建造崇高性

后数字时代的建筑寓言

SUBLIME BODIES

Architectural Problems in the Postdigital Age

（奥）马德朴 （奥）马宁格 著

周渐佳 译

Matias del Campo & Sandra Manninger

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BUNDESKANZLERAMT ÖSTERREICH

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图书在版编目（CIP）数据

建造崇高性：后数字时代的建筑寓言 / (奥) 马德朴 (Matias del Campo)，(奥) 马宁格 (Sandra Manninger) 著；周渐佳译. -- 上海：同济大学出版社，2017.3
（数字设计前沿系列丛书 / 袁烽，江岱主编）
ISBN 978-7-5608-6779-3

Ⅰ. ①建… Ⅱ. ①马… ②马… ③周… Ⅲ. ①数字技术—应用—建筑设计—文集 Ⅳ. ①TU201.4-53

中国版本图书馆CIP数据核字(2017)第041266号

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责任编辑 袁佳麟
责任校对 徐春莲
封面设计 张 微
出版发行 同济大学出版社（地址：上海市四平路1239号
邮编：200092 电话：021-65982473）
经 销 全国各地新华书店
印 刷 常熟市华顺印刷有限公司
开 本 787mm×960mm 1/32
印 张 6.5
字 数 175 000
版 次 2017年3月第1版 2017年3月第1次印刷
书 号 ISBN 978-7-5608-6779-3
定 价 52.00元

致谢 *Acknowledgements*

本书出版得到奥地利联邦政府艺术与文化处的支持
This book was made possible through the generous support of the Bundeskanzleramt Österreich/ Sektion Kunst und Kultur.

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序言 *Preface*

《建造崇高性：后数字时代的建筑寓言》收录了马德朴和马宁格组成的SPAN建筑事务所近年来在专业与学术、理论与实践上产出的各种作品。这本书不仅仅是一个关乎“设计方法理论”的论述，更为重要的是它提出一项关于“设计哲学与设计思维”的讨论。当我们习惯于建筑师所处的主体身份，并且认定对建筑技术与设计方法的应用已经形成种种约定俗成之时，《建造崇高性：后数字时代的建筑寓言》一书恰恰在数字化设计与机器人建造技术的基础上，提出更有趣的感知与意识流程，以及机器与情感的全新对话关系。在这个后人文主义时代，这恰恰是我们籍以重新认识工具与思维关系的理论读本之一。

有关建筑自主性的探索向来是建筑学批判性思维的核心问题。一直以来，人作为思维的主体，始终将对自身意识与逻辑的模拟、生成置于设计与生产之上。无论这种设计思维的组织是自上而下，还是自下而上的，“人”的意志与欲求是一贯的核心。当自主性建构的主体由人变成智能机器人，或是人机合作的状态，那么这种对主体的悬置、合作和转移势必将重新定义建筑自主性的议程。

同时，书中提出了“后数字化转向”，此建筑话语的讨论已经从建筑形式范式转向基于建筑新物质性的设计与生产方式。伴随着机器认知时代的到来，机器学习、人工交互等议

题正在扩大和改造整个建筑生产的生态环境。介于此种观点，本书后半部分提及的材料聚合模式以及意识和情感的融入，是对建筑本体非常有意义的延伸。

作为2010年上海世博会奥地利馆的设计师，马德朴和马宁格一直在通过自身实验性的建筑探索推动建筑理论的发展。2013年以来，他们连续三年参加“上海数字未来”的工作营活动，其所坚持的“自主性建构”教学在不断地探索人工智能与机器智能的关联，并且从形式生成的本源出发，实现由机器参与的、不可预见的形态，这无疑是对建筑设计与生产系统的重新定义。通过数字化设计与建造的全新方法与思维实验，这同样预示人工智能所定义的全新未来。

袁 烽
同济大学建筑与城市规划学院教授

序言 *Preface*

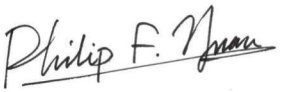
Sublime Bodies: Architectural Problems in the Postdigital Age compiles the professional and academic, theoretical and practical works of SPAN architecture founded by Matias del Campo and Sandra Manninger in 2003, in Vienna, Austria. Drawing on the discourse of design methodology, this book also investigates a conversation on design philosophy and design thinking. When we have become accustomed of placing architects on subject position, so as the conventions shaped by the affirmative architectural technology and techniques, this book enkindles an intriguing process of sensing and perception, and opens up a unprecedented dialogue between machine and emotion both based on digital design and robotic construction. It lays down a theoretical foundation for situating today's comprehension of the relationship between tools and design thinking in this very posthuman era.

