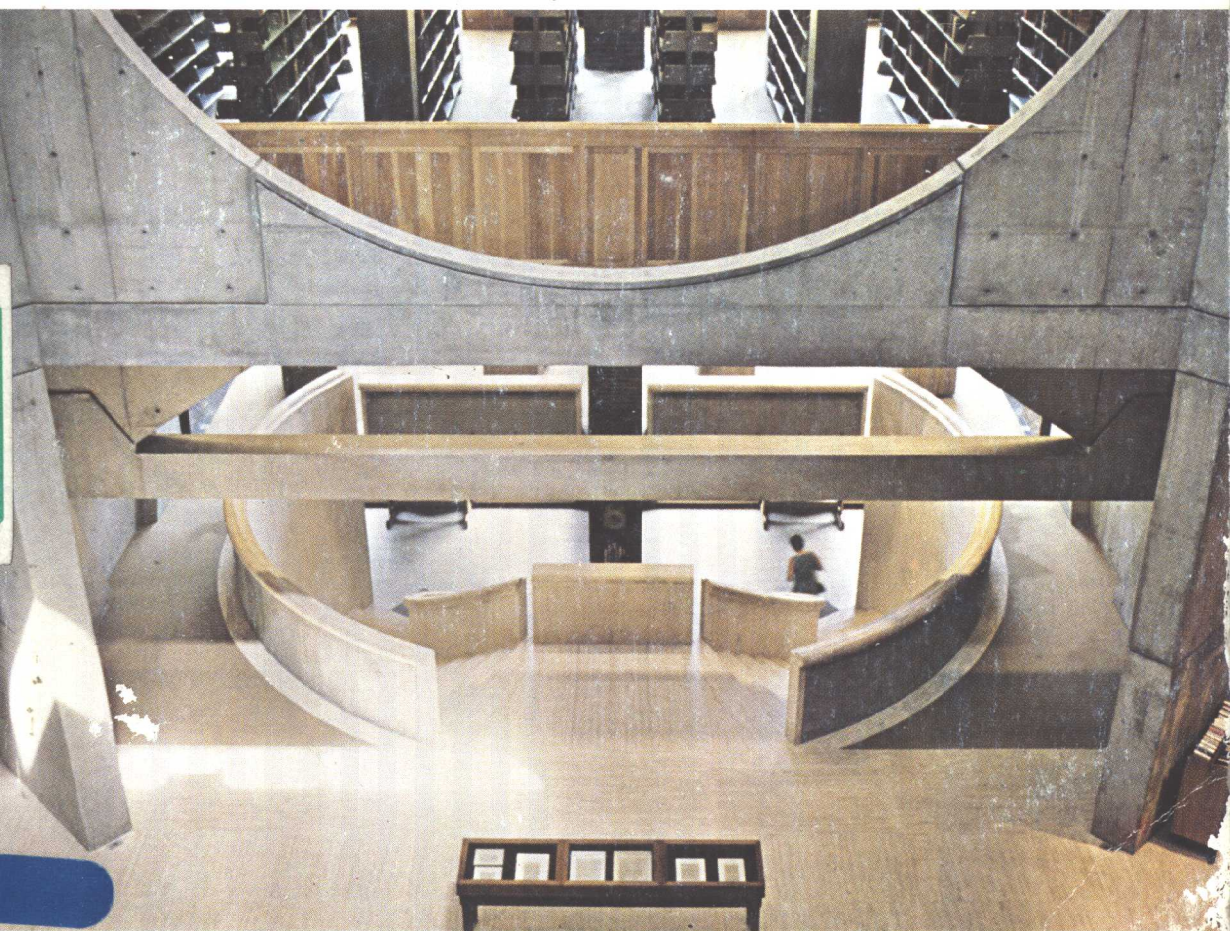


# SPACE in architecture

cornelis van de ven



third revised edition

Cornelis van de Ven

# SPACE in architecture

The evolution of a new idea  
in the theory and history of the modern movements

third revised edition



Van Gorcum 1987

Assen/Maastricht, The Netherlands  
Wolfeboro, New Hampshire 03894, U.S.A.

© 1987 Van Gorcum & Comp. B.V., P.O. Box 43, 9400 AA Assen, The Netherlands.  
Van Gorcum & Comp. B.V., 27 South Main Street, Wolfeboro, New Hampshire 03894, U.S.A.

No parts of this book may be reproduced in any form, by print, photoprint, microfilm or any other means without written permission from the publisher.

**Library of Congress Cataloging-in-Publication Data**

Van de Ven, Cornelis.  
Space in architecture.

**Bibliography**

Includes index.

1. Space (Architecture) – Philosophy. 2. Architecture, Modern – 19th century – History – Theory. 3. Architecture, Modern – 20th century – History – Theory I Title.

