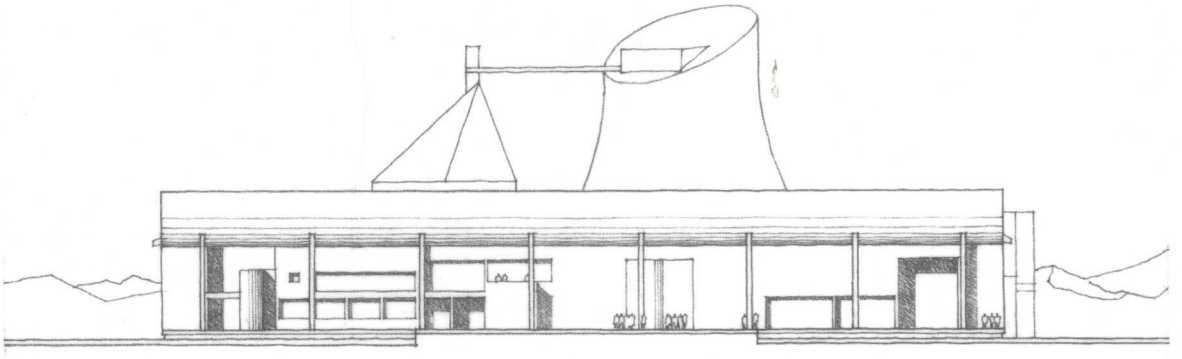

FRANCIS D.K. CHING

ARCHITECTURE

FORM, SPACE, & ORDER

FOURTH EDITION

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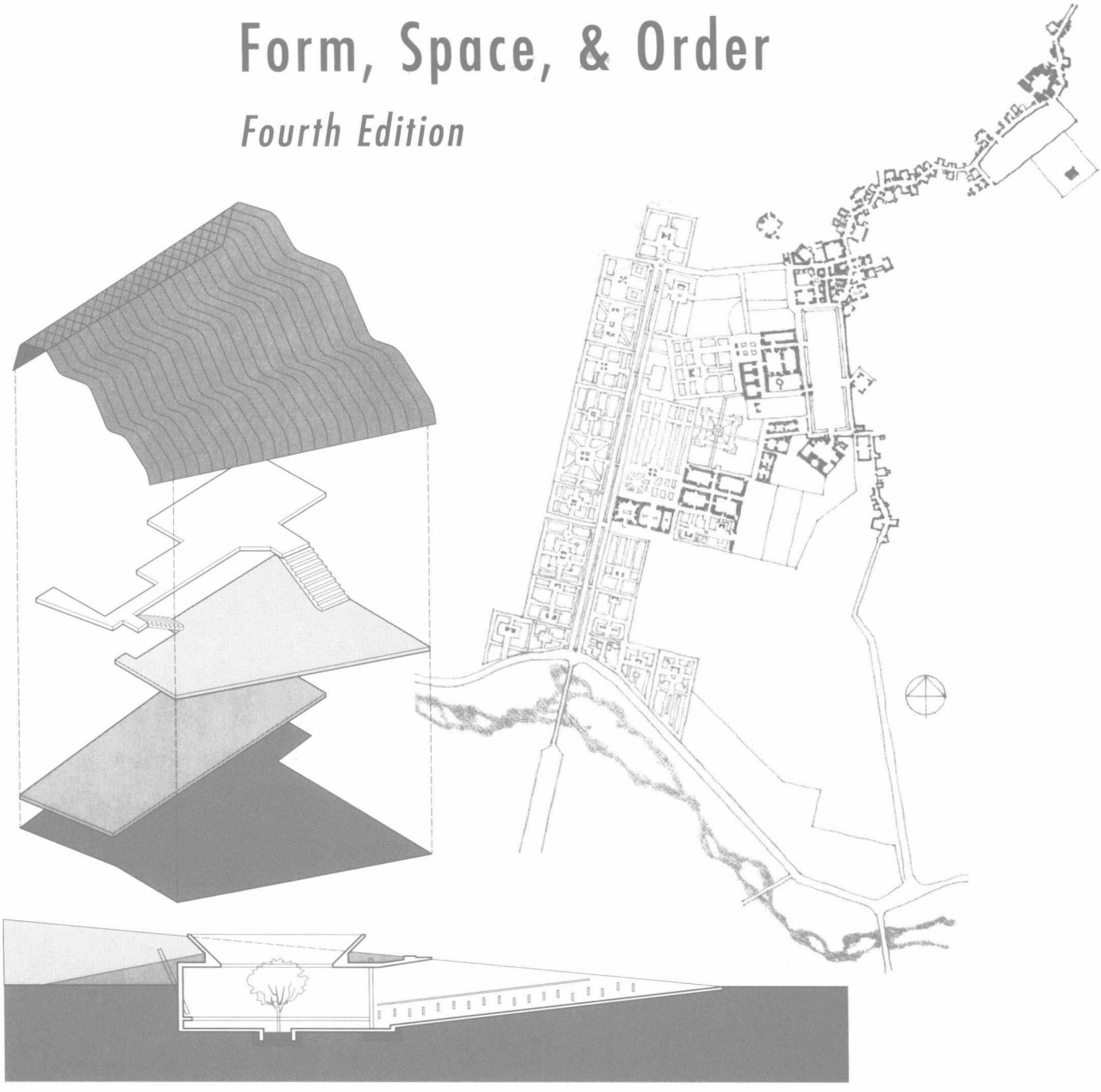
Form, Space, & Order

Fourth Edition



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The original edition of this study introduced the student of architecture to form and space and the principles that guide their ordering in the built environment. Form and space are the critical means of architecture comprising a design vocabulary that is both elemental and timeless. The second edition continued to be a comprehensive primer on the ways form and space are interrelated and organized in the shaping of our environment, and was refined by editing the text and incorporating diagrams for greater clarity, adding selected examples of architectural works, expanding the sections on openings, stairways, and scale, and finally, by including a glossary and an index to designers. The third edition persisted in illustrating the ways the fundamental elements and principles of architectural design manifest themselves over the course of human history but added an electronic component to introduce the aspects of time and movement to the exposition of elements and principles.