That exploration on the autonomy, is unquestioned the core issue of critical thinking in architecture. Human beings, the subject of thinking, has long been setting the simulation and generation of self-imposed consciousness and logic prior to design and production. Organized from top to bottom, or vice versa. This established thinking pattern, centers on none but human's own will and desire. Indicating a shifting subject from man to intelligent robots, or to man-machine coordination in autonomous tectonics, this suspension, collaboration and mutation will rewrite the agenda of architecture autonomy in its own right.

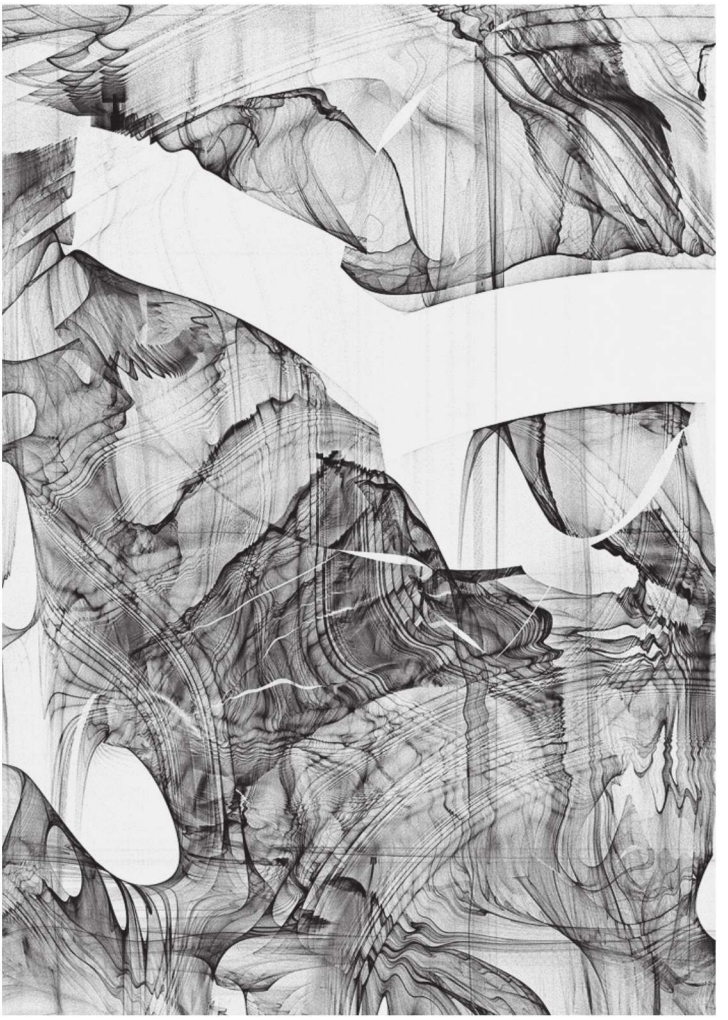
The "Postdigital Shift" put forward in *Sublime Bodies: Architectural Problems in the Postdigital Age*, contends that the architectural

discourse has devoted from form-making paradigm, to the design and production methods that new architectural new materiality may empower. With the arrival of machine cognition era, issues like machine learning, human-computer interactions have been constantly branched out and reshaped the ecology of building delivering. Based on this, through identifying the modes of material aggregation and integrating the consciousness and sensibility, the second half of the book introduces a significant extension to the ontology of architecture.

Being the designer of Australian Pavilion in 2010 Shanghai EXPO, Matias del Campo and Sandra Manninger have been exploring architecture theory in combination with cutting edge technologies. Through consecutive participation in the DigitalFUTURE Shanghai workshop since 2013, their pedagogy on autonomous tectonics continuously explores the boundary of human and machine intelligence, thus conducts on the unpredictable nature of morphological generation involving with machine participation. These efforts, undoubtedly, are redefining the design process and production system. The integration of digital technology, attests to the transformation of the design methods and thought exercise, further, foresees a future of artificial intelligence to come.



Philip F. Yuan
Ph.D., Professor in CAUP, Tongji University



基于生成算法的Dextro的画，K456_P54 -G001 2004
Dextro painting based on generative algorithm - K456_P54 -G001 2004

后数字化转向
Postdigital Shift

The machine has no feelings, it feels no fear and no hope ... it operates according to the pure logic of probability. For this reason I assert that the robot perceives more accurately than man.