Na2765.V46 1987 720'.1 87-10576

ISBN 90 232 2281 4

**1977, first edition**

**1980, second edition**

**1987, third, revised edition**

# Acknowledgments

I would like to thank the members of the *Architektengemeenschap Van de Broek & Bakema* in Rotterdam, who helped me in my practical training in architecture and urban design for several years, and created a significant environment for my development in architectural thinking. Particularly, the support of Jacob B. Bakema enabled me to realize my dearest wish: to study with Louis I. Kahn at the University of Pennsylvania.

To make the stay abroad possible, I benefited from a Fulbright Grant, the services of the *Nederland-Amerika Instituut* in Amsterdam and a Fellowship of the Graduate School of Fine Arts at the University of Pennsylvania in Philadelphia.

In Kahn's Master Studio, I became more and more interested in existing theories and conceptions of space in architecture. Soon afterwards, the Doctoral Program of the Graduate School of Arts and Sciences offered me the opportunity to continue my investigations.

My special thanks are to G. Holmes Perkins. Mainly by his guidance as Chairman of the Graduate Group in Architecture and finally as my Supervisor, I could fulfil my ambitions, leading towards the completion of this dissertation. Without this support, this work would never have achieved the desired end.

Next, I would like to express my gratitude to Peter Shephard, Edmund N. Bacon and David van Zanten for the valuable criticism I received. Jacob Bakema remained an ardent stimulus in my home country, eager to read the outlines and give me the benefit of his constructive remarks.

Unfortunately, Louis Kahn did not live to see the termination of this work. To his significant initial support, this dissertation should be seen as a modest return.

Finally, I am grateful to Mary Whealin, for her continuous care throughout my enrollment in the doctoral program, to James Westerhoven for painstakingly correcting the manuscript, and Doris Sklaroff for her excellent contribution in typing and editing the text.

Philadelphia, oct. 1974.

C.J.M. v.d. V.

Except minor corrections and a few incidental but necessary additions such as the conclusions, I decided to maintain in this volume the original format of the doctoral dissertation of 1974. Although, I felt the need to add new substantial material, such extensions, however, would interfere with other existing or forthcoming publications. At this point, I would like to express my thanks to Dick Apon, Jean Leering, Jacob Bakema and Fons Asselbergs, who have been valuable advisors for the present publication. In particular, I want to mention Jean Leering's suggestion on the space theory of Witelo. I am greatly indebted to the Netherlands Organization for the Advancement of Pure Research (Z.W.O.), who subsidized the present edition with a generous grant. It goes without saying that this book has come into being thanks to the never failing enthusiasm of the publisher.

I was in the position to present the content of the book to my new students and colleagues of Eindhoven University of Technology. Their fresh look upon the subject I warmly appreciated. My gratitude extends to Dick Apon of the Department of Architecture and Urban Design who kindly enabled me to continue this research, to Wilhelmus Kuipers of the Section of Applied Linguistics for his grammatical assistance, and to Rob van Wendel de Joode for his careful production of the photographic material.

Eindhoven, aug. 1976

C.J.M. v.d. V.

The second edition of this book appeared in 1980 and it included a few corrections to the original edition of 1977. Then, requests were received for it to be published in other languages; subsequently, the text was translated into Spanish and Japanese. These new editions were published in 1981, the Spanish version by Ediciones Cátedra, Madrid, and the Japanese version by Maruzen Co. Ltd.

In 1985, when stocks of the second edition were almost exhausted, it was decided to completely revise the English version in view of the continued demand. This revision was undertaken by Dr. Peter Attwood of Eindhoven University of Technology and I am indebted to him for his use of flawless English language and his practical background which have greatly improved the text of this book. Also, I wish to thank his wife Sheila who prepared the new typescript expertly.

Eindhoven, april 1986.

C.J.M. v.d. V.

# Introduction

The aim of our creations  
is the art of space,  
the essence of architecture

H.P. Berlage (1908)

Space! A word with such a magic appeal to the architect of the twentieth century, a word so often used and misused, that I began to wonder where it came from and what it could possibly mean. Listening to my masters I heard the word 'space' pass their lips with various intonations. Opening the books on architecture, I saw it used as the alpha and omega of architecture. And finally, as soon as I began to design, I experienced the excitement of having touched upon the most mysterious and intangible concept in architecture: space.

In 1957, Louis I. Kahn said: 'Architecture is the thoughtful making of spaces. The continual renewal of architecture comes from changing concepts of space.'<sup>1</sup> When I read this statement several years ago, it strengthened my curiosity for the concept of space; in fact it became the basis of a search, which finally resulted in this book.

Since antiquity, the idea of space has been a vital issue of discussion in general philosophy and the natural sciences. Yet, strangely enough, it first appeared only recently in architectural theory. As a matter of fact, not one architectural treatise before the last half of the nineteenth century will be found in which the concept of space is regarded as essential, if at all. Until then it remained a thought *in abstracto*, clearly reserved for the realm of the philosopher and scientist.

