BRADY PETERS

REALISING THE ARCHI-TECTURAL IDEA

COMPUTATIONAL DESIGN AT HERZOG & DE MEURON

Kai Strehlke heads up the Digital Technology Group at Herzog & de Meuron, a team of 12 based in the firm's Basle office. Herzog & de Meuron is a practice that is all about the architecture. However, how does technology interact with design in a practice that is all about the architectural concept? Guest-editor **Brady Peters** puts this question to Strehlke, revealing an approach that is all about finding the right tool and some very artful scripting to make the concept work.

Herzog & de Meuron is an award-winning architecture practice based in Basle. Founded in 1978, it currently has five partners and an office of more than 370 designing projects that range from exhibitions to buildings and masterplans. Its projects evolve by way of a constant dialogue between the practice, its partners and colleagues. While the office's projects do not come from a single controlling author, they are also not fragmented – each contains clarity. The work is 'strongly conceptual'.[1] Kurt Forster writes: 'By narrowing the premises from which the idea of a project arises, the architects increase the power of that idea to the point of letting some projects ride on a single premise.'[2]

In architecture, this conceptual world of design is balanced by the pragmatic world of construction; however, it is also influenced by technology. One approach is to buy a particular technology and experiment with it. For example, many architecture schools are investing in robots and exploring the potentials of this technology. Similarly, 3-D animation software has been hijacked to generate architecture. Architect Kai Strehlke, Head of the Digital Technology Group at Herzog & de Meuron, explained that the approach of the office is fundamentally different: 'The focus is, first of all, only on the architecture. So when we use methods of computation, it is not a technology that we try to do something with it; the focus is more on design intent and the architectural idea and concept. We try to find the right tool, and develop the tool to make the concept work.'[3]

HERZOG & DE MEURON, SÜDPARK, BASLE, SWITZERLAND, 2012

previous spread: Interlocking shapes make it difficult to see where apartments begin and end. The facade appears to be designed from the outside, however the main consideration was actually the experience from within.

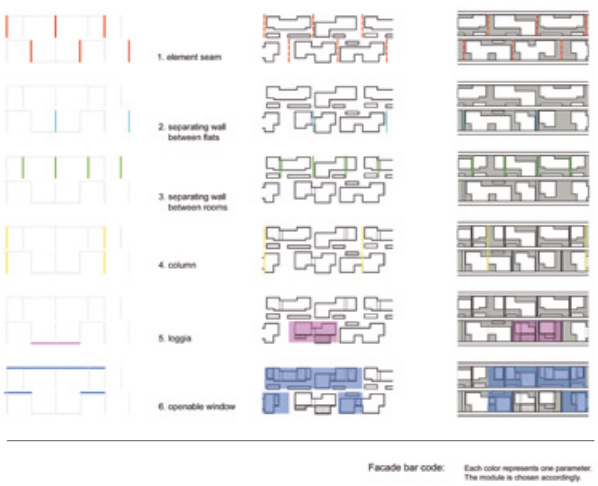
above right: Factory prefabrication of facade components.

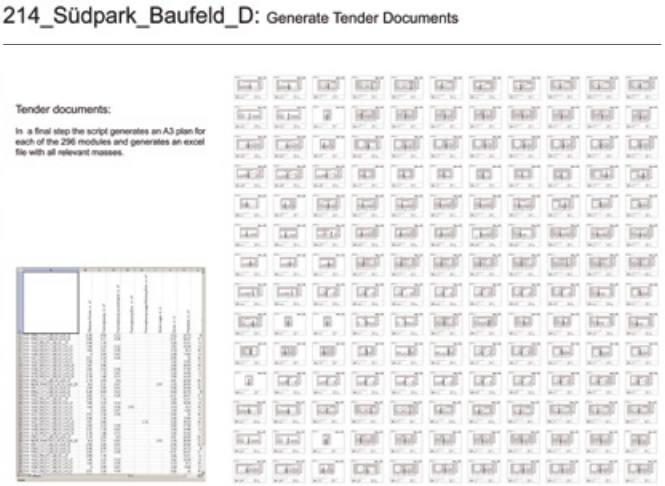
INTEGRATING COMPUTATION IN THE DESIGN PROCESS

The Digital Technology Group is a small team of 12 people working in the office in different fields: computer-aided design (CAD) management, building information modelling (BIM), parametric design and scripting, visualisation and video, and digital fabrication. The team can be consulted at any point in the design process, from concept design, to design development. As Strehlke explains: 'Very often a team approaches the Digital Technology Group for a small script that they usually want the same day. The group is very fast in programming the initial computational design tool for them. If our support for the design process is helpful, we continue to work closely with the design team to develop that tool in a more sophisticated manner.'

