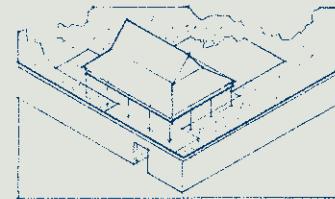
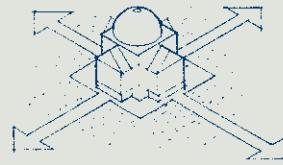
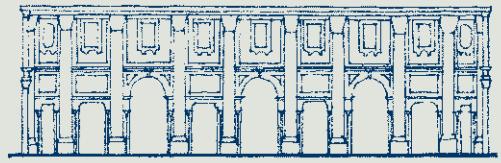
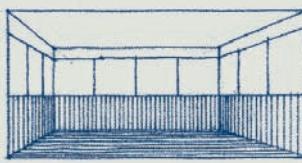
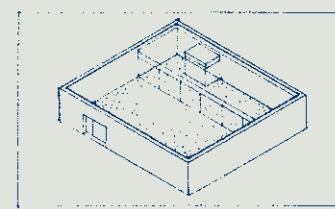
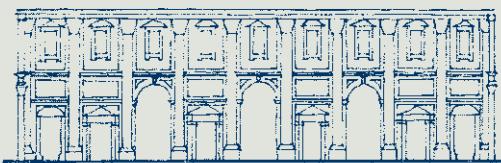
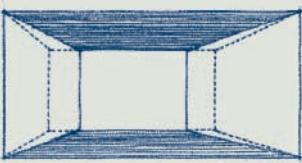


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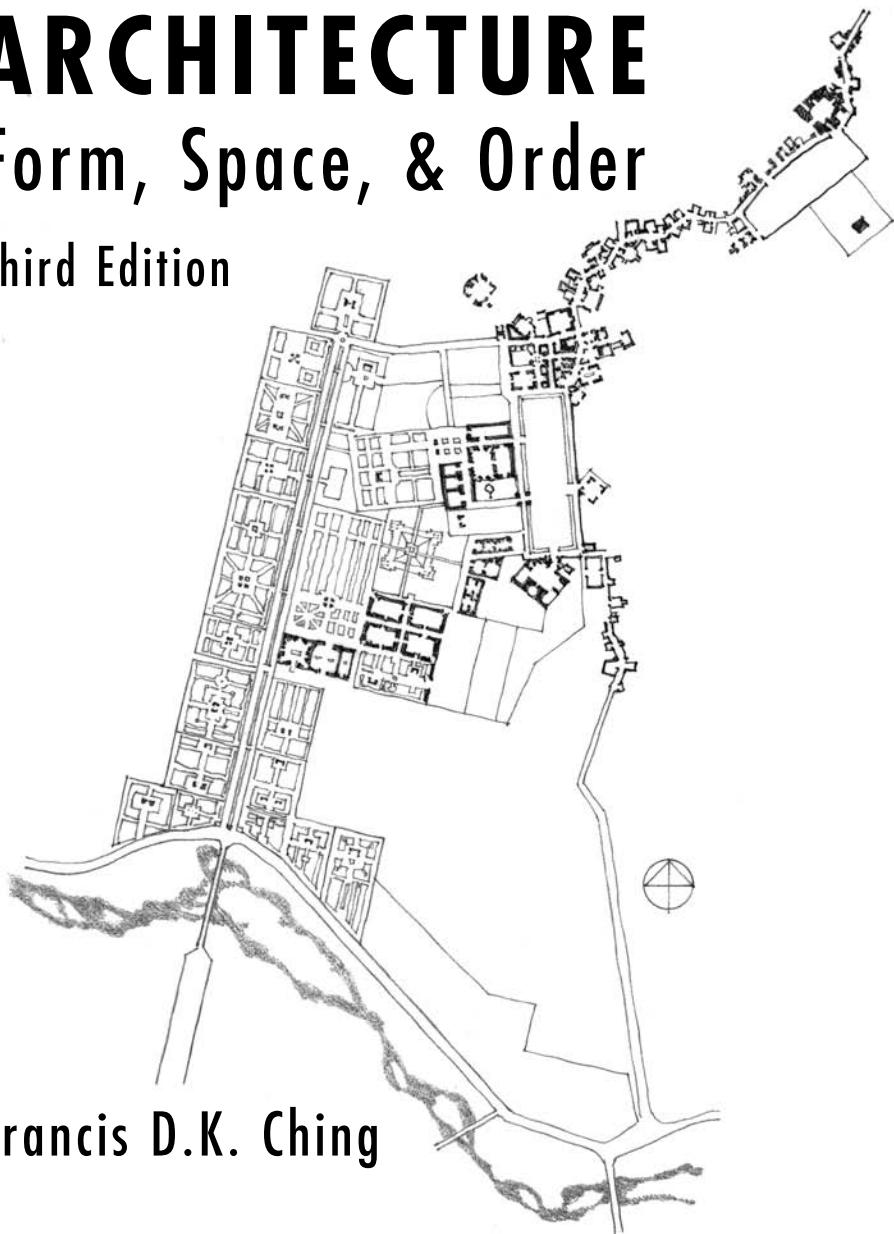
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ARCHITECTURE

Form, Space, & Order

Third Edition



Francis D.K. Ching



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Published by John Wiley & Sons, Inc., Hoboken, New Jersey

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Library of Congress Cataloging-in-Publication Data:

Ching, Frank, 1943-

Architecture--form, space, & order / Francis D.K. Ching. -- 3rd ed.

p. cm.

Includes bibliographical references and index.

ISBN 978-0-471-75216-5 (pbk.)

1. Architecture--Composition, proportion, etc. 2. Space (Architecture) I. Title.

NA2760.C46 2007

720.1--dc22

2007002358

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

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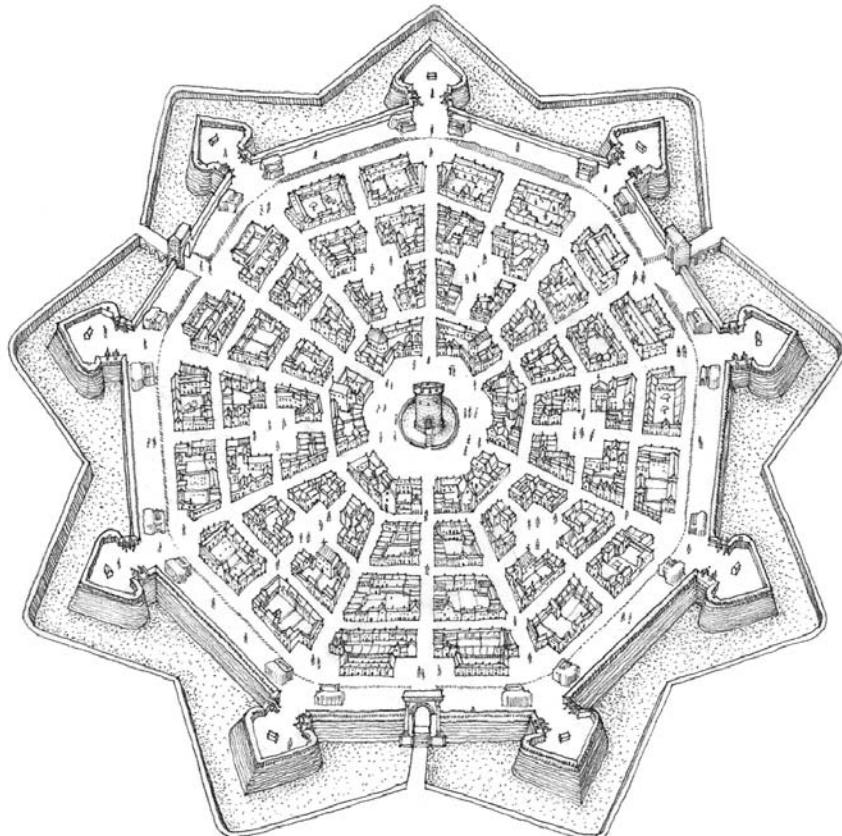
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The original edition of this study introduced the student of architecture to form and space and the principles that guide their ordering in the built environment. Form and space are the critical means of architecture that comprise a design vocabulary 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. This third edition continues to illustrate the ways the fundamental elements and principles of architectural design manifest themselves over the course of human history but adds an electronic component to introduce the aspects of time and movement to the exposition of elements and principles.

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.

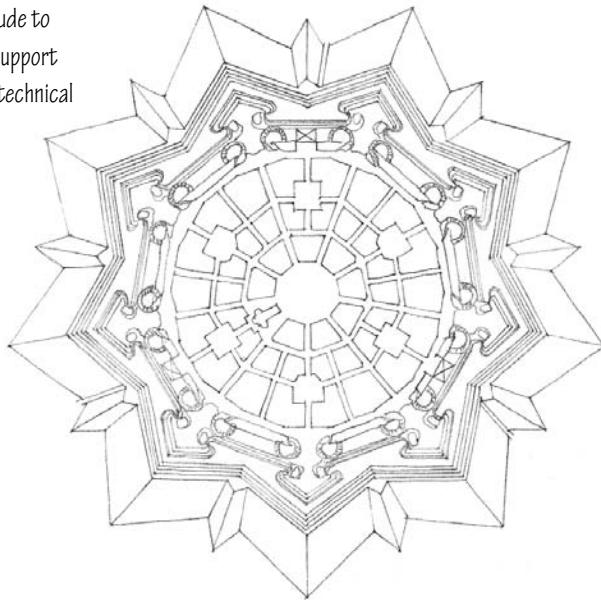
The illustrated examples are neither exhaustive nor necessarily the prototypes for the concepts and principles discussed. Their selection merely serves to illuminate and clarify the formal and spatial ideas being explored. These seminal ideas transcend their historical context and encourage speculation: 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.

ACKNOWLEDGEMENTS

I am 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 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 goes 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 this third edition, I am thankful to Michele Chiunini, Ahmeen Farooq, and Dexter Hulse for their thoughtful reviews of the second edition. While I have 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 this third edition.



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

Architecture is generally conceived—designed—and 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.

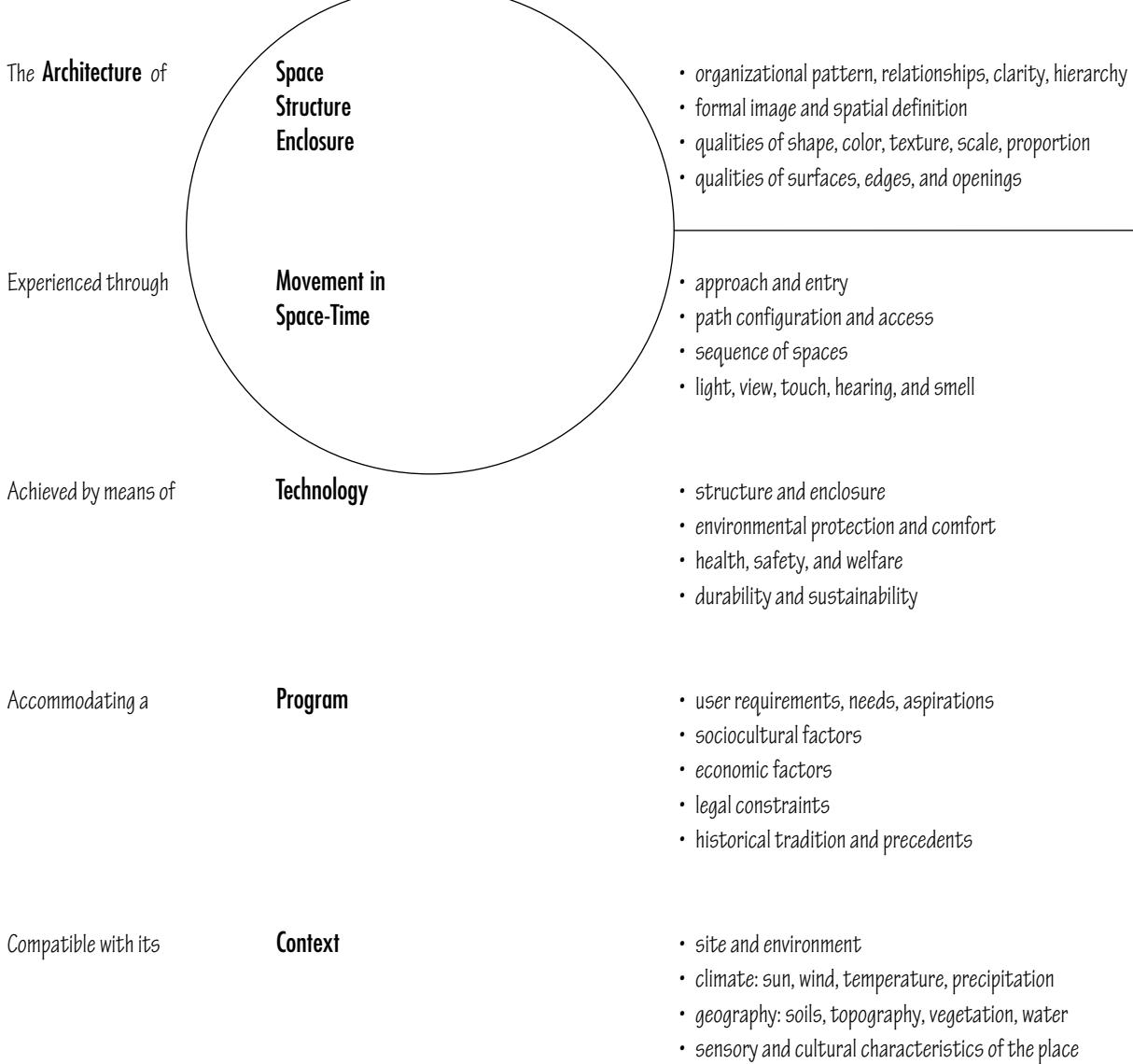
The analogy may be made that one must know and understand the alphabet before words can be formed and a vocabulary developed; one must understand the rules of grammar and syntax before sentences can be constructed; one must understand the principles of composition before essays, novels, and the like 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.

INTRODUCTION

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



...& Orders**Physical Form and Space**

- solids and voids
- interior and exterior

Systems and organizations of

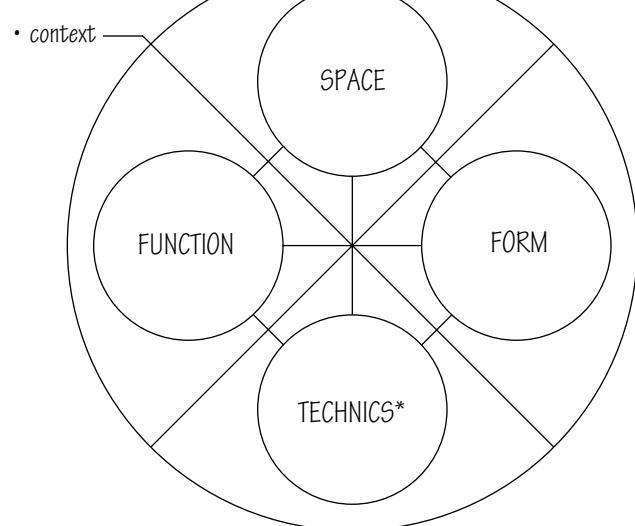
- space
- structure
- enclosure
- machines

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

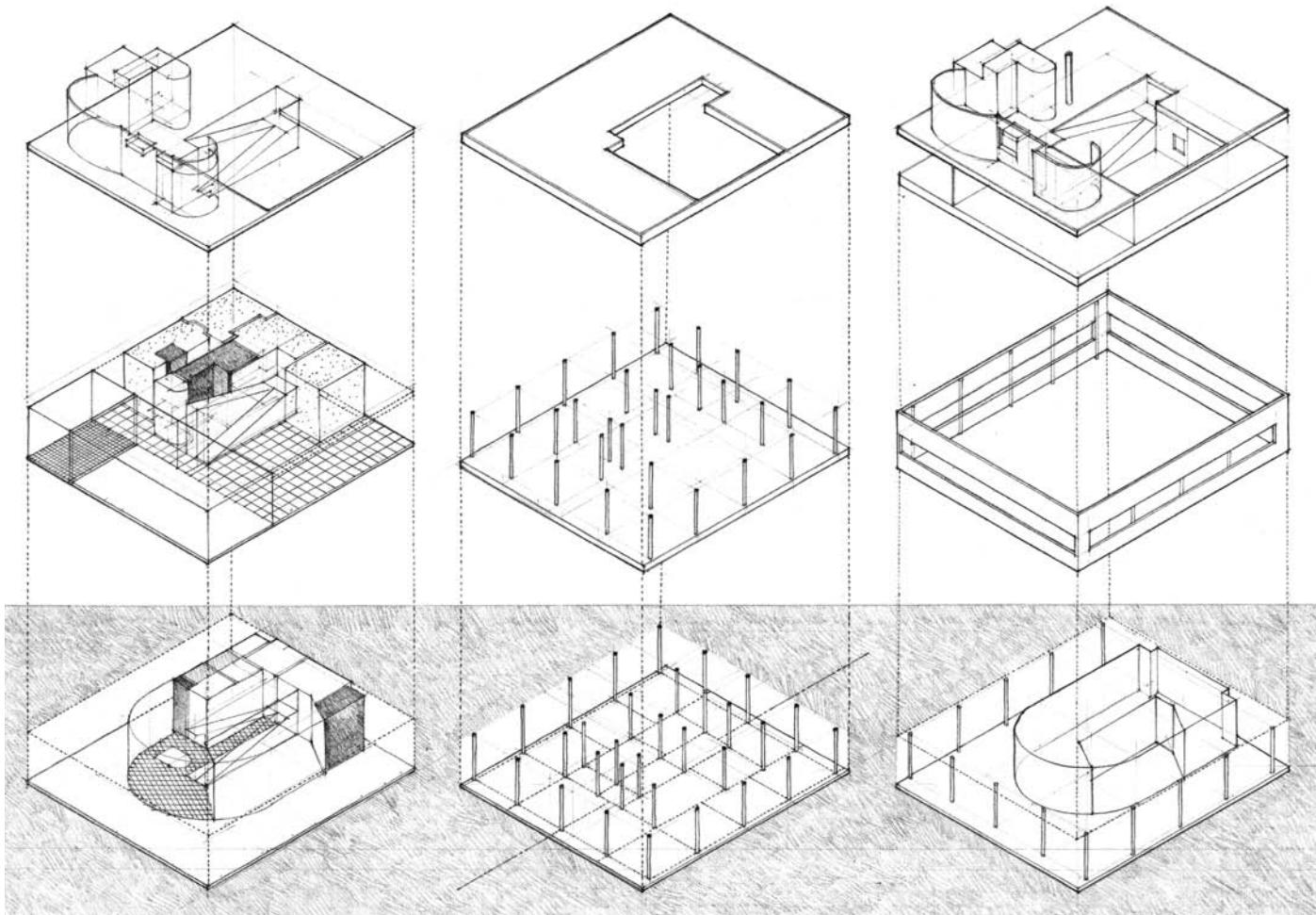
Conceptual Comprehension of the ordered or disordered relationships among a building's elements and systems, and responding to the meanings they evoke

- images
- patterns
- signs
- symbols



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

INTRODUCTION



Spatial System

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

Structural system

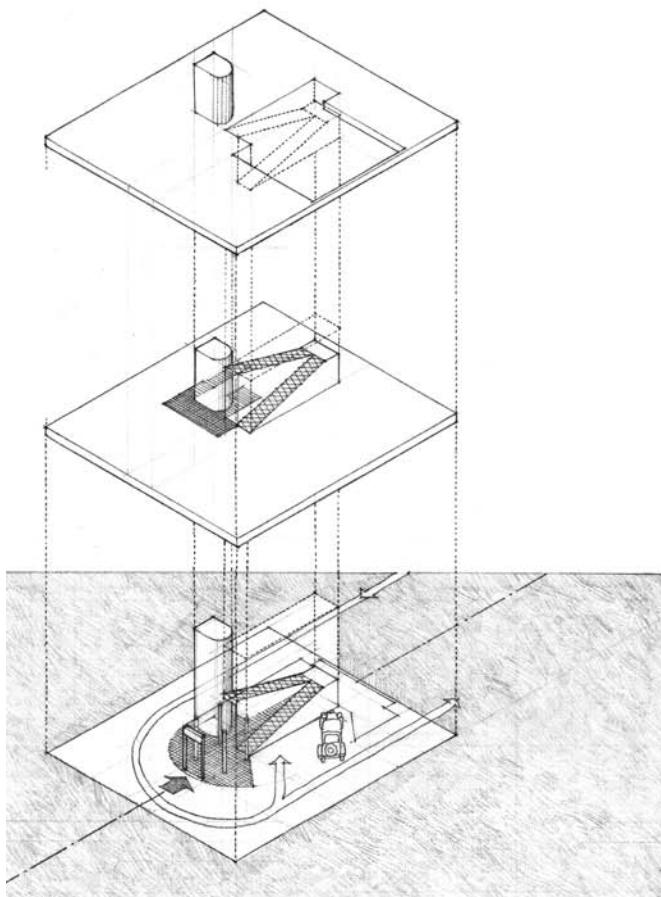
- A grid of columns supports horizontal beams and slabs.
- The cantilever acknowledges the direction of approach along the longitudinal axis.

Enclosure system

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

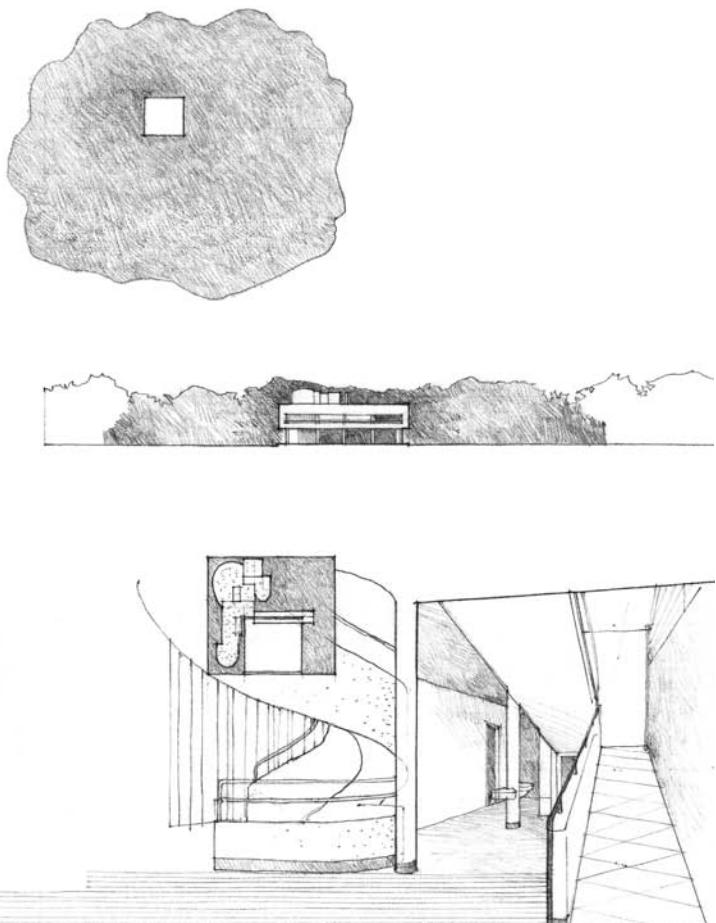
Villa Savoye, Poissy, east of Paris, 1923–31, Le Corbusier

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.

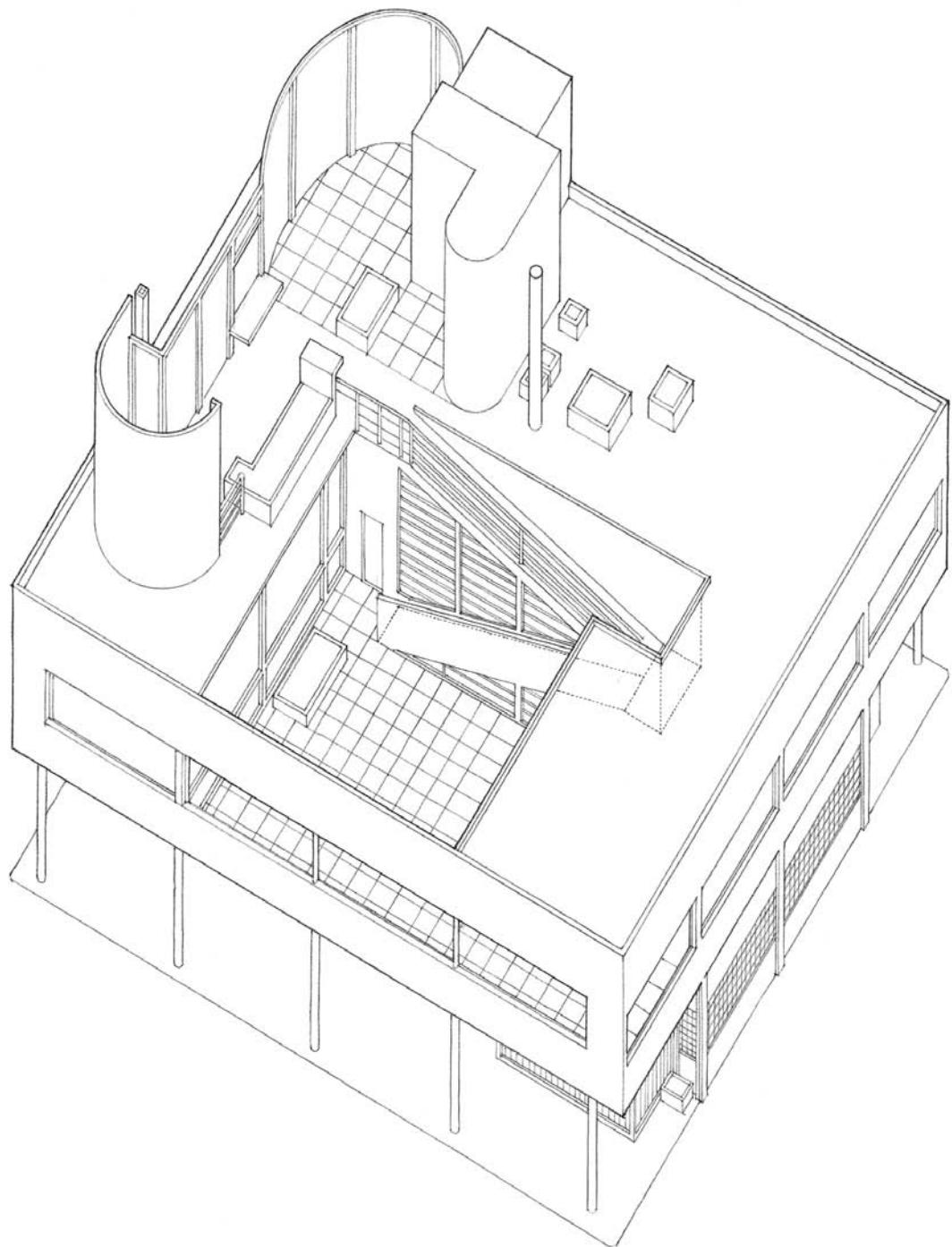


Context

- 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



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.”

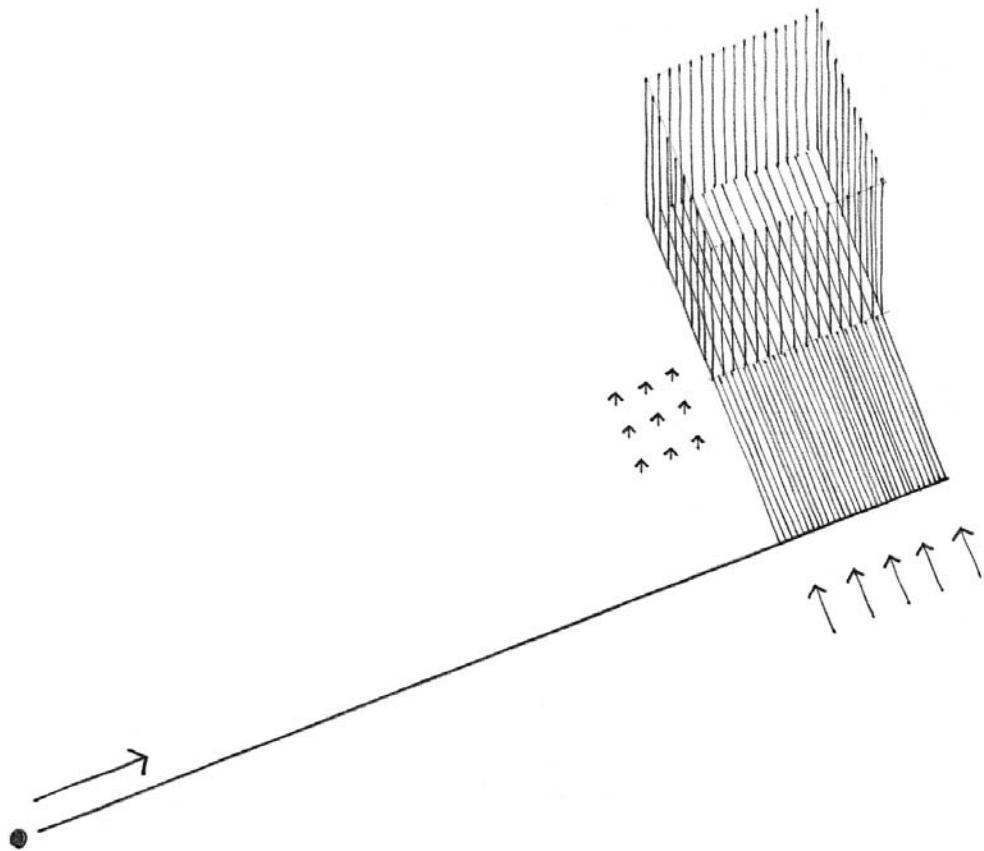
Paul Klee
The Thinking Eye: The Notebooks of Paul Klee
(English translation)
1961

PRIMARY ELEMENTS

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. •

A point extended becomes a
Line with properties of:

- length
- direction
- position



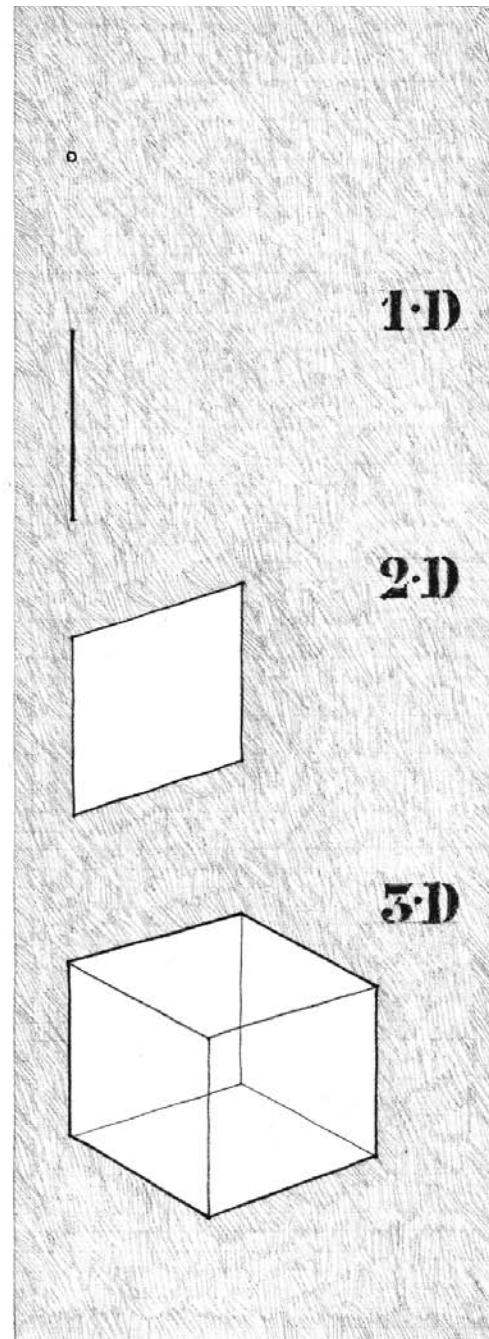
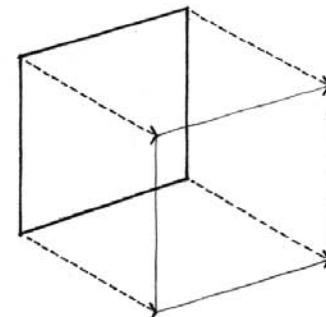
A line extended becomes a
Plane with properties of:

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



A plane extended becomes a
Volume with properties of:

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



Point

1·D

Line

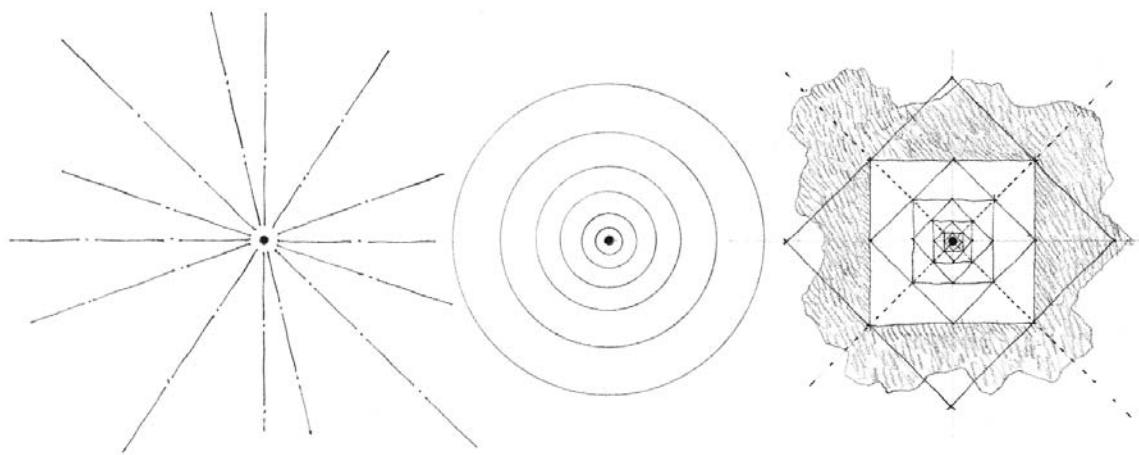
2·D

Plane

3·D

Volume

POINT



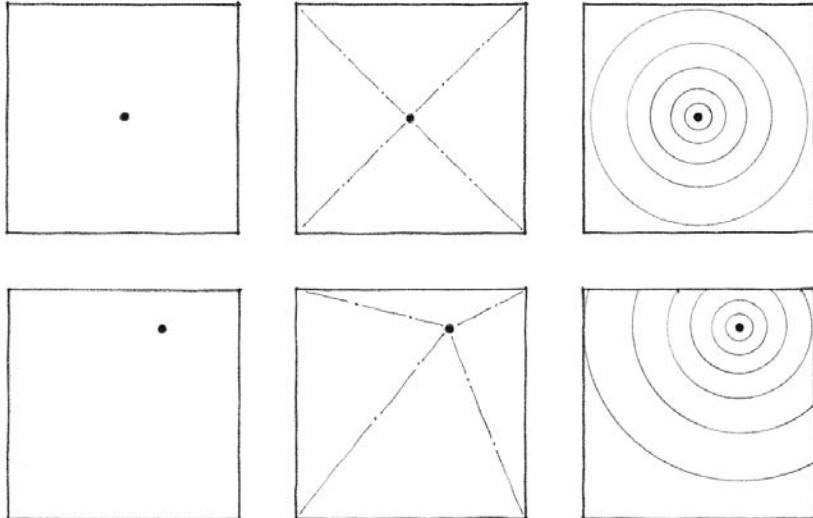
A point marks a position in space. Conceptually, it has no length, width, or depth, and is therefore static, centralized, and directionless.

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

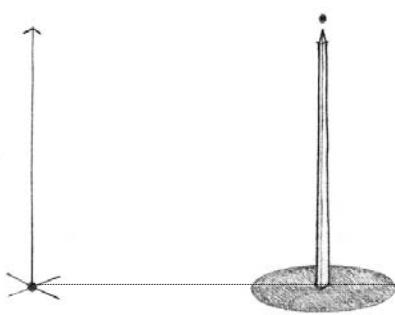
- the two ends of a line
- the intersection of two lines
- the meeting of lines at the corner of a plane or volume
- the center of a field



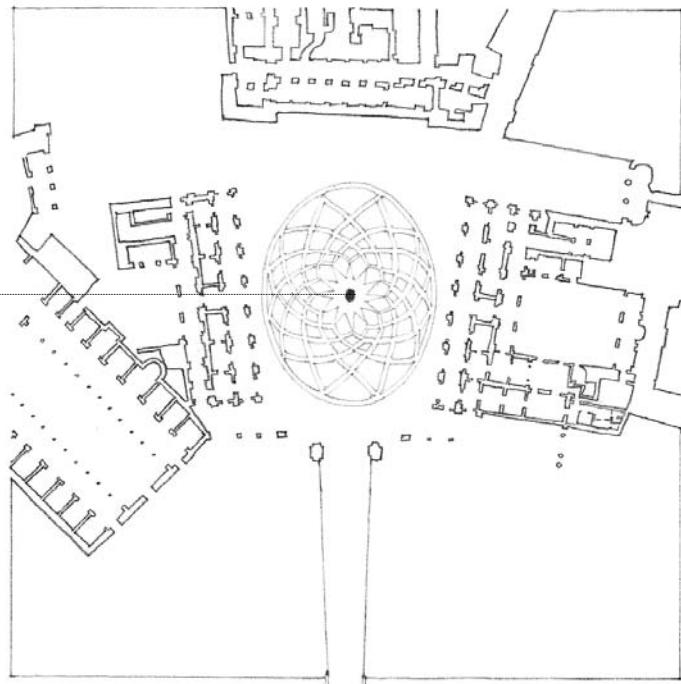
Although a point theoretically has neither shape nor form, it begins to make its presence felt when placed within a visual field. At the center of its environment, a point is stable and at rest, organizing surrounding elements about itself and dominating its field.



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.

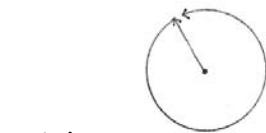


A point has no dimension. To visibly mark a position in space or on the ground plane, a point must be projected vertically into a linear form, as a column, obelisk, or tower. Any such columnar element is seen in plan as a point and therefore retains the visual characteristics of a point. Other point-generated forms that share these same visual attributes are the:



Piazza del Campidoglio, Rome, c. 1544, Michelangelo Buonarroti.

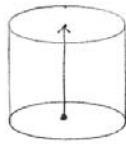
The equestrian statue of Marcus Aurelius marks the center of this urban space.



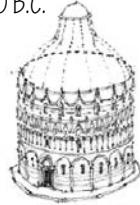
- circle



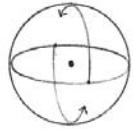
Tholos of Polycleitos, Epidauros, Greece, c. 350 B.C.



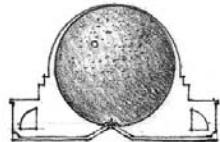
- cylinder



Baptistry at Pisa, Italy, 1153–1265, Dioti Salvi



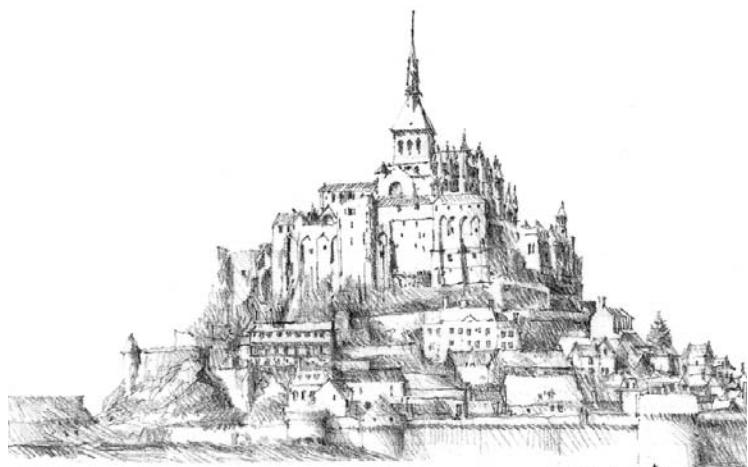
- sphere



Cenotaph for Sir Isaac Newton, Project, 1784, Étienne-Louis Boullée

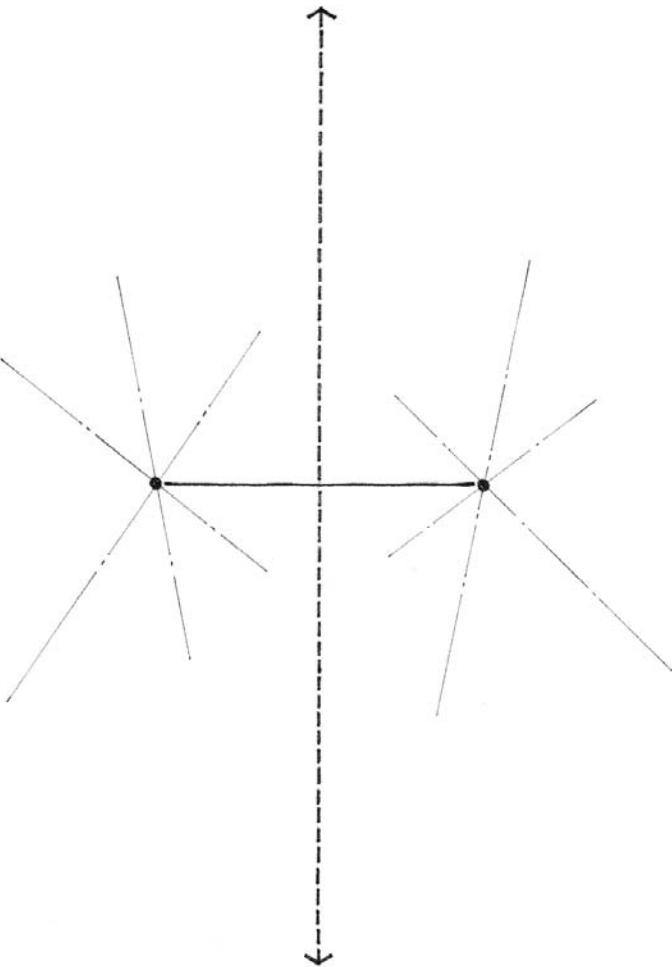
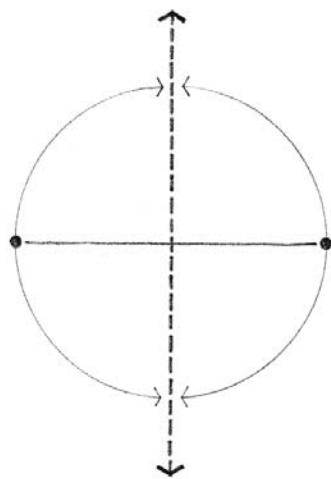
Mont St. Michel, France, 13th century and later.

The pyramidal composition culminates in a spire that serves to establish this fortified monastery as a specific place in the landscape.



TWO POINTS

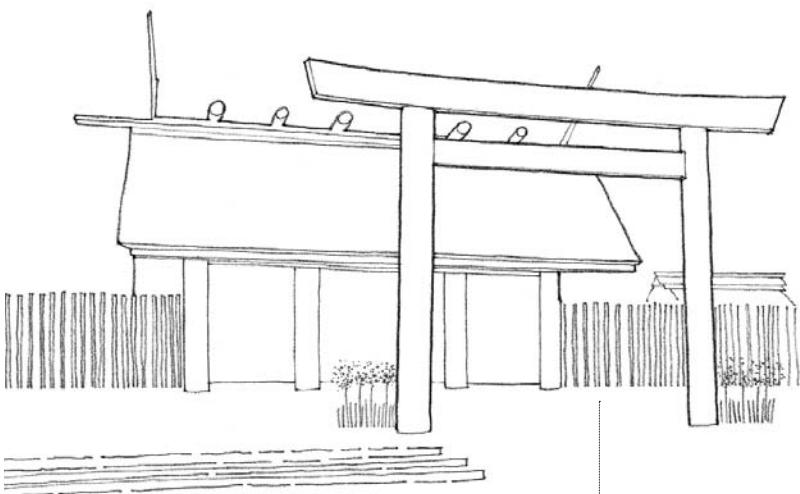
Two points describe a line that connects them. Although the points give this line finite length, the line can also be considered a segment of an infinitely longer path.



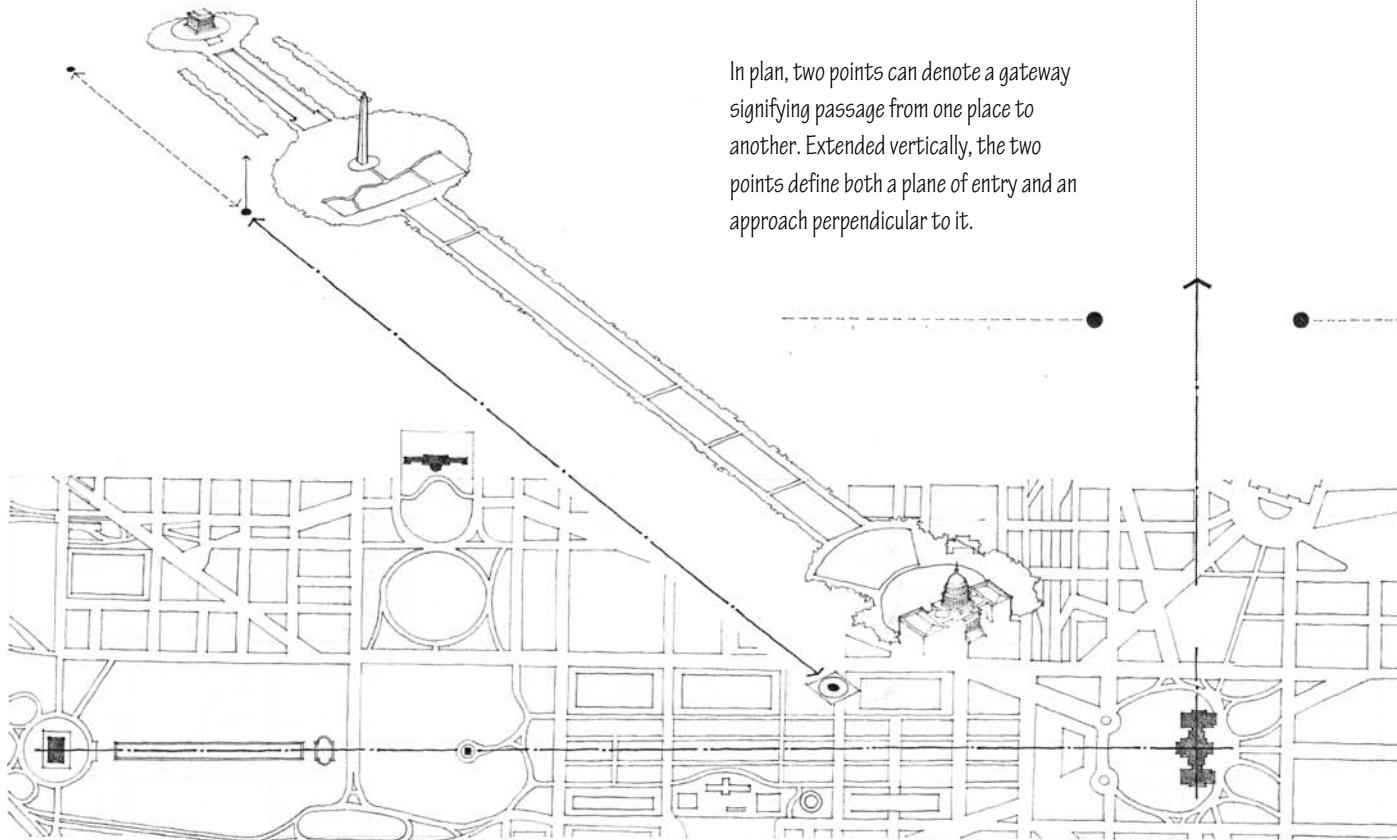
Two points further suggest an axis perpendicular to the line they describe and about which they are symmetrical. Because this axis may be infinite in length, it can be at times more dominant than the described line.

In both cases, however, the described line and the perpendicular axis are optically more dominant than the infinite number of lines that may pass through each of the individual points.

