

FROMFOAMTOFORM* DIGITAL STONES

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ABSTRACT

This paper documents a one-week workshop at the Institute of Architecture and Media with the topic of “Digital Real Stones as Architecture”. The workshop was completed with an exhibition in the HDA (Haus der Architektur Graz), which was arranged in June 2005. Real stones and their digital counterparts were exhibited, which were the results of individual processes of transformation by means of 3D-scanners, laser-cutters, motion tracking and 3D printers. Like sculptors, the participants worked (digitally) on their stone geometries in order to finally reach a “real” object again: digital stones that can be touched. In a series of reinterpretations of architectural meanings the participants examined the translation of three-dimensional design from virtual to tangible objects and vicar verse, constructing unpredictable versions of the same thing. The workshop implemented a collaboration between two course subjects: Sculpting Motion and Interdisciplinary Media Projects. Interdisciplinary Media Projects focus on the development of convergent media with the outlook on future innovative tendencies. Laboratory working between analogue and digital media is relevant in architectural processes, in order to realize poly-media products. Sculpting Motion implies a testing ground for new formal vocabularies in digital space, dealing with issues of perception and the design of movement and form-processes. Application of advanced animation and simulation methods in building virtual worlds is introduced. The main focus is not so much on geometric formal criteria, but on investigation of human perception. The main vision for this collaboration was to explore the human perception during creation and reinterpretation of an architectural design process using a variety of digital and physical media and their upcoming deliberately induced errors during the interchanging between them. With the partially wilful misinterpretation from a virtual to a real model, shape and design are translated in such a way that they fit into new media’s characteristic qualities. The translations and transformations from the real stones were achieved with 3Dscanners, Animation software, motion tracking systems, Laser cutters and 3Dprinters. The outcome can be labelled as “digital real stones that can be touched”. The following paper discusses different conditions of real and digital stone models and shows the resulting exhibition in the “Haus der Architektur Graz”, which was arranged in June 2005.

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1. INTRODUCTION



FROMFOAMTOFORM* DIGITAL STONES, June 2005 (picture: digitalstones_01.tif)

This paper documents a one-week workshop at the Institute of Architecture and Media with the topic of “Digital Real Stones as Architecture”. The workshop was completed with an exhibition in the HDA (Haus der Architektur Graz), which was arranged in June 2005. Therefore, we want to discuss different upcoming conditions of the "real" and the "digital" with their evident and hidden connections.

One of the major topics of the “GameSetandMatchII-Conference” results from the close examination of relevant trends within the digital-controlled, or respectively, digital-developed architectural production and its inherent potential through experimental and poly-medial design processes. Due to permanent electronic networking and the incorporation of digital media technologies into both research and practice, the boundaries of conventional work processes blur and make it possible that new trans-medial fields unfold. In regard to human perception processes, these new conditions make varied and emergent (Ch. Jencks) insights possible. The conference’s subtitle “SET:GEOMETRY++” addresses the subject area of complex geometrical form as well as its production. Today, computer-assisted processes of development play a significant role in the development and production of architecture.

Due to the connection of digital processes of development and digital processes of production, it is not only possible to print out precise models but also to examine them within real environments.

Two years ago, the Institute of Architecture and Media started a “Digital Studio”, in which 3D-printers and 2D-laser cutters enable the transformation of 2D/3D data into haptic models. The combination of Rapid Prototyping, or respectively, Reverse Engineering with trans-medial and process-oriented design experiments opens up a valuable playground for architecture. The workshop entitled “FromFoamToForm” lies within this field of experimentation.

2. MEDIA-BASED HYBRIDISATION WITHIN THE DESIGN PROCESS

Since the 1990s, we have been fascinated by film productions using digital animation. In the past few years, however, the popularity of digital media influenced the cinematic aesthetic tremendously (~Pixar Studio), culminating in the exhaustion of the field. Today, digital techniques are no longer used exclusively as tools to imitate reality and thus, redefine cinema as such from the inside out.

