

CAPTURING MOVEMENTS IN A 3D INTERACTIVE DYNAMIC SYSTEM

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This paper discuss 3d digital dynamic systems as an interactive design tool for 3d physical form as an approach to the design process useful for the ceramic artist and related fields. The paper is about an experiment based on the cooperation between the programmer and designer Marcin Ignac, and the author of this paper, a ceramic artist. The experiment explores interactive 3d digital drawing, which responds visually to the movement of the hand in a virtual 3d space using a wii remote as a device. The captured movement forms the basis for a 3D physical model produced by the use of Rapid Prototyping, which express the captured movement in physical form.

INTRODUCTION

This paper reflects an ongoing Ph.D. project titled "Experimental use of digital media within the field of ceramics", which comprises own experimental design practice by the author. The paper is presenting one of these experiments.

The overall research question is about how 3d designing by digital media can take advantage of the approach a ceramic artist has to designing. The approach to

designing is in this case based on the interaction between designer and material as a generative component. In the field of ceramics this generative potential is found in materials such as clay and plaster etc. and laws of physics. Such an approach is not defined by a field such as ceramics, but is rather an approach to the design process as such, which is found in related fields such as textile design, furniture design etc. The aim of the research is to explore 3d digital media as a tool, which makes it possible to invent and design such generative potentials. This can enable such a designer to focus on a phenomenon as such without being bound to a material and the laws of physics. This paper will focus on how the designer is supported to work experimentally, exploring themes such as movement, transience and metamorphosis by the use of digital media.

The paper is about an experiment based on the cooperation between the programmer and designer Marcin Ignac (<http://www.vorg.pl/>), and the author of this paper, a ceramic artist. The experiment explores interactive 3d digital drawing software, which responds visually to the movement of the hand in a virtual 3d space using a wii remote as a device.

The project focuses on 3d design, more specifically 3d digital graphics and Rapid Prototyping (RP).

Furthermore the study is focussing in the experimental stage of sketching - more precisely the stage, when form appears as physical form. In that sense the project does not operate with practical functional solutions and user centred problem identification.

METHOD

In this research it is relevant to use the term "research through design" (Frayling 1993), which for our purpose can be defined as an experimental design practice that is part of the design research and contributes empirical data. The method is explorative and experimental, which in this study means that the research questions and empirical series of experiments are produced and developed in the process of research. This approach can be seen as a "reflection in practice" similar to Schön ideas (Schön 1983). The method begins with a definition of a frame for carrying out experiments, which is defined by the overall research question. This approach is inspired by Binder and Redström's notion of 'exemplary design research':

With the notion of "exemplary design research driven by programs, experiments and interventions", we refer to research based on the explicit formulation of design programs that act as a frame and foundation for carrying out series of design experiments and interventions. It is 'exemplary' in the sense that it enables critical dissemination primarily by creating examples of what could be done and how, i.e. examples that both express the possibilities of the design program as well as more general suggestions about a (change to) design practice. (Binder and Redström 2006)

The intention with this paper is to give an insight into one of these experiments in this frame and the potential it may exhibit.

ON THE PROPERTIES OF CLAY

The role of the material and the approach to the design process can be very different in the field of ceramics. In this experiment the material is the pivotal point for the design process, which means the material itself generates form in interplay with the designer. An example of such an approach is the design by the Danish ceramist Anne Tophøj (figure 3).

The pattern of the edges at the plates has appeared by centrifuging fluid porcelain. It has been possible to intervene and control the way the dynamic pattern emerged based on parameters such as changing speed over time. Thus the design has appeared in interplay between the property of clay and the idea using centrifuged porcelain to design a pattern by Anne Tophøj (2009). This interplay in the design process can for this purpose be named *material driven form finding*.

The pattern of the edge is based on the basic structure of liquid clay, which can appear in a vast number of unpredictable and surprising versions depending on the values assigned to the parameters.



Figure 3

Sanford Kvinter (2002) describes a dynamic and uncertain process that links a virtual component to an actual one. The actual component expresses a variation of the virtual component. To exemplify such a relationship Sanford Kvinter refers to the Kymatic images by Hans Jenny. These images are generated by sinus tones emitted across steel plates covered by a mixture of sand and superfine lycopodium powder. The mixture is transported by the sinus tones into a pattern. The sinus tones and the steel plates make up the virtual component and the mixture makes up the actual component.

In a similar way the originality of the design by Anne Tophøj can be described as a process in two levels, forming a whole. Firstly to discover and identify a potential of a material, in this example the dynamic potential of the liquid porcelain to create patterns when centrifuged – this can be named *first level of material driven form finding*, and secondly to transform and actualize this potential within the framework established in a number of versions –this can be named *second level of material driven form finding*.

A potential of *material driven form finding* as described above is not based on predictability, but rather on unpredictable results generated by interventions in a dynamic potential in a material. This is not an approach which is specified for a particular material, but is rather a design methodology and approach that can be transferred to other fields. It is by this approach to the design process - material as a generative and responding component - that this research explores the digital media in relation to phenomena such as movement and metamorphosis.

A 3D DIGITAL INTERACTIVE DESIGN TOOL

The example by Anne Tophøj showed a need for interactive software. This led the research to other artists and designers experimenting with motion and interactive systems. Such an example is *Untitled 5* by the American-based artist Camilla Utterback, who has designed an interactive system, which can be explored by the audience, *Figure 7*.

Untitled 5 is the fifth interactive installation in the External Measures Series, which Utterback has been developing since 2001. The goal of these works is to create an aesthetic system which responds fluidly and intriguingly to physical movement in the exhibit space. The installations respond to their environment via input from an overhead video camera. Custom video tracking and drawing software outputs a changing wall projection in response to the activities in the space. The existence, positions, and behaviours of various parts of the projected image depend entirely on people's presence and movement in the exhibit area. (Camille Utterback 2004)

Another example is the Swedish based design group Front using Motion Capture, *Figure 8*.

