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nader tehrani: the tectonic grain

纳德·特那尼：建构的纹理



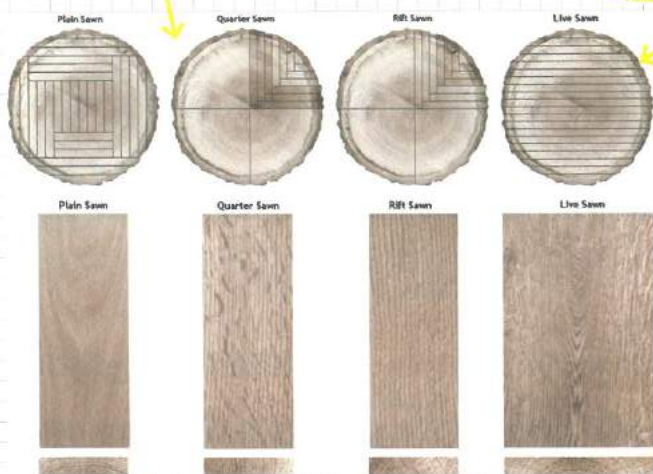
我说的纹理 (grain) 指的是什么呢? 纹理是一种物质的构成, 它产生组成形式, 比如说花纹、条纹, 或者棋盘格。当我们看到斑马时, 会认为它身上有竖条纹是理所当然的。而当我们观察自然时, 一般也如此识别纹理。但如果你仔细看第一幅图, 你会发现这是不对的。因为斑马天然的纹理一般是与其躯干和四肢的方向垂直的。只有当我们开始操控纹理的方向时, 才会发现建筑师在技艺背后所耍的伎俩。建筑与



自然无关, 而完全要看我们想让它怎样。因此, 当路易斯·康 (Louis Kahn) 问砖想要变成什么时, 他实际上正是指出了建筑师的这种主动性, 能够为砖块的组成自由地赋予形式。建筑师清楚地知道, 虽然砌砖有其限制, 但推动新的构造、装饰、组成的演化形式得到发明的, 还是设计师之手。

对立的纹理

我们知道, 木头自然的纹理有其自己的影响和作用。但实际上, 产生我们所熟悉的各种纹理图案的, 还是来自对锯的使用 (如径切法 (rift-sawing)、刻切法 (quarter-sawing)、弦切法 (live-sawing))。各种切割方式都适应于木材的不同等级, 并区分木材的用途, 是用于铺地、零件, 还是装修加工。它们对原木的利用都多少有自己的效率, 而费用也是依此计算的。



不同切割法下的木头纹理/Different cuts of wood

就这张桌子来说, 使用到了两种相互关联但又相互对立的建构方法。一种是木纹贴片 (veneer grain) 的技术, 像伊姆斯 (Eames) 的椅子一样, 薄薄一层。而另一种就是砧板的技术, 通过胶合板 (laminated plywood) 演化而来, 坚固、紧实, 有体积感。砧板胶合的层次和木纹贴片的刻切法纹理在转角处相遇, 在斜角上产生了由两种对立的技术形成的对

What do I mean by grain? The grain is the constitution of matter that produces organization, such as a pattern, a stripe or a checker board. When we look at the zebra, we take for granted that it has stripes. As we look at nature, we commonly identify grains much like this. However, as you look carefully at the first image, you realise that something is amiss. The natural grain of the zebra tends to go perpendicular to the orientation of its



torso and limbs. It is only when we manipulate the orientation of the grain that we understand the artifice behind the architect's craft. Architecture has nothing to do with nature and everything to do with that which we force it to do. So when Louis Kahn asks what the brick wants to be, he is actually pinpointing the architect's agency in giving willful form to the organization of bricks, knowing fully well that while brick aggregation offers some constraints, it is in fact the designer's instrumentality that pushes the invention of new forms of structural, decorative and organizational adaptations.

CONTRASTING GRAIN

We know that the natural grain of wood has an agency of its own. But it's actually our use of the saw (rift-sawing, quarter-sawing, live-sawing) that produces the graining patterns familiar to us. Each sawing method is adapted to different grades of wood, differentiating its use as flooring, hardware or millwork. Each is more or less efficient in its use of the log, and the expense is calculated accordingly. In the case of this table, two corresponding yet contradictory tectonics were used. One was the technology of veneer grain, thin and laminar much like the Eames furniture, and the other was the technology of butcher block technology, here adapted through laminated plywood, which becomes solid, compressive, and massive. The striations of the butcher block laminations, and the grain of the quarter-sawn veneer come together on the corner producing an oblique symmetry between contrasting technologies. When the butcher block is cut diagonally along the

inside of the leg, a figurative aspect of the grain is revealed.

The folly in book-matching striping on the oblique is that one cannot simultaneously retain symmetries along every edge. There will always be a moment of asymmetrical rift, one edge where the butcher block grain and veneer grain run perpendicular to each other. This piece of furniture is a kind

称。当砧板造的桌腿内部沿对角线斜着切开时，就露出了其纹理上有形态的一面。



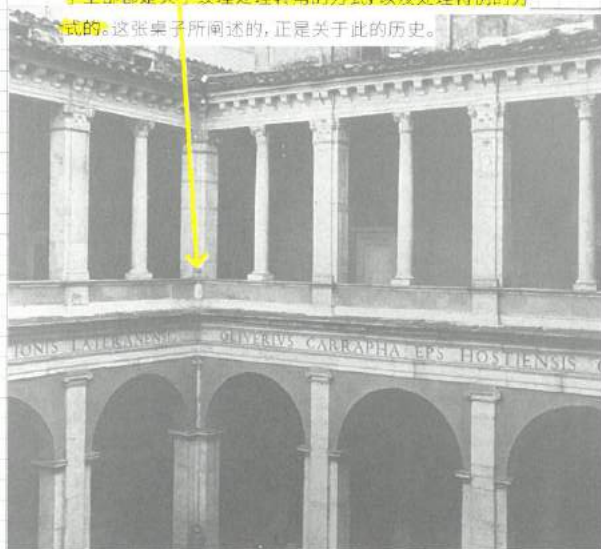
NADAAA设计的戈麦斯咖啡桌/
Gomez Coffee Table by NADAAA
Photo by Dan Bibb



译者注：又译为西式拼板，指相交的两个面上的纹线沿接缝向两边平行伸出，像打开的书，其上的文字方向一致。

斜角上的对纹拼合 (book-matching) 条纹的荒谬之处，在于无法同时在每个转角上都保持对称。必定会有一个非对称的断裂之处，在这个转角上，砧板的纹理和木纹贴片的纹理相互垂直。这件家具是一篇文章，讨论的是将事物综合起来，以及设法让纹理互治的不可能性。外面是刻切法的核桃木，里面是斑马木 (zebra wood)，而结构则是堆砌的胶合板，这三种条纹状的花纹在斜角上开始互相对话。

如果这个论点的出处看起来离建筑太过遥远，那么不妨想想罗马的和平圣玛利亚教堂 (Santa Maria Della Pace) 吧。古典式的柱头在向转角处前进时，产生了一种有韵律的节拍，直到它们被吞没、埋入到转角本身的内部去。这是违背常理还是疏忽大意？到底出了什么事？究竟布拉曼特 (Bramante) 是个诙谐幽默的家伙，还是玩忽职守了？如果你用帕拉迪奥 (Palladio) 后来转译布拉曼特的方式，以及数辈之后，密斯·凡德罗 (Mies Van der Rohe) 在伊利诺伊理工学院 (IIT) 中转译他的方式来遍观历史，你就会开始意识到，纹理的重要之处并不在于如何在平面上创造纹路，而几乎全部都是关于纹理处理转角的方式，以及处理特例的方式的。这张桌子所阐述的，正是关于此的历史。



of essay on the impossibility of bringing things together and finding ways for the grains to cohere. Quarter sawn Walnut on the outside, zebra wood on the interior and stacked plywood as structure, the three striated patterns come into conversation on the oblique.

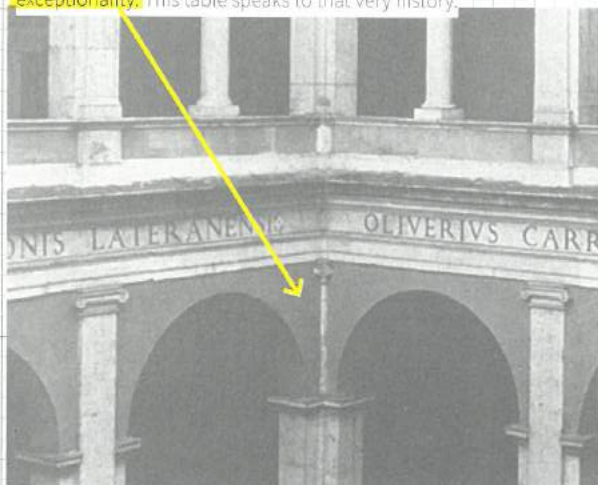


斑马木平行于与顶端垂直的柚木纹理/Zebra wood runs parallel to the teak grain perpendicular to the top.



木纹贴片/Veneer grain

If provenance of this argument all seems remote to architecture, think of Santa Maria Della Pace in Rome. The classical orders produce a rhythmic cadence as they march towards the corners, until suddenly they are swallowed up and engulfed within the corner itself. Perversity? Negligence? What happened there? Was Bramante a witty and humorous guy or did he simply fall asleep at the wheel? If you look through history at the way in which Bramante was subsequently translated by Palladio -- and generations later by Mies Van der Rohe in the IIT, you begin to realise that the importance of the grain is not so much about the way in which the striping is created on one face, but almost always about how it turns the corner and deals with exceptionality. This table speaks to that very history.



