THE DILEMMA – THE CREATION OF FORMS VIA DIGITAL OR MANUAL MODELS

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ABSTRACT
3D CAD sculpturing with subsequent printing or milling of physical models is becoming increasingly popular amongst university students and graduated designers. Thus this article raises the very pertinent question: If central parts of the process of form creation are solely based on 3D CAD sculpturing, what are the consequences for the result of the form creation? This question raises a new question: How do we set up a interpretation model for the registering of the characters that the digital and the manual process of form creations leave in the prototype? This question lays the ground for a discussion and the three week student project that took place February 5 – 26, 2008 in which 2nd years students could choose to design a computer mouse or a door handle.
The study revealed that digital process of form creation often results in more symmetrical and compound forms than manual process of form creation.

Keywords: Digital model, physical model, aesthetic values, design, point system.

1 INTRODUCTION

As far as possible you should try to avoid having an instrument between yourself and the object of observation or sensory perception. By touching the entire surface area of a physical object with your fingertips, you get a much deeper realisation than by mere study or registration of the same object via a medium [1]. Is this earlier notion of realisation still valid with the incorporation of digital three dimensional representations (CAD models)?
Digital models are both faster and cheaper to produce than a physical model made by a craftsman. Furthermore, it is possible to print or mill a physical form from a digital model quickly even though it is still relatively expensive. The materialization of the artefact's texture, mass and weighability (ponderability), that take place during the synthesis, is absent during the actual process of creation. Consequently, the complete knowledge about the form cannot be acknowledged until a digital representation has been printed or milled into a tangible model that our senses can respond to [2]. The craftsman like process of creation, on the other hand, presents a continuous opportunity for profound sensory perception of the form as well as its material surface. It is our claim that this difference in the opportunities for acknowledging the form during its creation is of crucial significance for the outcome, insofar that one does not conveniently switch between the two methods.

The interpretation of the impact of the creation process on aesthetical expression of the form may be based on expectations of which advantages the 3D CAD sculpturing and the manual sculpturing have respectively. Consequently, the interpretation must focus on differentiating advantages or rather characteristics left on the form by the process. Thus, we have chosen a pragmatic approach inspired by Peer Bundgård to answering the question [3].
In the university based design programmes which focus on the acquisition of theory, the preceding practical training in producing sculptured form and assessment of aesthetics is hardly prioritised at all. This study will not test whether the theoretical approach to design may replace the significant amount of the time that was previously devoted to absorption in the creation of forms.

2 MODEL FOR INTERPRETATION

As mentioned before, the model for interpretation is constituted of the expectations to the different characteristics seen in a craftsman like creation and in a creation made by CAD. This is presented in table 1. The set up is based on sculptor Erik Thommesen's uncovering of the sculptural problem [4], Grethe Ørskov's models for sculpture analysis [5] and our own experiences with CAD.

Table 1 Characteristics typical of manual and digital creation

	Manual characteristics		**Digital characteristics**
1	Proportion is perceived as being correct all around the artefact.	8	The surface is perfect (without repairs).
2	Rhythms and movements – are spread through the artefact – in three dimensions.	9	Dynamic ridges are frequently symmetrical.
3	The artefact is vivacious and expresses an inner energy. The curves swing in three dimensions and the surface is taut at convex /concave.	10	The artefact is often compound from form elements, or with a blob-like character [6] (bun dough).
4	The semiotics of product design-approach – is spread through the artefact – in three dimensions.	11	The semiotics of product design-approach – is spread through the artefact – in constituent elements.
5	Profiling (tightening lines) is often enhanced by convex - concave shifts.	12	Profiling – is often enhanced by convex – plane concave shift or impact between planes.
6	The colouring enhances profiling or proportions.	13	The colouring is uniform and matches the context.
7	Texture provides variation in material.	14	Texture with accurate reporting.

Points 1-4 deal with the form elements, points 6-7 deal with second degree features (4) and the last point deals with transition zones or jointing elements(5). At this point, the students have still not been taught semiotics of product design. However, the introductory presentation implies that the computer mouse ought to have a look that resembles that of a striped field mouse. Therefore, it is relevant to assess whether there is a difference in how well a possible semiotic meaning is articulated in the form.