The intellectual interpretations of the idea of space has undergone many changes since the early days, depending upon man's developing view of the world.<sup>2</sup> Yet those changing conceptions of space were not clearly connected with the architectural theories of the time until late in the second half of the nineteenth century.

This raises the question whether buildings in the past were really conscious representations *in concreto* of the philosophical and scientific understanding of the idea of space in each historical period. For instance, represented the Gothic cathedral a medieval scholastic idea of space? Such a question is hard, if not impossible, to answer for two different reasons. In the first place, most architects before the nineteenth century were primarily craftsmen, therefore, they were not interested in writing on metaphysical subjects, nor did they feel the need for them. Secondly, the idea of space, which nowadays is a rather familiar notion among architects, belonged to the world of intellectual intuition in the past. It was not considered to be an artistic concept but exclusively metaphysics. Illustrative of this view was Immanuel Kant, who at the end of the eighteenth century looked upon space and time as the *a priori* conditions for human intuition and not as principles for aesthetical criticism.<sup>3</sup> The same holds true for Schopenhauer half a century later. The idea of space began to be interpreted as an artistic ideal applied to all historical periods of the past, only after Riegl's introduction of the theory of artistic volition ('Kunstwollen') in 1901.

Since the 1890s when Hildebrand and Schmarsow crystallized the idea of space as essential for the plastic arts, most leading architects of the twentieth century followed these German historians by making explicit statements about space being fundamental to architecture.

It should be borne in mind that the theorizing architect is a fairly recent phenomenon. Apart from Vitruvius' *Ten Books on Architecture* we do not know of any critical treatises on architecture written by architects of before the time of Alberti. After the humanist revolution of the Early Renaissance the traditionally tight-lipped *master-builder* gradually acquired his new social position of a learned and intellectual *architect*. He is no longer inclined to be a professional servant, but he begins to face his clients on equal terms. If possible, he adopts the same manners as an aristocrat, he becomes eloquent and is trained in philosophical matters. Thus, he may have been vaguely familiar, depending on his intellectual ambience, with the concepts of space in general philosophy and science. Whatever might have been the case, the association of the art of building with the idea of space remained foreign to him.

As the architect became more and more concerned with ideas beyond the traditional limits of his field, the philosopher began to widen his scope as well. In the second half of the eighteenth century, aesthetics as a branch of philosophy started with Baumgarten. During the nineteenth century the extremely influential aesthetics of Hegel became connected with the science of art history, as it was called in Germany. This fusion produced the unique tradition of the German aesthetic historian. It was this group of theorists, at the end of the nineteenth century, who spanned the gap between the current unconnected modes of thought of the architect and the philosopher.

Here we can bring forward, though only briefly, several causes that have encouraged the architect since the Renaissance to reach out and establish his own metaphysics. The first and most important cause may have been the decline of religion. Some German scholars in the early twentieth century even went so far as to consider the Rococo building fever in Central Europe as the last convulsions of an already dying architecture.<sup>4</sup>

Another factor was the changing social status of the profession. As mentioned before, the master builder, the anonymous member of the building lodge, acquired the independent status of the architect. The gradual dismantling of the craft guilds and building lodges was finally completed by the French revolution.

A third reason was the change in the architect's *clientèle*. The educated, well-mannered patron of former days, who was able to surround himself with scientists, poets, musicians and artists, was now replaced by the illiterate *nouveau riche* of the nineteenth century. The protecting security of an established power has disappeared. The architect was forced to search for moral attitudes, because the rising class of industrial bourgeoisie did not offer the evident *trait d'union*, that had firmly established a cultural dialogue between the architect and his patron, in previous centuries.

The industrial revolution led to a fourth important factor. Some architects began to involve themselves with the specific problems of the expanding working class. Architecture was not only an aesthetic but a social concern too. Moral responsibilities drove the architect toward finding fair solutions or utopian visions when housing the growing masses, instead of exploiting them in slums, where they were hopelessly deprived of any harmonious human existence.

All these moral and social changes necessitated an increasing interest in theoretical attitudes by the architect. But perhaps the most important factor for the growth of architectural philosophy was the interest in the new techniques, materials and purposes; the three materialist functions as they were categorized by Semper. This interest more than anything else, gave an opportunity for purifying the nineteenth century of its arbitrary eclecticism of styles. It became clear to the architect that the eclectic confusion of the nineteenth century could be removed only by reconsidering the functions of materials, techniques and purposes as generators of new form.

The philosophy of architecture in the nineteenth century expanded rapidly. In addition to Semper's search for fundamentals based on the nature of materials, Viollet-le-Duc lectured on structural integrity, and, in England, Ruskin studied biomorphic analogies

between architectural form and nature. Nevertheless the practice of eclecticism was not halted immediately. In fact the three leading architect-theorists mentioned above proliferated the use of historic forms further. Only when the idea of space was introduced as a fundamental of architecture was the architect able to reduce the importance of historical styles, or to treat matter in terms of its content: the space within.

