国外高等院校土建学科基础教材（中英文对照）

设计方法

DESIGN METHODS

[奥] 卡里·约尔马卡 编著
王昳雯 译

中国建筑工业出版社

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BASICS

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序

设计是一个非均质的过程——途径、策略以及方法论通常是受到设计师自身经验和社会文化背景以及技术、经济条件所影响的。一方面，设计依靠个人的创造力；同时另一方面，设计也植根于方法论原则，反映出基本看法和过程的多样性。

基于本套丛书中《设计概念》（中国建筑工业出版社 2010 年 1 月出版，征订号：18821）的成果——主要涉及设计过程的灵感以及原始刺激——本书提出的设计方法是由规则支配，而非基于直觉。作者的目的是为读者提供一系列方法，从而激励读者对熟悉的观念以及建筑师作更详细的审视。本书从多方面进行阐释，包括几何学与自然环境，音乐与数学，无意识与理性主义起源以及衍生过程。通过使用著名的建筑作为范例来阐释这些方法，分析这些建筑的平面与剖面以展示建筑师是如何创造出独到的解决方案的。由于本书中阐述的概念大部分基于建筑史案例，由此产生的与丛书其他分册的分歧在于本系列不存在典型的风格元素来作为支撑全文的主线结构。

适应建筑学研究的结构，本书主要针对高年级建筑系学生以及愿意学习更多设计方法的毕业生们。本书的目的不在于宣扬任何一种设计方法，而是致力于提供一系列用于实践的设计工具，以用于因地制宜地解决具体问题。

编者

Bert Bielefeld

FOREWORD

Design is a heterogeneous process – approaches, strategies and methodologies are often influenced by the designer's own experiences and socio-cultural background, as well as by technical and economic conditions. On the one hand, design draws on individual creative power, while on the other, it is grounded in methodological principles that reflect a variety of basic attitudes and processes.

Building on the results of *Basics Design Idea* – which deals primarily with the inspiration and initial stimulus for the design process – this book presents design methods that are governed by rules and not based primarily on intuition. The authors' objective is to provide readers with a range of methods and to motivate them to examine familiar concepts and architects in greater detail. The book describes approaches from geometry and the natural environment, from music and mathematics, from unconscious and rationalist sources, and from generative processes. Well-known buildings are used as examples to explain these methods: the plans and sections of these buildings are analyzed to show how the architects have derived specific solutions. Since the didactic concept of this book is largely based on examples from architectural history – thereby diverging from the concept of other *Basics* books – it does without typical stylistic elements of the series in favor of weaving a common thread throughout the essay.

Adapted to the structure of architectural studies, *Basics Design Methods* primarily targets advanced architectural students and graduates who wish to learn more about design methods. The book does not aim to disseminate any one design method, but to provide a series of practical design tools that can be used to solve design assignments based on specific needs.

Bert Bielefeld
Editor

INTRODUCTION

Most poets pretend that they compose by ecstatic intuition, and would positively shudder at letting the public take a peep behind the scenes – or so Edgar Allan Poe claims in his 1846 essay on "The Philosophy of Composition." Instead of mystifying the creative act, Poe candidly reveals how he composed his most famous poem, "The Raven." By his detailed exposition he wants to demonstrate that nothing in the darkly Romantic poem is referable to accident or intuition and that the work proceeded, step by step to its completion, with the precision and strict consequence of a mathematical proof.

Poe's method of composition has been the inspiration for many later writers, composers, artists – and architects, as well. But why should anyone follow a specific method to come up with an architectural design? Some architects claim we need such a method because the problems today are too complex to solve by unaided intuition or traditional wisdom. Others expect that a proper method will enable them to make objectively correct decisions. There are also those who recommend rigorous methods in order to prevent architecture from degenerating into a self-indulgent celebration of the architect's own personality – that is, a private language – or a thoughtless reproduction of familiar models. Some avant-garde methods play with the idea that the role of the architect is reduced by letting certain decisions be made according to chance, while others involve future users in the actual design process.

