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PROGRAMA DE DOUTORAMENTO EM ARQUITECTURA

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

Alexandra Castro

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

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FACULDADE DE ARQUITECTURA

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The Hidden Geometry of the Architecture of Herzog & de Meuron

Digital Tools and Design Practice

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Kai Strehlke

A.02
Kai Strehlke.
Head of the Digital Technologies Group at HdM from 2005 to 2015.

"I see it as a little bit like an orchestra."

Conversation with Kai Strehlke

Zurich HB train station, Zurich, April 16, 2019.

Alexandra Castro (AC): Maybe we should start from the beginning.

You joined the office of Herzog & de Meuron in 2005. What did you do before? What is your background?

Kai Strehlke (KS): *I studied architecture, and when I finished I worked for an architect in southern Germany for two years, but I got very fed up with the quality of the architects' work in Germany.*

In Switzerland, you always work in a team. Everybody—the client, the architect, the constructor—all these people work together. In Germany, it is more like a war zone. When you do the bidding, the companies present very low prices because they know, as things have not been really decided, that later on they will get the money back. So it's not about working together, it's more about working against each other.

AC: Even between architects and engineers?

KS: *Very much between architects and engineers. You always have the bidding phase, in which you have several companies giving a price, and if you are doing public commissions you have to give it, very often, to the lowest price. Later on, there are mistakes, changes, adaptations, and the companies, with this, make a lot of money. This situation also creates a lot of distrust between the architect, the companies, and the client who got the price and has to pay more. All this makes life very uncomfortable.*

So, then I decided to go back to the ETH in Zurich. I did post-graduate studies in digital architecture, which, at that time, was very CAD-based. It was based on virtual architecture, on creating platforms and exchanging design ideas. It was not so much based on tools to create digital architecture, as we think about it today.

Afterwards, when I finished these post-graduate studies, I worked for six years at the ETH as an assistant, where I got to know CNC fabrication, the Prefix, which was a milling machine bought by Greg Lynn. When he left for Austria, he left the machine at the ETH, and, together with a colleague, I was

setting courses for the machine and doing lectures on digital fabrication. This was when I got fascinated by the connection between scripting, doing parametric design and realising it on the machine. During these six years at ETH I did a lot of different kinds of projects, and afterwards I went to HdM.

At HdM, my first task was to create an ornamental pattern which was also a functional pattern for the building Ciudad del Flamenco, in Jerez de la Frontera. I started with this project, and afterwards I was always put into groups which could not solve their problems with the standard technics of drawing. So I started to become a kind of "ping pong" player. There was the office, who were working on architecture, thinking architecture, and me, coming from the scripting side, trying to create a tool to enhance, to push the teams to realise what they wanted to do.

AC: How did you start working in the office? Were they looking for someone with specific skills to work in the project for Ciudad del Flamenco?

KS: Yes. HdM had won the competition for the project Ciudad del Flamenco in which they wanted to use an ornamental pattern. Jacques Herzog had two ideas. He is always using these kinds of artifacts he finds in the place, in the region, in the culture, whatever. At that time Jacques was interested in Arabic calligraphy, on the one hand, and on street tags. For him, street tags were a kind of modern way of using calligraphy. He thought that it would be a good starting point to search for a formalism which could result in spaces, the facade, or a shading system between the inside and the outside. In that period, the team was working by hand. They were working with Photoshop and drawing everything by hand.

AC: Before you came in, were they working only manually?

KS: Yes. But HdM wanted this pattern for the facade to be much more adaptive, much more related to the architecture they had. They were not happy with the results coming from the teams, so they asked me to do a script for this facade, and this was the very first job I did there.

AC: So they asked you to come to the office to develop a script.

KS: No, they asked me to solve this problem. They didn't care about scripting, and they didn't care about whatever. They could not resolve it with the manpower they had until then, and they asked me to solve it with whatever approach I would use. They would have also been happy if I had done it with another tool.

AC: As long as the problem was solved.

KS: Yes. Have you seen my PhD?

AC: Yes, I've translated the part about Ciudad del Flamenco into Portuguese.

KS: This project was the very first one. What happened then was that I did not get the idea. I did the script for it and started to play a kind of "ping pong" game. I began to understand what a tag is. Then I created the very first tag, and afterwards I showed them what came out. Christine Binswanger was the partner in charge, and she reacted to it. She liked some of the stuff I did, disliked some other

stuff, and then it was a kind of "ping pong" game, between me doing something and she reacting to it. Also, Jacques Herzog and Pierre de Meuron were interacting in this process. It turned out that, in the end, they were quite happy with the result at that time! I think that now they would look at it differently.

You have to understand that an office has its own path. There's always a moment in which they open to new directions, and that was really a direction. HdM were very interested in using these digital tools and finding forms with them, and they were also very interested in patterns and ornamentation, which they abandoned later on.

