数字现实
MACHINIC PROCESSES
ARCHITECTURE BIENNIAL BEIJING 2010
ARCHITECTS
青年建筑师作品

尼尔·林奇（英）/ 徐卫国 编
Neil Leach / Xu Weiguo [eds.]

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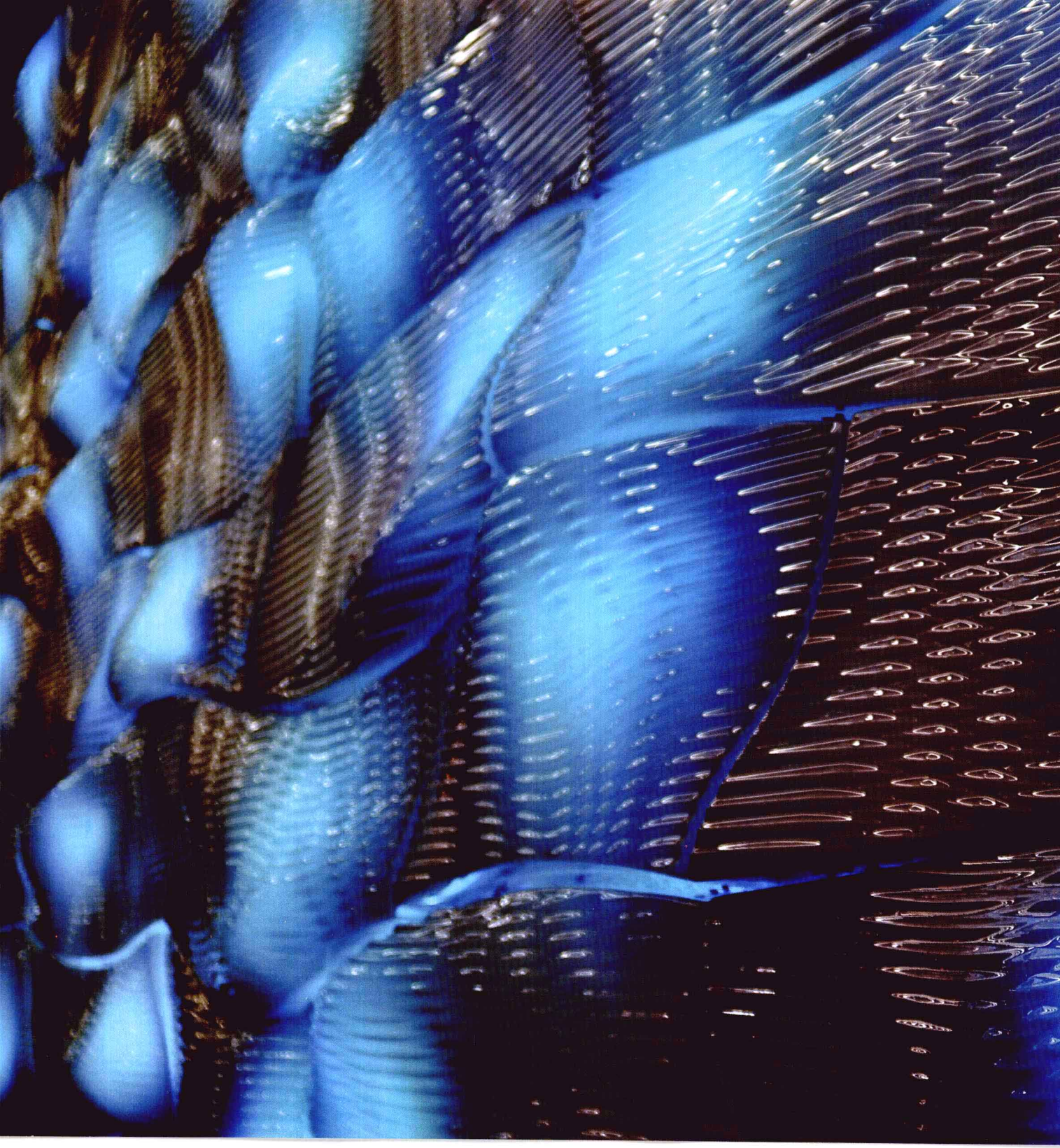