In this fourth edition, major changes consist of the addition of more than two dozen contemporary examples, selected to illustrate the new forms that go beyond the timeless elements of basic statics—the columns, beams, and load-bearing walls of stable constructions that are fixed in time and space. Five more modules have also been added to the electronic component to animate certain design decisions regarding scale and proportion, the type of visual, often subtle judgements that designers face in the development of a project.

The historical models in this book span time and cross cultural boundaries. While the juxtaposition of styles may appear to be abrupt at times, the diverse range of examples is deliberate. The collage is intended to persuade the reader to look for likenesses among seemingly unlike constructions and bring into sharper focus the critical distinctions that reflect the time and place of their making. Readers are encouraged to take note of additional examples encountered or recalled within the context of their individual experiences. As the design elements and principles become more familiar, new connections, relationships, and levels of meaning may be established.

The illustrated examples are neither exhaustive nor necessarily the prototypes for the concepts and principles discussed. Their selection merely serves to illuminate and clarify the formal and spatial ideas being explored. These seminal ideas transcend their historical context and encourage speculation: How might they be analyzed, perceived, and experienced? How might they be transformed into coherent, useful, and meaningful structures of space and enclosure? How might they be reapplied to a range of architectural problems? This manner of presentation attempts to promote a more evocative understanding of the architecture one experiences, the architecture one encounters in literature, and the architecture one imagines while designing.

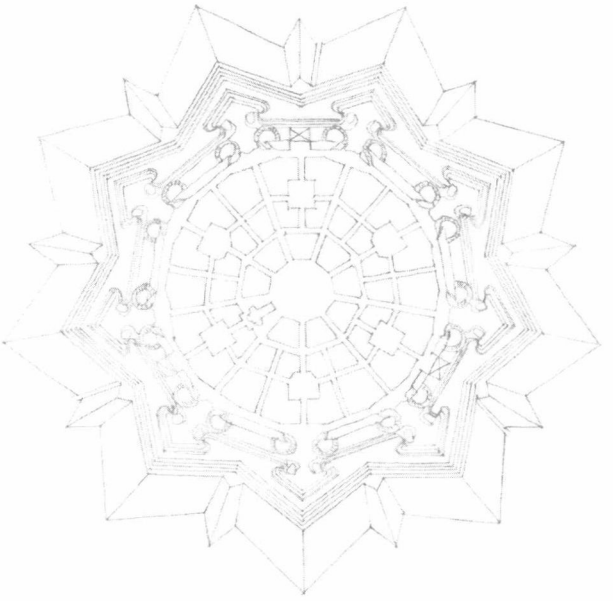
ACKNOWLEDGMENTS

I will always be indebted to the following people for their invaluable contributions to the original edition of this work: Forrest Wilson, whose insights into the communication of design principles helped clarify the organization of the material, and whose support made its initial publication possible; James Tice, whose knowledge and understanding of architectural history and theory strengthened the development of this study; Norman Crowe, whose diligence and skill in the teaching of architecture encouraged me to pursue this work; Roger Sherwood, whose research into the organizational principles of form fostered the development of the chapter on ordering principles; Daniel Friedman, for his enthusiasm and careful editing of the final copy; Diane Turner and Philip Hamp, for their assistance in researching material for the illustrations; and to the editorial and production staff at Van Nostrand Reinhold, for their exceptional support and service during the making of the first edition.

For the second edition, my appreciation extends to the many students and their teachers who have used this book over the years and offered suggestions for its improvement as a reference and tool for study and teaching. I want to especially thank the following educators for their careful critique of the first edition: L. Rudolph Barton, Laurence A. Clement, Jr., Kevin Forseth, Simon Herbert, Jan Jennings, Marjorie Kriebel, Thomas E. Steinfeld, Cheryl Wagner, James M. Wehler, and Robert L. Wright.

In preparing the third edition, I am grateful to Michele Chiuini, Ahmeen Farooq, and Dexter Hulse for their thoughtful reviews of the second edition. While I attempted to incorporate much of their wise counsel, I remain solely responsible for any deficiencies remaining in the text. I especially want to express my gratitude to the editorial and production staff at John Wiley & Sons for their invaluable support and encouragement, and to Nan-ching Tai for his creative contributions and technical assistance in preparing the electronic component of the third edition.

Dr. Karen Spence, Gary Crafts, Lohren Deeg, and Dr. Ralph Hammann provided valuable insights and suggestions for this fourth edition. I want to especially recognize Paul Drougas and Lauren Olesky of John Wiley & Sons for their continuing editorial assistance and support, which made this publication not only possible but also an enjoyable endeavor.



To Debra, Emily, and Andrew, whose love of life it is ultimately the role of architecture to nourish.

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Architecture is generally conceived—designed—realized—built—in response to an existing set of conditions. These conditions may be purely functional in nature, or they may also reflect in varying degrees the social, political, and economic climate. In any case, it is assumed that the existing set of conditions—the problem—is less than satisfactory and that a new set of conditions—a solution—would be desirable. The act of creating architecture, then, is a problem-solving or design process.

The initial phase of any design process is the recognition of a problematic condition and the decision to find a solution to it. Design is above all a willful act, a purposeful endeavor. A designer must first document the existing conditions of a problem, define its context, and collect relevant data to be assimilated and analyzed. This is the critical phase of the design process since the nature of a solution is inexorably related to how a problem is perceived, defined, and articulated. Piet Hein, the noted Danish poet and scientist, puts it this way: "Art is solving problems that cannot be formulated before they have been solved. The shaping of the question is part of the answer."