通透的纹理

在这个背景下，岩溪宅 (Rock Creek House) 就有一种主动的批判性了。这个项目是对华盛顿哥伦比亚特区的一座有

半地下室和屋顶阁楼的四层历史建筑的改造。我们的任务就是让半地下室和屋顶都可以供人使用，以借此将平面面积最大化，让房子扩大而不增加占地面积。

正如同你所见，这座房子看上去还是相对基

本的。它尊重了建筑的砖造结构，窗户有些向内凹陷，有些与表面平齐，有些凸出墙面，但除此之外并没有什么特别之处。

我们客户的主要要求之一，便是最大程度地增加南面的日照。在对平面进行研究之后，困难就变成了如何在维持建筑承重结构秩序的同时，打开它的跨度，以至于可能需要砖砌以外的其它形式的结构支撑。因此，我们设计了一种混合结构，在北面配合建筑的承重墙，而在南面打开，形成一种“自由平面”式的组成形式。这对建筑的结构有着彻底的影响。南面玻璃的跨度自然地要求钢结构，因此我们让南侧立面变成了玻璃幕墙。建构上的困难在于，如何让（北面）的承重砖墙转换到（南面）的玻璃幕墙上，以及在连接两者的东西侧墙上的转变区域里，这会意味着什么样的结果。因此，建筑的平面必须发生变化，好让北面的承重墙能够转换到既有的支撑南面玻璃幕墙的南北向结构砖墙上。

建筑的南立面有其精心设计的细节，在平齐、内凹与外凸的状态之间交替，但同时也有转角处，它让建筑的各翼能够插入到环境中去。在东南角上，纤细的室内钢柱支撑着外面的砖墙，让玻璃墙形成一幅画面，揭示出其内部的建构策略。这个转角窗便变成了能够深挖可居住面积的一次机会，也让室内装饰能够做成像是胶合板纹理伸展的效果，正是这种纹理组织起了整座建筑。

在剖面上，从一楼到地下室形成了一个通高空间，向南面的花园开放，同时通过一个中庭空间，连接起二楼的儿童作业室和顶楼的游戏室，让原本的阁楼也在剖面上打开了。在入



POROUS GRAIN

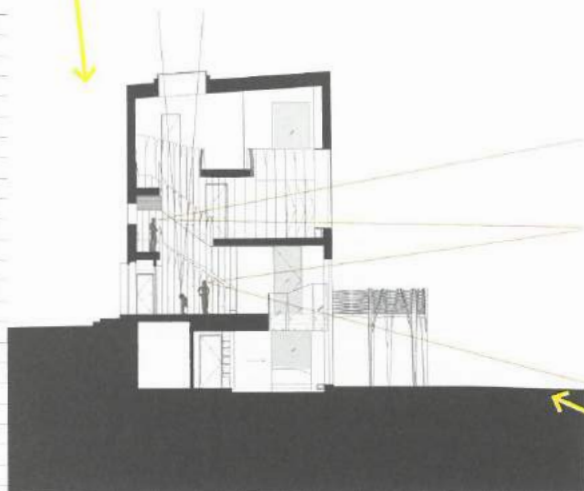
Within this context, the Rock Creek House has a certain kind of critical agency. An adaptation of a four story historic structure in Washington DC, with a half-basement and a roof attic, our job was to maximize the square footage of the house by making both the basement and roof occupiable: expanding the house without adding onto its footprint.

As you inspect it, the house seems relatively benign. It respects the brick structure of the building, with windows that are either carved out, flush, or popped out, but it's nothing extraordinary beyond that.

One of the main requests of the client was to maximise the sunlight on the southern face; on studying the plan, the challenge became how to maintain the load bearing structural order of the building while opening it up to spans that would require other forms of structural support, beyond masonry. For this reason, we developed a hybrid structure accommodating its load-bearing walls on the north, while opening up the south to a 'free-plan' organization. This had a radical impact on the structure. The expanses of glass on the south, naturally, necessitated steel, and as such we transformed the south face into a curtain wall. The tectonic challenge was, how do you turn a loadbearing brick wall (on the north) into a curtain wall (on the south), and what that would entail in the transition zones of the east-west wall that bind them together. As such, the building plan has to evolve in such a way that the load-bearing wall of the north is translated to the existing north-south structural brick walls which support the curtain wall on the south.

The southern façade has its moments of articulation, alternating between flush, inset and popped out conditions, but also the corners, whereby the wings of the building exert themselves into the landscape. In the south-east corner, delicate inset steel columns suspend the brick on the outside, using the glazing as a picture plane to reveal the tectonic ruse. The corner windows become opportunities to carve deep areas of occupation, allowing for furnishings that appear as extensions of the plywood grain that structures the house.

In section, a new double height space from the ground floor to the basement opens out to the garden to the south, and the former attic is opened up in section with an atrium connecting



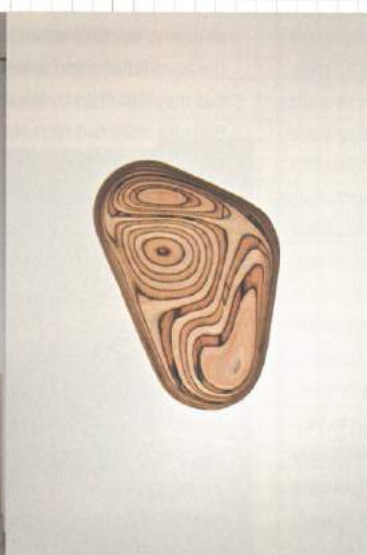
口层有一间冬季客厅，而下方的夏季客厅与花园相连。斜向的视线可以穿过整座建筑，将各个空间连接起来，用自由平面创造出承重墙系统所无法允许的联系。在进入室内时，还有一扇特别的窗子，让人能够通过多格的眼窗(oculus)窥探通往下方花园层的楼梯。

南北向的室内木装修(millwork)的条纹状逻辑，像承重墙一样，都增强了南侧墙面与房屋北侧的各个内部空间之间的连续空间的通透性，让阳光能够照射到房屋深处。与之相对，东西侧墙面都不透明，表现为坚实的木贴面，让卧室和

the kids' homework room on the second floor to the playroom on the top floor. A winter living room is located at entry level, while a summer living room below connects to the garden. Diagonal views pass through the building connecting spaces to the each other, using the free-plan to create connection that a load-bearing wall system would disallow. Upon entering, there is also unique window which peers into a cavernous oculus revealing a descending staircase to the garden level below. The striated logic of the millwork, runs north-south, much like the bearing walls, reinforcing the porosity of spatial continuity between the southern façade and the nested spaces within the northern portion of the house, allowing sunlight deep into the house; in contrast, the east-west faces are opaque and expressed as solid wood veneer, giving privacy to bedrooms and other domestic areas. All of the millwork is coordinated with electrical, lighting, diffusers and other fixtures, such that the logic of the north-south axis becomes apparent. The hardware of the building is also concealed within this logic. Services like the kitchen and family room can be concealed by large sliding wall panels so that they appear to be without doors, and completely solid.



其它室内区域有自己的隐私。所有的木装修都与电气、照明、散流器等设备协调过，好让南北轴的逻辑更加明显。这座建筑的零件也隐藏在这一逻辑当中。厨房、家庭活动室等服务空间可以通过大型推拉门隐藏起来，好让它们看起来没有门扇，完全实心。



容差的纹理

我们在韩国首尔完成的一个项目中，条纹的概念成了这个项目的武器，虽然我们并不懂韩语，和当地的建筑业也没有什么特别的联系。从核心上来说，我们用了四种细部来控制这个项目。

（译者注：类似国内的售楼处。）

这是为三星设计的一个“样板间陈列馆”项目，和既有的样板间陈列馆一样，这种建筑类型看起来像是豪华的文化设施，但实际上却是零售部门。现代、三星等公司都利用陈列馆中展出的样板间来贩卖公寓单元，这些公寓遍布首尔各地。在底层，他们为整个小区提供公共设施，其中就包括这些“长期”的临时建筑。

这个建筑的概念十分简单：制造一个玻璃底座，吸引人们从周围的街道、公园、地铁系统进来，同时与上方的零售空间产生一处垂直的视觉联系。

从类型上来说，这不过是在

底部放一个玻璃方盒，上面

顶着一个笨拙的黑匣子；不

多不少，仅此而已。我们认

真地思考了如何定义这种

建筑类型，它的一边面对的

是空无一物的景色，而另一

面却在一座新建的公园边上，一座地铁站将它与整个大都

市区域连接起来。一开始，他们保证这里将会变成繁华的都

市一角，但我们并未想象过这要花多久。不到一年，公园边

上就盖满了楼房。



我们画了这个项目的施工图，包括数字建造一些可能有些复杂性的细部的程序说明（protocol）。我们在十月底提交了整套图纸，但并没有得到客户方的回应。但在二月份，我们却突然收到了一张来自施工现场的照片。他们已经打好了地基，并建好了上面的楼板，但由于遇到了一些几何问题，因此打电话来寻求关于如何转角的建议。实际上，并没有任何部分是数字建造的。最后我们发现，这些基本都是在韩国工程师和现场监理员的协调下，由中国工人手工建造的。因此，我们就回到了项目中来，好说清楚项目各部分的进行。幸运的是，这栋楼是构想成由四种基本的材料装配，以及它们所需的细部组成的。花岗岩的地面穿过整座建筑，垂直的玻璃外墙（storefront）按照日照的性质形成了一种

TOLERANT GRAIN

This idea of striping becomes ammunition for a project we completed in Seoul, Korea — where we didn't speak the language, and had no special connection to the construction industry. We essentially used four details to control the project. The project was for a **model home gallery** for Samsung. As precedence goes, the model home gallery is a building typology that has the appearance of an extravagant cultural institution but is, in fact, a retail outfit. Companies like Hyundai, Samsung, and others use the model home displays in their galleries to sell apartment units all over Seoul. At ground level they provide public amenities to the communities within which these 'long-term' temporary buildings are built.