AC: I have a diagram with some of the projects from the office and, around 2005, we can see this interest they had for the use of patterns in other projects also.

KS: Yes, exactly. You have the Walker Art Centre Museum.

AC: The De Young Museum also. But before you came in, they already had some projects with a kind of complexity, like Elbphilharmonie or Beijing Stadium.

KS: Yes, of course, but Elbphilharmonie was different, because in 2005 it was in a very early stage. I worked on the frit pattern of the facade, and my team—not me, but Benjamin Koren—he worked on the acoustic system on the inside, but much later, maybe in 2006 to 2007, when we built the 1:10 scale model of the concert hall.

All of these patterns that we had on the surface of the hall, I think they still did not exist at that moment. HdM knew that they would work with Yasuhisa Toyota. They had to break the surfaces to improve the acoustic situation, so they thought about this pattern. The scripted pattern and the Voronoi system used inside were basically taken up by the team, which was guided later by Benjamin Koren.

So, I would say that around 2005, 2006 and 2007 they were very much interested in this kind of ornament. And they were searching for what happens inside an ornament, like the Jinhua structures. This is a project where they were exploring what kind of architectural qualities can be discovered from an ornament, how spaces can be created from an ornament. There's also another wooden structure built for the Beyeler Foundation in Basel. I think all these projects are pointing to a particular moment in the whole path of HdM.

AC: So is this all connected with scripting?

KS: No. For example, in Tate Modern, it is not connected with scripting. The scripting came later. I scripted on the facade of Tate Plus, and I translated what they wanted for the facade with the script.

I worked in quite a lot of different projects at different stages, but as you said at the beginning, the script was never pushing the architecture, it was always the architecture. I consider Jacques and Pierre to be like eagles, having a kind of meta view on the project. They know what they want, and, with them, the partners. Afterwards, it's all about how they do it, what kind of teams they play, what kind of manpower they put onto this idea, and then it starts a sort of "ping pong".

They would never hype any kind of technology for the sake of the technology. Jacques and Pierre are extremely wise and intelligent, they always try to take all the advantages they can from all of the

different people, from the team, the technology or whatever, and they try, from all of these, to get the maximum.

AC: I've got these two diagrams which I suppose were made by you.

KS: Yes, both of them are mine. This is a more difficult subject. There is a big, big push nowadays on BIM, and I'm extremely critical about BIM. There's always this argumentation that you have hand drawings, and then you jump into the CAD drawings which are only a translation of what used to be done by hand. Everybody is saying that the same thing is happening now. CAD is over, and now it's BIM. For me, this is too short-sighted, and it is not the reality. I see things as much more complicated. When you look at this diagram, we even have hand drawings much later in the office.

We have done a building in wood, and an architect drew a plan by hand at the scale of 1:1. At 1:1, you have the thickness of the wood, and while you draw it, you understand the forces, you understand if this piece of wood is too thin or too thick, if it becomes clumsy or if it becomes elegant. Before, with hand drawing, we worked in scales, and with time you got used to what a scale is. As an architect, you could jump between scales. It was a mindset which allowed you to do a certain kind of architecture.

When you do the CAD drawing, you can erase everything, and you can copy things, work with blocks. You have the technology to be much faster on the drawing, but, at the same time, you have lost something. You lost the sense of scale, because you are always zooming in and zooming out. You see it when you ask people to make a drawing at the scale 1:500. Nowadays, very often, students don't understand that at 1:500 it's a different abstraction, a different logic in what you want to say about the urban situation or the building. They just take the same drawing and scale it down, and this is not why you have different drawing scales in architecture. So, with this kind of CAD drawing we gain a lot, but we also lose something, which I think we should not forget. When we teach, we should be aware of these things.

BIM is extremely pushed by industry nowadays. With parametrics, I see that you get the geometrical sense of what the design should be. When you do a script, you try to use the idea which is in the architecture, and you translate it into a code, however, the driving motto is always architecture, is what you want to realise in the end.

AC: And you think in architecture using a geometric approach.

KS: Yes, yes, and BIM is different. The mindset we have is like a legal system. With BIM, you don't think very freely in an architectural way. You think very early in building elements and how they plug into each other. When I was working at HdM and we had to decide if we should do a building with BIM, I always wondered whether the model could be done using LEGO. If LEGO would have been a good system, like it would have been in some of these buildings, then BIM could be a good way to start quite early. But even then, I always preferred to have a very free approach in the beginning. We had projects which were squares, circles, triangles. You have huge changes inside the projects, and I think you are much faster with a hand sketch, a small poem you write, a clay model, or whatever. You have an idea, and you just try to catch the idea; this is what you try at the beginning of the design. I find it very confusing if you start with a very big model where you already have a database. So there are certainly

reasons to use BIM, whatever you call BIM, because BIM is just Building Information Model, and there are millions of definitions behind, or understandings of what BIM is afterwards. But for me, I see hand drawings, then CAD drawings, parametric design and BIM, and for me, they are different kinds of mindsets. I don't think this is only an evolution in one direction, but sometimes a particular technology is absolutely valid, even nowadays.