Designers inevitably and instinctively prefigure solutions to the problems they are confronted with, but the depth and range of their design vocabulary influence both their perception of a question and the shaping of its answer. If one's understanding of a design language is limited, then the range of possible solutions to a problem will also be limited. This book focuses, therefore, on broadening and enriching a vocabulary of design through the study of its essential elements and principles and the exploration of a wide array of solutions to architectural problems developed over the course of human history.

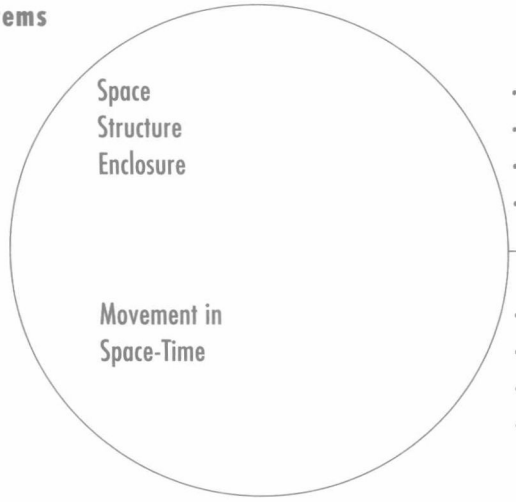
As an art, architecture is more than satisfying the purely functional requirements of a building program. Fundamentally, the physical manifestations of architecture accommodate human activity. However, the arrangement and ordering of forms and spaces also determine how architecture might promote endeavors, elicit responses, and communicate meaning. So while this study focuses on formal and spatial ideas, it is not intended to diminish the importance of the social, political, or economic aspects of architecture. Form and space are presented not as ends in themselves but as means to solve a problem in response to conditions of function, purpose, and context—that is, architecturally.

The analogy may be made that one must know and understand the alphabet before words can be formed and a vocabulary developed; one must understand the rules of grammar and syntax before sentences can be constructed; one must understand the principles of composition before essays, novels, and the like can be written. Once these elements are understood, one can write poignantly or with force, call for peace or incite to riot, comment on trivia or speak with insight and meaning. In a similar way, it might be appropriate to be able to recognize the basic elements of form and space and understand how they can be manipulated and organized in the development of a design concept, before addressing the more vital issue of meaning in architecture.

In order to place this study in proper context, the following is an overview of the basic elements, systems, and orders that constitute a work of architecture. All of these constituents can be perceived and experienced. Some may be readily apparent while others are more obscure to our intellect and senses. Some may dominate while others play a secondary role in a building's organization. Some may convey images and meaning while others serve as qualifiers or modifiers of these messages.

In all cases, however, these elements and systems should be interrelated to form an integrated whole having a unifying or coherent structure. Architectural order is created when the organization of parts makes visible their relationships to each other and the structure as a whole. When these relationships are perceived as mutually reinforcing and contributing to the singular nature of the whole, then a conceptual order exists—an order that may well be more enduring than transient perceptual visions.

Architectural Systems



The **Architecture** of

Space
Structure
Enclosure

- organizational pattern, relationships, clarity, hierarchy
- formal image and spatial definition
- qualities of shape, color, texture, scale, proportion
- qualities of surfaces, edges, and openings

Experienced through

Movement in Space-Time

- approach and entry
- path configuration and access
- sequence of spaces
- light, view, touch, sound, and smell

Achieved by means of

Technology

- structure and enclosure
- environmental protection and comfort
- health, safety, and welfare
- durability and sustainability

Accommodating a

Program

- user requirements, needs, aspirations
- sociocultural factors
- economic factors
- legal constraints
- historical tradition and precedents

Compatible with its

Context

- site and environment
- climate: sun, wind, temperature, precipitation
- geography: soils, topography, vegetation, water
- sensory and cultural characteristics of the place

...& Orders

Physical

Form and Space
- solids and voids
- interior and exterior

Systems and organizations of
- space
- structure
- enclosure
- machines

Perceptual

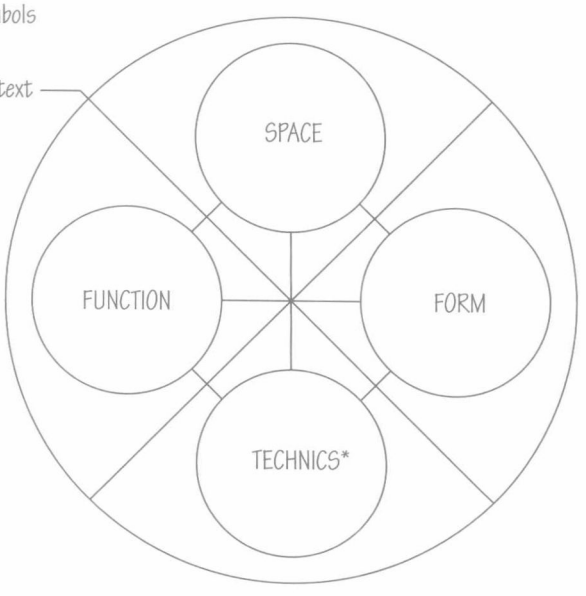
Sensory perception and recognition of the physical elements by experiencing them sequentially in time

- approach and departure
- entry and egress
- movement through the order of spaces
- functioning of and activities within spaces
- qualities of light, color, texture, view, and sound

