Informed Material

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Abstract: *Next to the possibilities of digital form-finding strategies, parametric design and computational visualization techniques, which lead to an increasing virtualization of our society - rapid technologies allow today for the direct translation of the digital model into the physical world. As a result of this process the experience of digital realities, driven by virtual environment gets an interesting shift back to the physical world. Against this background the paper points out that it is a question of design to define contemporary and intended matters, processes and strategies of interaction, in other words: to inform thedesign.*

Palabras clave: Rapid Prototyping; Materialization; Perception; Digital Design Tools; Human-Centered Design

Introduction

The generative production techniques are part of our reality and define new qualities in architecture and design. They offer the possibility to adapt the products, objects and spaces that surround us to our individual needs – an ostensive paradisiacal condition(*cf.Kolarevic 2005; Hemmerling/Tiggemann 2011*). Since we have these means and methods what are we going to produce - even more products in less time to fit our constantly changing demands? As soon as a product reaches the market it is already outdated and the value of a single product decreases more and more until it looses its significance completely. We have to find criteria for an evolutionary process that allows for the creation of spatial design with intersubjective values. The information society has displaced the product society. In this sense experience, adventure and knowledge - thus information - replaces the significance of the object itself. In addition the generative technologies bring up the questions whether this new paradigm - as part of our accelerating society – offers options for better products or will it even change our cultural understanding of products(*cf. Kwinter 1993)*? Already the wording - Rapid Prototyping - implies an acceleration of production processes using these technologies, which goes in line with a global celerity of time in the digital age.

Computation provides today the basis for mass-customization - the producing of goods and services to meet individual customer's needs with near mass production efficiency. At its core is a tremendous increase in variety and customization without a corresponding increase in costs. The variation within the design and production processes generates a new freedom and different demands at the same time. Next to the possibilities of individualized manufacturing we can observe a shift from a result to process-oriented design as well as a change of design strategies from top-down to bottom-up.An increasing number of consumer products can be expected from the development described above and globalization even accelerates the distribution of these new products. Within this mass of products the significance becomes the crucial factor for the perception, acceptance and success of a product. The rest remains useless, indifferent and irrelevant, but will exist in a huge quantity - materialized and physical. The significance of a product can as well be described as the value for the user and for society in general. This brings us back to the position of the designer and his responsibility for design. The generative technologies support an individualized mass-customization, which basically places everybody in the position of the designer and the producer at the same time. The personal fabricator offers a generic rather than a specific production method, so everything seems possible. The design itself is on the other hand strongly connected to the possibilities of handling the 3D-modeling software. Even though these technologies are fascinating for architects and designers - because they incorporate new possibilities and results - it's obvious that the pure materialization of digital designs will not result coactively in significant products and spaces. The way to experience the potentials and limits of new methods is often driven by an experimental approach rather than a predefined strategy. Try and error as well as excessive use and interpretation are part of this approach. It's absolutely legitimate – if not necessary - to operate like this, especially in architecture and design, in order to break new grounds. But after a period of several years of experience with rapid technologies it is time for a redefinition of the

goals. The materialized object, as goal by its own is not enough, even if the process and the results are promising and intriguing.

Materializing information vs. informing material

It's not the production process that defines the design; it's the design that determines the production. US-American architect NeriOxman emphasizes this shift of perspective, when she states: "Shape is cheaper than material. And in design this was never the case". Materialization becomes the key-issue of the design process, when we talk about the translation from the virtual to the digital. Material, in this sense, can be interpreted merely as any physical entity, which corresponds and reacts with its environment. But is it enough to say: form follows material? How can we materialize new products and contemporary spaces with the given means and methods? And what are the consequences of an apparently limitless freedom of production against the background of sustainability as well as social and environmental responsibility?

