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Construction and Atmosphere:

Modeling the tangible and intangible

by David Steiner

When dealing with the working methods and learning processes of 3D programs, one can approach the subject from various directions. The longer one works in this field, the more one begins to appreciate the structural logic of the digital programs, the interplay between program and designer, real world implications of working in the digital form, and challenges of conveying these themes to students. In this essay I present how I integrate these aspects into my teaching to instill in students a more generalized knowledge about methods and technologies beyond introducing them to software specific techniques. This enables them to have more freedom in the selection of their design medium. The first part of this essay explains my position on the digital design processes in general, while the second part describes the structure of courses I teach with specific examples.

The digital model: translation processes

The transformation from a design or a spatial idea into a three-dimensional computer model must always be seen as interplay between the individual's conceptions and expectations and how it could be represented and operated upon within the software. The computer forces a constant examination of the form, and its assembly of parts in detail. This demand for precision and specificity steers one towards a theoretical investigation resulting in a process of distillation and restructuring of the design concept. It is less important in which direction these interdependencies work, but that each decision in this process is made consciously and in a controlled manner. Being able to represent precisely (true to the idea) and then be able to control it (to study variations of theme) should be central to learning a 3D program for architectural design.

The logic that a three-dimensional program demands in every step of the way, forces one to think about the details and creates the largest obstacle for a free manner of working. So, to get around this, as a strategy, a spatial collage–developed as an image representing a specific design idea–in the form of a two dimensional representation, works the best to get the design process started. Once this collage sets the tone for design, the next and most difficult challenge is to develop appropriate strategies for three-dimensional digital representation to achieve this image. Successful strategies are the ones that support studying and evaluating the inherent design principles and the structural ideas. The next challenge is translating these into the command structure of the program.

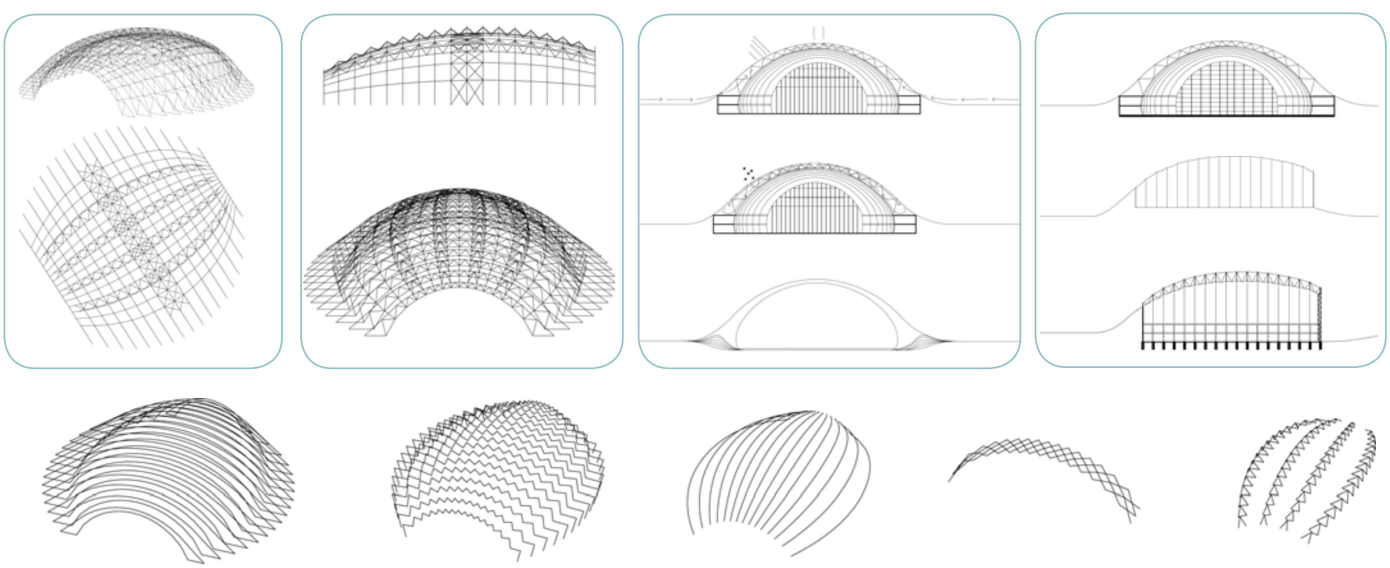

Figure 1: **Project showing structural development by Julian Schubert and Elena Schütz.**

In design studios we see a range of projects: some that excel in taking the initial concept to a deeper level of development replete with rich details which would not have been possible without the use of 3D programs. At the same time we also see others where design outcome appears to be hindered because of the 3D programs due to overly simplified details, conceptual contradictions, etc. A common preconception among the students that one cannot design with 3D programs needs to be alleviated. The issue can only be settled on a case-by-case basis, and is also largely dependent on a designer's proficiency of the program and the unique interaction formed between designer and program.