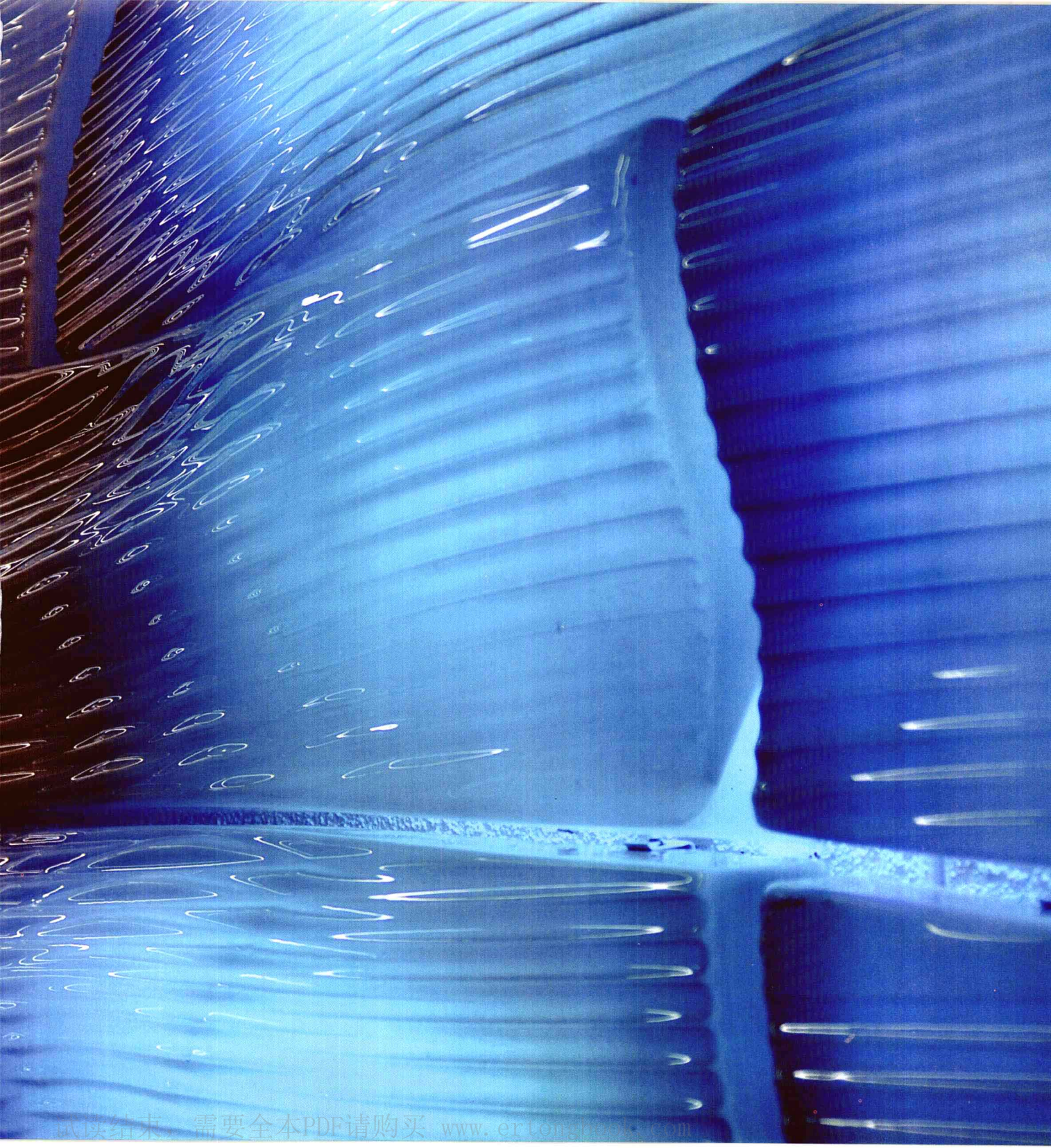

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前言 / Preface

这本作品集收录了“数字现实”青年建筑师作品展中的作品，该作品展作为北京 2010 建筑双年展的一部分，将会在 798 时态空间举办。这次展览是北京国际青年建筑师及学生建筑设计作品双年展系列的第四次展出。第一次是 2004 年在 UHN 国际村举办的“快进”，之后两次分别是 2006 年在世纪坛举办的“涌现”和 2008 年在 798 时态空间举办的“数字建构”。

这次的主题是“数字现实”，不仅是指数控机床和 3D 打印那样的数字建造过程，也包括在参数化算法设计技术方面的创新。从 2004 年以来，中国对这些新技术接受得很快，像鸟巢那样的建筑，如果离开了参数化建模技术和 BIM 软件的帮助，要想建成几乎是不可能的。虽然中国的建筑制造业在过去比较多地依赖手工劳动，但是数字建造技术在建筑方面扮演着越来越重要的角色，相信将来这种势头会继续下去。

本作品集为世界上最具潜力的建筑师和设计师的先锋数字设计作品提供了一个展示的平台。九位策展人来自九个不同的地方：美国东海岸、美国西海岸、澳大利亚、中国、英国、亚洲、拉丁美洲和欧洲，每位地区策展人从各自的地区挑选了六个新兴的使用先进数字技术的建筑和设计事务所，另外也包括国际部分。

本书收录的作品是同一主题展览的一部分，展览也包含了世界上顶尖建筑院校的先锋数字设计作品，包括英国建筑联盟建筑学院、美国南加州大学、美国哈佛大学设计研究生院、美国南加州建筑学院、耶鲁大学和清华大学，这部分作品收录在《数字现实　学生建筑设计作品》中。

展览的举办离不开许多个人和组织的帮助，特别感谢广州康逊贸易公司、LG Hausys、Spanish Ceramic Tile Manufacturers’ Association 和金晶集团的慷慨支持，以及 798 为展览提供的场地支持。

我们也十分感谢为作品集编排和设计付出努力的所有人，特别感谢：陈寅、明晔、姜赛双、娄晓一、林秋达、赵明、周实、梁其伟和顾芳。

尼尔 · 林奇
徐卫国

This is a catalogue of the works on display in the ‘Machinic Processes’ exhibition of architects’ work at 798 Space, Beijing, as part of the Architecture Biennial Beijing 2010. The exhibition is the fourth in a series of exhibitions at the Architecture Biennial Beijing that have addressed advanced digital design in architecture. The first exhibition, ‘Fast Forward >>’, took place in UHN in 2004. This was followed by two further exhibitions: ‘Emerging Talents, Emerging Technologies’ in the Millennium Museum in 2006, and ‘(Im) material Processes: New Digital Techniques for Architecture’ in 798 Space in 2008.

The theme, ‘Machinic Processes’, refers not only to new digital fabrication processes, such as CNC milling and 3-D printing, but also to the innovative use of new parametric and algorithmic design techniques. Since 2004 the adoption of these techniques in China has been rapid. The design of buildings such as the Birds Nest stadium would not have been feasible without the use of new parametric modeling techniques and Building Information Modeling software. Meanwhile, although the construction industry in China has relied heavily on manual labor in the past, digital fabrication technologies are beginning to play an increasingly important role in the construction of buildings throughout China, and are set to play an even more significant role in the future.

The catalogue offers a showcase of the most progressive digital design work by some of the most talented architects and designers in the world. Nine curators have been chosen from nine different regions - East Coast USA, West Coast USA, Australia, China, United Kingdom, Asia, Latin America and Europe. From their respective regions these curators have each selected six emerging architectural and design practices noted for their use of advanced digital techniques. There is also an international selection.

The work included here is part of a larger exhibition on the same theme, which also encompasses some of the most progressive digital design work by students from some of the leading schools of architecture in the world, including the Architectural Association, University of Southern California, Harvard GSD, SCI-Arc, Yale University and Tsinghua University.

This exhibition would not have been possible without the help of several individuals and organizations. In particular the organizers are grateful to Guangzhou Kangxun Trading Company, LG Hausys, the Spanish Ceramic Tile Manufacturers’ Association and Jinjing Group for their generous support of the exhibition, and to the directors of 798 Space for permitting the exhibition to take place.

The organizers are also grateful to all who have contributed to the preparation of this catalogue. In particular they would like to thank Chen Yin, Ming Ye, Jiang Saishuang, Lou Xiaoyi, Lin Qiuda, Zhao Ming, Zhou Shi, Liang Qiwei and Gu Fang for their invaluable contribution in helping to design and compile this catalogue.