This book examines various methods of designing architecture, with the help of examples, to determine the strengths and weaknesses of each. Many of them were developed in recent decades, while others have been part of the architect's toolbox for centuries. Although many theorists have stated that they were presenting a universal method that was applicable to all buildings throughout the world, there is good reason to argue that no one particular method can be declared the only correct one for every task. It is thus important to choose a method that is most suitable to the challenge of a particular assignment. Familiarity with several methods offers the designer the most flexibility. But a method is not a machine to solve architectural problems automatically: it focuses, but does not curtail, the real work of solving design challenges.

BIOMORPHIC ARCHITECTURE

Originally the question of a design method concerned the generation of form. Central to the modernist program was the claim that the forms of historical architecture no longer corresponded to the spirit of the age: the old styles had degenerated into an immoral, anachronistic masquerade that hampered the creativity of architects, sent reactionary and dishonest messages, and failed to meet the challenges of the new social and technological conditions.

The architects who were determined to be modern, as architect and theorist Claude Bragdon observed in 1915, identified three main sources of a new architectural language: original genius, nature, and geometry. The reliance on genius may be illustrated by Antoni Gaudí's Casa Milà (1907) in Barcelona and August Endell's Atelier Elvira (1897) in Munich. › **Figs 1 and 2**

However, many architects felt that such experiments were too subjective and whimsical to replace the authority of the past. They wanted to ground architecture on a basis more universal than the caprice of an individual designer, more timeless than changing fashions, and more general than local customs. The study of nature provided models that would be understandable and valid in different societies, irrespective of historical and political contingencies, while geometry promised access to what may be even more invariable: namely, the principles of order and the laws of thought. Hence, in their attempt to avoid imitating historical precedents,

Fig.1:
Antoni Gaudí, roofscape of Casa Milà, Barcelona

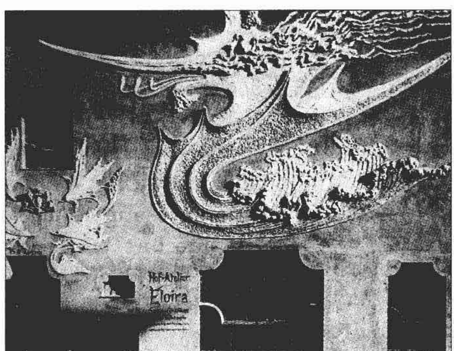


Fig.2:
August Endell, facade of Atelier Elvira, Munich

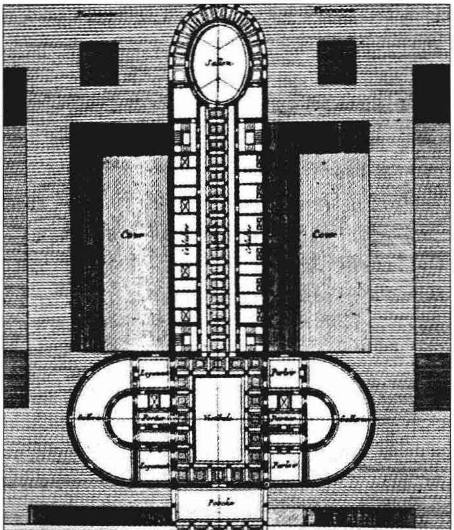


Fig.3:
Claude-Nicolas Ledoux, project for a brothel

early modern architects often turned to models taken from nature or to the sciences in general to find new shapes for buildings.

Many historical ornaments were derived from the shapes of plants or animals: the classical Corinthian capital features acanthus leaves, and the classical bucranium ornament is in the form of an ox skull. At the end of 18th century, certain architects who argued for *l'architecture parlante*, a "speaking architecture" that referred more or less directly to the objects for which the building was intended, took this idea to extremes: Jean-Jacques Lequeu designed a dairy building in the form of a cow and Claude-Nicolas Ledoux gave the floor plan for a brothel a phallic shape. › **Fig. 3**

The use of such iconic signs was intended to form a natural language of architecture that would make the function of the buildings understandable across centuries and latitudes, but the more radical designs of "speaking architecture" were never built.

