INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
10 & 11 SEPTEMBER 2009, UNIVERSITY OF BRIGHTON, UK

BASIC SCULPTURING METHODS AS INNOVATORY INCENTIVES IN THE DEVELOPMENT OF AESTHETIC FORM CONCEPTS

Bente Dahl THOMSEN
Department of Architecture & Design, Aalborg University, Denmark

ABSTRACT
Many project teams grapple for a long time with developing ideas to the form concept because of a lack of methods to solve the many form problems they face in sketching. They also have difficulty in translating the project requirements for product proportions or volumes to an aesthetic form. It is therefore interesting to clarify the methods that could boost sketching and generate incentives to create new forms. Achieving a transformation of the leading feature to three-dimensional form early in the process promotes the form development considerably. The six methods we have identified from practice or developed have proved to be ideal for attacking many of the early form problems and they also generate incentives for new forms in the development process itself. The methods require only simple tools such as wood blocks, wire, paper and graphite leads. The article identifies the substance of the methods seen from a design perspective while clarifying what kind of issues they are particularly suited to solve. Innovation is not only promoted by the incentives produced by some of the methods, but also by the frottages created in the process.

Keywords: Aesthetic sculpturing, frottage, volume study, paper folding, organic form

1 INTRODUCTION

The objective of the study is to create a collection of methods that are well suited to resolve the form problems we meet during concept development. The blocking of an unclarified form problem through a lack of direction poses the initial problem, which we have studied with this practice based method clarification. The next problem we put into focus is how to achieve a rapid activation of space, which involves a materialisation of ideas in the leading feature with an opportunity to manipulate the relationships of the form elements. In this connection another problem arises: namely to get an overview of the sculptural mass available for the task. Must the massing of the form be resolved as a dominant element in a specific context, or must it disappear? Balancing of organic forms and choice of governing or firming lines, represent a form problem requiring particular methodological approaches. Finally, focus is put on the resilience of the form, shape contrasts, complementary convex - concave and the incorporation of fragmentation which can break the triviality of form.
Inspired by a very positive evaluation of a previous course in architectural design based on frottage technique in a lecture given by architect Svein Tønsager, we started to examine the features in the method. As a consequence of Tønsager's death, the course had been discontinued as had his unravelling of methodology. The technique is developed by the painter Max Ernst in 1925 [1] and Co Hulén [2] brings the technique to the architectural scene around 1948. In newly started project teams, we have observed that the method removes the restraint which people, who are not good at sketching, can demonstrate. Our experiments with translating a study of university students' aesthetic form creation conducted by psychologist Kristian Holt-Hansen [3] have resulted in the method: 'Methodological aesthetics sculpturing' which is good at achieving a rapid activation of space. During 15-30 minutes a group has the first option proposal. [4]
A study of the methods artists use in sculpturing revealed that a collaboration between the sculptor Niels Guttormsen and practicing architect Jens Bertelsen resulted in an approach to sculpturing they called 'Art as a model'[5]. Bertelsen was asked to teach our students the underlying methods. This resulted in us observing the method: 'Combinatorics with cubic blocks' which lends itself to fitting into context, while it helps to ensure the conceptual level against inappropriate detail.

An exhibition project on the Utzon family led us to a method for scaling the demands of the project programme on the product proportions, or volumes, to a tangible size. In this connection, a group of students comprising: Sanne Birk Vilsen, Tina Bredgaard, Niels Nydam Andersen, Thomas Flygenring and Thomas Lænner interviewed Kim Utzon on the working methods of his father, Jørn Utzon. The method 'Volume Study with Toy Bricks' builds on the additive principle, which accommodates the needs of the industrialized process for elements which can be added up to more or less complex devices. Architect Lise Juel Grønbjerg, Kim Utzon Architects, has later presented the approach to our students.
The last two methods we will touch on, were identified through a study of the methodical approach to sculpture and design of architect and artist Erik Lynge [6]. The method 'The three-dimensional outline wire' was constructed on the basis of interviews with associate professor Torben Získa, a student of Erik Lynge, and by studying photographs of some of the students of Lynge at work. Subsequently, our students have had much benefit from the method for sculpturing organic form issues as well as for supporting the representations of the spatial sketch. The incentive collection at Art Køge Sketch Collection and interviews with designer Andreas Nicolai Hansen has contributed to an emerging identification of the method: 'Folding from plan to form'. The method itself generates incentives to create new proposals to the form concept during explorations of the resilience of the folded forms, form contrast as complementary convex - concave, and the incorporation of fragmentation, which can break the triviality of the form. The mentioned methods have in the project work proved to be a very constructive contribution to solving the problems outlined. The method collection is based on the assumption that aesthetic form making has common methodological approaches across the creative disciplines in the sculpturing profession or, as Kristian Holt-Hansen's studies showed: people who create aesthetic forms share certain methodological approaches.