Neil Leach
Xu Weiguo

参数化解析 / Parametrics Explained

当代数字设计实践正处于快速演化期。虽然早在几十年前，建筑师就开始使用电脑辅助绘图（CAD）系统，但直到最近，建筑师才清晰地意识到参数化设计与算法设计的巨大影响力。早期的建筑研究者与程序员在实践中逐步发展了这两种设计方法，现在它们也越来越广泛地得到专业人士和学术界的认可。

参数化设计与算法设计开启了建筑实践新的可能性。更重要的是，它们并非发轫于学术界，而是已在商业实践中发展与完善。20 世纪 90 年代后期以来，商业实践领域涌现出若干数字设计研究小组（DRU），与技术进展并行。DRU 包括福斯特事务所的专家建模团队，从盖里事务所剥离出来的铿利科技，奥雅纳的高级几何小组，以及扎哈 · 哈迪德 CODE 小组。如今，为确保复杂形式的建筑能在预算范围内按时、高效地完成设计与建造，设计事务所设置了这些内部数字研究小组。因此，我们可以清楚地看到数字化设计工具发展的历史流变：从 20 世纪 90 年代将设计工具与科幻小说和虚拟现实挂钩，到 21 世纪初期应用它们来理解数字构造与材料行为，直指向未来十年的某个时刻，将它们转变为复杂形式建筑的生产中密不可分的工具。

然而，参数化设计与算法设计经常混淆，有时竟混为一谈，统称为“参数主义”。本文试图澄清该状况，并提供了某些术语的确切定义，以区分这两个截然不同的数字技术。与此同时，本文也试图评价“参数主义”这一术语本身，并探究我们所看到的是否意味着一个新的建筑“风格”的涌现 [1]。

参数化设计

从数学到设计，参数化作为术语在诸多学科均有使用。从字面上看，参数是指操作定义区间内的参数。而在当代设计的特定领域，参数化的意义则广泛得多，多指使用参数化建模软件。与基于数据几何对象的标准软件包不同，参数化软件赋予几何体维度与参数，从而能够通过增量调整几何体的局部来影响整体。例如，重新定位曲线上的某个点，整个曲线将进行自我调整。参数化软件让适应、融合和平滑这些操作更加容易。因此，它不但对单体形式的建模有用，也同样可以用于关联城市规划的整个领域。

参数化软件为曲线设计提供了机会。曲线设计在弗兰克 · 盖里、扎哈 · 哈迪德等建筑师作品中比比皆是。这些作品淋漓尽致地体现了建筑师对形式的操纵。参数化软件，就其自身而言，并没有创造新的形式语言。早在引入参数化软件之前，上述事务所就在使用模拟技术建模。然而，借助参数化软件，能高效地重新建模，从而更好地控制设计过程，并获取数字建造过程中所需的更为精确的信息。

但是，凭此假定参数化设计只与形式生成有关，则可能是错误的。相反，参数化技术为建筑师提供了与标准方式相比更高效的新模式，以及可协调建设过程的新方法（可称之为建筑信息模型），如应用铿利科技开发的适用于建筑行业的 DP，类似于 CATIA 的建筑版。这些软件包的显著优势在于，它们能够让设计与施工团队在同一平台上交互，从而在更高层次上控制项目，即监督建设时间和成本。

Contemporary digital design practice is in a state of rapid evolution. While architects have employed computer-aided drafting (CAD) systems for decades, only recently have two distinct and potent design sensibilities - parametric and algorithmic design - emerged. Nurtured by early architectural researchers and programmers operating in practice, these methodologies are now gaining widespread professional and academic acceptance.

Together these two techniques are opening up a new field of possibilities for architectural practice. Most significantly, they have been developed and refined primarily in commercial practice and not in academia. Since the late 90s, these advances have coincided with the emergence of a number of digital research units within commercial practice, such as the Specialist Modelling Group at Foster and Partners, Gehry Technologies spun off of Gehry Partners, the Advanced Geometry Unit at Arup, and CODE at Zaha Hadid Architects. These in-house digital research units have been developed as a means of ensuring that the complex buildings of today are designed and constructed efficiently, on time and within budget. We can therefore discern an evolution within the development of digital design tools, from a period when they were associated with science fiction and virtual reality in the 1990s, through to a period when they began to be used to understand within the realm of digital tectonics to understand material behaviors in the 2000s, through to a moment when they have become almost indispensable in the production of complex buildings in the 2010s.

However, these two design sensibilities – parametric and algorithmic design - are often confused, and sometimes collapsed into the single term, 'parametricism'. This article is an attempt to clarify the situation, and to offer some precise definitions of terms in order to differentiate these two quite distinct digital techniques. It is also an attempt to evaluate the term 'parametricism' itself, and to question whether or not what we see emerging is a new 'style' of architecture [1].

Parametric Design

Parametric is a term used in a variety of disciplines from mathematics through to design. Literally it means working within parameters of a defined range. Within the specific field of contemporary design, however, it refers broadly to the utilization of parametric modeling software. In contrast to standard software packages based on datum geometric objects, parametric software links dimensions and parameters to geometry thereby allowing for the incremental adjustment of a part which then affects the whole assembly. For example, as a point within a curve is repositioned the whole curve comes to realign itself. The operations that it facilitates are adaptation, blending and smoothing. It is therefore useful not only in modeling individual forms but also in the whole field of associative urban planning.

Parametric software lends itself to curvilinear design, as in the work of Frank Gehry, Zaha Hadid, and other architects whose work is characterized by the manipulation of form. In itself, however, parametric software does not open up a new vocabulary of form. Such offices were modeling using analog techniques long before the introduction of parametric software. However, these techniques are highly efficient for remodeling forms, and afford greater control in the design process. They also provide more precise information for digital fabrication processes.

It would be wrong, however, to assume that parametric design is concerned solely with form-making. On the contrary, parametric techniques afford the architect with new modes of efficiency compared to standard approaches and new ways of coordinating the construction process (called Building Information Modelling),

算法设计

算法指利用过程技术解决设计问题。技术上而言，算法是一个简单的指令。因此，它与标准的模拟设计流程和数字设计流程两者的相关性大致等同。但是，在数字设计领域，算法则特指设计人员使用脚本语言，从而能够进一步超越用户界面的限制，并通过直接操纵代码而非形式来进行设计。通常而言，算法设计通常采用计算机编程语言如 Rhino Script、MEL（Maya 嵌入式语言）、Visual Basic 或 3dMax Script。与此相反，由于编程困难，Generative Components 和 Grasshopper 则直接跳过了编码，采用了智能图形形式。因此，我们可以称它们为图形脚本形式。算法设计充分挖掘计算机作为搜索引擎的能力，并执行一些原本异常耗时的任务。因此，算法设计为优化提供了空间，并使超越了标准设计限制的某些任务成为可能 [2]。