The new idea of space supported the late nineteenth century attempts to crush the falsehood of eclectic styles in two ways. In the first place, space was seen as the embodiment of human activity inside the architectural shell. It represented the extension of the functional human body in three directions. Secondly, the idea of space was a new form of the centuries-old attempts in aesthetics to define Beauty. As such the introduction of the idea of space was just another logical step in nineteenth century Hegelian aesthetics. The origin of the first approach lies in the theories of Semper, who combined the new materialist approach with a startling perception of three spatial moments derived from the human body. But it was Schmarsow, who developed Semper's theory further, and proclaimed the idea of space as an aesthetic idea: even more than that, he defined it as the essence of architecture, as an art.

The following analyses concerns concepts of space in architectural theory in the beginning of the modern movements in architecture. It has been subdivided in four parts. The first two parts should be seen as being introductory.

Part One concerns aspects of ideas of space in general philosophy and science. For understanding the concept in architectural thought, I felt it necessary to begin this analyses with some of these aspects as far as they have been relevant to the development of the idea of space in architectural aesthetics.

Part Two deals with some aspects of Beaux-Arts theory in France and with the attitude of Ruskin in England, because both represent important streams in architectural thought during the nineteenth century, which cannot be isolated from the study of the idea of space in architecture.

Part Three attempts to cover the various ideas of space in German architectural aesthetics from 1850 to around 1930. Several studies facilitated my research.<sup>5</sup> It might appear from this section that the concept of space as an architectural fundamental is almost exclusively a German contribution. The reasons for this particular cultural belief are manifold. By the end of the nineteenth century German aesthetics was a combination of Hegelian thought and of the new born science of perceptual psychology. This science dealt with the concept of space as the medium in tactile and visual image formation.

The term *space* stems from the Classical term *spatium*, which became *espace* in French, *spazio* in Italian, and *espacio* in Spanish. The German *Raum*, developed from the Teutonic *ruun*, and it led to *room* in English and *ruimte* in Dutch.

In this respect, one should not overlook the semantic importance of the word 'Raum' meaning space. Apart from the more abstract 'space', the German word 'Raum' also means 'room', or 'pièce' (French). Other German words associated with the concept 'room' are 'Zimmer' and 'Kammer'. Semantically the word 'Raum', used for 'room', implies expansion, or the availability of space in a more positive manner. 'Zimmer' or 'Kammer' reflects a tighter sense of enclosure, and they are etymologically connected with medieval timber frame construction. In other words, by using 'Raum' the German language offers the opportunity to identify the internal contained space with a representation of the more abstract intellectual idea. It was here that a sensory perception of reality and an intellectual idea were fused together. Therefore, in the nineteenth century German architectural theories, one can never be sure, whether the author meant an ordinary 'room', or the more transcendental term 'space'.

Part Four tries to bring together the various concepts of space as they were formulated by the leading architects at the beginning of the modern architectural movements, primarily in Europe. Despite many studies concerning the heroic period of modern architecture,

the early definitions of the concepts of space by architects have rarely been investigated,<sup>6</sup> whereas, there have been several studies of the art-historical origins of concepts of space.

I have been careful in suggesting a direct exchange of thought between the German historians, discussed in Part Three, and their immediate successors, the theorizing architects of the modern movements, who are brought together in Part Four. Physically these two categories were two clearly distinct groups. Nevertheless a clear continuation of ideas exists on the theoretical level, despite attempts to distort or obscure its origins by later ambitious architect-theorists. The overwhelming success of such brilliant teachers as Wölfflin, Schmarsow, or Brinckmann should not be overlooked. They established the train of thought in the German speaking countries for many generations.

The first conscious recognition of the idea of space was made by the independent German theorists Hildebrand and Schmarsow; both published their ideas, curiously enough, in the same year, 1893. Despite its immediate relevance to Functionalist architect-theorists like Berlage, it was almost three decades before this new concept of space could proliferate into the theories of the modern movements in the twenties. One of the reasons for this delay was a belief in a counteracting urge in mankind toward empathy as propagated, for instance, by Worringer and Wölfflin. The Expressionist movement is the consequence of this opposing view being to some extent represented by the adoration of substance or mass, in order to satisfy Man's innate dread of space.

When the Expressionist movement was defeated finally by the more successful 'De Stijl' and 'Neue Sachlichkeit' in 1923, Gropius adopted the idea of space which became the core of the artistic research by the Bauhaus School. From then on the concept of space in the modern movements began to flourish culminating in the theory of space-time by Moholy-Nagy in 1928 and the acceptance of the idea of space by Frank Lloyd Wright in the same year.

Around 1930, the concept of space in the modern movements ceased to flourish; therefore this analysis concentrates on the first three decades of this century. After 1930, no new concepts of space was added to those already mentioned; however they were repeated over and over again.