AC: So, you're saying that some things from hand drawing, for instance, can also reappear nowadays because they are needed and still make sense.

KS: This diagram was an internal presentation I did when I was in charge of the CAD drawings in the office. For example, I think that for the CAD drawings to build Prada Tokyo there were less than 100 plans. I guess that for Elbphilharmonie there were 5000 to 10,000. Each toilet, each door, each element was one plan, and we had thousands and thousands of them. So it became extremely difficult to organise the plans and to be sure that we hadn't made any mistakes in any of these thousands of plans. So I started arguing about whether this is what we really need. Do we need so many drawings to define architecture? When we look back at hand drawings, we could not draw 1000 plans. We had plans which were capturing the main idea, and more details were drawn on the plan with annotations.

AC: But we are also talking about a different size of project and with a higher complexity.

KS: Not always, Prada Tokyo is quite a complex project. These projects are bigger, but you have others which are also complex but with a small number of plans, and nowadays all the projects are going into thousands of plans.

AC: So you are saying that when we worked by hand, we were more synthetic.

KS: Yes!

AC: Because we knew that it takes time to make a drawing, and with CAD it is just copy-paste.

KS: Copy-paste, change a little bit. If you have a bathroom, and another one which is exactly the same, but in one of them there's the window which is a little wider, you copy the whole bathroom, and you have two floorplans and two interior elevations of the plan. You have an attitude to drawings, and this is something I was very much criticising.

I did an exhibition inside the office where I wanted to show how we had changed our way of drawing in the office from very old projects to very new projects, and how the scripting and all these things also changed the quality of drawings. In a big shed, we had this exhibition where you had the drawings of different periods and different phases of the work—initial designs, sketches, but also drawings for construction. You had a kind of metrics in which you had an evolution within the time and the project. I just hung these things, and I did a few of these graphs to say how many drawings, how many projects we had, what kind of types, and there were a few of these diagrams.

This was one of them. This diagram was also to show that the transition from hand drawings to CAD went quite fast. From a method point of view, first, it was only replacing the hand drawing with the CAD drawing. With scripting and BIM, we took much more time.

AC: Scripting and BIM appear and disappear, maybe because they are not always required.

KS: Scripting, yes, but BIM not quite.

The architecture pushes the scripting, so it depends on the projects if it makes sense to do scripting and what to script. Scripting is only pushed by architecture. BIM is pushed much more by the technology which is behind it, by the market and by the client. So why we choose different kinds of technologies depends also on who the driving force is that is behind it.

I am much more critical with BIM. For example, you have a project where you have a very small footpath, and from this footpath you create a smooth transition to a wall out of it, and then the wall starts to turn into a roof until eventually you get a very big covered space. If you would do this in a "normal" way you would take a piece of paper and you would glue it and lift it. It doesn't look pleasant, but it is a sketch, and it totally translates the idea. If you do this in Rhino 3D, you could work with a single surface which is lofted.

If you were to do it with BIM, what is your building element? Where is your floor, where is the transition? How does it work? You don't want to decide all these things at the beginning of the design. You only want to grasp the idea first, do your findings inside the idea and then make this idea sharp. If you start too early with this kind of definition, you do not support the idea. You kill the creativeness. This is why I'm quite sceptical about BIM.

My biggest luck was that I worked in an office which is driven by architecture and is doing this "ping-pong". That was my biggest luck—of having people who did not neglect the scripting but who were clearly interested in the architecture, and only in the architecture. Many other offices in the world are hyping technology and only thinking in one kind of way, and for them there's nothing else but this technology. Some of these offices were like star offices in 2000, and they do not exist any more. It was like a bubble that exploded.

AC: You joined the office in 2005, and then you set up the "Digital Technologies" group, right?

KS: They pushed me to set up the DT group. My greatest pleasure was to script, to be in the teams and to play this "ping-pong". This was one great pleasure that I had. Another one was working together with the workshop guys, and bringing these two worlds together, the analogue models, analogue design and digital models with the CNC machines.

So my greatest pleasure in the office was when I could work on the scripting on one side and the workshop on the other side.

I was asked to guide this DT group, and this implied having to conduct all the CAD management, to oversee the image-makers and to guide the scripting team, the digital workshop and the BIM team. I was trying to script myself and, at the same time, guiding the digital workshop. I was milling and creating models, but also conducting the people to work with this workshop. For CAD, we had

someone working on it, and I tried to put some logic inside, and some quietness. Also, with this kind of exhibition, it was a subtle way to ask people to create less unobligated data.