The idea of the building was very simple: produce a glass base that draws people in from the adjacent streets, the park and subway system, while offering one vertical moment of visual connection to the retail above. **Typologically, it is simply a glass box at the base with a dumb black box at the top, nothing more, nothing less.** We pondered how to give definition to this building type that found itself in between an empty barren landscape on one side and on the edge of a new park with a subway station linking it to the larger metropolitan region. It was promised that the site would become a dense urban corner, but we had not imagined how fast that might happen: **within one year, all of the buildings around the park were built.**

We developed the working drawings for this project, including the protocols for the digital fabrication of the details that required some complexity. We sent off the package at the end of October and we didn't hear from client group. **In January, abruptly, we received an image from the job site.** They had built the foundations and were already building the slabs above but they called us to ask advice about how to turn the corner because they had run into some geometric issues. In fact, none of it was being built digitally. It was all being done manually, as it turns out, predominantly by Chinese labour, coordinated by Korean engineers and site job captains. Thus, we were reintroduced back into the project to bring clarity to the various working parts of the project. Luckily, the building was conceived from four basic material assemblies and their requisite details. A granite floor that runs right through the building, a vertical storefront that has a certain cadence in relationship to solar performance, a series of louvers that break up the compound curvatures of the aluminium panels into discrete parts, and a plaster interior.

Conceptually, the project is about developing the lowest possible communicative denominator to build the structure



韵律；平行的格栅断开了铝板整体形成的曲面，将其分成不连续的部分；而室内则是粉刷处理。

从概念上来说，这个项目的目的在于开发一种最低程度的交流标准，好在不懂当地语言的情况下也能进行建造。由于这座建筑缺乏细节，因此也不会犯错。当然并不是说真的不会有差错，而是细部的设计允许最大限度的公差，这样对不准也不会有问题了。

在底部，深深的木遮阳板（fin）让玻璃外墙不受东西向阳光的照射，北面的玻璃竖框间距要空得更大，而竖框间玻璃上的纵向条纹（fritting）则保护室内不在南向立面上暴露出来。建筑的底座也有两种结构。一种较为粗壮，支撑着上面的建筑，而另一种则是更为纤细的钢框架，支撑着玻璃幕墙。在上方，横向的格栅在几处被拉开，好让光线照进室内的公共空间里。

从概念上来说，建筑的底层是开放的漫步空间，供公众穿过这座建筑。平面大体上吸收了柱式大厅（hypostyle hall）的意思，报告厅、贵宾室、会议室等主要的功能空间变成了整块的建筑体，仿佛粗壮一般。而剖面的大体意思是让天窗、柱子、楼梯从上方的建筑体吊挂下来。所有的照明、机械设备都隐藏在天花板上的条纹中。

有几处主要的地形变化。比如说，我们将向下通往车库的坡道与报告厅阶梯状地面的斜坡对接起来，并去掉了报告厅的后墙，这样就产生了一个360度的剧场，以及一座可以从台上望向四周外部景观的舞台（proscenium）。当它不用作陈列馆时，就变成了充满新鲜的相遇与各种功能体的舞台，将内部与外部连接起来。



without knowing the local language. Due to the lack of detail in this building, there was nothing that could go wrong. That wasn't the case of course, but you wouldn't know it because it's detailed for maximum tolerances such that misalignments just don't matter.



At the base, deep vertical fins protect storefront glazing from east/west sunlight, on the north the mullion bays are spaced with larger spans. Vertical fritting in between the mullions protects the interior from the southern exposure. The base of the building has two forms of structure. One is a robust structure that supports the building above, and the other is a finer steel filigree that holds up the glazing. Above, horizontal louvers are pried open in the few moments where light is permitted into interior public spaces.



Conceptually, the ground level is an open promenade that allows the public to filter through the building. The plan diagram is that of a hypostyle hall where primary programs such as auditorium, VIP rooms, and conference rooms become monolithic masses, as if thick columns. The section diagram is such that architectural elements like skylights, columns, and staircases suspend down from the mass above. All of the lighting and the mechanical equipment are hidden within the striations in the ceiling.

There are key moments of typological transformation. For instance, we aligned the ramp down into the garage with the slope of the auditorium's stepped floor and eliminated the back wall of the auditorium such that it produced both a theatre in the round and a proscenium with a view from the stage out towards the landscape. When it is not a gallery it becomes a theatre for novel encounters and programs bridging inside and outside.



建筑的外形是一个多米诺框架结构 (domino frame) 削去转角, 再紧紧裹上条纹状的表皮形成的。建筑上方体量光滑的形状是在斜面起效的, 应从四周环绕观看, 与周边天际线上立方体的公寓楼们形成了对比。

相反, 底座却是由三角形的形状构成的, 大致围绕下方公共领域的功能需求形成。两者以不同的方式回应了首尔的景观: 一方面与典型而重复的公寓大楼形成对比, 另一方面则呼应了围绕整座城市的山地景观。

从根本上来说, 这座建筑是对施工过程中发生的各种事件抱有弹性而建造的, 但还是能够忠实地保留四种关键的细节, 让它能够不执着于精确度。这座建筑的动态示意图揭示了它彻底的简约性: 玻璃外墙上建构性纹理的形态是按照日照的特性来排布的。当它叠加在下方的各种功能空间上时, 就开始压紧、框出底部的公共功能空间了。顶部的格栅将黑匣子隐藏了起来, 但在某些地方又睁开眼, 向你眨眼。

连续的纹理

材料的这种纹理形成与不同的建造技术有着直接关系。在新罕布什尔州住宅 (New Hampshire house) 项目中, 我们有幸能在山顶设计一座俯瞰



总统山脉 (Presidential Range) 的房子。每间房都设计成与一座山峰形成轴线关系, 包括华盛顿山、林肯山、拉法叶山等等。

每间房都是放射状平面上的一个预制单元, 中间围绕着一个中央庭院。不妨想一想历史上的诸多圆形建筑, 比如说环形监狱, 还有你可能熟悉的中国土楼 (位于福建的圆形泥土建筑), 再与狗跑屋 (dog-trot) 这种建筑类型结合起来吧, 后者在两个关闭的房间之间留出了空间, 形成了横贯前后的室外通道。



The massing of the building is the result of a domino frame with sliced corners and subsequently shrink-wrapped with a striated skin. The smooth figure of the building mass above operates on the oblique, and is meant to be viewed in the round, in contrast with the prismatic apartment buildings of the neighbouring skyline. In turn, the base is formed on triangulated figures that are formed around the approximate programmatic requirements of the public realm below. Each speaks to the landscape of Seoul in a different way: on the one hand in contrast to the repetition of conventional apartment buildings, and on the other the mountainous landscape that frames the city. In essence, the building is built with a sense of resilience to all of the things that happen in construction, but maintains its commitment to the four key details that protect it from precision. The animated diagram of the building demonstrates its stubborn simplicity: a patterning of a tectonic grain at the storefront distributes itself in relation to the solar performance. As you stack that with different programs underneath, it begins to compact and enframe the public programs at the base. The louvers at the top conceal the black box but then, at moments, they open up to wink back at you.

RELENTLESS GRAIN

This graining of material has a direct relationship with different construction techniques. With the New Hampshire house, we



had the good fortune of designing a house on a mountaintop that overlooks the entire Presidential Range. Each room is designed to be on axis with one mountaintop, including Mount Washington, Lincoln and Lafayette, etc.

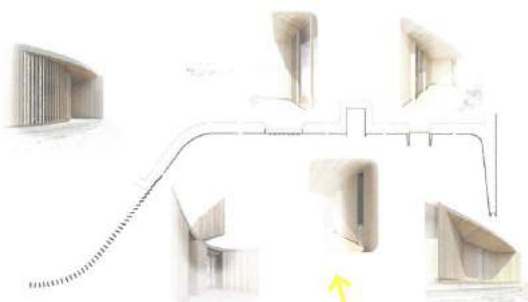
Each room is a prefabricated unit laid out in a radial plan that protects a central court. Think of the many circular building precedents, the Panopticons, the Tulou (round earthen buildings in Fujian) that you may be familiar with in China, in combination with the dog-trot building type, whose void between two enclosed rooms provides for lateral outdoor connections.

这个项目是以我们从新英格兰地区住宅学来的**胶条通 (board and batten)** 做法建成的。请注意这里没有用到五金件，因为**车库门**是将多层胶合板伸长、弯曲做成的。建构的纹理彻底地挪用了所有建筑的元素，让所有的五金件都被吸收到纵向条纹的纹理中去了。



译者注：由木板和板条交替拼贴的做法。

在新罕布什尔度假屋中，遮阳板、榫舌 (tongue)、企口板 (groove board)、木板、板条与原本的纹理通过互相对话，共同构成了一种建构策略，还在关键之处创造出**一片直纹曲面 (ruled surface)**。曲面的造型对应的是本项目中漫步道的高潮：一架楼梯，通往视野开阔、能够环望四周的屋顶平台。直纹曲面的下方也是进入房子内部的入口。

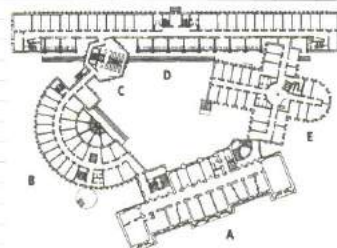


关于这一纹理的主题，这个项目构建了一种**局部到整体的关系**。所有的房间共同在宏观层面制造出了一种纹理，而结构、棚栏、表皮元素的纵向纹理则在微观层面起作用。这些部分一起变成了一种工具，让人能够制造出内部与外部之间的终极联系。

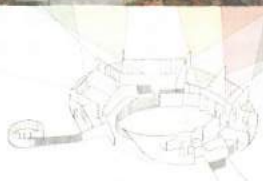
这种构成的技术并非没有先例。路易斯·康的多明我会修女院 (Dominican Motherhouse) 和詹姆斯·斯特林 (James Stirling) 的社会科学中心 (Wissenschaftszentrum) 都展现了互不相关的建筑类型是如何通过重叠、碰撞、铰合而联系到一起的。我们的探索就建立在这个难題之上，但我们发明的是流动的技术，将不同表面嫁接到一起，让不连续的空间融合成连续的领域——成功地将形式与空间合并到了一起。



路易斯·康的多明我会修女院/Louis Kahn's Dominican Motherhouse



詹姆斯·斯特林的社会科学中心/James Stirling's Wissenschaftszentrum

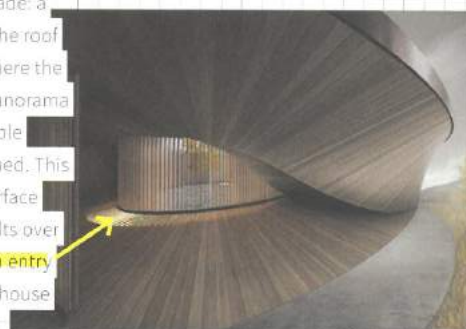


This project builds on the **board and batten tectonics** that we adopted in the New England House. Note the lack of hardware, as **the garage doors** are formed from a delaminated and bent extrusion of the battens. The tectonic grain stubbornly appropriates all architectural elements, causing all hardware to be absorbed by the grain of the vertical striation.

