

VARIOUS MEDIA IN THE DESIGN PROCESS AND METHODOLOGY

The balanced employment of different design media within the design process

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Abstract. The paper describes the mergence of traditional architectural design processes with approaches that rely on digital media and software for the creation of architectural space. The depicted projects are part of a 'work in progress' process, with a recent studio that is set up to apply the so far accumulated experiences.

Within the projects, focus is on those design phases where the applied media and methodology is changed and where the back and forth between different media and the depth of their implementation is perceptible in, and / or has a significant influence on the design itself. Through a line of successive experiments, the paper explains the development of a possible method that utilizes a variety of today's accessible tools in architecture, making use of phenomena that appear when changing from one tool to another. Goal is to avoid limitations that are existent by the solely employment of one media or method, and to understand the fusion between different media as an inspiring momentum to develop the design further. The paper draws a line from an initially experienced and analyzed design method over several projects in practice and academia to conclude with a possible design method that could be established successfully in both fields of architectural teaching and practice.

Initial experiences had been drawn from professional practice, in which the digital realm was limited to a support device of the design process. The first project that is described in the paper, explored the employment of digital media as a possible tool to drive the design process in a broader sense. The studio setting was organized as a laboratory for the exploration of the change of applied media. Focus was on the influence on the design progress. The design method required of the studios participants was not exclusively based on an architectural program, but on an initial, very conceptual process with an artistic approach, based on personal experiences of each participant. This was meant to detach the students entirely from architectural

processes and mindsets they had picked up so far. Parallel to that kind of an intellectual process, studio participants learned to handle Maya as the 3D modeling software of their choice. Both the technical knowledge and the artistic projects were merged in a second project phase, in which participants had to further develop their work by applying a very effective mix of various design tools.

Using digital media as a parametric design generator, subsequent projects were developed. The task for the designers here were to decide what kind of algorithm could be applied to which process and when it was to be stopped for the best result. Applying such an automatism successfully to the design process, the employment of traditional media and methodology remained, to adapt the digital driven schemes to the required design task.

The diverse design experiments demonstrate important aspects when merging complex design and animation software with traditional design processes. To achieve good architectural design results, all examined projects showed that traditional design methods with its physical models are hardly replaceable to its full extent by other media, but digital media are able to strengthen design processes and invite designers to explore new means of design work.

1. Introduction

“Having abandoned the discourse of style, the architecture of modern times is characterized by its capacity to take advantage of specific achievements of that same modernity: the innovations offered it by present-day science and technology. The relationship between new technology and new architecture even comprises a fundamental datum of what are referred to as avant-garde architectures, so fundamental as to constitute a dominant albeit diffuse motif in the figuration of new architectures” [De Sola Morales 1997].

Digital technologies are at home in today’s architectural practices and schools of architecture. Just a decade ago, we could hardly imagine what is state of the art in present days. Being more than just a simple substitute of the drafting board, recent digital tools enable us to incorporate design methods that might be solely based on the employment of digital technologies, generating a new kind of architecture, which is based on dynamic, open-ended and sometimes unpredictable digitally driven design processes. Furthermore, we now can establish continuous production process chains from early schematic design phases right into final production, reducing the necessity to produce traditional drawings and models for representation purposes only. Computer numeric controlled (CNC) fabrication technologies have given us possibilities to re-thing and re-configure design, fabrication, and construction processes. Peter Zellner observed in his book *Hybrid Space* that “architecture is recasting itself, becoming in part an experimental investigation of topological geometries, partly a computational orchestration of robotic material production and partly a generative, kinematic sculpting of space” [Zellner 1999].