At the end of the 1950s the idea of space entered a new phase. The concepts of space and space-time of the De Stijl and Bauhaus School, after thirty years of practicing CIAM doctrines for the layout of new urban communities, were denounced by the new avant-garde architects as alienating formal aesthetics. The old concepts were gradually overthrown with the help of existential philosophy which had entered into a second phase in France and Germany, directly after the Second World War. At this time Aristotle's theory of place, after a long rejection, was accepted again as being just as relevant to the day to day human existence, even by such an authority as Albert Einstein. The earth again was seen again a finite whole that was forced to grow inwardly rather than outwardly like in the former optimistic view. It led to the new concepts of integration, ecological complexity and maximum density, the existential theory of place, substituting the former materialist concept of space, which had been investigated by Bollnow, Badt and Norberg Schulz.<sup>7</sup>

Among other ideas, the concept of space has become an inseparable part of architectural theory, whatever the attitudes to the architectural form in the near future will be.

It is my hope that a better understanding of this viewpoint will be provided by reading this book.

# Table of contents

Acknowledgments vii

Introduction xi

## Part one. Aspects of ideas of space in philosophy and science

- I. Making space tangible 3  
(Lao-Tzu)
- II. The finite geometry of the universe 9  
(Plato)
- III. The theory of place 15  
(Aristotle)
- IV. Divine space: the gothic light 21  
(Suger, Aquinas, Augustinus, Witelo)
- V. The infinite space of the universe 29  
(Copernicus, Galilei, Descartes, Locke, Newton, Leibniz)
- VI. Metaphysical intuition and the content of form 35  
(Kant, Hegel, Schopenhauer)
- VII. Physics: the space-time continuum 43  
(Weyl, Jammer, Lorentz, Einstein)

## Part two. Aspects of ideas of space in french and english architectural theories before the beginning of the modern movements

- I. The french academy I: distribution and the idea of space 49  
(de l'Orme, Blondel, Ledoux, Laugier, Boullée)
- II. The french academy II: plan, section and isometric 58  
(Durand, Guadet, Viollet-le-Duc, Choisy)
- III. The analogy with nature: living architecture 64  
(Ruskin)

## Part three. Ideas of space in german architectural theory, 1850-1930

- I. Materialism and the three spatial moments 71  
(Semper)
- II. The theory of empathy: mass 78  
(Vischer, Lipps)
- III. Pure and kinetic vision 84  
(Hildebrand)

- IV. The creatress of space and artistic volition 90  
(Schmarsow, Riegl)
- V. From empathy to planar vision 94  
(Wölfflin)
- VI. Abstraction and the fear of space 99  
(Worringer)
- VII. Concavity and convexity: the double face of architectural space 102  
(Sitte)
- VIII. The aesthetic coalition of mass and space 110  
(Brinckmann, Sörgel, Schumacher)
- IX. The morphology of space 118  
(Frankl)
- X. The third generation of architectural theorists, the 1920s 125  
(Höyer, Karow, Klopfer, Zucker, Adler, Frey, Jantzen)

#### Part four. Ideas of space in the modern movements 1890-1930

- I. The importance of genetic-materialist ideas 135  
(Sullivan, Van de Velde, Gropius, Wright)
- II. The artistic volition of space 145  
(Berlage, Endell, Schindler, Scott)
- III. Expressionism and futurism I: the faustian idea of space 154  
(Nietzsche, Poelzig, Marinetti, Sant'Elia, Wijdeveld, Steiner, Kohtz, Taut, Scheerbar, Spengler)
- IV. Expressionism II: organic and geometric space 168  
(Mendelsohn, Taut, Hansen, De Fries, Finsterlin, Häring)
- V. 'Après le cubisme': from four to three dimensional space 179  
(Apollinaire, Gleizes & Metzinger, Ozenfant, Le Corbusier)
- VI. De Stijl: plane versus fourth dimension 193  
(Mondrian, Van Doesburg, Kiesler, Severini, Poincaré)
- VII. Russian suprematism: irrational space 209  
(Malevich, Gabo, Lissitzky, Stam)
- VIII. The Bauhaus School: a science of space 221  
(Gropius, Hilberseimer, Van der Rohe, Moholy-Nagy)
- IX. Wright and the third dimension 231  
(Wright)