For the New Hampshire Retreat, the grain of fins, tongue and groove boards, board and batten, and logs all amount to a **tectonic strategy** in dialogue with each other, and in one key moment, **producing a ruled surface, whose figure corresponds to**



promenade: a stair to the roof deck, where the entire panorama is available unconfined. This ruled surface also vaults over **the main entry** into the house proper.

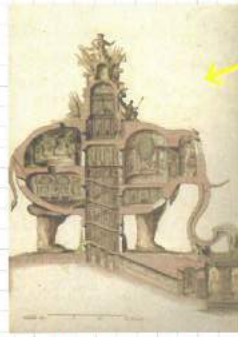


The project builds a **part to whole relationship of this graining proposition**. The rooms together produce a grain at the macro level while the vertical grain of the structure, pickets and skin elements operate at the micro scale. Together, these become the vehicle around which one is able to produce the ultimate relationship between the inside and the outside.

The technique of composition is not without precedent. Louis Kahn's Dominican Motherhouse and James Stirling's Wissenschaftszentrum both demonstrate how the connections between disparate building types are brought together through overlaps, collision and hinging. **We build on this predicament, but instead develop fluid techniques that graft surfaces together, conjoining disparate spaces into continuous realms—effectively melding forms and spaces together.**

波纹状纹理

勒克(Lequeu)的这幅历史图片表明了大象的形状与其容纳的空间的功能之间的直接联系——比如说,象鼻处正好是一座喷泉。在威斯頓宅(Weston House)中,我们的任务是在既有的住宅顶部增加一层。我们用波纹金属板当作这两层的墙面材料,并赋予了这座建筑一个有机且统一的形象。我们并未满足于更换建筑的表皮,而是想要探索这层表皮的可能性,让它产生空间性,在客厅与花园之间创造一个凉篷,甚至能够放进几级新台阶来。

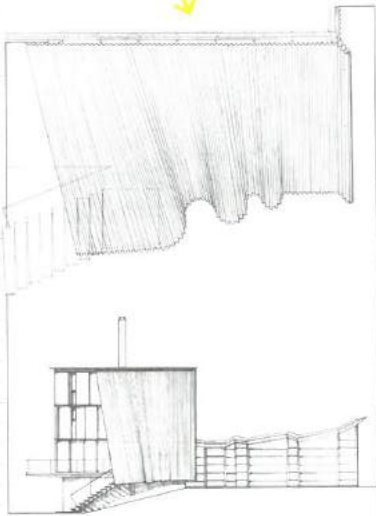


巴士底狱大象/ Elephant of the Bastille

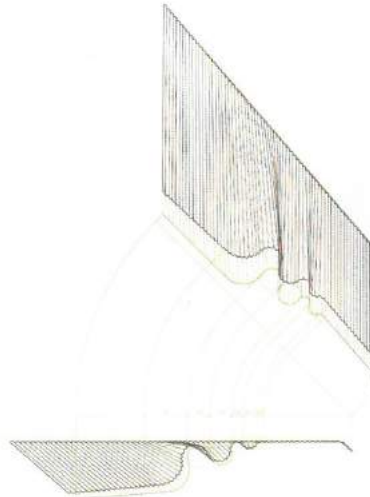
CORRUGATED GRAIN

This historic image by Lequeu conveys the direct relationship between the figure of the elephant and the programs of the spaces that it sponsors --such as the trunk which serves as a fountain. For the Weston House, we were tasked to add another floor on top of the existing building. We used corrugated metal as a cladding surface to wrap both floors, and offer an organic and singular identity to the house. We were not content to just re-skin it. We wanted to explore the possibility to expanding that skin so that it becomes spatial, to produce an awning between the living room and the garden and even allow for the insertion of a new flight of stairs.

The idea of graining in architecture takes on much a more spatial proposition in this project, and in designing it, we discovered something that we had assumed but could never



Arch. Drawing with Larsen and Olsen



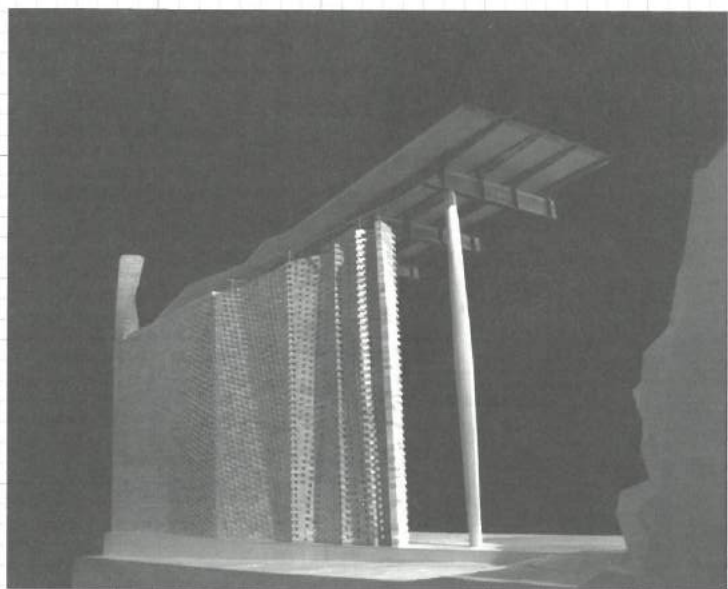
威斯頓宅/Weston House

在这个项目中,建筑中纹理的概念有了更加空间性的主题,在再设计的过程中,我们发现了我们一直默认,但从未完整表达出来的一点:在建筑学上,图纸并不仅仅是用来说明,或者形象化地表达的。图纸本身就已经成为一种建造的行为了。如果说波纹板的波纹是沿纵轴方向的,那就意味着它在横轴方向也是有延展性的。请注意波纹板顶部的线条和底部的线条是长度一样的。这便是直纹曲面,也称可展曲面(developable surface)原理的证明。在审视图纸的过程中,我们已经知道它是可以建造的,因为主导这幅图纸的几何规则就是基于物理与表现双重意义上的建造概念的。同时,也正是在几何上让曲面分层的原则,为曲面赋予了厚度存在的可能性:成为了一张能够将空间围合起来的表皮。在几何抽象之外,我们也在这种“幕墙”的概念中认识到了一种潜在的语义学能力,它能够创造联系,架构指涉性(referentiality),并且期盼解读。

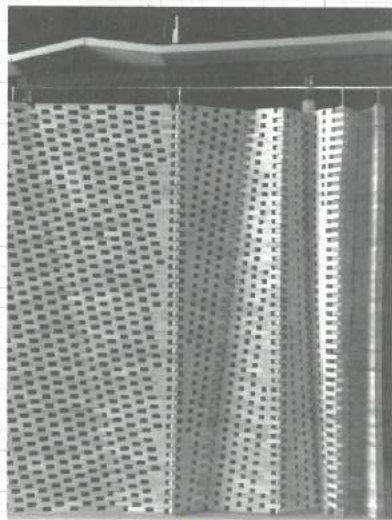
岩石住宅(Casa la Roca)中的一处看上去相似的幕墙变体,却引发了一系列完全不同的发现。在绘制这个项目的图纸时,我们正在关注西格蒙德·劳伦兹(Sigurd Lewerentz)的作品,特别是他对砖砌的专注,是如何在全

fully articulate: in architecture, drawing is not merely illustrative or pictorial. It is always already an act of construction. If corrugation is oriented on a vertical axis, that means it is also malleable on its horizontal axis. Note that the line at the top is exactly the same length as the line at the bottom. That is what proves the theorem of a ruled surface, alternatively called a developable surface. In inspecting the drawing, we already know this is buildable, because the geometric principle that guides the drawing is based on a constructive idea, both physical and representational. At the same time, the very principle that geometrically delaminates the surface produces the possibility of depth within the surface: a skin that envelops space. Beyond geometric abstraction, we also become aware of a semantic aptitude that is embedded in the idea of this 'curtain wall', something that creates associations, builds referentiality, and begs interpretation.