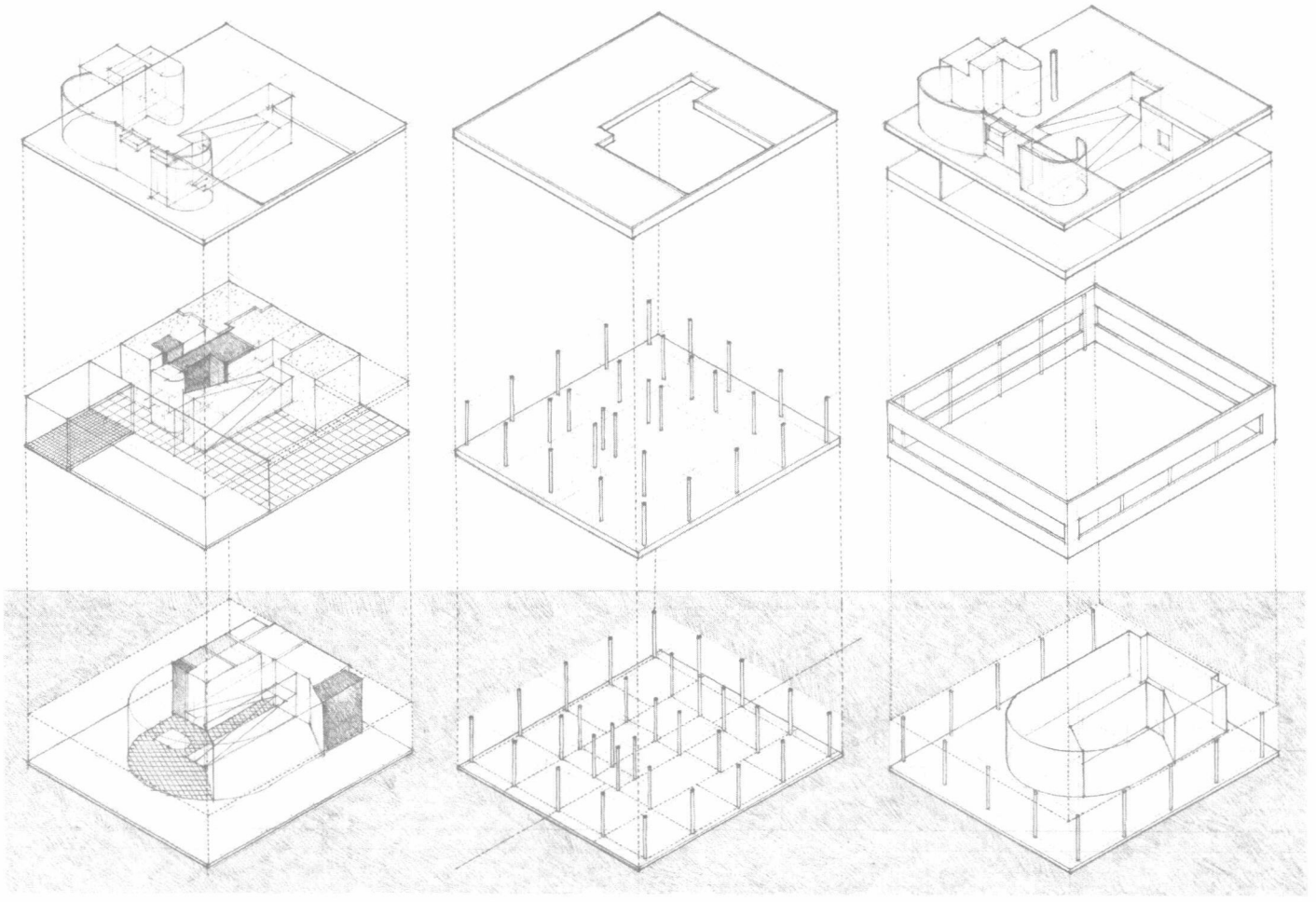
Conceptual

Comprehension of the ordered or disordered relationships among a building's elements and systems, and responding to the meanings they evoke

- images
- patterns
- signs
- symbols
- context



* Technics refers to the theory, principles, or study of an art or a process.



Spatial System

- The three-dimensional integration of program elements and spaces accommodates the multiple functions and relationships of a house.

Structural System

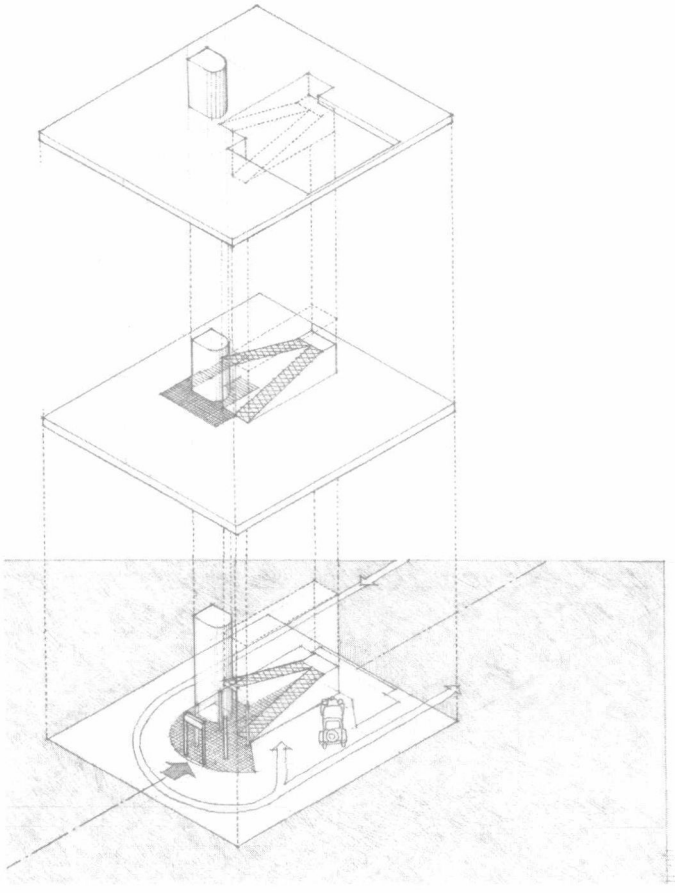
- A grid of columns supports horizontal beams and slabs.
- The cantilever acknowledges the direction of approach along the longitudinal axis.