Conclusions 239

Notes 247

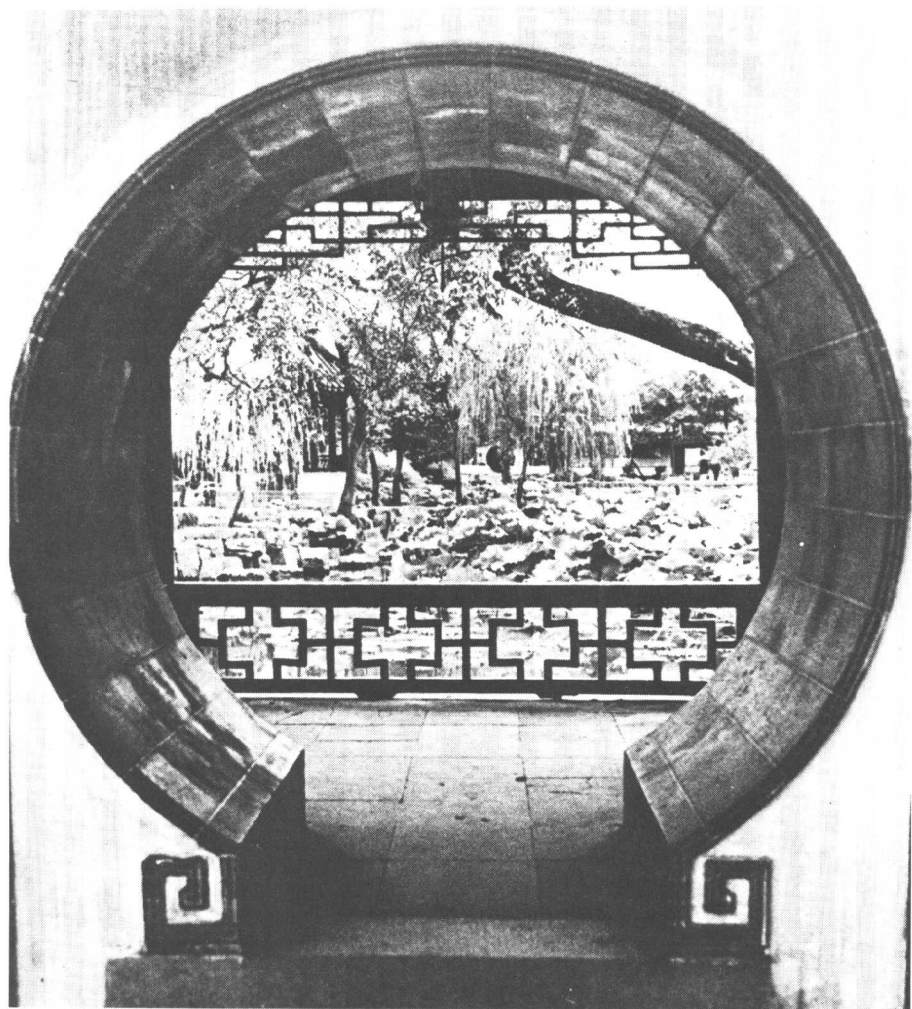
Bibliography 261

Sources of illustrations 268

Index 271

## Part one

# Aspects of ideas of space in philosophy and science



(1) Zhuozhing yuan at Suzhou. 'We make doors and windows for a room'.

# 1 Making space tangible

Thirty spokes converge upon a single hub;  
It is on the hole in the center that the purpose of the axle depends

We make a vessel from a lump of clay;  
It is the empty space within the vessel that makes it useful

We make doors and windows for a room;  
But it is these empty spaces that make the room habitable

Thus while the tangible has advantages;  
It is the intangible that makes it useful

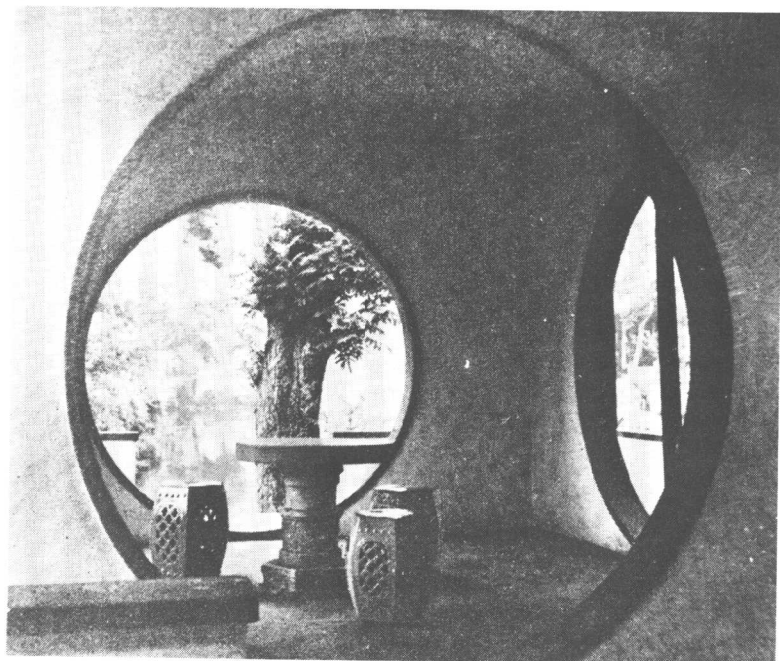
from Lao Tzu (c. 550 B.C.)<sup>1</sup>

The core of Lao Tzu's philosophy is *Tao*, or the Way of Becoming. It portrays the notion that nothing is permanent in an everchanging world.<sup>2</sup> All static concepts such as the ones put forward by Lao Tzu's contemporary Confucius are considered to be errors by the Taoists. The flexibility of Tao thinking reflects a true foresight in man's changing ideas, not in the least concerning the idea of space, the subject of this book.