By favoring continuous experimentation, contemporary digital architecture admittedly and often disregards notion of context, conventions of style, the urban environment, and certain ties to history. An *everything goes* mentality repeatedly rejects architectural aesthetics by denying structural typology, functionality, and materiality. This might be partly because digital design processes require new ways of defining those processes, and partly because of the distinct disconnection of our hands as crafting and creative tools, being replaced by abstract digital devices that can barely satisfy our desires to create with our brain and body. We are torn between the desire to express and construct complex spatial forms, for which the computer is a powerful and necessary tool, and its very specific and *controlling* nature, which might be so overwhelming and time-consuming to distract us from the essence of a successful and satisfying design process.

To overcome this ambivalence, the paper describes the mergence of contemporary, digitally driven design methods with traditional architectural design process approaches, including the employment of conventional media with handcrafted models and sketches. Within these processes, focus is on those design phases where the applied media and methodology is changed and where the back and forth between the different media and the depth of their implementation is perceptible in, and / or has a significant influence on the design itself. The following line of diverse experiments utilizes a variety of today's accessible design and process tools in architecture, making use of phenomena that appear when changing from one tool and process to another. Limitations, which are existent by the solely employment of one media or method, are avoided, the "intimate connection to the process of making" [Ceccato 2004] is being re-established, and participants are able to understand the fusion between different media as an inspiring momentum to develop the design further. The paper draws a line from an initially experienced and analyzed design method over several projects in practice and academia. It is meant to be a work-in-progress documentation with the goal to conclude with a possible design method that can be established successfully in both fields of architectural teaching and practice.

2. Project Initiation

Initial experiences had been drawn from the professional practice of Frank O. Gehry. In his design processes, the digital realm is mostly related to as a support device. Very complex architectural spaces and masses are developed and produced by the solely use of architectural sketches and models, which are mainly build out of solid chunks of bass wood and Plexiglas as massing models in the early design stages. With growing scale and complexity, materials get more diverse and sophisticated. At a certain point within the design process, and *after* the architecture is more or less established through the tangible model, digital software is introduced as a tool that actually enables the architects to geometrically describe the difficult shapes and translate those to the next scale and detail level, in order to refine the architecture and its spaces. In case of Frank O. Gehry's Zollhof Project in Düsseldorf, Germany, computer driven processes were intensively applied

after the design development package was created, since geometrically very complex structural concrete and steel elements had to be prefabricated for the construction process, using a process chain that both incorporated CNC driven manufacturing, as well as traditional craftsmanship.

Besides the extraordinary formal architectural language that emerged from the design processes at Gehry's office, the remarkable aspect of the methodology was the very strict and disciplined usage of the architectural model as a device to solve the design tasks and problems on one hand. On the other, to handle the very complex spatial forms, and to make it possible to develop them further, the employment of the computer as a semi-creative tool was essential. The digital model was used only as a means to support the process; every influence on the design process itself was fortuitous and not intended at all.

Looking at recent, complex architecturally building constructions, we find similar approaches and processes, where very sophisticated techniques meet traditional procedures. In Ben van Berkel's *UN Studio* new design for the Mercedes-Benz Museum in Stuttgart, Germany, the design and construction team relied on a Building Information Modeling (BIM) model shared by all project participants. Similar to the Zollhof project, the BIM data (and therefore the process chain from design into manufacturing) was especially useful to create the building's many compound-curved concrete and reinforcement work, which could not be described in two dimensions. Additionally, the digital model's spatial coordinates were used to precisely place the individual formwork elements on the construction site. Interestingly enough, the design team did not rely solely on the digital model. The construction process was also based on traditional two-dimensional shop drawings, which were applied for the description of elements of the building that did not contain compound curves and therefore were made with typical formwork components [Gonchar 2006].

Taking these issues into consideration, the author describes projects in the following pages that explore the employment of digital media as a possible tool to drive the design process in a broader sense. Based on several years of experience in teaching in the field of traditional and digital design, it is the author's belief that the quality of architectural design suffers by the solely employment of digital software as a design tool. Therefore, the studio settings are organized as a laboratory for the exploration of the employment of *various* media. Focus is on the influence on the design progress.