Two points established in space by columnar elements or centralized forms can define an axis, an ordering device used throughout history to organize building forms and spaces.

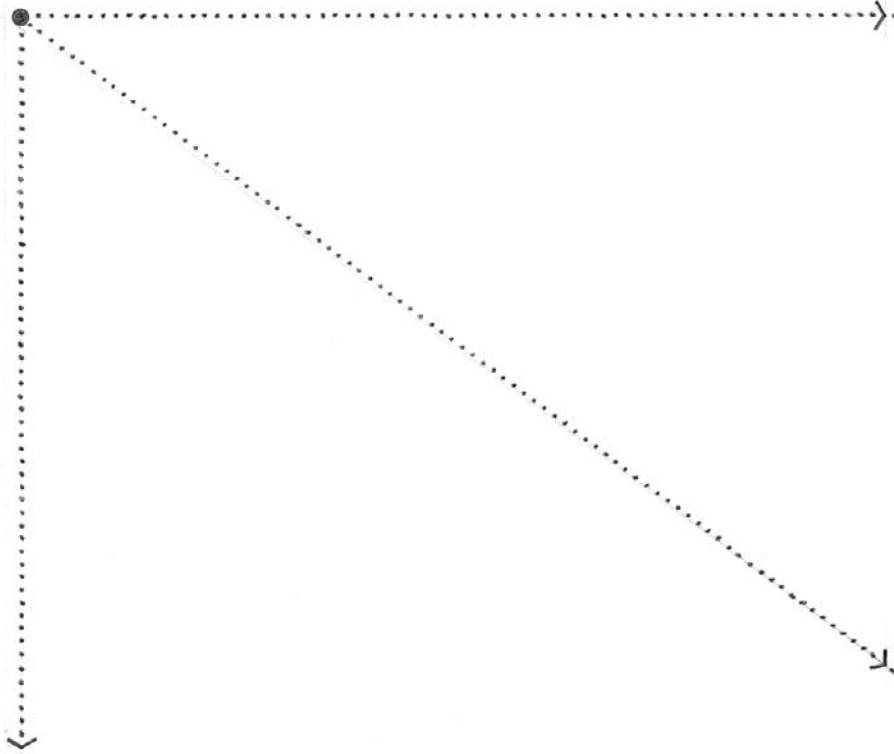


Torii, Ise Shrine, Mie Prefecture, Japan, A.D. 690



The Mall, Washington, D.C., lies along the axis established by the Lincoln Memorial, the Washington Monument, and the United States Capitol building.

LINE



A point extended becomes a line. Conceptually, a line has length, but no width or depth. Whereas a point is by nature static, a line, in describing the path of a point in motion, is capable of visually expressing direction, movement, and growth.

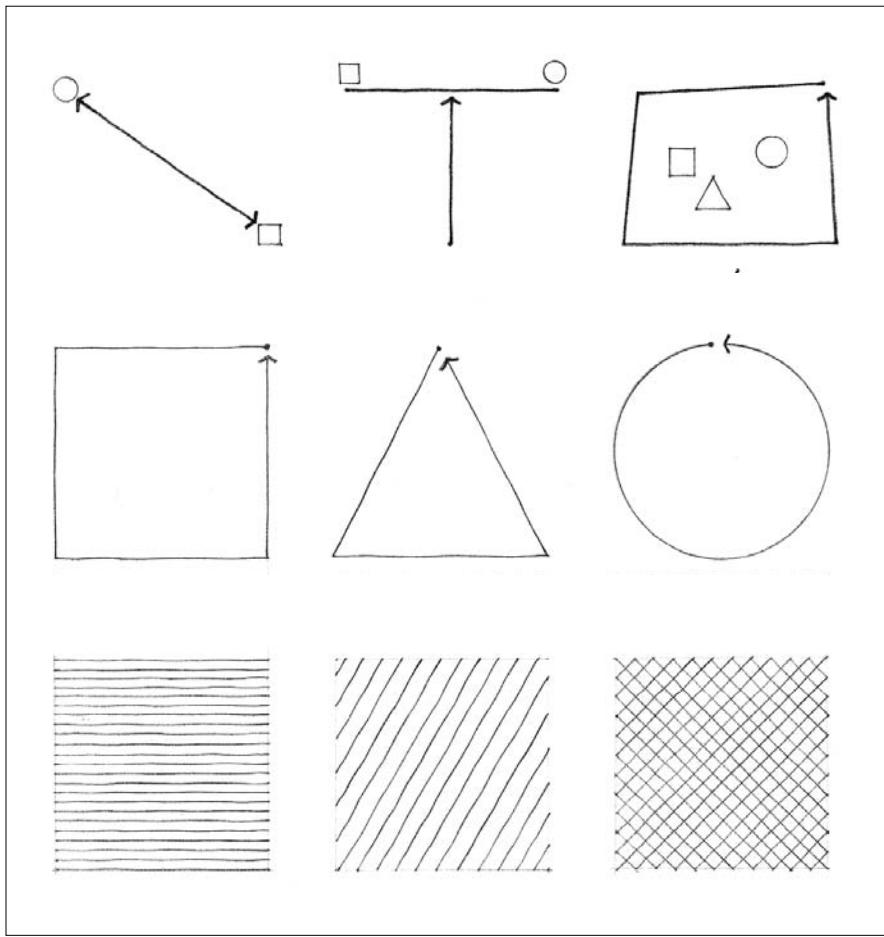
A line is a critical element in the formation of any visual construction.

It can serve to:

- join, link, support, surround, or intersect other visual elements

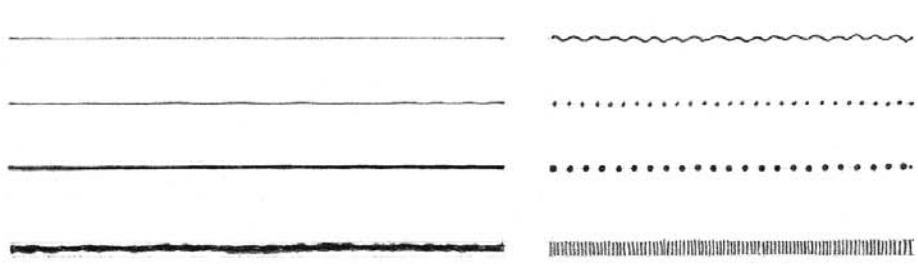
- describe the edges of and give shape to planes

- articulate the surfaces of planes



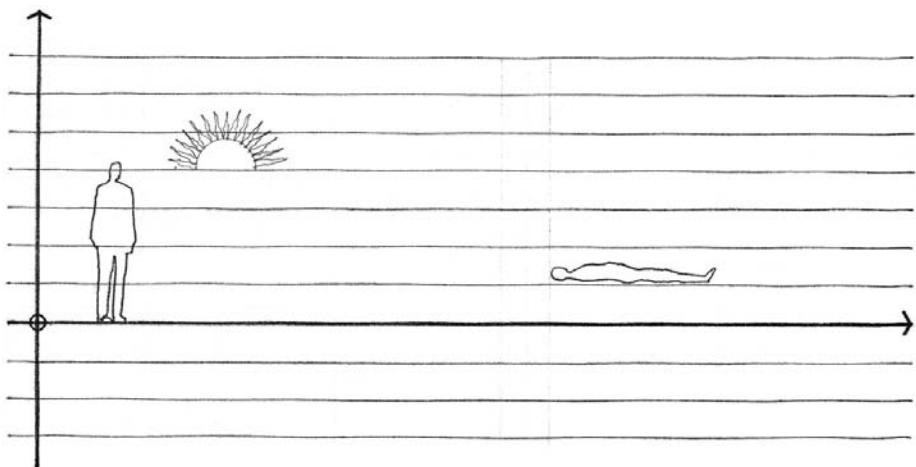
Although a line theoretically has only one dimension, it must have some degree of thickness to become visible. It is seen as a line simply because its length dominates its width. The character of a line, whether taut or limp, bold or tentative, graceful or ragged, is determined by our perception of its length-width ratio, its contour, and its degree of continuity.

Even the simple repetition of like or similar elements, if continuous enough, can be regarded as a line. This type of line has significant textural qualities.

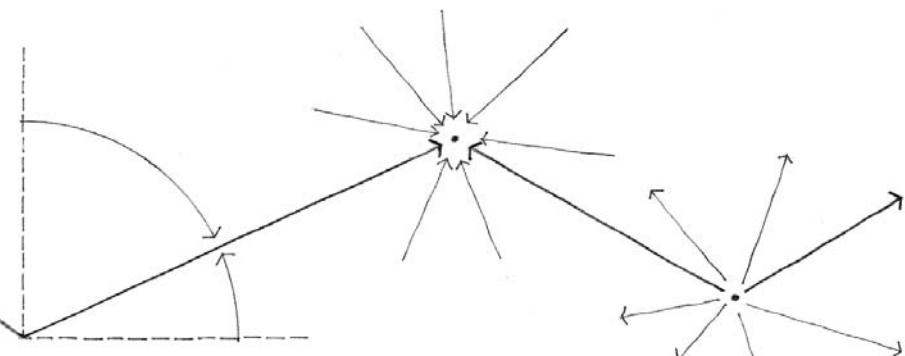


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The orientation of a line affects its role in a visual construction. While a vertical line can express a state of equilibrium with the force of gravity, symbolize the human condition, or mark a position in space, a horizontal line can represent stability, the ground plane, the horizon, or a body at rest.

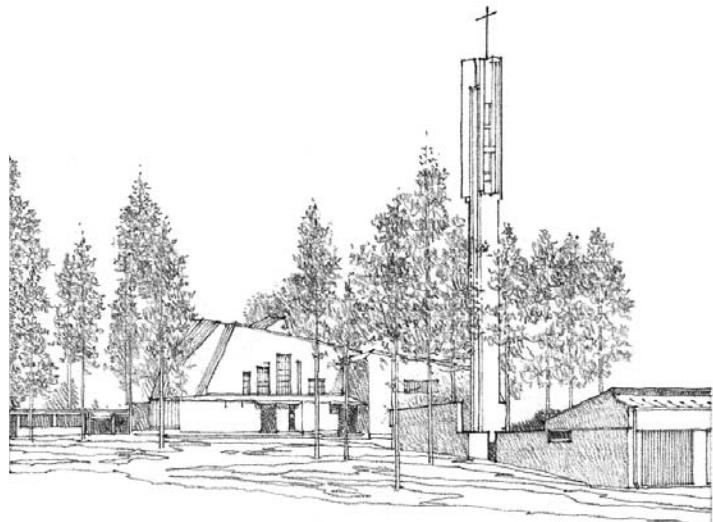


An oblique line is a deviation from the vertical or horizontal. It may be seen as a vertical line falling or a horizontal line rising. In either case, whether it is falling toward a point on the ground plane or rising to a place in the sky, it is dynamic and visually active in its unbalanced state.

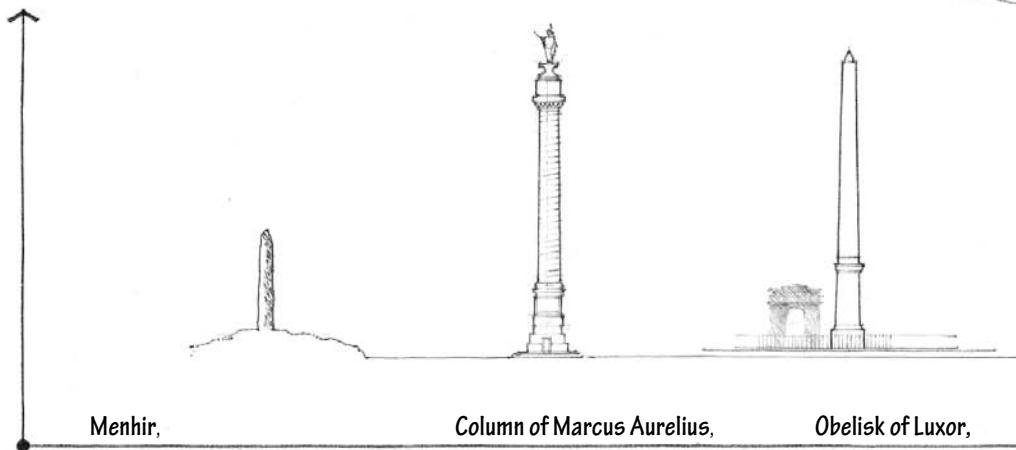


LINEAR ELEMENTS

Vertical linear elements, such as columns, obelisks, and towers, have been used throughout history to commemorate significant events and establish particular points in space.



Bell Tower, Church at Vuokseniska,
Finland, 1956, Alvar Aalto



Menhir,

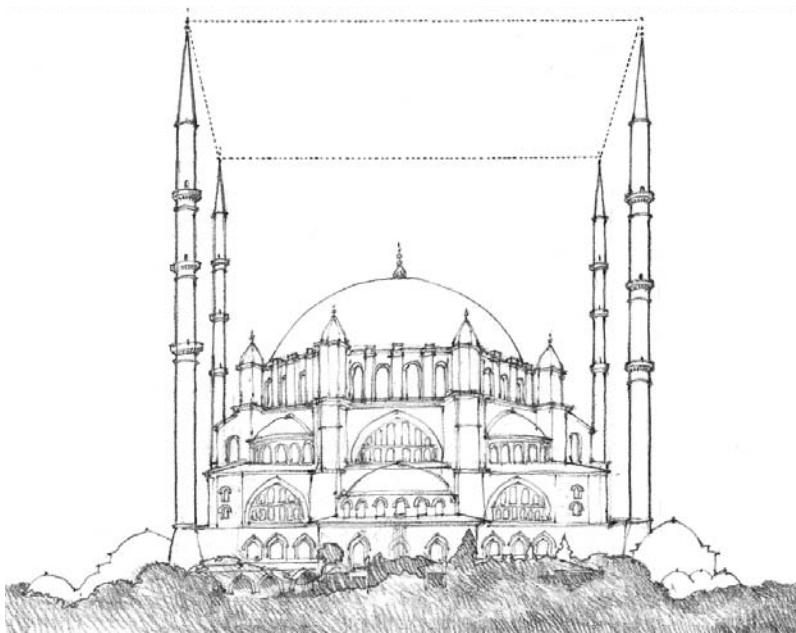
a prehistoric monument consisting of an upright megalith, usually standing alone but sometimes aligned with others.

Column of Marcus Aurelius,

Piazza Colonna, Rome, A.D. 174.
This cylindrical shaft commemorates the emperor's victory over Germanic tribes north of the Danube.

Obelisk of Luxor,

Place de la Concorde, Paris. The obelisk, which marked the entrance to the Amon temple at Luxor, was given by the viceroy of Egypt, Mohamed Ali, to Louis Philippe and installed in 1836.

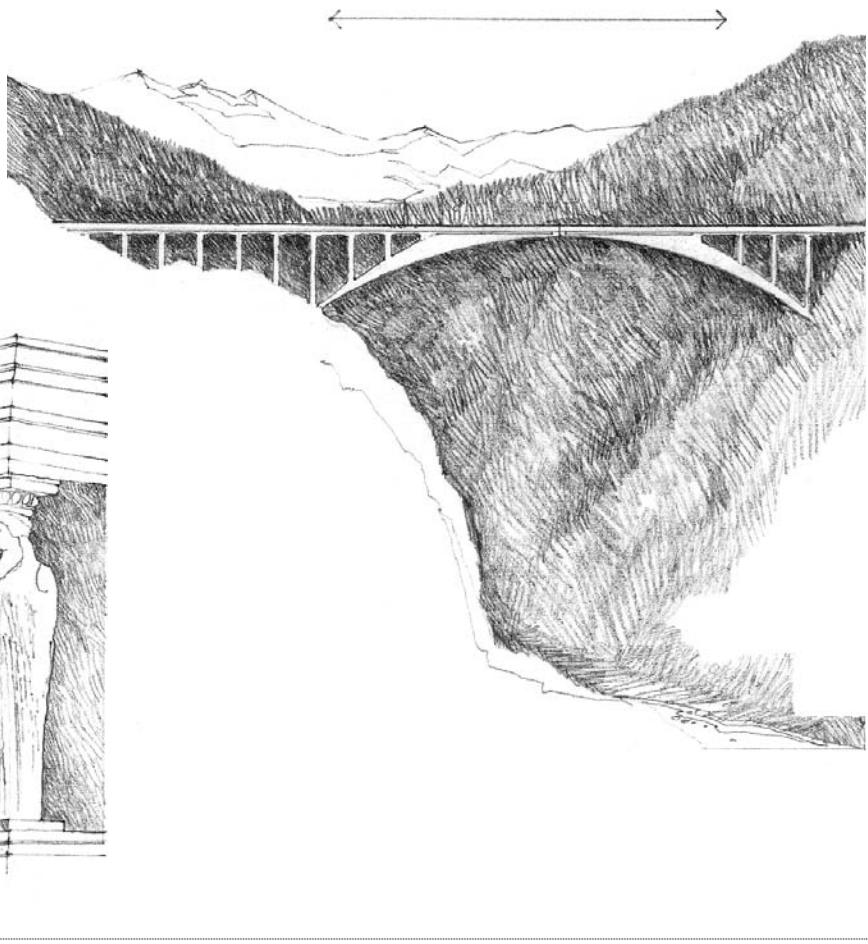


Vertical linear elements can also define a transparent volume of space. In the example illustrated to the left, four minaret towers outline a spatial field from which the dome of the Selim Mosque rises in splendor.

Selim Mosque, Edirne, Turkey,
A.D. 1569–75

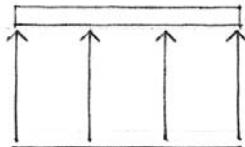
Linear members that possess the necessary material strength can perform structural functions. In these three examples, linear elements:

- express movement across space
- provide support for an overhead plane
- form a three-dimensional structural frame for architectural space



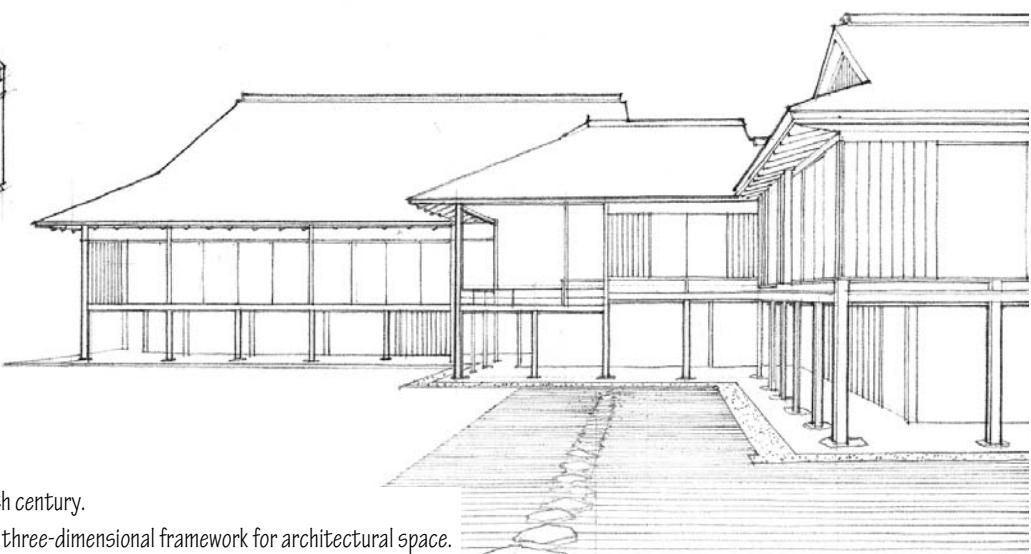
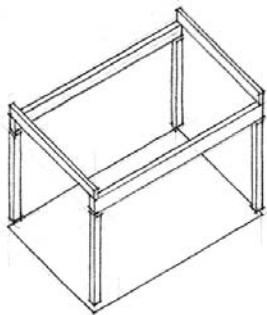
Caryatid Porch, The Erechtheion, Athens, 421–405 B.C., Mnesicles.

The sculptured female figures stand as columnar supports for the entablature.



Salginatobel Bridge, Switzerland, 1929–30, Robert Maillart.

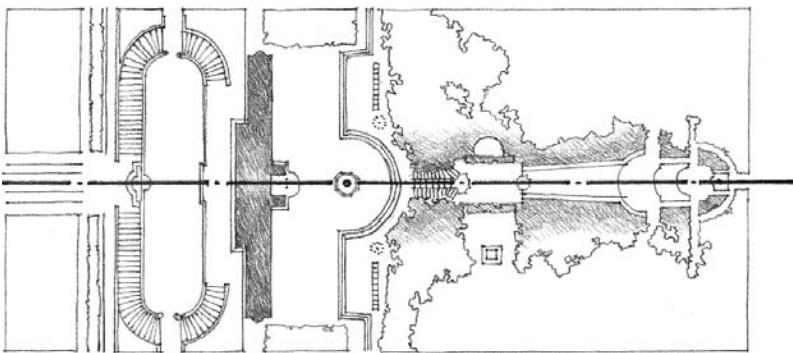
Beams and girders have the bending strength to span the space between their supports and carry transverse loads.



Katsura Imperial Villa, Kyoto, Japan, 17th century.

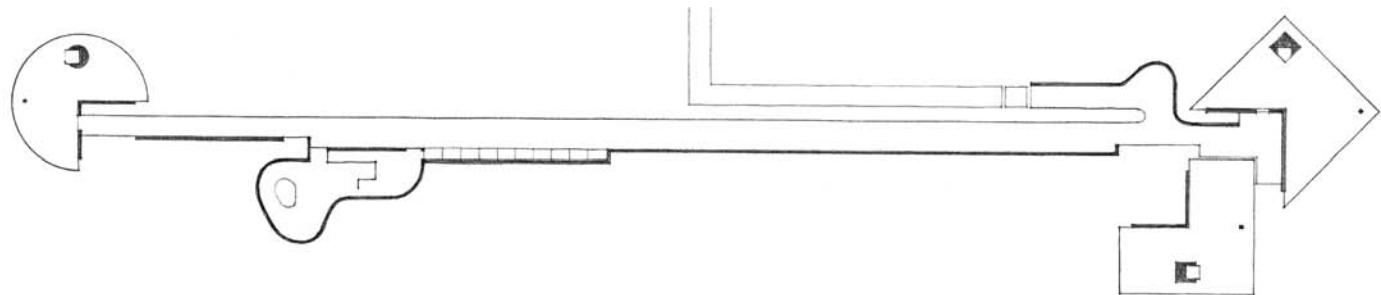
Linear columns and beams together form a three-dimensional framework for architectural space.

LINEAR ELEMENTS



A line can be an imagined element rather than a visible one in architecture. An example is the axis, a regulating line established by two distant points in space and about which elements are symmetrically arranged.

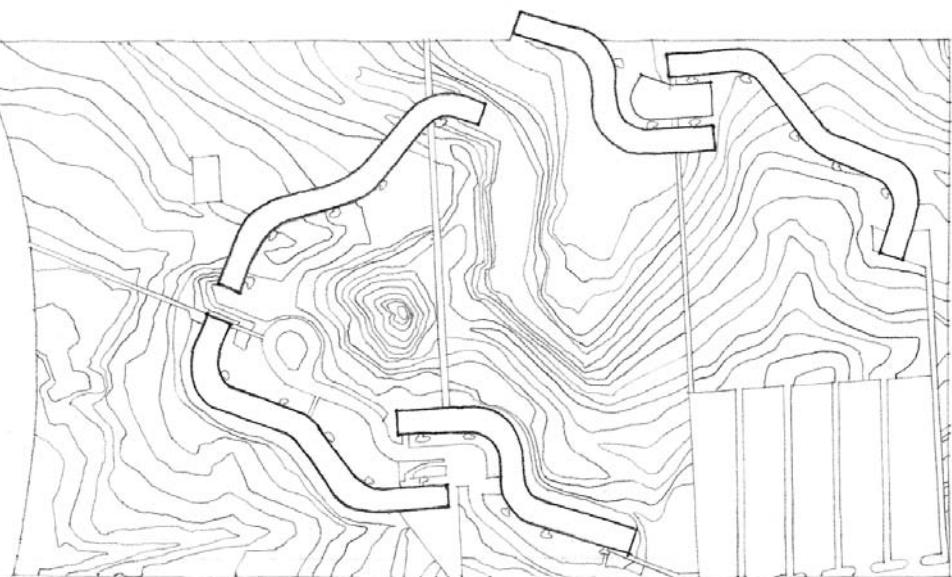
Villa Aldobrandini, Italy, 1598–1603, Giacomo Della Porta



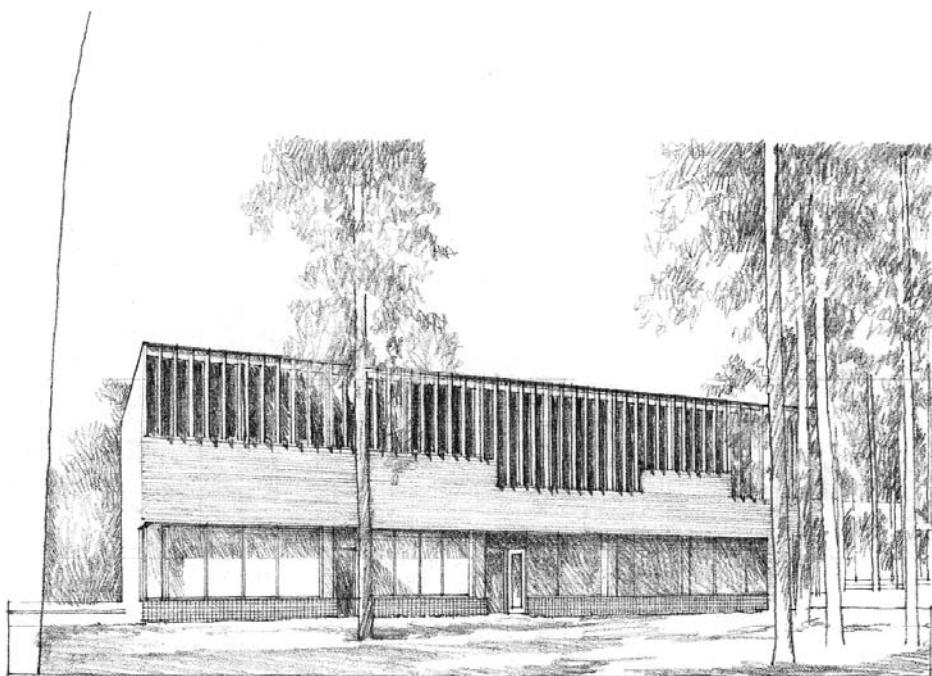
House 10, 1966, John Hejduk

Although architectural space exists in three dimensions, it can be linear in form to accommodate the path of movement through a building and link its spaces to one another.

Buildings also can be linear in form, particularly when they consist of repetitive spaces organized along a circulation path. As illustrated here, linear building forms have the ability to enclose exterior spaces as well as adapt to the environmental conditions of a site.

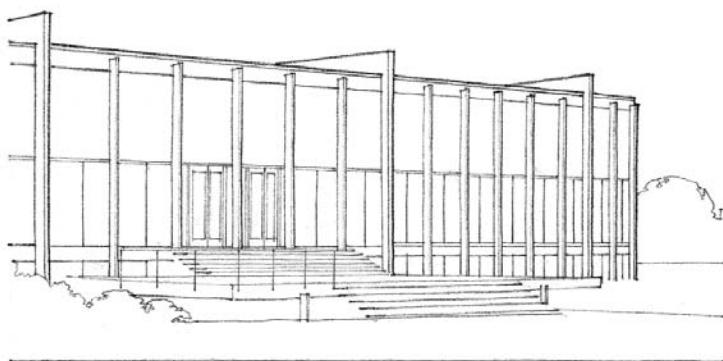


Cornell University Undergraduate Housing, Ithaca, New York, 1974, Richard Meier

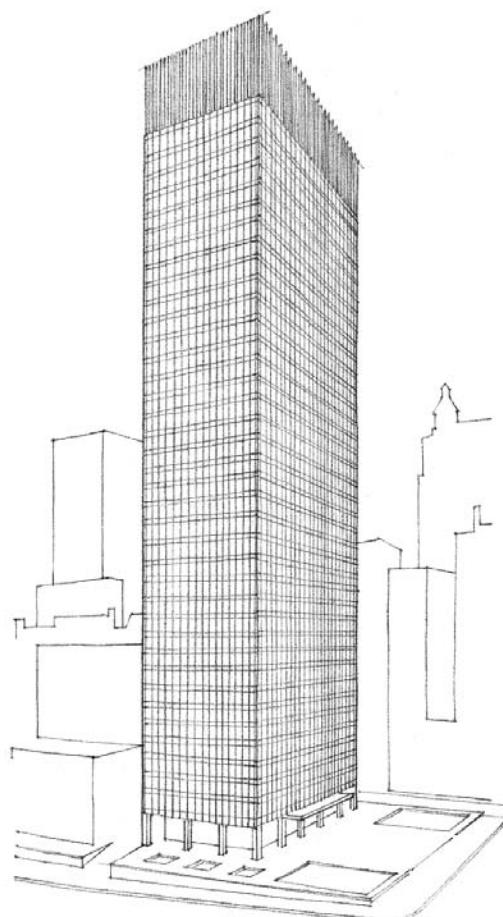


Town Hall, **Säynätsalo**, Finland, 1950–52, Alvar Aalto

At a smaller scale, lines articulate the edges and surfaces of planes and volumes. These lines can be expressed by joints within or between building materials, by frames around window or door openings, or by a structural grid of columns and beams. How these linear elements affect the texture of a surface will depend on their visual weight, spacing, and direction.

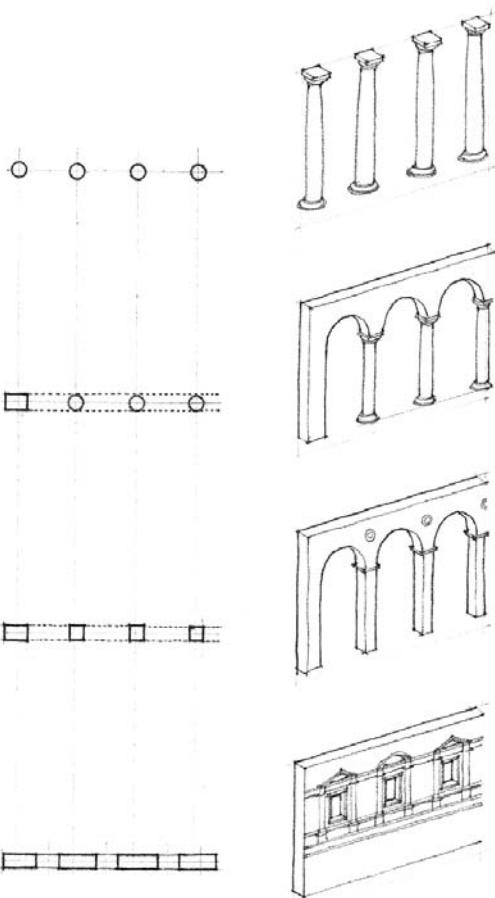
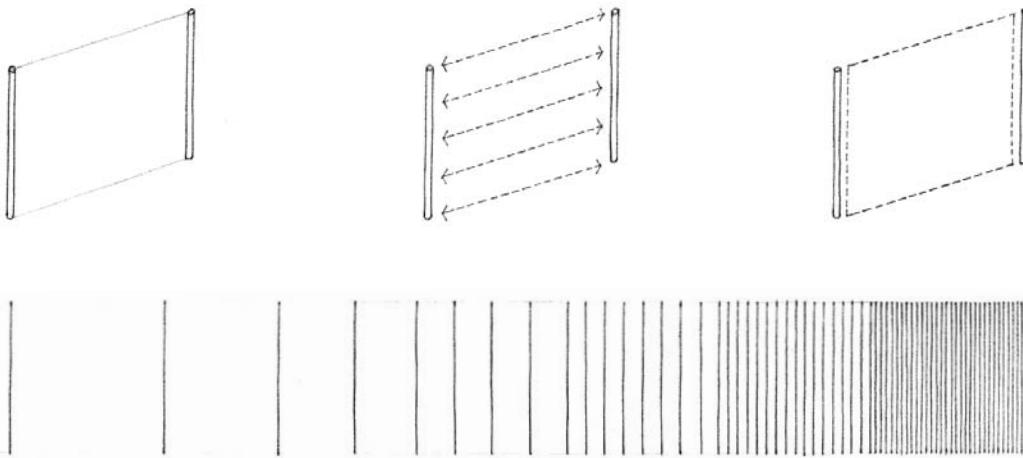


Crown Hall, School of Architecture and Urban Design, Illinois Institute of Technology, Chicago, 1956, Mies van der Rohe



Seagram Building, New York City, 1956–58, Mies van de Rohe and Philip Johnson

FROM LINE TO PLANE

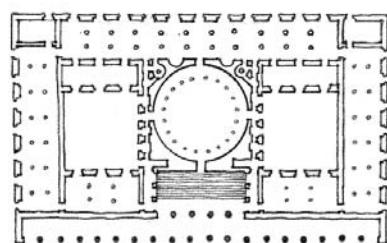
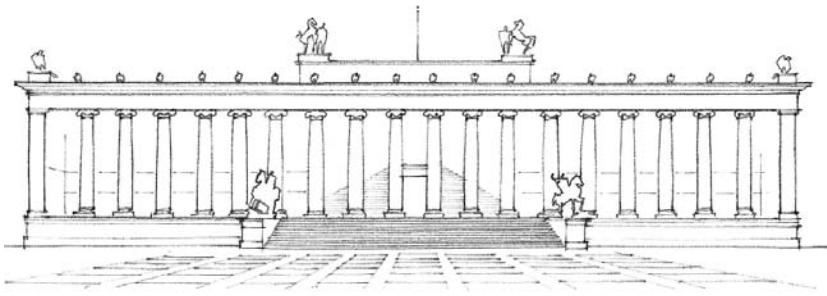


Two parallel lines have the ability to visually describe a plane. A transparent spatial membrane can be stretched between them to acknowledge their visual relationship. The closer these lines are to each other, the stronger will be the sense of plane they convey.

A series of parallel lines, through their repetitiveness, reinforces our perception of the plane they describe. As these lines extend themselves along the plane they describe, the implied plane becomes real and the original voids between the lines revert to being mere interruptions of the planar surface.

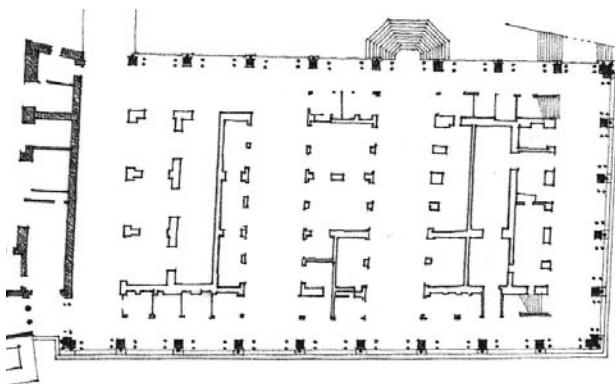
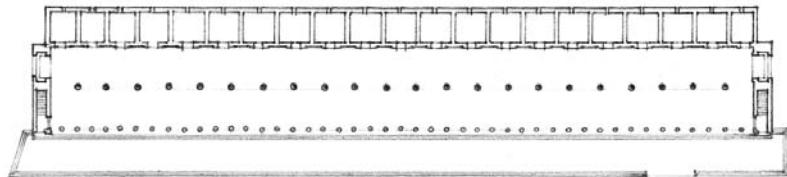
The diagrams illustrate the transformation of a row of round columns, initially supporting a portion of a wall, then evolving into square piers which are an integral part of the wall plane, and finally becoming pilasters—remnants of the original columns occurring as a relief along the surface of the wall.

"The column is a certain strengthened part of a wall, carried up perpendicular from the foundation to the top . . . A row of columns is indeed nothing but a wall, open and discontinued in several places." Leon Battista Alberti



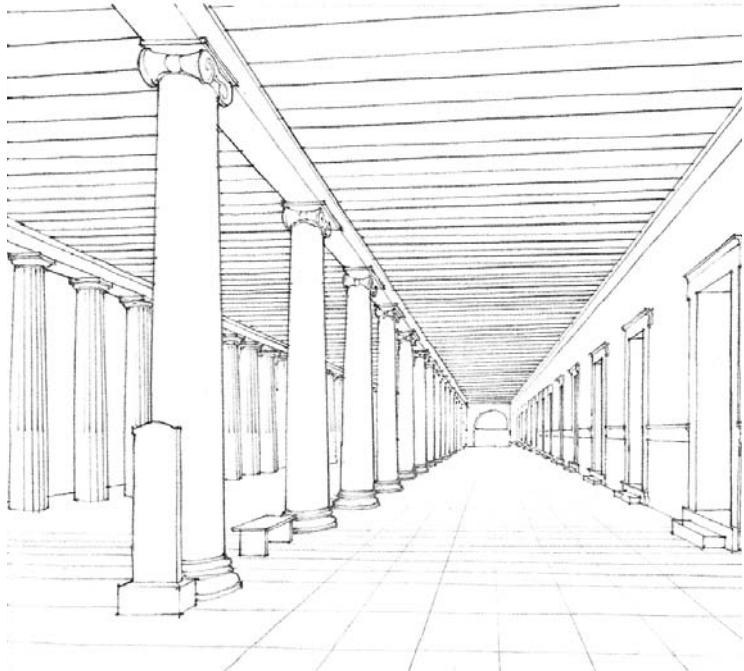
Altes Museum, Berlin, 1823–30, Karl Friedrich von Schinkel

A row of columns supporting an entablature—a colonnade—is often used to define the public face or facade of a building, especially one that fronts on a major civic space. A colonnaded facade can be penetrated easily for entry, offers a degree of shelter from the elements, and forms a semi-transparent screen that unifies individual building forms behind it.



The Basilica, Vicenza, Italy.

Andrea Palladio designed this two-story loggia in 1545 to wrap around an existing medieval structure. This addition not only buttressed the existing structure but also acted as a screen that disguised the irregularity of the original core and presented a uniform but elegant face to the Piazza del Signori.



Stoa of Attalus fronting the Agora in Athens

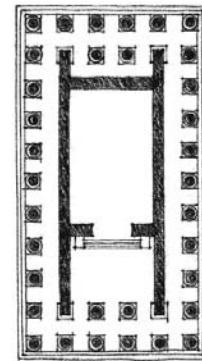
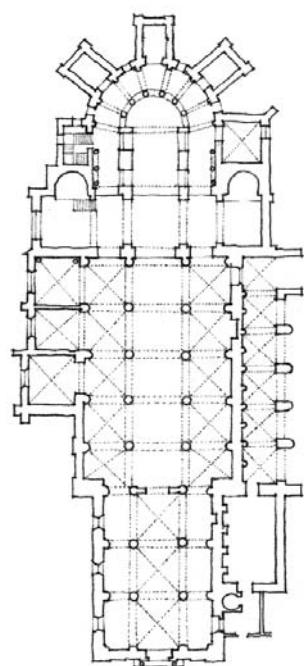
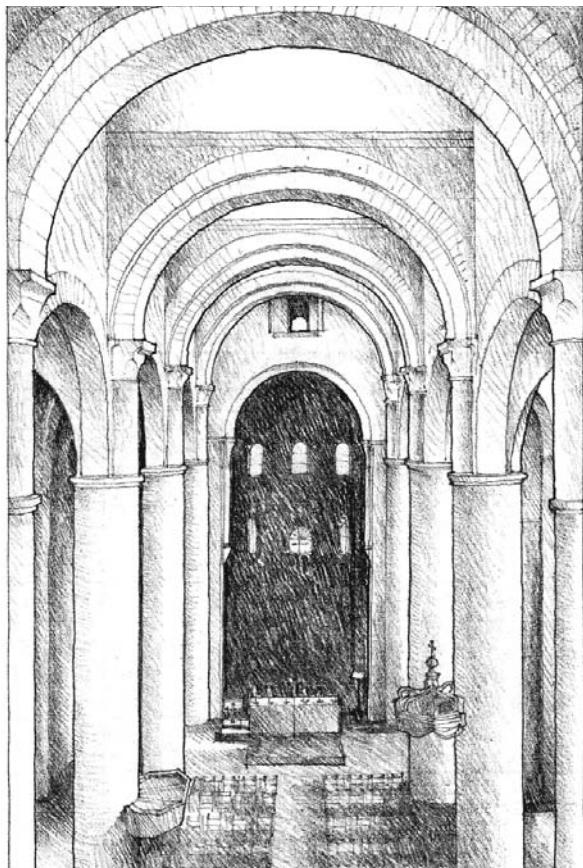
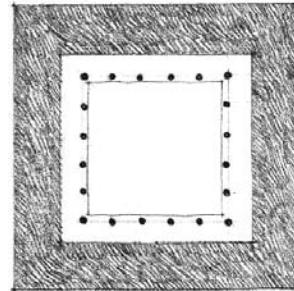
LINEAR ELEMENTS DEFINING PLANES



Cloister of Moissac Abbey, France, c. 1100

In addition to the structural role columns play in supporting an overhead floor or roof plane, they can articulate the penetrable boundaries of spatial zones which mesh easily with adjacent spaces.

These two examples illustrate how columns can define the edges of an exterior space defined within the mass of a building as well as articulate the edges of a building mass in space.

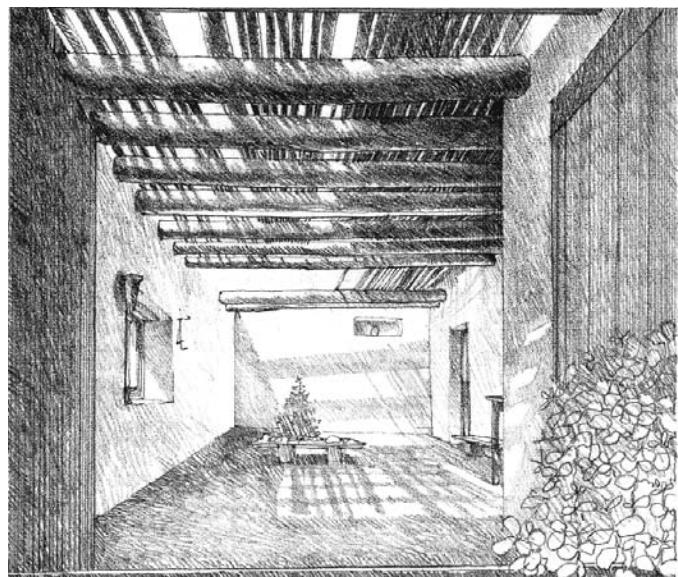


**Temple of Athena Polias,
Priene, c. 334 B.C., Pythius**

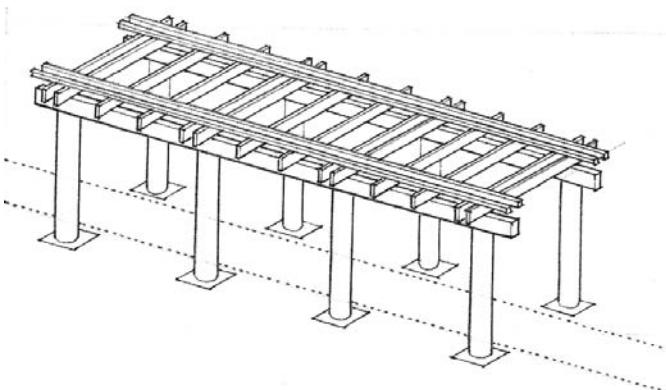
St. Philibert, Tournus, France, 950–1120.
This view of the nave shows how rows of columns can provide a rhythmic measure of space.



Cary House, Mill Valley, California, 1963, Joseph Esherick



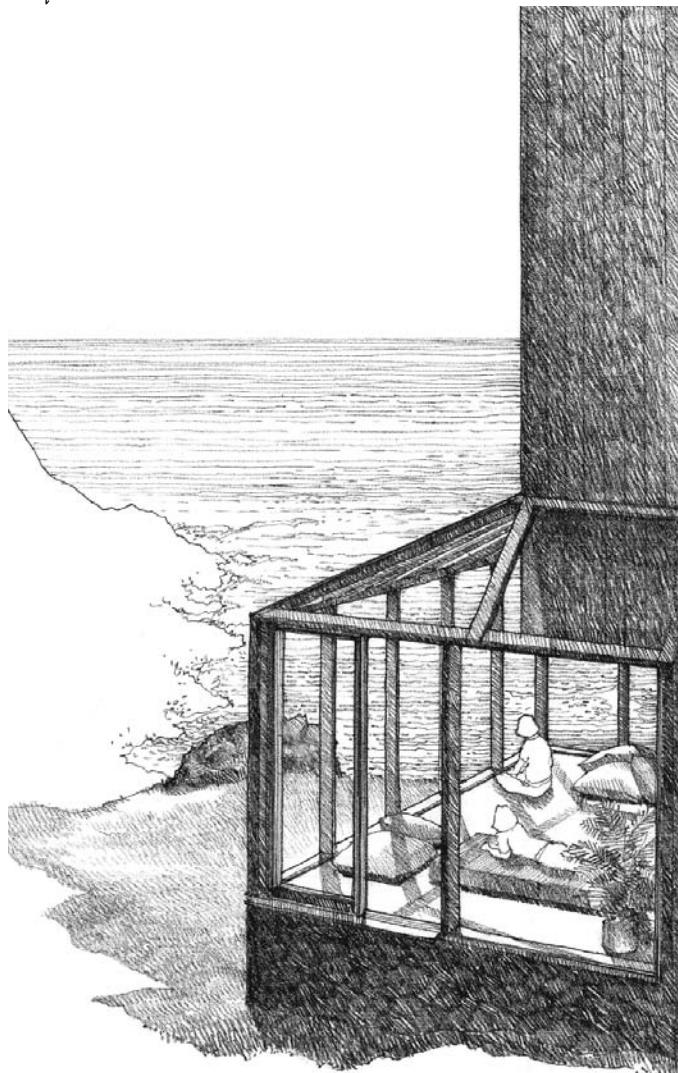
Trellised Courtyard, Georgia O'Keefe Residence,
Abiquiu, northwest of Sante Fe, New Mexico



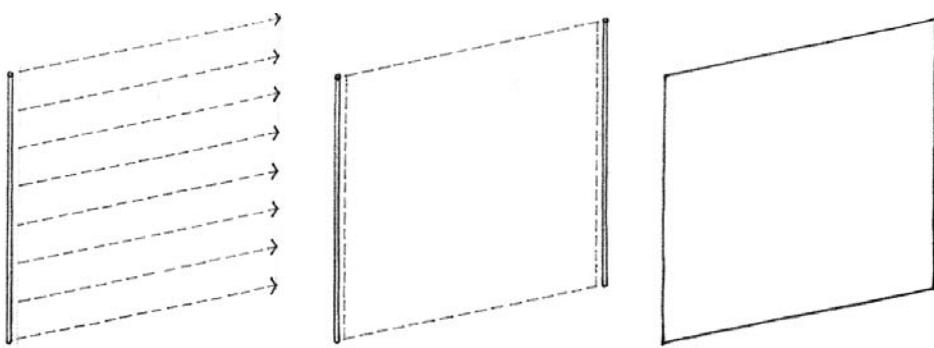
The linear members of trellises and pergolas can provide a moderate degree of definition and enclosure for outdoor spaces while allowing filtered sunlight and breezes to penetrate.

Vertical and horizontal linear elements together can define a volume of space such as the solarium illustrated to the right. Note that the form of the volume is determined solely by the configuration of the linear elements.

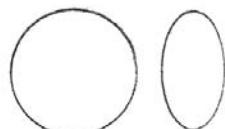
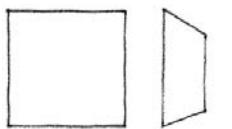
Solarium of Condominium Unit 1, Sea Ranch, California, 1966, MLTW



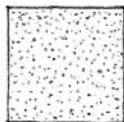
PLANE



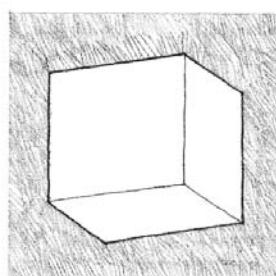
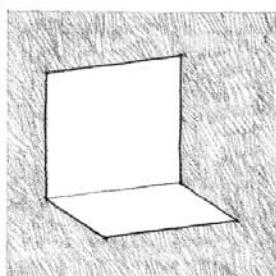
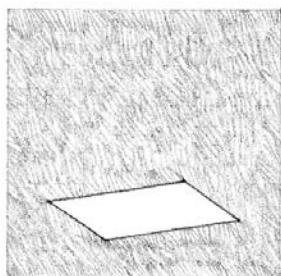
A line extended in a direction other than its intrinsic direction becomes a plane. Conceptually, a plane has length and width, but no depth.