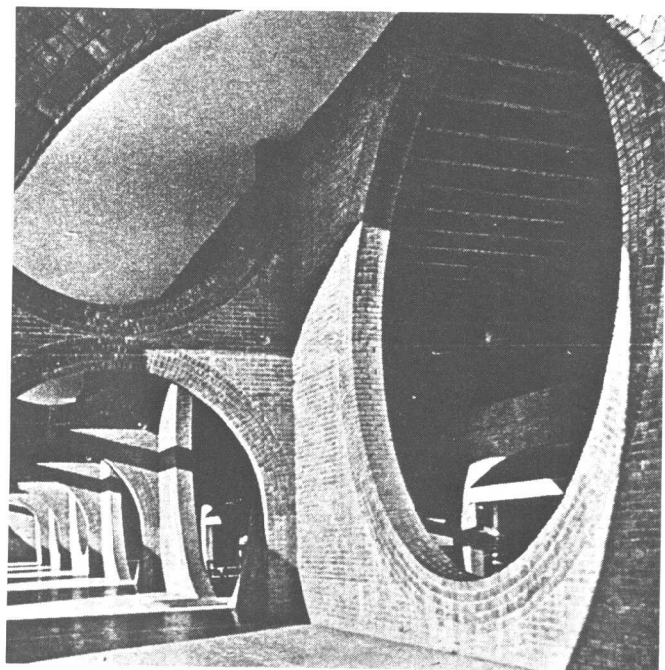
The legendary Old Man, Lao Tzu, laid the foundation of the philosophical and phenomenological principle of polarity more than two and a half thousand years ago. In the opening chapters of his book, the *Tao Teh Ching*, he united Being and Non-Being into one concept that has remained a vibrant one throughout the entire development of human civilization. Indeed, this unity of two opposing conditions is still the vital structure in contemporary aesthetics concerning space, as will be discussed later on.

The famous eleventh chapter of the *Tao Teh Ching*, quoted above, contains more than just the principle of two opposing elements; since it reveals the superiority of the contained, the *space within*. The non-existent is the essential, made tangible in material form. Late nineteenth century architectural aesthetics put forward that the existence of space is the essence of architecture. In the beginning of the twentieth century certain artistic trends, recognizing the old oriental saying that mass is the servant of the void and they led to a rigid dematerialization of the solidity of mass. An example was the De Stijl movement. Even today Lao Tzu's contemplations exert a strong influence on architects who perceive the intangible content of architectural form as the true potential of architecture.<sup>3</sup> (2)\*

\* Numbers between parenthesis refer to illustration numbers.

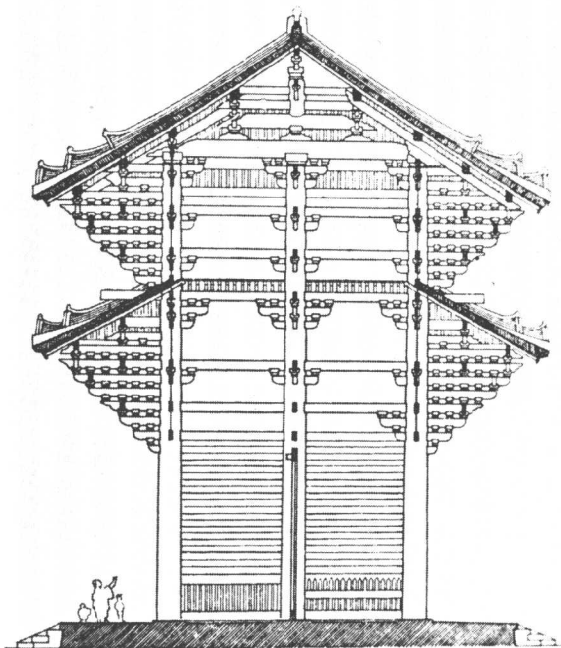


(2a) *Transitional space in a Chinese garden.*



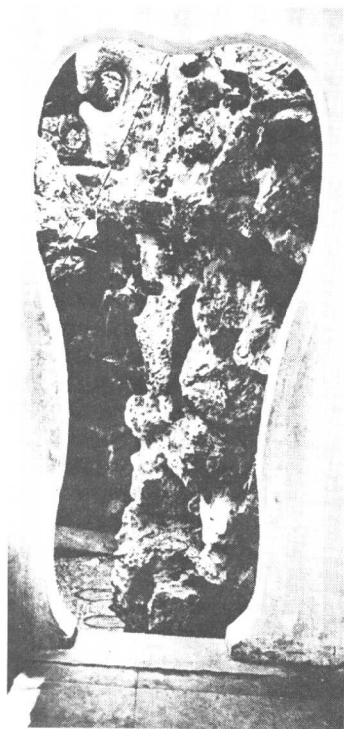
(2b) *Louis I Kahn. Ayub National Hospital, Dacca, Bangladesh.*

(3) Great South Gate at Todaiji,  
cross section. Tectonic form.