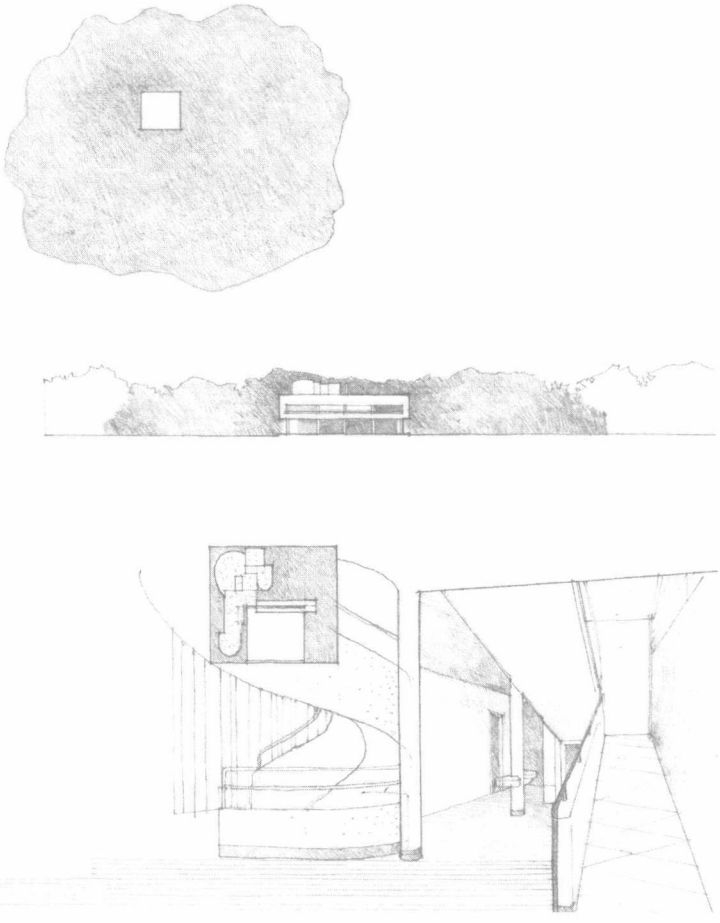
Enclosure System

- Four exterior wall planes define a rectangular volume that contains the program elements and spaces.

Villa Savoye, Poissy, east of Paris, 1923–31, Le Corbusier

This graphic analysis illustrates the way architecture embodies the harmonious integration of interacting and interrelated parts into a complex and unified whole.





Circulation System

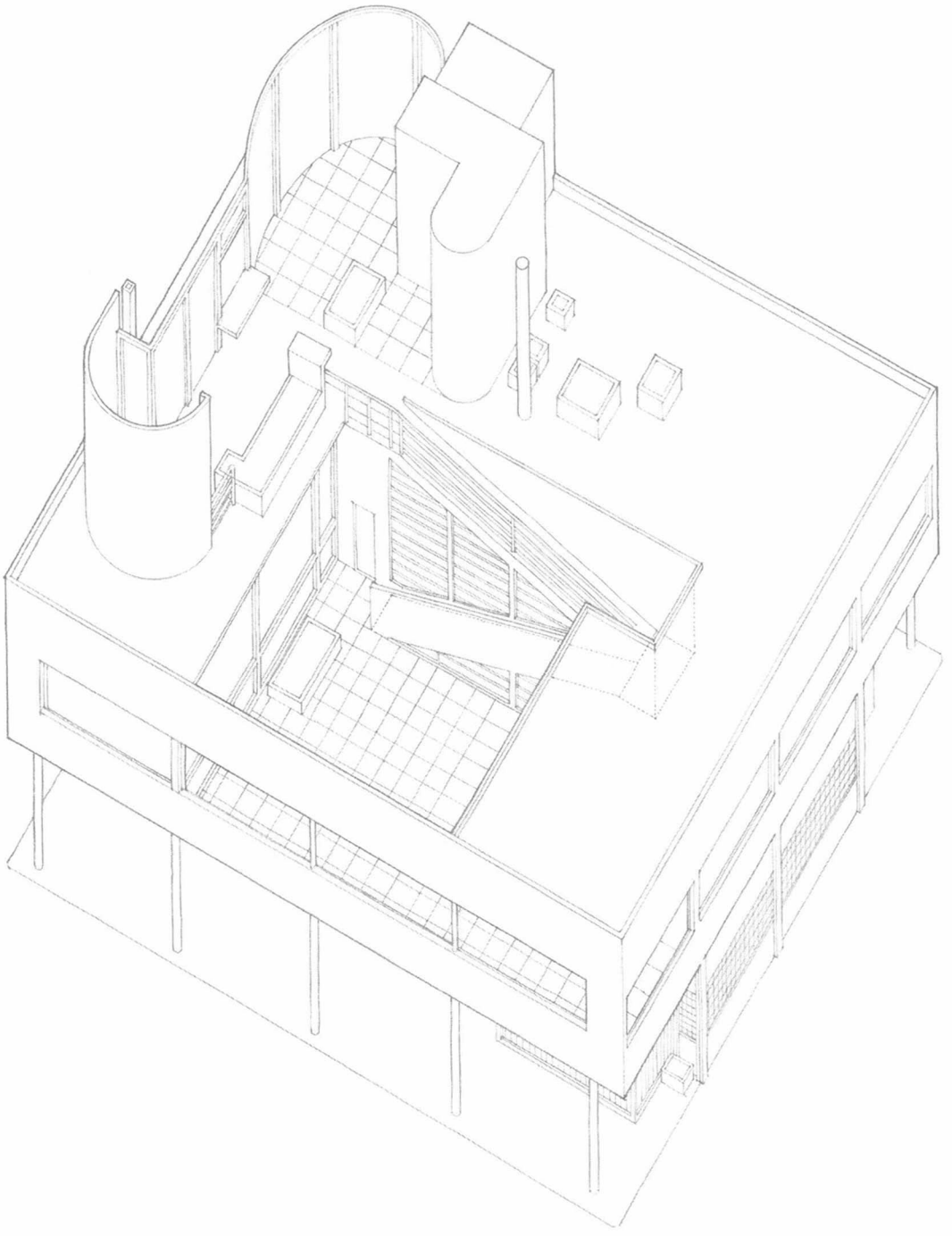
- The stair and ramp penetrate and link the three levels, and heighten the viewer's perception of forms in space and light.
- The curved form of the entrance foyer reflects the movement of the automobile.