3 THE EXPERIMENT

Before the project begins, the students choose whether they prefer to design a door handle or a computer mouse and they commit to using either a digital or manual process of creation.

The design specification is given in the presentation of the project and include requirements concerning: aesthetic values, form, operation, ergonomics, functionality, choice of material, manufacturing technology, adjustments to the lock/computer equipment, maintenance, wear and tear, patination etc. in order to obtain comparable results.

Requirements in terms of aesthetic values were as follows: The product must have a qualitative appearance that catches the attention of or makes an impression on passers-by (at least one distinctive quality that rouses people's attention). Furthermore, the door handle should emphasise the architecture of the house and add a sense of identity to the entrance as illustrated in *'The Danes' houses – as viewed from the street, narrow streets and roads'* [7]. As for the computer mouse, the aesthetic value must add to the mouse a distinctive feature by expressing a notion of something organic, based on the behaviour of the striped field mouse as described by Kristian Holt-Hansen [8]. Alternatively, the anatomy of the striped field mouse may be used to design the internal structure, similar to the manner in which Thommesen uses the human anatomy as an internal structure in his non-figurative sculptures [4, p. 56]

Requirements in terms of the form were as follows: A clear leading feature i.e. the product idea (theme) and the product structure (the principle of the project's coherence as a whole) must be evident. Furthermore, the content/meaning of the form elements and the principles of the joints must be apparent and pertain to the theme.

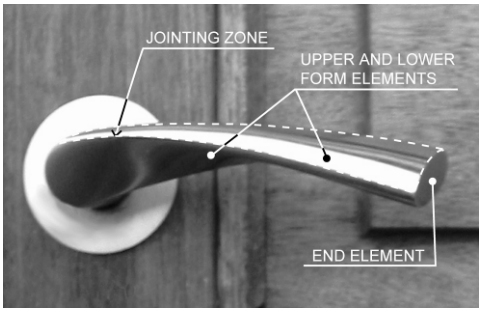

Figure 1 Form elements of a handle

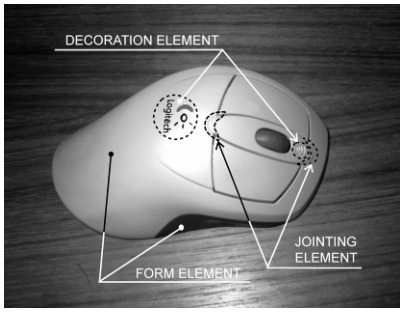

Figure 2 Form elements of a mouse

The students were encouraged to work on the basis of a chosen leading feature, partly in order to make the process transparent and partly to simplify their description of the design. The benefits when using the leading feature as the basis for the design process are explained in 'A Tool in Designing'[9]. In addition, students were encouraged to use form elements in the creation of the form and for characterisation of the expression of the form Grethe Ørskov's models for sculpture analysis [5] and Erik Thommesen's work method were uses as inspiration. During the refinement or detailing of the design, the students were encouraged to experiment by varying the proportions of the form elements. Suggestions for form elements are exemplified in figures 1 and 2.

4 CONDITIONS FOR EXPERIMENT

In order to ensure that all the students are introduced to the same theories, they are expected to attend the same courses - “Model Process and Materials” and “Ergonomics, Construction and Aesthetics in Industrial Products”, each consisting of five lessons. However, two lessons on CAD and two on manual creation of forms turn out to be beneficial to the students who chose to work with the digital or the manual process of form, respectively. The supervisors take turns working with the group of students who work with digital sculpturing and the group who work manual sculpturing. The total number of students is 44 and divided as follows: 13 students choose to make door handles manually while 12 students choose to make the handles digitally. Ten students make computer mice manually while eight make them digitally.

For the projects, we established a number of assessment criteria suitable for determining the aesthetic and ergonomic qualities of the design, thus ensuring that the students know with which criteria they will be assessed during the examination. The supervisors and students’ knowledge of the assessment criteria also help to ensure a standardisation of the results.