The design method required of the studio participants is not exclusively based on the architectural program and function, but on initial conceptual processes, abstract diagramming, preliminary experiments or personal experiences of participants, or the employment of media like film, sound, and photo. This is meant to detach students in the initial phase as much as possible from architectural mindsets they have picked up so far.

Parallel to such intellectual processes, participants learn to handle architectural modeling software. As studio progresses, both technical

knowledge and conceptual project approaches are merged in a second project phase, in which participants have to further develop their work by applying a mix of various design tools.

3. Studio Setting

3.1. 160 CUSTOM-MADE

Initially conceived as a design studio to explore the coherence of applied digital media onto possible manufacturing methods, the studio setting 160 custom-made turned out to be a laboratory for the exploration of change of applied media and their influence on the design progress. The pattern between the employment of analogue and digital media reinforced the application of modeling software within the design process itself. Instead of working with an initial analytical interpretation, an architectural program, or a specific design task, students were asked to approach the project with an intuitive strategy, acting as readers of their own work. Rather than occupying themselves as authors of their form, they were now able to unravel and interpret the emerged objects. Analogue as well as digital modeling was the studio's chosen process for translating those conceptual ideas into tangible sculptures and shapes.

Understanding architecture is very much based on our personal knowledge and perception. Consequently, for the initial project approach participants had to choose images of analogies that were based on partly given, partly self-chosen terms, which were deduced from personal experiences. These analogies were the basis for the succeeding project steps. The shapes that emerged from this method were of dynamic, artistic nature, detached from architectural-spatial conventions, and produced against the backdrop of personal experience by the individual employment of digital and analogue data. Since participants had a very different level of knowledge about 3D-computer modeling software, the studio group also learned to handle Maya as a complex 3D modeling software. This enabled them to translate and further develop their ideas within the digital realm. By the continuous change between the process of handcrafting the models, and digitally developing their shapes and sculptures, the students experienced the advantages and disadvantages of each method over the other; they very well understood the benefit to combine different methods to reach an architectural or spatial goal. Due to the fact that participants weren't permitted to use digital equipment for the digitization of their physical models, they had to experience an intense *media-jump* through the analogue work of cutting and slicing their shapes and models in order to translate them into the digital realm, which enabled them to truly understand the projects in detail. This is different from many exclusively digital driven design processes in studio settings, where students often get lost in the complexity of their own spatial creations on the computer screen due to a lack of physical control of the computer-generated data structures.

The studio's first phase outcome was a physical model as a tangible representation of the student's design ideas, including a precise copy of a digital data structure in Maya. In a subsequent project phase, an actual architectural program was superimposed onto the designs, and the projects were analyzed for building structures, details and several features that would transform them into an actual building. Here participants had to be very precise about their spatial articulation by considering the actual program and a given site. The applied process was supposed to follow the same method as in the previous phase. Anyhow, many students put an emphasis on a digital development of their projects, and the chosen method for the final presentation was a digital one. Because participants were very occupied by the use of the complex software, the final projects turned out to be still very conceptual, considering architectural space on one hand, but lacking a certain level of detail on the other. The final translation of the digital model into a readable stereolithographic (STL) file for a rapid prototyping production of the physical presentation model was another issue experienced by all studio participants. This process turned out to be far more complex than expected. Students realized that it is not about "pushing the button and there is the model". The usage of Maya as a conceptual design tool might produce very impressive digital model representations on the screen, but if the digital model is not built to appropriate precision, which is obviously hard to do in a creative design process, a CNC based machine simply cannot read the data. Participants had to add a considerable amount of extra time in order to adapt their digital data structures. At this point, everybody agreed that a semi-digital, semi-analogue model would have served the final process much better.