Context

- A simple exterior form wraps around a complex interior organization of forms and spaces.
- Elevating the main floor provides a better view and avoids the humidity of the ground.
- A garden terrace distributes sunlight to the spaces gathered around it.

"Its severe, almost square exterior surrounds an intricate interior configuration glimpsed through openings and from protrusions above. . . . Its inside order accommodates the multiple functions of a house, domestic scale, and partial mystery inherent in a sense of privacy. Its outside order expresses the unity of the idea of house at an easy scale appropriate to the green field it dominated and possibly to the city it will one day be part of."

Robert Venturi, *Complexity and Contradiction in Architecture*, 1966



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Preface vii
Acknowledgments viii
Introduction ix

1 Primary Elements
Primary Elements 2
Point 4
Point Elements 5
Two Points 6
Line 8
Linear Elements 10
Linear Elements Defining Planes 15
From Line to Plane 14
Plane 18
Planar Elements 20
Volume 28
Volumetric Elements 30

2 Form
Form 34
Properties of Form 35
Shape 36
Primary Shapes 38
Circle 39
Triangle 40
Square 41
Surfaces 42
Curved Surfaces 43
Primary Solids 46
Regular & Irregular Forms 50
Transformation of Form 54
Dimensional Transformation 56
Subtractive Form 58
Subtractive & Additive Forms 61
Additive Form 62
Centralized Form 64
Linear Form 66
Radial Form 70
Clustered Form 72
Grid Form 76
Formal Collisions of Geometry 78
Circle & Square 80
Rotated Grid 82
Articulation of Form 84
Edges & Corners 86
Corners 87
Surface Articulation 92

3 Form & Space
Form & Space 100
Form & Space: Unity of Opposites 102
Form Defining Space 110
Horizontal Elements Defining Space 111
Base Plane 112
Elevated Base Plane 114
Depressed Base Plane 120
Overhead Plane 126
Vertical Elements Defining Space 134
Vertical Linear Elements 136
Single Vertical Plane 144
L-Shaped Configuration of Planes 148
L-Shaped Planes 149
Parallel Vertical Planes 154
Parallel Planes 155
U-Shaped Planes 160
Four Planes: Closure 166
Four Planes: Enlosure 170
Openings in Space-Defining Elements 174
Openings within Planes 176
Openings at Corners 178
Openings between Planes 180
Qualities of Architectural Space 182
Degree of Enclosure 184
Light 186
View 190

4 Organization
Organization of Form & Space 196
Spatial Relationships 197
Space within a Space 198
Interlocking Spaces 200
Adjacent Spaces 202
Spaces Linked by a Common Space 204
Spatial Organizations 206
Centralized Organizations 208
Linear Organizations 218
Radial Organizations 228
Clustered Organizations 234
Grid Organizations 242

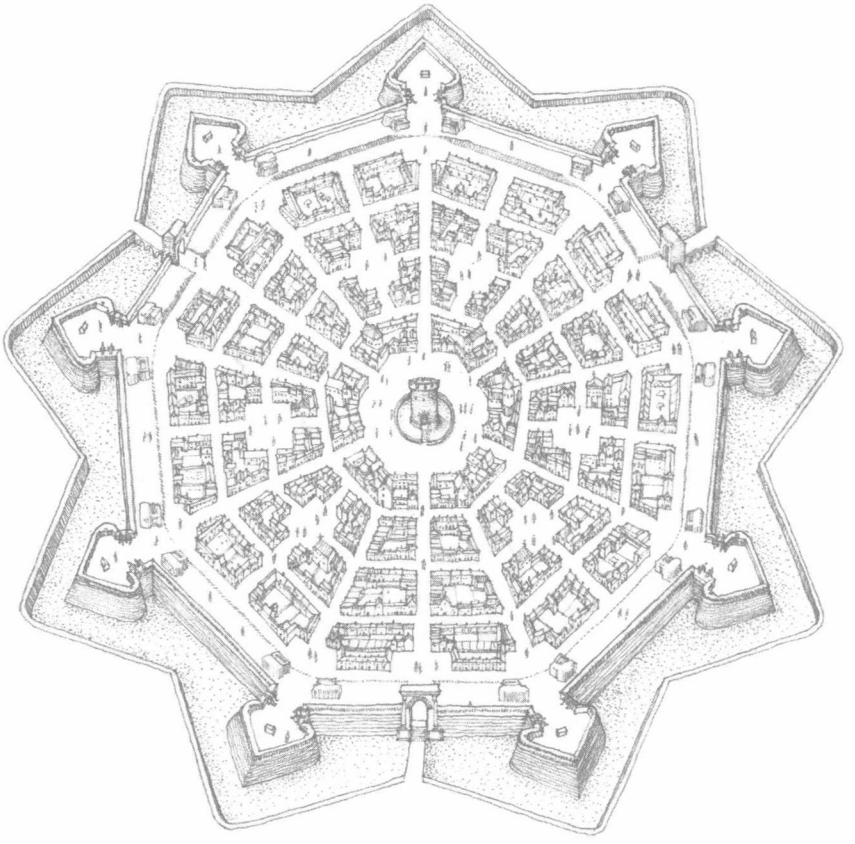
5 Circulation
Circulation: Movement through Space 252
Circulation Elements 253
Approach 254
Entrance 262
Configuration of the Path 276
Path-Space Relationships 290
Form of the Circulation Space 294

6 Proportion & Scale
Proportion & Scale 306
Material Proportions 307
Structural Proportions 308
Manufactured Proportions 310
Proportioning Systems 311
Golden Section 314
Regulating Lines 318
Classical Orders 320
Renaissance Theories 326
Modulor 330
Ken 334
Anthropometry 338
Scale 341
Visual Scale 342
Human Scale 344
A Scalar Comparison 346