As these custom digital design tools are developed from the architectural idea, the Digital Technology Group is not restricted to any particular technique, and works on projects of all scales, from furniture to facades and urban design. As Herzog & de Meuron founder and Senior Partner Jacques Herzog has said: 'We see a huge potential for the computer in the very hybrid and eclectic design processes we have developed over the last 20 years which combine all techniques from primitive to technologically advanced with no personal preferences.'[4] Rather than being experts in free-form surfaces, the main driver for the Digital Technology Group is to grasp the idea the office's designers are trying to develop and then write a specific tool for it. Strehlke says: 'Normally what we do is write one tool, one piece of software for one project. This reflects the architecture of the office, as we try not to copy ourselves. There is not a style of Herzog & de Meuron; each building conceptually stands by itself. Therefore, when we develop tools we also develop them in an extremely dedicated way.'

At Herzog & de Meuron, just as each building design is specific, so is the strategy behind each tool. The Digital Technology Group works with available software, but, trying to stay dynamic, is open to everything. While scripting is often used as a technique, the group will also use tools that designers are more easily able to understand. And while the office has expertise in several BIM software systems, these are not seen as necessarily adding to the architectural design, but as allowing the whole building to be seen as a complete data structure, or database system. When the group works with a design team, it is often only on one system or part of a building, for example the facade or a staircase. This part then becomes very special and is designed using computational tools. It is here that the two worlds of computation and the architectural idea are brought together.





top: The generation of the facade was informed by a computer program developed in-house by the Digital Technology Group. Randomisation was used to generate the initial pattern, though later on in the process the design became fixed. Computational design techniques were used to control the data structure right up to the end.

bottom: Production drawings and data spreadsheets for facade elements were generated in RhinoScript. A new script was then developed in-house that re-generated a complete facade from the production information and spreadsheets as a way of checking the data.

Strehlke is adamant that, in the office's use of computational tools, 'performance is the only consideration'. He explains: 'Ornament as decoration is not what we try to achieve.' While he admits that there is often an ornamental aspect, the designs are not primarily visually driven. The generation of geometry and material configurations are performance driven.

When considering aspects of performance in the architectural design process, feedback from engineering consultants is sometimes slow, and there is a need for feedback that is quicker and simpler. 'For example,' says Strehlke, 'when looking at environmental performance we get a booklet of many pages from the consultant, and this is too much information to really trigger the design directly.' As a result, the office often develops such tools itself; for example, it has written its own solar design tools to determine the hours of sunlight a design will get. As the tools are developed in house, the architects are able to react much faster to design iterations. 'Ultimately, though, the team will communicate with the project consultants to see whether what we have done is correct,' says Strehlke. However, he cautions that: 'very often teams use these tools to prove that their building is located in a good way, that it is working, and this takes the focus away from the main design idea. In architecture, we always work at different levels of abstraction, and we always focus on certain points. However, these performance tools, though they can be very helpful for certain designs, can also distract.'

Here, the development of computational tools emerges from the architectural idea, and the building's performance is a primary consideration for the development of a form. Architectural design is always a balance of many contradicting constraints, and so it is important that issues of performance are not all considered equally, and that the primacy of the architectural idea remains.

HERZOG & DE MEURON, MESSE BASEL – NEW HALL, BASLE, SWITZERLAND, DUE FOR COMPLETION APRIL 2013

top: Visualisation of the project. The design concept comes from a simple idea – two boxes, one on top of the other, slightly twisted to produce a hyperbolic surface. The facade thus faces towards the street, or towards the sky.

right: 2-D CNC-milled components are assembled into a complex 3-D structure. This facade strategy has both double curvature and variably sized openings.