参数与算法

现在普遍将“参数化”和“算法化”两个术语混为一谈。这一现象部分是因为这两个技术最终产生的形式可能类似。如采用 Processing 或者 Rhino 生成的算法设计作品，通常为曲线形式，看起来和使用参数化工具生成的作品差不多。但这一现象更多的是因为很少有人真正理解这些术语的实际含义，至少对不熟悉计算机的人如此。因此，从某种程度而言，某些设计，尽管看似表达曲线美学，仍将“参数化”作为标榜数字设计的快捷方式，而参数化也为新的建筑风格提供了表达之便。

尽管描述广义的方法总是需要同义词或其他可及的术语，但发展这些词汇却令人担忧，发展无疑将导致进一步的混乱。通常，建筑文化中采用的术语与这些术语在文化中的使用迥然不同。事实上，我们可以浏览建筑史，并找到一些术语，如“后现代主义”或“解构主义 / 解构”，它们在建筑语境中，是指某些建筑风格通过某种方式消解了原有文化的意义 [3]。参数化或者参数设计目前正在遭受同样的命运，尽管它实际上是一种新的数字技术，能够培育一个新的进程或设计方法，但现在它已被认定是指一种新的美学表达或建筑风格。

由于计算在建筑文化中日益盛行，在混乱扩散之前，必须作一些努力来澄清术语，避免将参数化这一术语用于描述某种风格这一误用得到普遍认可。因此，让我们在这里很清楚地阐释：算法技术是基于使用代码，而参数化技术则是基于形式的操作。因此，它们是截然不同的技术。

同时算法技术往往与参数技术一起使用。我们不妨来看，例如，用某些算法技术来生成初始形式，随后使用参数技术来操作。相反，一旦通过参数技术生成模型，也可使用算法技术在设计流程末端进行优化或其他操作。

不过，尽管参数化与算法化貌似泾渭分明，但更深一步想会令人隐隐不安。它们之间明显的差异，可能会因设计过程的视觉化而模糊。许多建筑师并没有从头开始学习编写代码，而是借助 Maya 或 Rhino 平台的操作界面，学习使用内嵌逻辑代码的工具箱来建模。换言之，这些代码只是用来提供形式操作的钥匙，并主要以视觉媒介为建筑师所理解。Grasshopper 以智能的图形形式取代了代码。它的推出，进一步提升了对视觉的强调。最后，as in the case of Digital Project, an architectural version of CATIA customized for the building industry by Gehry Technologies. The big advantage of such packages is that they allow the construction team to interface on a single platform, and afford a higher level of control in terms of monitoring the time and cost of construction.

Algorithmic Design

Algorithmic is a term that refers to the use of procedural techniques in solving design problems. Technically an algorithm is a simple instruction. It therefore relates as much to standard analog design processes, as it does to digital design processes. Within the field of digital design, however, it refers specifically to the use of scripting languages that allow the designer to step beyond the limitations of the user interface, and to design through the direct manipulation not of form but of code. Typically algorithmic design would be performed through computer programming languages like RhinoScript, MEL (Maya Embedded Language), Visual Basic, or 3dMaxScript. In contrast, due to the difficulty of programming, the applications Generative Components and Grasshopper bypass code with pictographic forms of automation. We might therefore describe them as forms of graphic scripting. Algorithmic design exploits the capacity of the computer to operate as a search engine, and perform tasks that would otherwise consume inordinate time. It therefore lends itself to optimization and other tasks beyond the limitations of standard design constraints [2].

Parametric versus Algorithmic

There is now a widespread practice of conflation the two terms, 'parametric' and 'algorithmic'. This is partly due to the fact that the two techniques can end up producing similar forms. Algorithmic work generated using Processing or Rhino script, for example, often has curvilinear forms that are seemingly similar to work produced using parametric tools. But it is also partly due to the fact that as yet there is little real understanding of what the terms actually mean – at least on the part of those less familiar with the world of computation. To some extent the term, 'parametric', has become a short hand way of bracketing much digital design that seems to be curvilinear in its aesthetic expression, thereby providing a convenient expression for a new style in architecture.

Although there will always be a need for synonyms or accessible terms to describe broad approaches, this development is a little disturbing, and will lead no doubt to further confusion. Often within architectural culture terms have been adopted that have little relevance to their use in culture at large. Indeed we can look through the history of architecture, and find several terms, such as 'Postmodernism' or 'Deconstructivism/ Deconstruction', adopted within an architectural context to refer to architectural styles in a way that has made them reduced parodies of their original cultural meanings [3]. Parametrics or parametric design now seems to be suffering a similar fate: although it is actually a new digital technique that fosters a new process or methodology of design, it has now been adopted to refer to a new aesthetic expression or style of architecture.

As computation becomes increasingly prevalent within architectural culture, some effort must therefore be made to clarify the terms, before the confusion becomes so widespread that the use of the term parametric to describe a style is sanctioned through sheer popularity. So let us state here quite clearly: algorithmic techniques are based on the use of code. Parametric techniques are based on the manipulation of form. They are therefore quite distinct techniques.

At the same time algorithmic techniques are often used in association with parametric techniques. We

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并不清楚究竟有多少建筑师是在一个真实的算法框架内，而不是简单地在一个可视化框架内运作。

此外，参数操作和算法操作的确都有一些相似之处，比如说双方包含的数值，均会随着用户的输入而改变。正如改变代码的算法将会产生不同的结果一样，调整形式的参数也可以产生不同的结果。这两个操作似乎都是基于对参数的调整。而事实上，像 Grasshopper 等图形脚本技术的引入，只会模糊参数设计和算法设计的区别。此外，所有参数设计都依靠一定的代码。换句话说，我们必须辩证地看到：代码与形式互相依赖。不可能有没有代码的形式，也没有不指向形式的代码。因此，在一定程度上，算法设计和参数设计只不过是同一个硬币的两面。

不过，我们能够而且必须对设计的算法化和参数化作出明确的区分。重要的是，这两种操作与参数之间联系的期限与恒久性，可以用来区分它们。此外，参数化设计在很大程度上取决于对一个可能生成视觉趣味的形体进行形式上的操作，但它往往是肤浅的。而融合形体的建模操作，例如可用于理顺形体并将其以一个诱人的视觉方式呈现，特别是在城市尺度，但并不能将任何与性能相关的有用信息嵌入到 BIM 模型中。