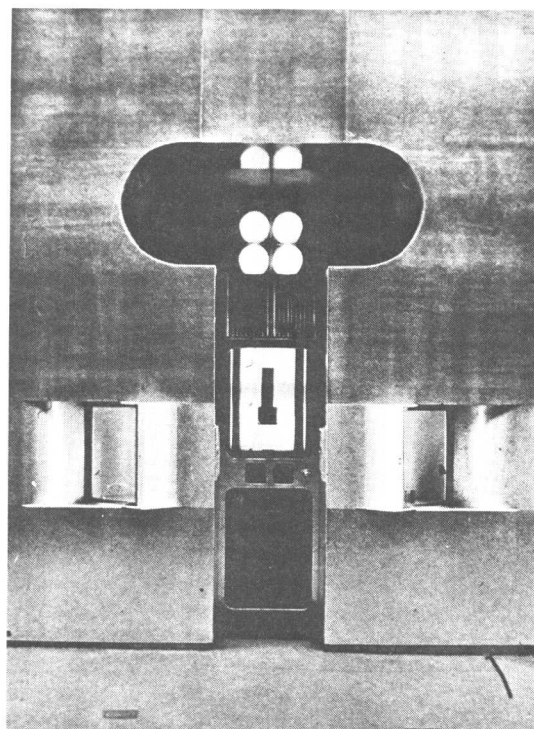


A closer look at the contents of the chapter quoted will reveal another phenomenon which has a particular interest for architecture. In the verse that introduces this chapter the assembly of spokes into a whole can be identified as a *tectonic* form. (3). In the second couplet space is created by hollowing out a lump of clay, (4) this suggests a material and technical quality like that named by Gottfried Semper as *stereotomic* form.<sup>4</sup> Thus, the two material methods of creating space in architecture (tectonic and stereotomic), often regarded as an original nineteenth century thought, were actually perceived more than two and a half thousand years ago.

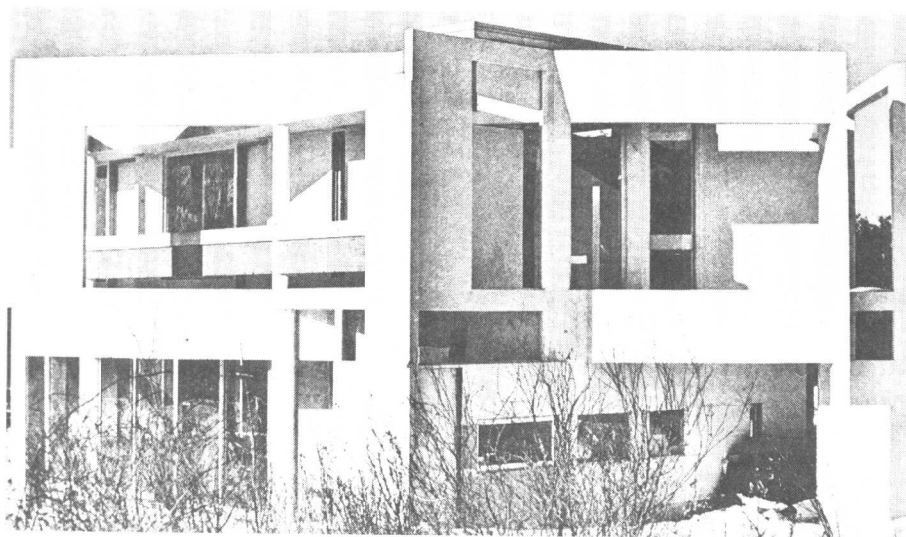
Another contemporary thought is contained in the third couplet of the verse. Lao Tzu had already remarked that the space within was more essential than its material counterpart, mass. But at this point Lao Tzu places his emphasis on the boundary between internal and external space: the separating wall. He referred to the voids framed by doors and windows which can be understood as being the transitional spaces that define the fundamental architectural form. Here we find perhaps the first written attempt at interpreting the boundary as a continuation of space, shifting the emphasis from the space



(4a) *In the Shizi lin at Suzhou. Stereotomic form in clay.*



(4b) *Hans Hollein. Candle Shop, Vienna, (1964-'65). Stereotomic form in metal.*



(5) *Peter Eisenman. House III, Miller Residence, Lakeville, Conn, (1974). transmittance of inside and outside space.*