U.PORTO

PROGRAMA DE DOUTORAMENTO EM ARQUITECTURA

The Hidden Geometry of the Architecture of Herzog & de Meuron
Digital Tools and Design Practice

Alexandra Castro

D
2023

U.PORTO

Alexandra Castro. The Hidden Geometry of the Architecture of Herzog & de Meuron, Digital Tools and Design Practice

The Hidden Geometry of the Architecture of Herzog & de Meuron
Digital Tools and Design Practice

Alexandra Castro

FACULDADE DE ARQUITECTURA

D.FAUP **2023**

The Hidden Geometry of the Architecture of Herzog & de Meuron

Digital Tools and Design Practice

Presented by

Alexandra Castro

Supervised by
Prof. Dr João Pedro Xavier
Prof. Dr José Miguel Rodrigues
Dr Kai Strehlke

Faculdade de Arquitectura da Universidade do Porto (FAUP)
Programa de Doutoramento em Arquitectura (PDA)
November 2023

C.4
Volker Helm

A.04
Volker Helm.
Architect at HdM from 2003 to 2010.

"The computer is just a hand tool for Herzog & de Meuron."

Conversation with Volker Helm

University of Applied Sciences and Arts of Dortmund, Dortmund, January 23, 2020.

Zoom meeting Porto-Dortmund, June 8, 2020.

Alexandra Castro (AC): When did you start working at Herzog & de Meuron?

Volker Helm (VH): After studying architecture in Germany and completing a postgraduate study in Zurich, I started working for Herzog & de Meuron in 2003.

AC: I suppose that also Kai Strehlke did this postgraduate course.

VH: Kai was a supervisor at the chair of Ludger Hovestadt. I'm not sure if he graduated as well.

AC: How long have you worked in the office?

VH: I started in 2003 and left in 2010.

AC: I know that you began by making visualisations. In which projects were you involved?

VH: I was mainly responsible for the 3D modelling as a "virtual constructor". For example, I was involved in projects like the Beijing Stadium, Prada Levanella or the Tate Modern project "The Tanks".

Then, under the supervision of Philipp Schaerer, I also created a lot of visualisations and/or the associated 3D models. The form of expression and the quality of the visualisations by Philipp Schaerer are absolutely unique to me.

AC: Was there anyone else doing visualisations in the office?

VH: Christian Zöllner from Hamburg, who after this founded BloomImages, came afterwards.

AC: Can you tell me a little bit more about the period before Kai joined the office? What were the digital tools that you were using at the beginning of 2000?

VH: For the 2D planning, mainly "Autocad" and "Archicad" were used.

The software “Form-Z” was used for the 3D modelling, and there were a few licenses for “Maya” and “3D Max”. Then I introduced the “Rhino 3D” modelling software into the office.

Of course, there were also licenses for the usual image and layout editing programs.

AC: In which projects did they need digital modelling?

VH: The National Stadium in Beijing for the 2008 Olympic Games.

After the competition phase, a precise 3D model of the stadium had to be created. This was not possible with “Form-Z” by itself. So we switched to "Rhino" because this software has better functions for the 3D modelling of complex geometries. "Rhino" has some features that lend itself well to architecture that other 3D programs do not have.

AC: In which projects did you use Rhino for the first time?

VH: Difficult question. I have provided digital support for many different projects.

The good thing about Herzog & de Meuron was that they gave me the freedom to experiment with different technologies.

I've always been very interested in the connection between architecture and computer science, so I quickly got involved with the programming interfaces of Rhino. It is possible to program and parameterise complex operations instead of drawing them. At this time, this approach was absolutely unusual for architecture offices.

AC: So you showed them Rhino.

VH: Yes, in addition to Rhino, I also introduced scripting into the office.

At that time, I started with Visual Basic and used examples to demonstrate how you could program and change complex geometries without having to redraw them over and over again.

This is nothing new these days, and many offices are familiar with this approach.

AC: So you convinced them that Rhino could be a helpful tool to go further in the design process, experimenting on the objects' shape.

VH: At the beginning of my job, I supported the teams with 3D modelling.

The interest was enormous, and I was then more and more often involved in design changes and design adjustments. I enjoyed that, of course, and showed that digital tools could also play a role in the design process.

AC: I have the idea that they are curious and very open to any kind of technological tool. If they recognise some interest in a particular tool, they try to integrate it in their approach to architecture, exploring the possibilities that this can open in the design process.