Nonetheless, organicism returned at the end of the 19th century. For example, in 1905 H.P. Berlage designed a chandelier in the form of a jellyfish (as illustrated in Ernst Haeckel's *Kunstformen der Natur*). And at about the same time, Hector Guimard imitated the shapes of flowers

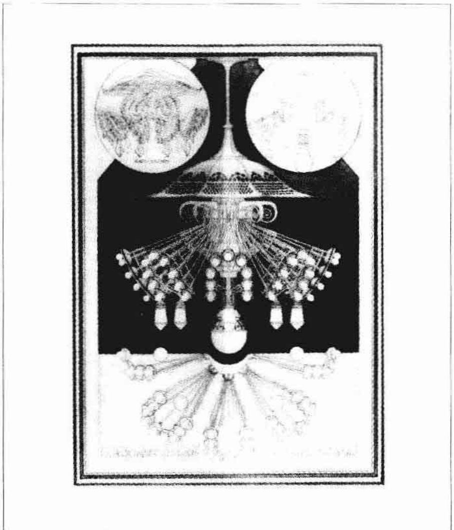


Fig.4:
Hendrik Petrus Berlage, lamp in the shape of a jellyfish

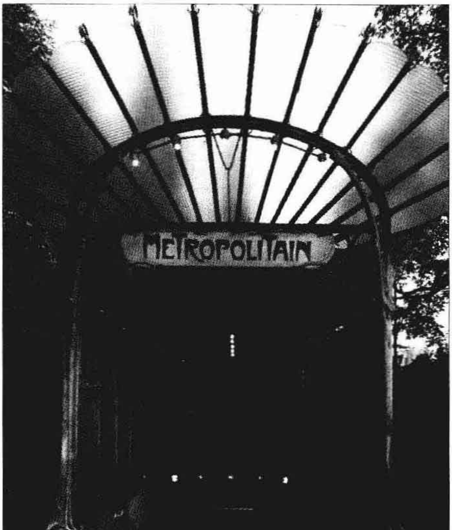


Fig.5:
Hector Guimard, metro entrance in Paris

and insects in his designs for entrances to the Paris metro stations. › **Figs 4 and 5**

The anthroposophist Rudolf Steiner seems to have mixed metaphors in the design of the boiler house (1915) for his Society's commune in Dornach, Switzerland, merging plant leaves with an overall phallic form. Another expressionist architect from that time, Hermann Finsterlin, evoked the shapes of jellyfish, mussels and amoebae in his highly idiosyncratic, unbuilt designs in the early 1920s. › **Figs 6 and 7**

Even later, architects occasionally returned to shapes directly suggesting plants or animals. A case in point is the TWA terminal (1956–62) at the JFK International Airport, New York, designed by Eero Saarinen: to signal its function as the entryway to the airplanes, it was shaped like a bird ready to take flight.

Such direct borrowings from the natural world have also been criticized. Instead of imitating the shapes as such, many architects have opted for the imitation of nature in more abstract terms. Already the oldest surviving treatise on architectural theory, the *Ten Books on Architecture* (c. 46–30 BC) by Roman architect Vitruvius, recommends applying human