—Max Frisch, *Homo Faber: A Report*

机器人没有情感，既无恐惧也无希望……它只是根据概率发生的纯粹逻辑运行。正是基于这个原因，我断定机器人比人类更精确。

——马克斯·弗里舍，《能干的法贝尔：一份报告》

Computational tools have become a standard in the discipline of architecture, in that extent we can think of a saturation of the field with computational tools. From early design stages, to visualization to the execution of building designs, every aspect of the industry is dominated by the use of computers and software. Insofar computational tools do not form the exception but have become today's standard, the rule, the norm. The consequence is not necessarily the omnipresence of sophisticated applications, on the contrary the predominant method

计算机工具已经成为建筑学科内的一项标准，一定程度上我们可以说学科的领域已经被计算机工具所渗透。从设计的前期开始，到可视化，再到设计的实现，这项产业的各个层面都被计算机和软件的使用主导着。这样说来，计算化工具的产生并不是例外，而是成为今天的标准、法则和规范。它造成的结果并不一定是已被成熟应用或随处可见，相反，占主导的方法还是依赖于传统的、前数字化的设计方法，比如平面、剖面的绘

1: Whilst the former needs computers, as a mean of translating a preconceived idea into digital files to achieve a result, the later does not, as it relies on various forms of computation including but not limited to Analogue Computation and Material Computation.

2: Paul Markillie, The Third Industrial Revolution, The Economist, April 2012, P.46-52

relies on the translation of conventional, pre-digital, design methods such as the drafting of plans and sections and visualization of preconceived ideas. This can be described as computerized methods in contrast to the opposite end of the spectrum which relies on computational ideas[1]. Considering the ubiquitous presence of digital tools in the discipline, we can consider our current stage as the dawn of the Postdigital Age the initial fascination with the opportunities inherent in computational tools has evaporated, instead we enter a phase of maturation, of virtuosity and of exploration into alternative design methods relying on computational ecologies consisting of code and computer controlled machinery. The result is a shift away from architecture design paradigms discussing issues of visualization and simulation towards an exploration of in situ matter

制以及预想概念的呈现。这些计算机化方法与此范畴内的另一极——计算机化思考[1]背道而驰。学科内的计算机工具已经比比皆是，我们可以把目前所处的阶段视为数字化时代的黎明，对计算机工具中蕴藏机遇的最初的迷恋已经烟消云散，取而代之的是我们进入一种讲求成熟、技巧和探索的阶段，特别是依靠计算机生态的其他设计方法，包括代码与数控机器。其结果是从讨论视觉化和模拟的建筑设计范式转向了对在场建造管理的探索，这在历史上就是建筑竞争的核心如今发生在数控机器的

1:前者将计算机作为把已有的想法转化为数字文件以得到成果，后者则依赖计算机得出的各种形式，包含但不限于模拟运算和材料运算。

3: David Bourne, My Boss the Robot, Scientific America, Volume 308, Nr.5, New York, May 2013,P.39-41

4: Ibid.

5: Manuel de Landa, Computer and the War Machine, presented at NetAccess, Vienna, Austria 1996

management, historically a core competence of architecture, within the frame of computer controlled machines. The rise of 3D printing along with all the opportunities inherent in computer controlled fabrication (Laser Cutting, CNC Milling, Robotics etc.) serve as an indicator for an era of individualized fabrication which has been described by commentators as the Third Industrial Revolution[2]. Aspects such as machine learning, robot-human cooperation[3] and cognitive machines[4] are expanding and transforming the entire ecology of production, morphing from economies of scale to economies of agglomeration[5]. For the discipline of architecture to be part of this massive shift, it is of paramount importance to understand how the Postdigital Age will change the game in terms of architectural production and design, as

框架下。3D打印的兴起伴随着计算机控制建造的所有机遇（激光切割，数控铣床，机器人技术等）已经成为个人制造时代到来的信号，它们是第三次工业革命[2]的解说。像机器学习、人机协同[3]以及识别机器[4]这样的技术在不断扩张，改变了整个生产体系的生态全貌，塑造着尺度经济和聚集经济[5]。建筑学科身处于这场巨大的转变之中，因此理解后数字化时代的到来会如何在建筑生产与设计上改变游戏的局面显得至关重要，同样重要的还有它所带来的一种新奇文化。这种文化将联系起编程、代码和其他材料系统的现实（和不确定性）。

well as how it produces a novel culture at large. A culture which brokers the realities (and uncertainties) of programming, coding and alternative material systems.

To address the before mentioned paradigmatic shift, from visualization and simulation to real-time matter management I will rely on two examples based on robotic fabrication, both are emergent deposition modeling systems which rely on sets of simple rules to generate highly intricate spatial conditions. Both of them are results of basic explorations. The catalogue of terms to describe the results of this explorations include vocabulary such as index, indexicality, emergence and autonomous behavior.

为了进一步展开之前提到的从视觉化和模拟到实时管理的范式转变，本书将通过两个与机器人制造相关的例子加以说明，二者都是涌现积淀建模系统，依靠简单的原则生成高度复杂的空间。它们都是基础探索的结果，用来描述这次探索的词汇包括索引、索引性、涌现和自主行为。

6: Robotic system is composed of a Kuka KR100 HA L90 arm, K-1500-3 linear axis. BAK Extruder 6007CS, Canon EOS 600D as optical sensor.