7 Principles
Ordering Principles 350
Axis 352
Symmetry 360
Hierarchy 370
Datum 380
Rhythm 396
Repetition 397
Transformation 418

Conclusion 422

A Selected Bibliography 425
Glossary 427
Index of Buildings 435
Index of Designers 441
Index of Subject Matter 443



1

Primary Elements

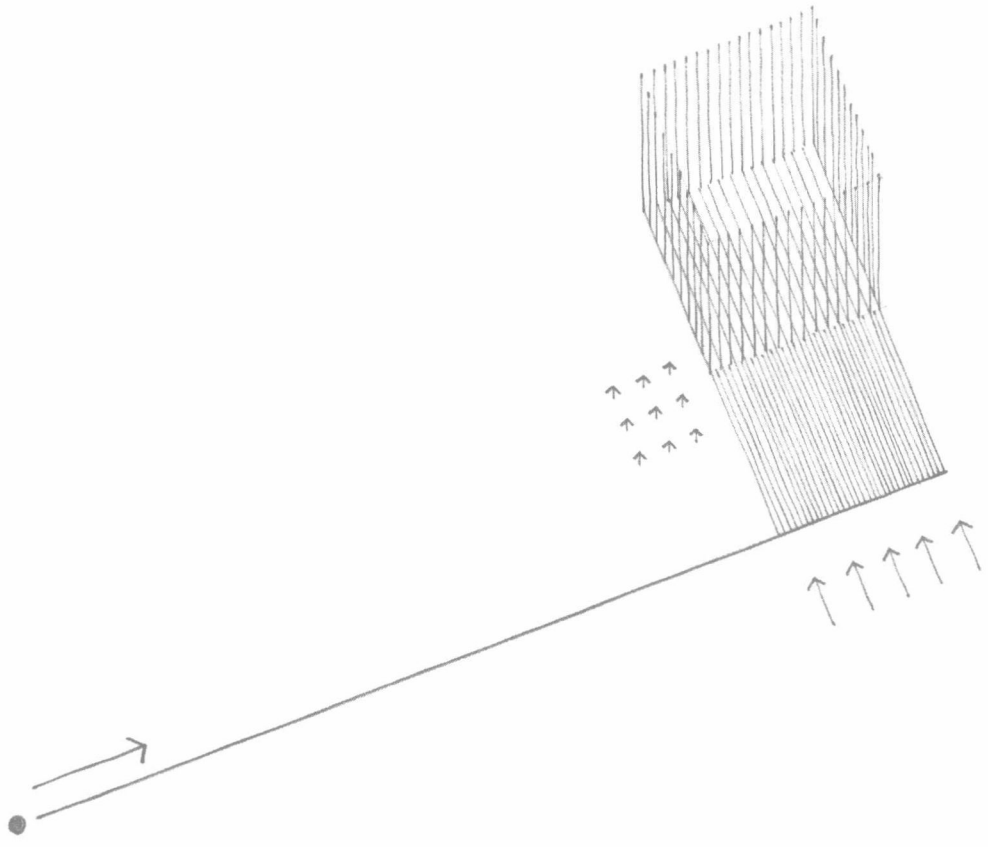
"All pictorial form begins with the point that sets itself in motion . . .
The point moves . . . and the line comes into being—the first dimension.
If the line shifts to form a plane, we obtain a two-dimensional element.
In the movement from plane to spaces, the clash of planes gives rise to
body (three-dimensional) . . . A summary of the kinetic energies
which move the point into a line, the line into a plane,
and the plane into a spatial dimension."

Paul Klee
The Thinking Eye: The Notebooks of Paul Klee
(English translation)
1961

This opening chapter presents the primary elements of form in the order of their growth from the point to a one-dimensional line, from the line to a two-dimensional plane, and from the plane to a three-dimensional volume. Each element is first considered as a conceptual element, then as a visual element in the vocabulary of architectural design.

As conceptual elements, the point, line, plane, and volume are not visible except to the mind's eye. While they do not actually exist, we nevertheless feel their presence. We can sense a point at the meeting of two lines, a line marking the contour of a plane, a plane enclosing a volume, and the volume of an object that occupies space.

When made visible to the eye on paper or in three-dimensional space, these elements become form with characteristics of substance, shape, size, color, and texture. As we experience these forms in our environment, we should be able to perceive in their structure the existence of the primary elements of point, line, plane, and volume.



As the prime generator of form, the

Point indicates a position in space.

Line A point extended becomes a with properties of:

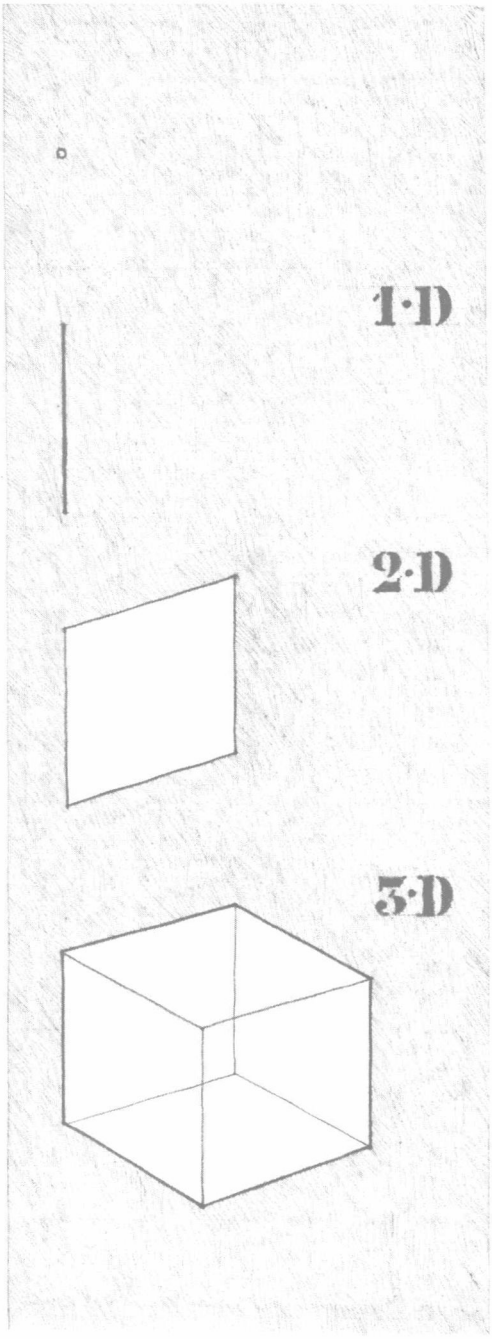
- length
- direction
- position

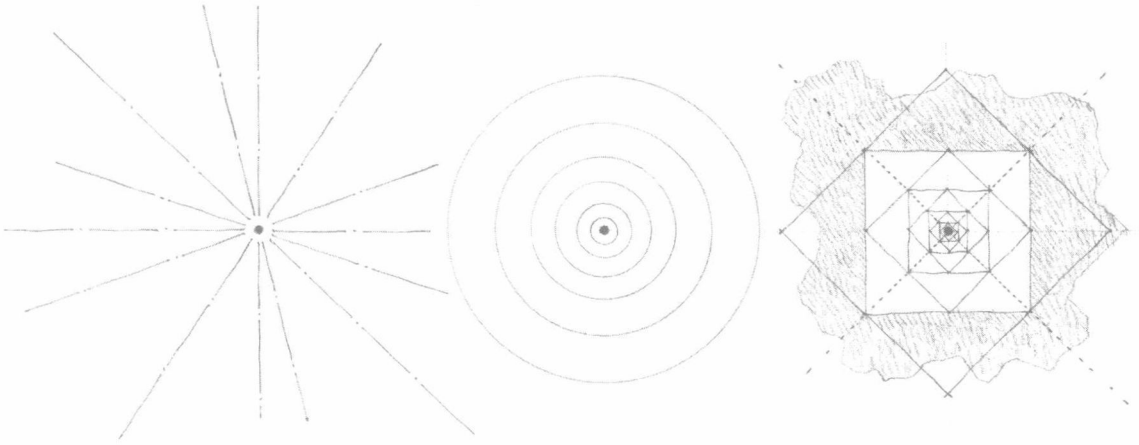
Plane A line extended becomes a with properties of:

- length and width
- shape
- surface
- orientation
- position

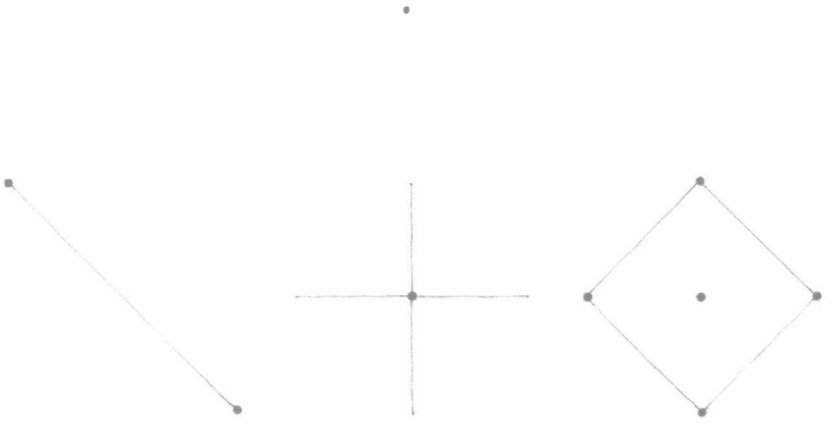
Volume A plane extended becomes a with properties of:

- length, width, and depth
- form and space
- surface
- orientation
- position



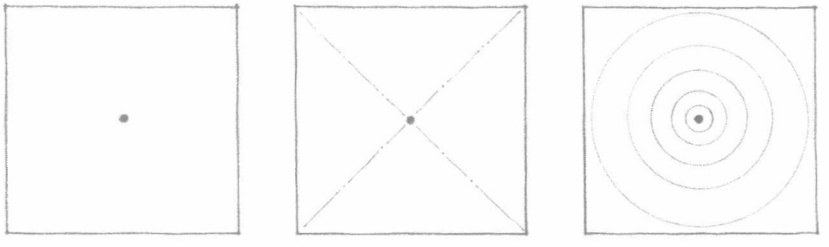


A point marks a position in space. Conceptually, it has no length, width, or depth, and is therefore static, centralized, and directionless.

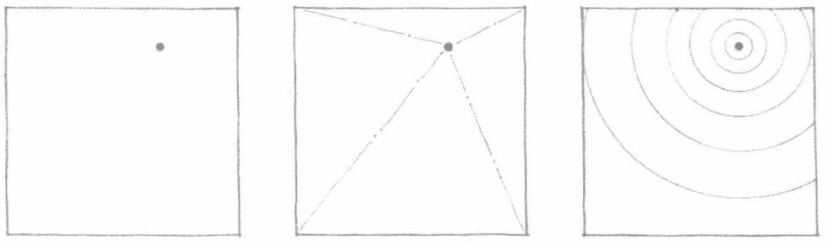


As the prime element in the vocabulary of form, a point can serve to mark:

- the two ends of a line
- the intersection of two lines
- the meeting of lines at the corner of a plane or volume
- the center of a field



Although a point theoretically has neither shape nor form, it begins to make its presence felt when placed within a visual field. At the center of its environment, a point is stable and at rest, organizing surrounding elements about itself and dominating its field.



When the point is moved off-center, however, its field becomes more aggressive and begins to compete for visual supremacy. Visual tension is created between the point and its field.

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