same form problems, as seen in figure 2. The group is characterized by minimizing the meeting between the form and support surface, a significant volume is raised up, or the centre of gravity is displaced to unstable equilibrium. Forms that balance on supports as sharp as needles are also seen in this category.

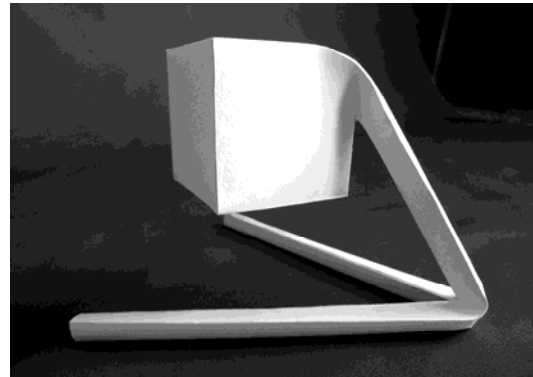


Figure 2: Impact of gravity is "neutralized"

3.3 Scientific Forms

New forms arose from Lyngé's fascination of scientific fields. Lyngé followed e.g. Niels Bohr's lectures, and he himself mentioned that studies of such as R. Buckminster Fuller's elucidations had inspired him. Among Lyngé's sketches there are some with structures that complete the molecules. The form which is shown in figure 3 bears resemblance to the C₆₀ molecule. Similarly, Karl Friedrich Gauss's studies of curvature of surfaces were reflected in several of Lyngé's forms [Saghaug et al. 1998] [Lyngé, 1998].



Figure 3: Fuller inspired folded sphere

3.4 Vibrancy

Liveliness is expressed through tension in forms or of surfaces - seen in passages between two surfaces or in the surface itself – The phenomenon appears in the folding itself and most strongly in the passage between straight and curved lines, and when there is an inflexion between two curved lines as seen in figure 4. The effect is often enhanced by forcing the plane of paper over a curved line and at the same time the planeness of the opposing sides is secured by an inner structure.



Figure 4: Form contrasts emphasize the tension in the form

3.5 Modular Forms

Lynge illustrates in a video how he creates new forms by stacking modular forms [Braunstein, 1966]. By simply aggregating congruent form expressions manifested in several scales, or by combinatorically joining modules together to create an interesting pattern or interesting figures. Lynge paid particular attention to the laws that apply to mono-, di-, tri- or poly-modular forms in assemblies.

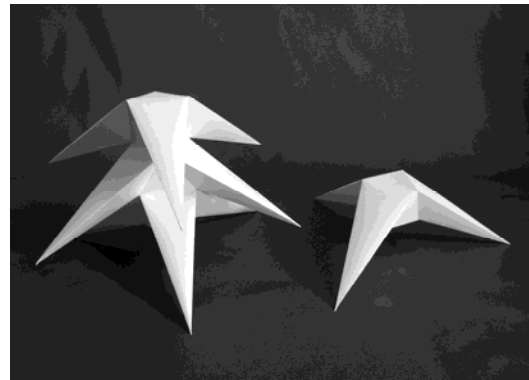


Figure 5: Modular stacking

3.6 Form Interference

The phenomenon 'form interference' occurs when two or more phenomena are added, such as e.g. mirroring, displacement or rotation and that there in the literal sense occurs a transformation of a form to a new form. The process can lead to both constructive and destructive form interference.

Constructive interference of forms occurs when two or more phenomena enhance the expression of the form.

Figure 6a illustrates the assumed starting point for constructive form interference to the left and the result to the right.

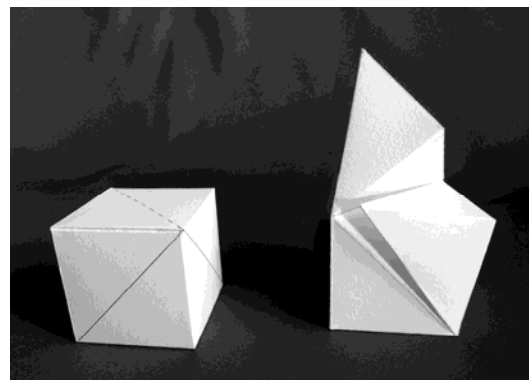


Figure 6a: Constructive form interference

Destructive form interference occurs when two or more phenomena are reduced or eliminated under the mutual effect.

This will in most cases give an undesirable effect, but figure 6b shows a destructive interference of two similar forms, which are desirable.

In this case, the new form builds on the addition principle. The added forms are in balance like the form copy that shapes the socket.