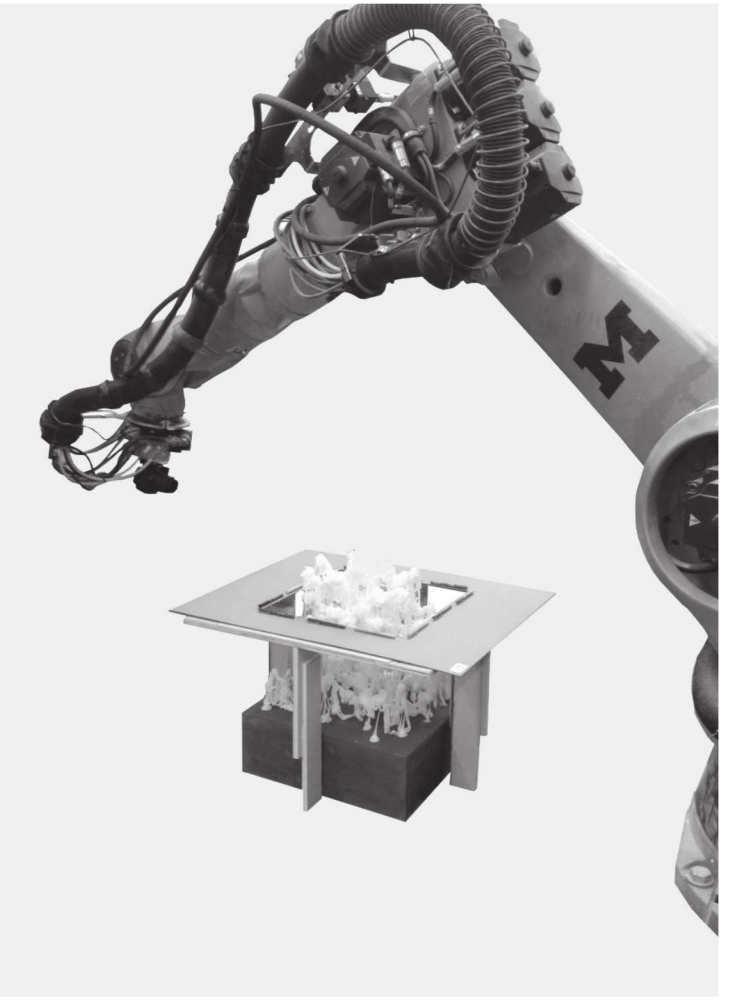
Robotic Construction, Autonomous Tectonics, Thermo-formations

Autonomous Tectonics is based on explorations into emergent robotic fabrication methods and basic research on autonomous material formations. This approach allows the exploration of aggregations of matter; based on rule sets on the one side, and specific material behavior on the other, including the programming of procedures to infuse a robotic setup with the possibility to, independently, make decisions about material deposition based on criteria defined as a result of the information perceived by the robotic setup[6]. The information processed by the robot involved the building perimeter and the scanned result of the initial material deposition. Following these initial tests, the focus shifted from the programming, and algorithmic aspect of the investigation to the performative qualities inherent in alternative

机器人建造，自主建构，热成形

自主建构是建立在涌现机器人建造方法和对自主材料成形的基础研究上的探索。在这种做法下得以实验物质的聚集，一面是原则，另一面是特定材料的表现，包括通过步骤的编程来激活机器人设定，使它能按照标准对材料的堆积做出独立判断，这些设定的标准是作为信息的结果被机器人设定[6]读取的。机器人处理的信息包括建造外缘和初次材料堆积的扫描结果。在最

6: 机器人系统是由一台库卡KR100 HA L90机械臂，K-1500-3直线光轴，BAK 6007CS挤出机和佳能EOS 600D光学传感器组成。



关联生态课程设计，在陶布曼学院建造实验室的首个原型模型的建造过程，密歇根大学，2012年秋季

Apophenic Ecologies Studio, construction of first prototype model at the FabLab of Taubman College, University of Michigan, Fall 2012

material systems. Performative in this realm of thinking is not intended primarily as a noun describing utilitarian qualities but as an index of qualities encompassing primeraly intensive properties such as firmness, plasticity, malleability, elasticity, refractiveness, density, anisotropy, translucency and transparency. The technique applied in order to create a spatial formation can be described as *emergent modeling*. To generate a clear picture of we need to clarify the criteria that describe a technique such as emergent modeling.

初的测试下，焦点从编程和研究的算法层面转移到其他材料系统的性能特点。在这种思考方式下，性能不是首先被当作描述使用特征的词条，而是当作指示重要属性的索引来使用，包括硬度、可塑性、延展性、折射性、密度、各向异性、不透明性和透明性。采用这种技术是为了创造出一种能被描述为涌现模型的空间形式。为了使之更加清晰，我们需要进一步说明这种可以被描述为涌现建模技术的标准。