An apparently similar derivation of the curtain wall in Casa la Roca prompts a completely different set of discoveries. While drawing this project, we were focused on the work of



岩石住宅模型/Model of Casa la Roca



岩石住宅模型细节/Detail of Casa la Roca model



西格蒙特·劳伦兹作品细节/Detail of Sigurd Lewerentz's work

顺砌法 (running bond) 或梅花丁 (Flemish bond) 等传统的砖砌方式之外, 带来了一些新的创造的。我们发现, 劳伦兹并没有将注意力放在砖块本身上, 而是更加关注砂浆所占的空间, 将其视为探索之处。在某些地方, 砖块看上去像是漂浮在“砂浆场”中, 以非建构性的方式悬挂着。这一发现让我们提出了“可变灰缝 (Variable Bond)”的概念, 即砂浆灰缝的尺寸可以随墙面的长度变化, 在纵轴和横轴上产生贯通的变化, 并且可以反过来, 让光线和空气有穿透砖砌表面的可能性。对灰缝的控制, 也让我们能够沿着砖砌花样的对角线, 对一层厚的砖面进行折叠, 为十分轻薄的墙面带来结构上的厚度和横向的稳定性, 延续杰弗逊在弗吉尼亚大学 (UVA) 的蛇形墙面的传统。这一项目延续了艾拉迪欧·迪斯特 (Eladio Dieste) 和弗兰克·盖里 (Frank Gehry) 等人的作品中的探讨, 他们的造形墙面分别是非常不同的做法的结果。迪斯特创新性的结构, 在本质上是混合的, 是砖块、钢筋与砂浆协力堆叠, 形成结构壳体的结果: 是纯粹的结构。而在另一方面, 盖里的墙体是不同层次叠加的结果。表皮起的是墙纸的作用, 是一件有象征意义的外衣, 而并不寻求墙面的局部与整体之间的直接联系。在岩石住宅中, 砖块、砖砌的组成, 墙面的结构性折叠, 其通风与采光等环境问题之间的联系, 都推动了让它局部与整体间的关系发生相互作用。

Sigurd Lewerentz and, in particular, how his monocular focus on brick aggregation coerced certain inventions that would escape conventional bonding procedures such as the running or Flemish bond. Instead of centering his attention on the brick itself, we discovered that Lewerentz was more targeting the space of the mortar as the site of play. In some instances, brick can be seen floating in a field of mortar, a tectonically suspended. This discovery led us into proposing the "Variable Bond", whereby the dimension of the mortar bond can vary over the length of the wall, creating lateral shifts on the X and Y axes, and in turn, introduce the possibility of light and air through the brick membrane. Controlling the bonding also enables us to fold a single wythe of brick along the diagonal axis of a bonding pattern, giving structural depth and lateral stability to a substantially thin wall, extending the tradition of Jefferson's serpentine walls at UVA. The project extends this discussion through the works of figures like Eladio Dieste and Frank Gehry, whose figural walls are the results of significantly different procedures. Dieste's inventive structures are hybrid in nature, the result of the layering of brick, rebars, and mortar acting in tandem to structural shells: pure structure. Gehry's walls, on the other hand, are the result of the layering of varied laminates, with the skin serving as wallpaper, a symbolic vestiture that seeks no direct relationship between the walls parts and its whole. In the case of Casa La Roca, the relationship between the brick, its bonding organization, the structural folding of the wall, the environmental aspects of its ventilation and illumination all contribute to creating reciprocities in its part to whole relationships.

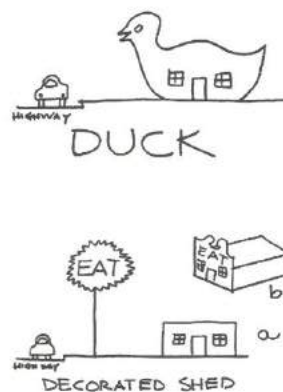


TOD'S表参道大楼/TOD'S Omotesando Building, by Toyo Ito & Associates, Architects

分叉的纹理

当我最初看到数年前伊东丰雄 (Toyo Ito) 发表的托德斯大楼 (Tod's) 时, 我在其中看出了一些并未建造出来, 但潜藏在其组织中的可能性——这些特性能够佐证我的论述中的一些论点。我当时认为, 从组成的角度来看, 这栋楼裸露在立面上的结构, 也应该同时表示了其内部空间的分隔, 它实际上就是一片柱丛, 越往楼顶去越是分叉。此外, 我还注意到了其立面上的形状与面前的树之间的语义学关系, 似乎这栋楼试图通过它的建筑来映射周围的自然环境。当我终于实地参观了这座建筑的时候, 我才发现它的内部实际上并不包含我所想象的那些解读, 组成立面那些切片并不透露其内部布置的情况; 它实际上起到的更加是装饰性栖屋 (decorated shed) 的作用。

当时, 我们也入围了美国贝鲁特大学 (American University of Beirut) 伊萨姆·法利斯学院 (Issam Fares Institute) 竞赛的决选, 决选名单由一些崭露头角的新人和已经大名鼎鼎的扎哈·哈迪德 (Zaha Hadid) 组成。她作为该校的校友, 令我们认为她与学校的关系已经为她锁定了胜利。这也让我们得以自由地参与到竞赛当中, 把它当作学术上的项目, 不抱一丝得奖的幻想。因此, 我们希望借此机会, 来完成伊东丰雄潜在的, 但还没有做出来的项目。我们在开始设计之前, 就已经知道这座建筑的意象了。我们知道, 因为它将



丹尼斯·斯科特·布朗 (Robert Scott) 和罗伯特·文图里 (Robert Venturi) 的“鸭子”和“装饰棚子”的图形描述。《向拉斯维加斯学习》, 麻省理工学院出版社, 剑桥大学, 1972年, 1977年修订; ©MIT Press, /Graphic depiction of a “duck” and “decorated shed” by Denise Scott Brown and Robert Venturi. *Learning from Las Vegas*. MIT Press, Cambridge MA, 1972, revised 1977; © MIT Press.

BRANCHING GRAIN

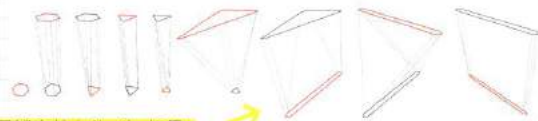
When I first saw Toyo Ito's Tod's published some years ago, I read into it certain possibilities that were not actually built, but latent within its organization—aspects that reinforce some of the arguments in this discussion. From an organizational point of view, I thought that the structure of this building, as evident on its facades, was also a diagram for the spatial subdivision of its interior, effectively a bosk of columns branching up towards the building's top. By extension, I also noted the semantic relationship between the figuration of the facade and the trees in the foreground, whereby the building attempts to somehow mirror its natural context through architecture. When I finally visited the building, I realised that it's interior is actually devoid of the interpretations onto which I had projected. None of the organizational tropes of the facades are indicative of its interior layout; it operates more as a decorated shed.

Concurrently, we were shortlisted for the Issam Fares Institute competition at the American University of Beirut. The shortlist was composed of a few emerging names, alongside Zaha Hadid, whose reputation had already crested, and whose prior affiliation with the school, as alumna, had in our minds already secured the outcome. This allowed us to freely engage in the

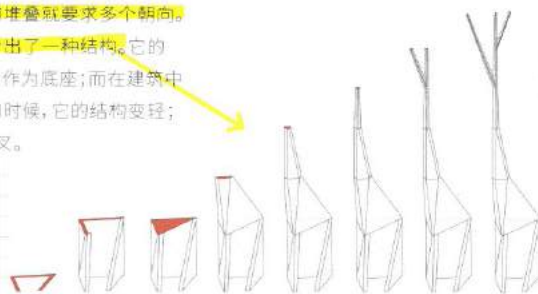


会身处树丛之中, 因此不会与校园中的其它历史建筑发生直接的关系, 而是隐藏在这些植被之间, 在那些棕榈树、雪松、松树, 以及巨大的榕树背后。我们知道, 实际上, 我们的项目应该将榕树作为一种空间与结构系统, 来研究它的形态学。问题就是: “我们该如何设计这棵树?” 请注意, 如果一个六边形经过裁剪, 就变成了三角形; 如果经过拉伸, 就变成了

competition as an intellectual enterprise without the illusion of victory. For this reason, we wanted to use the opportunity to complete Toyo Ito's project in a way that was latent, but never yet adopted. We knew the image of this building before we started designing it. We knew that because it would be amongst these trees, it would not be in dialogue with the campus'



柱子,如果将顶部扩大,就变成了底层架空柱(piloti),如果经过旋转,就可以承重,如果拉直,就变成了简单的墙体。一种简单的几何形态,可以承担许多建构上的功能。既然在一个开放的场地进行设计,不同功能的堆叠就要求多个朝向。因此,我们利用不同的几何形态设计出了一种结构。它的底部沉重,厚实的剖面(poché)可以作为底座;而在建筑中部,由一种组成转变到另一种组成的时候,它的结构变轻;而在建筑的顶部,它的结构打开、分叉。



historic architecture, per se. It would be, instead, camouflaged within its flora, behind the palm trees, the cedar, the pine, and the monumental ficus. Effectively, we knew that our project needed to develop the morphology of the ficus as a spatial and structural system.

The question was, "How do we design that tree?" Note that a hexagon, when truncated, becomes a triangle. When extruded it becomes a column, when expanded at the top it becomes a piloti, when rotated it can transfer loads, when straightened up a simple wall. A simple geometry can take on many architectonic functions. Operating on a site in the round, the stacking of programs required multiple orientations; for this reason, we used the variable geometries to develop a structure that could be heavy at its base using its poché as the foundation, then lightening the structure as it transfers from one organization to another in the middle of the building, and then branching open at the top of the building at its top.