此外，应该区分图形脚本技术（如 Grasshopper）和非图形形式脚本。图形脚本的范围相对有限。很少发现 Grasshopper 的代码树能强大到与通常的基于文本的脚本抗衡。事实上，图形代码没有文本编辑器，并在精确度、实施性、合理化和可扩展性方面存在严重限制；而基于代码的脚本则享有更高的控制力。尽管图形脚本技术和非图形形式脚本有明显的相似之处，但两者之间，无论是在算法操作和参数操作，还是在视觉脚本和纯粹基于代码的算法操作之间，都存在着天壤之别。

参数主义

诸多新技术的普及催生了一个新名词：Parametricism。帕特里克·舒马赫，扎哈·哈迪德的合伙人之一，也是伦敦 AA 设计研究实验室 DRL 的创始人，认为该术语应被吸纳为一种新的建筑“风格”。他大胆而高调地强调了参数设计在当今盛行的趋势，并坚信新进开发参数化建模技术的普及，将为该趋势提供更加基本的支持。

在《参数主义：一种全球建筑与都市设计的新风格》一文中，舒马赫开篇提到参数化将是全球建筑的新风格：“最近在全球先锋建筑中，出现了一股称之为参数主义的合流。它是根植于数字动画技术的一种风格，最近借助于先进的参数化设计系统和脚本方法而日趋完善 [4]。”

对于舒马赫而言，更重要的是，参数主义已经成功取代现代主义成为新的全球风格：“历时 15 年的发展，到现在，在先锋建筑实践领域称雄，参数主义作为下一股系统性革新的浪潮，已经战胜了现代主义。参数主义终结了现代主义危机导致的不确定的转型期，及其后一系列相对短暂的建筑思潮插曲，包括后现代主义、解构主义和极少主义。参数化技术在不同尺度的广泛应用已被证实。无论是建筑，还是室内设计与大型城市设计。事实上，项目越大，参数主义阐明方案复杂性的优越性就越明显 [5]。”

might point, for example, to the use of certain algorithmic techniques to generate the initial form that is subsequently manipulated using parametric techniques. Conversely, algorithmic techniques can be used for optimization and other operations at the other end of the design process, once the initial generated form has been modeled through parametric techniques.

There is, however, a deeper concern that destabilizes this neat distinction between the parametric and the algorithmic, and this is the role of visualization in the process of design. Many architects do not learn to write code from scratch, but learn by 'hacking into' the logic of the code displayed in boxes on the screen, as they model forms using platforms such as Maya or Rhino. In other words, the code is used merely to provide the 'key' to the manipulation of form, and can be understood primarily through the medium of the visual. This emphasis on the visual is heightened further with the introduction of recent applications - such as Grasshopper - that bypass code by using pictographic forms of automation. In the end it is not so clear how many architects are working within a truly algorithmic framework, as opposed to simply operating within a visual framework.

Further, it could be argued that parametric and algorithmic operations share certain similarities, in that both are containers in which values can change based on user input. Just as one can adjust the code algorithmically to generate different outcomes, so one can adjust the form parametrically to generate different outcomes. Both operations appear to be based on the adjustment of parameters. Indeed the introduction of graphic scripting techniques, such as Grasshopper, serves only to blur the distinction between parametric and algorithmic design. Moreover all parametric design relies necessarily on code. In other words we find ourselves in a dialectical situation where code and form rely upon one another. There can be no form without code, and often no code without form. To some extent, then, algorithmic design and parametric design are merely two sides of the same coin.

Yet there are clear distinctions that can and must be made between the algorithmic and parametric design. Importantly, it is the duration and permanency of their connections to parameters that distinguish them as operations. Further, parametric design depends greatly on a manipulation of form that might appear visually interesting, but is often superficial. The blend-shape modeling operation, for example, can be used to smooth out form in a seductive visual way – especially at an urban level - but cannot take account of any useful performance related information embedded in a Building Information Modeling (BIM) model.

Moreover, a distinction should made between graphic scripting techniques, such as Grasshopper, and non-pictorial forms of scripting. Graphic scripting is relatively limited in its scope. Seldom are there any code trees to be found in Grasshopper robust enough to compete with the average text based scripting. Indeed graphic codes have no text editor, and have severe limitations in terms of accuracy, constructability, rationalization and scalability. Code based scripting enjoys far greater levels of control. Despite their apparent similarities, then, there are important distinctions to be made not only between algorithmic and parametric operations, but also between visual scripting and purely code-based algorithmic operations.

Parametricism

The popularity of these new techniques has spawned a new term, 'Parametricism'. Patrik Schumacher, a partner in Zaha Hadid Architects and a founding director of the Design Research Laboratory at the Architectural Association in London, has argued that the term should be adopted for a new 'style' of architecture. In his bold claim he highlights the prevalence of parametric design today, a prevalence that is

有趣的是，尽管舒马赫仔细地区分脚本技术与参数技术，他仍将两者捆绑在一起，作为他称之为“参数主义”这一更大提议的一部分。换句话说，尽管他没有犯将两者混为一谈的错误，但是他发明了一个新术语，“参数主义”，并定义它包含了上述两种技术。可见，舒马赫认为参数主义并不限于参数化。

舒马赫定义参数化的方式可能更值得商榷。舒马赫提到参数化貌似已经成为主要的操作模式。然而，如果我们勾一张图，就很可能发现，在当今的学术界的众多设计模式中，真正使用参数化软件（如 DP）的，相当小众。绝大多数可能使用直观的建模技术如 Maya 或 3D Rhino，以及相对少数人会使用某种形式的智能图形或代码，但只有很小一部分，或许 1%，会使用实际的参数化软件。当然舒马赫在扎哈·哈迪德事务所的办公室，DP 的确被广泛使用，但 DP 很少作为一个设计工具使用。事实上，DP 的主要作用是控制施工阶段的物流。

显而易见，舒马赫论断最弱的部分是他试图将整个前参数化时期的 NURBS 和分维几何规则集纳入他所谓的参数化主义的语汇。这样，不管曲线形式是否是通过参数生成，他都能有效地将所有曲线形式归于参数主义的范围内。此外，尽管舒马赫援引了弗雷·奥托的找形实验，甚至声称奥托可能被视为参数主义唯一的真正先驱，舒马赫在自己的作品中并没有证实任何实际的找形技术 [6]。由此可见，舒马赫主要争论的，与其说是为了设计方法，不如说是为了风格，与其说是为了找形，不如说是为了形式。