What impact did 3D modelling have in the office? Do you think they felt it somehow as an improvement?

VH: The computer offers the opportunity to generate geometries that a person cannot easily imagine.

For example, if you subtract two three-dimensional bodies from each other, the result is not necessarily predictable, but inspiring residual spaces or areas can arise.

The computer can carry out such operations in seconds, and the result can be viewed immediately from all sides.

AC: What you are describing is an operation similar to that of the Jinhua structure, right?

VH: Exactly.

AC: I know that for Jacques Herzog, Jinhua is a significant project. He speaks about Jinhua as the first project that they designed entirely in the virtual environment, using 3D modelling to conceive and visualise the form, which would have been difficult by other means.

Looking at the work of HdM, we notice that around 2000–2005 there's a shift from 2D to 3D. For example, before that, ornament was mainly explored bidimensionally. The ornamental motifs were applied directly to the materials' surface. I wonder if it is connected to this, that when HdM introduced 3D modelling in the design process, the projects gained a three-dimensionality.

VH: The “gain in three-dimensionality” is perhaps the wrong formulation here. At least some projects have become more digital.

New tools open up the possibility of experimentation, and they also took advantage of it.

This means that the computer was not only used for the process of generating the shape. In addition to providing the basis for visualisations, the computer also allowed us to create sections and floorplans directly from the 3D model. Even production data for CNC machines could be generated from precisely constructed 3D models.

AC: HdM work a lot with physical models, which are an excellent means to visualise the shapes you conceive in your head. So I suppose that working with 3D modelling allowed them to improve the complexity of the projects.

VH: I'm not really sure if a 3D model can completely replace the physical model. I could often see that in a meeting, the built model always got more attention.

Despite new technologies such as VR, I can well imagine that this has not changed until today.

AC: In one of the HdM monographs by Gerhard Mack, the author mentioned that in Actelion, a stacking project that comes from the original idea developed in Qingdao, China, the computer played a fundamental role. It helped the architects to control the complexity of the form.

VH: In your statement, I like the word “help”.

The computer helps but is not at the same time the source of ideas. However, the computing potential of the computer can also be used for architectural purposes. For example — as you say — for controlling complex geometries.

AC: HdM are always and only thinking about architecture. I agree with you.

However, there is always an influence between the means and the research you have in mind. For example, if you have a collaborator in the office who can develop specific architectural topics with the tools that he masters, this, of course, allows the architects to go further with their interests, otherwise they perhaps have to change direction.

VH: During my work, I became aware that the computer is just a hand tool for Herzog & de Meuron, but that with the increasing digitisation, you can dive into specific areas and research them. For example, parametric design, in which one can use algorithms to bring components into certain dependencies.

However, I can also well imagine that, for example, algorithmically generated shapes are no longer of interest for the office and that new technologies and approaches have been researched there for some time.

AC: Currently, they are exploring more BIM and virtual reality.

VH: It could be. Or maybe a mix of several technologies. That's a good question for the current digital technology group.

AC: I think that they are very wise in catching the possibilities of a design tool. Just think about the passage from the 2D to the 3D of which we spoke before. HdM like to experiment with new things. And when they feel that some specific tool, that, for instance, one of their collaborators has mastered, can improve their research interests, they explore it.

VH: I absolutely agree with you.

Fortunately, at the time, I was in a position where I had the opportunity to try out many different technologies. Some of the results were of interest to the office, were followed up and partially incorporated into the projects.

AC: Do you think that the work you developed in digital modelling has somehow led to a new way of approaching architecture in the office?

VH: I do believe that new technological possibilities have influenced some projects.

At the time, I was fascinated by the fact that projects never repeated themselves and that HdM always sought new approaches. Therefore, digital processes certainly also played a role for a certain period.

AC: Kai Strehlke joined the office in 2005 to work on the Ciudad del Flamenco project, and from this moment, scripting became relevant in the office as a supporting tool in the design process. However, first, you said that before 2005 you were already working with small scriptings.

VH: I started by creating some "helping" scripts, like those for the National Stadium in Beijing. When developing the stands for a stadium, there are some important rules to keep in mind. This can be easily

inserted in a computer script, and the algorithm behind it is relatively simple — for example, the quality of the view from a grandstand to the field.

By changing individual values, it can have a significant impact on the shape but also the capacity of the stadium. With this script, you could try out quickly and automatically different situations and settings.