The image-makers were a very, very strong group. I was not doing any images myself, but it was more human resources. I was getting people and placing them, and trying to support them in a way so that the quality of their work was always at a top level. In an office like this, you have the tendency that every working model, every working sketch, becomes like a final submission sketch. Every team inside the office wishes to make, already, on the first sketch, a fantastic rendering. And this is something you have to fight against. I was trying to have the teams working only on important images. I was also trying to work with external companies that did professional images, to have these renderings always on a very high level, but, in a way, so that not everything became a super important image.

The BIM department was the team with which I had more problems. I had to decide when we should take BIM, how deep we should go. Some people knew how to use it and always wanted to solve everything in BIM. I tried to understand when it worked, but I didn't touch it myself; I never worked with REVIT, I never worked with these tools, it was more about managing these tools from the outside.

So, image-makers, CAD and BIM was more about managing, while scripting and the digital workshop, I did work on them.

AC: The main fields of the DT group were parametric design and scripting.

KS: My favourite.

AC: Digital fabrication and digital workshop.

KS: My second favourite.

AC: CAD management and geometric support, then visualisation and video and finally BIM.

KS: Here, we should make two differences. One is CAD management, which was AutoCad. We had one guy who was inside and outside Autocad.

Geometric support for me was different. For example, we had one project, which I think was the Blavatnik School, where Jacques Herzog came in with four points, saying that these were very important for one of the shapes. So the team took these four points, did a NURBS curve with them, and asked me for scripting. I said these four points were nearly a circle, and it didn't make sense to do this NURBS curve. So I suggested they just take three of these points to have a perfect circle, and then we would see how much we were out of the four points. It was like 30 cm. It was nothing! So I said, "We make a circle, and we just push the four points into the circle." At that time, the team said, "No, no. Jacques said the four points could not be touched! We have to make a shape out of it." And I said, "This is nonsense because if we make this, every single window will become unique, but the difference between them will be nothing. Nobody will understand this. By just using these four points, you will make the building a few million more expensive, and this does not make sense." This is what I considered “geometric support”— to make people aware of what kinds of simple geometric rules could be applied, in what situations, to create something easier, simpler.

AC: Now, when people use Rhino they get in contact with complex geometries, and most of the time they don't understand them, they do not control them, and they are not aware of what they are doing.

KS: Yes, exactly. This is what I said very often when we had these design problems. I always tried to understand what the kind of ruleset is which could drive the design, which I could use in scripting and which could also be used in construction.

Another situation happened with the Sud Park building, which is not very esteemed in the office, but I like it a lot. I worked on the scripting of this project. This was first done and scripted by the ETH. They did a script where you pushed on a button and then the whole facade was generated. You pushed again, and the entire facade was generated again, again, and again, and everything changed. HdM wanted to have this randomness, but, at the same time, they wanted to have control. So, when HdM stopped working with ETH, I took over the script, and I said, "Let's take out what has been scripted by ETH, interesting shapes. Let's try to build one and to understand what it means as a window. What is the frame, how much glass do we have?" Because we had some of these windows in which the glass became like one millimetre, and the frame around was complete nonsense!

AC: They did a script without thinking about the architectural result.

KS: Yes. So I suggested, "Okay, let's take one of these openings. Let's understand it as a module, as something we could use." The constructor also explained that if we started to repeat some elements it would become cheaper, so HdM decided to work with a set of so many modules. At the same time, the design team came and said, "We don't want this to be just driven by a facade study. We want this to react on each floor, on each room that is inside." And this makes sense because it is not an artificial facade, but a facade driven by what happens behind. There was a difficult communication happening between the ETH, who saw this more like a purely geometric problem, and the team that could not work with what they got from them.

In the beginning, they asked me to work on this, but I was working on the project Ciudad del Flamenco. As I did not want to take everything on me, I suggested we collaborate with the ETH. Hdm started to work on that project together with ETH, then they stopped and I took it over.

AC: So this is what you call geometric support.

KS: Yes—clarify the geometric structure, the logic, and why you do it.

For example, on the roof of Elbphilharmonie, these are very simple NURBS. They are driven out of the NURBS logic, and it works. It works for the roof, it works for the appearance, and things like these are understandable there.

Another beautiful thing is the furniture designed by the office. Herzog & de Meuron often focus on the details and also design chairs and tables. There was a table in which Jacques worked with an older person in the office, Mario. They were drawing by hand, and they did not want to have a round table, they wanted a table which looked a little bit like an egg. The drawing they created had millions of lines, so they came to us with this drawing, and we had to understand what kind of shape they wanted. We drew a NURBS shape on it, and they were happy. But then Steffen Riegas tried to understand how this

NURBS shape functioned, and he found out that it was four ellipses fitted together, in which you have the tangencies. So we build these four ellipses on top of this hand drawing, and it was exactly—exactly—what they were drawing before.