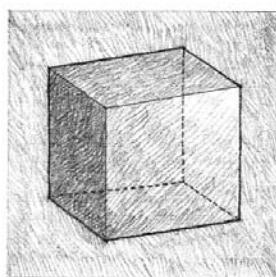
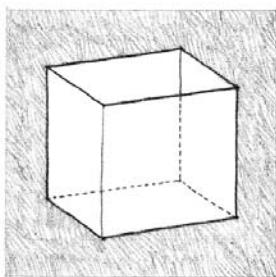
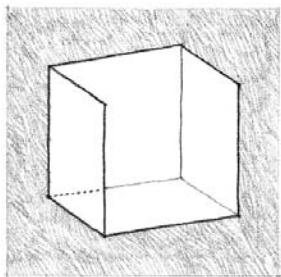
Shape is the primary identifying characteristic of a plane. It is determined by the contour of the line forming the edges of a plane. Because our perception of shape can be distorted by perspective foreshortening, we see the true shape of a plane only when we view it frontally.



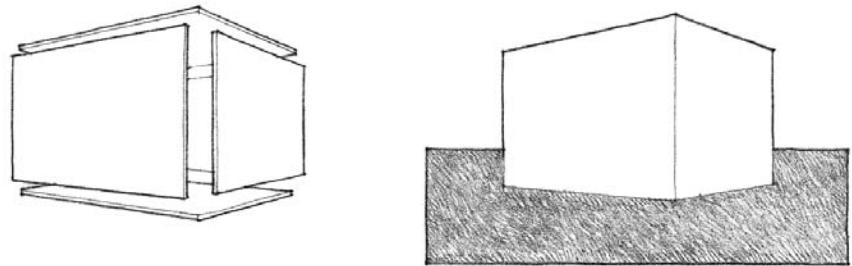
The supplementary properties of a plane—its surface color, pattern, and texture—affect its visual weight and stability.



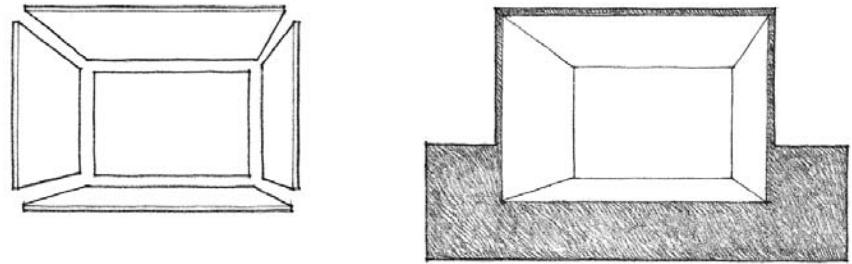
In the composition of a visual construction, a plane serves to define the limits or boundaries of a volume. If architecture as a visual art deals specifically with the formation of three-dimensional volumes of mass and space, then the plane should be regarded as a key element in the vocabulary of architectural design.



Planes in architecture define three-dimensional volumes of mass and space. The properties of each plane—size, shape, color, texture—as well as their spatial relationship to one another ultimately determine the visual attributes of the form they define and the qualities of the space they enclose.



In architectural design, we manipulate three generic types of planes:



Overhead Plane

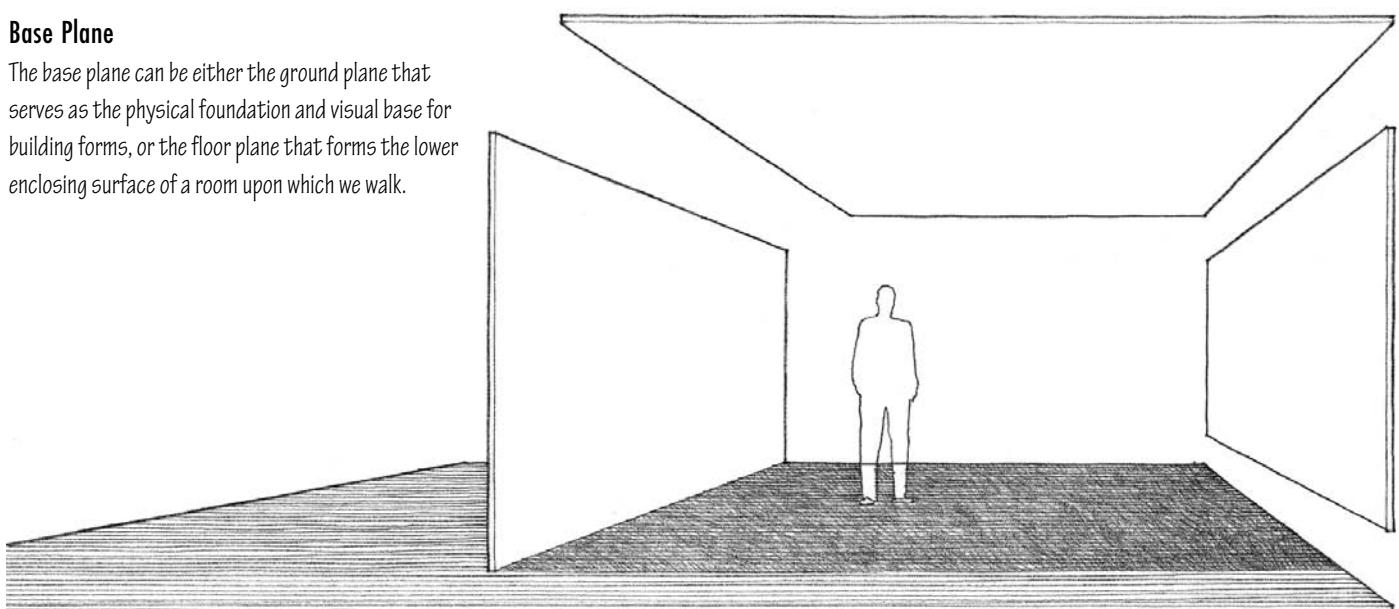
The overhead plane can be either the roof plane that spans and shelters the interior spaces of a building from the climatic elements, or the ceiling plane that forms the upper enclosing surface of a room.

Wall Plane

The wall plane, because of its vertical orientation, is active in our normal field of vision and vital to the shaping and enclosure of architectural space.

Base Plane

The base plane can be either the ground plane that serves as the physical foundation and visual base for building forms, or the floor plane that forms the lower enclosing surface of a room upon which we walk.



PLANAR ELEMENTS

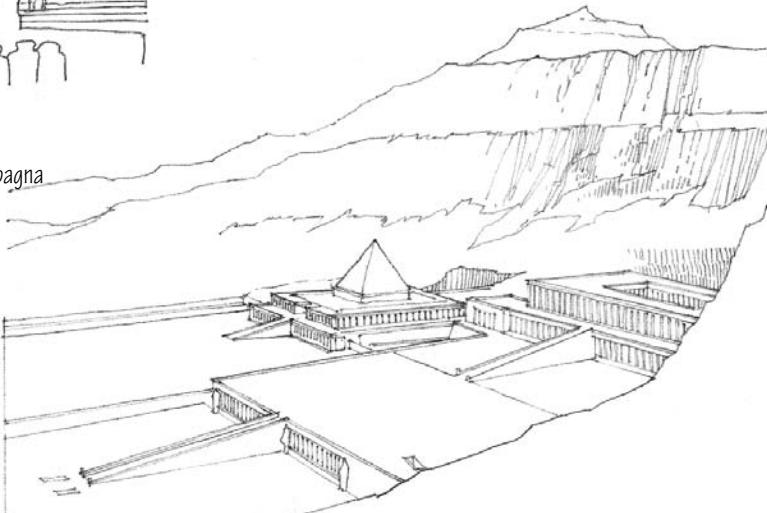


Scala de Spagna (Spanish Steps), Rome, 1721–25.

Alessandro Specchi designed this civic project to connect the Piazza di Spagna with SS. Trinita de' Monti; completed by Francesco de Sanctis.

The ground plane ultimately supports all architectural construction. Along with climate and other environmental conditions of a site, the topographical character of the ground plane influences the form of the building that rises from it. The building can merge with the ground plane, rest firmly on it, or be elevated above it.

The ground plane itself can be manipulated as well to establish a podium for a building form. It can be elevated to honor a sacred or significant place; bermed to define outdoor spaces or buffer against undesirable conditions; carved or terraced to provide a suitable platform on which to build; or stepped to allow changes in elevation to be easily traversed.



Mortuary Temple of Queen Hatshepsut,

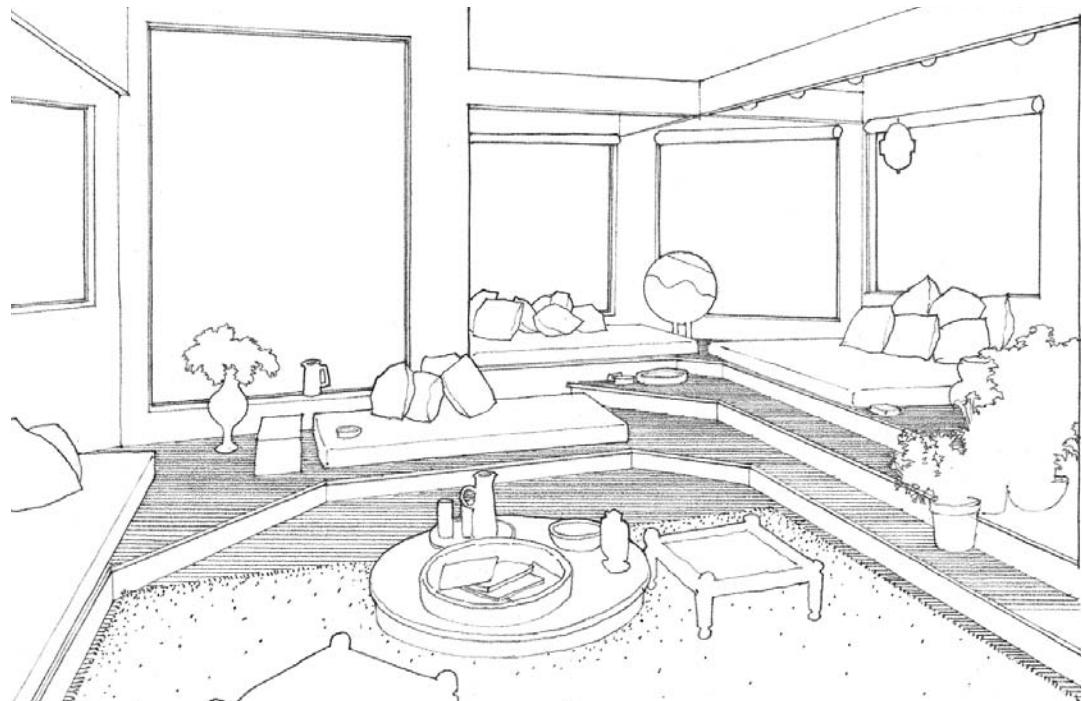
Dér el-Bahari, Thebes, 1511–1480 B.C., Senmut.

Three terraces approached by ramps rise toward the base of the cliffs where the chief sanctuary is cut deep into the rock.



Machu Picchu, an ancient Incan city established c.1500 in the Andes Mountains on a saddle between two peaks, 8000 ft. above the Urubamba River in south-central Peru.

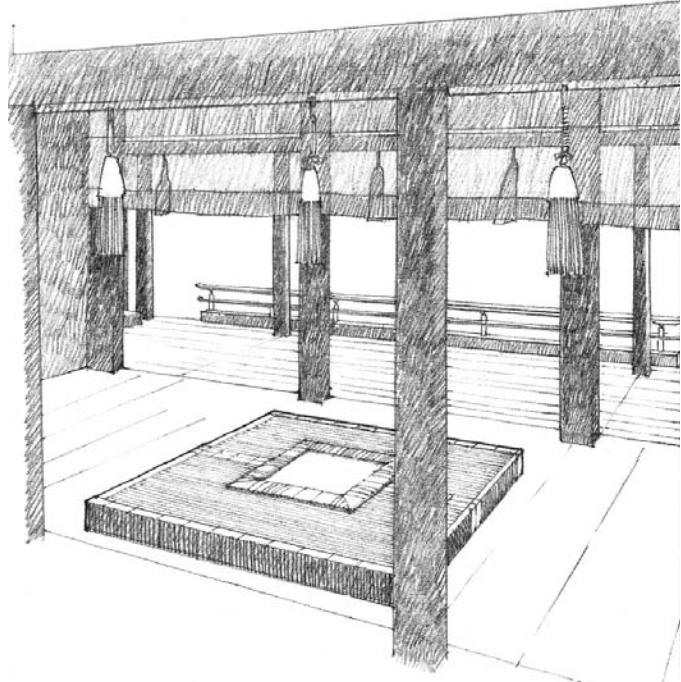
Sitting Area, Lawrence House,
Sea Ranch, California, 1966, MLTW/
Moore-Turnbull



The floor plane is the horizontal element that sustains the force of gravity as we move around and place objects for our use on it. It may be a durable covering of the ground plane or a more artificial, elevated plane spanning the space between its supports. In either case, the texture and density of the flooring material influences both the acoustical quality of a space and how we feel as we walk across its surface.

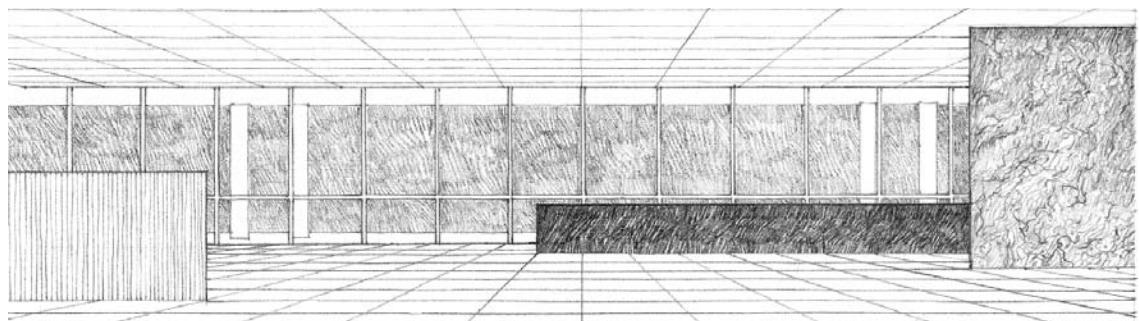
While the pragmatic, supportive nature of the floor plane limits the extent to which it can be manipulated, it is nonetheless an important element of architectural design. Its shape, color, and pattern determine to what degree it defines spatial boundaries or serves as a unifying element for the different parts of a space.

Like the ground plane, the form of a floor plane can be stepped or terraced to break the scale of a space down to human dimensions and create platforms for sitting, viewing, or performing. It can be elevated to define a sacred or honorific place. It can be rendered as a neutral ground against which other elements in a space are seen as figures.

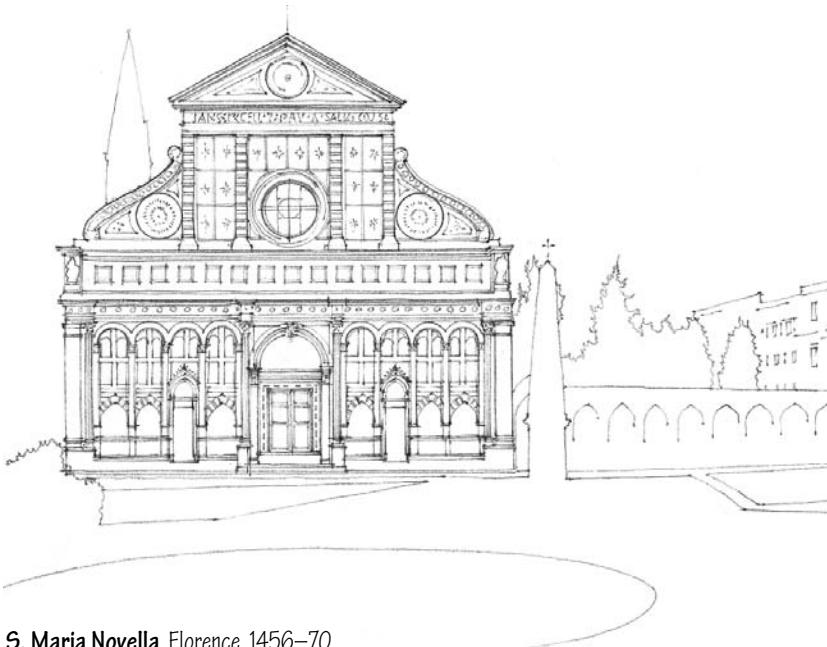


Emperor's Seat, Imperial Palace, Kyoto, Japan, 17th century

Bacardi Office Building,
Santiago de Cuba, 1958,
Mies van der Rohe



PLANAR ELEMENTS



S. Maria Novella, Florence, 1456–70.

The Renaissance facade by Alberti presents a public face to a square.

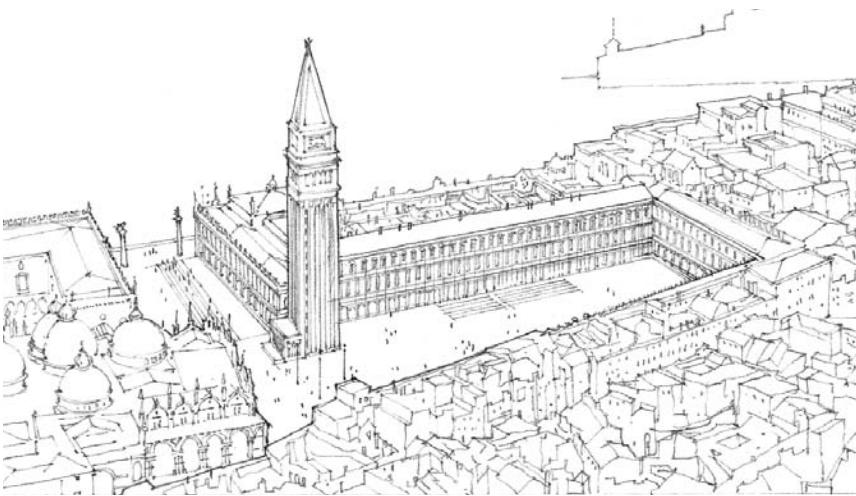
Exterior wall planes isolate a portion of space to create a controlled interior environment. Their construction provides both privacy and protection from the climatic elements for the interior spaces of a building, while openings within or between their boundaries reestablish a connection with the exterior environment. As exterior walls mold interior space, they simultaneously shape exterior space and describe the form, massing, and image of a building in space.

As a design element, the plane of an exterior wall can be articulated as the front or primary facade of a building. In urban situations, these facades serve as walls that define courtyards, streets, and such public gathering places as squares and marketplaces.



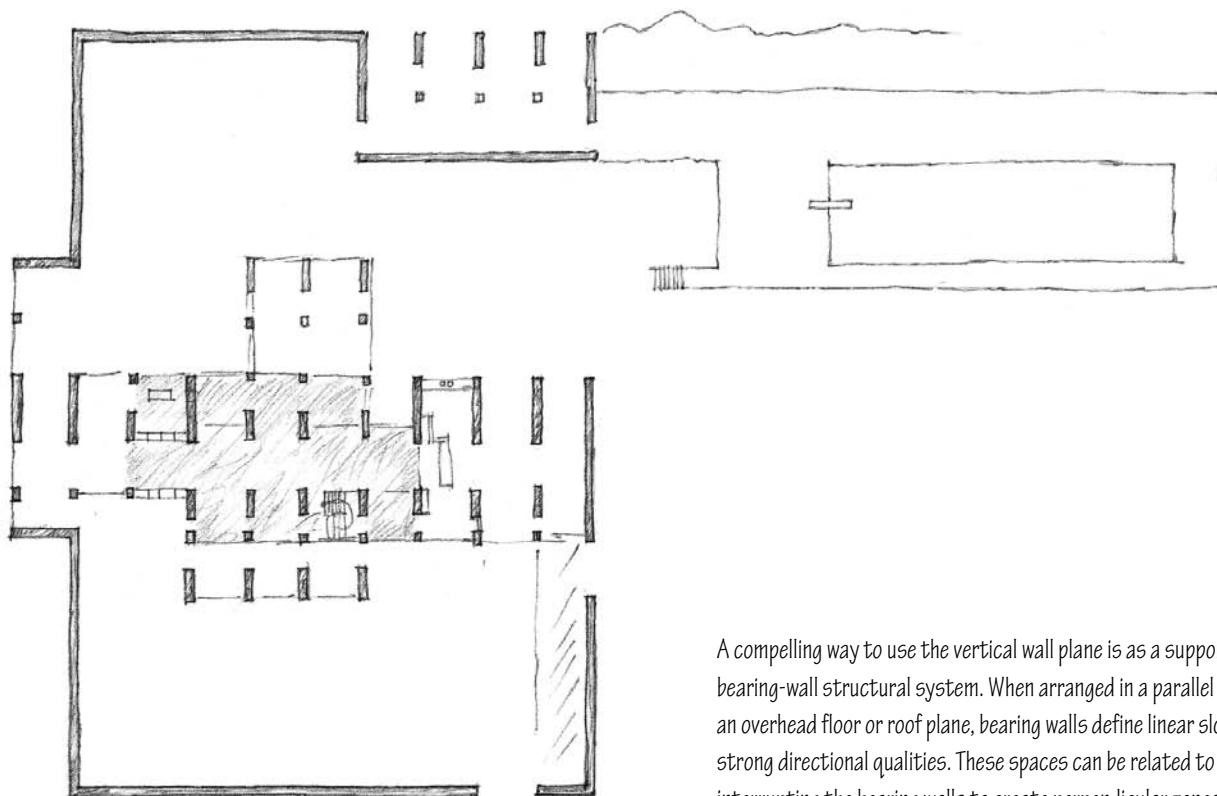
Uffizi Palace, 1560–65, Giorgio Vasari.

This Florentine street defined by the two wings of the Uffizi Palace links the Piazza della Signoria with the River Arno.



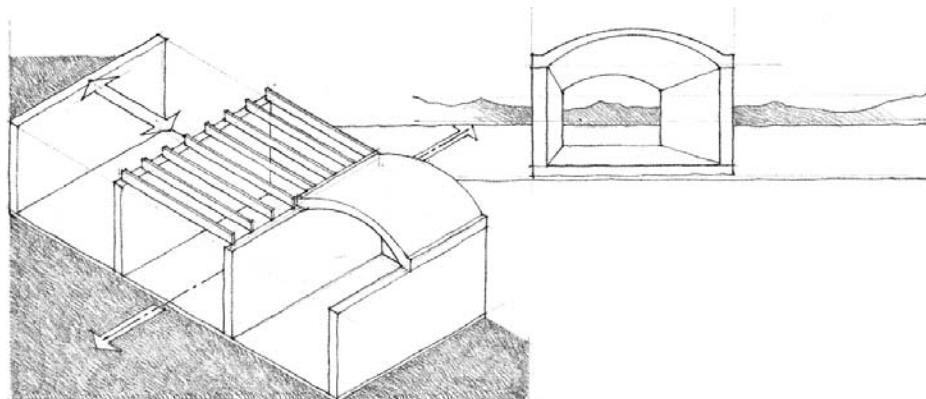
Piazza of San Marco, Venice.

The continuous facades of buildings form the “walls” of the urban space.

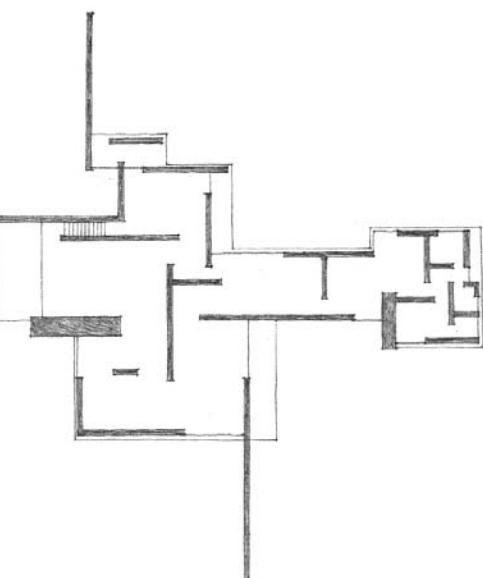


Peyrissac Residence, Cherchell, North Africa, 1942, Le Corbusier

A compelling way to use the vertical wall plane is as a supporting element in the bearing-wall structural system. When arranged in a parallel series to support an overhead floor or roof plane, bearing walls define linear slots of space with strong directional qualities. These spaces can be related to one another only by interrupting the bearing walls to create perpendicular zones of space.

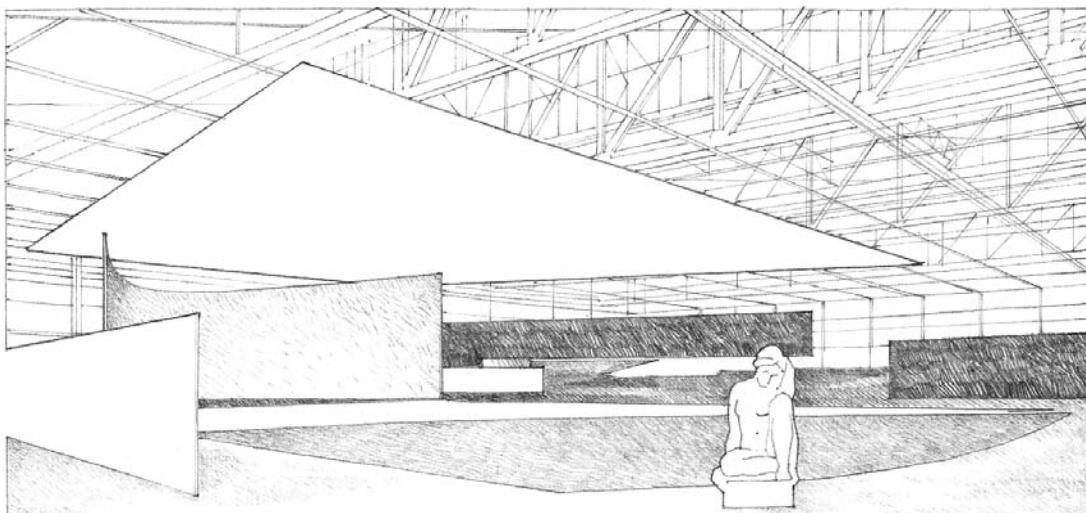


Country House in Brick, Project, 1923, Mies van der Rohe



In the project to the right, freestanding brick bearing walls, together with L-shaped and T-shaped configurations of planes, create an interlocking series of spaces.

PLANAR ELEMENTS

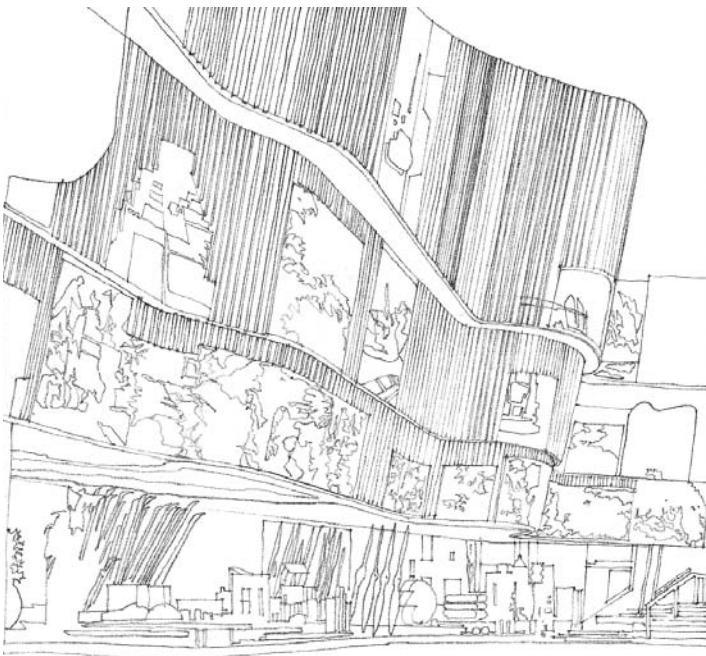


Concert Hall, Project, 1942,
Mies van der Rohe

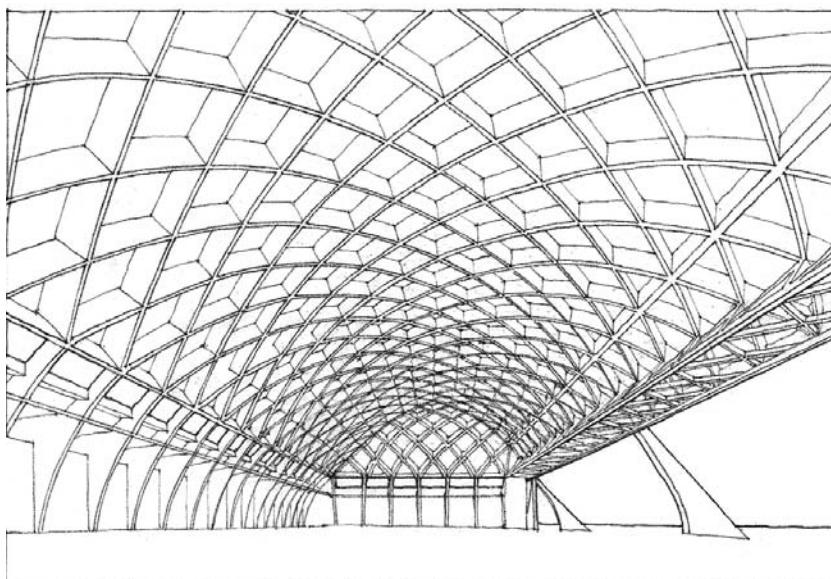
Interior wall planes govern the size and shape of the internal spaces or rooms within a building. Their visual properties, their relationship to one another, and the size and distribution of openings within their boundaries determine both the quality of the spaces they define and the degree to which adjoining spaces relate to one another.

As a design element, a wall plane can merge with the floor or ceiling plane, or be articulated as an element isolated from adjacent planes. It can be treated as a passive or receding backdrop for other elements in the space, or it can assert itself as a visually active element within a room by virtue of its form, color, texture, or material.

While walls provide privacy for interior spaces and serve as barriers that limit our movement, doorways and windows reestablish continuity with neighboring spaces and allow the passage of light, heat, and sound. As they increase in size, these openings begin to erode the natural sense of enclosure walls provide. Views seen through the openings become part of the spatial experience.



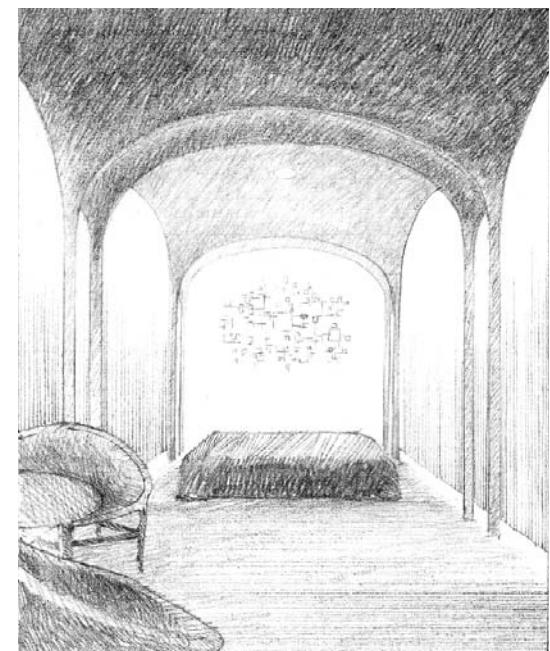
Finnish Pavilion, New York World's Fair, 1939, Alvar Aalto



Hangar, Design I, 1935, Pier Luigi Nervi.

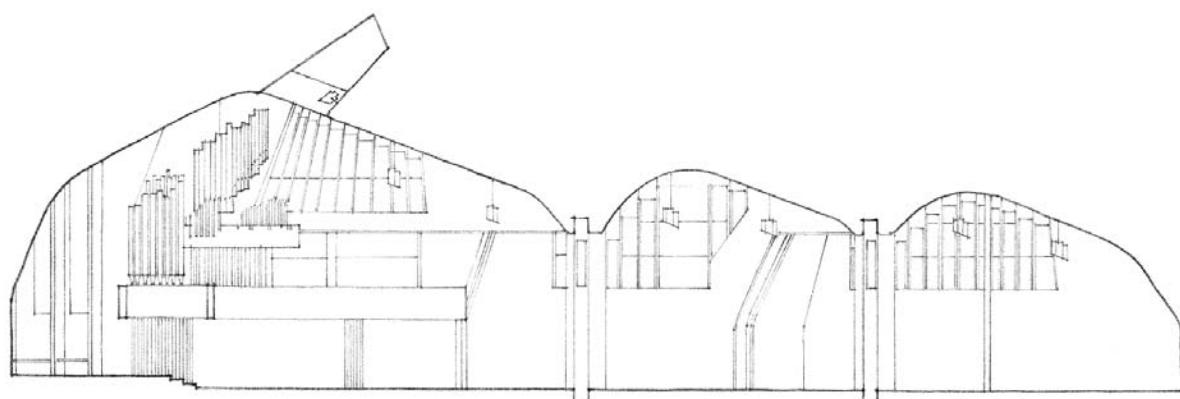
The lamella structure expresses the way forces are resolved and channeled down to the roof supports.

While we walk on a floor and have physical contact with walls, the ceiling plane is usually out of our reach and is almost always a purely visual event in a space. It may be the underside of an overhead floor or roof plane and express the form of its structure as it spans the space between its supports, or it may be suspended as the upper enclosing surface of a room or hall.



Brick House, New Canaan, Connecticut, 1949, Philip Johnson. The detached vaulted ceiling plane appears to float above the bed.

As a detached lining, the ceiling plane can symbolize the sky vault or be the primary sheltering element that unifies the different parts of a space. It can serve as a repository for frescoes and other means of artistic expression or be treated simply as a passive or receding surface. It can be raised or lowered to alter the scale of a space or to define spatial zones within a room. Its form can be manipulated to control the quality of light or sound within a space.



Church at Vuoksenniska, Finland, 1956, Alvar Aalto.

The form of the ceiling plane defines a progression of spaces and enhances their acoustical quality.

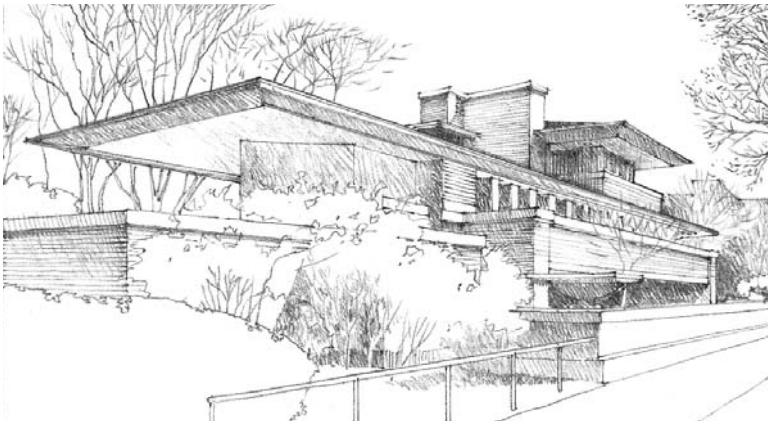
PLANAR ELEMENTS



Dolmen, a prehistoric monument consisting of two or more large upright stones supporting a horizontal stone slab, found especially in Britain and France and usually regarded as a burial place for an important person.

The roof plane is the essential sheltering element that protects the interior of a building from the climatic elements. The form and geometry of its structure is established by the manner in which it spans across space to bear on its supports and slopes to shed rain and melting snow. As a design element, the roof plane is significant because of the impact it can have on the form and silhouette of a building within its setting.

The roof plane can be hidden from view by the exterior walls of a building or merge with the walls to emphasize the volume of the building mass. It can be expressed as a single sheltering form that encompasses a variety of spaces beneath its canopy, or comprise a number of hats that articulate a series of spaces within a single building.



Robie House, Chicago, 1909, Frank Lloyd Wright.

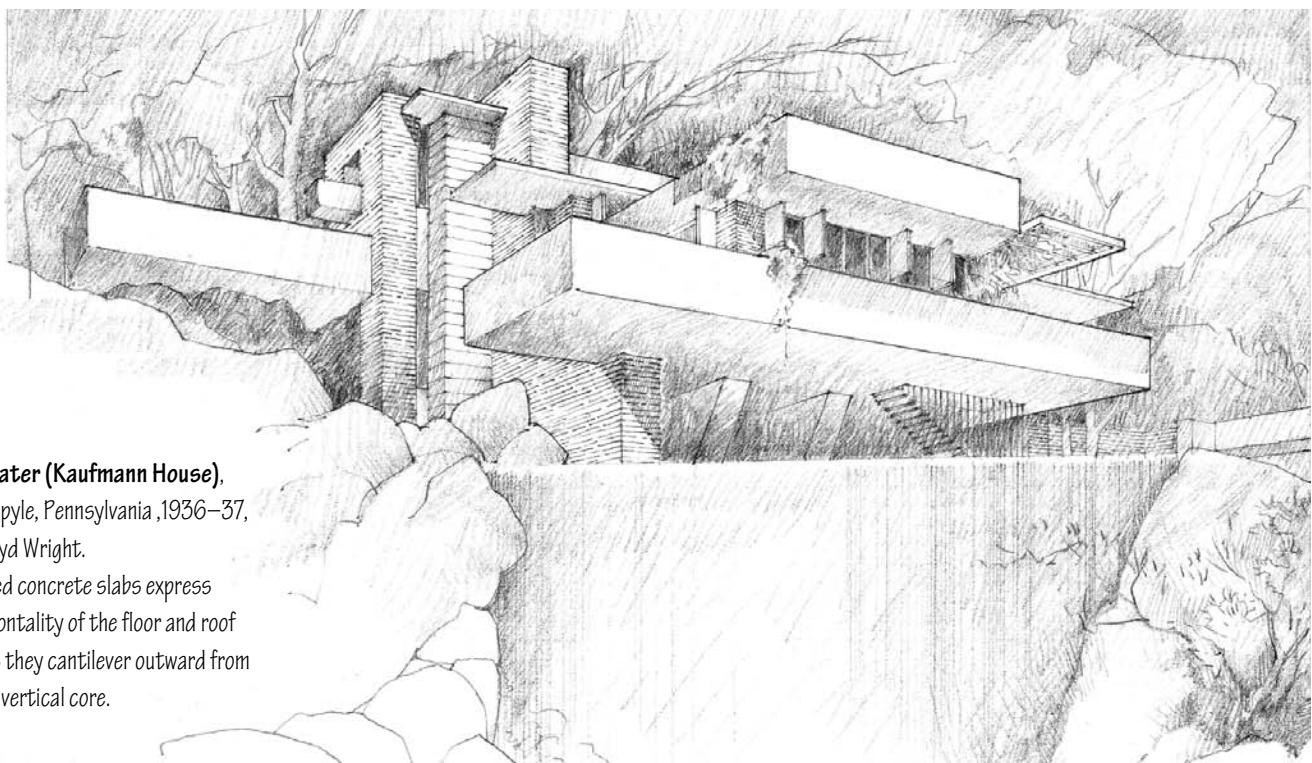
The low sloping roof planes and broad overhangs are characteristic of the Prairie School of Architecture.

A roof plane can extend outward to form overhangs that shield door and window openings from sun or rain, or continue downward further still to relate itself more closely to the ground plane. In warm climates, it can be elevated to allow cooling breezes to flow across and through the interior spaces of a building.

Shodhan House, Ahmedabad, India, 1956, Le Corbusier.

A grid of columns elevates the reinforced concrete roof slab above the main volume of the house.





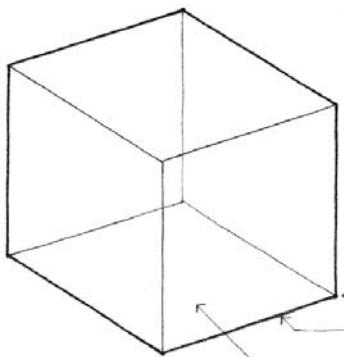
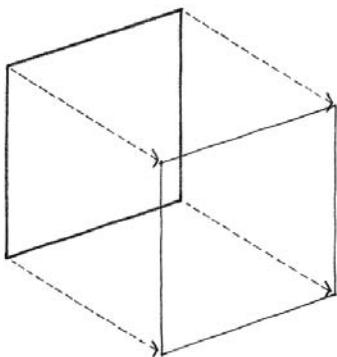
Fallingwater (Kaufmann House),
near Ohiopyle, Pennsylvania, 1936–37,
Frank Lloyd Wright.
Reinforced concrete slabs express
the horizontality of the floor and roof
planes as they cantilever outward from
a central vertical core.

The overall form of a building can be endowed with a distinctly planar quality by carefully introducing openings that expose the edges of vertical and horizontal planes. These planes can be further differentiated and accentuated by changes in color, texture, or material.



Schröder House, Utrecht, 1924–25, Gerrit Thomas Rietveld.
Asymmetrical compositions of simple rectangular forms and primary
colors characterized the de Stijl school of art and architecture.

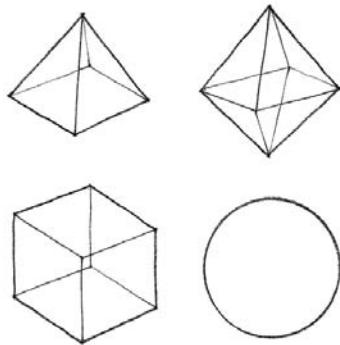
VOLUME



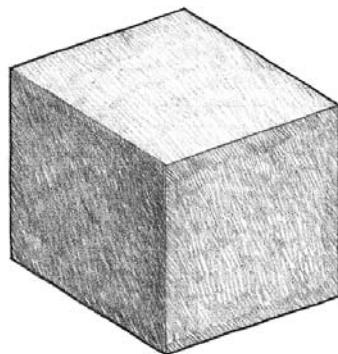
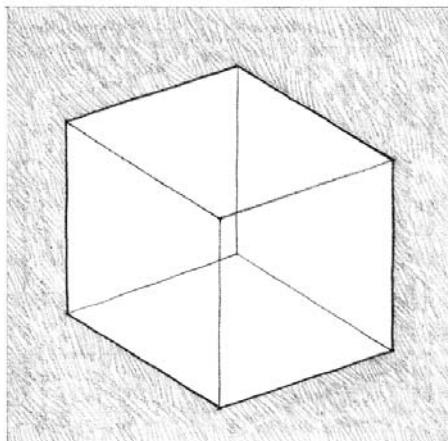
A plane extended in a direction other than its intrinsic direction becomes a volume. Conceptually, a volume has three dimensions: length, width, and depth.

All volumes can be analyzed and understood to consist of:

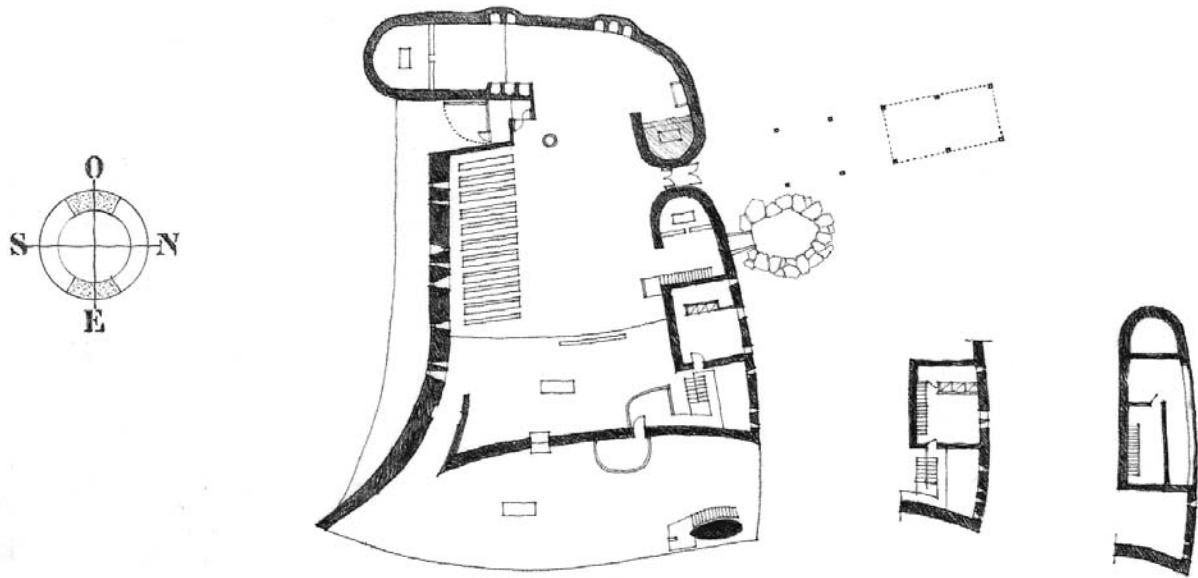
- points or vertices where several planes come together
- lines or edges where two planes meet
- planes or surfaces that define the limits or boundaries of a volume



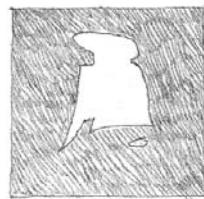
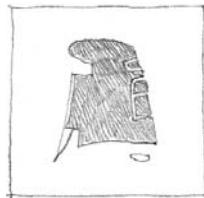
Form is the primary identifying characteristic of a volume. It is established by the shapes and interrelationships of the planes that describe the boundaries of the volume.



As the three-dimensional element in the vocabulary of architectural design, a volume can be either a solid—space displaced by mass—or a void—space contained or enclosed by planes.

**Plan and Section**

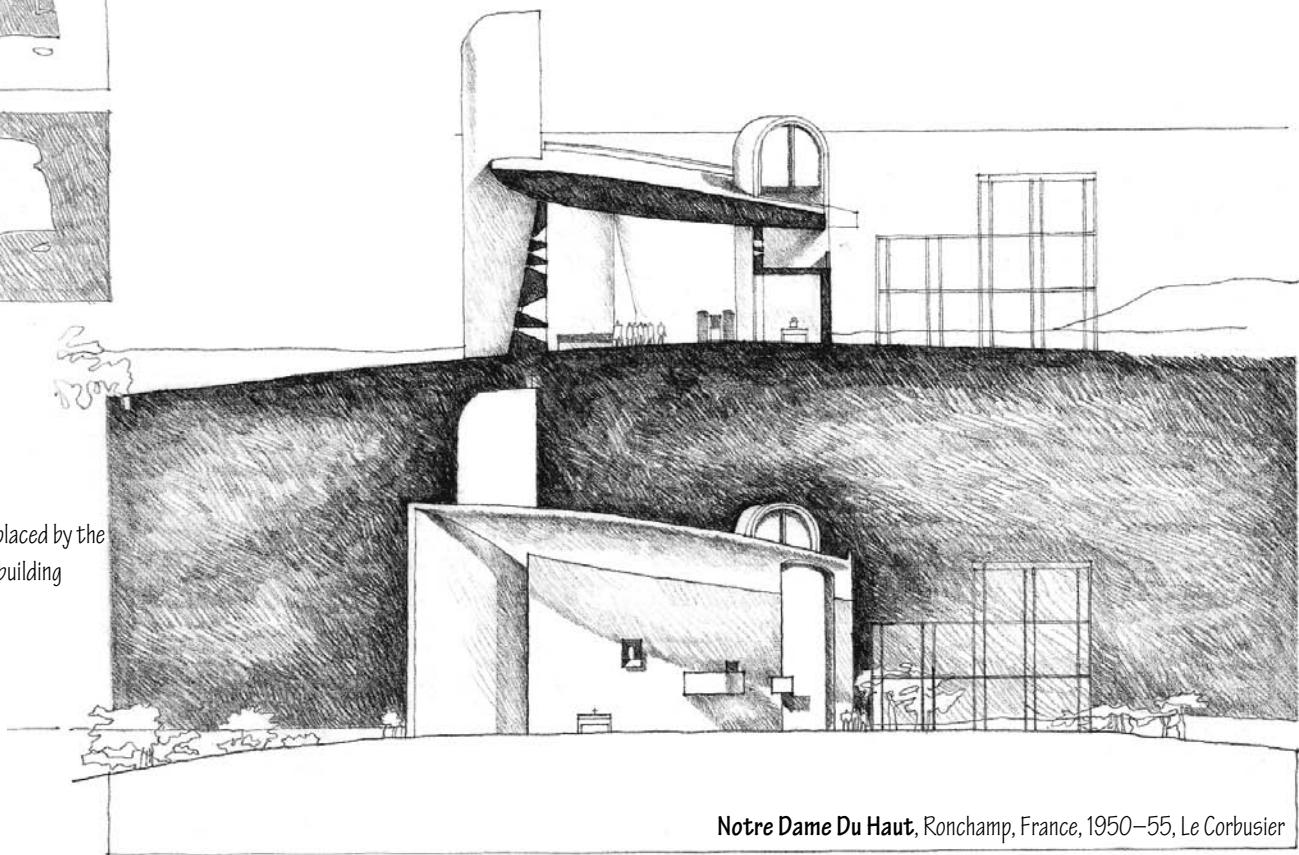
Space defined by wall, floor, and ceiling or roof planes



In architecture, a volume can be seen to be either a portion of space contained and defined by wall, floor, and ceiling or roof planes, or a quantity of space displaced by the mass of a building. It is important to perceive this duality, especially when reading orthographic plans, elevations, and sections.

