Craftsmanship in the Digital Age
Architecture, Values and Digital Fabrication

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At Gramazio Kohler Architects we have been engaging with digital craftsmanship for the last 15 to 20 years. At a certain point the crucial question for us as architects became: how do we bring these amazing possibilities digital design techniques give us back into the physical world? In the 1990s this was a problem because although machines could ‘produce’ data as renderings and synthetic images of designs, there were no techniques and virtually no machines that could build directly from that data. The machines used in other fields such as mechanical engineering were very expensive and not at the scale of architecture. This was frustrating for us, but also a big motivation. We started our practice in 2000, to programmatically look into techniques that could allow a scaling up of this materialisation of the digital.

Computational design and digital fabrication are connected in our profession as architects.

We are convinced that architectural design is a profoundly parametric practice, and that designing is very close to programming as an intellectual activity: it’s about sequences, it’s about hierarchies and structures, it’s about decisions. Although one can describe many decisions with a formula and can compute these, this often does not make sense, because our human skills and our training allows us to efficiently iterate through possible solutions in an analogue manner. While this holds true for design problems involving a limited amount of elements, when their quantity exceeds a certain threshold, we absolutely need computers to help us. Moreover, this is not a matter of efficiency but of crude feasibility: it’s about being able or not to cognitively work through the solutions parameters. And, in order to access this new dimension, we are forced to formalise design algorithmically, to programme computers.

The vertical timber cladding on this small house (Wohnhaus, Riedikon, Switzerland, 2004–2009) provides shade and privacy by controlling views to and from the interior Fig.1 and 2. The individual timber slats are tapered at certain heights to open up views and left uncut in other places to block views, depending on the position and heights of window openings and where fields of view are desired. As a result, each of the 315 slats has a unique profile Fig. 3. To manually design each slat would not only be very time consuming, but virtually impossible, because of the geometric interdependencies between the single elements. But, given the fact that the
design rules informing the slats geometries are fairly simple, the task can be programmed and executed by a computer in a fraction of a second, allowing us to iterate through many solutions and examine the results. Furthermore, even if we were to design them all manually, it would be difficult to efficiently transmit this huge amount of diverse information to the craftsman or manufacturer. We solved this second problem by identifying a CNC-controlled machine normally used to cut slats to desired heights. By digitally controlling the tilt of the rotating blade as well as its height we could easily produce each single slat, which then only needed to be numbered correctly and positioned in the right place on the building site.

Data drives the machine. It tells it what to do, or tells a robot where to put an element. The amount and complexity is irrelevant, because the machine does not distinguish between simplicity and complexity as we humans do. While we recognise the superiority of the machine in these areas, we are also aware of the domains in which we clearly outperform it. We, humans, are intelligent. We are able to define rules and at the same time to critically question them. We understand things with our hands as well as with our intellect – for example, the aesthetic possibilities, structural behaviours, and previous applications of a material. We are able to synthesise complex and abstract questions. Thus, we are able to master the act of designing.

If we redefine our relationship to machines in terms of ‘cooperation’ between unequal but complementary partners we can finally overcome the rhetoric of ‘competition’ that has burdened this relationship since the early days of industrialisation, when the machine started to be a threat and an instrument of alienation. The post-industrial information age we live in gives us the opportunity to reinvent a positive narrative about technology, in which machines are tools that can extend our bodies and minds, allowing us to achieve things we desire and long for and, in the best tradition of craftsmanship, shape the world.