2 THE CONTENT OF THE SKETCHING METHODS

The basic components of the methods are listed below so that we subsequently can show how they contributed to get around the sculpturing problems. The individual methods have several variations which we have identified in the methods from practice: partly through interviews with people who have learned from the person who developed the method and partly from our own experiments with methods developed on the basis of psychological studies of people who create aesthetic forms.[3]

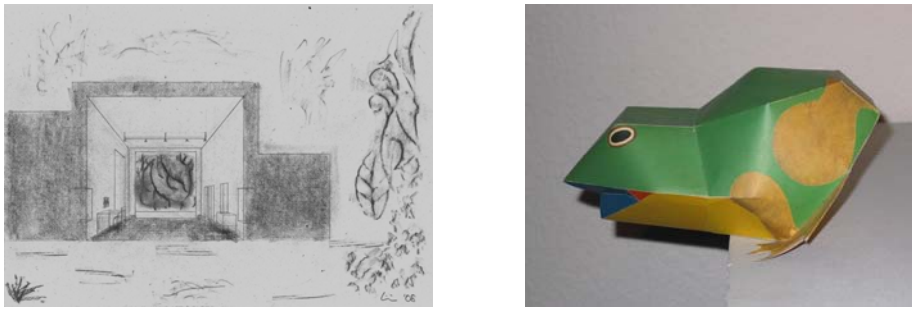

Figure 1. Frottage at an exhibition and a rain water drain fold by architect Mogens Koch

2.1 Frottage techniques:

Two different approaches are used: the planned, in which we draw up an outline for the motif in advance, and the intuitive, in which the motif is constructed from an edge or an arbitral place on the paper. In both cases the paper is placed on top of or by the object the texture of which we wish to rub. This can be anything ranging from a wall, gravestone, part of plant, wicker basket, boards, grid, fabric etc. Rub the texture off – move the paper to a new object – rub the texture or figure off and so on. The rubbing colour can be changed during the process. It is possible to draw lines on the contour of a figure if you want to bring it out. Cartridge paper, China paper or other strong paper are best suited. Therefore, figures and texture on objects with clear materiality are preferable. For the rubbing crayons, oil pastels**,** graphite leads are used. The colour is fixated by fixative. Alternatively, the frottage can be constructed as a collage from scraps of paper with rubbed texture or figures, which have been prearranged.

The members of the project group present their frottages, and then the group analyzes which moods the frottages reflect and which ideas the frottages offer for the leading feature [Fig. 1 to left]. The central concept is composed of the idea (theme) for the form concept, structure (structural system) and content (this can be understood as substance like plastics, glass, concrete, motor, axles and others) and a possible selection by joining principles, such as a cylindrical form element linking two disparate forms with a square cross section.

2.2 Methodical aesthetic sculpturing:

Media: A plate of, say, 20x20 cm, 7-9 wood blocks and instructions with a questionnaire [Fig. 2 to left]. Both plate size and the number of blocks may be tailored according to the project.
The first group used one of the procedures A to D while setting up 7 (9) wood blocks on plates, in a way which allowed the most beautiful arrangement of the blocks.
A: Work with the experience of forces, movement, rhythm or the like.
B: Work from your ideals, ideas and fantasies.
C: Work from method A + B.
D: Use a selected leading feature as the generating system.
The group gives the plate a title which can be connected with the figure immediately.

The block arrangement is swapped with another group, who analyzes the figure by making a sketch of it. Subsequently, the second group assesses the figure by answering the questions, which are grounded in Gottlib Alexander Baumgarten rules [7]. The questions are:

- Do you recognize a leading feature (a theme) in the setting up of blocks?
- Which characteristics does the leading feature contain?
- Does the block arrangement produce any known or unknown features?
- Does the arrangement contain anything amazing?
- Is the location of the individual blocks determined by the theme? _____. If no, please draw a ring around the blocks whose location is not determined by the theme, on your sketch.
- Does the block arrangement represent sub-themes? _____, If yes, which ones?
- Does the arrangement have anything in common with the arrangements on the other group plates? _____, If yes, how will you describe the characteristics of the shared feature?
- Which title would you think will clarify the characteristics of block arrangement?