At that time, I was working with Steffen Marbach, one of the partners. He was very interested in these processes and realised that they saved us time and enabled us to react more quickly to changing things. I assume that he talked to Jacques and Pierre about it and then gave me the chance to delve deeper into the subject.

I was also involved in the Prada Levanella project. At that time, there was no parametric software like Grasshopper, so I developed a program with which the free-form roof could be set and changed using an Excel table. This, of course, helped the design team to make their own settings. The data for a 3D print was then created directly from this generated 3D model. This was the first step towards a digital process chain, so to speak.

AC: You told me that this was the first 3D printed model of the office.

VH: In fact, I'm not sure if it was the first 3D print. However, it was certainly the biggest and most noticeable print in the office at the time. In contrast to the 3D prints made of plastic, the plaster model was convincing. After an internal evaluation, the decision taken was to outsource the 3D printing.

Regarding scripting, I forgot one more interesting project. I worked as well on an oval table based on a small computer script.

AC: Kai spoke to me about this table.

VH: There were four control points that outlined an oval. The script was able to automatically move the x and y coordinates of the points according to a certain rule so that each time a change was made, a different oval-like drawing was created. After this procedure, I generated a PDF with many slightly different shapes, and from this, the shape for the table was selected.

AC: I saw this table in the archive.

VH: Yes, the project was fun, and I think this parametric approach helped me to make decisions.

AC: That's why HdM interest me. They are open to technology and have integrated it into their design practice. However, this is somehow hidden. When you look at their buildings, you don't see that kind of architecture in which you suddenly feel that there's a digital tool behind it.

VH: I agree with you. In some projects, however, conclusions can be drawn about the tools. At least with the people who know a little about it. For example, I would mention the facade of the Basel Exhibition Centre or the glass printing of the Elbphilharmonie.

AC: I know that you also worked on the competition for the Gazprom highrise.

VH: The Gazprom City project was very interesting for me. It led me to learn how to include the topic of parametric design in a competition. In this project, it could be shown that scripting is helpful for the generation of form but also for the analysis of design statuses.

In this case, the area calculation was output directly when a proposal for the tower was generated.

It was similar to the Messe Basel project in which I worked with Steffen Riegas. For the facade, for example, the maximum bending of each individual aluminium sheet could be displayed.

AC: All of these functions allow you to optimise your design in specific topics.

VH: Exactly. By iterating with different design parameters, shapes can be optimised.

AC: When I spoke to Harry Gugger, he told me that one of the first times they used scripting in the office was in the competition for the high-rise in Zurich, to calculate the "two hours shadow".

VH: Yes, this is a very good example of how a computer can take over repetitive processes that follow a clear rule. For example, in this case, the script was able to calculate the shading of a building at any time, both as a percentage and as a line drawing. Nowadays, such tools are probably already implemented as a standard in the CAD software.

AC: Harry Gugger also described Südpark as a paradigmatic project in terms scripting. So, there was the table, Prada Levanella, and the competition for both Gazprom and the Zurich high-rise.

VH: Yes, and many more smaller projects.

In any case, I would also include the facade of Messe Basel.

AC: I know that you were also involved in the project for the Tate Modern extension. I suppose you developed the first scripting for the facade.

VH: The challenge in this project was the geometry of the building. The project team had difficulties creating a 3D model for the building because the surfaces are inclined. Geometrically, this is not that easy — especially when sloping surfaces intersect. Together with Dominik Nüssen, we helped the team to translate the 2D drawing into a 3D drawing.

AC: There was a big issue with the bricks and their geometry, especially at the creases and corners.

VH: The formulation of the crease and corners was solved by the project team. We supported the automatic distribution of the stones in 3D.

AC: Why did they ask you for the scripting? Was it because of the amount of data?

VH: Yes that's right. With every change in the building envelope—such as the inclination of the surfaces—the position of the stones also changed. If you had to draw each one individually, it would be quite time-consuming.

AC: What do you remember about this process?

VH: At this point in time, it became increasingly clear to me that the digital processes described can provide enormous support in the development of architectural projects. Today this topic has found more acceptance in offices — especially for large projects. It was already clear to me at the time that generative approaches in architecture were not just a fad.

AC: In your opinion, what are the most relevant design tools in the practice of HdM?

VH: You'd best ask Jacques Herzog and Pierre de Meuron. I would also be very interested in the answer. I would imagine that part of the answer is creativity and good ideas. The computer will likely have a minor role.

END