I believe this happens with the axes, it happens with the arm, with the way of movement, of how our human being is drawing something that is not a perfect circle. It is beautiful to see that someone is sketching a weird form, then you rationalise it, and you see that there's something very clear about it. There's a rule behind this form, and you can translate it into something with three control points, it's very simple. And this is something which I find absolutely fascinating about geometry.

AC: Does this have something to do with the courtyard of BBVA? Did you work on it?

KS: I've worked on the shading system of the BBVA. On the main egg; I had someone working on it, but I don't know exactly how it was defined.

AC: I have the idea that the work developed by the DT group on parametrics and scripting is concerned only with specific parts of the building, for example, the facade, the spiral staircases, the random patterns. It's never applied to the entire project.

KS: Sometimes you have situations, like in the Elbphilharmonie, where you have particular things on specific scales, like the frit pattern of the facade, the roof, the pattern on the roof, or inside the auditorium. Different moments where you use different tools to create the architecture. You create a specific tool for a particular architectural element, which later becomes important for the building.

I worked in Austria as a professor, and I always had students who wanted to work only with one technology or one material. They wanted to make a wood building, without using any piece of steel, and very often it resulted in a kind of poor architecture. It's a radical movement, but it's a movement which is too intellectual. This office is also very radical in what they do. Still, scripting is not the solution for everything. It is the solution for the facade or the spiral staircases, which then become a very important element inside the overall design, in contrast to something else.

AC: Digital fabrication is quite connected to parametric design and scripting, which, besides solving specific design problems, facilitates their translation into fabrication, allowing, therefore, the building to be customised.

KS: Yes, but this also came much later in the way I worked in the office. The first thing I did in Ciudad del Flamenco was an ornamental pattern. I scripted it, but I was not considering how to build it and what the advantages could be.

When we developed the Messe Basel, in which Steffen Riegas and Volker Helm worked a lot, here it was about how much torsion and pressure you can put into a flat panel to deform it. You can distort the panel only by forcing it onto the surface below, which makes it much cheaper than creating a formwork to bend the panels. So, understanding the production process and using its advantages in the scripting to also make the production easier—this came a little later in the office.

AC: So the Messe Basel was one of the first projects in which the topic of digital fabrication was taken into consideration in the design.

KS: It is one of them. The Elbphilharmonie, where we used the frit pattern, is another one. In the beginning, somebody else was working on the frit pattern. They created tremendous, big Autocad files, where the construction company took an extremely long time to transfer the design data onto the machine. We went to the company and asked them what kind of data their machine was getting. In the end, we did not submit a drawing, but the pure data for the machine included additional information, like logistical information. Everything was in this dataset. They didn't have to do anything. In the beginning, they took, like, eight hours for the workflow to get the design produced by the machine. We reduced this to five minutes. At that time this was quite difficult, because, as an architect, you design something and afterwards the constructors do their own construction drawings. In this case, there were no construction drawings, and my data fed the machine directly. I was extremely afraid about what could happen if I made a mistake. To control my work I designed a reverse engineer process where I converted the production data back into a two-dimensional design. This was a time-consuming process, but it gave me the confidence that my production data was correct. An error in the production data would have caused enormous costs.

AC: But it makes sense to establish a connection with the production phase and to work in a digital chain in which design and fabrication are connected.

KS: I'm now working in Blumer Lehmann, and there we try to get in contact with the architect very early to make one prototype to solve technical, production and material issues. In this way, before defining everything, before the bidding phase, you can take this knowledge and use it to understand your design.

This is something we tried in the office. We tried to work with mock-ups a lot. But if we had a public building, like the Elbphilharmonie, we were not allowed to do it. We were allowed to get in contact with the constructor only after the bidding phase. This is a big mistake. When you do standard buildings, you can work with standard building elements, and you can define them in a standard way. Then you can ask for prices and compare prices. But when you do something where everything is unique, it's very difficult to make a definition of what you want. Even as an architect, you still don't really know how you are describing it, in a perfect way.

AC: If you work closely with companies, you can inform your design process and make the building more economical because its design is connected with the construction system.

KS: Exactly, and this is the main difference between private and public buildings. In a private building, the investors understand it and can say, “Okay, we’ll make a mock-up”. Public clients are bound to follow official rules.

AC: In your opinion, what was the great added value that parametric design and scripting brought to the design process of HdM?