Similarly, in architecture it is the combination of analogue and digital media which enable the design team to develop a multitude of different versions rather than only variants of one task.

In cases where the skill of imagination is fading, the feedback of computerized simulation can facilitate both assessment and practical work. During the workshop, digital as well as physical media had been used sequentially or parallel, which allowed a careful investigation of the development, or respectively, the reinterpretation of design-processes. Within real and virtual workspaces and through the use of different design tools, the students had the opportunity to study their perception processes, their understanding of space, and the modification of spatial structures. The intermediate steps and reinterpretations of a concept were discussed in regard to its haptic and virtual quality and vicar versa. According to Becker and Tessmann, it is the cyclic response between both worlds, which produces coherent design models. The specified assessment criteria of spatial compositions are descriptiveness, reproducibility, spatial quality and interpretability in the future; “The Production of the Alien” (M. Novak) being the main emphasis here.

On the one hand, virtual workspaces facilitate decision making, on the other hand, they require real models for comprehension. Hence, the challenge lies not only in the constant interplay between these two media-based environments but also in the detection of suitable interfaces in order to do both digitalize real complexity and grasp digital quality.

Numerous architects and artists, such as Gehry, dECOi and Maeda, work somehow with real and digital models. Digital technologies do not only link us to history (B. Cache) but make an intensive study of complexities possible (W. Mitchell). During the design of F. O. Gehry’s Guggenheim Museums, it was models made of wood and cardboard that have been digitalized. These computer-generated 3D models have been used for further spatial studies within virtual workspaces. During the process of reinterpretation, the information has to be readapted to the media.

It appears that a multidimensional interaction between different types of media within a process chain has the benefit of ascribing special features and opportunities to every step of transformation. In doing so, direct tactility is retained. If these features affect the conceptual advancement, a constant interaction between the media will increase the possibilities of interpretation. In his study “Understanding Media“ McLuhan deals with the significance of the hybrid, hypothesizing that “the crossings or hybridizations of the media release great new force and energy as by fission or fusion”. At the same time, these crossings mark periods of transition, as new media constantly changes the functioning of old media. According to McLuhan, such periods of transition are of particular interest, as hybridization affords the opportunity to recognize structural components and features of the media. An integrated process of media-based hybridisation does not only entail an increase in efficiency but also an increase in diversified architectural design concepts.

The main intention of this experimental workshop was to figure out how the participants would expand their design processes using different types of media and how they would communicate their ideas within the context of hybridisation. During the workshop, the process chain has been recorded via a CSCW interface program. Thus, the projects became useful also for people not involved in the workshop. Each participant gained different experiences while working with digital tools, assuring a diversity of the projects.

The creative processes were initiated through a fictitious design task, in which the students were asked to produce a digital model of a real stone, which they had found themselves. The task also involved an individual transformation, manipulation and interpretation of the digital model.

According to Wojtowicz, the incorporation of small-scale organic forms in the design process is highly underestimated. The fact that the so-called Micro Landscapes possess great potential has also been figured out by Le Corbusier. For his “reaction poétique” he studied natural micro-elements in order to incorporate them into his designs. The students were expected to mirror the object into a virtual context, to manipulate it in a digital way and finally, to use a prototyping machine in order to materialize the new structure.

Every day was concluded with a „Daily Review“, in which each student was asked to present his/her design process to the team. In addition to the web interface, students used models, posters, films, projections and photographs for their individual presentations.

On June 3rd 2005 the results of the workshop were presented to the public in an exhibition at the HDA-Graz (Haus der Architektur Graz).

3. FROM REAL OBJECTS TO DIGITAL MODELS AND BACK

The preliminary stages of the workshop involved a series of events, such as the Peter Eisenman exhibition in Vienna, entitled “Barefoot on White-Hot Walls”. Eisenman characterized his MAK-show as “a negative exhibition, sparse and hard hitting”. The mode of presentation features diagrammatic analysis, which eliminates any authorial signature and, at the same time, opens up a broad range of new possibilities.