我们来看舒马赫最有争议的论断：参数主义是一种新的建筑和都市设计“风格”。尽管这种“风格”是“根植”于特定技术，包括参数技术和某些脚本技术，但它并不等同于这些技术。舒马赫注意到“摆在我们面前的，是一种新的风格，而不仅仅是一组新的技术”。[7] 他认为，这些技术本身激发了“一种具有新渴望和新价值观的集体新动向”。这反过来又导致了“全球的设计研究者竞相争锋，共同研究许多新的但本质相关的设计问题”。因此舒马赫总结道：“正是这种普遍共享、长久一致的设计渴望（问题），僭越和超越了美学意义上的可识别性，名正言顺地宣告了一种具有划时代意义的新风格。”[8]

舒马赫正确地使用了“风格”一词，即使“风格”已成为一个有点争议的术语。舒马赫无疑会认为，在该情境下采用“风格”一词与它在后现代语境的使用截然不同。后现代将风格视为再现或者表象；而“风格”在此则被理解为“效果”。理解风格应置于更深层次的历史框架之中。我们可追溯到戈特弗里德·散普尔甚至更前。当时，外在表象被理解为某种基本过程产生的“效果”。其次，尽管当代流行关注过程，我们仍不能轻易地脱离再现。这不仅仅是因为在德勒兹的框架内“过程”和“代表”应该被理解为锁定在互为前提的机制中：过程滋养并将再现去领域化，反之亦然。相反，我们应将再现理解为材料考量的直接“效果”，而材料考量又统领了整个设计过程 [9]。我们永远无法逃避风格。

毫无疑问，舒马赫正确地暗示了技术本身总是植根于“新渴望和新价

underpinned, he maintains, by the popularity of recently developed parametric modeling techniques.

Schumacher begins his article, 'Parametricism: A New Global Style for Architecture and Urban Design', by claiming that parametricism is the new global style for architecture: 'There is a global convergence in recent avant-garde architecture that justifies its designation as a new style: parametricism. It is a style rooted in digital animation techniques, its latest refinements based on advanced parametric design systems and scripting methods [4].

For Schumacher, moreover, it is a style that has succeeded Modernism as the new global style: 'Developed over the past 15 years and now claiming hegemony within avant-garde architecture practice, it succeeds Modernism as the next long wave of systematic innovation. Parametricism finally brings to an end the transitional phase of uncertainty engendered by the crisis of Modernism and marked by a series of relatively short-lived architectural episodes that included Postmodernism, Deconstructivism and Minimalism. So pervasive is the application of its techniques that parametricism is now evidenced at all scales from architecture to interior design to large urban design. Indeed, the larger the project, the more pronounced is parametricism's superior capacity to articulate programmatic complexity [5].

Interestingly, although Schumacher is careful to distinguish parametric techniques from scripting techniques, he nonetheless brackets them together as part of a bigger movement that he calls 'Parametricism'. In other words, although he does not make the mistake of conflating the two, he invents a new term, 'Parametricism', that is defined in such a way that it embraces both techniques. According to Schumacher, then, Parametricism is not limited to the parametric.

What is perhaps more problematic, however, is the way in which Schumacher defines the parametric itself. Schumacher speaks about it as though it has become some dominant mode of operation. Were we to chart, however, the various modes of designing in the contemporary academic environment, we would probably find the use of genuine parametric softwares, such as Digital Project, to be fairly marginal. The vast majority might be using explicit modeling techniques, such as Maya or 3D Rhino, and a relative minority would be using graphic/coded automation of some form, but only a very small fraction – maybe 1% - would be using actual parametric software. Certainly within Schumacher's own office – Zaha Hadid Architects – Digital Project is used extensively, but seldom as a design tool. Indeed its role is largely to control the logistics of construction.

What becomes clear – and this is surely the weakest part of the argument – is that Schumacher seems to want to appropriate the whole pre-parametric legacy of NURBS and SUB-D geometry rule-sets within his vocabulary of 'Parametricism'. By doing this, within the scope of 'Parametricism' he effectively lays claim to all curvilinear forms, whether or not they are generated parametrically. Furthermore, although Schumacher cites Frei Otto's form-finding experiments, and even claims that Otto 'might be considered as the sole true precursor of Parametricism', he shows little evidence of actual form-finding techniques in his own work [6]. It begins to emerge that Schumacher is arguing largely not only for style rather than design methodology, but also for form rather than form-finding.

This brings us to perhaps the most controversial claim made by Schumacher – that Parametricism is a new 'style' for architecture and urban design. Although this 'style' is 'rooted in' certain techniques including parametric techniques and scripting, it cannot be reduced to those techniques. 'What confronts us,' notes Schumacher, 'is a new style rather than merely a new set of techniques.' [7] He argues that the techniques themselves have inspired 'a new collective movement with radically new ambitions and values'. This in

值观”这一文化脉络之中。技术可以促进，甚至“引发”某些操作。简单来说，因为技术让实施操作更容易。正如过去，通过在绘图板上架设移动平行尺规，从而鼓励了在设计过程中应用平行直线；今天大量采用计算机参数化软件，也将鼓励曲线形式的使用。但是，并不是技术本身决定选择这些形式。技术本身是中性的。相反，正如舒马赫观察到的，文化本身孕育着设计美学要求，而技术只是促进了设计与美学的衔接。当然，另一方面，纯粹的审美需求也可以鼓励软件工具的开发——正如定制化 CATIA 诞生了 DP。但是，技术本身并不负责生成设计美学。

最后，舒马赫也清楚而正确地发现世界各地建筑实践中存在的共同倾向。很显然，使用类似的工具和技术极有可能促成一个日益同质化的设计文化。一般来说，该倾向将随着文化全球化，以及建筑实践和教育日益国际化而日趋严重。明星建筑师，如扎哈 · 哈迪德或雷姆 · 库哈斯的设计遍布世界；建筑教授，格雷格 · 林或罗兰 · 斯努克斯，同一时期在不同大洲的多所建筑院校教学。同样，通过互联网和全球出版物（如本书），建筑理念得到越来越有效的传播。因此很容易理解，一个新的设计美学缘何会在全球范围内蔓延。

舒马赫使用“参数主义”一词来形容这个新的设计美学是值得质疑的。他阐述的作品大部分不是由参数化工具生成，因此是非参数化的，更别说这些作品源于前计算时代。此外，舒马赫自相矛盾：一方面，他清晰地认为他所阐述的“是一种新的风格，而不仅仅是一组新的技术”；另一方面，他又采用“参数主义”一词，该术语显然是从特定技术的词源派生而来的。无疑，我们身处乱象之中：一个相对边缘的计算技术竟被用来代指一种全新的建筑风格。

一种新的全局风格?

