戈蒂贝恩酒厂立面
非标准化砖墙
FACADE GANTENBEIN WINERY
Non-Standardised Brick Facade

弗拉兹（瑞士），2006
Flach (Switzerland), 2006

格拉玛兹 & 科勒事务所
Gramazio & Kohler

In cooperation with: Beerth & Deplazes Architekten, 
Valentin Beerth, Andrea Deplazes, Daniel Ladner, Churf 
Zurich
Client: Marta and Daniel Gantenbein
Collaborators: Tobias Bonwetsch (project manager), 
Michael Kneuss, Michael Lyrenmann, Silvan Oesterle, 
Daniel Abrahao, Stephan Achermann, Christoph Junk, 
Andi Lüscher, Martin Tani
Selected experts: Jörg Buchli (structural engineer) Dr. 
Nebasja Majislovic and Markus Baumann (BK ETH 
Zurich (structural tests)
Industry partner: Keller AG Ziegelstein

菲比·格拉玛兹和马西亚斯·科勒是数位建筑师及城市研究工作室格拉玛兹和科勒的联合创始人，他们的作品包括由丹麦建筑师和阿联酋阿布扎比艺术家合作的“Swish”项目。他们在苏黎世联邦理工学院建筑系的建筑与数字制作教授，他们曾在苏黎世联邦理工学院城市研究工作室担任助理教授。他们的获奖作品已在国际舞台上发表与展示。

Fabiio Gramazio and Matthias Kohler hold the chair for 
Architecture and Digital Fabrication at the Department 
of Architecture of ETH Zurich. They are joint partners of 
the office for architecture and urbanism Gramazio & 
Kohler in Zurich. Their works include the contemporary 
dance institution Tanzhaus and the Christmas illumin-
ation for the prestigious Bahnhofstrasse in Zurich as well 
as the SWISH Pavilion at the Swiss National Exposition 
“Expo.02”. Gramazio & Kohler are the authors of the 
bok Digital Materiality in Architecture. Their award-
winning work is published and exhibited internationally.
这项已实现的项目是为一家小而非常成功的葡萄园进行的扩建。酿酒师希望建造一幢新的多功能建筑，包括一间处理葡萄的发酵房，一间储存酒桶用的密室，以及一个用来品酒和接待的天台。此项目是由Beauvoir & Deapos建筑设计的。他们邀请我们为外墙做设计的时候，这个项目已正在施工。

初步的设计提案是简单地用砖堆砌混凝土骨架，建筑外墙用作温度缓冲，并为背后的发酵房过滤阳光。不对称的砖块让阳光由窗口穿透大厅，影响发酵效果的直射阳光则被玻璃遮蔽。螺旋在里面的PC板撕破轻风。在上层，砖块在天台形成栏杆。

在ETH开发的机械生产方法让我们能根据系统的数据精确地安排20,000块砖——最理想的尺寸和比例的间距。这项技术让我们能在同一面墙设计合适的光与空气渗透度的同时，创造出一种横跨整个建筑外观的纹理。角度的设定让每一块砖块在光与空气产生不同的折射，从而能透出不同程度的光亮度，与砌体厚度的映像相类似。它们结合起来形成一个独特的形象，从而带出葡萄园的特征，但与平面画布不同，这是一场根据观察者的感受和阳光的角度在可变性，深度和色彩之间富有戏剧性的互动。

葡萄园的砖块外墙看来像一个巨大的葡萄的巨大的草丛。近看时——与建筑时的影像—砌块表面的效果恰好相反——堆砌的质感和木条的肌理质感与现代建筑融合，隐喻的柔韧，画面的形式，实际上是由一块块坚硬的砖块组合而成的，外墙成为一个虚实的动感形式。其三维深度和结构的视觉触感。在画室，穿过外墙的光与空气营造了一种带有某种历史而又不明显的感觉，当先去去去—横数化的窗口可以清楚地显露设计本身，它与外界景观的印象相重叠，并随着感知到的变化以不同的程度渗透到画室。

落下的球体

我们为制造外墙设计并实行这个想法。我们用Beauvoir & Deapos建造的混凝土骨架构造为一个草丛，然后用抽象而大小不同的块的葡萄把它们填满。我们用数码模拟和它吸引令葡萄消失在这个虚无的草丛中直至它的阴影网。我们从这个画面去观察结果，然后将数码影像作为数字转换为每一块独立砖块的旋转角度。在已建的外墙上，游客能量量我们在此处设计的在建造过程中里密不可分的巨大葡萄。

但是，在这面玻璃外和包含的双面玻璃构成的符号群落向光型的意象中，我们能发现，人的眼睛能察觉到草丛的光影变化。因此，砖块上的纹理对观察者的印象，太阳的旋转角度产生了不断变化，可变性更大的外观。

砖块间的空隙处能自由释放。墙面有一种在物质感，并且能让光线在建筑物中的影像。为了使光线在室内的可变性更高我们尽可能把砖块间的空隙减小。因此在完全遮挡的侧窗和平衡的塔式结构，窗结构可以与另一面外露的侧窗直接对物理过程产生影响。我们可以在材料和功能上的选择，对建筑设计造成更富意义。