The students were asked to think about their own definitions of the term „model“ and to explain their ideas. After various startup-software-tutorials and an introductory course to the digital studio, the students were asked to choose their object. Due to various reasons, the choice was limited to stones.

For centuries, Chinese scholars have admired oddly shaped stones, which came to be known as “Scholar’s Rocks”. However, it remains unknown, to what degree the natural shape of the stones had been manipulated. Interestingly, these stones can serve as conceptual models for architecture (cf. Herzog & de Meuron). Thus, certain features such as their ambiguity between naturalness and artificiality, their enigmatic history or their beauty, can serve as basic principles for architectural design.

Of particular interest were Scholar’s rocks which enabled fascinating sights, depending on the observer’s perspective. This workshop aimed at extending the study of stones via digital media. Every student was asked to digitalize, transform and reproduce his/her own stone.

The digitalization of the object has been carried out with a Microscribe 3D scanner, displaying a scatter-plot of the object on the screen. The transformation of a real stone to an abstract list of data was the first major process of manipulation, producing a digital reflection.

As the scanner only detects man-selected points, a first interpretation of the object becomes visible. Due to the transformation of the Reverse-Engineering Software, the scatter-plot became a “waterproof” surface. Errors or gaps within the geometry were characteristic aspects of the transformation process and thus interpreted in terms of intentional errors. The following section will discuss the chronological sequence of the transformation processes - “FROMFOAMTOFORM”:

DOCUMENT*

The first step involved a detailed documentation, as well as, a cartographic recordal of the stone. The documentation included, on the one hand, photographic as well as written accounts, e.g. on the place where the stone had been found and, on the other hand, the scatter-plot and screenshots of the 3D model. In a comparative analysis, the real model was contrasted with the digital one.



Student at the IAM presenting his documentary sequence (picture: digitalstones_02.tif)

The first interpretation of the real model derived from the personal accounts. The second interpretation goes back to the digitalisation itself (see above). Using projections and print, the students presented a documentary sequence from beginning to end, producing a “digital display-case” together with an analogous collection of stones.

EXPLORE*

The task involved an accurate study of the stone model within virtual as well as real workspaces. The students were asked to describe the optical and haptic characteristics of their objects and to give a personal interpretation of their stones.

After essential modelling- and unfolding-tutorials, the students were expected to find an adequate way to dissect their models according to Gordon Matta Clark’s “Cuttings”, and thus, uncover the hidden layers. The precise performing of the cutting was of great importance, since it influences the trait of the stone. The output included studies using the 2D laser-cutter, machine-made section models and additional blueprints. Logically, the comparative study of the digital section models and the real models entailed different kinds of new interpretations. Due to the almost medical investigations within virtual work environments, the stone extends its semantic content. The interpretations varied widely, including geometrical and material analysis and poetic accounts about new observations.

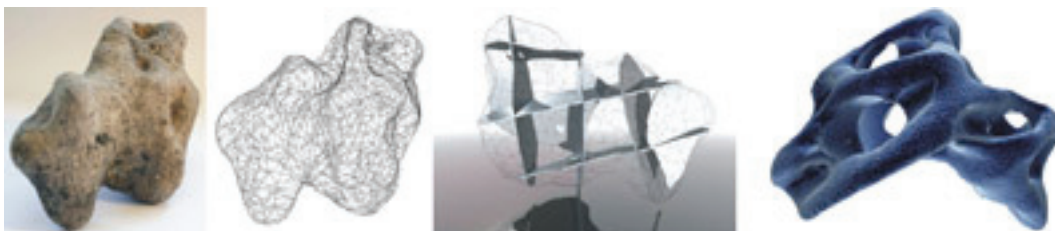


Typical section models (picture: digitalstones_03.tif)

TRANSFORM*

With this task, the main focus was on the processing of the stone, i.e. the students were asked to work on the stone, using analogous tools like a sculptor. In this way, distinctive features of the stone could be accentuated. The actual model was transformed digitally, scaled down to a miniature-size and finally, printed out with a Stratasys 3D ABS-printer. Consequently, the students compared their miniature models with the analytical section models and the real stone. In addition, they presented the transformation, using images and screen-shot of the different stages. The results of this experiment were highly heterogeneous and were only comprehensible within a digital context.