If viewed as a domino frame, the building organization allows for deformations that absorb its variations as part of an organic system. The system allows for the cantilever of the structure



如果视为多米诺框架结构,那么这座建筑的组成形式就允许了变形,将各种变体吸收到一个有机系统中来,作为它的一部分。这个系统允许结构中包含悬挑成分,令西侧的榕树根得以保留,它允许在底部的报告厅剖面中包含对角斜梁和转换梁,也同样允许顶部柱网减重。建筑的地面变成了一张结构性的隔膜,不光是作为固定荷载,也作为建造了整个结构体的动态三角形系统的一部分,承载张力和压力。这样,这座建筑就成为了其结构作用方式的一份直接索引。功能、表皮、结构之间发生了直接的对话。这座建筑的纹理并不在其表面上,而是攀登架(jungle gym)形的整个立体结构,它所创造的空间,以及它产生的自治性(autonomy)。

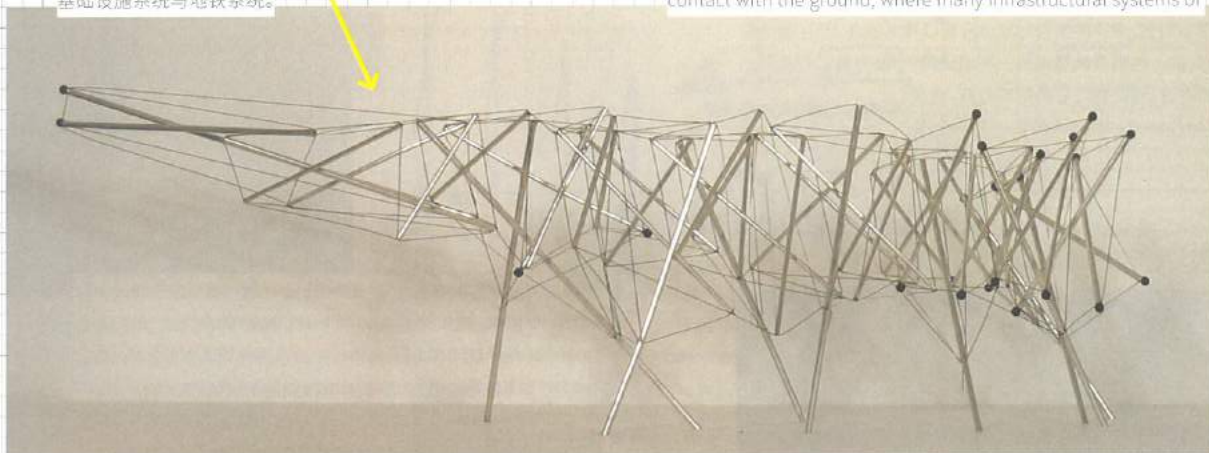
to allow the Ficus roots on the west side to thrive, it allows for diagonal and transfer spans in the auditorium section at the base, and so too the lightening of the column grid at the top. Its floors become a structural diaphragm, not only acting as dead-loads, but acting in tension and compression as part of the dynamic triangulated system that builds the overall structure. Thus, the building becomes a direct index of the way that the structure is performing. Program, skin, and structure come into direct dialogue with each other. The grain of the building is not its surface, per se, but the entire three dimensional jungle-gym structure, the spaces it creates, and the anatomy it produces.

分散的纹理

如果说我们操作的主要程序偏重于建造单元与建筑外形之间的局部—整体间关系,那么也并不是所有项目都允许这种相互关系发生的。在后者的场合,我们努力将另外的设计方法发挥到极致。在光州双年展(Gwangju Biennale)上,我们原本设计了一架轻盈的整体张拉结构,并通过组成形式,令其与地面的接触点降到最少,因为地面有许多街道的基础设施系统与地铁系统。

SCATTERED GRAIN

If the dominant protocol for our operations bias a part to whole relationship between the constructive unit and the building's figure, not all projects allow for that reciprocity; in those instances, we have sought to radicalize an alternative approach. For the Gwangju Biennale, we initially designed a light tensegrity structure, whose organization allowed for minimal points of contact with the ground, where many infrastructural systems of

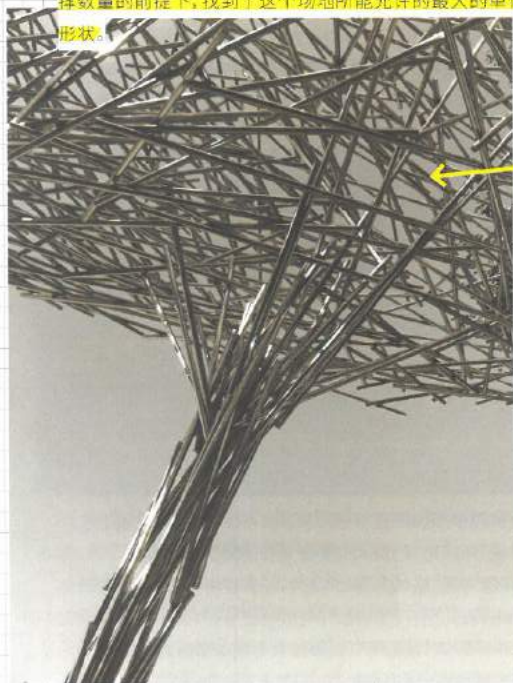


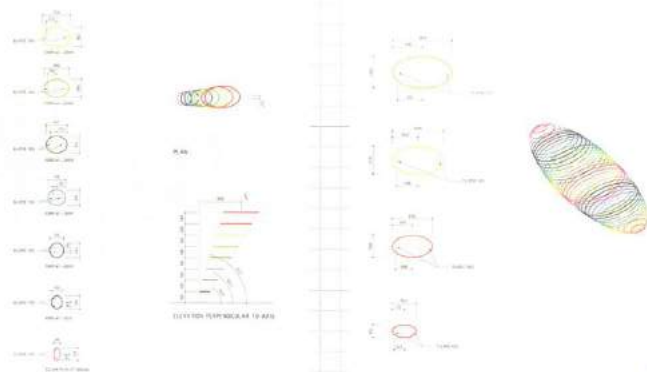
我们较早地提交了施工图,并发现由于与容差相关的事项十分复杂,这个项目在工时和造价问题上可能都无法克服。在检视我们的施工套图时,客户提出:“我们非常满意!但可不可以只用压力构件,不用张力构件?”这就意味着我们只有一个星期来完成一个新项目,并且需要承担最大限度的容差。我们认为,既然我们非得进行重新设计,那么就必须要经济地、有策略地思考,并在构成(configuration)与造形(figuration)这两个领域之间作出区隔,好推翻我们一般建造的局部与整体之间的相互关系。

因此,我们就在尊重树木的位置,并且尽量减少地面结构支撑数量的前提下,找到了这个场地所能允许的最大的单体形状。

the street, and subway system, were at play. With an early submission of our working drawings, it became clear that the complexities associated with tolerances created a project that would be unsurmountable in terms of both schedule and cost. In reviewing our CD package, the client remarked: “We love it! Do you mind if we just introduce compressive elements instead of the tensile ones?” This meant that we had one week within which to establish a new project, a project that could thrive under maximum tolerances. We thought that if we were going to really have to redesign this, let's think of it economically, strategically, and produce a divide between the configurative and the figurative realm, such that the reciprocities we conventionally construct between part and whole are overturned.

Thus, we identified the largest single figure the site could take, respecting the location of trees, while minimizing the structural struts that meet the ground.





我们并没有想好一个建构系统，因此，困难就变成了设计一种由相连的部件组成的系统，并符合我们提出的“云形”构造。我们用不锈钢门把手作为圆形的支撑构件，并设计了一种结构方法，令它“撑满”我们所提出的展馆形状。它由三角形组成，以在密度最小的情况下，获得最大的横向强度。支撑构件的分布是认识到柱子、柱头、顶篷的受力不同而设计的，在不同的地区密度不一，有效地达到了要求的可靠的结构性能。

Without an a priori tectonic system in mind, our challenge was to develop a system of connecting parts for the proposed 'cloud' structure. Working with stainless steel door handles as round extruded struts, we developed a structural approach that would 'fill' the proposed figure of the pavilion, triangulating to gain maximum lateral strength, while minimizing density. Acknowledging that columns, capitals and canopies react to different forces, the densities of struts in different areas

varied, effectively swarming to reliable structural performance as required.

For the construction, all we gave the builders was the figure that was produced by the overall form of the pavilion and the requisite density of structure in each of its parts, with the construction method of welding



就建造来说，我们给施工方的只有展馆整体形式所产生的外形，每个部分中必须达到的结构密度，以及将每根杆件焊接二次的施工方法，以保证结构是三角形的。……还有一条注意事项，即定期震动结构体，以测试其稳固性。在没有每个支撑构件准确参数的情况下，这种新的程序可以在没有技术图纸的条件下进行建造。局部与整体先被分隔开，然后又通过一个随机应变，调整测试，然后找出容差的过程，将两者重新连接起来。

一方面，我提出了一个关于造形的论点；而另一方面，也有一个关于构成，以及两者之间关系的论点。构成是造形的前提。碗和巢看上去像是两种不同的东西，但实际上是一枚硬币的两面。一个人可以从下往上，追寻一片玻璃可以建成什么。而另一个人则可以从柏拉图式的理想形式开始，并抹去其中建造的纹理。



each stick three times to ensure triangulation and then with a note to shake the structure periodically to test its sturdiness. Without precise coordinates for each strut, this new process allowed the structure to be constructed without technical drawings as such. Part and whole were divided and reconnected through a process of improvisation, testing, and teasing out of tolerances.

On the one hand, I'm making an argument about figuration, and on the other hand, an argument about configuration as its prerequisite, and the reciprocity between the two. The bowl and the nest seem to be two different things but are in fact two sides of the same coin. One starts from the bottom up and asks what can be built with a blade of grass? The other begins with a platonic ideal, and erases the grain of construction within it.