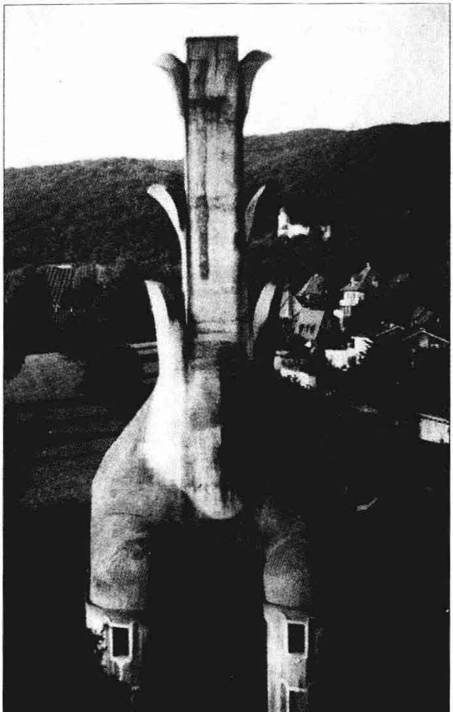
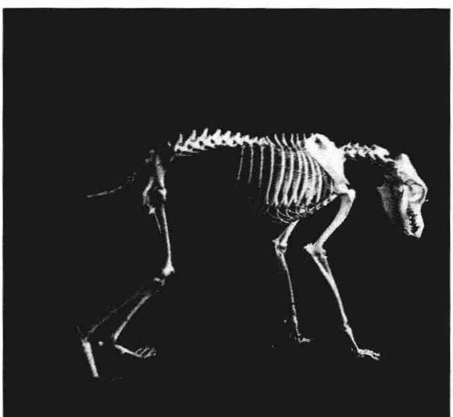


Fig.6:
Rudolf Steiner, boiler house in Dornach

Fig.7:
Eero Saarinen, TWA terminal in New York



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Dog skeleton

Fig.9:
Santiago Calatrava, structure inspired by a dog skeleton (project)

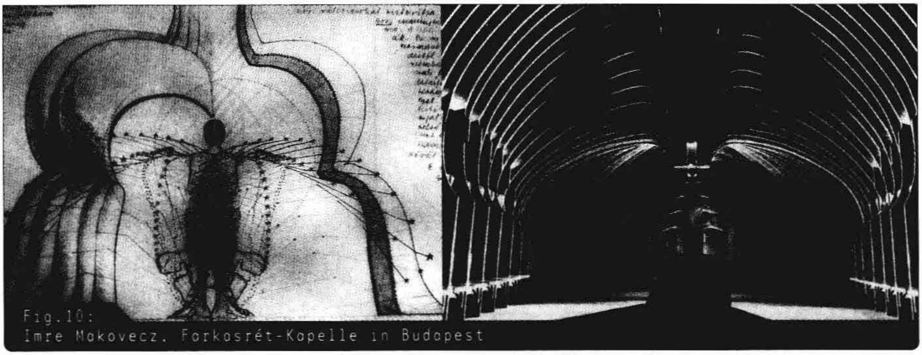

Fig.10:
Imre Makovecz, Farkasrét-Kapelle in Budapest

proportions in buildings without imitating any of the specific shapes of the human body. Later, architects often studied organisms in order to develop optimum structural shapes. For example, when Santiago Calatrava was commissioned to design an extension to the Cathedral Church of St. John the Divine in New York, he derived inspiration from the skeleton of dog. The final design is a synthesis of two fundamentally different considerations: on the one hand, the evocation of organic shapes; on the other, structural performance. › Fig. 8

The funeral chapel in Farkasrét, Hungary (1975), designed by Imre Makovecz, illustrates a different way of how the shapes of natural organisms can be adjusted to make architectural sense. The highly articulate roof structure was derived from a chronophotograph of Makovecz waving his arms. Here, the photographic technique retains the complex geometry of the body, while providing an image abstract enough to make a reasonable structure. › Figs 9 and 10