Elevation

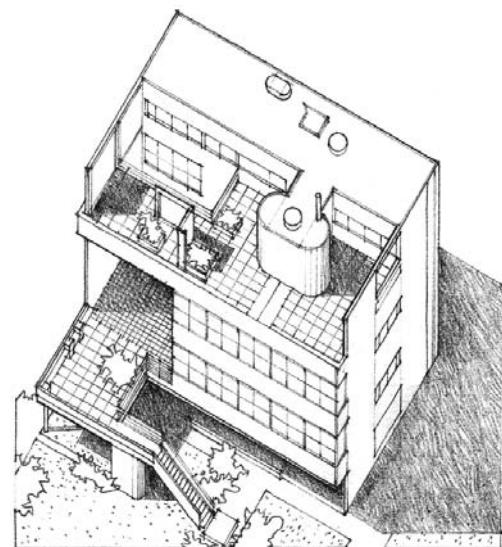
Space displaced by the mass of a building



Notre Dame Du Haut, Ronchamp, France, 1950–55, Le Corbusier

VOLUMETRIC ELEMENTS

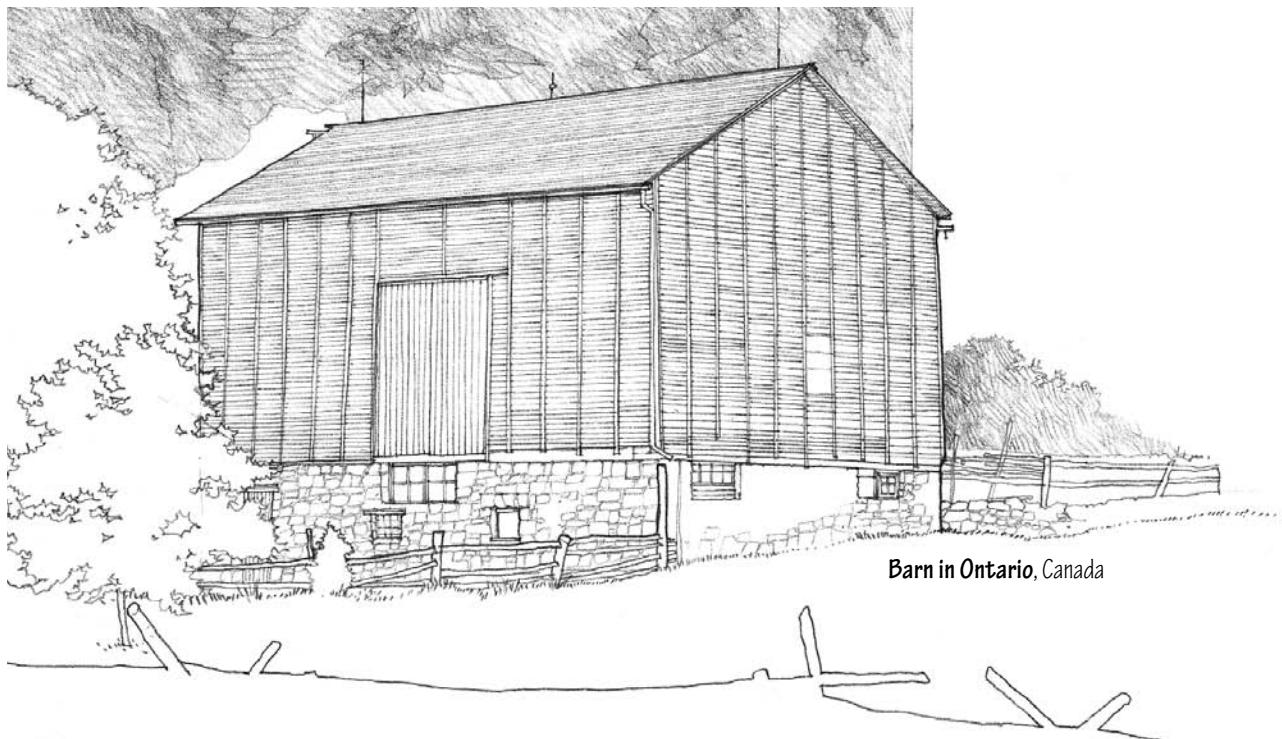
Building forms that stand as objects in the landscape can be read as occupying volumes in space.



Doric Temple at Segesta, Sicily, c. 424–416 B.C.



Villa Garches, Vaucresson, France, 1926–27, Le Corbusier



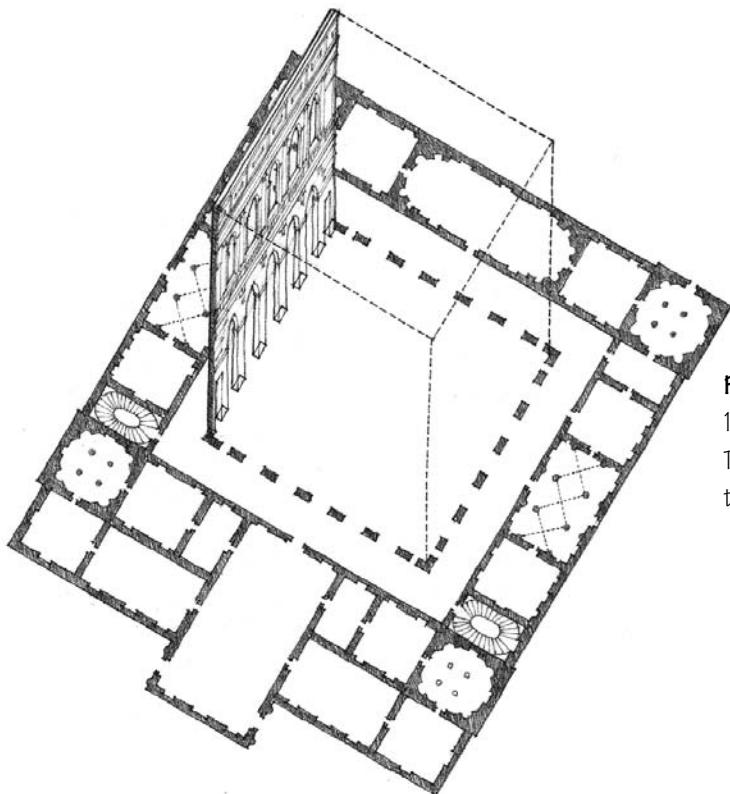
Barn in Ontario, Canada

Building forms that serve as containers can be read as masses that define volumes of space.



Piazza Maggiore, Sabbioneta, Italy.

A series of buildings enclose an urban square.



Palazzo Thiene, Vicenza, Italy,

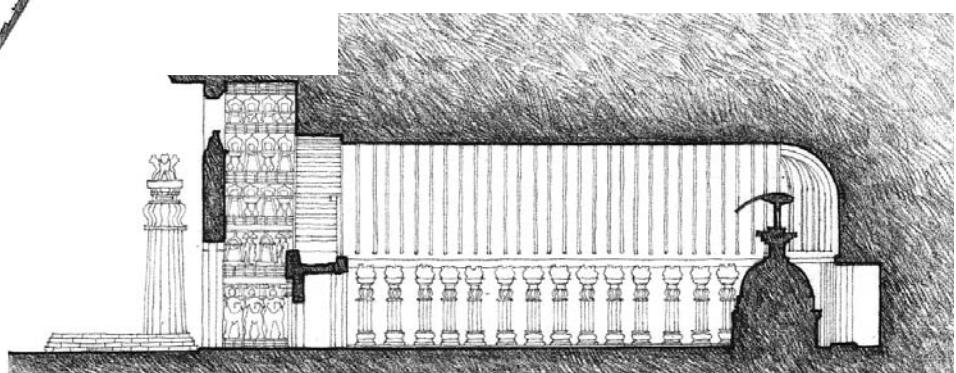
1545, Andrea Palladio.

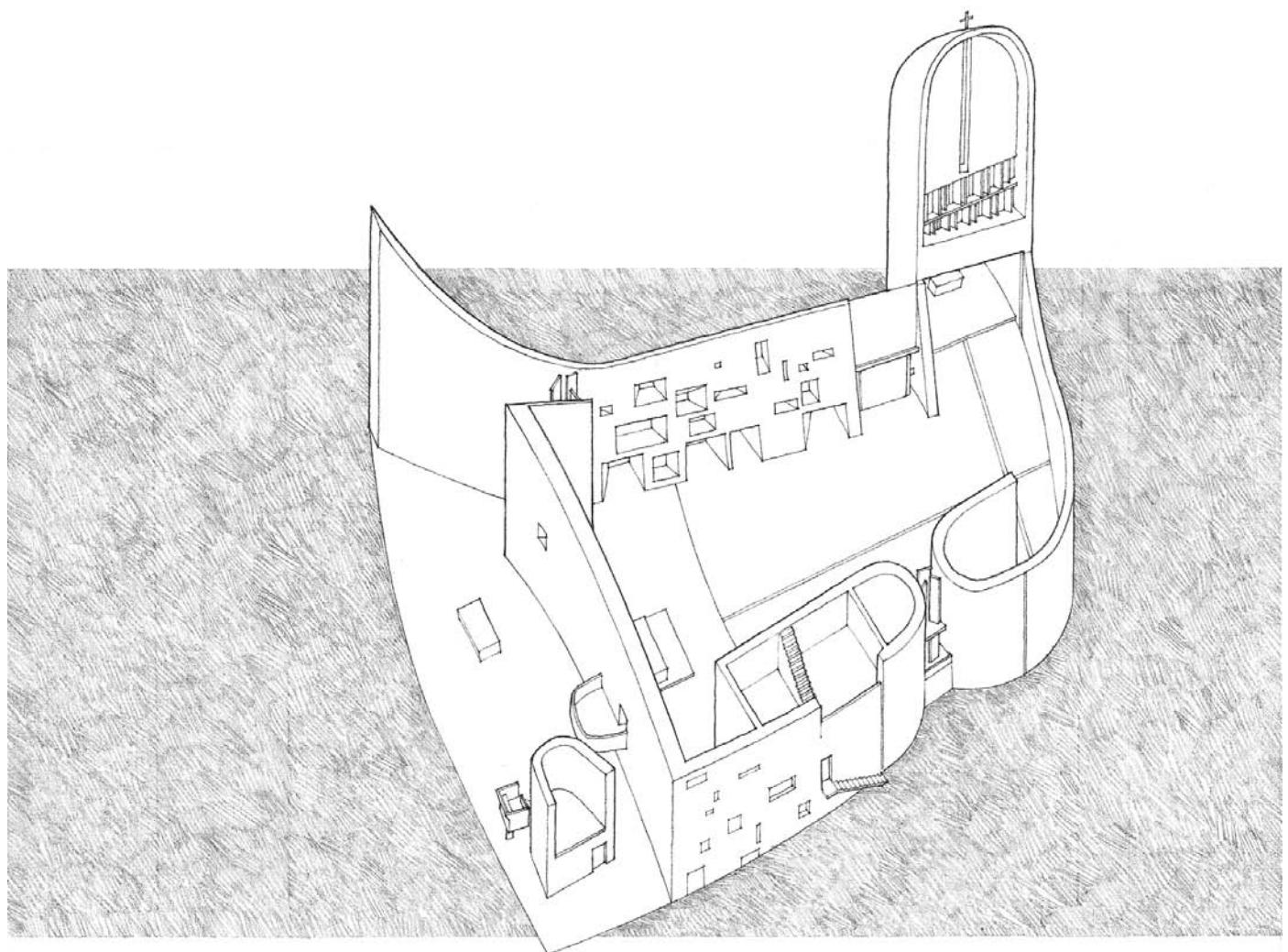
The interior rooms surround a cortile—the principal courtyard of an Italian palazzo.

Buddhist Chaitya Hall at Karli,

Maharashtra, India, A.D. 100–125.

The sanctuary is a volume of space carved out of the mass of solid rock.





2

Form

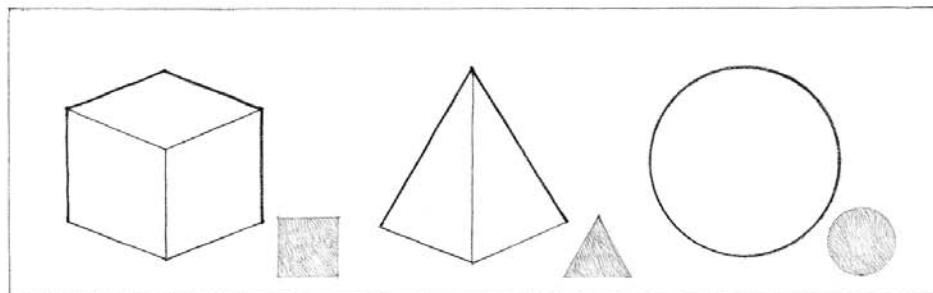
“Architectural form is the point of contact between mass and space . . . Architectural forms, textures, materials, modulation of light and shade, color, all combine to inject a quality or spirit that articulates space. The quality of the architecture will be determined by the skill of the designer in using and relating these elements, both in the interior spaces and in the spaces around buildings.”

Edmund N. Bacon
The Design of Cities
1974

FORM

Form is an inclusive term that has several meanings. It may refer to an external appearance that can be recognized, as that of a chair or the human body that sits in it. It may also allude to a particular condition in which something acts or manifests itself, as when we speak of water in the form of ice or steam. In art and design, we often use the term to denote the formal structure of a work—the manner of arranging and coordinating the elements and parts of a composition so as to produce a coherent image.

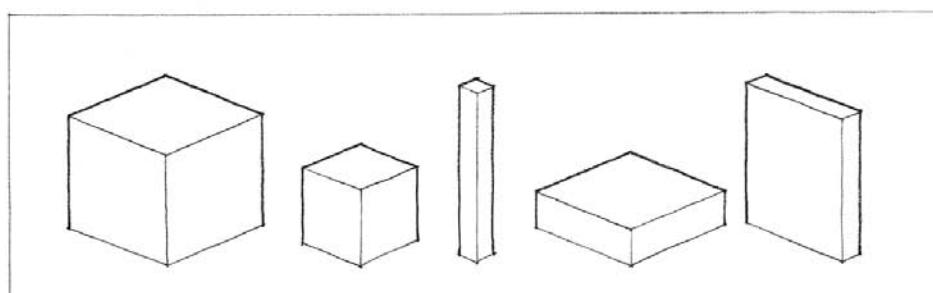
In the context of this study, form suggests reference to both internal structure and external outline and the principle that gives unity to the whole. While form often includes a sense of three-dimensional mass or volume, shape refers more specifically to the essential aspect of form that governs its appearance—the configuration or relative disposition of the lines or contours that delimit a figure or form.



Shape

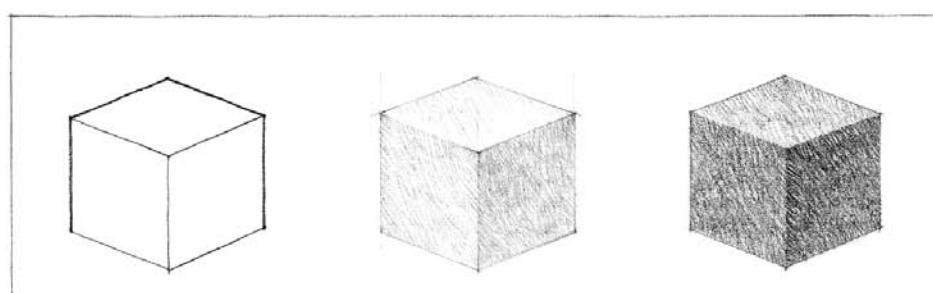
The characteristic outline or surface configuration of a particular form. Shape is the principal aspect by which we identify and categorize forms.

In addition to shape, forms have visual properties of:



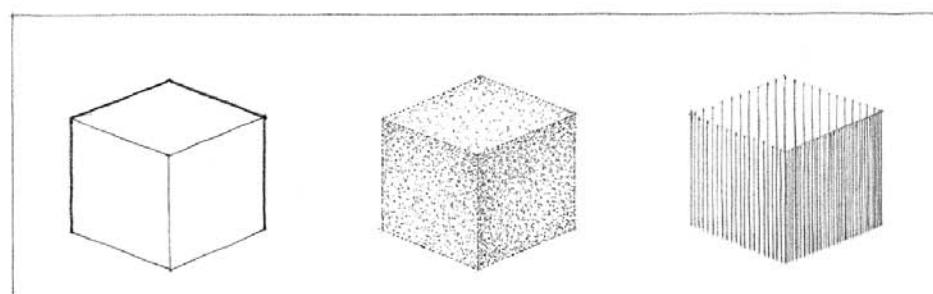
Size

The physical dimensions of length, width, and depth of a form. While these dimensions determine the proportions of a form, its scale is determined by its size relative to other forms in its context.



Color

A phenomenon of light and visual perception that may be described in terms of an individual's perception of hue, saturation, and tonal value. Color is the attribute that most clearly distinguishes a form from its environment. It also affects the visual weight of a form.



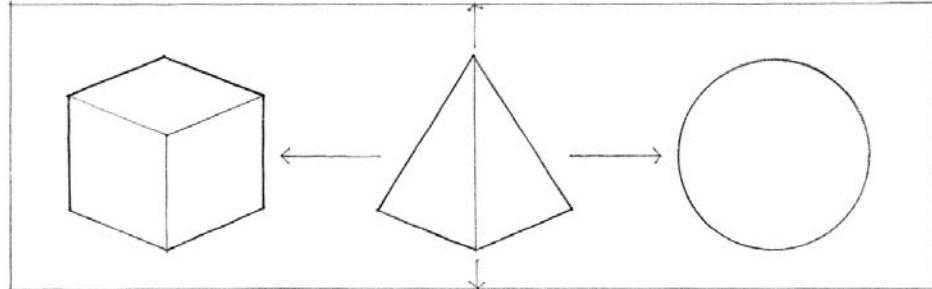
Texture

The visual and especially tactile quality given to a surface by the size, shape, arrangement, and proportions of the parts. Texture also determines the degree to which the surfaces of a form reflect or absorb incident light.

Forms also have relational properties that govern the pattern and composition of elements:

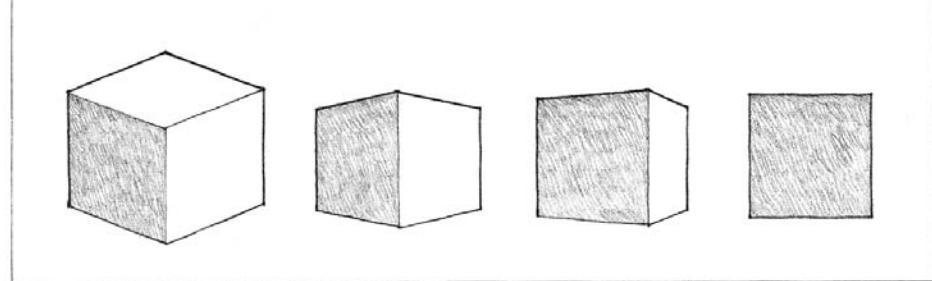
Position

The location of a form relative to its environment or the visual field within which it is seen.



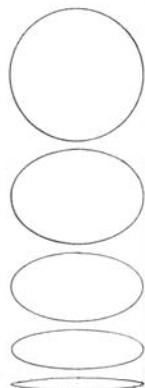
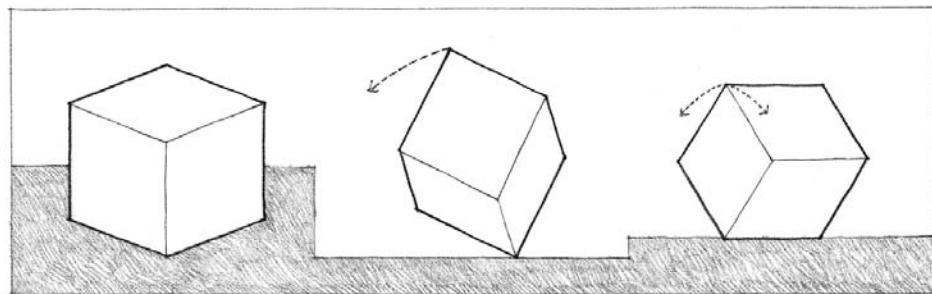
Orientation

The direction of a form relative to the ground plane, the compass points, other forms, or to the person viewing the form.



Visual Inertia

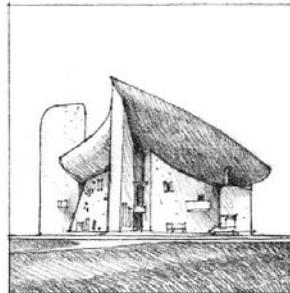
The degree of concentration and stability of a form. The visual inertia of a form depends on its geometry as well as its orientation relative to the ground plane, the pull of gravity, and our line of sight.



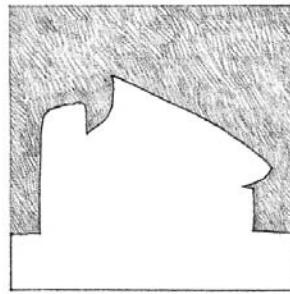
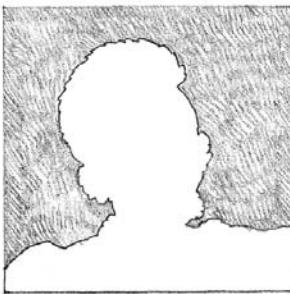
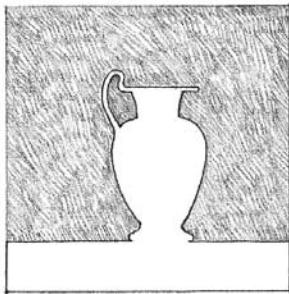
All of these properties of form are in reality affected by the conditions under which we view them.

- A changing perspective or angle of view presents different shapes or aspects of a form to our eyes.
- Our distance from a form determines its apparent size.
- The lighting conditions under which we view a form affects the clarity of its shape and structure.
- The visual field surrounding a form influences our ability to read and identify it.

SHAPE

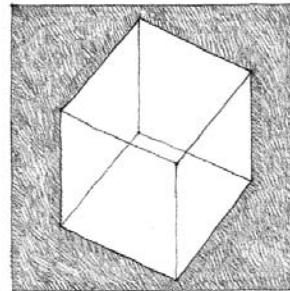
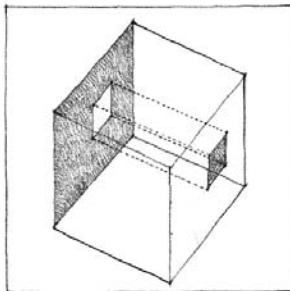
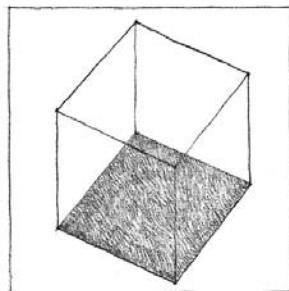


Shape refers to the characteristic outline of a plane figure or the surface configuration of a volumetric form. It is the primary means by which we recognize, identify, and categorize particular figures and forms. Our perception of shape depends on the degree of visual contrast that exists along the contour separating a figure from its ground or between a form and its field.



Bust of Queen Nefertiti

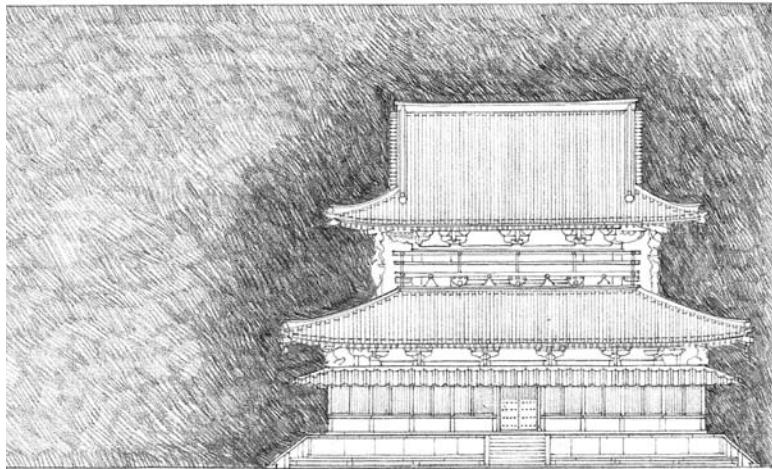
The pattern of eye movement of a person viewing the figure, from research by Alfred L. Yarbus of the Institute for Problems of Information Transmission in Moscow.



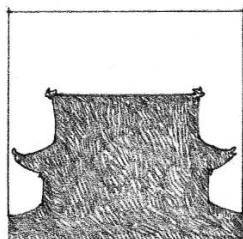
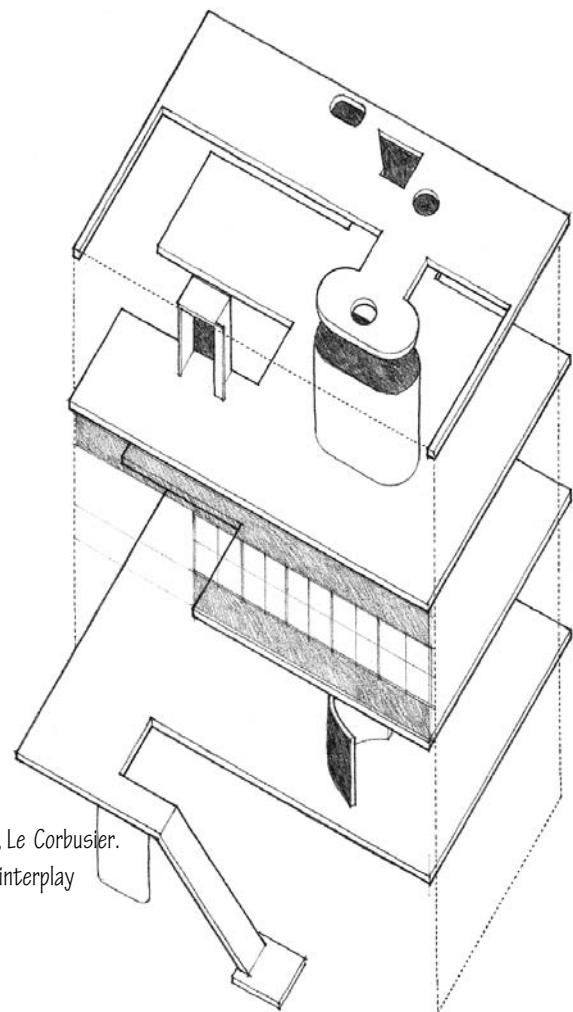
In architecture, we are concerned with the shapes of:

- floor, wall, and ceiling planes that enclose space
- door and window openings within a spatial enclosure
- silhouettes and contours of building forms

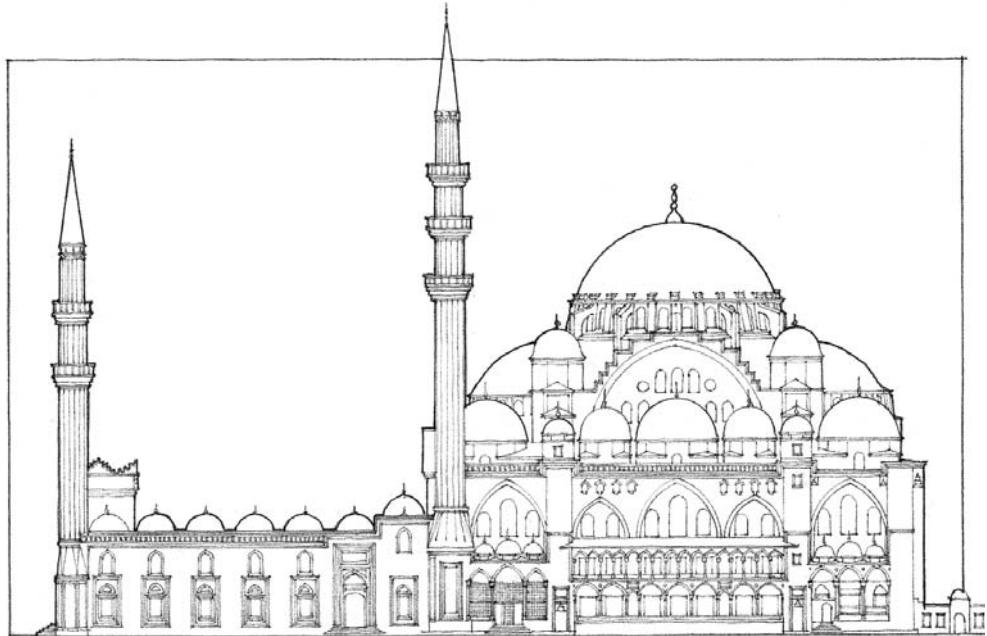
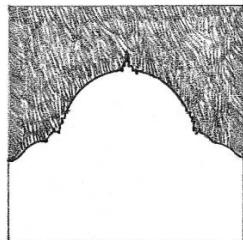
These examples illustrate how shaping the juncture between mass and space expresses the manner in which the contours of a building mass rise from the ground plane and meet the sky.



Central Pavilion, Horyu-Ji Temple, Nara, Japan, A.D. 607



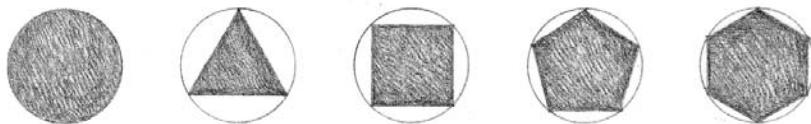
Villa Garches, Vauresson, France, 1926–27, Le Corbusier.
This architectural composition illustrates the interplay
between the shapes of planar solids and voids.



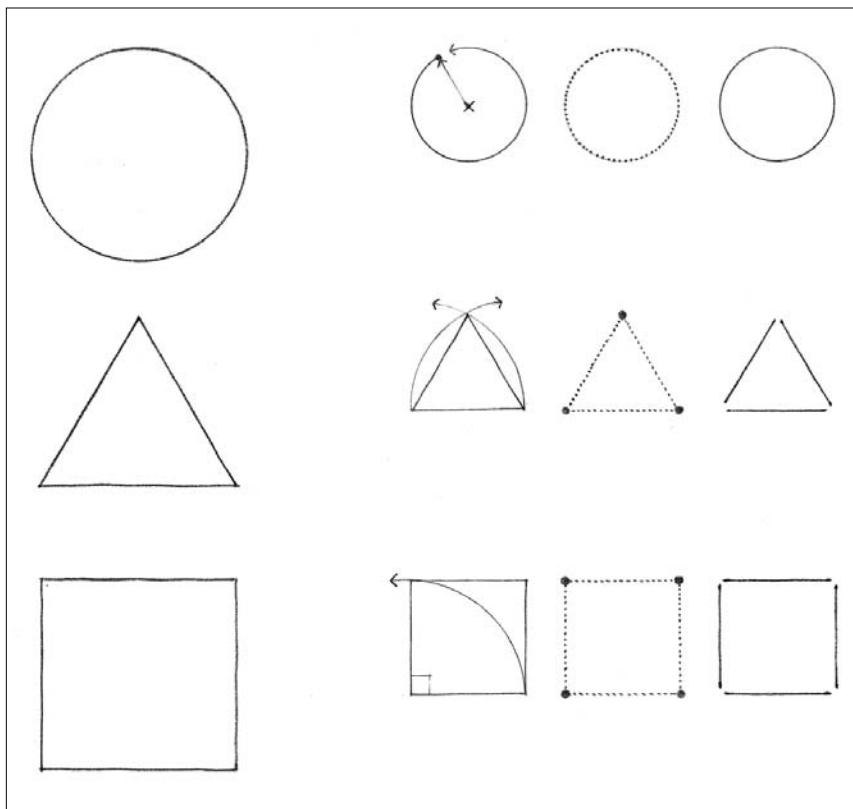
Suleymaniye Mosque,
Constantinople (Istanbul), 1551–58, Sinan

PRIMARY SHAPES

Gestalt psychology affirms that the mind will simplify the visual environment in order to understand it. Given any composition of forms, we tend to reduce the subject matter in our visual field to the simplest and most regular shapes. The simpler and more regular a shape is, the easier it is to perceive and understand.



From geometry we know the regular shapes to be the circle, and the infinite series of regular polygons that can be inscribed within it. Of these, the most significant are the primary shapes: the circle, the triangle, and the square.



Circle

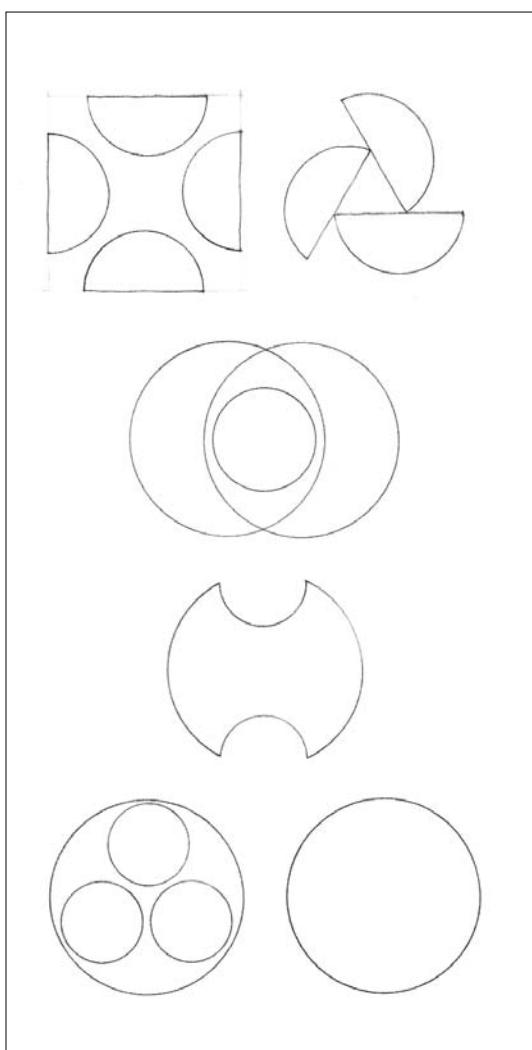
A plane curve every point of which is equidistant from a fixed point within the curve

Triangle

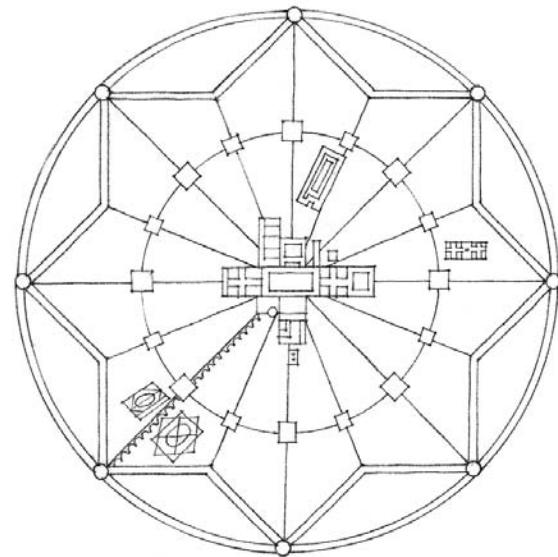
A plane figure bounded by three sides and having three angles

Square

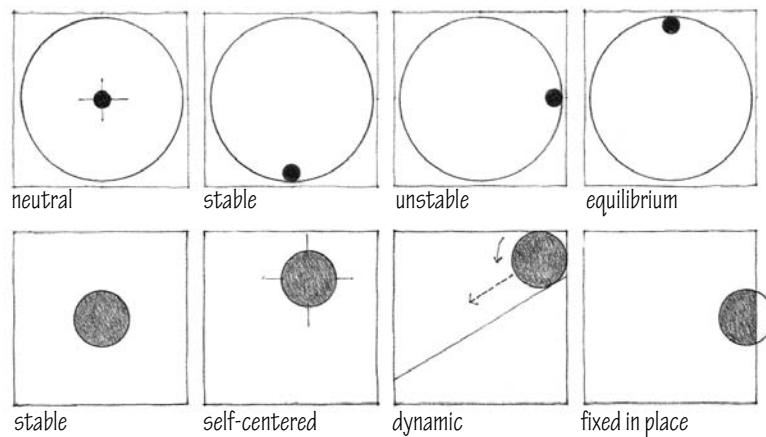
A plane figure having four equal sides and four right angles



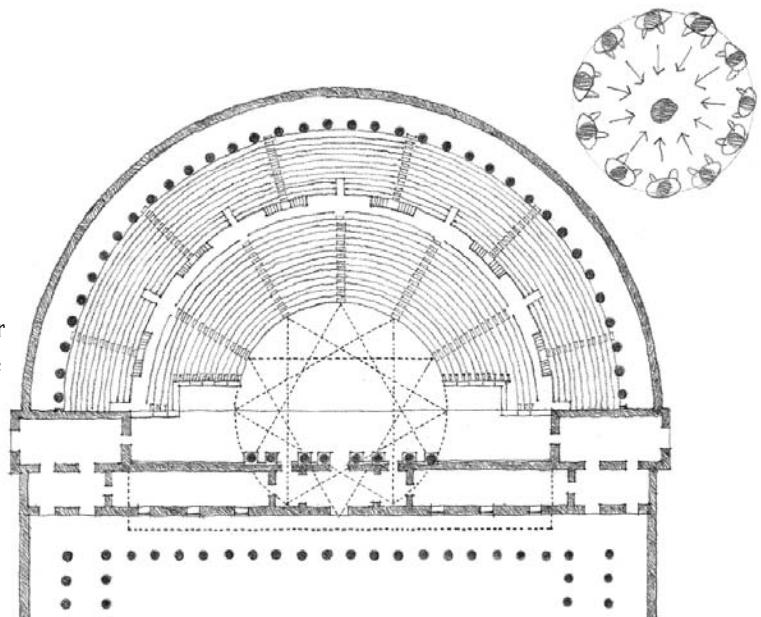
Compositions of circles and circular segments



Plan of the Ideal City of Sforzinda, 1464, Antonio Filarete

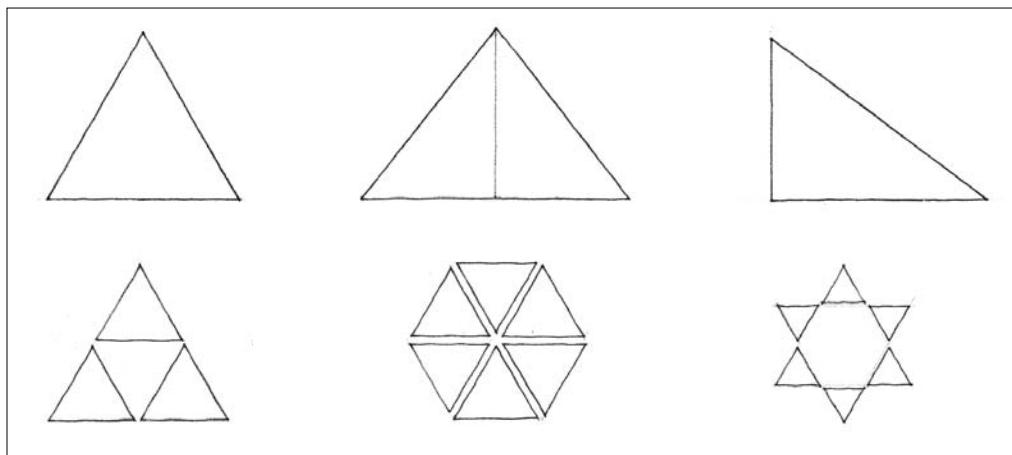


The circle is a centralized, introverted figure that is normally stable and self-centering in its environment. Placing a circle in the center of a field reinforces its inherent centrality. Associating it with straight or angular forms or placing an element along its circumference, however, can induce in the circle an apparent rotary motion.

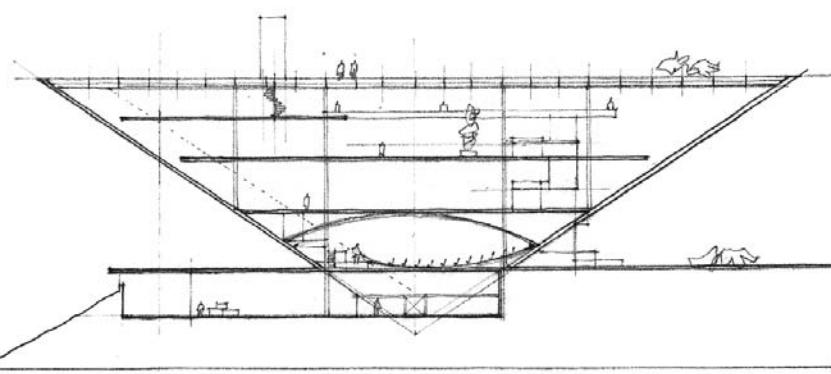
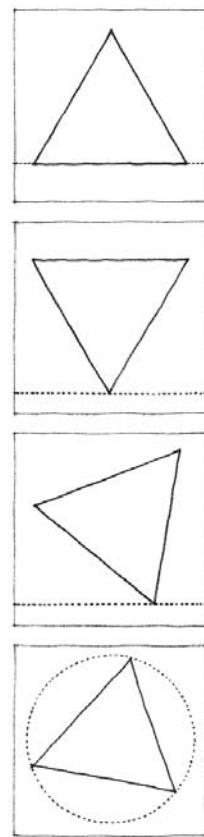


Roman Theater according to Vitruvius

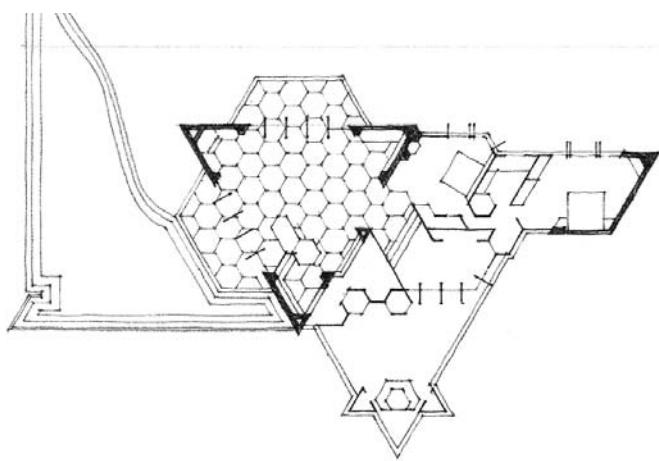
TRIANGLE



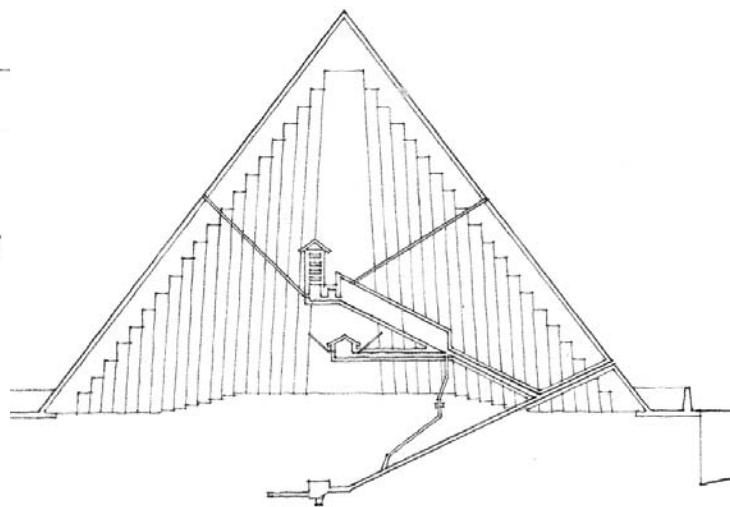
The triangle signifies stability. When resting on one of its sides, the triangle is an extremely stable figure. When tipped to stand on one of its vertices, however, it can either be balanced in a precarious state of equilibrium or be unstable and tend to fall over onto one of its sides.



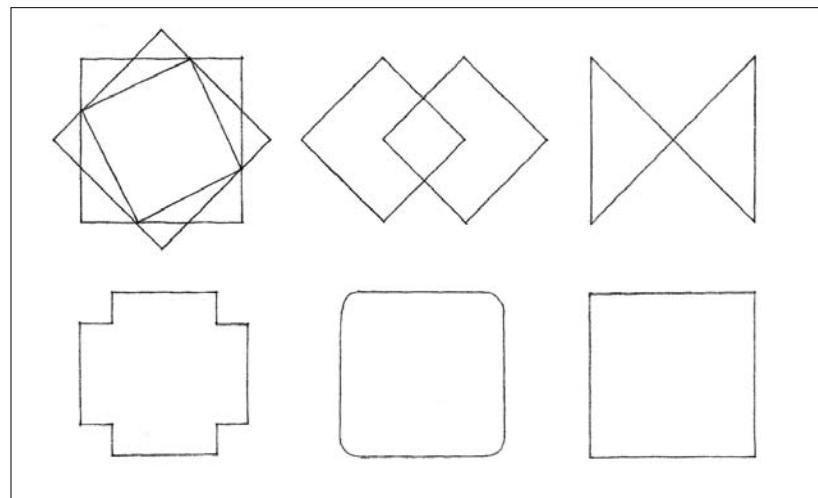
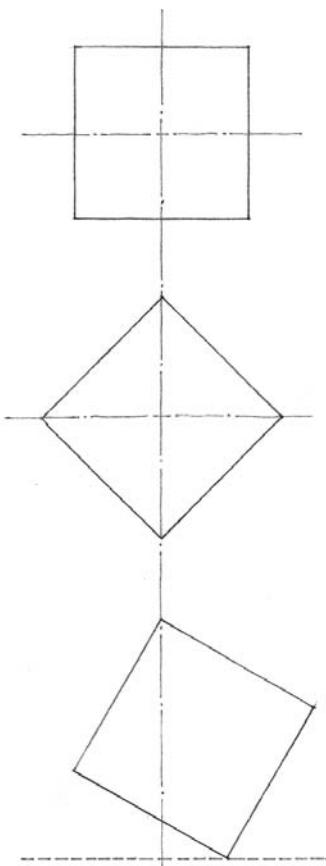
Modern Art Museum, Caracas, Venezuela, 1955, Oscar Niemeyer



Vigo Sundt House, Madison, Wisconsin, 1942, Frank Lloyd Wright

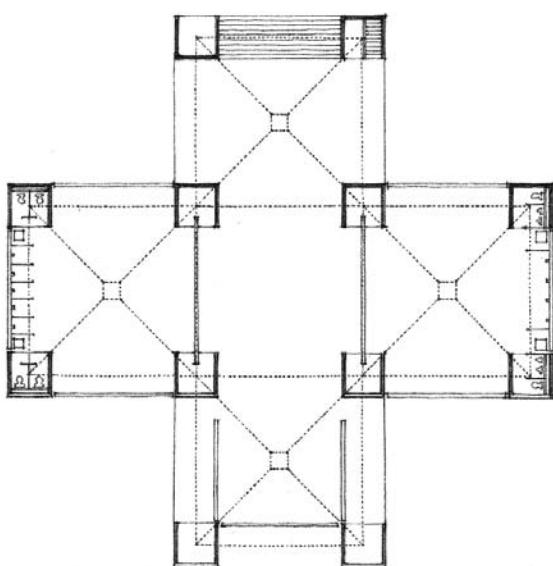


Great Pyramid of Cheops at Giza, Egypt, c. 2500 B.C.