现代主义议题往往倾向于世界的普适性。相比之下，后现代话语则常常呈现世界的多元性。现代主义的“宏大叙事”让位于后现代的微观叙述，我们可以察觉到从普适性趋向多元性，由同质性走向差异性的转移 [10]。我们现在生活在一个充满差异的世界，一个质疑任何普适真理或任何形式的共性的世界。因此，认为某种新的普适风格现已经篡夺现代主义这一想法，无疑会自相矛盾地给人留下现代主义者的印象。

然而，我真正担心的是舒马赫的立场，不是现代主义而是后现代主义，因为后现代文化的细分差异本来就非常受人争议。正如弗雷德里克 · 詹姆逊所称：建筑界呼唤地域主义，迫切希望通过祭奠“差异性”来反对晚期资本主义同质化，这些举动自身反而成为了晚期资本主义逻辑的一环 [11]。差异性，正如詹姆逊所言，成为市场的另一种商品。差异性，与其说是抑制晚期资本主义同质化倾向的拮抗剂，不如看作是保养晚期资本主义的滋补品。

推而广之，其他企图抵制全球性的议题——如反全球化的全球，实际上也陷入了全球化的逻辑之中，就如同试图抵抗名牌文化一样，如无印良品——日本的无品牌店，也最终陷入了名牌的逻辑。当然，这种微妙的辩证观点在其他情况也适用。如果事情变得更普遍，我们就越能看到它们之间的

turn has led to 'many new, systematically connected design problems that are worked on competitively by a global network of design researchers'. This leads Schumacher to conclude, 'Over and above aesthetic recognisability, it is this pervasive, long-term consistency of shared design ambitions/problems that justifies the enunciation of a new style in the sense of an epochal phenomenon.' [8]

Schumacher is correct to use the term 'style', even though it has become a somewhat controversial term. Schumacher would no doubt argue that 'style' is being used here in a very different sense to the typical Postmodern treatment of it as mere representation or appearance. Style here comes to mean 'effect' and should be understood within a deeper historical framework that stretches back to Gottfried Semper and beyond, where outward appearance is understood as the 'effect' of certain underlying processes. Whatever the techniques used in generating any form, we certainly need to address the question of the resultant appearance or representation. Moreover, despite the fashionable contemporary interest in process, we simply cannot escape representation. It is not simply that within a Deleuzian framework 'process' and 'representation' should be understood as locked within a mechanism of reciprocal presupposition, in that process feeds into – and deterritorializes – representation, no less than representation feeds into – and deterritorializes - process. Rather we should understand representation as a direct 'effect' of material concerns that govern the design process [9]. We can never escape style.

Schumacher is also correct no doubt in implying that techniques themselves are always grounded in a cultural context – with new 'ambitions and values'. Techniques can facilitate or even 'invite' certain operations, simply because they make it easier to perform them. Just as in the past the adoption of the parallel motion on drawing boards encouraged the use of parallel straight lines in the design process, so too today the adoption of parametric software in the computers encourages the use of curvilinear forms. However, there is nothing in techniques themselves that ensures the selection of such forms. Techniques themselves are neutral. Rather, as Schumacher observes, it is culture itself that engenders a certain design aesthetic, and the techniques can merely facilitate the articulation of that aesthetic. Of course, the system can also work in reverse, in that the sheer demand for a certain aesthetic can encourage the development of certain software tools – as happened with the customization of CATIA to produce Digital Project. But techniques themselves are not responsible for generating a design aesthetic.

Finally, Schumacher is also clearly correct in detecting certain common tendencies within design practices around the world. It is clear that the use of similar tools and techniques is likely to promote an increasingly homogenized design culture, a tendency that will be exacerbated by the globalization of culture in general, along with the growing internationalization of architectural practice and education. Just as architectural practitioners, such as Zaha Hadid or Rem Koolhaas, are designing buildings all over the world, so too architectural professors, such as Greg Lynn or Roland Snooks, are teaching in multiple schools of architecture in different continents at the same time. Likewise through the internet and global publications – such as this catalog - architectural ideas are being disseminated more and more effectively. It is easy to understand therefore how a new design aesthetic might be spreading across the globe.

Where Schumacher needs to be challenged, however, is in his use of the term, 'Parametricism' to describe this new design aesthetic. Not only is the work described largely not parametric in that it has not been generated using parametric tools, but also it has its origins in a pre-computational world. Furthermore, it seems somewhat perverse, given that Schumacher expresses clearly that what he is describing 'is a new

差异。例如，常见的摩天大楼在世界各地受到的待遇也各不相同。在东欧，它往往被讥讽为苏联组团的代表，在中国却被尊为新中国的象征。有时候会发现，全球化和本土化并不是截然不同的类别，而是锁定在同一互为前提的逻辑中。全球化促进本土化，正如同本地化增进全球化一般。那么，将全球化和本土化合二为一，出现“全球本土化”这一语汇也就不足为奇了。事实上，全球本土化这一术语在近年来日渐显盛。

我们可能会因此认为，舒马赫试图终结“一系列相对短暂的建筑思潮插曲，包括后现代主义、解构主义和极少主义”，从而呼唤新风格。但舒马赫的呼唤本身，就是一种将被卷入他所试图抵抗的漩涡之中的冒险[12]。换言之，正如解构主义和极少主义，远非抵制后现代主义，而被视为是后现代主义的产品，因此参数主义也可视为后现代主义逻辑的同谋。难道“参数主义”的新风格不是后现代主义逻辑的最新化身？

如此激进的结论，未必像它表面看上去那么牵强。如果宽泛地定义后现代主义为迷恋场景性和表象，可能舒马赫关注的并不是抵制后现代主义，而是为其提供新的审美语汇，正如我们在他的作品中读到的高度诱人的一系列术语，从“连续变化”、“无缝流动性”到“深度关联”。然而，曼努埃尔·迪兰塔在唯物主义哲学家（如德勒兹）的基础上，发展了一系列新唯物主义的观点。如果我们转向他的新近思考，我们也许会发现一个新的范式正在呼之欲出，跃出地平线[13]。该范式不那么关注形式和美学，而侧重于材料行为和设计智能。在这个范式中，性能——包括结构和环境性能——变得日益重要，结构工程师，如塞西尔·巴尔蒙德和哈尼夫·卡拉，正成为新的“唯物哲学家”。面对新进展，舒马赫还在强调新的视觉语言，未免有些过时。

当然，计算所许诺的，不仅是一种新风格，而是一种全新的设计方式：我们能够将新计算技术嵌入到进化和涌现系统之中，而且我们实时培植和检测系统，从而图解成为现实，而现实就是图解。形式因被视作与新地平线基本无关。相反，我们更应该关注更加智能而逻辑的设计过程。逻辑将成为新的形式。[14]

尼尔·林奇

style rather than merely a new set of techniques', that he adopts a term, 'Parametricism', that is clearly derived etymologically from a particular technique. We therefore find ourselves in a somewhat confusing situation where a relatively marginal computational technique has been co-opted to refer to a whole new style of architecture.