There is a significant difference between materializing information on the one hand, which basically translates vectors and voxels into physical entities – mainly by the means of synthetic materials, and on the other hand informing material by adding new aspects and applications to the material through computational design. The latter approach is based on a deeper understanding of material properties and generates an added value through digital fabrication technologies (*cf. Gramazio/Kohler 2007*).

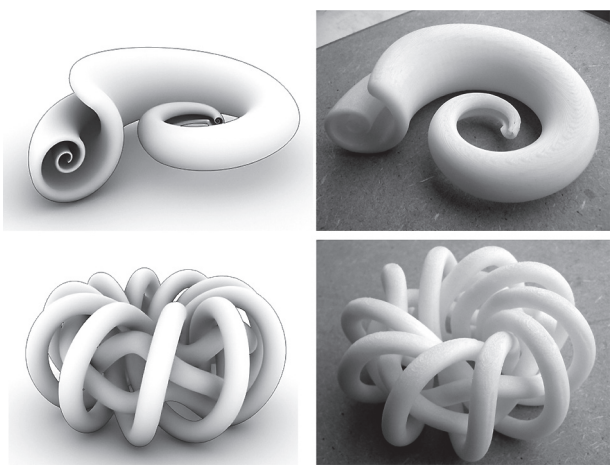

Fig. 1.Materializing information. Translation of digital design models through Rapid Protoytping technologies (examples from the project Printables at the HochschuleOstwestfalen-Lippe by Matthias Kemper and JakobHeining).

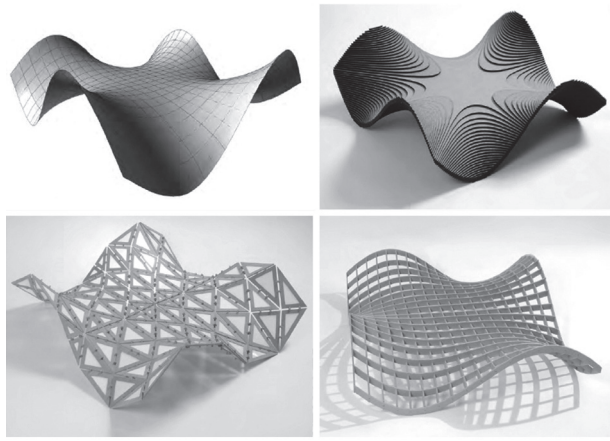

Fig. 2. Informing material. Variations of digital fabrication methods-based on a gliding plane by Frank Püchner at the HochschuleOstwestfalen-Lippe.

Even though informing material through computational techniques offers significant efficiencyand affordance for an ecological and economical design that fits the individual needs of a design problem, the intersubjective relation between the object or space and the user as well as the interpersonal acceptance is not yet incorporated in this approach.The media philosopher VilémFlusser emphasizes this lack of meaning, when he describes the shift of values from the object to the information, which is transported by the object. Shape and material are nothing without meaning. The Swiss sociologist Lucius Burckhardt postulates a similar approach when he says: "design is invisible". The postulate of this apparent paradox aims at the added value of design, which goes beyond our sensual perception. It rather defines an intersubjective impact and function of the designed object. This brings us back to the question of the designer's responsibility. Burckhardt established already in the 1990s his "normative criteria" to define social and interpersonal as well as ecological and economical values for design. Against the background of globalization and sustainability these definitions become relevant and active again.

PerceptionLab

This being the situation the research platform *PerceptionLab* at the *HochschuleOstwestfalen-Lippe*, University of Applied Sciences in Detmold tries to identify parameters that define the intersubjective relation between user and space. Within this human centered approach the research focuses on the analysis of spatial atmospheres and conditions in real and virtual environments.