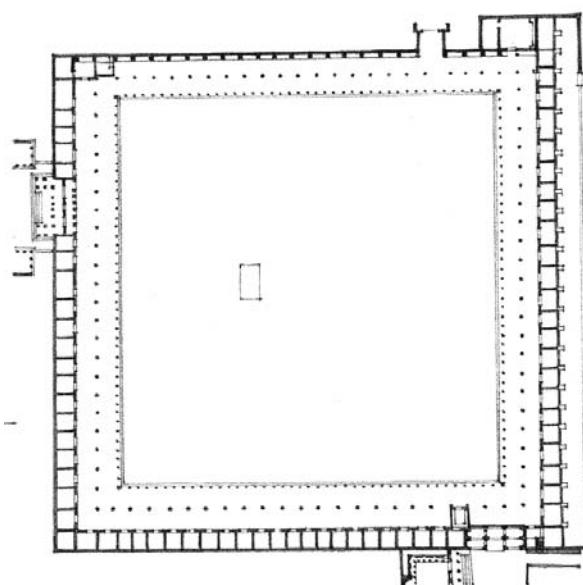


Compositions resulting from the rotation and modification of the square

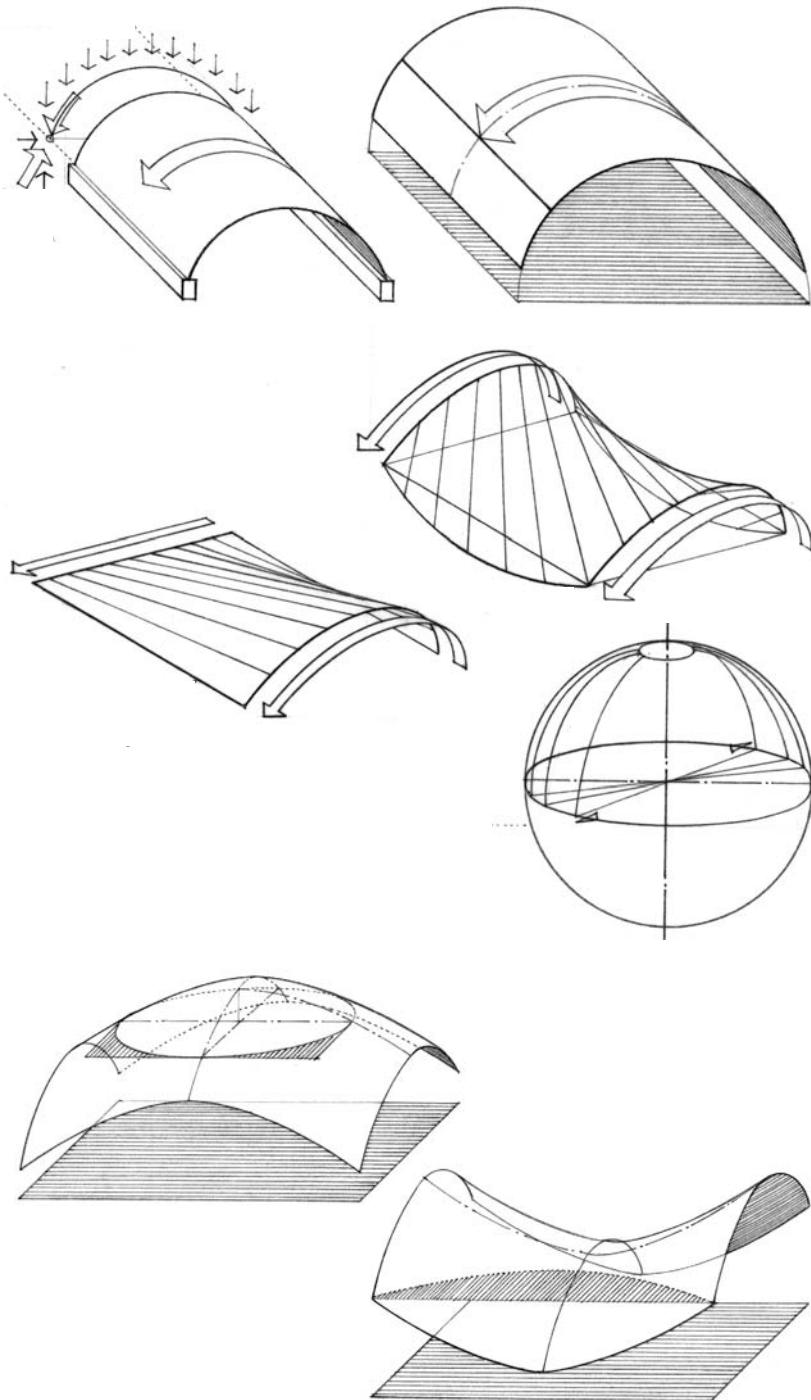
The square represents the pure and the rational. It is a bilaterally symmetrical figure having two equal and perpendicular axes. All other rectangles can be considered variations of the square – deviations from the norm by the addition of height or width. Like the triangle, the square is stable when resting on one of its sides and dynamic when standing on one of its corners. When its diagonals are vertical and horizontal, however, the square exists in a balanced state of equilibrium.



Bathhouse, Jewish Community Center, Trenton, New Jersey,
1954–59, Louis Kahn



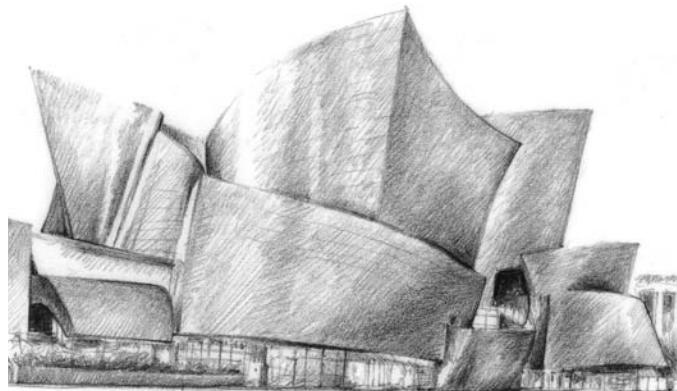
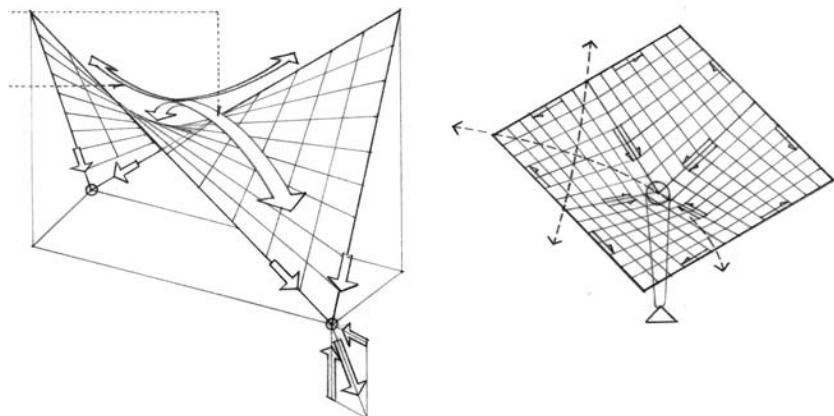
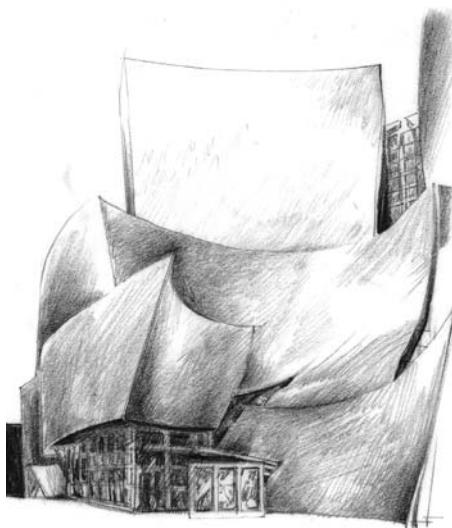
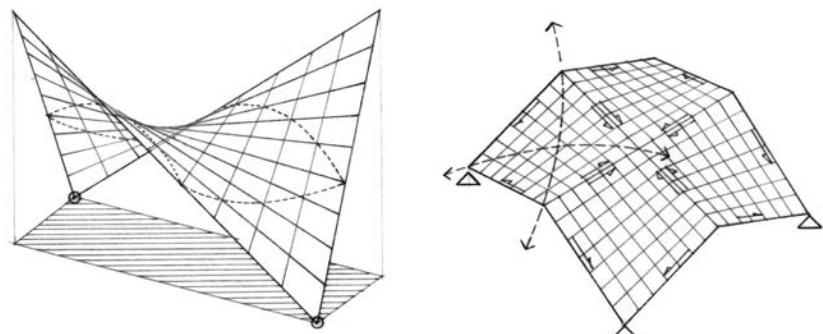
Agora of Ephesus, Asia Minor, 3rd century B.C.



In the transition from the shapes of planes to the forms of volumes is situated the realm of surfaces. Surface first refers to any figure having only two dimensions, such as a flat plane. The term, however, can also allude to a curved two-dimensional locus of points defining the boundary of a three-dimensional solid. There is a special class of the latter that can be generated from the geometric family of curves and straight lines. This class of curved surfaces include the following:

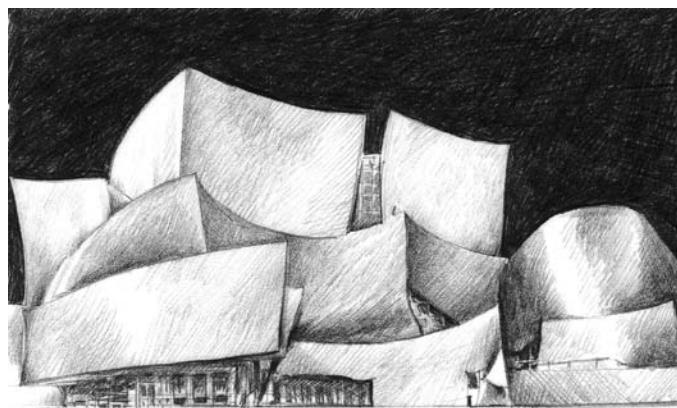
- Cylindrical surfaces are generated by sliding a straight line along a plane curve, or vice versa. Depending on the curve, a cylindrical surface may be circular, elliptic, or parabolic. Because of its straight line geometry, a cylindrical surface can be regarded as being either a translational or a ruled surface.
- Translational surfaces are generated by sliding a plane curve along a straight line or over another plane curve.
- Ruled surfaces are generated by the motion of a straight line. Because of its straight line geometry, a ruled surface is generally easier to form and construct than a rotational or translational surface.
- Rotational surfaces are generated by rotating a plane curve about an axis.
- Paraboloids are surfaces all of whose intersections by planes are either parabolas and ellipses or parabolas and hyperbolas. Parabolas are plane curves generated by a moving point that remains equidistant from a fixed line and a fixed point not on the line. Hyperbolas are plane curves formed by the intersection of a right circular cone with a plane that cuts both halves of the cone.
- Hyperbolic paraboloids are surfaces generated by sliding a parabola with downward curvature along a parabola with upward curvature, or by sliding a straight line segment with its ends on two skew lines. It can thus be considered to be both a translational and a ruled surface.

Saddle surfaces have an upward curvature in one direction and a downward curvature in the perpendicular direction. Regions of downward curvature exhibit archlike action while regions of upward curvature behave as a cable structure. If the edges of a saddle surface are not supported, beam behavior may also be present.



The geometric basis for these curved surfaces can be effectively utilized in digital modeling as well as in the description, fabrication and assembly of curvilinear architectural elements and components. The fluid quality of curved surfaces contrasts with the angular nature of rectilinear forms and are appropriate for describing the form of shell structures as well as nonloadbearing elements of enclosure.

Symmetrical curved surfaces, such as domes and barrel vaults, are inherently stable. Asymmetrical curved surfaces, on the other hand, can be more vigorous and expressive in nature. Their shapes change dramatically as we view them from different perspectives.

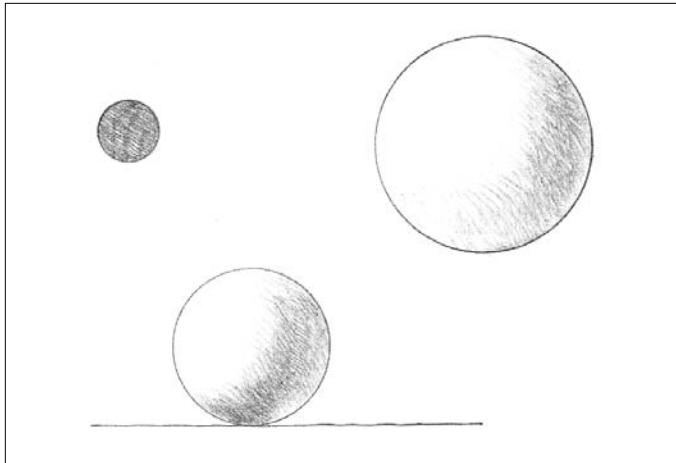


Walt Disney Concert Hall, Los Angeles, California, 1987–2003, Frank O. Gehry & Partners

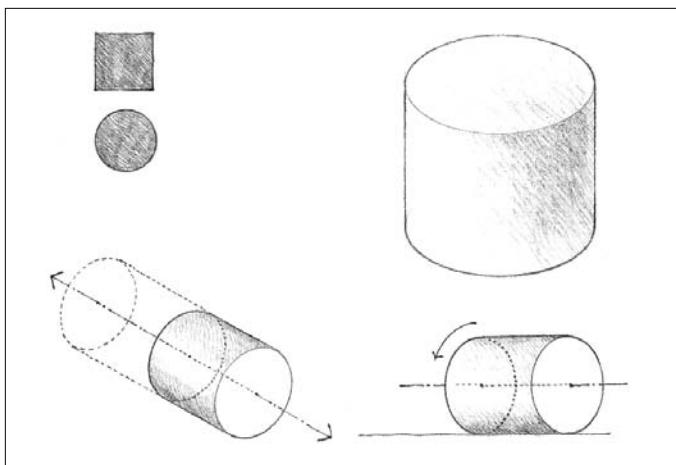
PRIMARY SOLIDS

"...cubes, cones, spheres, cylinders, or pyramids are the great primary forms that light reveals to advantage; the image of these is distinct and tangible within us and without ambiguity. It is for this reason that these are beautiful forms, the most beautiful forms." *Le Corbusier*

The primary shapes can be extended or rotated to generate volumetric forms or solids that are distinct, regular, and easily recognizable. Circles generate spheres and cylinders; triangles generate cones and pyramids; squares generate cubes. In this context, the term solid does not refer to firmness of substance but rather to a three-dimensional geometric body or figure.

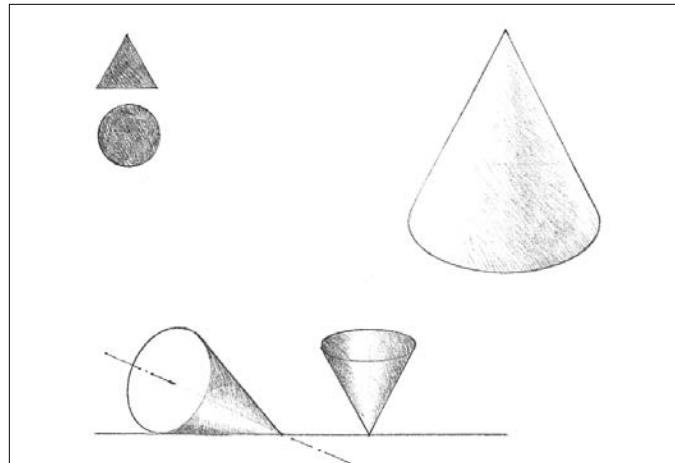


Sphere A solid generated by the revolution of a semicircle about its diameter, whose surface is at all points equidistant from the center. A sphere is a centralized and highly concentrated form. Like the circle from which it is generated, it is self-centering and normally stable in its environment. It can be inclined toward a rotary motion when placed on a sloping plane. From any viewpoint, it retains its circular shape.

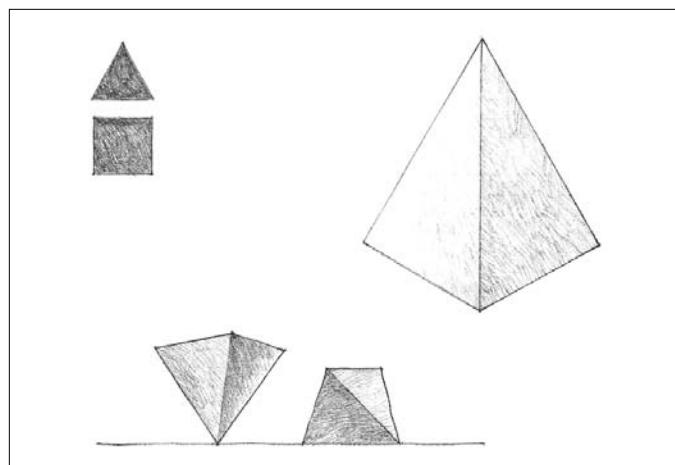


Cylinder A solid generated by the revolution of a rectangle about one of its sides. A cylinder is centralized about the axis passing through the centers of its two circular faces. Along this axis, it can be easily extended. The cylinder is stable if it rests on one of its circular faces; it becomes unstable when its central axis is inclined from the vertical.

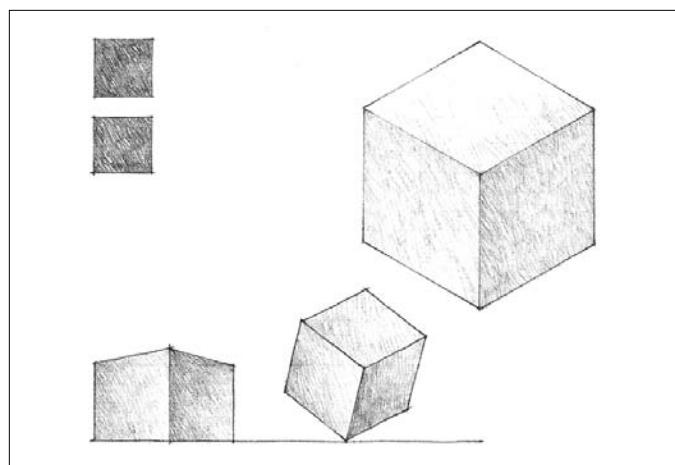
Cone A solid generated by the revolution of a right triangle about one of its sides. Like the cylinder, the cone is a highly stable form when resting on its circular base, and unstable when its vertical axis is tipped or overturned. It can also rest on its apex in a precarious state of balance.



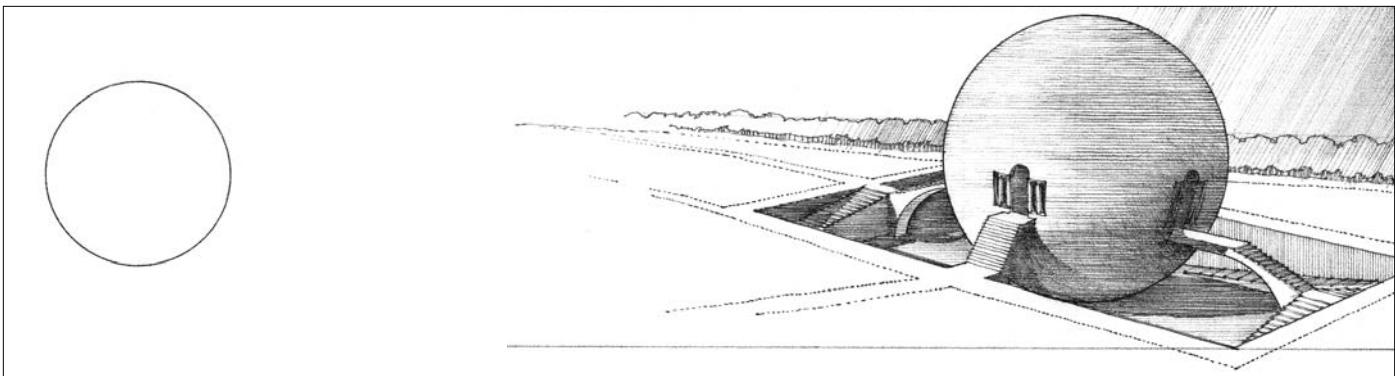
Pyramid A polyhedron having a polygonal base and triangular faces meeting at a common point or vertex. The pyramid has properties similar to those of the cone. Because all of its surfaces are flat planes, however, the pyramid can rest in a stable manner on any of its faces. While the cone is a soft form, the pyramid is relatively hard and angular.



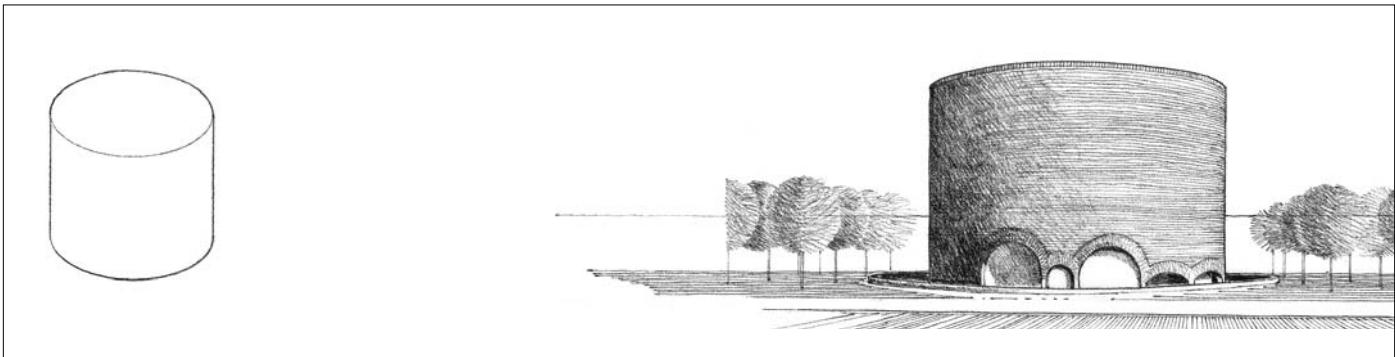
Cube A prismatic solid bounded by six equal square sides, the angle between any two adjacent faces being a right angle. Because of the equality of its dimensions, the cube is a static form that lacks apparent movement or direction. It is a stable form except when it stands on one of its edges or corners. Even though its angular profile is affected by our point of view, the cube remains a highly recognizable form.



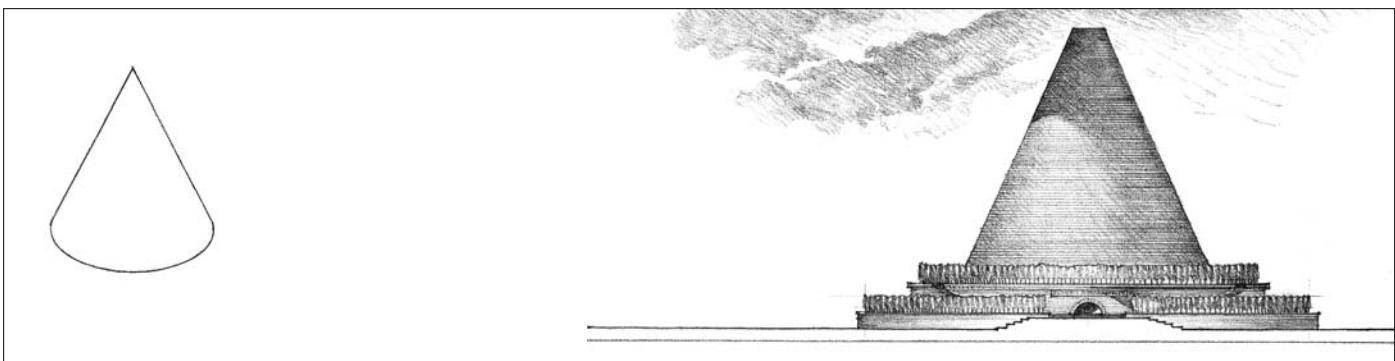
PRIMARY SOLIDS



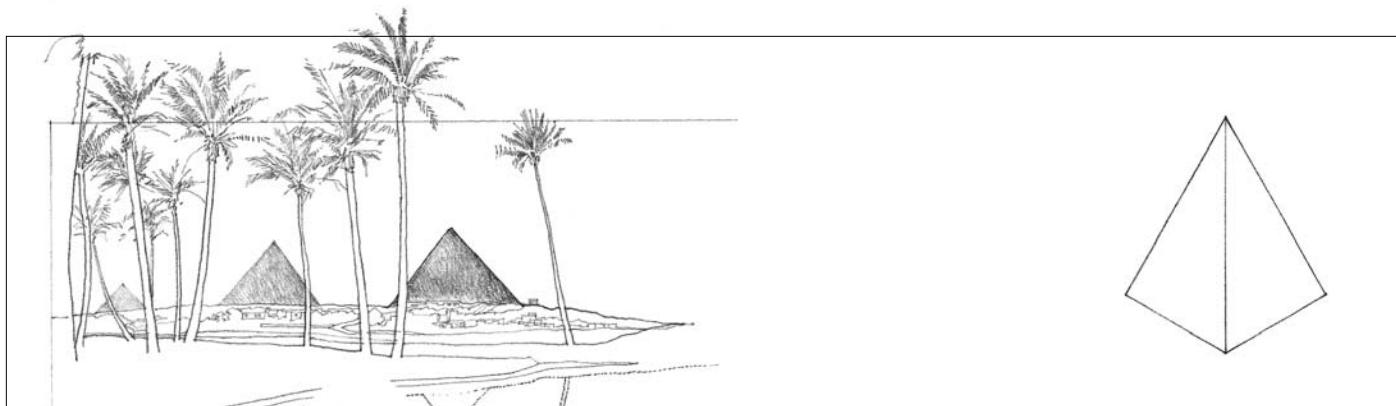
Maupertius, Project for an Agricultural Lodge, 1775, Claude-Nicolas Ledoux



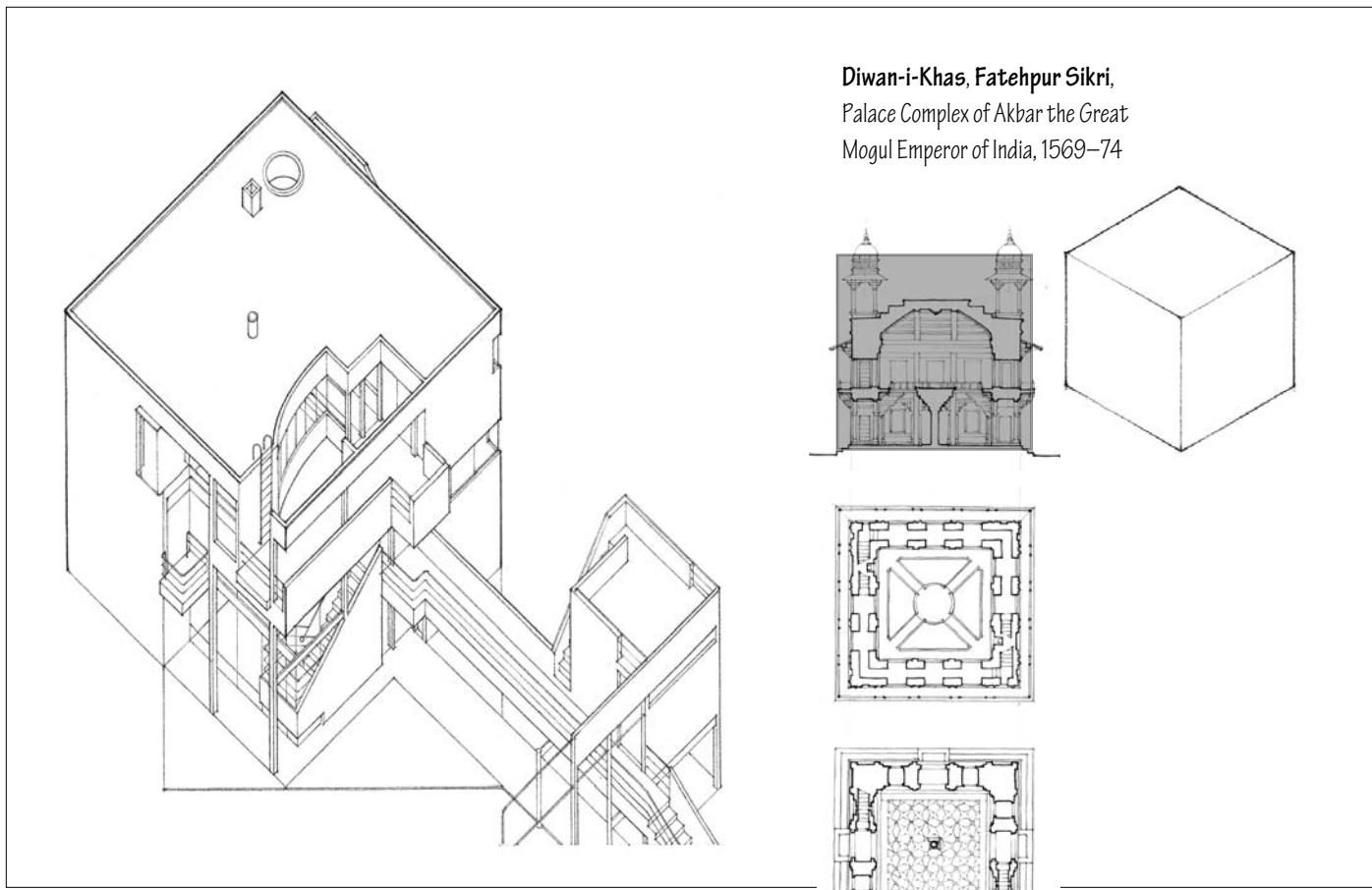
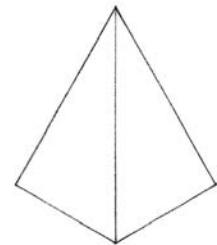
Chapel, Massachusetts Institute of Technology, Cambridge, Massachusetts, 1955, Eero Saarinen and Associates



Project for a Conical Cenotaph, 1784, Étienne-Louis Boullée



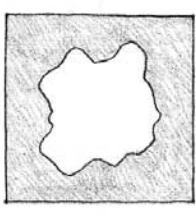
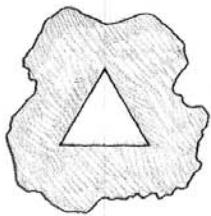
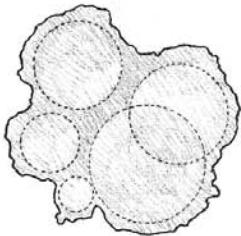
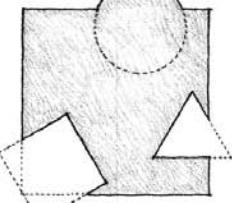
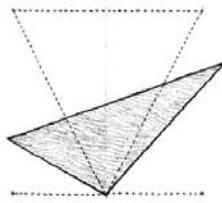
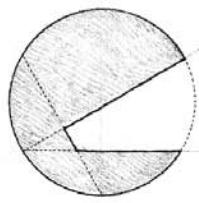
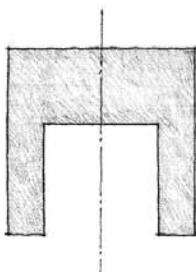
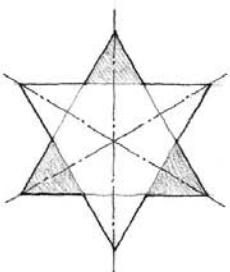
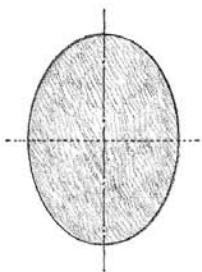
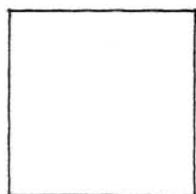
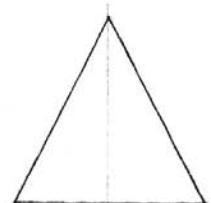
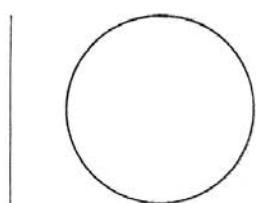
Pyramids of Cheops, Chephren, and Mykerinos at Giza, Egypt, c. 2500 B.C.



Hanselmann House, Fort Wayne, Indiana, 1967, Michael Graves

Diwan-i-Khas, Fatehpur Sikri,
Palace Complex of Akbar the Great
Mogul Emperor of India, 1569–74

REGULAR & IRREGULAR FORMS

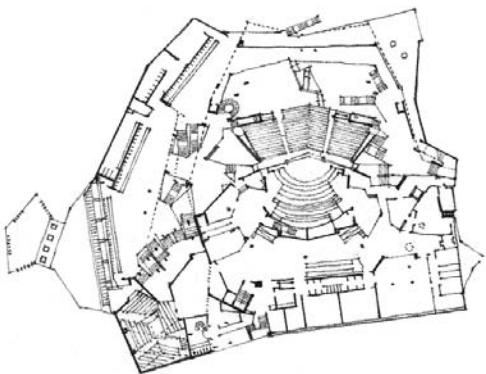


Regular forms refer to those whose parts are related to one another in a consistent and orderly manner. They are generally stable in nature and symmetrical about one or more axes. The sphere, cylinder, cone, cube, and pyramid are prime examples of regular forms.

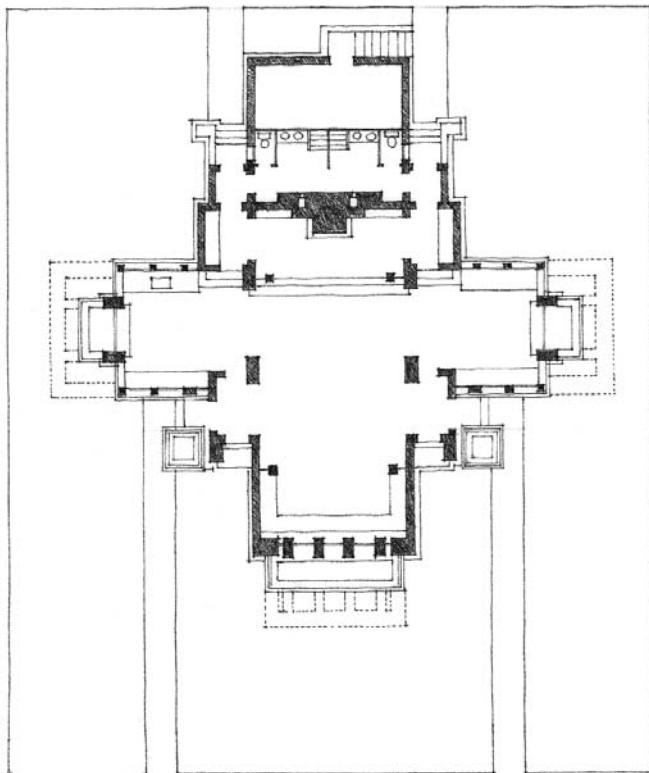
Forms can retain their regularity even when transformed dimensionally or by the addition or subtraction of elements. From our experiences with similar forms, we can construct a mental model of the original whole even when a fragment is missing or another part is added.

Irregular forms are those whose parts are dissimilar in nature and related to one another in an inconsistent manner. They are generally asymmetrical and more dynamic than regular forms. They can be regular forms from which irregular elements have been subtracted or result from an irregular composition of regular forms.

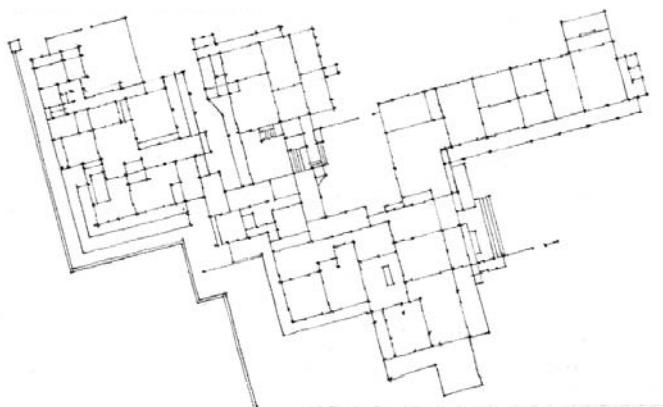
Since we deal with both solid masses and spatial voids in architecture, regular forms can be contained within irregular forms. In a similar manner, irregular forms can be enclosed by regular forms.



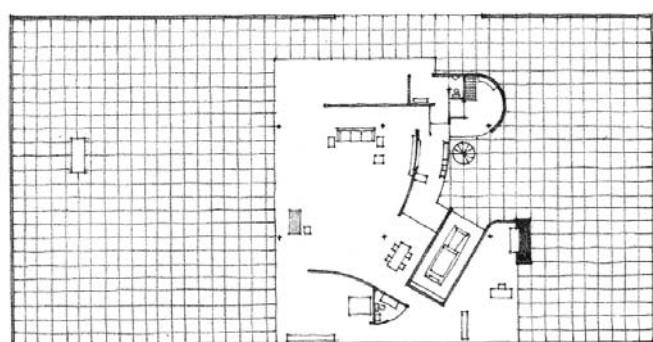
Irregular Forms:
Philharmonic Hall, Berlin, 1956–63, Hans Scharoun



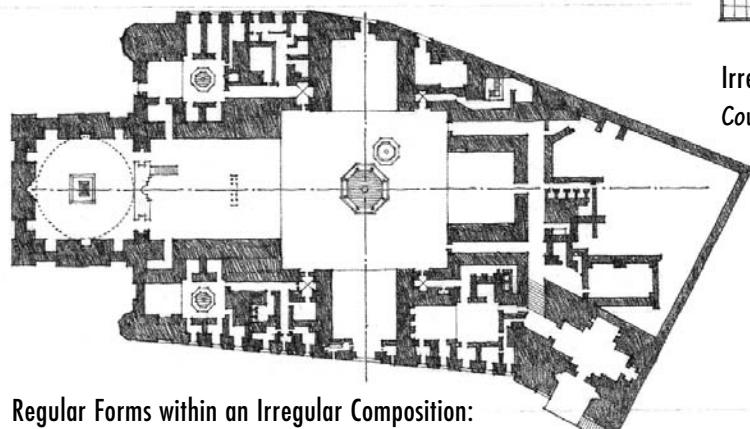
A Regular Composition of Regular Forms:
Coonley Playhouse, Riverside, Illinois, 1912, Frank Lloyd Wright



An Irregular Composition of Regular Forms:
Katsura Imperial Villa, Kyoto, Japan, 17th century



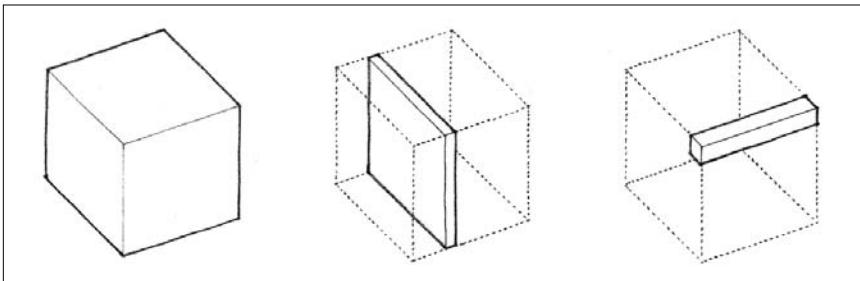
Irregular Forms within a Regular Field:
Courtyard House Project, 1934, Mies van de Rohe



Regular Forms within an Irregular Composition:
Mosque of Sultan Hasan, Cairo, Egypt, 1356–63

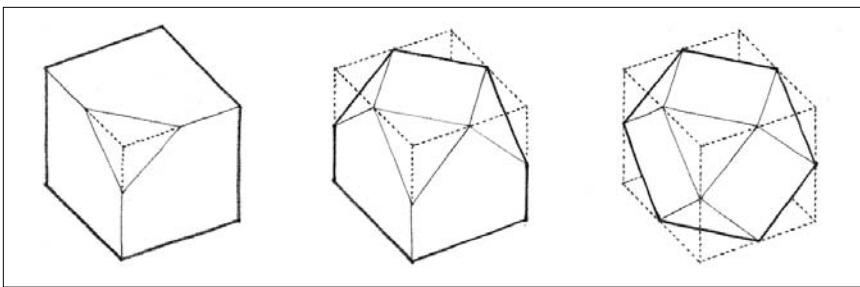
TRANSFORMATION OF FORM

All other forms can be understood to be transformations of the primary solids, variations which are generated by the manipulation of one or more dimensions or by the addition or subtraction of elements.



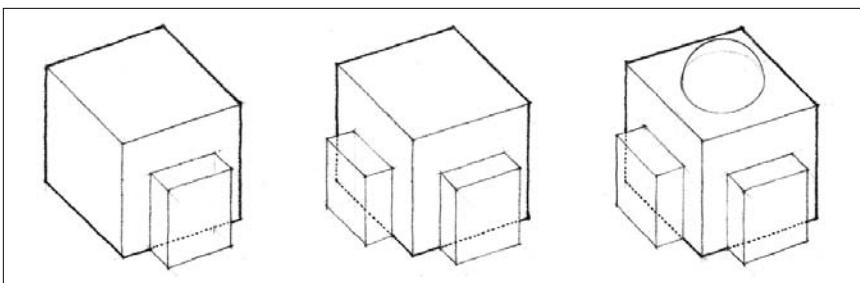
Dimensional Transformation

A form can be transformed by altering one or more of its dimensions and still retain its identity as a member of a family of forms. A cube, for example, can be transformed into similar prismatic forms through discrete changes in height, width, or length. It can be compressed into a planar form or be stretched out into a linear one.



Subtractive Transformation

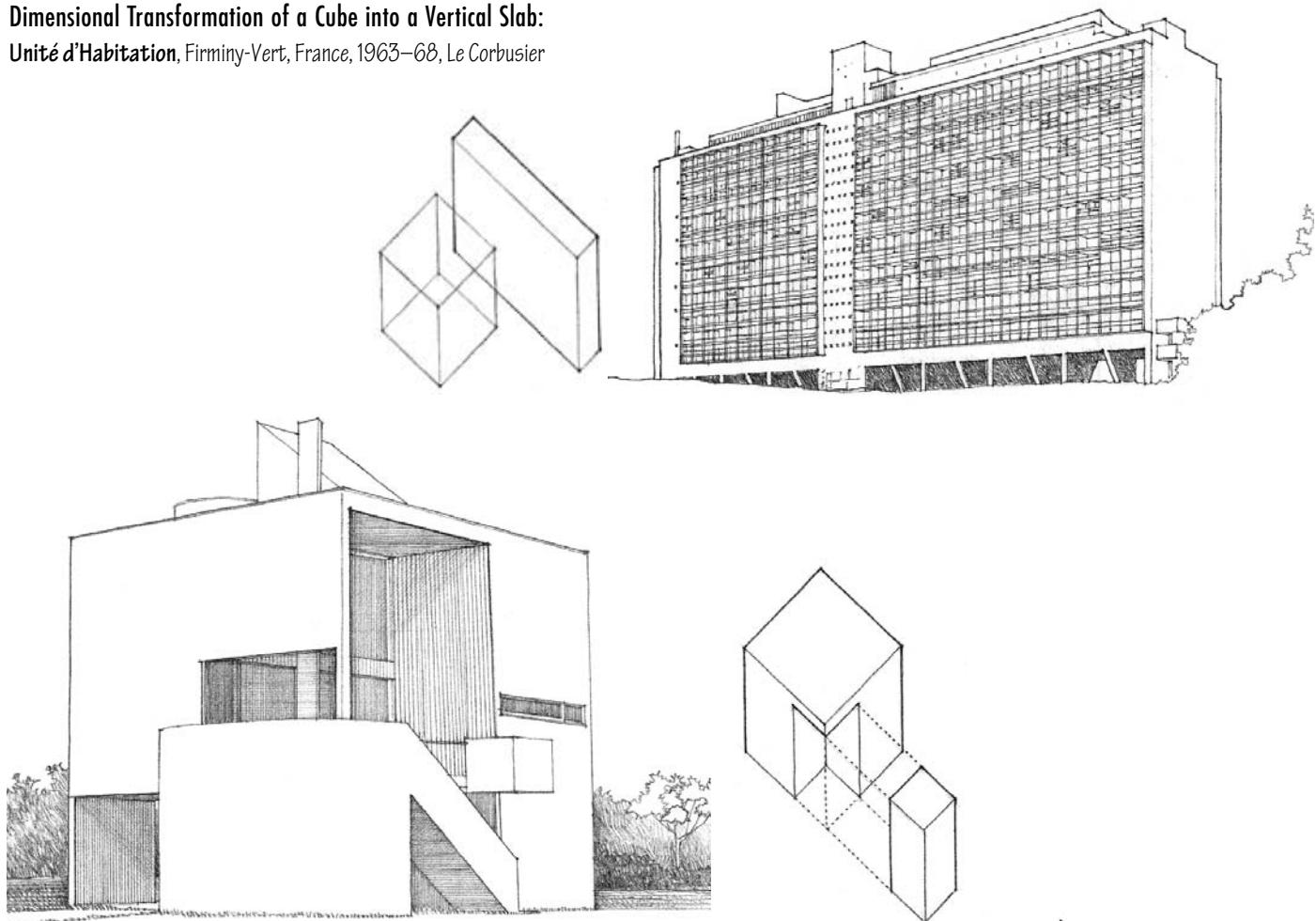
A form can be transformed by subtracting a portion of its volume. Depending on the extent of the subtractive process, the form can retain its initial identity or be transformed into a form of another family. For example, a cube can retain its identity as a cube even though a portion of it is removed, or be transformed into a series of regular polyhedrons that begin to approximate a sphere.



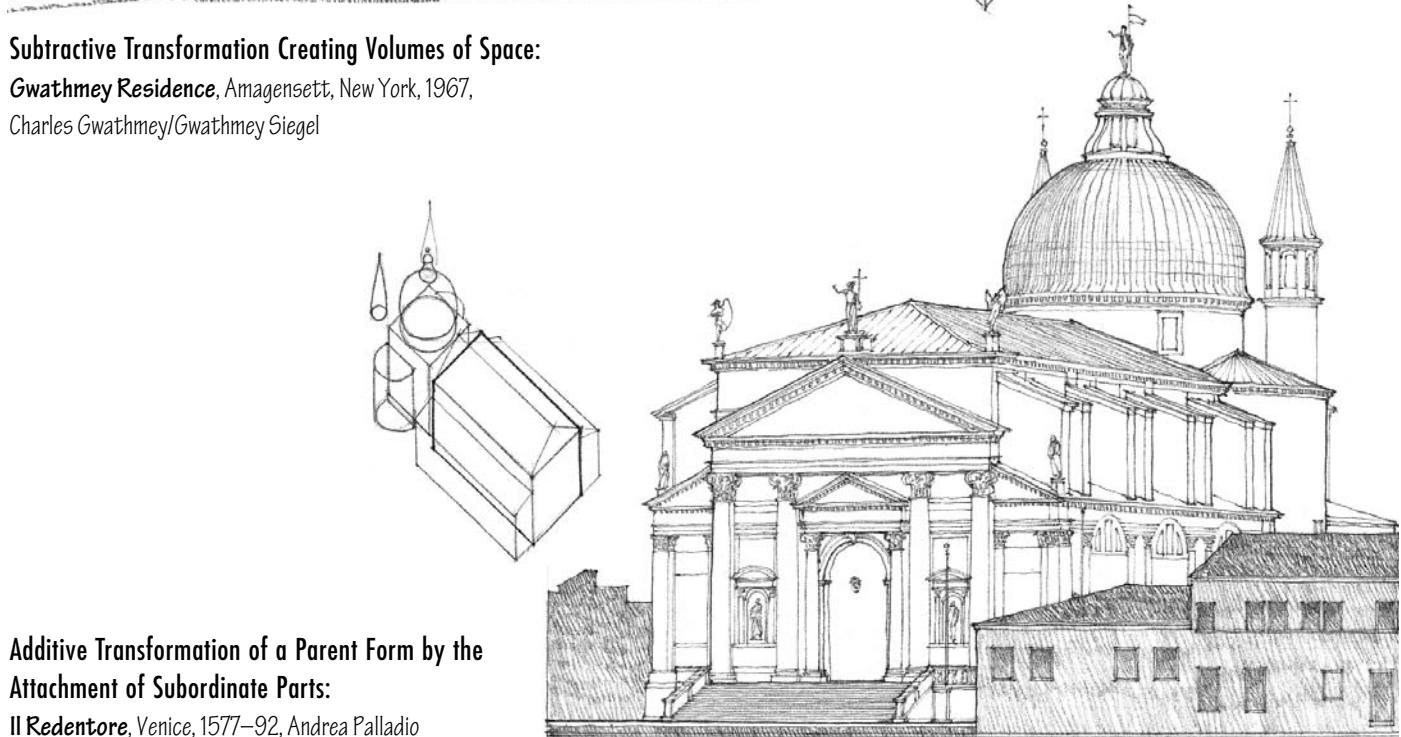
Additive Transformation

A form can be transformed by the addition of elements to its volume. The nature of the additive process and the number and relative sizes of the elements being attached determine whether the identity of the initial form is altered or retained.