A New Global Style?

Modernist discourse tends to see the world in terms of universals. By contrast postmodern discourse tends to present the world in terms of multiplicities. As the 'grand narratives' of modernity give way to the minor narratives of Postmodernity, we can detect a shift from universals to multiplicities, from homogenization to differentiation [10]. We now live in a world of differences, where the belief in universal truths or universals of any kind has been called into question. As such, the notion that a new universal style has now usurped Modernism comes across as paradoxically Modernist.

Yet my real concern is that Schumacher's position is not Modernist, but Postmodernist, as the very differentiation of Postmodern culture is also highly problematic. As Fredric Jameson has argued – in the context of the call for Regionalism within architecture – the urge to counter the homogenization of late capitalism by celebrating 'difference' is itself complicit within the logic of late capitalism itself [11]. Difference, as Jameson notes, becomes another commodity within the marketplace. Rather then overcoming the homogenizing tendencies of late capitalism, it can therefore be seen to be feeding them.

By extension, it could be argued that other attempts to resist the global – such as anti-globalization – fall within the logic of globalization, just as attempts to resist brand-name culture, such as the Japanese no-brand-name store, Muji, fall ultimately within the brand-name logic. Of course, such a subtly dialectical argument can work the other way. The more universal things become, the more we notice the differences between them. The universal tower block, for example, is treated very differently across the globe. While in Eastern Europe it is often derided as an emblem of Soviet Bloc totalitarianism, in China is celebrated as the emblem of the new China. The global and the local, it would appear, are not distinct categories, but are locked into a logic of reciprocal presupposition. The global promotes the local, just as the local promotes the global. It is not surprising, then, that the hybrid term 'glocalization' – a mix of the global and the local - has gained prominence in recent years.

We might therefore argue that Schumacher's call for a new style to bring to an end the 'series of relatively short-lived architectural episodes that included Postmodernism, Deconstructivism and Minimalism' is itself at risk of being co-opted by that which it seeks to resist [12]. In other words, just as Deconstructivism and Minimalism – far from resisting Postmodernism - can be seen to be the products of Postmodernism, so too Parametricism could be seen to be complicit within the logic of Postmodernism. Is the new style of 'Parametricism' not the latest incarnation of the logic of Postmodernism?

Such a radical conclusion may not be so far fetched as it might seem. If loosely we are to define Postmodernism as an obsession with the scenographic and appearances, we might see in Schumacher's repertoire of highly seductive formal terms – 'continuous variation', 'seemless fluidity', 'deep relationality' – a concern not to overcome Postmodernism but simply to supply it with a new aesthetic language. If, however, we are to subscribe to the recent thinking of philosophers such as Manuel DeLanda, who has developed a discourse of New Materialism out of the materialist philosophies of thinkers such as Gilles Deleuze, we might see that there is a new paradigm on the horizon [13]. This is a paradigm that focuses less on

formal concerns and aesthetics, and more on material behavior and design intelligence. It is a paradigm in which performance – including both structural and environmental performance - is becoming increasingly important, and one in which structural engineers, such as Cecil Balmond and Hanif Kara, have become the new 'material philosophers'. In the context of these new developments, Schumacher's emphasis on a new visual language seems a little dated.

Surely what the world of computation promises is not merely a new style, but a radically new way of approaching design, where we embed new computational techniques into evolutionary and emergent systems, and where we breed systems and test them out in real time, so that the diagram becomes the reality and reality is the diagram. Form should be seen as largely irrelevant within this new horizon. Instead we should be focusing on more intelligent and logical design processes. Logic should be the new form [14].

Neil Leach

注释

[1] I am deeply indebted to Nick Pisca for his advice on this article. Certain sections were co-written with him, and Nick has provided some invaluable feedback on the ideas expressed here.

[2] The term 'optimization' should be used with a degree of caution. It is often impossible to know what the optimum might be, and much depends on the parameters being used to judge that optimum. As those parameters vary, so the definition of the optimum will also vary. Instead of thinking in terms of optimized solutions we should perhaps refer to 'improvements'. A more appropriate term might therefore be 'ameliorization' (from the Latin, 'melior', meaning 'better'), rather than 'optimization' (from the Latin term, 'optimum', meaning 'best'). Here, at any rate, the term 'optimization' is used to refer not to the act of finding the optimum solution, but rather to the process of searching for it.

[3] In the case of Postmodernism, a word used to describe the aesthetic reflex of Postmodernity, an era generally categorized by cultural theorists as a moment in which everything is co-opted into images and commodities, the term was promoted by writers such as Charles Jencks, and used to describe a new style of architecture. In the case of Deconstruction - a mode of philosophical enquiry that was premised on the notion of challenging the value-laden hierarchies within Western metaphysics – the term was adopted by the publishing industry, and somehow became charged - for a short time at any rate - with describing a new formal language in architecture.

[4] Patrik Schumacher, 'Parametricism: A New Global Style for Architecture and Urban Design' in Neil Leach (ed.), Digital Cities, Architectural Design, Vol. 79, No. 4, July/August 2009, pp. 14-23.

[5] Ibid.

[6] Schumacher, p. 23.

[7] Schumacher, p. 15.

[8] Ibid.

[9] We might argue, for example, that the generic appearance of a bicycle is not a consequence of some arbitrary aesthetic decision making process, but of the material configuration of the bicycle itself, as a machine designed to offer an efficient form of leg-powered transportation. In other words, although some form of stylization is inevitable in the design process, the form has evolved into a more or less stable state primarily through a consideration of mechanical efficiency.

[10] On this see Jean-François Lyotard, The Postmodern Condition: A Report on Knowledge, Minneapolis: University of Minnesota Press, 1984.

[11] Fredric Jameson, 'The Constraints of Postmodernism' (extract) in Neil Leach ed., Rethinking Architecture, London: Routledge, 1997.

[12] Schumacher, p. 15.

[13] For a discussion of New Materialism, see Neil Leach, 'New Materialism' in Neil Leach, Xu Wei-Guo (eds.), (Im)material Processes: New Digital Techniques for Architecture, Volume 2: Students, Beijing: China Architecture and Building Press, 2008.

[14] I am indebted once more to Nick Pisca for this slogan.

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