Since there are numerous parameters to describe atmosphere – such as proportions, material, light ... – and so many different ways to perceive such a complex subject, atmospheric design derives generally by subjective intuition and experience – but rarely based on objective parameters and scientific knowledge.
The *PerceptionLab* tries to fill this gap between subjectivity and objectivity by measuring and evaluating impacts of spaces on wellbeing and quality of life. Through the participation of various fields of study from the areas of design, planning and visualization, and through the additional integration of external experts from the areas of psychology and scenography, the complex of issues is examined from a holistic perspective.The purpose of this laboratory for the observation, analysis and assessment of human perception in the spatial and medial context is to develop empirically ascertained knowledge in connection with concrete experiences from planning practice into an application-oriented toolkit for design and planning. Furthermore the research tries to develop design tools based on the scientific experiments and results that could be implemented as intersubjective parameters into the design process.
Dynamic, spatial and user-related facts and interactions in the areas of living and working, in communications and experience spaces, in the areas of care, therapy and services, and at places of learning are concretely displayed and examined for their effect and mode of action. That permits developments to be optimized and accelerated; weak points and discrepancies become visible. The impact of geometry, material, light, movement, etc. on spatial perception is researched by significant, clear questions, which focus on one aspect of perception at a time (*cf. Hemmerling 2008*). Since the PerceptionLab is a cooperative platform of the departments architecture and interior design as well as media production a wide range of human perceptions levels – visual, auditory, olfactory, gustatory and kinesthetic – can be investigated. The research in this field is conducted by using the following tools and instruments to measure the impact of space:
- Space Laboratory: Realization of design concepts as physical Mock-Ups in scale 1:1.
- Powerwall: Virtual 3D-scenarios based on stereoscopic projections.
- Eye-Tracking System: Analysis and evaluation of the visual perception.
- Biofeedback-System: Survey of physiological data.
- Questionnaires: Analysis and testing of conditions.
- Light Laboratory: Analysis and evaluation of lightning-concepts.
- Material Laboratory: Analysis and evaluation of material properties.
- Media Laboratory: Behavioranalysis based on motion capturing.

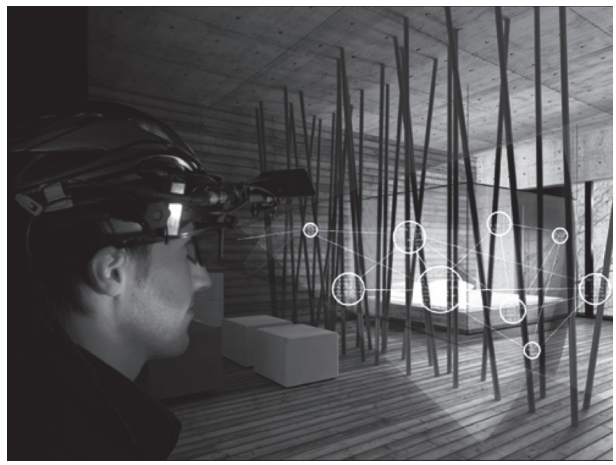

Fig. 3. Research set-up in the PercpetionLab, using the eye-tracking system and the Powerwall.

In the development of objects, spaces and medial environments from the design to execution, various disciplines are involved in the planning process. With the *PerceptionLab*, this necessity for interdisciplinary work is to be expanded with regard to research and teaching. To evaluate and optimize a solution for a room or a building scientifically, methods of testing with prototype models or simulations are often necessary. Thus, the Perception Lab works interdisciplinary, concentrating and using the knowledge from the different fields. On the other hand, various areas of the University use the laboratory, and profit from its facilities. The facilities and services of the laboratory can also be made available to outside institutions for test series, simulations and investigations.

Conclusion and Outlook

The use of digital design tools and fabrication methods offer new possibilities for the development of significant and meaningful objects and spaces. In order to achieve this goal the development from the digital to physical has to been extended towards the integration of intersubjective aspects of the design. A user-orientated approach that takes the perception, interaction, communication and use into account would consequently result in an augmented culture of architecture and design. Against this background the human-centered research in the *PerceptionLab* continues in defining parameters

on the level of perception that have an influence on the well-being and acceptance of objects and spaces.

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