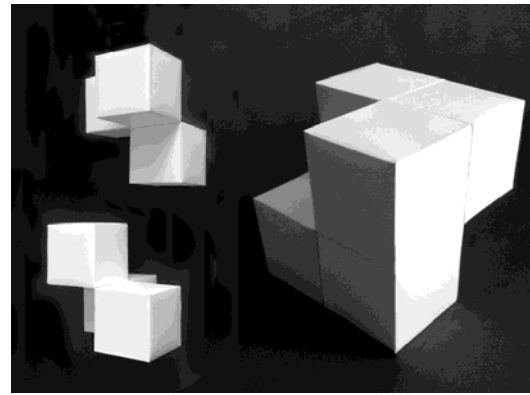


Figure 6b: Destructive form interference

3.7 Form Complementarity

The phenomenon 'form complementarity' occurs for example when complement form elements interact so that a form transformation occurs. This happens for example when a bi-convex form interacts with a concave-convex form to create a form that resembles a waning crescent moon.

With reference to Johannes Itten's color chromatology [Itten, 2006] one can speak of a complementary when two form elements make a contrast form such as the cube and the sphere or more pronounced a geometric form against a blob form. It is the phenomenon that can be seen when climbing grips of exposit are screwed onto a flat concrete wall. Form complementarity has both a constructive and destructive side:

Constructive complementary forms are associated with addition of complementary form elements.

Destructive complementary forms are associated with subtraction of complementary form elements.

The relief in figure 7 represents in this terminology a constructive complementary form to left and a destructive complementary form to right. To the left form is added a cone in the middle and a form element that gave the ridge. Conversely, a cone has been subtracted from the cone to right while a gorge has cleared away from the center of the cone and up. The aesthetic effects of the destructive complementary forms can be entirely in line with the constructive complementary forms.

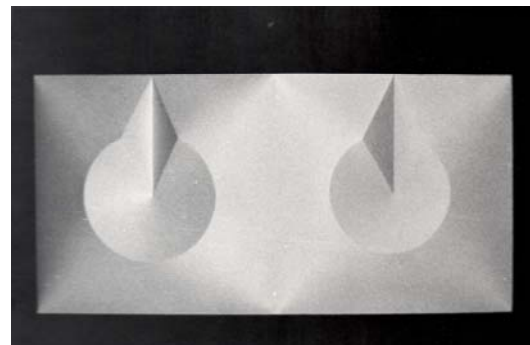


Figure 7: Complementary forms

3.8 Cutting

Lynge did not use the 'cutting' to show an imperfection, but to highlight a particular feature of a form or to give it a special character. Among Lynge's sketches, the phenomenon does not appear as a further processing of a corresponding form without a cutting. On the basis of this, it is not possible to decide whether this category should act as a subgroup or not. In the present context the cutting is an indication not to be mistaken for the category with Willy Ørskov's construction or breakdown principles, which conveys the creation processes [Ørskovs, 1966].

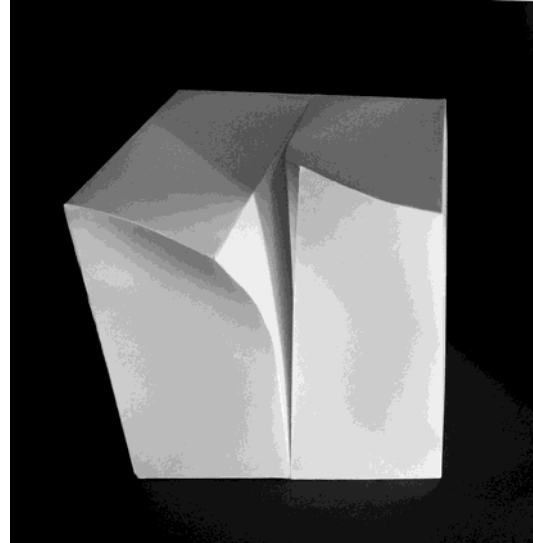


Figure 8: Cutting in a form

3.9 Transparency (Interference)

Figure 9 reveals that Lynge challenged the transparency phenomenon and possibly also the pattern interference that occurs when two or more hole patterns integrate with each other. Alternatively, interference occurs between patterned fields and their shadow images. The phenomenon is called the 'Moiré effect'. However, the most interesting thing about the cube in figure 9 is the special folding pattern that the transparent material reveals.



Figure 9 Transparent folded cube

4 A TAKSOMOMETRIC MODEL FOR THREE-DIMENSIONAL SKETCHES

Based on the previously identified categories, the taxonomy shown in figure 10 was constructed.