The analysis is returned to the first group, who receives feedback on the strengths and weaknesses in its block arrangement.

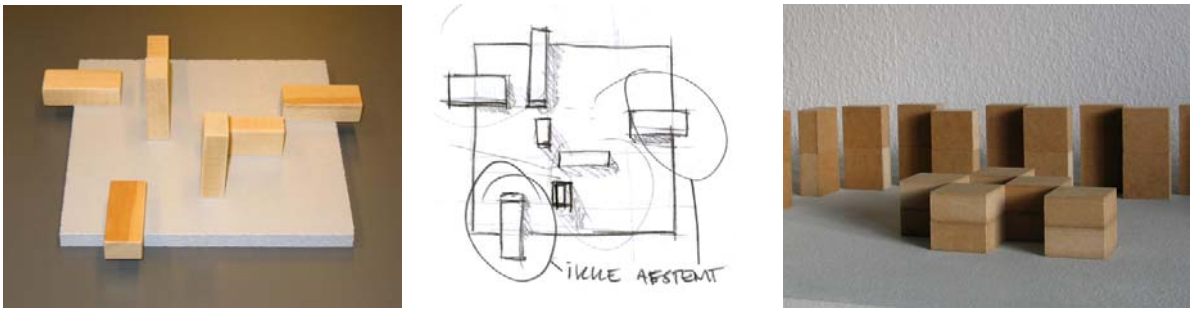

Figure 2. Block arrangement and a sketch of it. Block combination of half cubes.

2.3 Combinatorics with cubic blocks:

Initially a quantity of wood fibre sheet equilateral cubic blocks, double cubes or quarter cubes is produced which are going to be used as building modules. On the small scale the cubes represent 'building blocks'. An assembly is prepared according to a composition system which can be guided by coincidence or for example the rhythm in a piece of music [Fig. 2 to right].
The elevation, as well as the plan of the block assembly, is sketched so that it can be recreated. The outline, the space and the shadow formation are analyzed by drawing lines, showing respectively the outline and the spaces seen with eyes positioned at eye level, corresponding to a person standing in the selected scale. Moreover sketches are made of the shadow image in varying lighting. The cubes are shifted or presented in new combinations and the design process is repeated.

After 5-6 combinations have been tested, the sketches of the outline, space and shadow are hung up side by side. The outlines are assessed against or put directly into images of the place, where the product is going to be used. The project design specification should also be included in the selection base. As far as possible, the best partial solutions from other proposals are integrated into the combination of blocks chosen as the best, before a refinement of the block combination is carried out by intervening sketching rounds.

2.4 Volume Study with Toy Bricks:

In the method for studying the sculptural mass of the project, toy building bricks with attaching buds are chosen to represent a suitable building module and a similar number of bricks to form the desired volume are counted up. By doing so, the size of the mass to be handled becomes obvious. A toy brick with 2x2 buds might represent an area of 2.5 x 2.5 m^2 and a height of 1.5 m, depending on whether the final result is related to f.ex. seats or apartments.

Then the bricks are assembled, corresponding to the size of sculptural entities desired, representing seats or apartment volume. These are subsequently distributed or stacked on a floor area or building site in 'volume-units'. It may be necessary to include transitional elements, if these entities will not work together.

Every time a change is made in the set up of 'volume-units', the arrangement must be photographed from the top and from at least 2 angles [Fig. 3]. Often, the arrangement is photographed from four sides and from the diagonals, in order to assess the importance of the modifications for the emergence of sculptural effects and the interaction between the 'volume-units'. Following the stacking trials of a series the results are evaluated by comparing the photos. The proportional requirements of the project and the needs for compositions of 'volume-units' must be considered in assessing the final results of the volume study.