The input of a design into computer requires one to have a very good ability to abstract one's ideas within the logic of the program, without allowing oneself to become dominated by the logic. This involves the spatial disassembly of complex forms into basic elements, the geometrical definition of a free form, and the ability to define procedural steps to reach a specific end result. Figure 1 provides an example for such a process. Often there are many methods to get the same result. Students, who are successful in harnessing the specific powers of the computers in their design projects, possess this type of cognitive ability– something that cannot be provided by the computer or learned from software manuals. It should be recognized that despite the variations in interface, and number of features, every program has a certain predisposition to input, and predictable operational support. The interaction between the user and the computer always leads to special limitations with various programs. One aquires the abilities to work with the constraints, tricks, and deficiencies of the program with a lot of experimentation by "trial and error". It is important for the instructor to mediate this and pass on his/her experiences to the students.

In regard to the output of digital media, an ability to abstract is likewise required. For example, visual parameters of a printout such as sense of scale and size, line weights, patterns or colors cannot be effectively evaluated on the computer. One obtains experience with the corresponding program by making test prints and from systematic testing of variants. Proficient use of a 3D program as a tool means choosing the correct degree of exploration and appropriately limiting oneself to the relevant parameters for the input and output depending upon the task and objective, without losing sight of the complexity of the design.

Construction and Atmosphere

With an understanding of the issues of design input and output which are integral to any final presentation, the free spatial collage and the strict logical structural idea form the starting point for use of a digital program. In the last two years, **form•Z** has been preferred for use for these two distinct tasks, in a three-month long basic course I teach. This course has an enrolment of fifteen students and meets two hours per week. It deals with the basic functions of 3D digital programs involving several short projects culminating in a final project. The first project covers the coordinate system, dimensionally accurate input modes, and the logic of generative tools. In sequential order of complexity, other tools along with their functions are introduced. An effort is made to situate the functions relative to a spatial task. For instance, the derivative tools are introduced as expanders of the "degree of freedom" in modeling using existing objects – reducing the need to draw, and ensuring that forms fit with one another. The tools can be explained better in this manner and are internalized by the students more effectively. Concurrent to this, certain functions are discussed in generality, without relation to any specific programs. For example, Booleans are discussed as set operations, whose logic is applied to volumes. Much of the work is concentrated on the questions framed previously concerning the transformation process on the computer; specifically the possibilities of abstracting one's ideas based on the logic of the digital program.

Next, environment and rendering are addressed. Here as well, there are subjects that can be described in a generalized and program-unspecific way. For example, students are taught the distinction between pixel or vector-based renderings, or the ray tracing process. Simultaneously, we discuss certain specific issues as possible

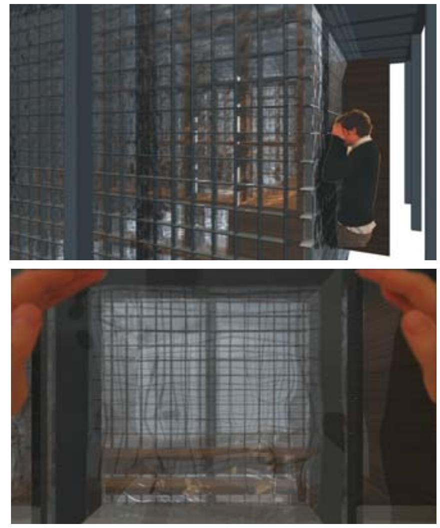

Figure 2:
Glass Brick Pavillon by Jan Lindschulte.