KS: I think you can push the design and you can realise things with scripting which would have been much more difficult to do without it. But I also think that it's because of the way we scripted it. In the Auditorium du Jura, the team wanted me to script something. I went into my small room and started scripting it. After ten days, I came and said, "I have a result!" and they said, "No, we don't want this any more, we are in a completely new design direction now". And they gave me another exercise. I went back into my room and started scripting again. When I finished, I came, and I said, "Look! It works" and they said, "Yeah, but it's over, we already changed the design". So, when I was in the office, I understood that you have to play "ping pong". There's the speed of the design team, and when you play "ping pong", you just get a certain amount of time to bounce the ball back on the other side. If you don't do it, the ball falls out, and you are out of the game.

This was something I understood very much here in this project. If I want to play with the design teams, I have to react within one or two days, and sometimes within hours. Then the scripting was also very often not perfect, but enough for the design crit to grasp the idea, to still be in this game. So the added value was that, from the moment I understood this, I was able to play this "ping pong" and work together with the design teams.

I learned another important aspect when scripting for a design team with the project Ciudad del Flamenco. In this project, they asked me if I could do some variations. I did ten variations. They looked at them and asked me again for variations of the variations. This process repeated to the point where I had scripted more than 400 to 500 different kinds of facades. There was a moment where it became difficult for the design team to react. This was when I understood that scripting is not pushing on a button to create 100 different shapes, but it was to understand how many shapes you can create for the other side to grasp it, to understand it, to work with it and to react to it, and I became much more subtle and efficient with the time.

For the Elbphilharmonie, I worked on the frit pattern, and I only provided them with ten different design possibilities of how these dots, triangles and small different other shapes could be. Very little information. I worked a lot, I decided by myself, I reflected by myself, and I only let—after a very strong self-filter—little things into the design team. I understood that a lot of people were in this design. Even my scripting group, who was so proud because there was a design team which was doing one version, and they had scripted fifty versions. This is not what you want. If you want to have “ping pong”, you play with one version against another one. If you start submerging the office with a lot of variations, it becomes more difficult to choose what you really want, and to develop something which is there and is good.

In the image-making, the marketing department, which is called the "kitchen", worked with photographers a lot and sometimes I got some subsets of photos to analyse. Sometimes you've got photographers that, when they go to a newly built project, they make 800 images, and they submit these 800 images. Then the partner in charge—Jacques, Pierre, the marketing, the project manager, some architects—everybody is going through 800 images, analysing the subset, and it becomes difficult. As a photographer, you have the power of choice. First of all, when you make an image, when you shoot your camera, but also after, when you have 800 images, you have to choose what the four or five images are you should really give to your client. For me, it was the same in scripting. I could click on

a button and create 800 versions, but in the end, for me, the important thing is how many versions, how many variations I have to submit to be in this "ping pong" game, and not make things too difficult.

AC: I suppose that one added value of parametrics and scripting is to open up the design possibilities and allow their control from a geometric and numeric point of view.

KS: Not always, because you have the parametric design, but then you have agent-based design and optimisation design.

Parametric design is very simple to translate to the team because you have parameters which are driving your design idea, and this is quite simple to decide. For example, in the Elbphilharmonie you had rooms with one to five windows. You had to achieve 30% of G-value for every room. Big rooms with five windows could have some windows with a higher light transmission and some with a lower light transmission, as long as the complete G factor for the room was achieved. In this case the parameters where very clear.

But, for example, if you have an agent-based system it becomes much more difficult to control the design. It also becomes more difficult for the design team to understand how much you are still driving the design, and how much it is a random process completely out of control and you just click when you like it. So for me, I work much more with parametric tools. I also work with optimisations and agent-based, but I found out that for this office, for the spirit of the office, a parametric design approach was the best.

AC: I read that you implemented in the office a digital workshop with CNC machines, which had a relevant impact in the model-making process.

KS: When I started in the office, they were thinking about having a 3D printer. They asked me to support the 3D printer, and I declined. I said I didn't want the 3D printer, and they didn't understand. They said, "You are a digital guy, and you don't want a 3D printer?!" I replied that, for me, a 3D printer is very often quite easy. The easiness of using Rhino to create complex forms is very cheap to translate on a 3D printer. But if you take a cardboard cutter or a milling machine, you have to understand the form, you have to understand the tool, and you have to understand how to assemble it. All this kind of understanding—how you make the model, how you assemble the model, how you subdivide the model into elements—is part of the construction process. If you just 3D print, you are not so critical about the construction process. This is why I was, in the beginning of my career in the office, very critical of 3D printing.

First, I asked for a laser cutter, then I got a 3D mill, and after, a cardboard cutter. With the laser, they started to make every model with plexiglass, which looks very shiny, very beautiful, but with this materiel every working model looks like a final model. People didn't understand that a model is only an abstraction in the process of the design development. With the laser, you don't change the model. If you have a cardboard model you can tear things off, you can glue things on, and you can change things. The model becomes ugly, but there's a process in which you work with the model, and you work on the architecture. You understand what happens, and there's a transformation process

occurring in the architecture, in the design process, but also in the making of the model. This is why I tried to work more with the cardboard and the milling than with the 3D printer.