Dimensional Transformation of a Cube into a Vertical Slab:
Unité d'Habitation, Firminy-Vert, France, 1963–68, Le Corbusier

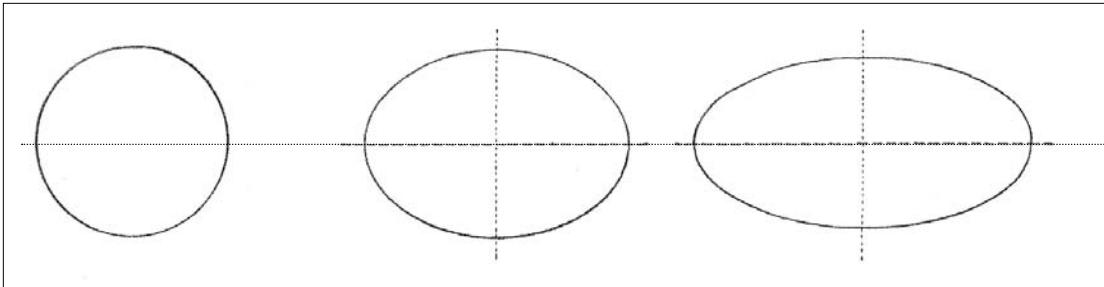


Subtractive Transformation Creating Volumes of Space:
Gwathmey Residence, Amagansett, New York, 1967,
Charles Gwathmey/Gwathmey Siegel

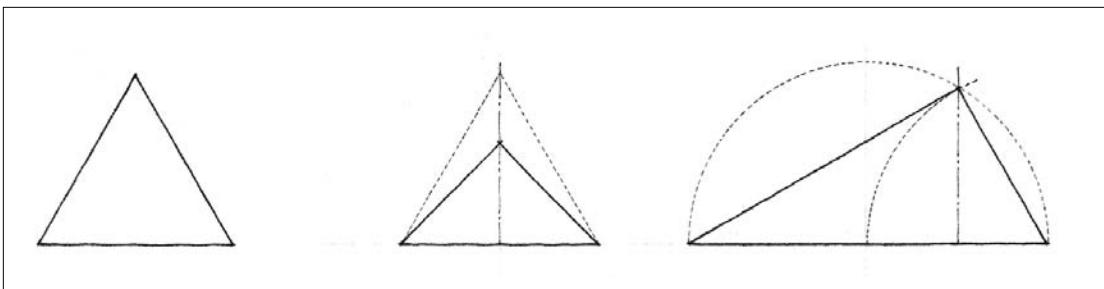


Additive Transformation of a Parent Form by the Attachment of Subordinate Parts:
Il Redentore, Venice, 1577–92, Andrea Palladio

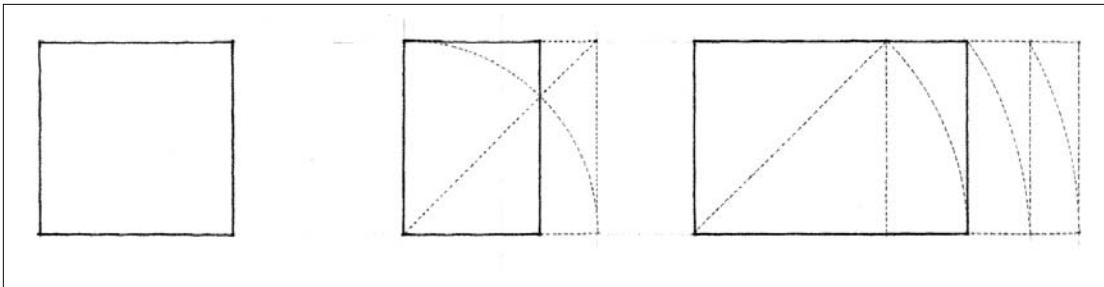
DIMENSIONAL TRANSFORMATION



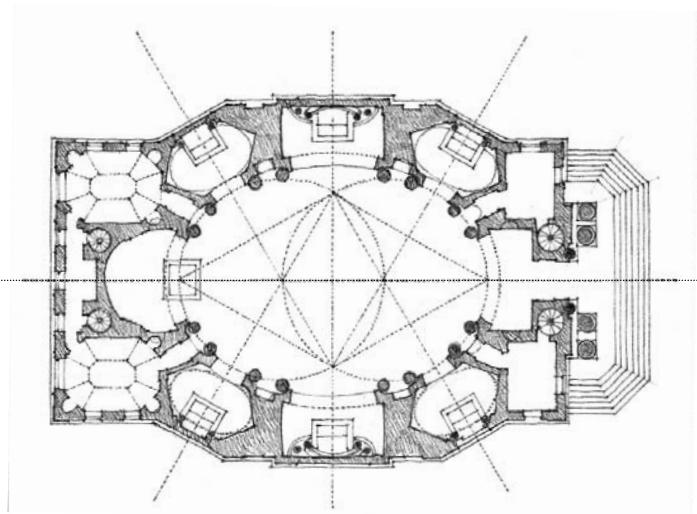
A sphere can be transformed into any number of ovoid or ellipsoidal forms by elongating it along an axis.



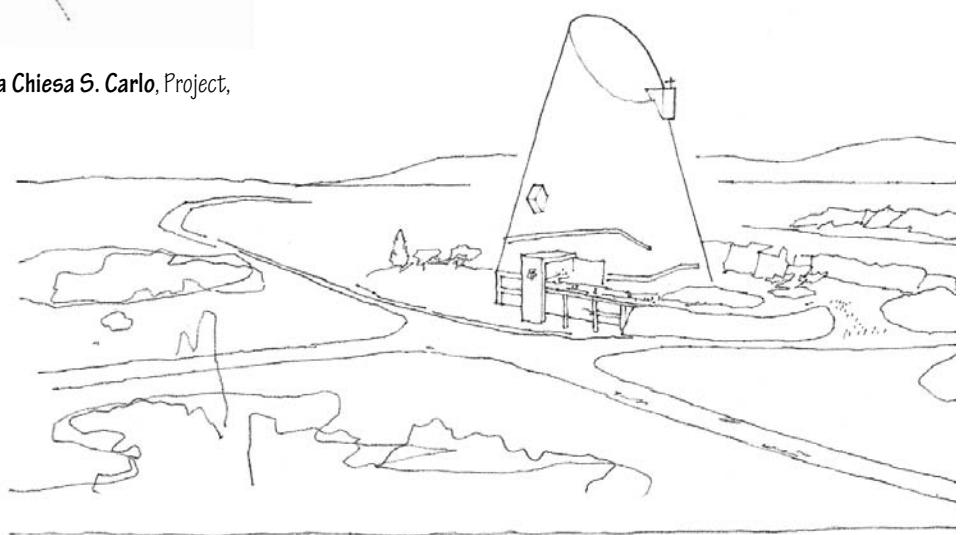
A pyramid can be transformed by altering the dimensions of the base, modifying the height of the apex, or tilting the normally vertical axis.



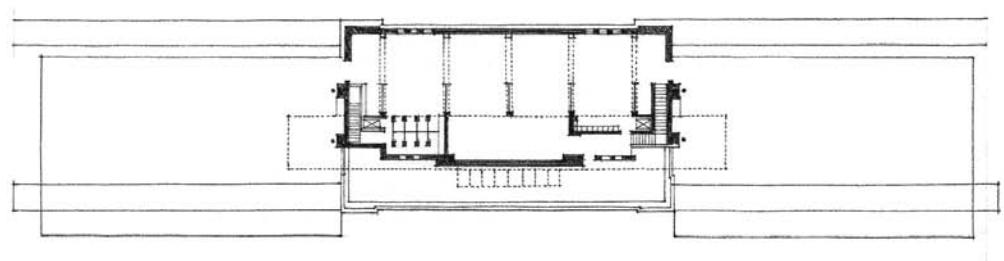
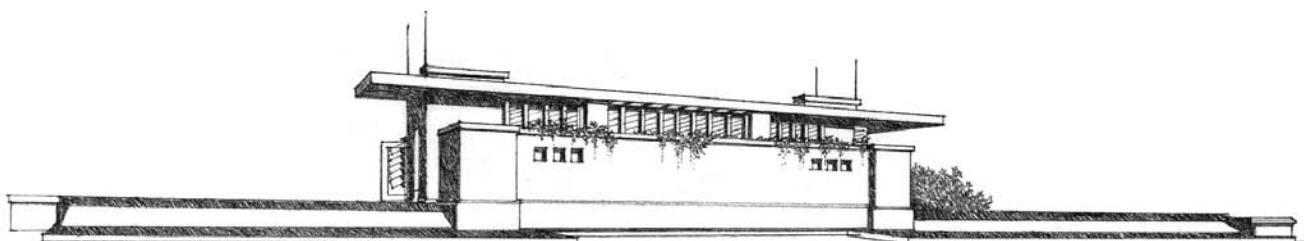
A cube can be transformed into similar prismatic forms by shortening or elongating its height, width, or depth.



Plan of an Elliptical Church, *Pensiero Della Chiesa S. Carlo*, Project,
17th century, Francesco Borromini

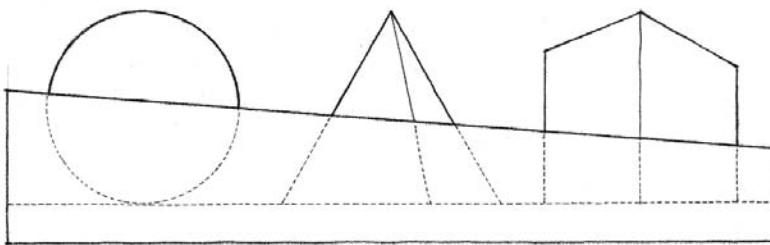


St. Pierre, Firminy-Vert, France, 1965, Le Corbusier

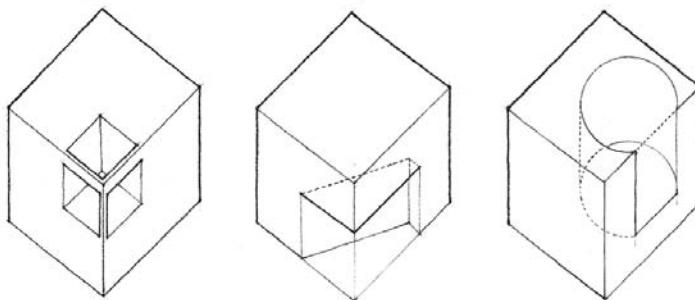


Project for Yahara Boat Club, Madison, Wisconsin, 1902, Frank Lloyd Wright

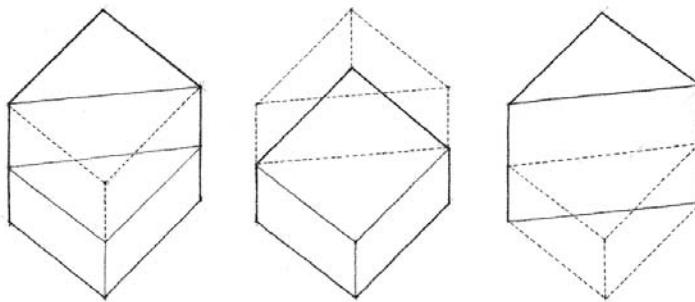
SUBTRACTIVE FORM



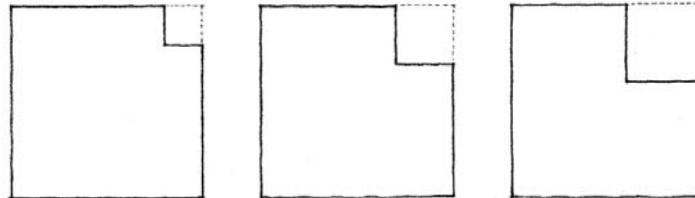
We search for regularity and continuity in the forms we see within our field of vision. If any of the primary solids is partially hidden from our view, we tend to complete its form and visualize it as if it were whole because the mind fills in what the eyes do not see. In a similar manner, when regular forms have fragments missing from their volumes, they retain their formal identities if we perceive them as incomplete wholes. We refer to these mutilated forms as subtractive forms.



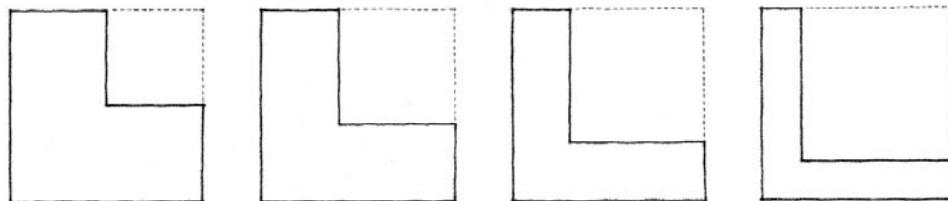
Because they are easily recognizable, simple geometric forms, such as the primary solids, adapt readily to subtractive treatment. These forms will retain their formal identities if portions of their volumes are removed without deteriorating their edges, corners, and overall profile.

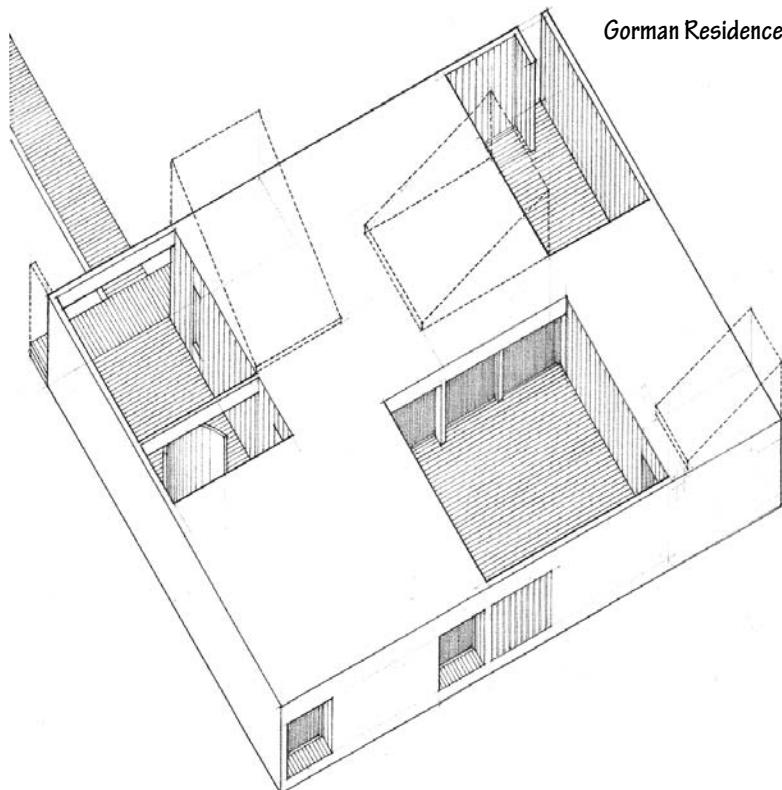


Ambiguity regarding the original identity of a form will result if the portion removed from its volume erodes its edges and drastically alters its profile.

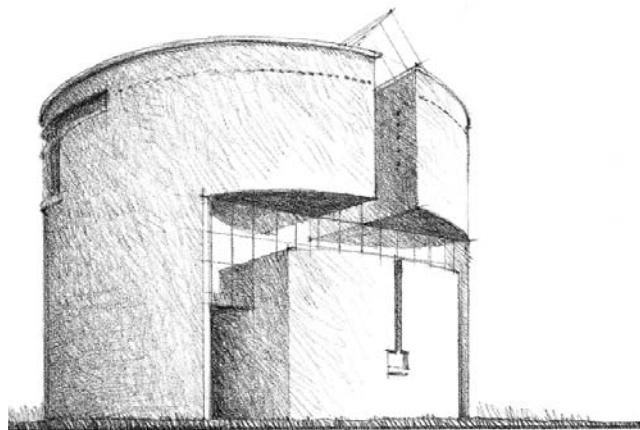


In the series of figures below, at what point does the square shape with a corner portion removed become an L-shaped configuration of two rectangular planes?



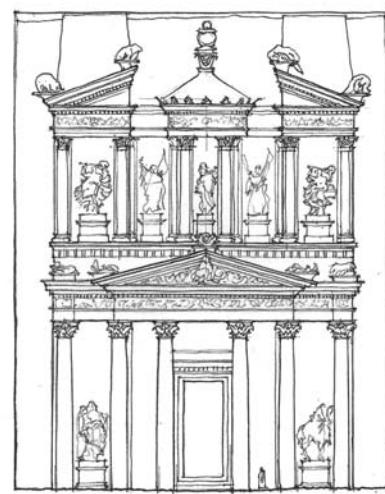
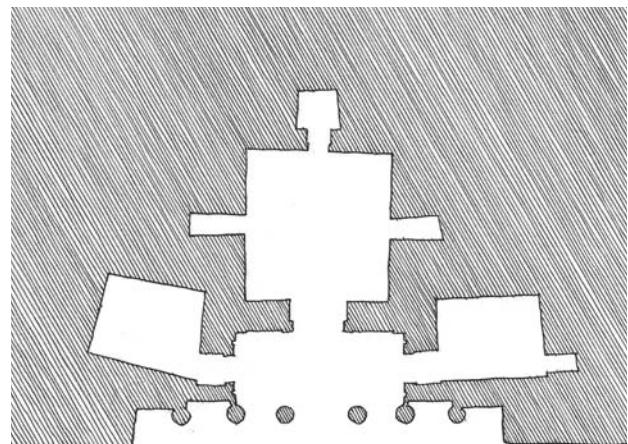


Gorman Residence, Amagansett, New York, 1968, Julian and Barbara Neski



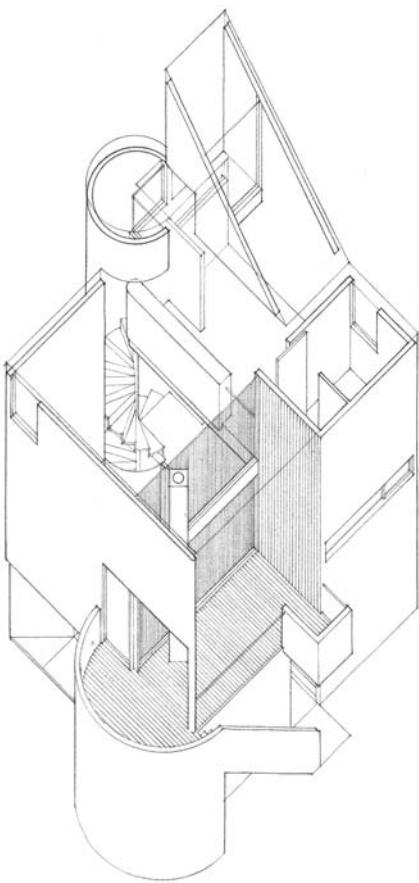
House at Stabio, Switzerland, 1981, Mario Botta

Spatial volumes may be subtracted from a form to create recessed entrances, positive courtyard spaces, or window openings shaded by the vertical and horizontal surfaces of the recess.

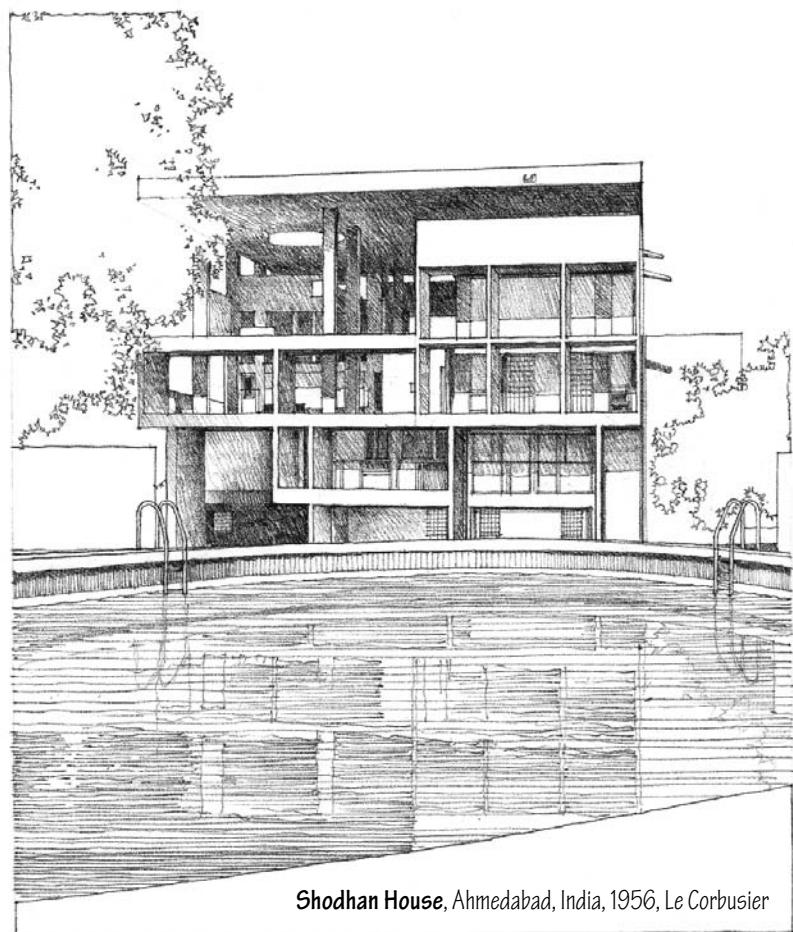


Khasneh al Faroun, Petra, 1st century A.D.

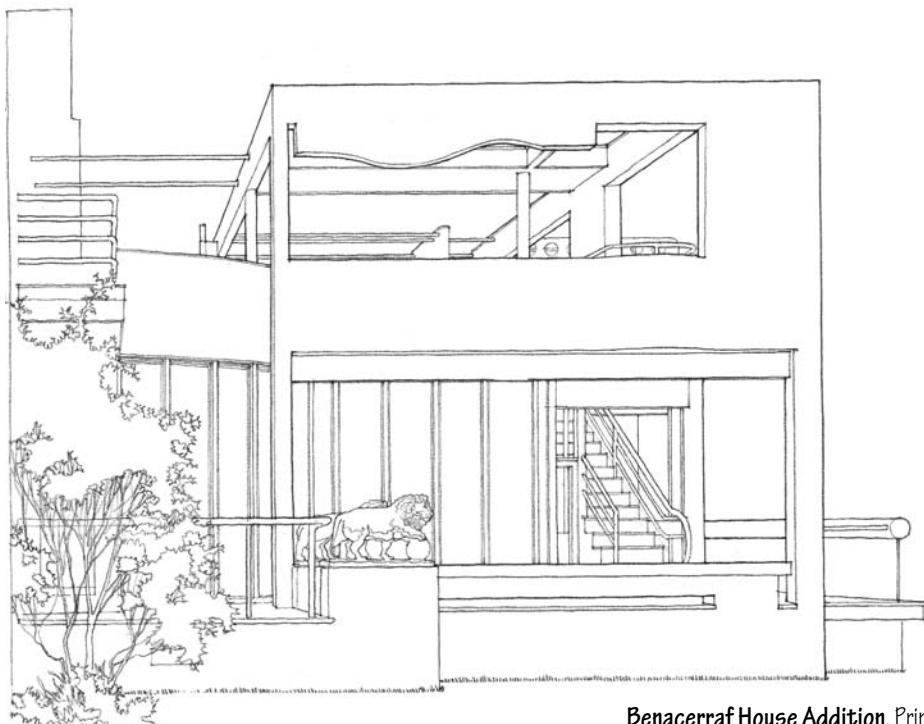
SUBTRACTIVE FORM



Gwathmey Residence, Amagansett, New York, 1967,
Charles Gwathmey/Gwathmey Siegel & Associates



Shodhan House, Ahmedabad, India, 1956, Le Corbusier

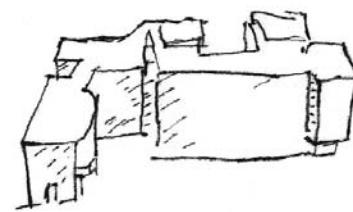
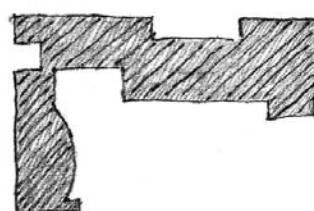


Benacerraf House Addition, Princeton, New Jersey, 1969, Michael Graves

Le Corbusier comments on form:

"Cumulative Composition

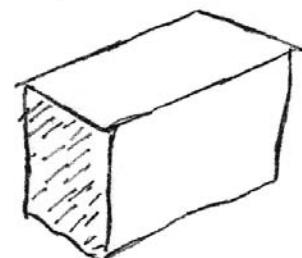
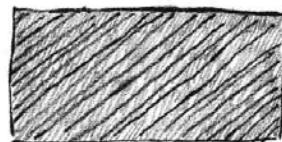
- additive form
- a rather easy type
- picturesque; full of movement
- can be completely disciplined by classification and hierarchy"



La Roche-Jeanneret Houses, Paris

"Cubic Compositions (Pure Prisms)

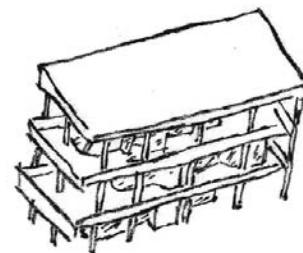
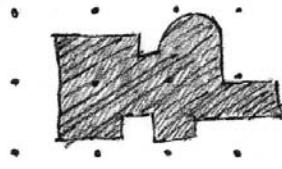
- very difficult
- (to satisfy the spirit)"



Villa at Garches

"very easy

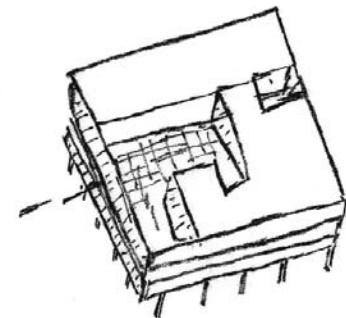
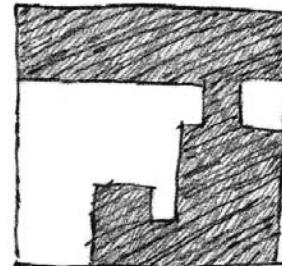
- (convenient combining)"



House at Stuttgart

"subtractive form

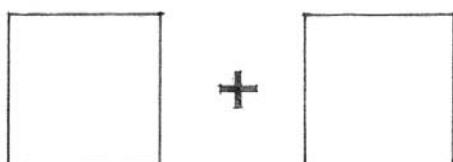
- very generous
- on the exterior an architectural will is confirmed
- on the interior all functional needs are satisfied (light penetration, continuity, circulation)"



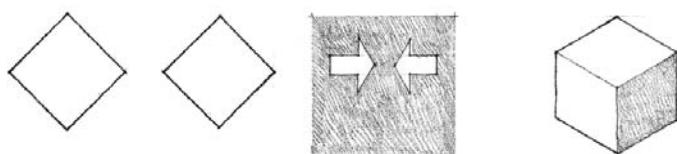
House at Poissy

After a sketch, *Four House Forms*, by Le Corbusier for the cover of Volume Two of the *Oeuvre Complète*, published in 1935.

ADDITIVE FORM



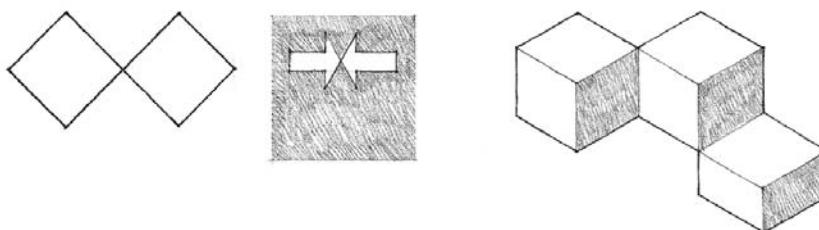
While a subtractive form results from the removal of a portion of its original volume, an additive form is produced by relating or physically attaching one or more subordinate forms to its volume.



The basic possibilities for grouping two or more forms are by:

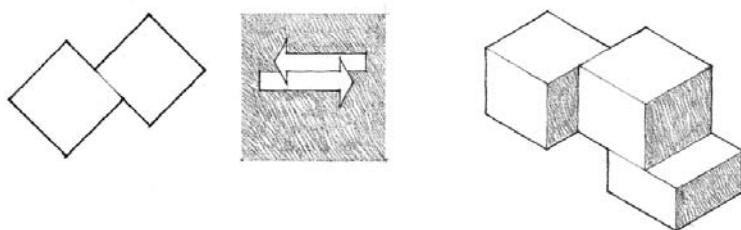
Spatial Tension

This type of relationship relies on the close proximity of the forms or their sharing of a common visual trait, such as shape, color, or material.



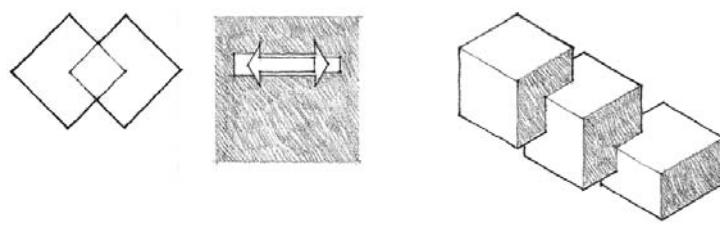
Edge-to-edge Contact

In this type of relationship, the forms share a common edge and can pivot about that edge.



Face-to-face Contact

This type of relationship requires that the two forms have corresponding planar surfaces which are parallel to each other.

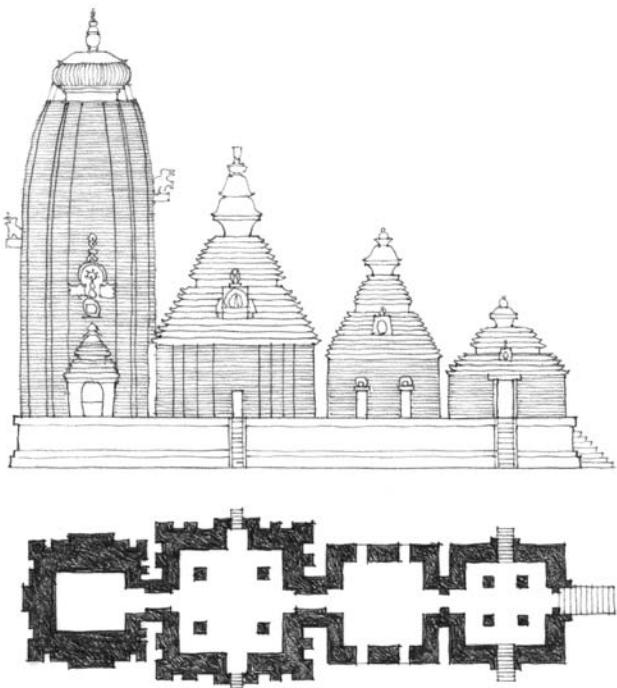


Interlocking Volumes

In this type of relationship, the forms interpenetrate each other's space. The forms need not share any visual traits.

Additive forms resulting from the accretion of discrete elements can be characterized by their ability to grow and merge with other forms. For us to perceive additive groupings as unified compositions of form—as figures in our visual field—the combining elements must be related to one another in a coherent manner.

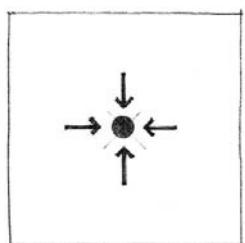
These diagrams categorize additive forms according to the nature of the relationships that exist among the component forms as well as their overall configurations. This outline of formal organizations should be compared with a parallel discussion of spatial organizations in Chapter 4.



Lingaraja Temple, Bhubaneshwar, India, c. A.D. 1100

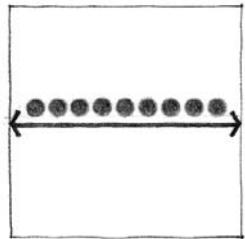
Centralized Form

A number of secondary forms clustered about a dominant, central parent-form



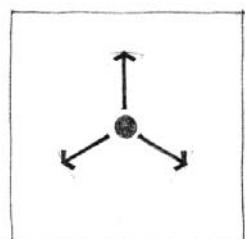
Linear Form

A series of forms arranged sequentially in a row



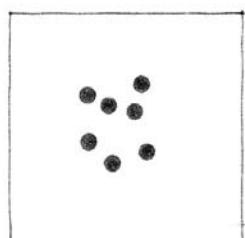
Radial Form

A composition of linear forms extending outward from a central form in a radial manner



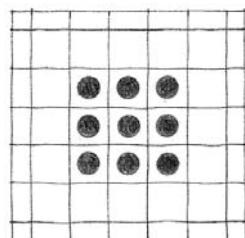
Clustered Form

A collection of forms grouped together by proximity or the sharing of a common visual trait

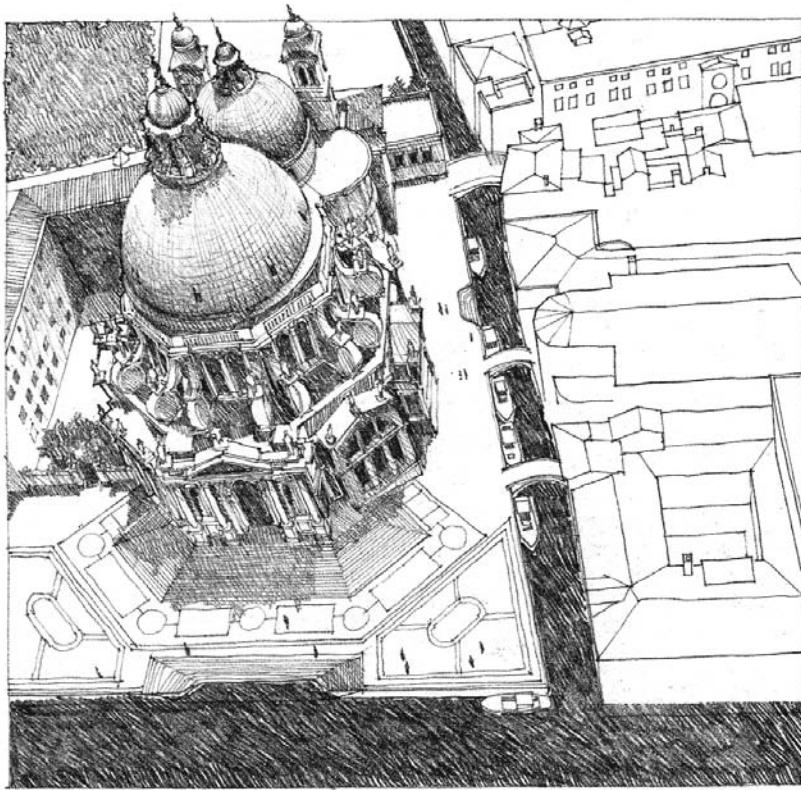


Grid Form

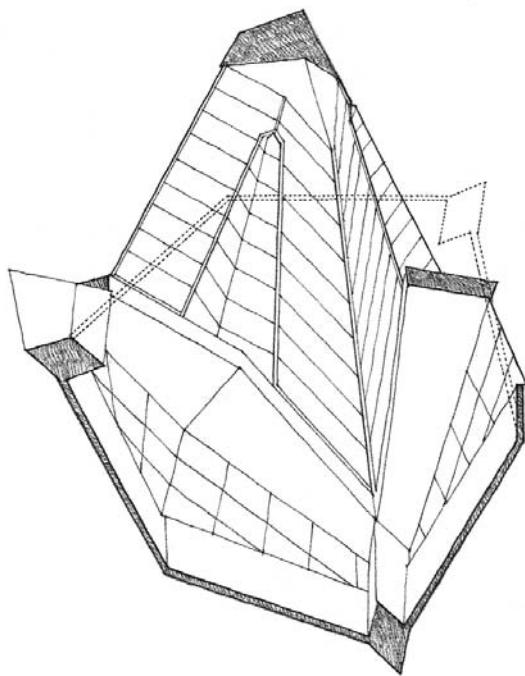
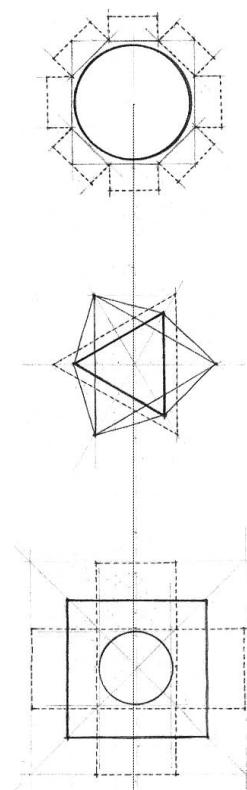
A set of modular forms related and regulated by a three-dimensional grid



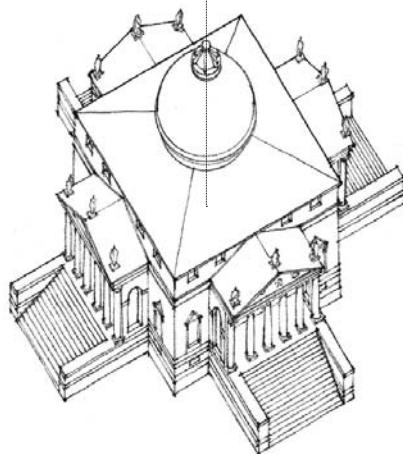
CENTRALIZED FORM



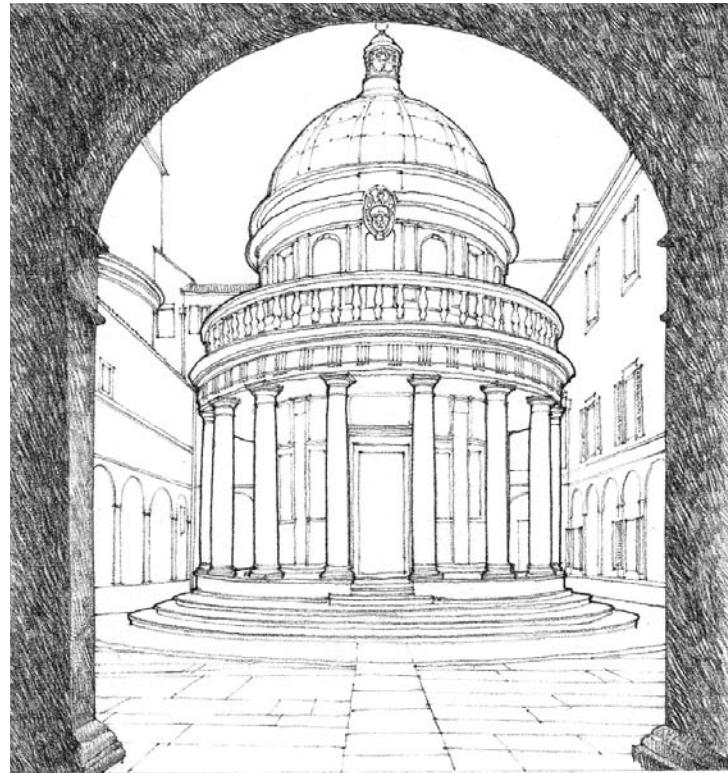
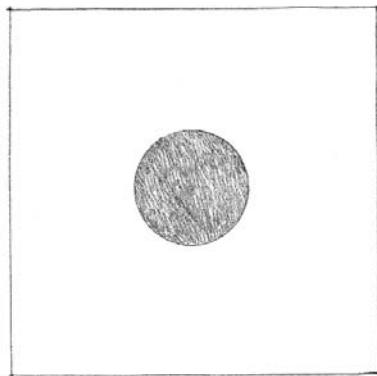
S. Maria Della Salute, Venice, 1631–82, Baldassare Longhena



Beth Shalom Synagogue, Elkins Park, Pennsylvania, 1959, Frank Lloyd Wright



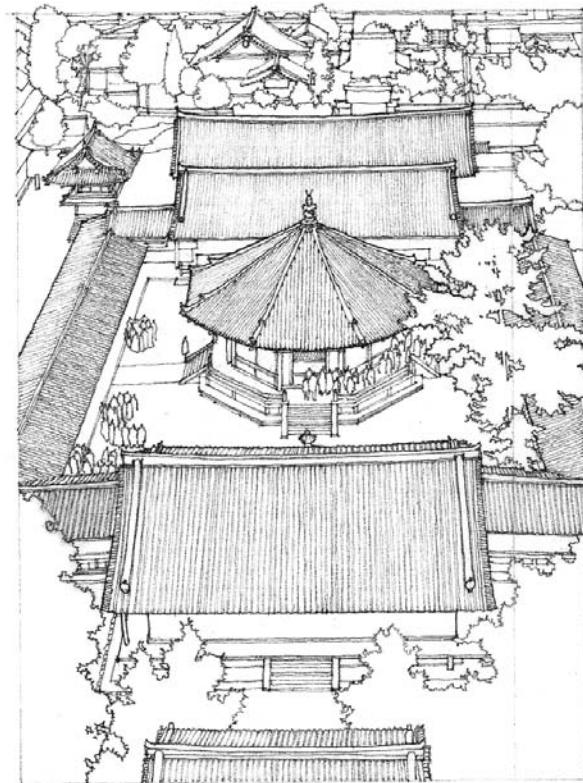
Villa Capra (The Rotunda), Vicenza, Italy, 1552–67, Andrea Palladio



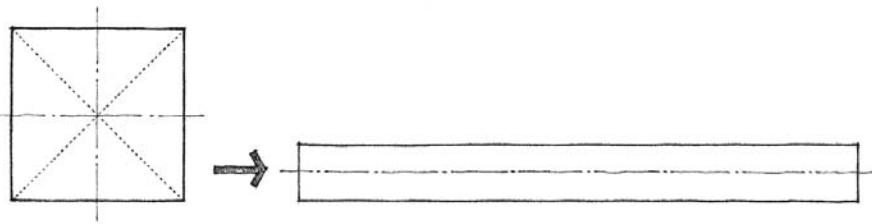
Tempietto, S. Pietro in Montorio, Rome, 1502, Donato Bramante

Centralized forms require the visual dominance of a geometrically regular, centrally located form, such as a sphere, cone, or cylinder. Because of their inherent centrality, these forms share the self-centering properties of the point and circle. They are ideal as freestanding structures isolated within their context, dominating a point in space, or occupying the center of a defined field. They can embody sacred or honorific places, or commemorate significant persons or events.

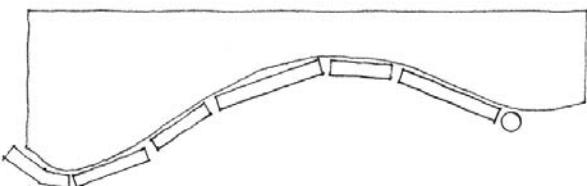
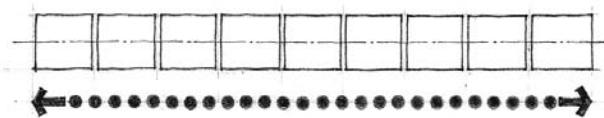
Yume-Dono, Eastern precinct of Horyu-Ji Temple, Nara, Japan, A.D. 607



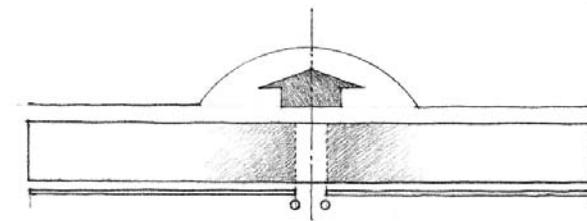
LINEAR FORM



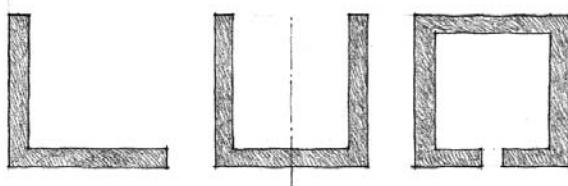
A linear form can result from a proportional change in a form's dimensions or the arrangement of a series of discrete forms along a line. In the latter case, the series of forms may be either repetitive or dissimilar in nature and organized by a separate and distinct element such as a wall or path.



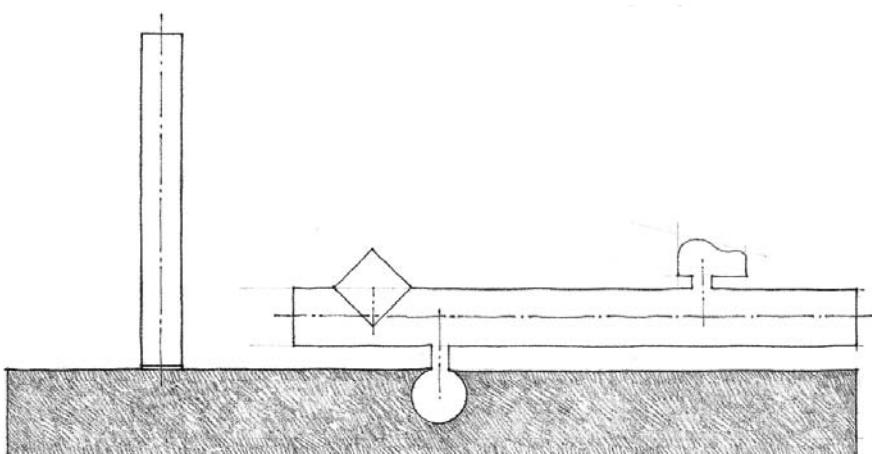
- A linear form can be segmented or curvilinear to respond to topography, vegetation, views, or other features of a site.



- A linear form can front on or define an edge of an exterior space, or define a plane of entry into the spaces behind it.

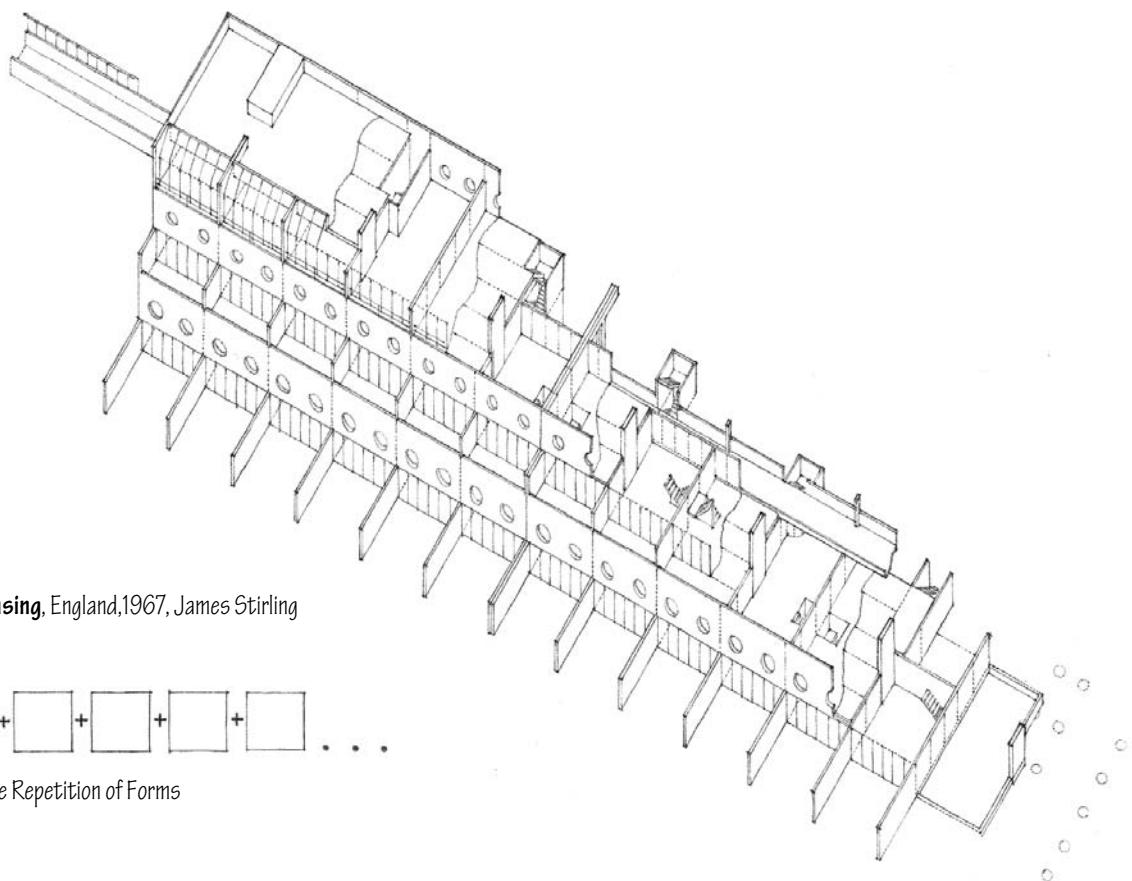


- A linear form can be manipulated to enclose a portion of space.