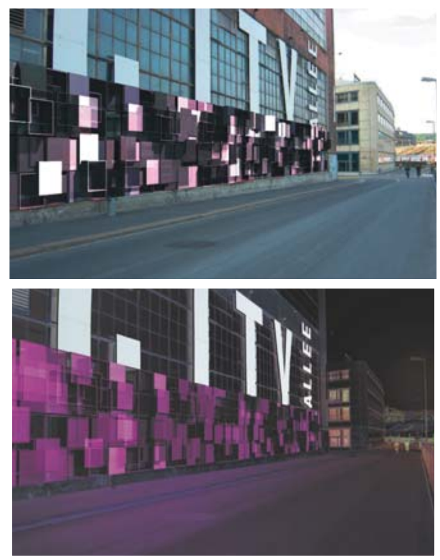

Figure 3:
Light Installation by Stefan Soom.

Figure 4:
Sports Center by Likas Schwind.

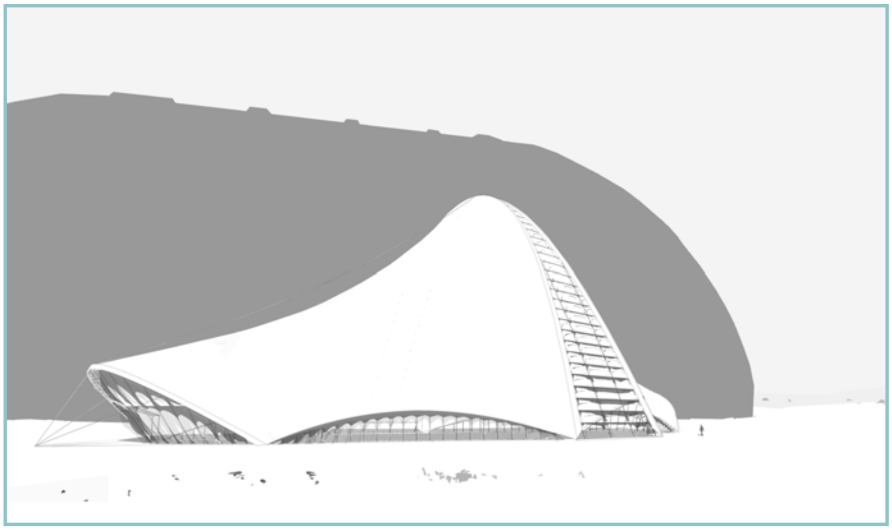

Figure 5: **Airship Hall by Veit Eickelt.**

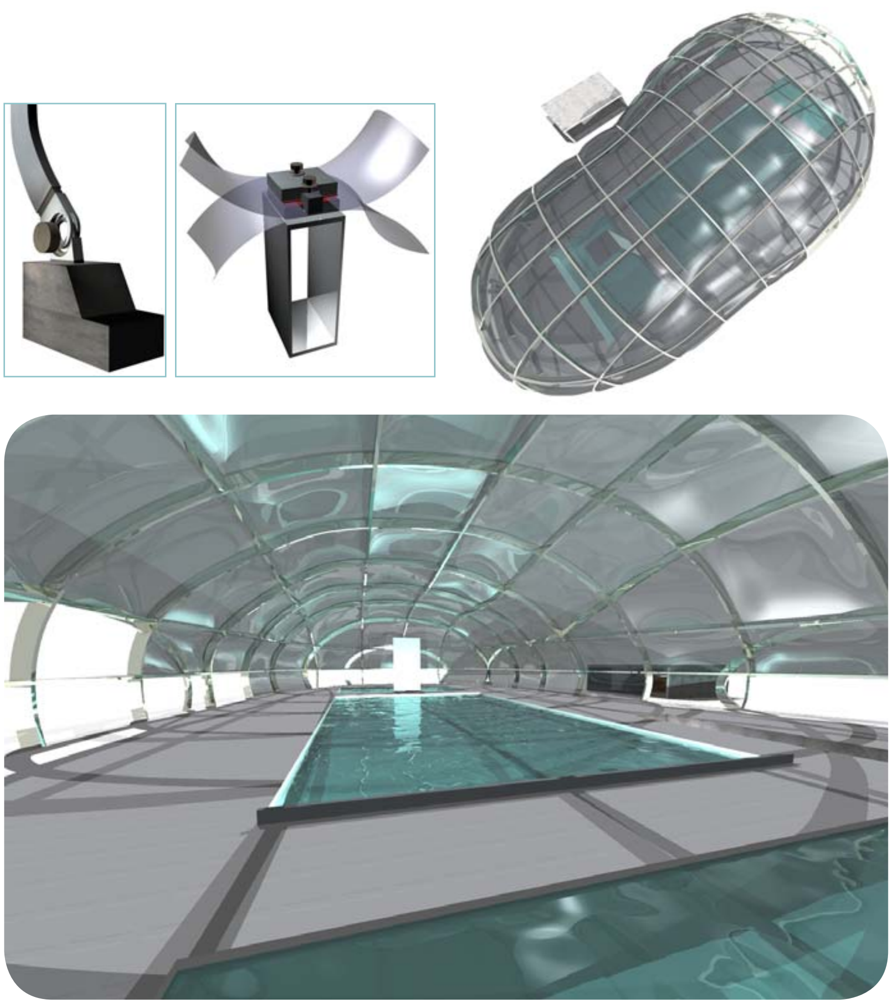

Figure 6: **Indoor pool by Ilja Bentscheff with Prof. Eddy Widijaja.**

The wing assembly of the hall is built of a light steel construction. Its surface is covered with air-filled cushions consisting of synthetic diaphragms. The main idea for this design was to develop an experimental wing assembly and to simulate its load-capacity by making use of computer calculations and models.

material settings for water or glass. Students complete several focused short projects, to gain a hands on understanding of these principles. The lessons from the program, in this regard, have more to do with matters of light, material, and environmental control; using all of the „tricks“ that these tools can offer. Essentially, my task is to identify the logic and interdependency of the parameters, which is often not evident. For example, the brightness of an object is dependent upon settings for materials, the various light sources and the environment. A central principle of my teachings in this field is that the quality of the work is dependent less upon the proximity to photorealism as it is from a precise elaboration of an atmospheric idea. If one observes design representations, the more abstract and unrealistic these atmospheric effects become, the more room they allow the viewer for interpretation.

For the final presentation, students select a project from their work from design studios. The projects are often done in groups of two or three students. With a distinct focus, they formulate “construction and atmosphere” guidelines for their projects. All projects start with a rigorous examination of logic of the form, scale, and tectonics. We formulate specific challenges for the rendering and consciously reduce the amount of modeling. My role is primarily to help develop the design approach, and help formalize steps to be taken with the digital program to translate the design into a computable form.

Perhaps the most interesting works to be mentioned, combining both aspects, are the projects from Veit Eickelt and Ilja Bentscheff. The image from Veit Eickelt, which appears so simple, yet was produced with great effort, draws its strength from the relationship between surface representation and complex geometries formed through its shadows. The work from Ilja Bentscheff is to a large degree an attempt to develop computer-generated forms that reach the limits of the program’s technical capabilities. These are examples of successful representations of “construction and atmosphere”. More examples of student outcomes of this project can be found on the DVD that accompanies this publication.