I also later bought 3D printers. The office became bigger, the 3D printers became cheaper, and you want to play with all the possibilities you have, so we also bought a 3D printer. When I left, there were three 3D printers in the office. The decision-making process in acquiring the digital tools was very well-considered.

AC: About visualisation and video. I suppose that, in the office, renders are considered important design tools that contribute to having a more clear perception of the project.

KS: Steffen and I, we have different views on this. Maybe I'm older, maybe I'm more ancient with technologies, but, for me, an image is something which is grasping the idea of the architecture. When you make a building, you tell a story. When you have a client, you tell a story, and you tell him that your architecture is fantastic and that he has to build it because it is going to be a key piece in the city or whatever. You are telling a story with your building, and to create an image is to put everything into one single frame. When a client looks at a picture, you can follow his view and also control it. You have the possibility to explain to him what he sees. With a VR environment you are in a different world; I have no control of you any more. This is what I am criticising with VR. It is fascinating, but you lose control of what you show.

For example, when I lived in an old watermill near Geneva, we had three different entrances. We had entrances that we took every day, but when we had visitors, we took another entrance. There was also a window where we had a beautiful view of Mont Blanc, and it was always the same; we went up, and when we were at this window, it was very beautiful because we could see the top of Mont Blanc from there. And when we showed the building to someone, we started walking in the building and had a very precise idea of what to show. It was like a promenade architecturale inside the building. It wasn't about not letting people go into some areas, but it was because we wanted to orchestrate how they perceived the building.

For me, images are the highest point of the orchestration because you define the perspective, you put together the information, the detailing, an atmosphere, and people have to concentrate on this image. When you work with a movie, it becomes a little blurrier, and when you work with the virtual environment, it becomes even blurrier still. This is where Steffen has a completely different approach than I have. But this is amazing, because it shows how important it is to have different people with different approaches in a design studio.

AC: But as a design tool to be used in the office, I think VR is a powerful tool. It gives you a more realistic sense of space. It is like entering into a model, and I understand that HdM appreciate physical models very much. They do big models to have exactly this possibility, to experience the space.

KS: There was one image maker in the office who was amazing, and he did a lot of images for the Beijing Stadium. It was Philipp Schaerer. He didn't know how to render, and was doing everything with Photoshop. He had a very small and cheap digital camera, wich he used in the workshop to photograph

the cardboard models to find the right perspective. Then he used the photos as a basis to make fantastic images of the project with Photoshop. These images have an artistic quality, and they have such a strong atmosphere. So all the image makers I called into the office, I didn't look at whether they knew how to render, but I was looking much more at whether they knew how to tell a story with an image using Photoshop or other tools. It's not about them being professionals, but it's about them being strong in understanding the sensibility of an image language.

AC: Which projects of HdM do you highlight as being paradigmatic of a strong connection with digital tools?

KS: With digital imaging, I think in all of them. This was a very, very important step in all the designs we have done.

The scripting, for me, I have to say that the buildings which I've worked on most of my time I consider as highlights; the Elbphilharmonie, SudPark, Ciudad del Flamenco, Messe Basel, Tate Plus.

With the BBVA I had a very strange relationship. I was asked to do the scripting for the shading system, I submitted it, and then I didn't hear anything any more. Once, when I took a taxi in Madrid, I saw that they had built my proposal without any changes. For me, this was too fast; the "ping pong" game was not over. That didn't feel as strong as the Tate Plus, for example, in which I worked intensively with one architect from the office.

I worked on the Roche Tower a lot before it became this triangle. On an earlier stage the design was driven by a double spiral. I really liked it. Towers are very often phallic symbols. The first design for the Roche tower was very feminine. It looked more like an Italian Madonna than a phallic symbol. I found this tower extremely unique in the line of skyscrapers and highrises all over the world. But it was not a Roche tower, it was too far away from the mindset of the company, and I totally understand that they killed the project.

AC: Roche is now constructing a new tower, right next to the first one. So it would not have worked if both buildings had such an expressive shape.

KS: The second didn't exist at this time. Everybody thought that there would be only one big tower. At that time I liked working on the elliptical tower a lot.

If you want, these are more or less the highlights on which I worked.