悬挂的纹理

我们对材料研究的兴趣，很大一部分都转移到了更大、更加复杂的建筑中去。我们在亚特兰大、墨尔本和多伦多的三所建筑学校，都为推进其中的一部分想法提供了机会。想一想阿尔瓦罗·西扎 (Alvaro Siza) 的葡萄牙世博会展馆中悬挂的混凝土顶篷吧；想一想路易斯·康未建成的威尼斯议会宫 (Palazzo dei Congressi) 中，绞索造的桁架是如何变成议会大厅的可使用空间，同时其倾斜的形状是如何成为报告厅基座的吧。也可以想一想高迪 (Gaudi) 的悬链实验，是如何成为优化结构的方法的吧。对我们来说，“压缩悬链 (Compressive Catenary)”项目让我们得以试验该如何解读悬链结构，并从中制造出可使用的空间。



阿尔瓦罗·西扎的葡萄牙世博会展馆/ Expo '98 Portuguese National Pavilion by Alvaro Siza



路易斯·康未建成的威尼斯议会宫/Louis Kahn's unbuilt Palazzo dei Congressi in Venice

我们的想法源于对埃斯科里亚尔修道院 (El Escorial) 下方平拱的迷恋，它来自受到挤压的空间，对跨度的需求，以及拱顶上方对水平地面的需要。其实，建筑的历史上产生过许多非同寻常的拱顶，同时它们也因为各自的所在地而闻名，但它们基本不会影响到彼此。埃斯科里亚尔修道院极端的限制条件，为这种微小的操作提供了借口，将拱顶石 (keystone) 的逻辑延长到了整个拱顶的长度，仿佛只是为了将结构受力横向分散到两端的终点上。

如果说拱券的标志是其顶部的拱顶石，那么对于我们的悬挂式拱顶来说，就必须通过制造连锁的拼图碎片，以将拱顶石翻转过来，保证受压的块体变成受拉。反过来，随着拱顶石结构被转移到两边，其中心就变成了一层眼窗，作为定义拱顶形状的三个矢量之间的侧壁。



压缩悬链项目/The Compressive Catenary project

SUSPENDED GRAIN

Much of our preoccupation with material research translates itself into larger and more complex buildings; our three schools of architecture, in Atlanta, Melbourne and Toronto offered opportunities to advance some of this thinking. Consider the suspended concrete tarp of Alvaro Siza's Expo Pavilion in Portugal; consider Louis Kahn's unbuilt Palazzo dei Congressi in Venice and how the bowstring truss becomes an inhabitable space of the congress hall, with its raked figure as the base of the auditorium. Consider also the catenary experiments by Gaudi and how they become the mechanism by which to optimize structure. For us, the "Compressive Catenary" project became a way to test out how we could take the structure of the catenary and produce an inhabitable space out of it.



高迪的悬链实验/The catenary experiments by Gaudi



圣家堂拱顶/Arch of Temple Expiatori de la Sagrada Família



埃斯科里亚尔修道院的下方平拱/The flat arch that lies underneath the monastery of El Escorial

The idea we had was born out of a fascination with the flat arch that lies underneath the monastery of El Escorial, the result of compressed dimensions, the necessity to span, as well as the need for a flat floor above the vault. Indeed, the history of architecture has produced many extraordinary vaults, and yet they are also all characterized by a corresponding ground, but rarely does one impact, or determine, the other. The radical constraints of El Escorial produce an alibi for this subtle invention, extending the logic of the keystone along the length of the entire vault, if only to defer to the structural forces laterally to their ultimate destination at their edges.

If an arch is marked by a keystone at the top, for our hanging vault, we needed to invert the keystone by making interlocking puzzle pieces to insure that the compressive blocks could act in tension. In turn, as the keystone elements are displaced to the side, the central point is overtaken but an oculus, serving as a reveal between the three vectors that define the vault.



不管这个想法有多么不合常理,它的意图还是设计一种轻型的受压结构,作用于张力与压力之间,而且同样重要地,可以作为一个人造的地面。这一原则被直接转译到了亚特兰大与墨尔本的项目当中去,在那里,关于悬挂的研究成为了具有革新意义的教学工具。



However contradictory it is to intuition, the idea was to develop a light-gauge compressive structure that operates between tension and compression, and equally importantly, something that can serve as a constructed ground. This is a principle that translated directly into the Atlanta and Melbourne projects,

where the research on suspension becomes a transformative pedagogical tool.

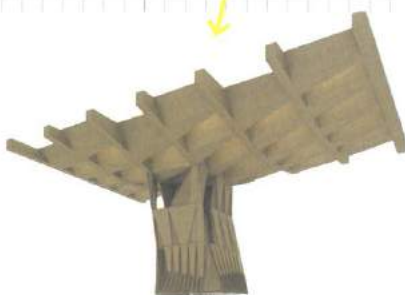
At the Georgia Tech School of Architecture, we used the gantry crane above to delicately suspend an entire studio space — the 'crib' — in order to maintain the flexibility of the ground level. In the Melbourne School of Architecture, where

吊挂在乔治亚理工学院建筑学院里的工作室空间/Suspended studio space at the Georgia Tech School of Architecture

在佐治亚理工学院(Georgia Tech)的建筑学院中,我们在上方用到了桥式起重机结构(gantry crane),巧妙地悬挂了一整个工作室空间,它被称作“摇篮”,以保持底层最大程度的灵活性。在墨尔本建筑学院(Melbourne School of Architecture)中,并没有建造专门的工作室空间的经费,我们就让22米长的单层层积梁(LVL)横跨了整个中庭空间,建造了一个图腾柱般的悬挂空间,作为仅有的一系列专用工作室空间。结构的顶部体量巨大,以浅浮雕(bas-relief)的形式沿工作室墙面向下延伸,并向底部变薄,最终变成了木纹贴片。在底部,贴片的表面创造出了方格形的吸音天花网格,悬挂在大厅的上方。这种建构系统的变化可以看作是对古典系统的颠倒。在传统上,重量应该在底部的粗石面(rustication)上,而随着向主层(piano nobile)和上层的上升,再为墙壁赋予轻盈感。

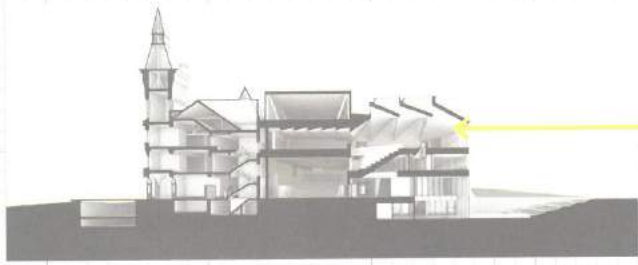
墨尔本设计学院(MSD)构件的结构纹理作用于造形与表面两个层面上。一方面,屋顶结构的体量厚壮而广阔,而它向一种精细轻盈的状态的转化,也是一种整体的造形策略的一部分——这或许可以称作其形态学纹理。同时,天花反向图中方格系统的木纹贴片表面是包裹在悬挂的工作室的纵向表面下方的,成功地制造出了一种同样像皮肤一样薄的纹理,我们让这两种纹理开始互相对话。

there is no budgetary allocation for a dedicated studio space, 22 meter LVL beams span the atrium and form the structure for a totemic suspended structure that served as the only dedicated series of studio spaces. The structure is massive and volumetric at its top, extending down the studio walls in a kind of bas-relief, and eventually thinning out to plywood veneers at its base, where the surface of the cladding serves to create a coffered acoustic ceiling that hovers above the great hall. The transformation of this tectonic system can be seen as an inversion of the classical system, whereby weight is traditionally given to rustication at the ground, with ascending thinness attributed to the walls of the piano nobile and the upper floors. The structural grain of the MSD members operated as both figural and surficial. The volumes of the roof structure are robust and spatial on the one hand, and yet their transformation to a state of delicate thinness is part of an integrated figural strategy; this could be called its morphological grain. At the same time, the wood veneer surfaces of the coffering system in the reflected ceiling plan are wrapped down the vertical surfaces of the suspended studio, effectively producing a grain that is also skin deep. The two grains are brought into dialogue with each other.



墨尔本建筑学院里图腾柱般的悬挂空间/The totemic suspended structure at the Melbourne School of Architecture





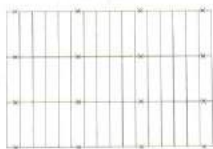
丹尼尔大楼, 多伦多大学建筑学院/Daniels Building, John H. Daniels Faculty of Architecture, Landscape, and Design, University of Toronto

在大多伦多的丹尼尔大楼 (Daniels Building) 中, 虽然悬挂的概念并非设计的推动力, 但亚特兰大和墨尔本项目的整体要求和教训在设计中起到了重要作用。当混凝土壳体屋顶结构受到否定时, 这个项目也基本上被击垮, 到了最关键的时刻。实际上, 当时已经马上就要牺牲掉这座建筑最优秀的特点了。对我们来说, 问题是这个屋顶究竟是由材料所推动的概念, 还是只是结构、照明、环境与水文性能的结合。随着后者逐渐占据了我们的想法, 我们用更加经济的钢材重新设计了结构, 而维持了最核心的形状和性能不变。然而在此时, 施工队还是拒绝了这个方案, 称其无法建成, 再次将

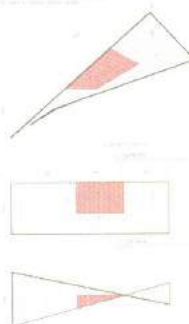
For The Daniels Building in Toronto, while the idea of suspension was not a motivating force, the integrative mandates –and lessons– of the Atlanta and Melbourne projects became instrumental in the transformation of the design. When the concrete shell roof structure was challenged, the project was virtually brought to its knees in a moment of truth, as it were, effectively on the verge of compromising the building's most salient feature. The question, for us, was whether this roof was a materially driven idea, or rather just about the integration of structural, illumination, environmental and hydrological performance; as the latter became to dominate our thinking, we



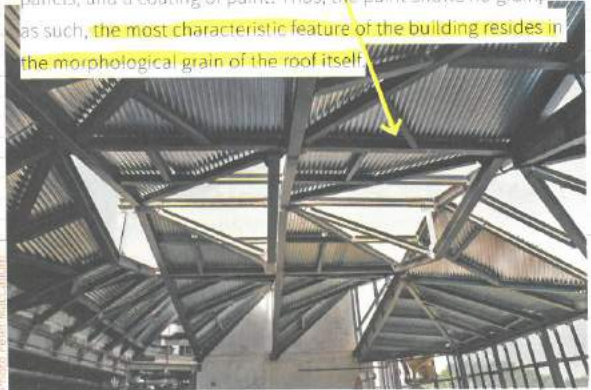
我们在事务所里建造了一座足尺模型证明设计的可建性/We built a full scale mock-up in our own studio proving our design is buildable.