Geometries were digitally riddled, sharpened, smoothed, dismantled or reconfigured with strange materials (~softbodies), which only could be manipulated, using dynamic powers. Due to the fact that digital models have higher continuity within the design process, they do not require permanent reconstruction. However, they require constant examination in reality.



Real, digital and rendered models (picture: digitalstones_04.tif)

MANIPULATE*

During this stage, the physical features of a stone, such as weight, centre of gravity or the composition of the surface became the major matter of interest. The analysis focussed on the digital modification of the features of the stone, while performing a dynamic activity. The

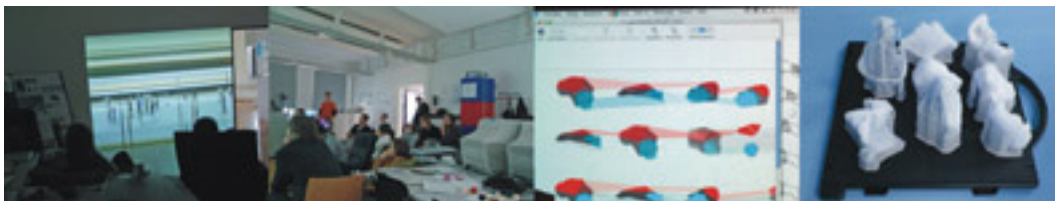
students started a “stone bowling event”, themed “I welcome whatever happens next” (J. Cage). Moreover, the Fluxus movement, an experimental and radical art form of the 20th century which, for the first time, produced mix-media works, was used as a conceptual analogy. In order to make analysis and documentation possible, the students had built a setting in which the movement of the stones could be captured with a video-camera. The stones were set in motion on a track. Depending on size, weight and surface composition, the stones developed different trajectories. The students analyzed these kinematic experiments via motion-tracking processes and produced a slow-motion-video and a trace-picture, documenting the run of the stone. Thus, the students produced direction vectors, flash-movies, as well as detail-screen sequences.



Kinematic experiments, trace-picture (picture: digitalstones_05.tif)

TRANSLATE*

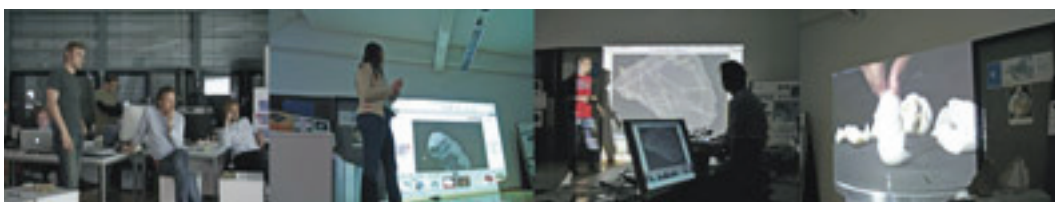
The task was to transmit the information of the real motion into the virtual animation. Using inverse Kinematics, Dynamics and Dynamic Baking, the students were able to use the information of the real motion in order to transform the digital counterpart. The approaches ranged from the digital simulation of real kinematical processes or dynamic forces, to translations on a conceptual level (e.g. listen to a stone). The direct or indirect translation of information that is a priori incompatible requires a great deal of creativity in order to make out suitable interfaces. There lies a great potential in the acceptance of these Using projections, diagrams and videos, the students presented the outcome of the translations.