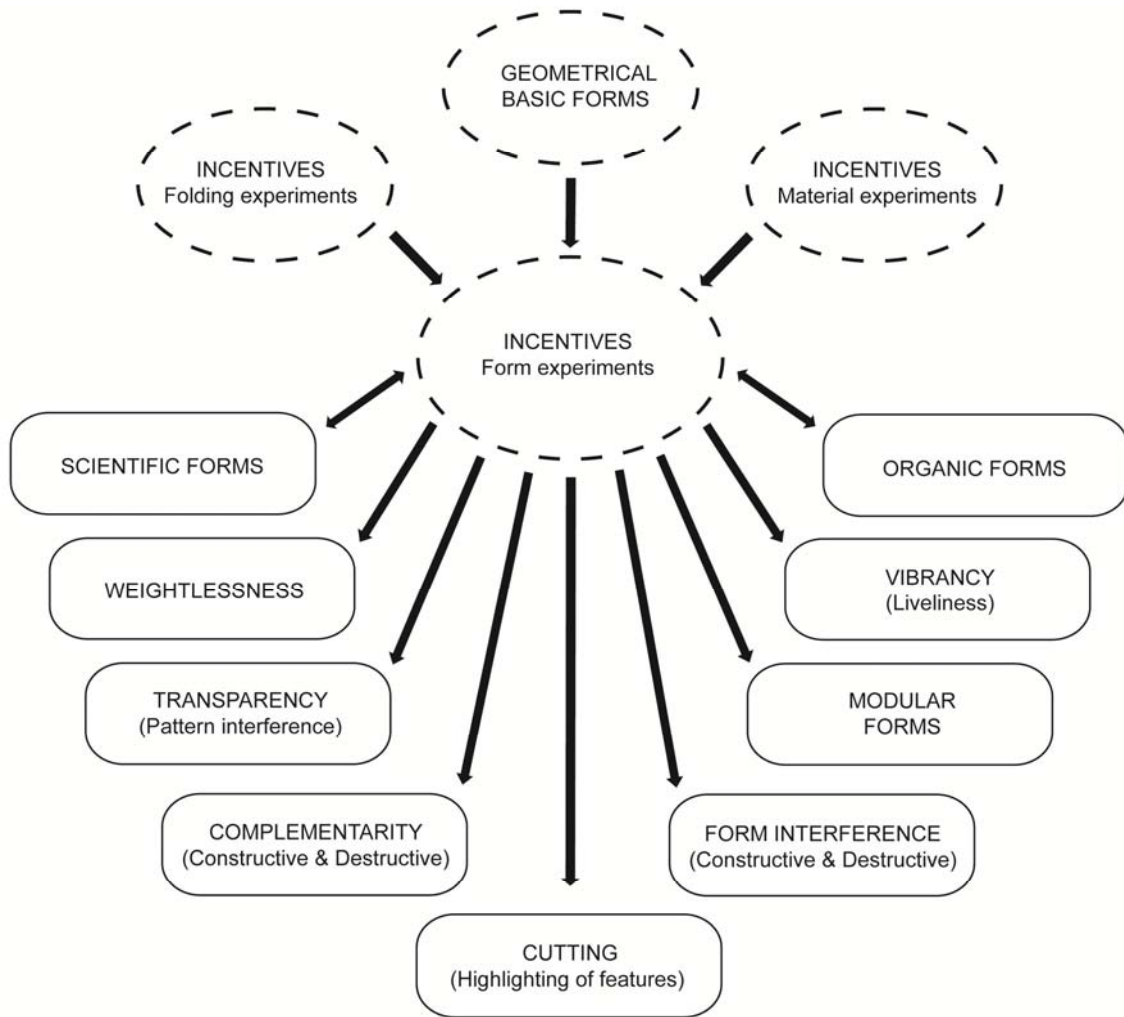


Figure 10: A framing of a taxonomy for three-dimensional sketches or sketching

The dotted oval symbols indicate that they are independent bases for form development. The oblong boxes indicate sketch categories. The arrows indicate the direction of inspiration and double arrows that inspiration can go both ways. Thus, complementarity can draw on form elements from either the categories' geometrical basic forms, scientific forms or organic forms as its ancestors.

This taxonomy has been developed as a result of a suggestion from a reviewer of the paper 'Incentive to Form' [Thomsen & Madsen, 2011], in which we explained how Lynges sketches and sculptures had served as inspiration for architecture and design students' efforts to create buildings and products with aesthetic qualities.

The objective of the tentative taxonomy has therefore been to categorize Lynges three-dimensional sketches and sculptures so they could encourage readers to create new and interesting forms. The taxonomy was thus developed with a specific application on a limited material in mind, and therefore it is referred to as 'tentative' and is seen as a framework for a more general taxonomy for sketching and cataloguing of sketches and partly as a framing in a sketching process.

5 THE NEXT STEPS

The resulting taxonomy for sketching and cataloguing of sketches reflects the fact that both Erik Lyngé and the students, who have used his sketches as incentives to create new aesthetic forms, are interested in geometry and sciences. The 'vivacity/liveliness' category stands out from the other categories and indicates a sculpture theme which is quite broad. However, it is put into words by demonstrable characteristics which narrow the category to something to do with the 'tension in form and surface'. In a generalization of the taxonomy, dynamic forms and staccato movement would also belong to the same category.

Therefore, future works will, on the one hand, be aimed at case studies of other types of sketch collections in order to generalize and expand the taxonomic groupings and to create subdivisions of them. On the other hand, tests of the axonometric structure's strengths and weaknesses will serve as a means of creating order and direction in the project groups' sketching processes, as it can be measured whether organizing the groups' sketches according to the named categories leads to aesthetic statements or to the realization that there is a need for new inspiration. This tentative taxonomy clearly works for architecture and design students who receive teaching in geometry; but whether it could be used by others as a tool to form analogies is still to be examined.

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