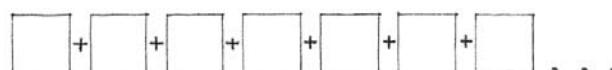


- A linear form can be oriented vertically as a tower element to establish or denote a point in space.

- A linear form can serve as an organizing element to which a variety of secondary forms are attached.



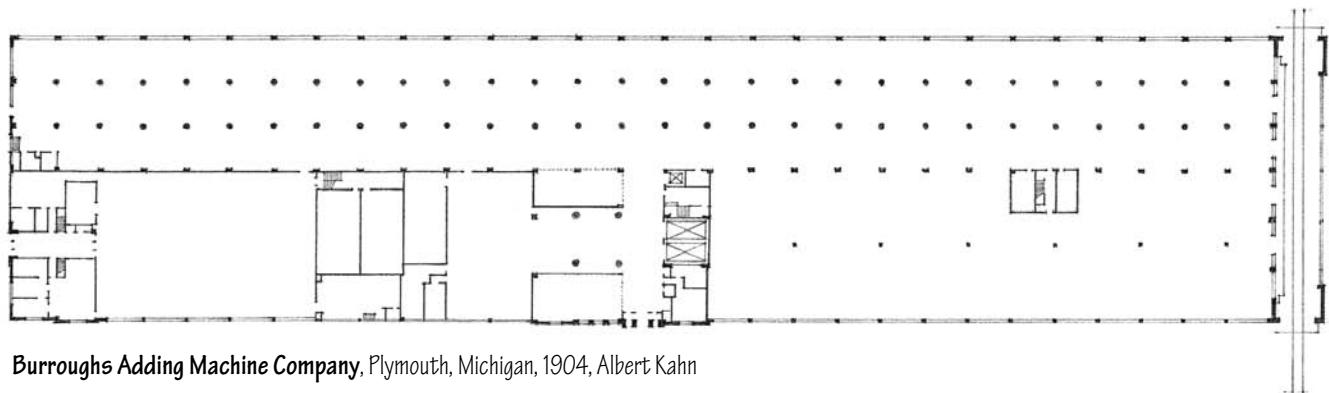
Runcorn New Town Housing, England, 1967, James Stirling



Linear Growth through the Repetition of Forms

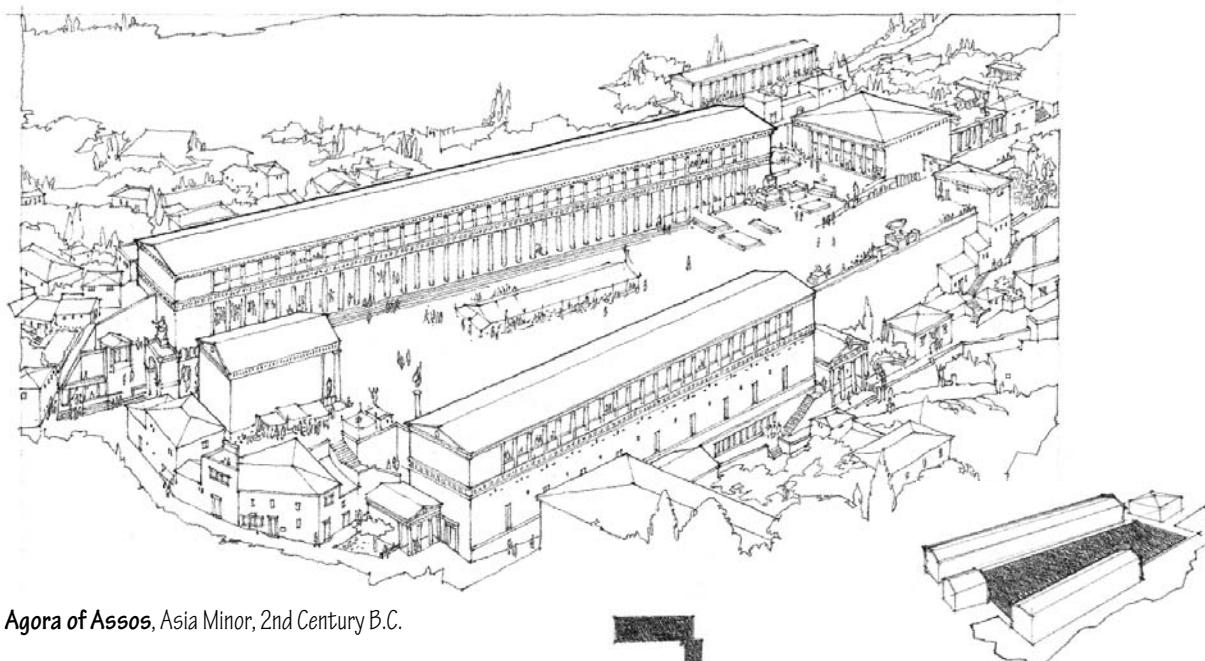


Linear Form Expressing Procession or Movement

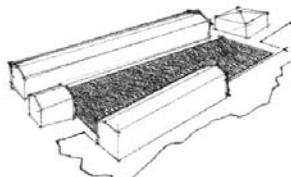


Burroughs Adding Machine Company, Plymouth, Michigan, 1904, Albert Kahn

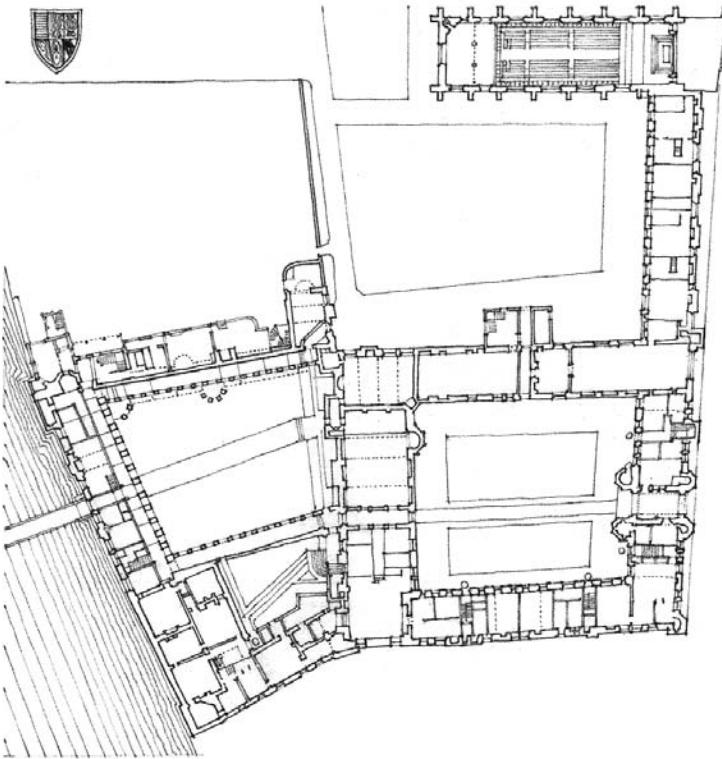
LINEAR FORM



Agora of Assos, Asia Minor, 2nd Century B.C.



Linear Forms Fronting on or Defining Exterior Space

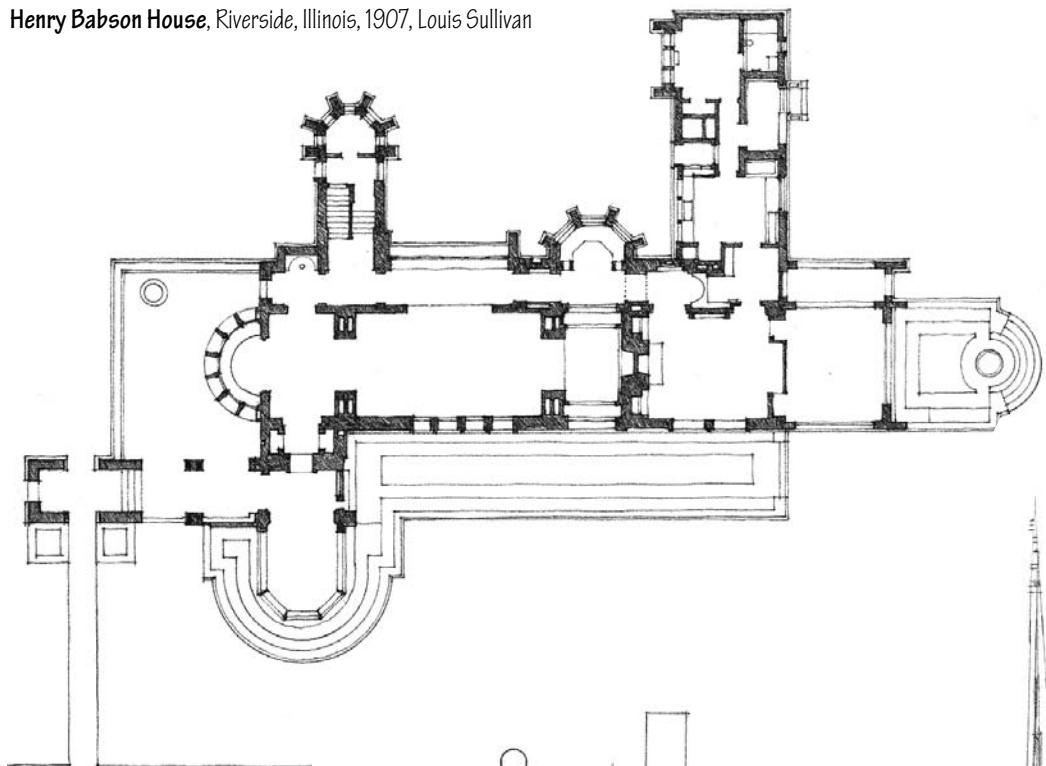


Queen's College, Cambridge, England, 1709–38, Nicholas Hawksmoor

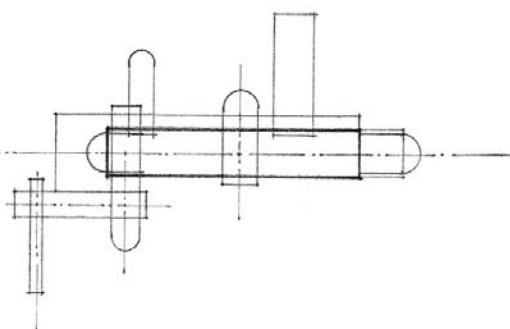


18th-century buildings fronting a tree-lined canal in Kampen, Holland

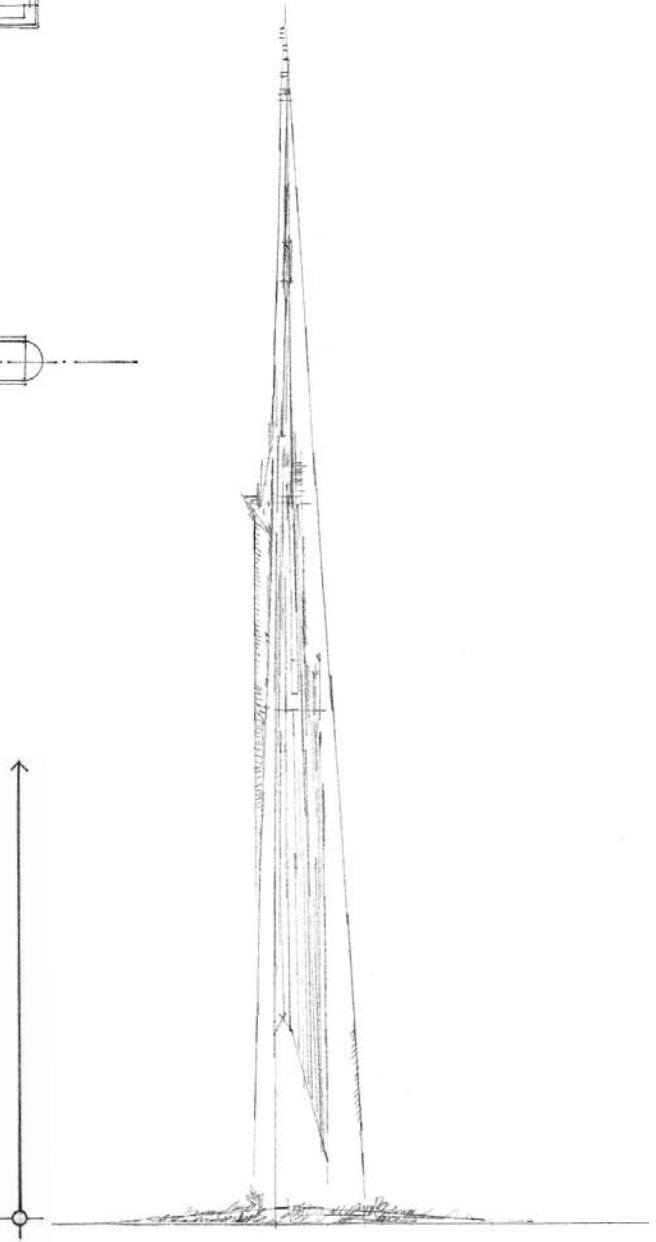
Henry Babson House, Riverside, Illinois, 1907, Louis Sullivan



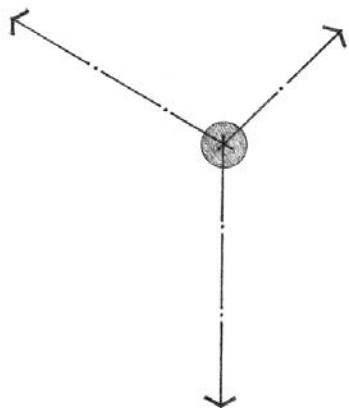
Linear Organizations of Space



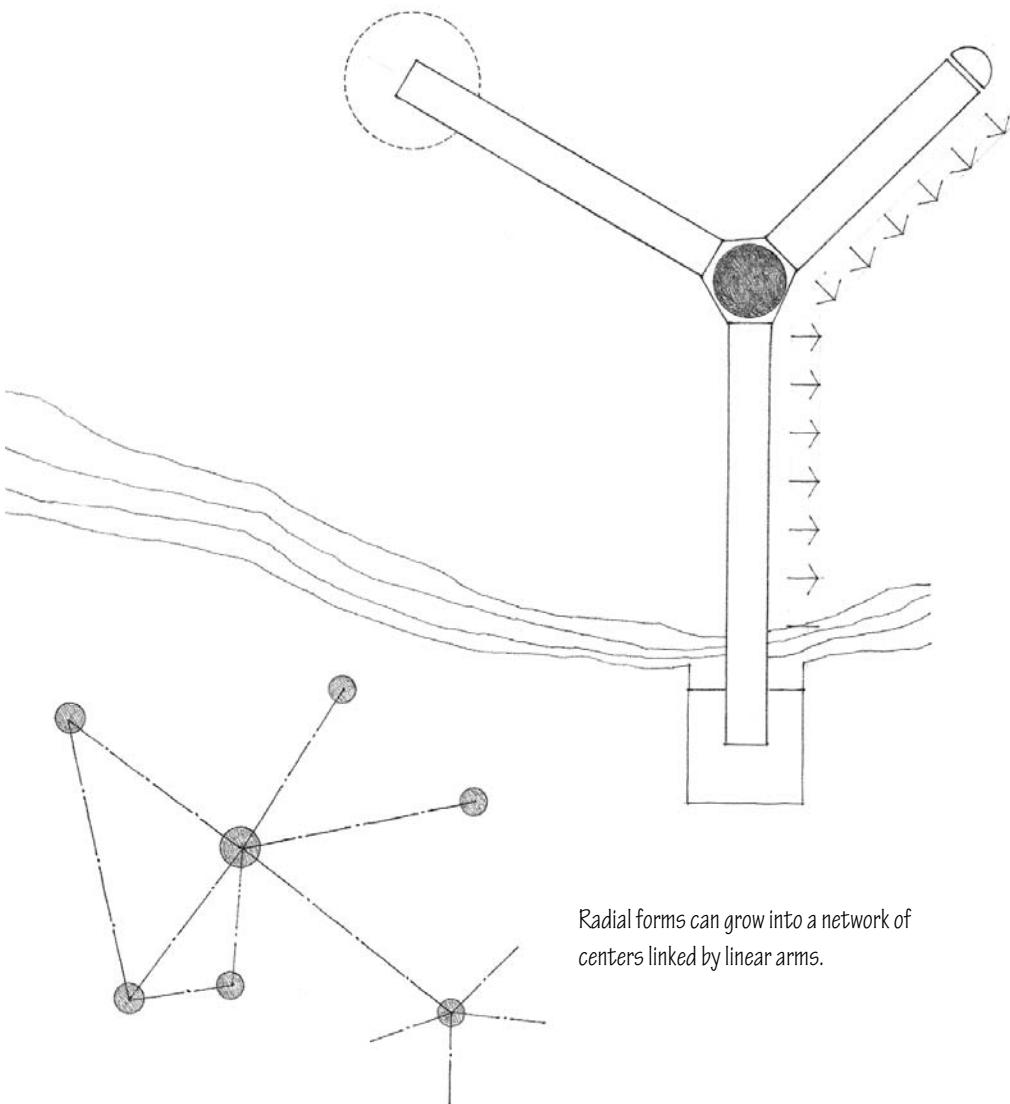
The Mile-high Illinois, Skyscraper Project, Chicago, Illinois, 1956, Frank Lloyd Wright



RADIAL FORM



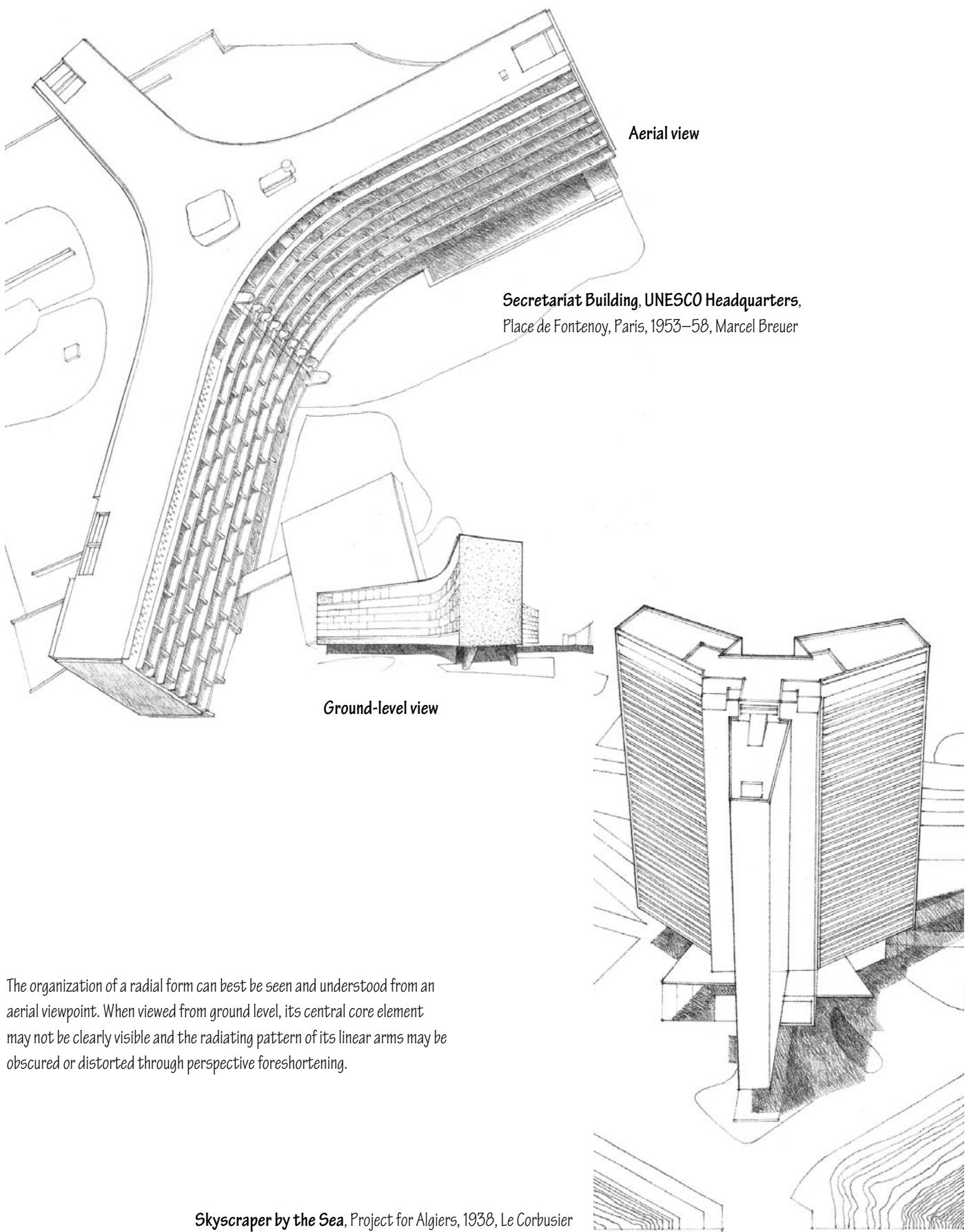
A radial form consists of linear forms that extend outward from a centrally located core element in a radiating manner. It combines the aspects of centrality and linearity into a single composition.



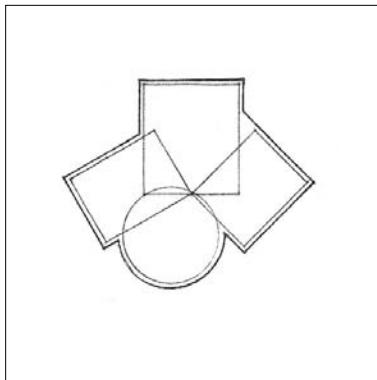
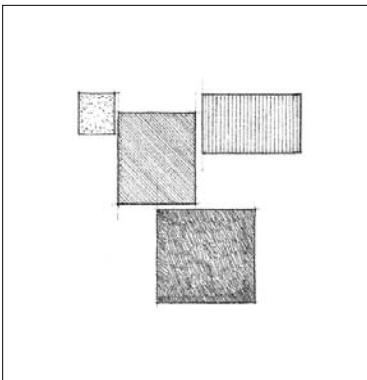
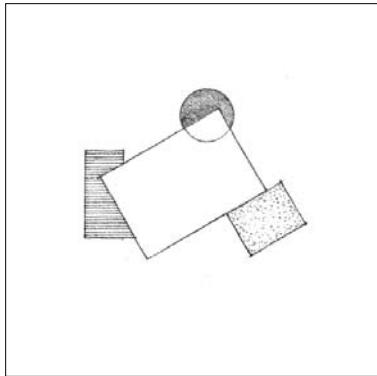
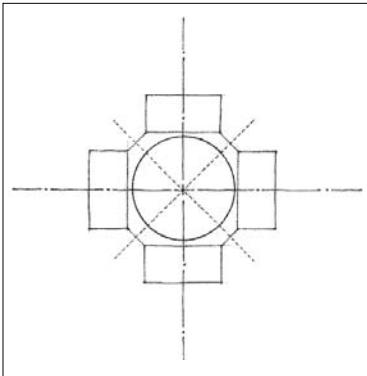
The core is either the symbolic or functional center of the organization. Its central position can be articulated with a visually dominant form, or it can merge with and become subservient to the radiating arms.

The radiating arms, having properties similar to those of linear forms, give a radial form its extroverted nature. They can reach out and relate to or attach themselves to specific features of a site. They can expose their elongated surfaces to desirable conditions of sun, wind, view, or space.

Radial forms can grow into a network of centers linked by linear arms.



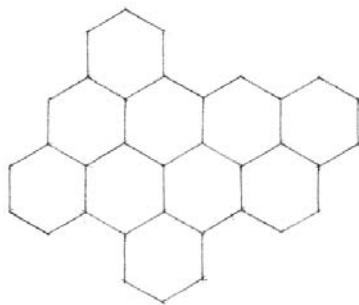
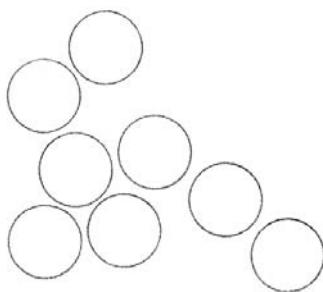
CLUSTERED FORM



While a centralized organization has a strong geometric basis for the ordering of its forms, a clustered organization groups its forms according to functional requirements of size, shape, or proximity. While it lacks the geometric regularity and introverted nature of centralized forms, a clustered organization is flexible enough to incorporate forms of various shapes, sizes, and orientations into its structure.

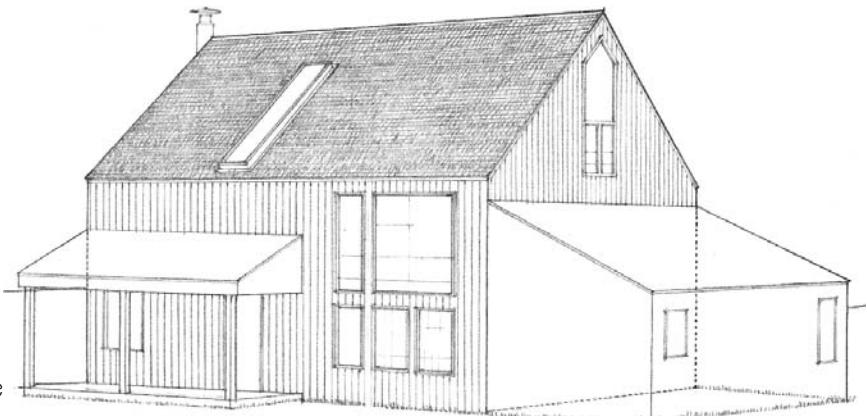
Considering their flexibility, clustered organizations of forms may be organized in the following ways:

- They can be attached as appendages to a larger parent form or space.
- They can be related by proximity alone to articulate and express their volumes as individual entities.
- They can interlock their volumes and merge into a single form having a variety of faces.



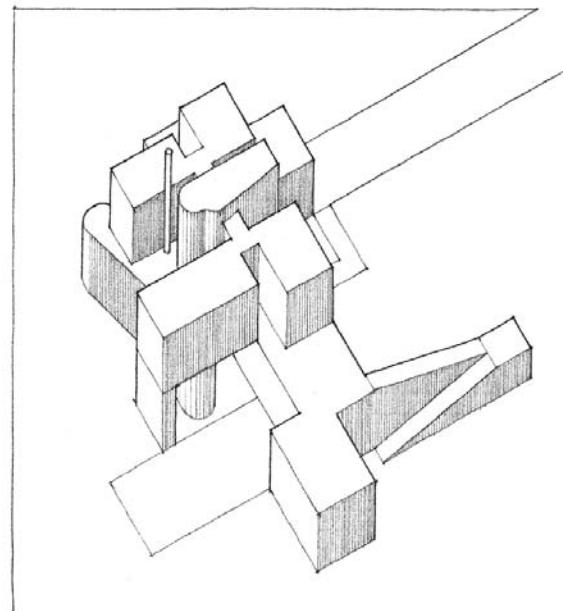
A clustered organization can also consist of forms that are generally equivalent in size, shape, and function. These forms are visually ordered into a coherent, nonhierarchical organization not only by their close proximity to one another, but also by the similarity of their visual properties.

A Cluster of Forms Attached to a Parent Form:
Vacation House, Sea Ranch, California, 1968, MLTW/Moore



A Cluster of Interlocking Forms:
G.N. Black House (Kragsyde), Manchester-by-the-Sea, Massachusetts,
1882–83, Peabody & Stearns

A Cluster of Articulated Forms:
House Study, 1956, James Stirling & James Gowan



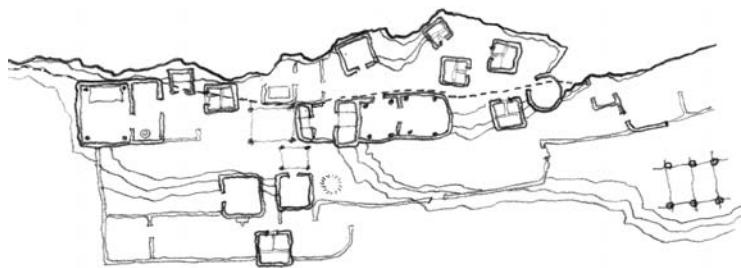
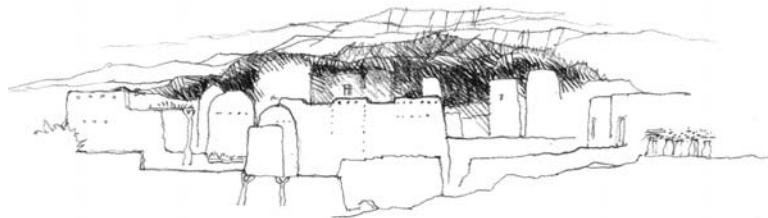
CLUSTERED FORM



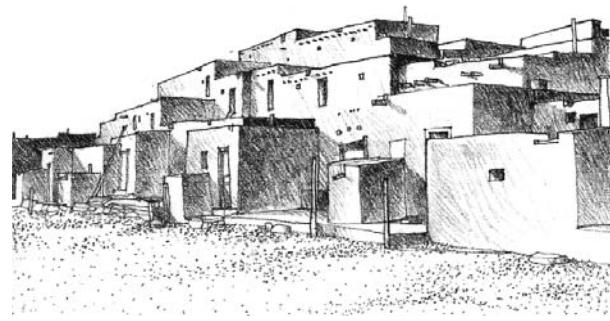
Trulli Village, Alberobello, Italy

Traditional dry-stone shelters in existence since the 17th century.

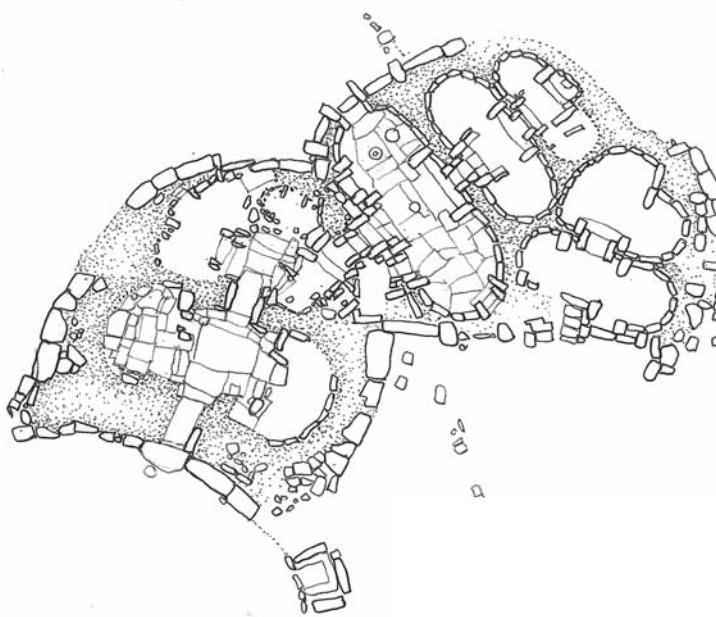
Numerous examples of clustered housing forms can be found in the vernacular architecture of various cultures. Even though each culture produced a unique style in response to differing technical, climatic, and sociocultural factors, these clustered housing organizations usually maintained the individuality of each unit and a moderate degree of diversity within the context of an ordered whole.



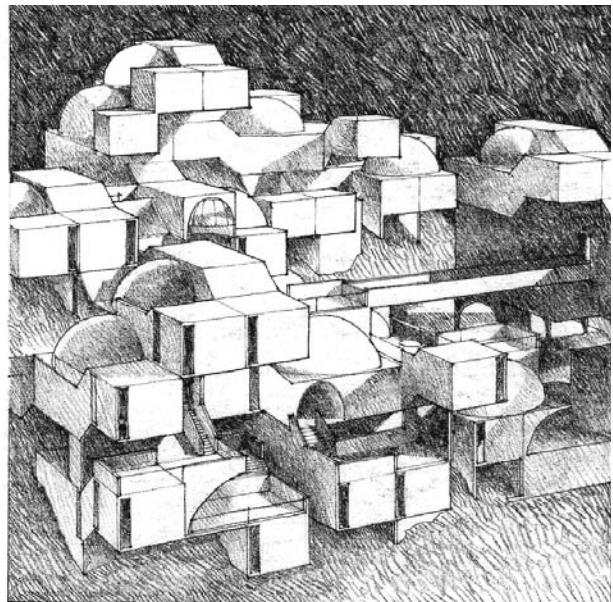
Dogon Housing Cluster, Southeastern Mali, West Africa, 15th century–present



Taos Pueblo, New Mexico, 13th century

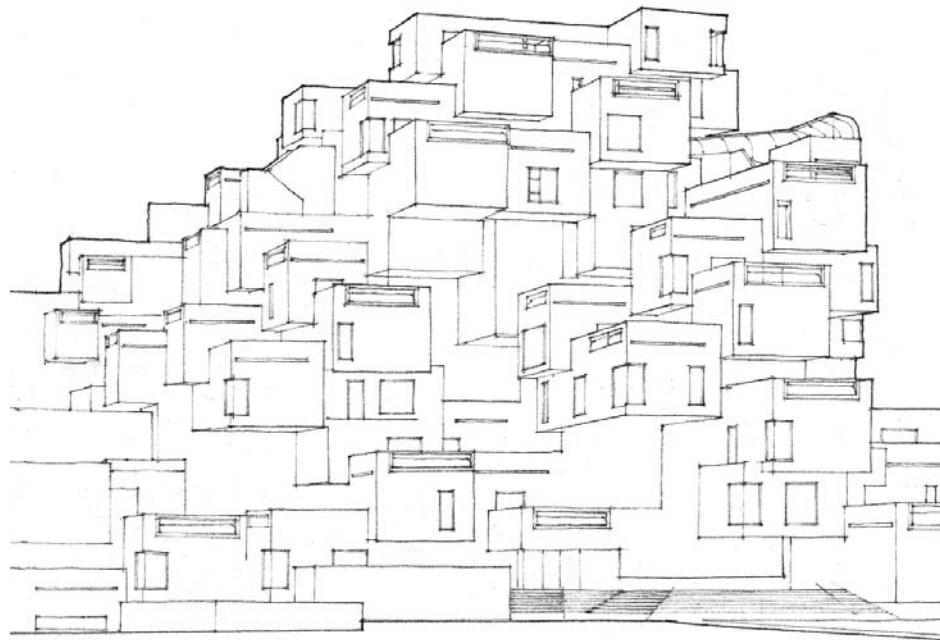


Ggantija temple complex, Malta, c. 3000 B.C.



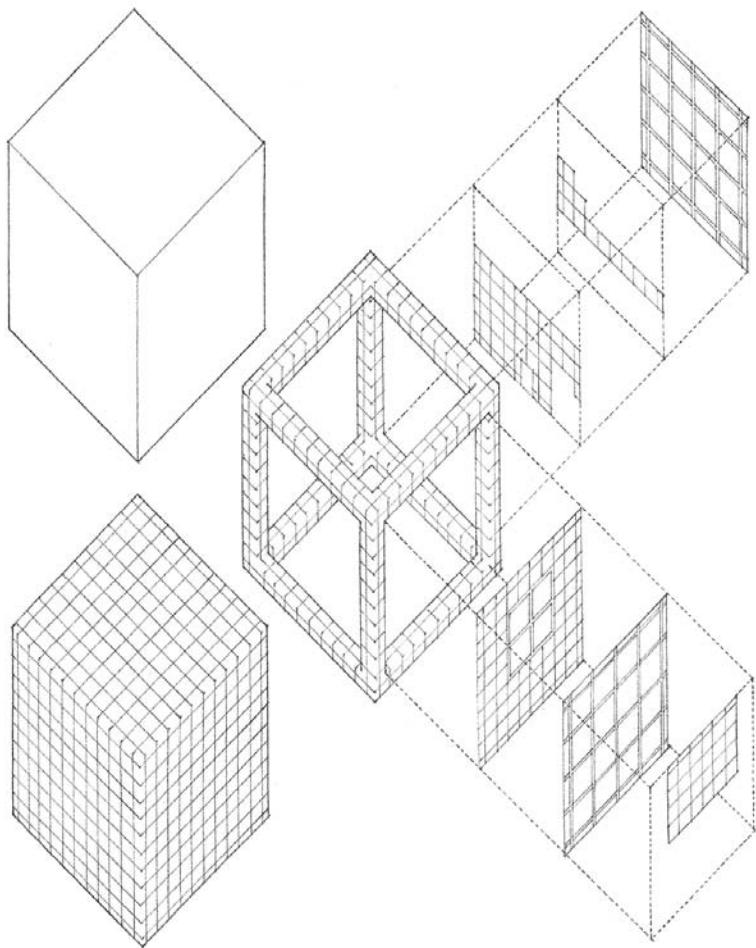
Habitat Israel, Jerusalem, 1969, Moshe Safdie

Vernacular examples of clustered forms can be readily transformed into modular, geometrically ordered compositions which are related to grid organizations of form.



Habitat Montreal, 1967, Moshe Safdie

GRID FORM

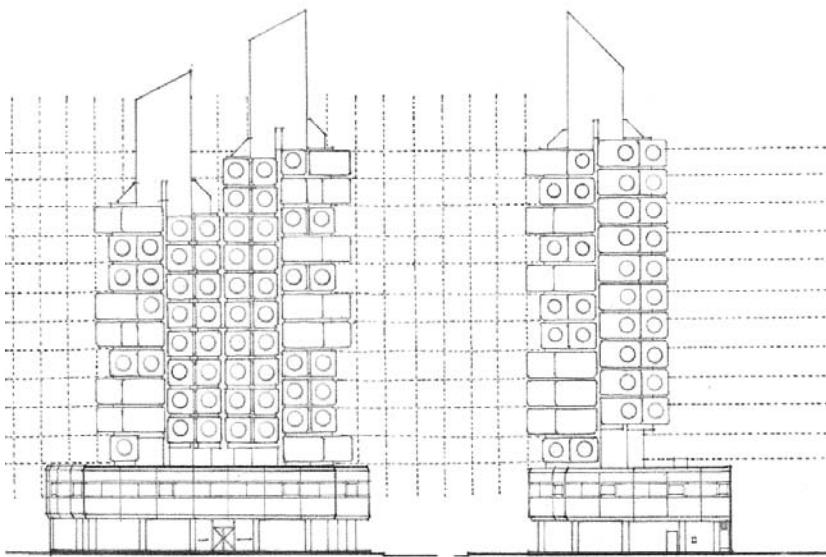


A grid is a system of two or more intersecting sets of regularly spaced parallel lines. It generates a geometric pattern of regularly spaced points at the intersections of the grid lines and regularly shaped fields defined by the grid lines themselves.

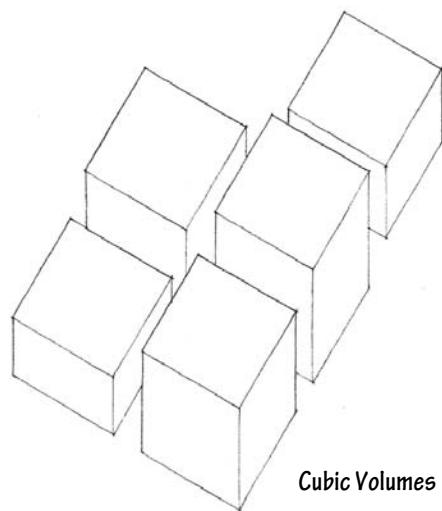
The most common grid is based on the geometry of the square. Because of the equality of its dimensions and its bilateral symmetry, a square grid is essentially nonhierarchical and bidirectional. It can be used to break the scale of a surface down into measurable units and give it an even texture. It can be used to wrap several surfaces of a form and unify them with its repetitive and pervasive geometry.

The square grid, when projected into the third dimension, generates a spatial network of reference points and lines. Within this modular framework, any number of forms and spaces can be visually organized.

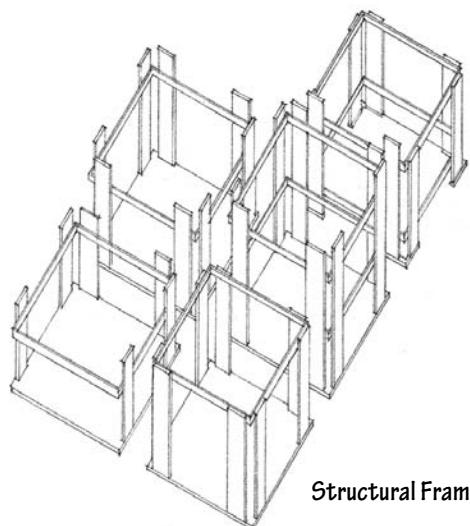
Conceptual Diagram, *Gunma Prefectural Museum of Fine Arts*, Japan, 1974, Arata Isozaki



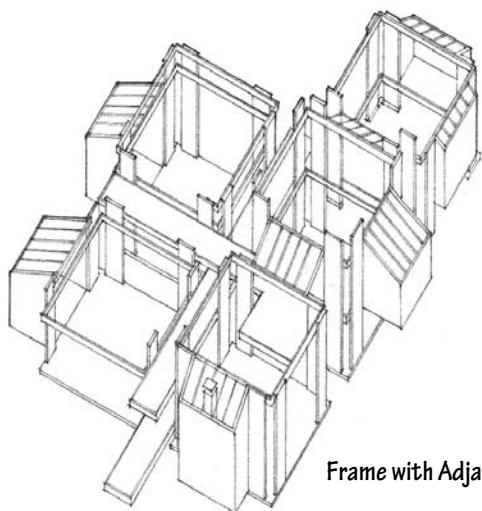
Nakagin Capsule Building, Tokyo, 1972, Kisho Kurokawa



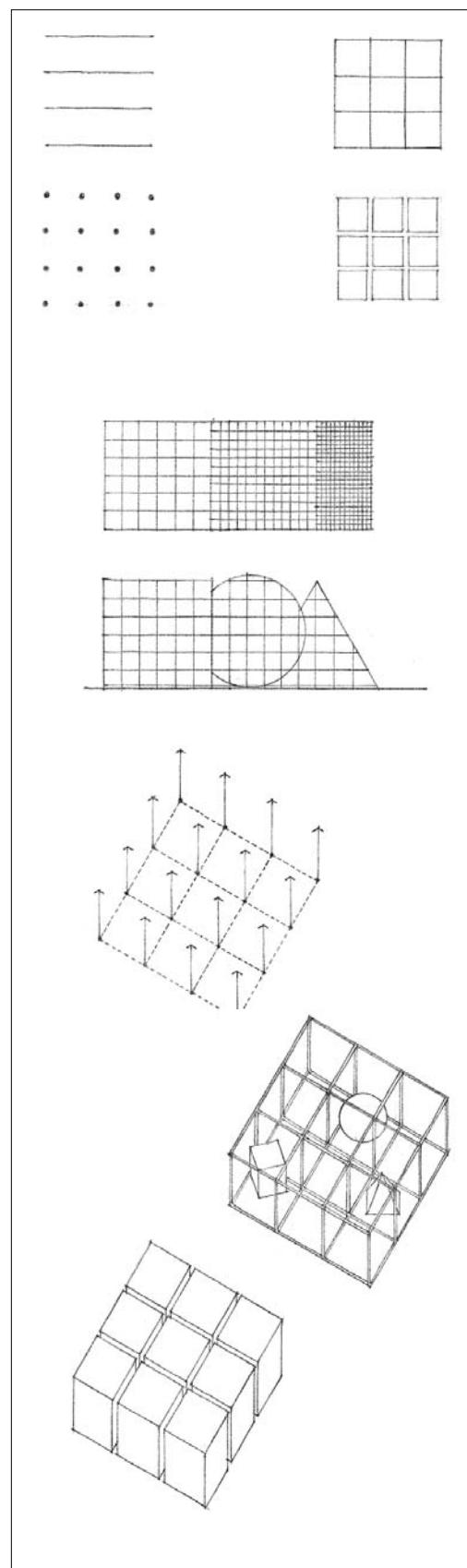
Cubic Volumes



Structural Frame

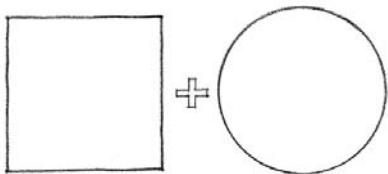


Frame with Adjacent Spaces

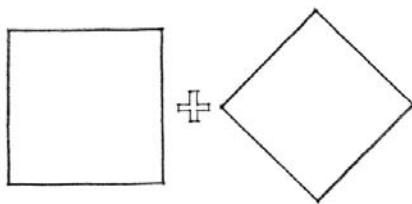


Hattenbach Residence, Santa Monica, California, 1971–73, Raymond Kappe

FORMAL COLLISIONS OF GEOMETRY

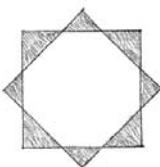
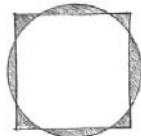


Circle and Square

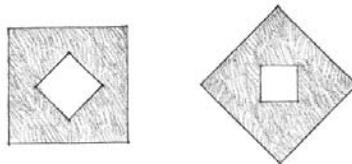
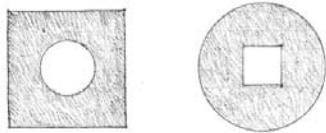


Rotated Grid

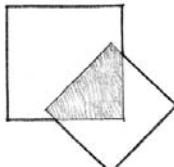
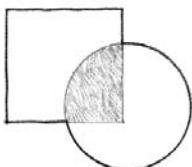
When two forms differing in geometry or orientation collide and interpenetrate each other's boundaries, each will vie for visual supremacy and dominance. In these situations, the following forms can evolve:



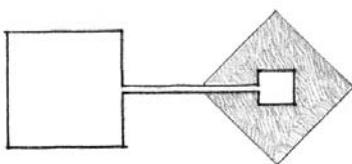
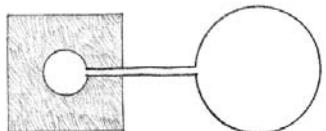
- The two forms can subvert their individual identities and merge to create a new composite form.



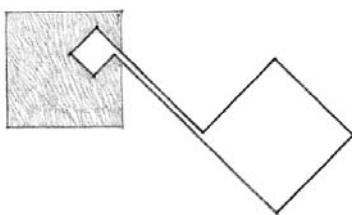
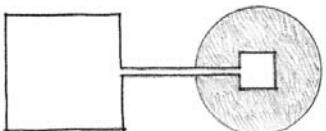
- One of the two forms can receive the other totally within its volume.



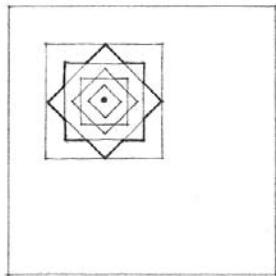
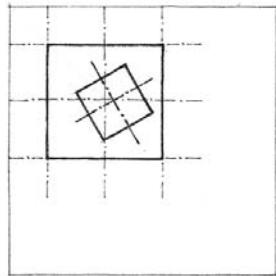
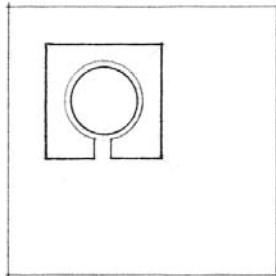
- The two forms can retain their individual identities and share the interlocking portion of their volumes.