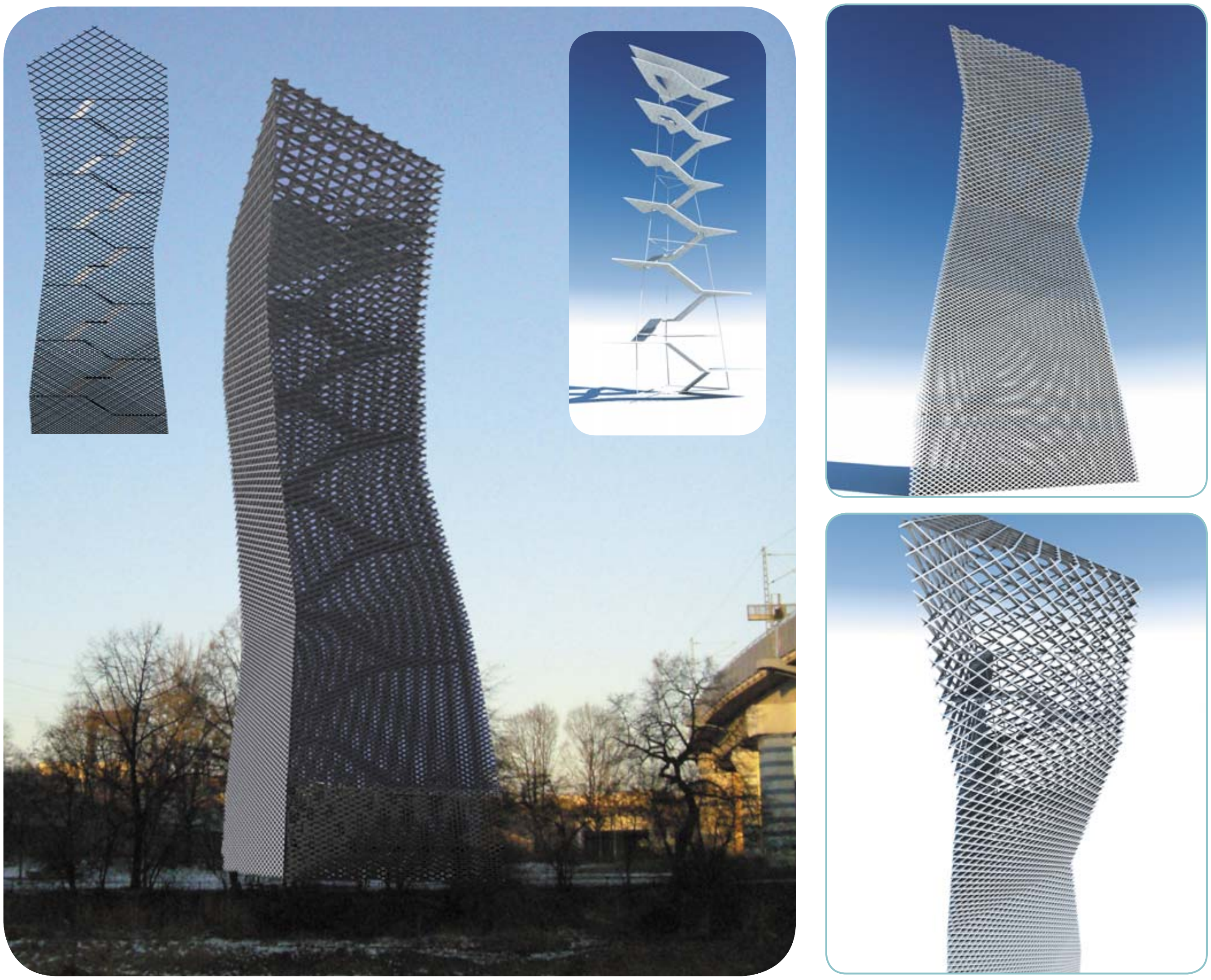

Figure 7: **Look out tower by Ilija Bentscheff**

"*The site is located at the canal, where there are two elevated train routes that separate a dense old working class quarter and a large scale industrial area of Berlin's Westhafen (West Harbour). The look out tower is a monolithic structure, 60 metres in height, competing with the huge industrial buildings in its midst. It loses its mass as it gets higher. This appearance comes out of the way the structure holds itself up. The power moments acting on the tower decrease the higher up you go. I used the legality of the structure to form the supporting frame and from this developed the diamond pattern, which widens from 30 to 90cm from bottom to top.*

The basic shape of the tower is generated by its 6 section lines and the boundary paths by the Skin tool. The top is stitched from triangles. The stairs are offset parallel to the surface with a distance of two meters. I generated their shape with the Parallel tool and diverse Boolean operations. The suspension structure that defines the surface is modelled from one line, which I scaled to distance (200x multicopy). The result was an increasing distance between the lines, which evolves from 30 to 90 centimetres. After extruding and joining them I used the Line of Intersection tool to generate the paths in the exact position of the basic shape of the tower for the surface forming panels. The panels are generated with the Sweep tool."

David Steiner was born in Hanover, Germany, and studied architecture at the University of Arts, Berlin, where he graduated with a diploma in civil engineering. Beginning in 1998 he worked as a student tutor at the university's CAD laboratory, and in 1999 he became its director. Also in 1999, David worked in the field of Architecture for Professor A. Krischanitz and Behles & Jochimsen in Berlin, specializing in competition work and 3D drawings. During this time, he also worked in collaboration with Erika Schaar for J. Mayer H, Berlin. In 2001, David collaborated on a book project with Mark Pzryrembel titled "Dortustrasse 61: Documentation of the restoration of a landmarked house in Potsdam" (editor Professor Pichler). He also worked on various architectural and cultural websites which include www.behlesjochimsen.de, www.nigihaven.de, www.mullerdechiara.com, www.huthbuch.de, and www.arch.udk-berlin.de. Since 2001, David has been working as a freelance architect in the office of Professor B. Tonon, Berlin. There he supervised the extension of Wetzlar primary school, a hotel and business building at the Zoo railway station, a shopping centre in Lichterfelde Ost and a Waldorfkindergarten. David is currently an assistant lecturer for Computer Aided Drafting and media courses at the University of Arts, Berlin. He teaches CAD and 3D programs, video layout, and image processing programs. David Steiner is a member in the Berlin Architectural Association. Email: office@d-steiner.de.