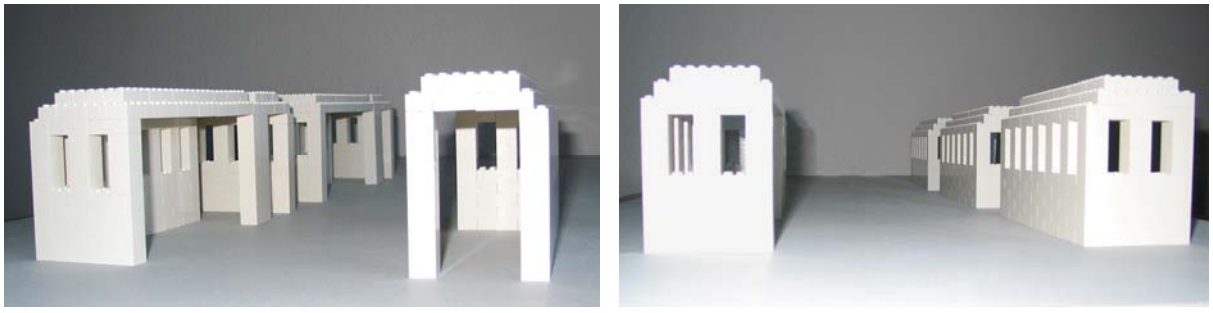

Figure 3. Toy Volume Study busterminal

2.5 The three-dimensional outline wire:

In this method, a 2 mm black iron wire (annealed wire) + reel with 0.5 mm wire and skewed bite, pinch bar or a flat bar with a tip are used.

1. Create a three-dimensional wireform by marking the outlines of a form in the space.
2. Use an arbitrary concept for the proposal, as point of reference.
3. Register the outcome by making axonometric drawings of the wire form. Imagine that the form is closed. Lines illustrating wires, which will be visible in the closed form, are drawn with 'thick full line' and invisible wires are drawn with 'thick short dash line'.
4. Remove a flat section of the wireform. Begin by marking two parallel plans that cut through the form of double wire. Cut the section free - take care that the section does not fall apart. 3 form elements have now been created. If necessary, reinforce the tie between the 'cut' wire and the form elements [Fig. 4].
5. The form elements are analysed by making drawings of them, as specified in item 2. Make a sketch of three new solution concepts for your project, based on the three form elements.
6. Try to balance the two form elements from the original wireform (without the section) into a whole. Keep these two form elements together in the cut surface and shift or turn them until a balanced whole has been created.

Evaluate continuously the arisen wire forms in relation to your demands of the form. Continue the development of the form, by cutting or adding form elements as described above. Get inspiration in

the forms generated by previous cuts. If necessary, repeat the process with the sections, which you think have the greatest potential.

Figure 4. Sketch of wireform, marking of cut lines and 3 form elements

2.6 Folding from plan to form:

The method aims at, seeing both constructive and organic laws by using observations of nature [Fig.1 to right]. As an example, conch shells constitute very special forms in nature which have both the easy movement of plants, the hardness of stone and the rhythm in the wind and breaking waves. In addition, to gather inspiration materials and place objects together so closely that a relation between the shapes of the objects emerges. You must reflect on the form relationships in different degrees of lighting and sense the materiality and gravity of the forms by taking objects into your hands, feel their weight, moving them around while observing the proportional expression that occur between the objects. The handling sharpens your feeling for both substance and form. Building on the resulting insights into form you generate forms (incentives) intuitively by folding the cardboard in a search for modular systems and for the solution to the form problem. With the zeal of a scientist, you penetrate deeper into the problems by combining incentives for new forms. By seeing forms taking shape and investigating the laws which make the limp piece of cardboard tighten up as a supple and sustainable bridge or a pillar, standing as an independent creature in all its strength.

3 THE INNOVATION EFFECT OF THE METHODS

Motivation provides desire and energy to be in the creative modus, which can trigger ideas for new forms; ideas can be further developed into a concept through sketching. A concept must be implemented as a physical form and be based on a new idea before we can talk about an innovation [8].

If the project team has only a vague idea or feeling for which direction the project must take, the production of the frottage brings something new and tangible into the process. The abstract character of the frottage offers several possible interpretations, which have been shown to contribute to the definition of the space of solution as well as to clarify the main ideas in project work

With 7 or more bricks and an instruction for how the group should address the problem of getting from the two-dimensional to the three-dimensional expression, all groups move quickly towards the figure, they find most beautiful. It is far from always that one of the ideas to be tested ends up giving the best expression, because playing with blocks offers new angles. At feedback sessions, in cases with block arrangements with weak leading features, others will often interpret different figurative expressions than the group itself, and hereby indicate new approaches for developing the form concept.

If the product is a photovoltaic plant or an animal-feed silo which takes up a lot of space, it is a puzzle to get the function and placing in the context to work out, so that such silos do not throw shadows on a greenhouse or such like. When clarifying these contextual issues, the 'Combinatorics of cubic blocks' method proved to be very effective.