Processes of translation (picture: digitalstones_06.tif)

MATERIALIZER*

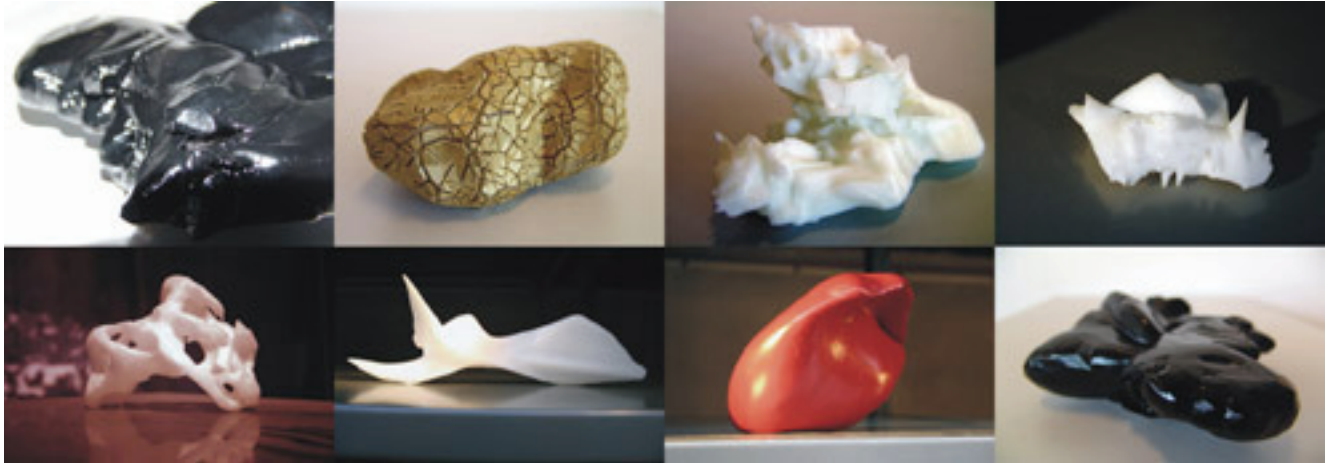
The last day of the workshop was devoted to the finalization of translation and transformation processes. Additional support was necessary in order to guarantee the favoured output. Finally, the participants worked on a coherent written summary of the multimedia-based process chains, which, in a final step, was presented to the team. The presentations included the documentation of relevant phases of the process chains, carried out via prints, real and virtual models, animations, films and a 360° QTVR.



Final presentation (picture: digitalstones_07.tif)

FINAL RELEASE*

The results of the workshop were presented to the public in the „Haus der Architektur“ in Graz. The inner courtyard of the HDA gave place to various installations. A heavy-load shelf was used to display the digitally designed stones, as well as the original objects and the section models: “digital stones that can be touched”. In addition, there were open-air terminals, where people could trace back the single steps of the projects via the workshop-webpage. Moreover, the students had prepared an A3 prints, 360° QTVRs and animations of the transformations, which functioned as additional information material. The posters resembled huge banners, the films were projected outdoors on a big screen, which contributed to the harmonious and positive atmosphere.



Digital stones that can be touched (picture: [digitalstones_08.tif](#))

4. CONCLUSION

Whereas virtual workspaces made it possible to create a great number of different versions of one model as well as their hyperreal images, the workshop realized architectural design processes, using both real and virtual environments simultaneously. One of the major features of these poly-media process chains is the multidimensional interaction between the media and the emergent production of the “alien” (M. Novak), or respectively, of the new. Due to hybrid workspaces and their constant interaction, a completely new architectural paradigm has been created.

Although the prevalent linear sequence of real and digital work environments or tools, entail some automatism and thus quickens the process or its representation, it does not a priori add unforeseen circumstances. The interaction of real and digital workspaces during the design process stimulates perception and intensifies the creative process through complexity. Thus, architecture can be redefined from the inside out.

Within architectural production, digital methods are usually used to save time, to realize complex geometries and to create digital reflections for a perfect visual representation afterwards. However, as one can observe on the basis of some current attempts within teams of architects, or respectively, within schools of architecture, a balanced use of different design tools leads to a new understanding of the design process and to a better communication of the idea. In this way, digital media and its several and immersive applications do not create limitations, but rather encourage creative contemplation about design.

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