3.2. THE URBICLES PROJECT AND ANAMORPHOSIS

The following studio setting for the *urbicles* project was more successful and understandable by its participants in its full extent. It was intentionally based on the exploration of media jumps between digital and analogue tools and methods, demanding defined changes in the design methodology and a more diversified project outcome, including both digital and traditional models and representations. The *urbicles* project studied the dynamic behavior and movement of pedestrians in a highly frequented location in the city of Berlin, Germany. Defined goal was the creation of an architectural intervention that would re-stimulate partly neglected areas within that location. Similar to the digitally driven design process, the students created analogue parameters that would change the behavior of the involved persons, generating curiosity, attracting them to the ignored inner courtyard areas. Alike a scientific process, the results were precisely captured through spreadsheets, photos, and video documentation, and served as a base for the further design investigations.

In a first media jump, the datasets were used as parameters for a dynamic design process within Maya. The digital process was based on the captured movement patterns produced by the urban actors within the investigated area, based on time, day, specific location and particular events. A digital overlay of the different 'movement masses' determined the outcome; an abstract and spatially desired diagram was generated.

At this point, the next media jump was applied by the literal translation of the digital model into a huge, physical cardboard structure as a representation of the data in real space. Once finished, the structure produced new, tangible qualities that inspired the designers for the further process. The most dominant feature was the flexibility of the corrugated cardboard structure, which then was translated into a folded paper strip model, further emphasizing the newly found quality in a different language.

Afterward, the group unwrapped the initial digital diagram into a two-dimensional, true-length surface, which was printed and physically re-assembled, following the principles of the previous physical model. The new model's shape was influenced by and based on the initial digital diagrams, therefore obtaining a strong tie to the urban context by considering the site experiments and their results in an abstract language. This virtual-to-real tie was then used to re-define the model in the digital realm, which again inspired the group to advance the spatial shape more and more. The project's final outcome was a sophisticated, yet abstract three-dimensional structure that had a good degree of detailing, hence was taken as serious architecture due to its depth of development. It functioned as a dynamic, flexible, space-creating element that would inhabit the neglected spaces within the area of investigation, creating new architecture within existing buildings, re-animating the abandoned areas of most valuable urban space.

Analyzing the project's very successful strategy, it was obvious that the most remarkable design decisions emerged during the media jumps by interpretation of the so far applied methods and generated designs, and the superimposition of different stages and media of the overall design process. To strengthen this experience, another similar studio project was set up that dealt with the phenomena of anamorphosis (an optical distortion). Similar to the *urbicles* project, *anamorphosis* also turned out to be very successful in its employment of media changes and their interpretation, including a depth of development for the final projects. In both cases, the successful outcome of the projects was essentially based on employing opportunities to experience the fruitful and inspiring project enhancement made in the media jumps.

4. Conclusion

The diverse design experiments demonstrate important aspects when merging complex design and animation software with traditional design processes. It is the line of studio's assertion that we must focus not only on the reliance of complex digital design tools that promise innovation and efficiency, but also on our intuition, craftsmanship and creativity.

Today's available and highly complex three-dimensional modeling software demand excellent knowledge about its handling and the appropriate amount of time to spend with it in order to use it inventively in early design stages. The examined projects showed that traditional design methods with its mostly handcrafted models are hardly replaceable to its full extent by other media, because our ability to craft relies on intuitive processes. Technology is able to strengthen design processes and invite designers to explore new means of design work; it can become the catalyst for new opportunities to

occur. As the different projects demonstrated, vast possibilities exist for the application of hybrid design methods that are based on different media and design approaches. As designers take advantage of those tools, a harmonious mix of both thought and working processes is needed. Experiences in solely digitally driven design studios showed that students are often overwhelmed by the exclusive use of that specific tool; they might get caught in the enormous opportunities the digital machine is offering. By applying changes of media and method, designers are able to step back from the very demanding work within the three-dimensional digital environment, reflecting on their work in a more comprehensive way that the digital representation of a space normally allows.

The line of experiments is continued toward the employment of rapid prototyping technologies in the early design process to explore further possibilities of merging different media and architectural tools to enhance design processes.

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