We have observed that only part of the explanation of the efficiency of the method is related to the fact that the blocks are easy to move around and that the solutions are regularly related to context. Another part of the explanation is that it forces designers to consider the block arrangement at eye level and to focus on transparency.

'Volume Study with Toy Bricks' has a clear scale relationship with the final product proportions, which simplifies a comparison of the results of the volume study to the product. The small units are easy to put together in many different ways, but in principle one could assemble the wood blocks, with

a known scale, with double adhesive tape. The important thing is to keep the possibility of creating 'volume-units' with relief effect of the surfaces in order to assess the sculptural effect in depth.
Even though the organic form in its expression or in its structure is a simplification of something known, the proportions can easily get out of balance or lose their resilience when adjusting to function and to the demands of proportions that must be considered. 'The three-dimensional outline wire' method has proved to be useful, when solving this problem, as the wire can be stretched across the volume represented by toy bricks; a wire model is very easy to shape and adjust. Reduction of the form by cutting sections free will generate new elements, which may contain new solution proposals themselves. If it is difficult for the groups to interpret the open form, it will help some to make a partial indication of the surfaces of the form by means of wire mesh.
If the form concept in wire is folded into paper the form will be closed entirely or partially and thereby it will be uncovered if the surfaces of the form achieve tension. If not, a few attempts to incorporate the complementary convex - concave surface along the peripheral of a selected area, for example in the fold between the seat and the back of a chair. Among others engineer Cecil Balmond solved many problems using this folding method. [9]
Designer Andreas Nicolai Hansen often uses the 'Folding from plan to form' approach, when he designs furniture because paper and plywood have many similar characteristics.

4 THE IMPORTANCE OF SCULPTURING METHODS FOR A BETTER WORLD

A more beautiful world is a better world, as people feel better when surrounded by good design in a well proportioned space. In schools, it has even turned out that beautiful renovation and new furniture of a good design reduce the propensity to vandalism among the pupils, who previously damaged the old neglected furniture. Since 2001, all students in Denmark have had the right to a good mental, physical and aesthetic learning environment. The new thing about the law is that the aesthetic has now been legislated, and that it should be prioritize it in line with the physical and mental elements of training, because it has a positive impact on improving learning [10].

5 FUTURE WORKS

The 'folding from plan to form' method needs a sort of script to make it easier to use. Erik Lynge's demand to penetrate deeper into the problem, with the zeal of a scientist toward solutions, makes the method slow. It may be necessary to do so to create products at the level that Lynge mastered. A study aiming to get deeper into the content of Lynge's method is taking place at the present time. It is also our intention to investigate whether the approaches of other artists can help to develop the quality of aesthetic forms as well as a clarification of what 'beautiful' means.

REFERENCES

[1] Max Ernst Målningar, collage, frottage, teckningar, graftik, böcker, skulptuere 1917 – 1969, 1969 (Moderna Museets utsuällingskatalog nr. 82, Stockholm) pp. 13-14
[2] Nordgreen S. Co Hultén Drömmarur Bladens hander Frottgage 1983 (Kalejdoskop Stockholm)
[3] Holt Hansen, K. Formskaben 1971 (G E C Gad, Copenhagen) pp. 5-38
[4] Dahl Thomsen, B. Et redskab i formskaben 2005 (Projekt innovativ Didaktik, Aalborg Universitet)
[5] Guttormsen, N. and Bertelsen Kunst som model 2003 (Aristo Copenhagen) p. 58-99
[6] Hobolth N. red. Erik Lynge Fra plan til rum 1998 (Nordjyllands Kunstmuseum, Aalborg)
[7] Dahl Thomsen, B. and Munk, T. Transformation af Baumgartens æstetik til et redskab i værk-analysen og i formgivningen. 2006 (Arkitektur & Design, Aalborg Universitet)
[8] Hjerkinn Haug, S. Stigs bok om Kreativitet 2002 (Chr. Schibsteds Forlag A/S, Olso) pp.139-145
[9] Aksamija, A., Potrc, M., Pumhösl, F. and Wodiczko, K. Designs for the Real World 2002 (Generali Foundation, Wien) pp.87-94 pp. 218-228
[10] http://www.dcum.dk/neobuilder.20080124094415515000038949.html (2009-04-15)