堆砌砖块

我们用一片片砖炮组成作为会议项目在位于苏黎世联邦理工学院的研究中心里生产备用机车到工地，然后用起重机吊起，由于工程本身的进度要求我们只能在工作期间有3个月的时间准备，就技术与星期而言，这些制造中的砖块组件成了一项挑战。这种结构可以用另外一种方式直接对建筑过程进行。我们原能在生产前争取最后一分钟再对建筑外墙。

为了把400m²外墙的生产过程加快我们需要发展一种自动程序。在一台整合了内部融化的机器，由于每一块砖都有不同的颜色，所以在每一块砖都有不同的色号，所以每一块砖都需要一个一个的色号。色号的融合面积如此之大，因此我们就会联想到我们只需要再某一个的色号就可以实现一种色号。根据砖块组件的构建过程之间的空间距离和位置在每一块砖上加上四条平衡的粘合剂。我们在实验中得到的结果，而制备的砖炮组件上作的实验中发现，使用粘合剂在结构上十分有效，以至一般用于传统制作中的硅胶也不再需要。（黄智辉 译）
The project was realised as an extension of a small but remarkably successful vineyard. The wine producers wanted a new service building, consisting of a large fermentation room for processing grapes, a cellar dug into the ground for storing the wine barrels, and a roof terrace for wine tastings and receptions. Bearth & Deplazes Architects designed the project and it was already under construction when they invited us to design its façade.

The initial design proposed a simple concrete skeleton filled with bricks. The masonry acts as a temperature buffer, as well filtering the sunlight for the fermentation room behind it. The bricks are so offset so that daylight penetrates the hall through the gaps between the bricks. Direct sunlight, which would have a detrimental effect on the fermentation, is however excluded. Polycarbonate panels are mounted inside to protect against wind. On the upper floor, the bricks form the balustrade of the roof terrace.

The robotic production method that we developed at the ETH enabled us to lay each one of the 20,000 bricks precisely according to programmed parameters—at the desired angle and at the exact prescribed intervals. This allowed us to design and construct each wall to possess the desired light and air permeability, while creating a pattern that covers the entire building façades. According to the angle at which they are set, the individual bricks each reflect light differently and thus take on different degrees of lightness. Similarly to pixels on a computer screen they add up to a distinctive image and thus communicate the identity of the vineyard, in contrast to a two-dimensional screen, however, there is a dramatic play between plasticity, depth and colour, dependent on the viewer’s position and the angle of the sun.

The masonry of the vineyard’s façade looks like an enormous basket filled with grapes. At closer view – in contrast to its pictorial effect at a distance – the sensual, textile softness of the walls dissolves into the materiality of the stonework. The observer is surprised that the soft, round forms are actually composed of individual, hard bricks. The façade appears as a solidified dynamic form, in whose three-dimensional depth the viewer’s eye is invited to wander. In the interior, the daylight that penetrates creates a mild, yet luminous atmosphere. Looking towards the light, the design becomes manifest in its modulation through the open gaps. It is superimposed on the image of the landscape that glimmers through at different levels of definition according to the perceived contrast.

Falling Spheres

To create the façade, we designed a generation process. We interpreted the concrete frame structure by Bearth & Deplazes as a basket and filled it with abstract, oversized grapes of varying diameters. We digitally simulated gravity to make the grapes fall into this virtual basket, until they were closely packed. Then we viewed the result from all four sides and transferred the digital image data to the rotation of the individual bricks. On the built façades, the visitor discerns gigantic synthetic grapes, which were virtually inside the building as we developed our design.

However, the architectural implications of this brick façade are more elaborate and diverse than those of a two-dimensional image. To the human eye, able to detect even the finest difference in colour and lightness, the subtle deflection of the bricks create an appearance and plasticity that is constantly shifting along with the movement of the observer and of the sun over the course of the day.

The joints between the bricks were left open to create transparency and allow daylight to trickle into the building. In order to make the pattern discernible from the interior we laid the bricks as close together as possible so that the gap at full deflection was nearly closed. This produced a maximum contrast between the open and the closed joints and allowed the light to model the interior walls poetically.

Bricklaying

The wall elements were manufactured as a pilot project in our research facilities at the ETH Zürich, transported by lorry to the construction site and installed using a crane. Because construction was already quite advanced, we had only three months before assembly on site. This made manufacturing the 72 façade elements a challenge both technologically and in terms of deadlines. As the robot could be driven directly by the design data, without our having to produce additional implementation drawings, we were able to work on the design of the façade up to the very last minute before starting production.

To accelerate the manufacturing process for the 400 square metre façade, we had to develop an automated process for applying the two-component bonding agent. Because each brick has a different rotation, every single brick has a different and unique overlap with the brick below it, and the one below that. Together with the brick manufacturer’s engineers, we established a method in which four parallel bonding agent paths are applied, for each brick individually, at pre-defined intervals to the central axis of the wall element. Load tests performed on the first elements manufactured revealed that the bonding agent was so structurally effective that the reinforcements normally required for conventionally prefabricated walls were unnecessary.