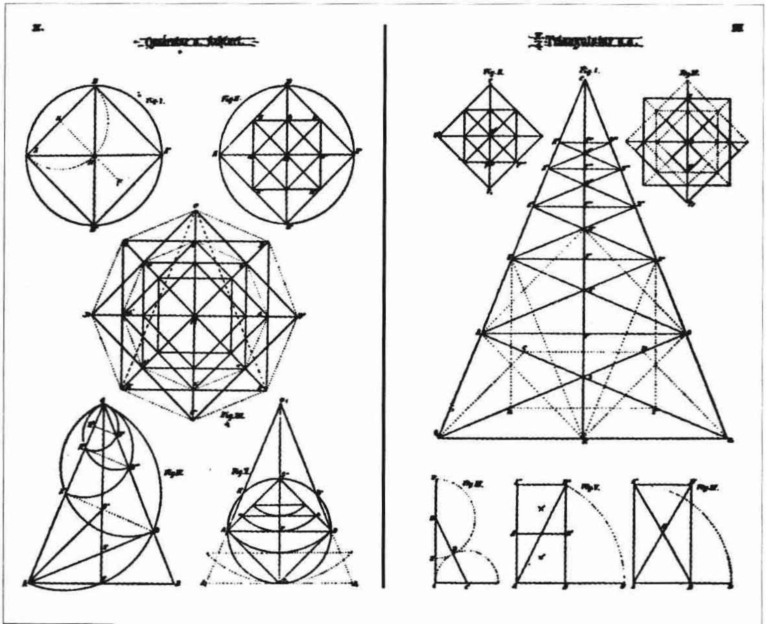

Fig.11:
Hendrik Petrus Berlage, quadrature and triangulation

QUADRATURE AND TRIANGULATION

Another attempt to escape the traps of architectural convention involved scientific models and mathematical procedures. For instance, in his mature work, instead of organic models, Berlage usually worked with proportional systems and geometrical grids to determine his forms with precision. In his writings he discusses two methods from Gothic architecture, known as "quadrature" and "triangulation". › **Figs 11 and 12**

In general, quadrature is a mathematical method of determining the area of a plane figure by dividing it into a collection of shapes, the overall area of which is known. In architecture, however, quadrature refers to a specific method of doubling or halving the area of a known square. For example, if we have a square, then a new one, half its size, can be easily drawn by connecting the middle points on each side with lines at an angle of 45°. Triangulation involves a similar method, usually based on an equilateral triangle.

One reason why the early modernists were fascinated by quadrature and triangulation is that these design methods were part of the mythical

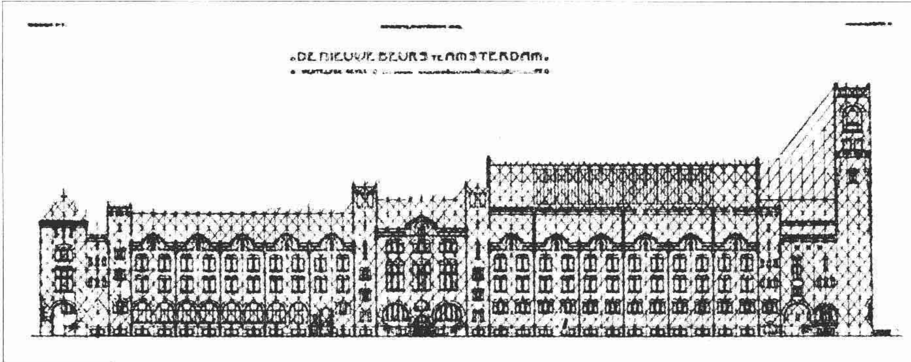

Fig.12:
Hendrik Petrus Berlage, Stock Exchange in Amsterdam

"secret of the masons" in the Middle Ages. Gothic architects used these techniques mainly for pragmatic reasons. Itinerant masons could not use scale drawings, as there was no generally agreed system of measurement-the length of the foot varied from country to country, even from town to town. Instead, they used geometry as a tool for deriving the measurements of the building from a scaleless sketch without a yardstick. Although quadrature and triangulation were largely matters of expediency, they produced highly complex architecture that was coherent and harmonious in its proportions.