Motion Capture is a technique that translates motions into 3D-files. Motion capture is mostly used for animations in movies and computer games. Front have used the technique to simply record the tip of a pen when they draw pieces of furniture in the air. (Front 2006)



Figure 7

The combination of operating in three dimensions, while being able to interact with a dynamic and efficient generating system formed the basis for an experiment and the notion of a 3d digital interactive design tool.

This was executed in cooperation with the programmer and designer Marcin Ignac. The experiment made use of the programming language *Processing* and a *wii* remote as a device to capture the 3d motions. By the *wii* remote the movement of the hand is tracked in a 3d virtual space, *Figure 9*.



Figure 8



Figure 9

The dynamic and generative system is defined by emerging 3d geometries which respond to speed. The size of geometry and the distance between the geometries reflects the speed of the movement of the hand with the *wii* remote, see *figure 10*. Furthermore the emerged geometries can either increase or decrease and be affected by the following movements of the hand by being repelled or attracted. The emerged geometries provide a trace of the movement in the interactive dynamic system, which may be captured at any time. The captured movement forms the basis for a 3D physical model produced by the use of Rapid Prototyping, *figure 11*, which express the captured movement in physical form.

The cooperation about the 3d digital interactive design tool was a constructive and continuous dialogue between the programmer and the designer developing the dynamic system. This development occurred in an interaction with actualized 3d artefacts to reflect on and improve the potential of the dynamic system. The experiment constitutes *material driven form*

finding, and a parallel to Anne Tophøj's approach can be drawn. The development of the designed dynamic system and Anne Tophøj's "discovery" of the potential of the liquid material are both examples of what was termed *first level material driven form finding* and the captured movements in the dynamic system expressed in physical form and Anne Tophøj's patterns of the edges at the plates are both examples of what was termed *second level material driven form finding*.

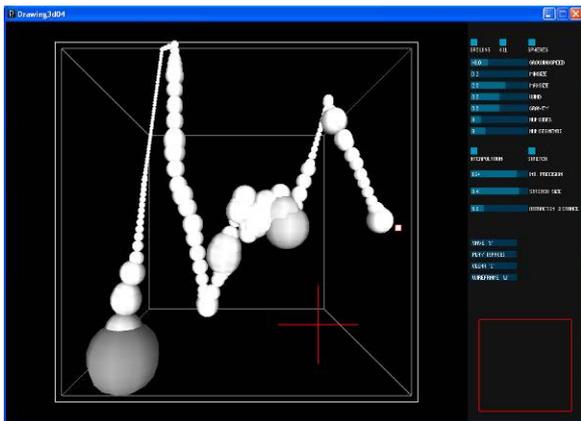


figure 10

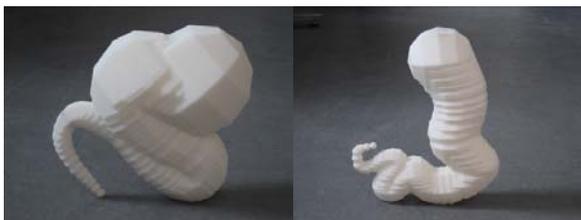


figure 11

CONCLUSION

This paper has described an approach to the design process named *material driven form finding* practised in the field of ceramics and related fields. This approach is characterized by two levels; a *first level* which is to identify a dynamic and generative potential in a material, and a *second level* which is to transform and actualize this potential in a representative number of artefacts by interacting with the generative potential in the material.

This approach was explored in an experiment using 3d digital media in collaboration with the programmer and designer Marcin Ignac. The experiment was argued to be similar in nature to *material driven form finding*. It is obvious in an approach such as *material driven form finding* that creative thinking relies on the condition of the form finding, that is *first level material driven form findings*, rather than the particular artefact.

In the field of ceramics, the ceramicist is used to identify such generative potentials to explore specifically in the ceramic material. It requires a thorough knowledge and critical awareness of the material to identify such a generative system and subsequently to transform and realize it in a particular context.

In the experiment using digital media the constellation of a programmer and designer was found constructive. The programmer is the specialist in the "material" that is programming and the designer is the specialist within the context of which the digital material should be transformed and developed. The experiment showed a great potential not only to identify, but rather invent and design generative and responding systems to explore in the *first level material driven form finding*. This enabled an exploration which was not bound to a material and by laws of physics, but rather explored a phenomena as such.

The experiment was successful, but limited to a visual responding system and asks for further exploration. Generative and responding systems for 3d form embedding tactility as well could be a topic relevant to explore in an interdisciplinary collaboration with designers and programmers.

REFERENCES

- Binder, T. and J. Redström (2006). Exemplary Design Research. Wonderground conference, Lissabon, Portugal, 2006.
- Camille Utterback (2004). Retrieved 2009-2-12, from <http://www.camilleutterback.com>
- Frayling, C. (1993). "Research in Art and Design." Royal College of Art Research Papers 1(1): 1-5.
- Front (2006). Retrieved 2009-2-12, from http://www.frontdesign.se/newsupdate_JAPAN_TOKYO%20WONDER%20SITE_02.htm
- Ignac, M. (2009). "retrieved March 1, 2009 <http://www.vorg.pl/>)."
- Kwinter, Sanford (2002) Architectures of Time: Toward a Theory of the Event in Modernist Culture. MIT Press.
- Schön, D. (1983). The Reflective Practitioner. How Professionals Think in Action. New York, Basic Books.
- Tophøj, A. (2009). Personal communication March 1, 2009.