In Beirut Terraces, there was also a very interesting script done by one of my colleagues. There they did a floor plan, they did a second-floor plan, and after that they created a rule for how one floor could then go on to the next one. There were not so many floor plans, but we had, I don't know, like 80 million different kinds of towers. Then we looked at one tower and said "this is not beautiful." It is not beautiful when three or four floorplans are copied one on top of each other. So we created a rule in which it was not possible to have three or four equal plans on top of each other. So, from these 80 million, we had 30% less. Then there was a very ugly column through which one floor was connected to others, and there was an edge that people didn't like, and so on. In the end, there was a pure randomness of floor plans stacked together but controlled by very specific aesthetic rules, based on the criteria that this is beautiful, this is not beautiful. In the end, only this set of rules reduced these millions of possibilities to

five. The team developed these five possibilities, and for me this was one of the most amazing moments. Jacques came, looked at them and said, "Wow, this is nice!" and we asked "Which one do you want?" and he said, "I don't care, you choose!" It was not about him saying “This is what I want”, but it was about him being the eagle, driving all the processes, and the scripting team getting, in the end, to something which fitted the idea.

AC: In your opinion, what criteria could guide the choice of the case studies in my PhD?

KS: I think one criterion could be ornament. Some buildings, like Jinhua, Ciudad del Flamenco, The Walker Art Centre, the sculpture in the Beyeler Museum, and also the Caixa Forum, are strongly connected to the theme of ornament.

Then there are projects which are much more functional. For example the Messe in Basel. There's a purely functional aspect which is driving the ornamental aspect and appearance of the facade. I would also put the Elbphilharmonie in this category. The driver of the frit pattern of the facade is functional, the appearance is ornamental.

Another kind of criteria are buildings where digital tools, like BIM, are used to solve complexity, to put the design together from a technical point of view. Here, we can no longer speak of digital design tools but of digital management tools. The projects in the office became bigger, more complex and faster.

There are three types of criteria to look at: ornamental, functional, and complexity, which is also related to the size of the projects.

One further aspect is the construction process. In the Messe Basel, the parametric system of the facade panels is connected with the material and the fabrication process. The same happens in the Elbphilharmonie, where we worked together with the glass imprinting companies. This also happened in the early years of the office, like the Eberswalde Library. There, you already had a direct connection between the design, the material and the production process. However, in recent projects, you have the fabrication process, which includes digital tools. That could be a fourth criteria to investigate in your PhD.

AC: Do you think that it could also make sense to look at an issue and make a comparison between how it was solved with the digital technologies and the traditional tools?

KS: You could. For example, when you work with brick as a material, you could look at Tate Plus and Caixa Forum. In Tate 2, there is a very clear relationship with the old Tate Modern and its brick tradition. In Caixa Forum you also had the existing brick facade, and the question about how they were dealing with it. In these older projects, the design was driven in a much more graphical and radical way. In Tate, we worked with different colours, with different grains; we worked with the logics of how to have a pattern that is evolving from the bottom to the top. So there could be situations where you compare an older building with no digital tools and a newer one.

AC: For now, I have to identify what the most paradigmatic projects are that could be more interesting to speak about, and, also, to understand if it would make sense to go back to the

beginning and interrelate things from the initial period with others from the digital one. I think that it would be interesting to talk about the design tools, without neglecting the hand drawing. We could try to see what the differences are, and probably, in the end, we will recognise that digital tools improve some aspects; however, we still should use hand drawing because you can also have some benefits from it. It is not about saying that we should only work with digital tools, but it is trying to understand what they can improve in architecture and what their role is.

KS: I see it as a little bit like an orchestra. We have a lot of different instruments. We have violins, trumpets, synthesisers, flutes. It is not about the violin being the only instrument in the world. It is about all these instruments playing their part in the music and bringing this fantastic music together. This is what we do very often. A lot of people say I am a trumpet player, I am a scripter, I am a Grasshopper guru, I am a BIM guru, and they only focus on and see the world from their perspective. If you are a good violin player, you should play the violin, but this is only one of the instruments that make an orchestra, that make the overall music. My role was that of a scripter; with this clear standpoint I was able to give my input to the projects in the office.

AC: And they liked that, right?

KS: They liked that because they got a clear standpoint from me. They could take it or reject it. In Lyon Confluence, I worked on a masterplan. Pierre came and said that he wanted a tool to decide which of the variations was better. I created a tool, and Pierre was very happy. However, Christine Binswanger thought it was complete nonsense. It was her project, so the tool was rejected.

AC: You developed a tool to decide which master plan would be better. What kind of parameters did you use?

KS: I created a tool that was taking a screenshot out of every window. I got 20,000 images, and with a histogram of every image I could analyse all the images. I could analyse how many other buildings could be seen from a window, or if the street, a river or the mountains were visible from a window.

AC: So it was a question of views.

KS: Yes, and a lot of people found it really interesting. I found it an interesting way of translating what Pierre wanted.

AC: Did he tell you first what the criteria could be?

KS: No, no. I came up with this, but he liked it, and Christine didn't like it. She was the partner in charge. It's okay! I still think it was a good tool. This is how things happen. Very often, I was taken out of teams, and then I came back later and helped them again.

END