Louis Sullivan, one of the pioneers of modern architecture, explained his own geometric methods in his 1924 book *A System of Architectural Ornament*. Starting with a simple square intersected by diagonal and orthogonal axes, he applied quadrature and other geometrical operations to ultimately arrive at delicate floral motifs, which gradually cover up the basic square. Moreover, Sullivan argued that he recognized in these organic forms a feminine principle emerging out of the dominant male principle of geometric order. The transcendentalist idea, according to which life grows out of such opposing powers and that the universe rests on a dualist foundation, formed the conceptual basis for his ornamental designs. › Fig. 13

Later modernists suppressed such symbolic readings but often continued to rely on geometry. Frank Lloyd Wright, who once worked as an assistant to Sullivan, even used a quadrature diagram as his office logo. Instead of transcendental symbolism, however, Wright used geometry as a tool to liberate himself from what he regarded as the stifling influence of European architecture, and to create something uniquely American. His

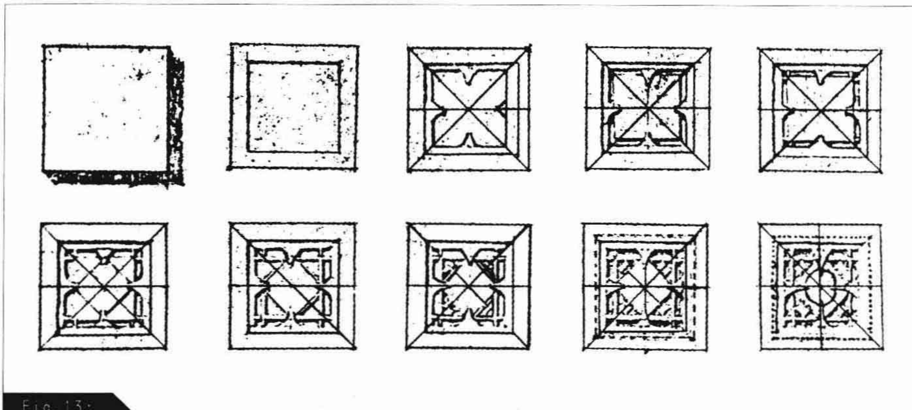

Fig.13:
Louis H. Sullivan, geometrical derivation of organic form

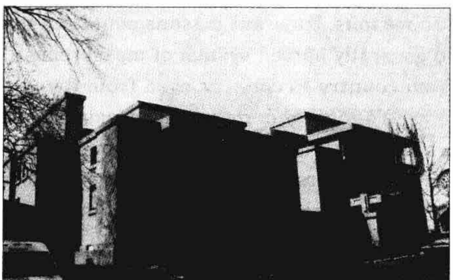

Fig.14:
Frank Lloyd Wright, Unity Temple in Oak Park, Chicago

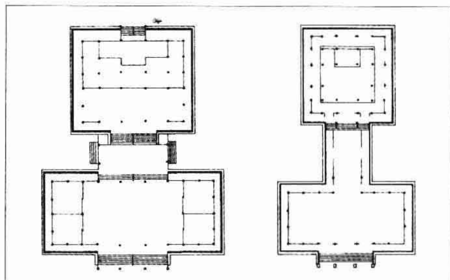

Fig.15:
Frank Lloyd Wright, Unity Temple, ground floor plan

early masterpiece, the Unity Temple (1906–08), Oak Park, Chicago, USA, is a good example. › **Figs 14 and 15**

Historians usually explain the design of Wright's building by identifying earlier buildings and other things that could have served as models. Some claim, for instance, that Wright imitated the cubic style of the German pavilion, designed by Peter Behrens, for the World's Fair in St. Louis, USA, in 1904; other historians say that he adopted a plan typology › **Chapter Responses to site, Regionalism** from Japanese gongen-style temples, such as the Nikko Taiyu-in-byo. Indeed, Wright's church and these non-Christian temples feature two major masses, one almost square in plan and the other a longer rectangle, connected by a subordinate element. › **Fig. 16**