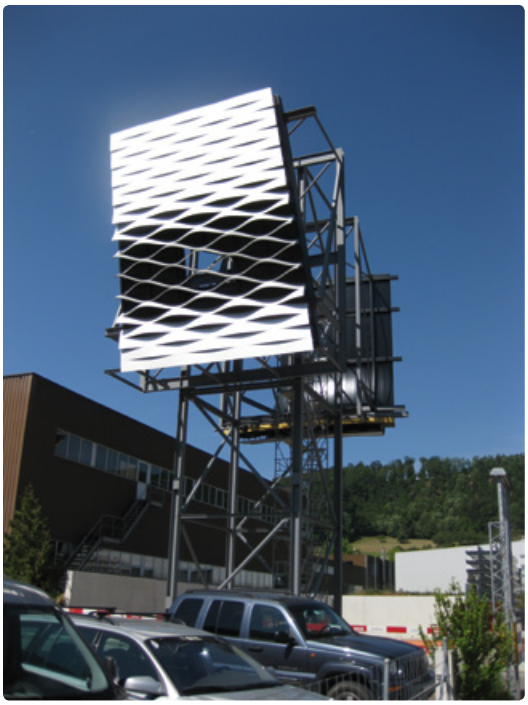
While the Digital Technology Group's scripts are an important part of the design process, the building of physical models and testing of design concepts at various scales play an equally important role. A digital workshop in the office thus complements the traditional workshop. Here, digital fabrication machines such as cardboard cutters, laser cutters and CNC milling are used because the office believes that the physical model is vital to understanding architecture, to anticipating the construction of a building or component. It is now possible to write computational tools to generate almost any kind of geometry. However, the office is not interested in arbitrary geometric possibilities. As Strehlke says, the goal is to anticipate fabrication 'so that the design is not only buildable, but meaningfully buildable, buildable in a way that does not explode costs.' A digital workshop in the office thus complements the traditional workshop. Thus, the office does not have any 3-D printers, as these are seen to be associated with the ability to produce any geometric configuration without the constraints of assembly.

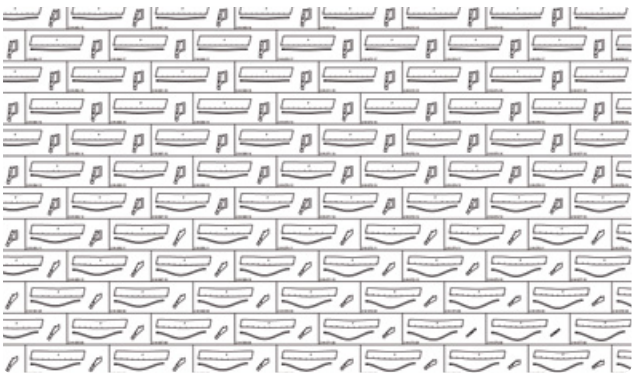
It can be argued that computational design tools need to be more closely connected with the building process. Herzog & de Meuron's Digital Technology Group sees integration with fabricators as an important part of informing the computational design. Through approaching fabricators early in the design process, techniques and machine sizes can be incorporated as parameters in the custom digital tool, and then used to make the design more efficient, more buildable, and more integrated with the architectural idea. However, as Strehlke explains: 'Very often we are constrained by the regulations of the contract, and not allowed to contact fabricators before the bidding phase. This is a big problem in architecture today, and something that, in my opinion, has to change in the future. We have to try to find different ways of working between the architects and fabricators.'

Herzog & de Meuron's computational design team is thus very much a part of the practice's overall conceptual approach to design. As Jacques Herzog said in his acceptance speech for the Pritzker Prize: 'this conceptual approach is actually a device developed for each project by means of which we remain invisible as authors. ... It is a strategy that gives us the freedom to reinvent architecture with each new project rather than consolidating our style.'[5] ◬

Notes

1. Kurt W Forster, 'Pieces for Four and More Hands', in Philip Ursprung (ed), *Natural History*, Lars Muller Publishers (Baden), 2005, p 42.
2. Ibid, p 54.
3. Conversation between the author and Kai Strehlke, 5 September 2012.
4. William JR Curtis, 'The Nature of Artifice', *El Croquis*, Vol 109/110, 2002, p 29.
5. Jacques Herzog and Pierre de Meuron, 'Acceptance Speech 2001 Pritzker Architecture Prize', *El Croquis*, op cit, p 12.





above left: Fabrication prototype. This double-layer cladding system has a rainscreen of wavy elements over a facade composed of standard components; where there are glazing panels in the facade, the wavy screen opens up to allow views out.

above right: Fabrication drawing for CNC milling. Computational design techniques created a system for communicating the fabrication information.