The assessment criteria used at the examination were for example:

The submitted product (or the model) must possess substantial aesthetic qualities, which the students should be able to be described in words.

2 points = the product has obtained clear fundamental qualities that are associated with the context, a good preparation, etc, and the student has been able to clarify the product’s quality in writing.

3 points = in addition to the product’s fundamental qualities, there are distinct qualities in terms of the product’s appearance, adding to the product an identity.

4 points = the product has obtained a clear appearance that catches the attention of, or makes a particularly positive impression on, passers-by.

The sculpturing of the product:

2 points = the leading feature is clearly materialized and the student has identified the form elements.

3 points = in addition, the organisation of the form elements and the principles of joints have been accounted for.

4 points = the student has further discussed second degree features both in terms of the form of the material and a distinct description of the idiom.

If there is no preparation of the object with regard to aesthetics and form, 0 points will be given. Similarly, 1 point is given for an unacceptably poor preparation.

The student is assessed in a similar manner in the following categories:

Explanation of the choice of material and manufacturing technology; ergonomics; construction as well as a presentation of the suggested solution.

These types of workshops have their limitations in terms of printing and milling capacities and also space. Therefore unintended queues and waiting time may occur. Attendance is not compulsory, and everyone is expected to submit an expanded drawing of the product. They are free to choose whether they want to do the drawing manually or by computer, since it is the design process alone that is the object of the investigation. Due to these conditions, we have to trust that the students carry out the project as agreed since we are unable to keep check.

5 RESULTS

This study show that the manual respectively the digital process of form creation had the expected characteristics with exception of the manually created door handle in which case the result was vague, as it appears from table 2.

Table 2 The result of the study

Digital process:	**Predominant digital characters:**
Computer mice	7 out of 8
Door handles	8 out of 10
Manuel process:	**Predominant manual characters:**
Computer mice	11 out of 12
Door handles	7 out of 13

The reason behind the unclear result of the manual created door handles is because of characteristic number 8. This group created their castings models in sheets of MDF and were very thorough in their finishing treatment of the object as opposed to the digital group who created their casting models in foam due to problems with milling in MDF sheets.

The characteristics which typically distinguish the digitally created products were number 9 and 10 in Table 1, while number 6 and 14 were not characteristics seen in door handles at all.

The characteristics which typically distinguish the manual created products were number 6 and 5, where number 5 apply only to door handles. Only one door handle showed characteristic no 14. Since texture include all sort of possible micro patterns of material on or in the surface, we had expected that this second degree feature would be used to improve the safety grip and to indicate functionality, but only the computer mouse groups took this into account. It is unclear whether the door handles groups deliberately used the reflection as a means to creating variation, but we had regarded reflection as a property of the material, since this second degree feature is a property in the material just as the transparency of plaster surface.

To their examination the students should bring five models and one prototype. The purpose of this was to teach them the value of using models in the process of form creation and to improve their technique of model creation. We acknowledge that this requirement probably has contributed to the vague result.

6 FUTURE WORK

This is our first experiment in many aspects. Requesting the students to develop at product using either digital or manual sculpturing, and using the interpretation model. The interpretation model was not developed on the basis of experience from the assessment of door handles and computer mice but rather on the experience from the assessment of other design products. Therefore, a repetition of this experiment, where the special characteristics of sand casting and thermo forming are taken into consideration, will probably clarify the result. Therefore, we will study the results in order to check whether the model has taken into account all the relevant differences between the two methods of production. We will present the result of this study at the E&PDE08 conference and invite to a discussion. In view of the aforementioned conditions, an answer to the two raised questions seems to be implied. We will continue

to repeat the experiment in connection with future projects in order to harvest more results.
In future work we will also look for an answer to the question: At what stage(s) of the process of creation is the practical training (the process of craftsman like creation) particularly significant for the realisation process? In this connection, the process will be divided into 1) the articulation of aesthetic values in the leading feature, 2) the materialisation of the leading feature, and 3) the detailing of the form/product.

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