它推到了断头台上。因此, 我们在事务所里建造了一座足尺模型, 不仅向他们证明, 直纹曲面是完全可以建成的, 而且证明了它可以内嵌辐射供暖模块, 作为本建筑的环设系统。这个系统由多个层次叠加而成, 底层是工字钢梁和波纹钢板, 表面覆盖了轻量支撑构件。石膏板和辐射供暖板, 最后上一层漆。因此, 表面的油漆并没有纹理, 但是建筑最有特点的性质就存在于屋顶的形态与纹理中。



redesigned the structure more economically in steel, while keeping its essential figure and performance intact. Even then, the construction team rejected the proposal, claiming it unbuildable, putting it once again on the chopping block. For this reason, we built a full scale mock-up in our own studio, proving to them not only that a ruled surface was completely buildable, but that it can also be embedded with a radiant slab that can serve as its environmental system. Composed of a layered system of parts, the steel I-beams with corrugated steel deck, covered with light gauge struts, gypsum board sheets with radiant panels, and a coating of paint. Thus, the paint shows no grain, as such, the most characteristic feature of the building resides in the morphological grain of the roof itself.



混凝土纹理

如果说我们在多伦多没能建成混凝土的纹理,那么它在拉马蒂埃尔(Ramatuelle)回到了我们身边。我们在那里设计了一座俯瞰地中海的独栋别墅,它原本是一座带有庭院的住宅,我们在剖面上对它进行了错位处理,为房子的上下两



翼都创造出了景观。这座房子错开的剖面是通过角落上的两座楼梯间连接起来的,而中央带游泳池的庭院则是视线的焦点。这座房子由三片混凝土楼板组成,分别是底层、主层和屋顶,并被构想成是景观的延伸。实际上,景观从建筑的南侧立面下方直接穿入中央庭院,全面地穿过住宅的客厅区域,并沿坡而上,到达一座顶层平台。



实际上,南侧立面与其说是立面,不如说是一根梁,从泳池的挡水墙上巧妙地悬挑而出,并与挡水墙垂直相交。在这里,混凝土的结构性纹理成为了这座房子里重要的主角,它实现了大幅的跨度,但看上去还是一个统一的整体,与地形融为一体。如果没有这种结构性纹理,这座混凝土住宅就无法成立。

从材料的角度来看,我们也同样好奇,混凝土作为一种材料,是如何产生“建构的纹理”的?在研究中,我们发现,关于建构性纹理的问题其实可以用两种方式提出,因此我们也探究了两种形态。首先,我们发现所

有的模板都会根据其材料性质(铝、木材、竹子等)产生自己的纹理,因此,表面纹理就指明了模板材料本身。其次,我们发现混凝土本身是各种元素的组合,包括水泥、骨料、掺料、水和其它成分。因此,我们实际上可以通过改变配比来改变其纹理,不光在表面上,也在其内核深处。因此,这两种形态都包含了一种人为性,有一些可以操控的变量,以创造出的一面可以同时去物质化,而且重新构想的混凝土墙来。

通过案例研究,我们研究了主入口区域,以推动数字模板的设计,它能在实际上是一整块混凝土的情况下,显示出一种



粗糙的碎石墙面的效果。同时我们也研究了混凝土中骨料的密度和大小,是如何使建筑室内平滑的完成面,慢慢转变成花园部分的景观中一堵真正的挡土石墙的。关于建构的纹理究竟意味着什么,围绕混凝土的这两种想法有着完全不同的含义。

CONCRETE GRAIN

If the grain of concrete escaped us in Toronto, it was reintroduced as a challenge in Ramatuelle, where we designed a single-family house overlooking the Mediterranean. What was initially a courtyard building is, slipped in section to enable views for both the upper and the lower wings of the house. The slipped sections of the house are held together by two staircases on each corner of the house, while a central court, occupied by a pool serves as a focal point. Composed of three concrete slabs—a lower floor, a main floor and a roof—the house is conceived as an extension of the landscape; indeed, the landscape flows right under the southern facade of the structure into the central court, seamlessly navigating through the living area of the house and up the hill towards an upper terrace.

indeed, the south façade is not so much a façade as it is a beam, cantilevered delicately by the pool retaining wall that intercepts it in a perpendicular fashion. Here, the structural grain of concrete serves as a significant protagonist for the house, enabling long spans, though apparently monolithic and integral to its typological figure. Without this structural grain, this concrete building that would not stand.

At a material level, we were also curious how concrete, as a material, produces a “tectonic grain”? In our research, we realized that, in fact, the question about tectonic grain can be

posed in two different ways, so we investigated both modalities. First, we realized that all formwork produces its own grain, depending on its materiality (aluminium, wood, bamboo), and thus the surface grain serves as an index

of the formwork itself. Second, we realized that concrete itself is the result of a combination of elements, including cement, aggregates, admixtures, water, among other materials; for this reason, one can effectively alter its recipe to consider alternative grains that are embedded within its core, not only its surface. Thus, both modalities involve a level of artifice, with certain variables that can be manipulated to create a concrete wall that is at once dematerialized as reconceptualised.

By way of case studies, we researched the main entry area to serve as a catalyst for the design of digital formwork, which can serve to insinuate a rusticated rubble wall, while in fact being monolithic concrete. At the same time, we researched how the density and size of aggregate within the concrete can

serve to transform from a smooth finished surface on the interior of the building to a veritable stone wall serving to retain earth in the landscape in the garden areas. These two ideas about concrete have totally different implications about what is meant by the tectonic grain.

最后的纹理

第一次去罗马时，我被街道的建构性纹理和鹅卵石的组成形式所迷惑了。我没有发现拱券的纹路，与身体有着直接的联系。建造者应该是跪在地上，展开双臂，来确定每个拱券的半径的。



2000多年来，在建造物与身体之间一直有这种直接的联系。甚至连墙面上的涂鸦都是臂展的直接印记。然而，我们正见证着一个非常奇妙的时段，3D打印已经开始消除建构单元的界限了。我们不再被四片或者八片工业制造的产品所限制。在将来，我们或许能够在3D打印的微粒结构中，打印出各种功能来。现在最有趣的是，我在这次讲座中所说的，以后可能都已经不再重要了。

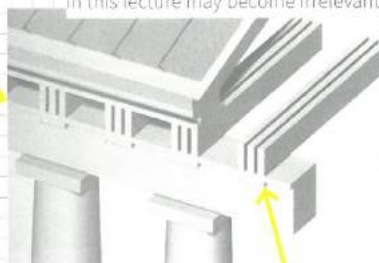
我在此以帕提农神庙的一幅图片，以我对实际的结构、概念上的结构，以及象征性的结构的迷恋作结。最早进入建筑学院时，我完全不知道三陇板(triglyph)是怎么起作用的。我以为这些只是装饰。后来，我才发现它们其实表示的是背后梁末端的纹理，它布满了整座建筑的跨度。突然间，它们获得了一种共鸣，对我产生了深刻的影响。梁的存在印刻在了神庙的石头表皮上。但如果我们知道实际上的跨度结构是木头组成的，为什么木制的梁还要用石头来表现呢？木材尾部纹理的石质化，以三陇板的形式隐藏起来，这正是建筑的作用的一部分——我应该补充一下，这是建筑做得最好的一部分。这暗示着，结构是可以服务于装饰的，而非相反。这暗示着建筑的真相是印刻在它的故事中的，由虚构和现实融合而成。

而且，就在你自以为你弄懂了的时候，建筑又向你丢了一个弧线球。在三陇板母题的转角处，架构起这种虚构的真相的故事崩塌了。我们很清楚地知道，这些三陇板背后的梁无法同时向两个方向延伸。这便是建构性纹理的神奇之处，真实与虚构的结构走到了一起，这便是我们所称的“建筑”。⑩

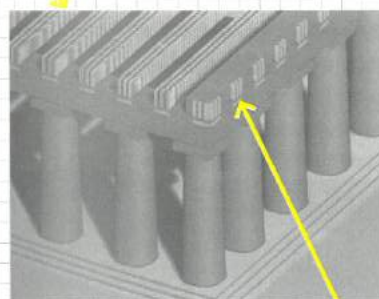


END GRAIN

When I first went to Rome, I was mystified by the tectonic grain of the streets, the organization of the cobble stone. I didn't realise that the pattern of arcs had a direct relationship to the body. A builder presumably sat on his or her knees and the reach of their arm length defined the radius around which each arc would be defined. For over 2000 years there has been this direct relationship between what is constructed and the body. Even the tagging of graffiti on the side of the wall is a direct imprint of the reach of the arm. However, we're now witnessing a very special moment where 3D printing is beginning to eradicate the limits of the tectonic unit. No longer are we necessarily defined by 4-by-8 sheets or other industrially manufactured products. We may yet to be able to print out different functionalities within the cellular structure of the 3d print, no longer limited to the laminar layering of constructed wall systems. What seems interesting right now, is the possibility that everything I've said in this lecture may become irrelevant.



I end here with an image of the Parthenon, and my fascination with actual structure, purported structure and symbolic structure. When I first came to architecture school, I had no idea how the triglyphs functioned. I thought they were just ornaments. Later, I discovered that they are, in fact, an index of the end-grain of the beams just behind, spanning the entire structure; all of a sudden, they acquired a resonance that had a profound impact on me. The beam's presence is imprinted in the temple's stone skin. But why would the wooden beam be registered in stone when we know that the actual spanning structure is composed of wood. The petrification of the wood end grain, in the guise of a triglyph, is part and parcel of what architecture does—and what architecture does best, I should add. It suggests that the structure might be in service of the ornament, not vice versa: that, somehow, the truth of the building is imprinted in this narrative, composed of a blend of fiction and actuality.



And just when you think you've understood it, it throws you another curve ball. As the motif of the triglyph turns the corner, the very narrative that upholds the truth of the fiction collapses. We know perfectly well that the beams behind these triglyphs cannot be spanning in both directions at once. This is the magic of the tectonic grain, where both the actual and fictional structure come into a dialogue in that we call "architecture". ⑩

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