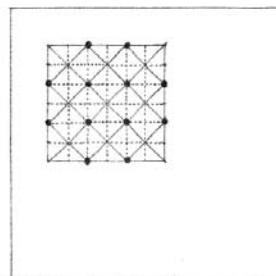
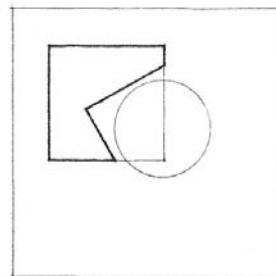
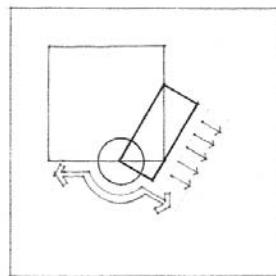
- The two forms can separate and be linked by a third element that recalls the geometry of one of the original forms.



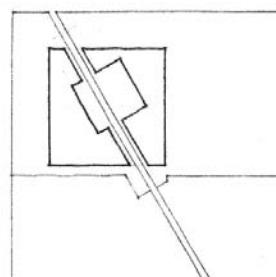
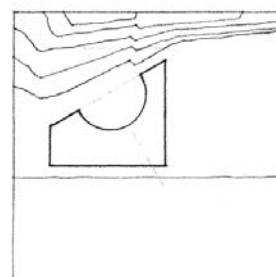
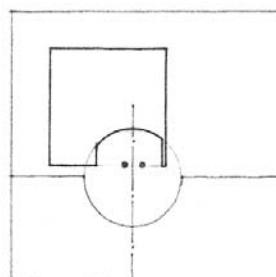
Forms differing in geometry or orientation may be incorporated into a single organization for any of the following reasons:



- To accommodate or accentuate the differing requirements of interior space and exterior form
- To express the functional or symbolic importance of a form or space within its context
- To generate a composite form that incorporates the contrasting geometries into its centralized organization

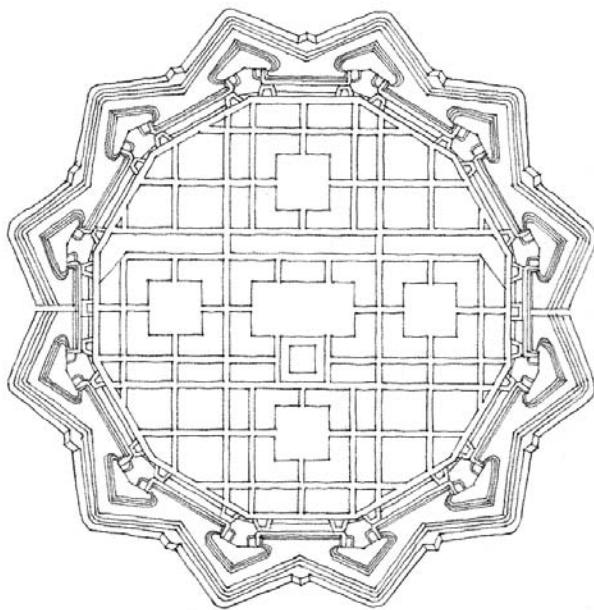


- To inflect a space toward a specific feature of a building site
- To carve a well-defined volume of space from a building form
- To express and articulate the various constructional or mechanical systems that exist within a building form



- To reinforce a local condition of symmetry in a building form
- To respond to contrasting geometries of the topography, vegetation, boundaries, or existing structures of a site
- To acknowledge an already existing path of movement through a building site

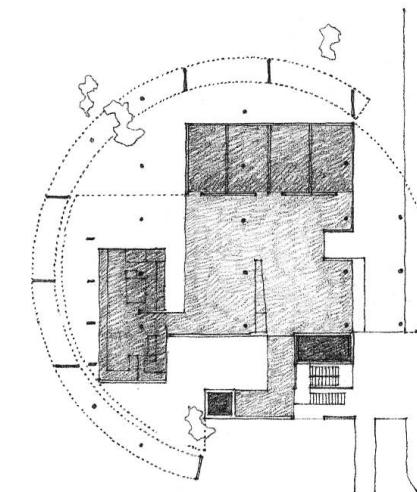
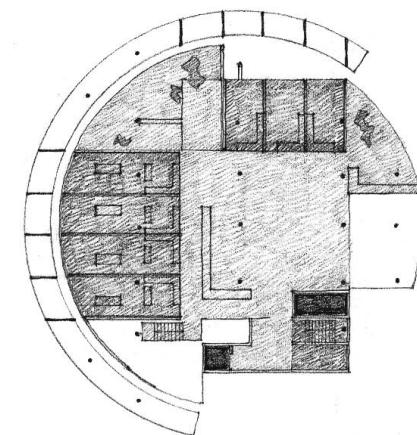
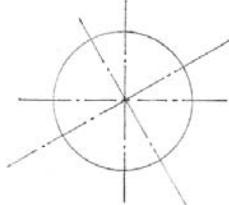
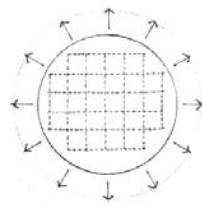
CIRCLE & SQUARE



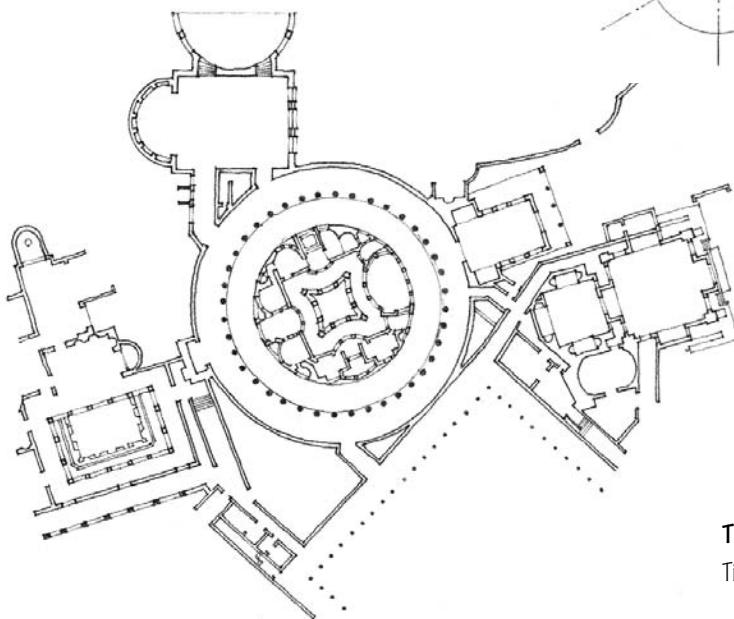
Plan for an Ideal City, 1615, Vincenzo Scamozzi

A circular form can be freestanding in its context to express its ideal shape and still incorporate a more functional, rectilinear geometry within its boundaries.

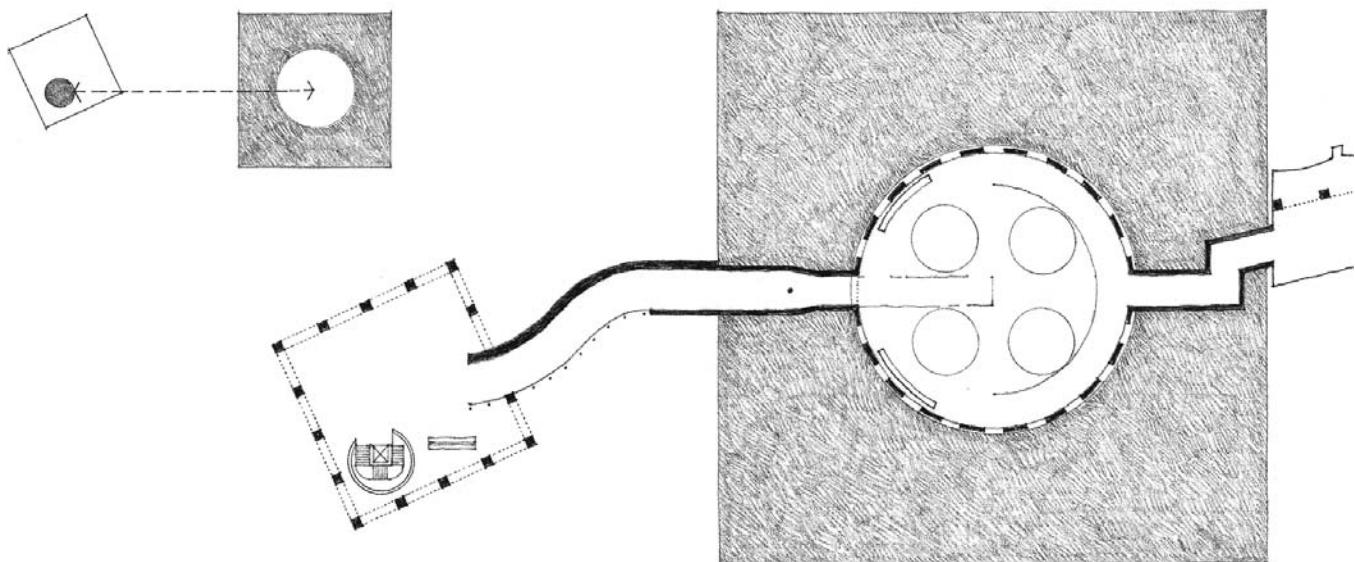
The centrality of a circular form enables it to act as a hub and unify forms of contrasting geometry or orientation about itself.



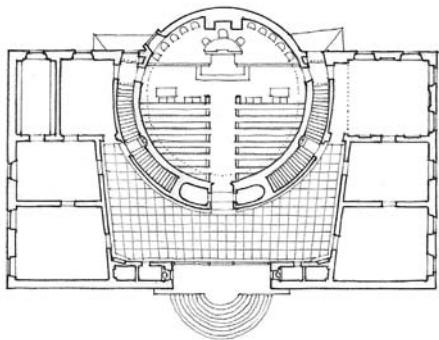
Chancellery Building, French Embassy, Brasilia, 1964–65,
Le Corbusier



The Island Villa (Teatro Marittimo), Hadrian's Villa,
Tivoli, Italy, A.D. 118–125

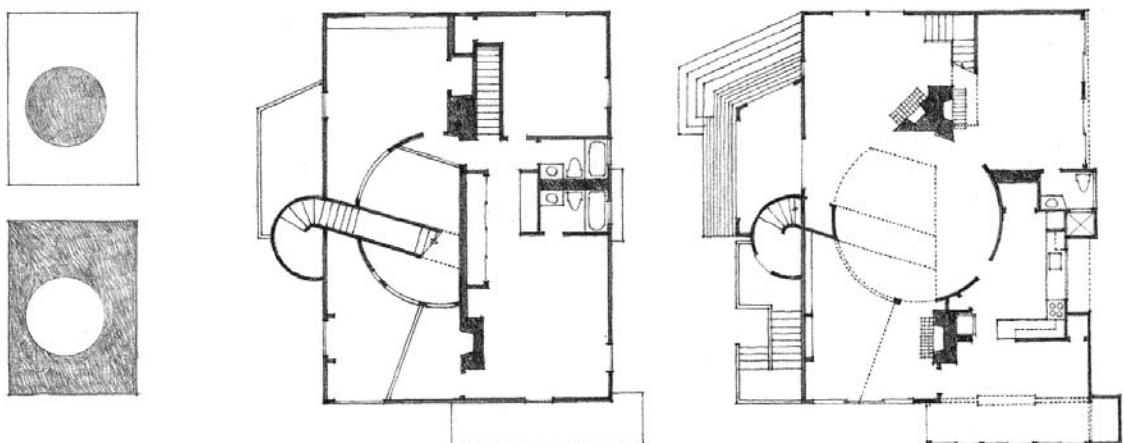


Museum for North Rhine-Westphalia, Dusseldorf, Germany,
1975, James Stirling & Michael Wilford



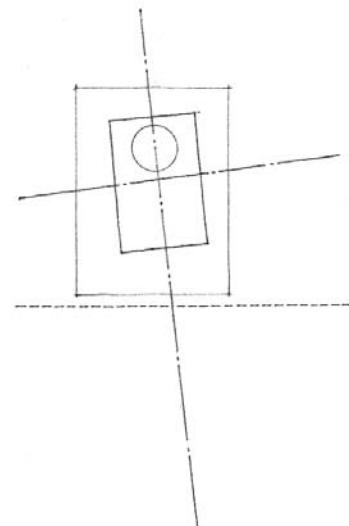
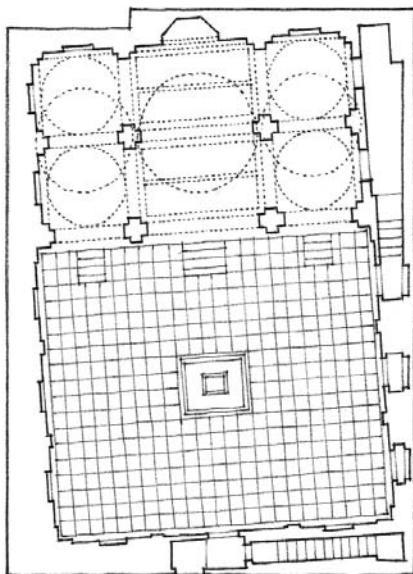
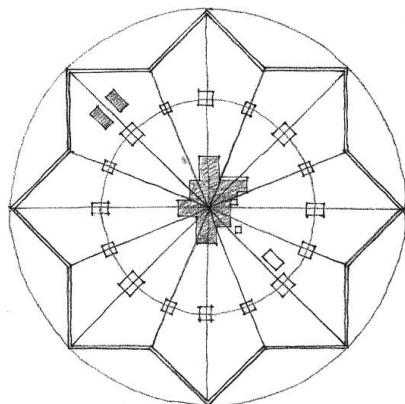
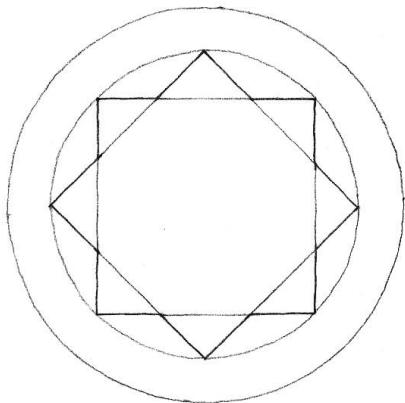
Lister County Courthouse, Söderköping, Sweden, 1917–21,
Gunnar Asplund

A circular or cylindrical space can serve to organize the spaces within a rectangular enclosure.



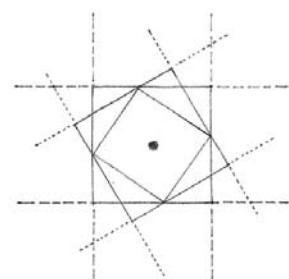
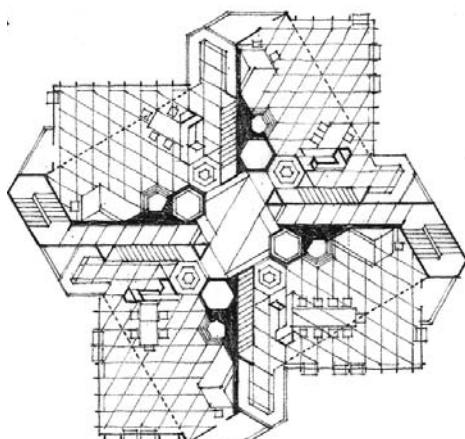
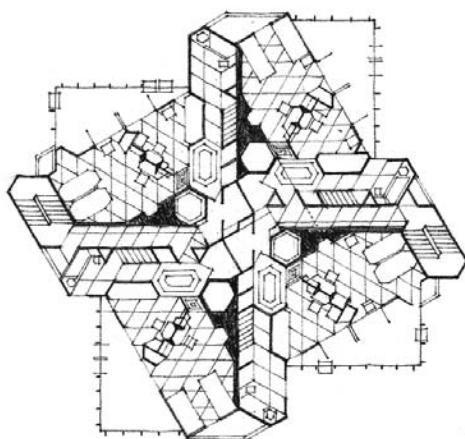
Murray House, Cambridge, Massachusetts, 1969, MLTW/Moore-Turnbull

ROTATED GRID

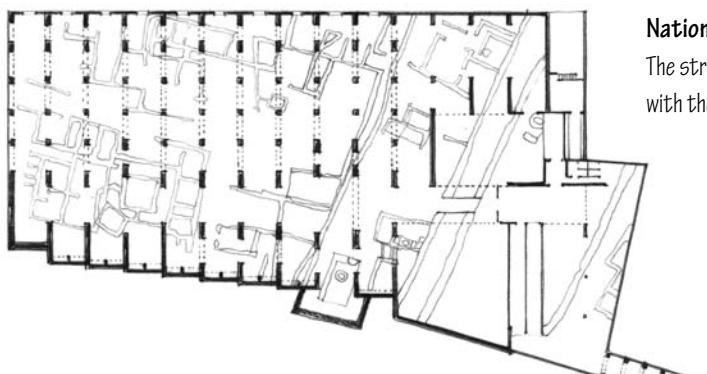


Pearl Mosque, within the Red Fort, an imperial palace at Agra, India, 1658–1707. The interior space of this mosque is oriented exactly with the cardinal points so that the qibla wall faces in the direction of the holy city of Mecca, while its exterior conforms to the existing layout of the fort.

Plan of the Ideal City of Sforzinda, 1464, Antonio Filarete

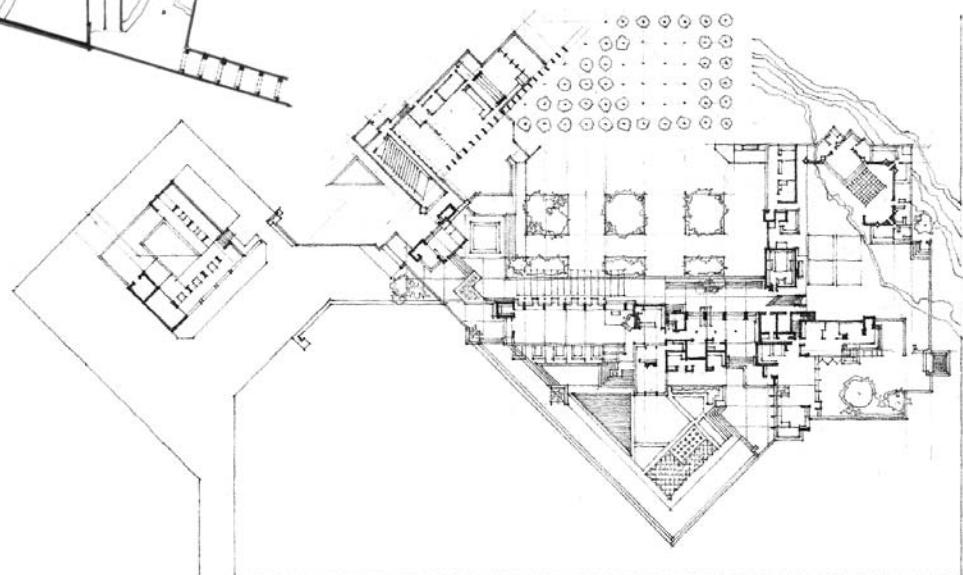


St. Mark's Tower, Project, New York City, 1929, Frank Lloyd Wright



National Museum of Roman Art, Mérida, Spain, 1980–6, Rafael Moneo.

The structural grid of the lower level of the museum floats over and contrasts with the geometry of the ancient Roman remains of Mérida.



A Diagram of Architecture:

Taliesin West, near Scottsdale, Arizona, 1938–59, Frank Lloyd Wright

A diagram by Bernhard Hoesli of the geometry regulating the layout of Taliesin West

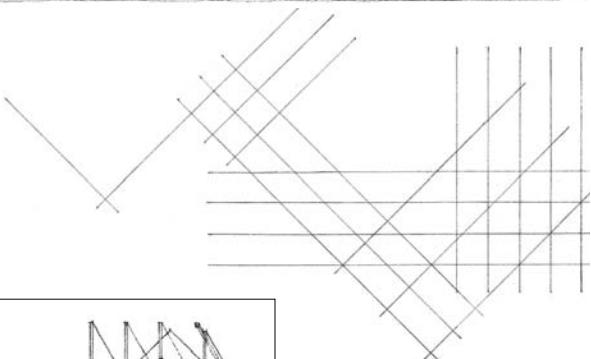
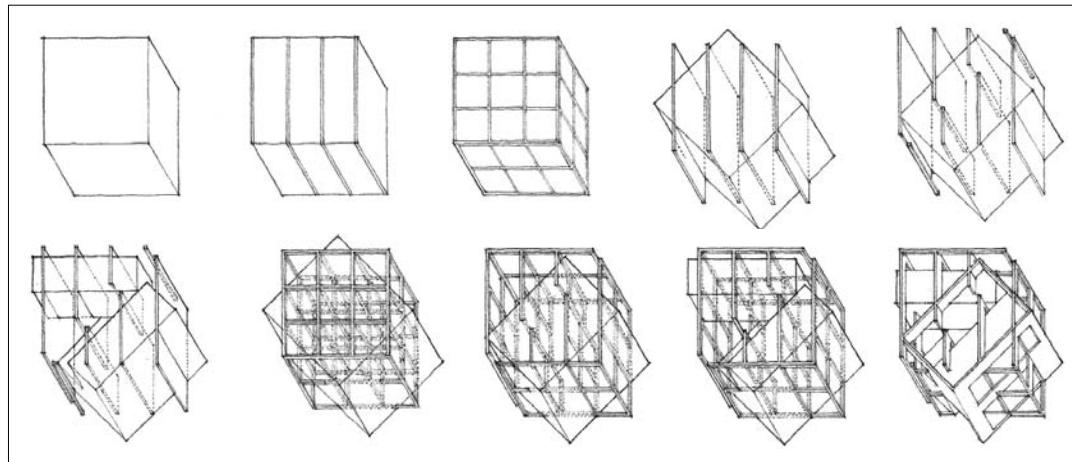
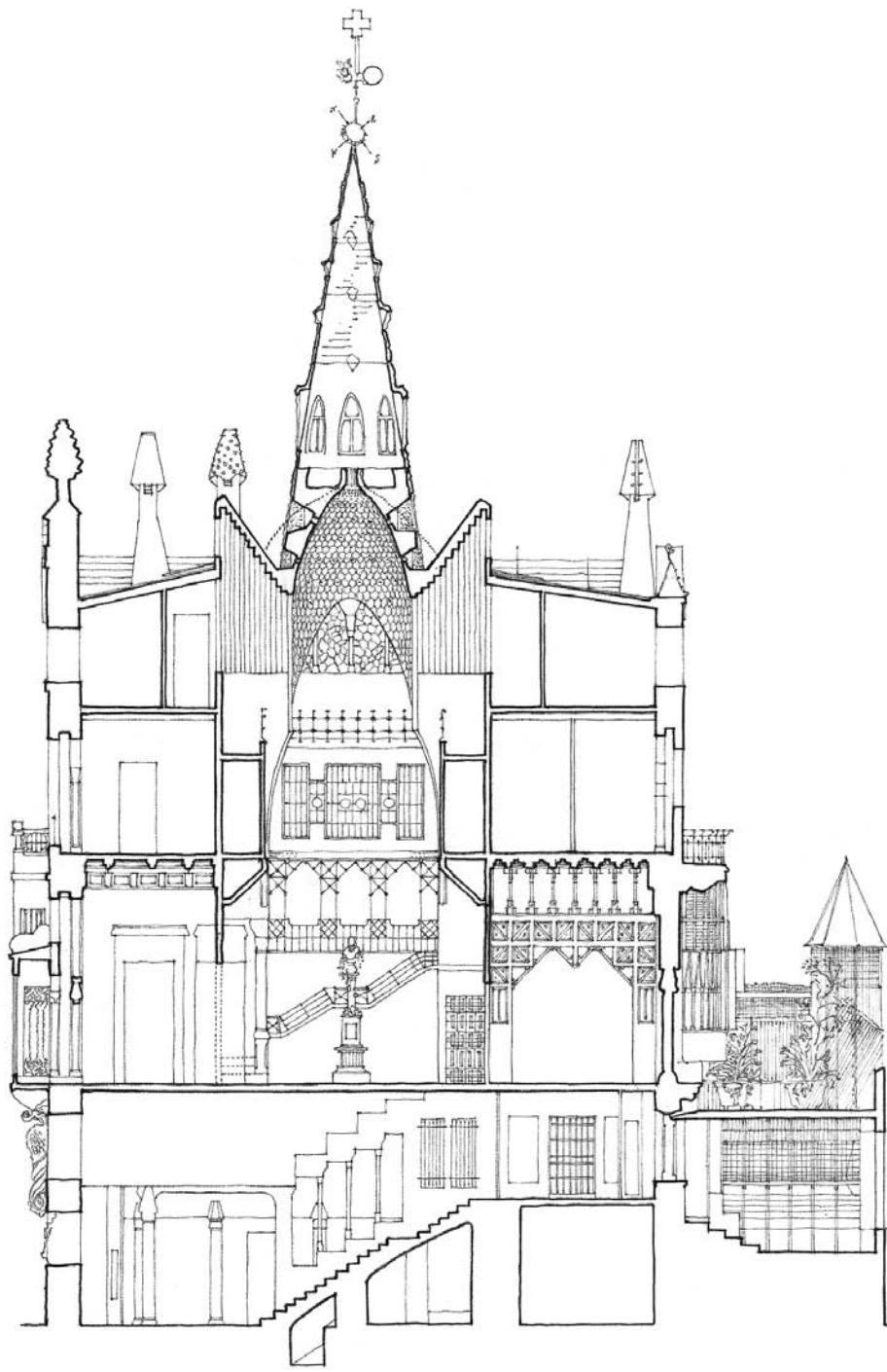


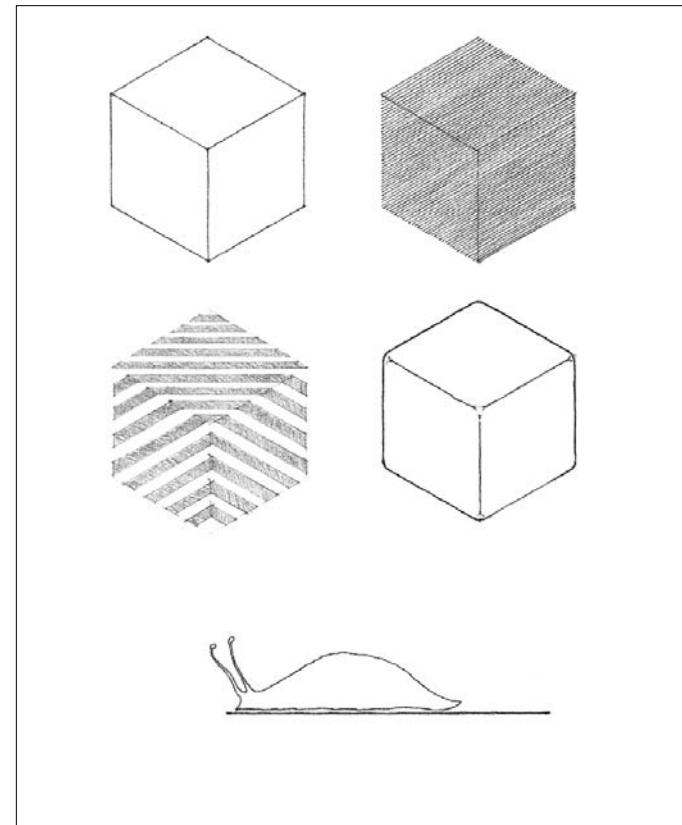
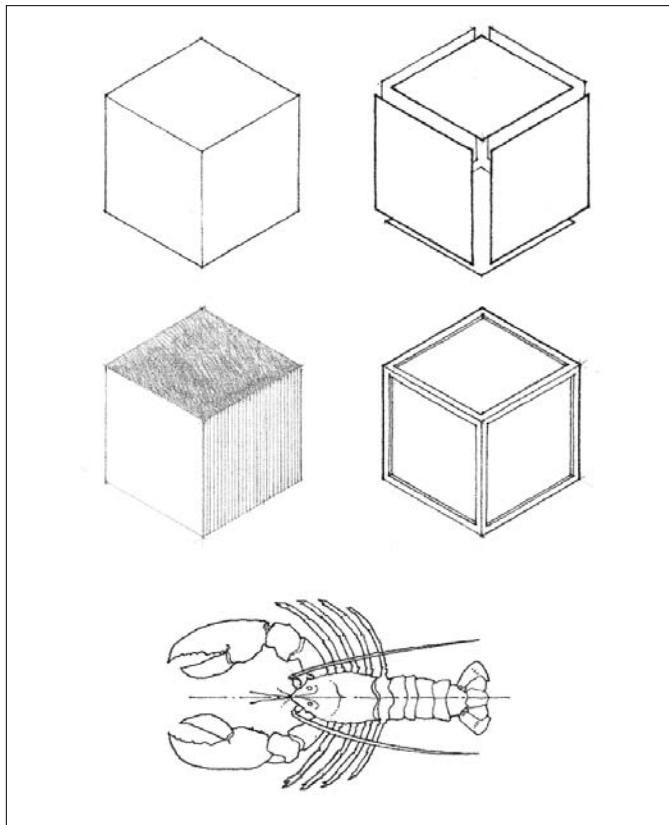
Diagram as Architecture:

House III for Robert Miller, Lakeville, Connecticut, 1971, Design Development Drawings, Peter Eisenman

ARTICULATION OF FORM



Palacio Güell, Barcelona, 1885–89, Antoni Gaudí



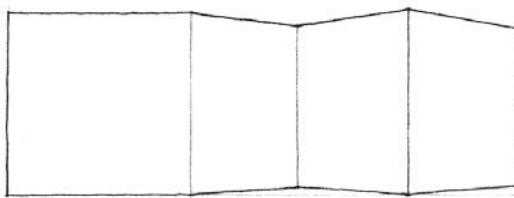
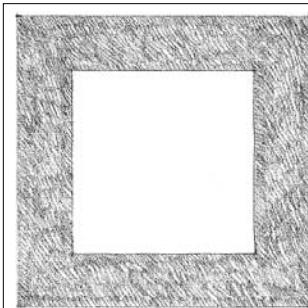
Articulation refers to the manner in which the surfaces of a form come together to define its shape and volume. An articulated form clearly reveals the precise nature of its parts and their relationships to each other and to the whole. Its surfaces appear as discrete planes with distinct shapes and their overall configuration is legible and easily perceived. In a similar manner, an articulated group of forms accentuates the joints between the constituent parts in order to visually express their individuality.

A form can be articulated by:

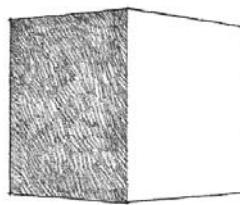
- differentiating adjoining planes with a change in material, color, texture, or pattern
- developing corners as distinct linear elements independent of the abutting planes
- removing corners to physically separate neighboring planes
- lighting the form to create sharp contrasts in tonal value along edges and corners

In opposition to the emphasis on joints and joinery, the corners of a form can be rounded and smoothed over to emphasize the continuity of its surfaces. Or a material, color, texture, or pattern can be carried across a corner onto the adjoining surfaces to de-emphasize the individuality of the surface planes and emphasize instead the volume of a form.

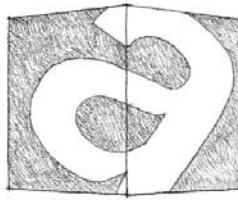
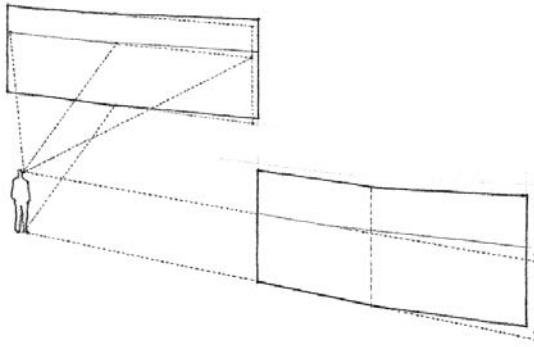
EDGES & CORNERS



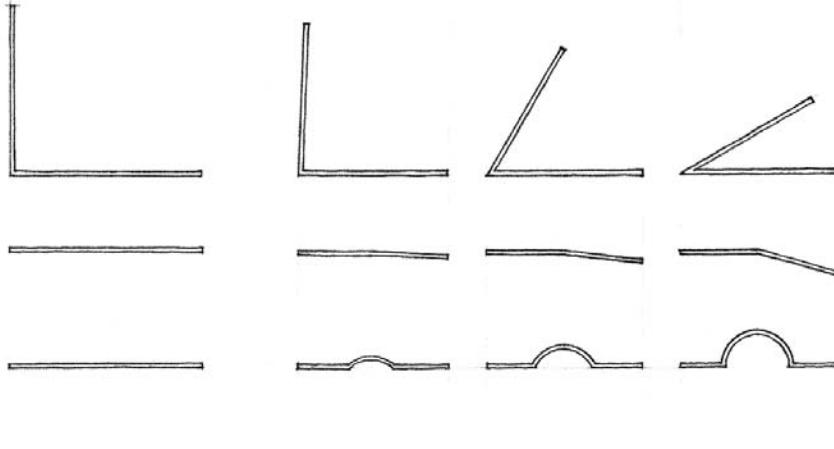
Since the articulation of a form depends to a great degree on how its surfaces meet each other at corners, how these edge conditions are resolved is critical to the definition and clarity of a form.



While a corner can be articulated by simply contrasting the surface qualities of the adjoining planes, or obscured by layering their joining with an optical pattern, our perception of its existence is also affected by the laws of perspective and the quality of light that illuminates the form.



For a corner to be formally active, there must be more than a slight deviation in the angle between the adjoining planes. Since we constantly search for regularity and continuity within our field of vision, we tend to regularize or smooth out slight irregularities in the forms we see. For example, a wall plane that is bent only slightly will appear to be a single flat plane, perhaps with a surface imperfection. A corner would not be perceived.



At what point do these formal deviations become an acute angle? ... a right angle?

a segmented line? ... a straight line?

a circular segment? ... a change in a line's contour?

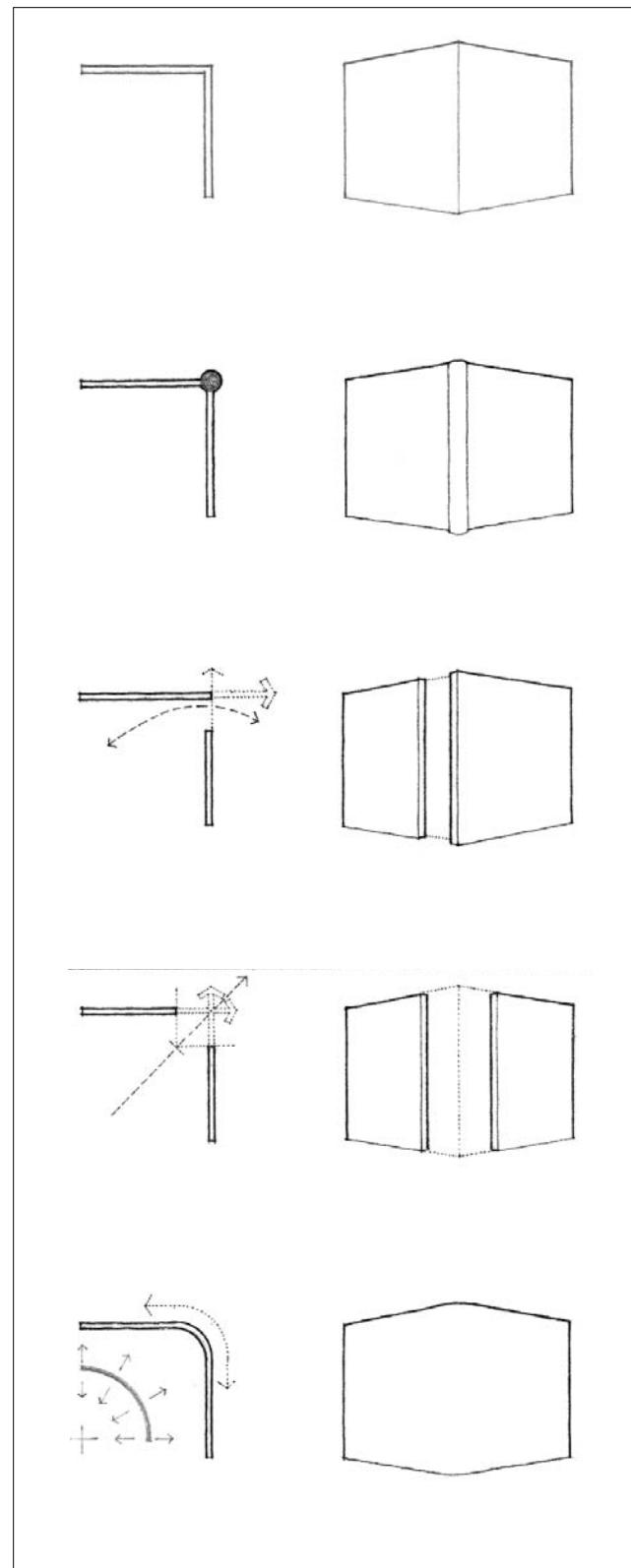
Corners define the meeting of two planes. If the two planes simply touch and the corner remains unadorned, the presence of the corner will depend on the visual treatment of the adjoining surfaces. This corner condition emphasizes the volume of a form.

A corner condition can be visually reinforced by introducing a separate and distinct element that is independent of the surfaces it joins. This element articulates the corner as a linear condition, defines the edges of the adjoining planes, and becomes a positive feature of the form.

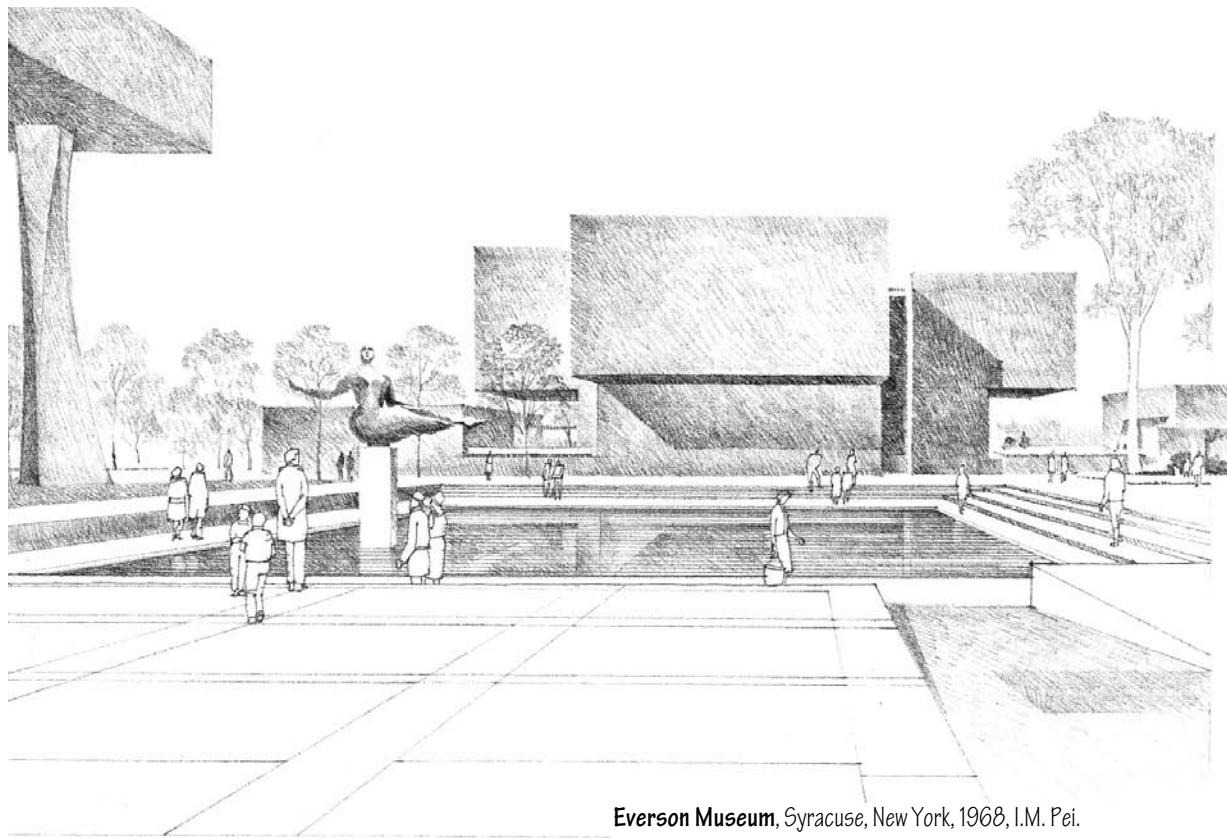
If an opening is introduced to one side of the corner, one of the planes will appear to bypass the other. The opening diminishes the corner condition, weakens the definition of the volume within the form, and emphasizes the planar qualities of the neighboring surfaces.

If neither plane is extended to define the corner, a volume of space is created to replace the corner. This corner condition deteriorates the volume of the form, allows the interior space to leak outward, and clearly reveals the surfaces as planes in space.

Rounding off the corner emphasizes the continuity of the bounding surfaces of a form, the compactness of its volume, and softness of its contour. The scale of the radius of curvature is important. If too small, it becomes visually insignificant; if too large, it affects the interior space it encloses and the exterior form it describes.

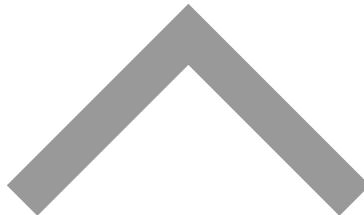
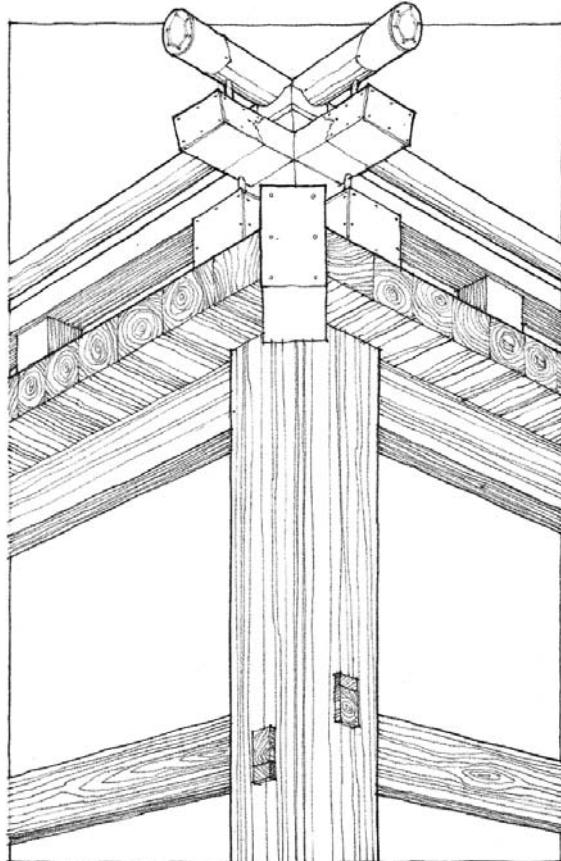


CORNERS



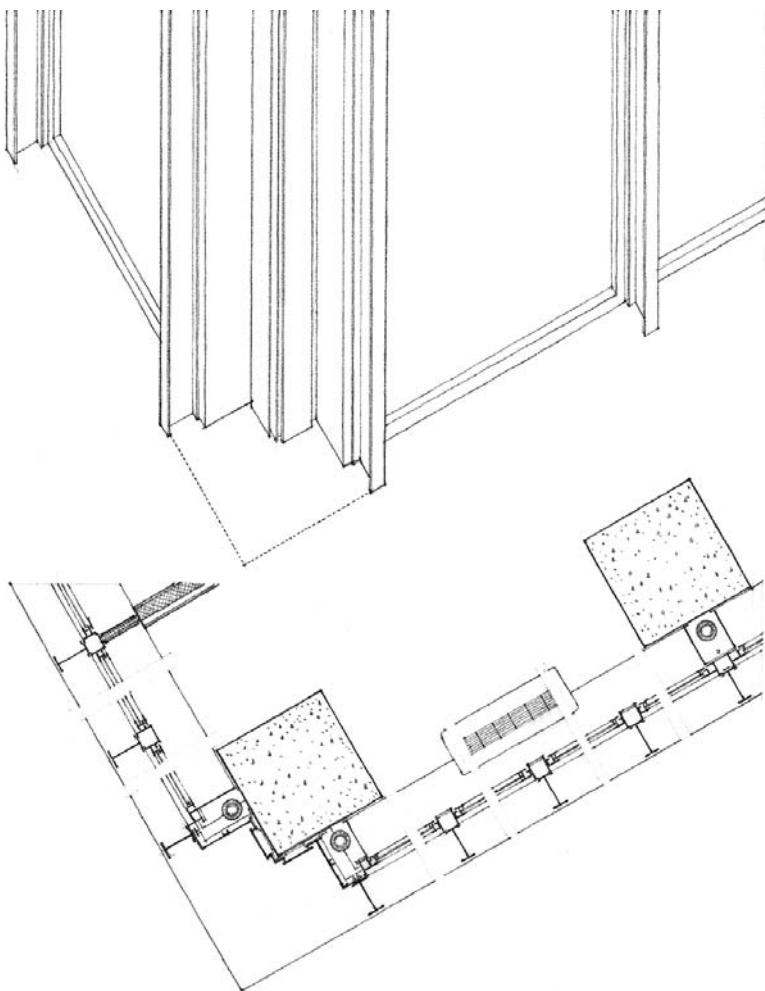
Everson Museum, Syracuse, New York, 1968, I.M. Pei.

The unadorned corners of the forms emphasize the volume of their mass.

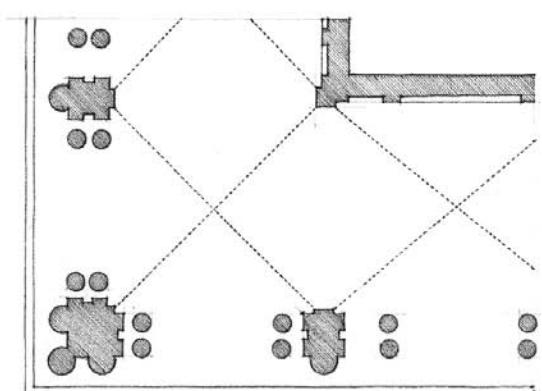
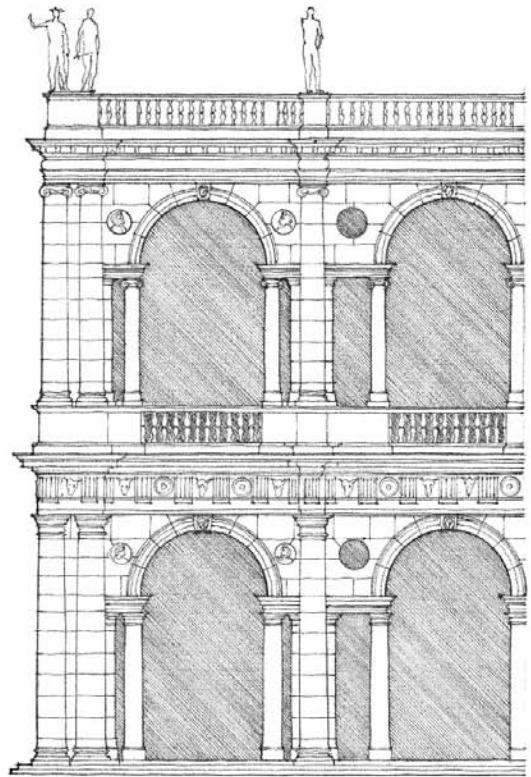


Corner Detail, Izumo Shrine, Shimane Prefecture, Japan, A.D. 717 (last rebuilt in 1744).

The timber joinery articulates the individuality of the members meeting at the corner.

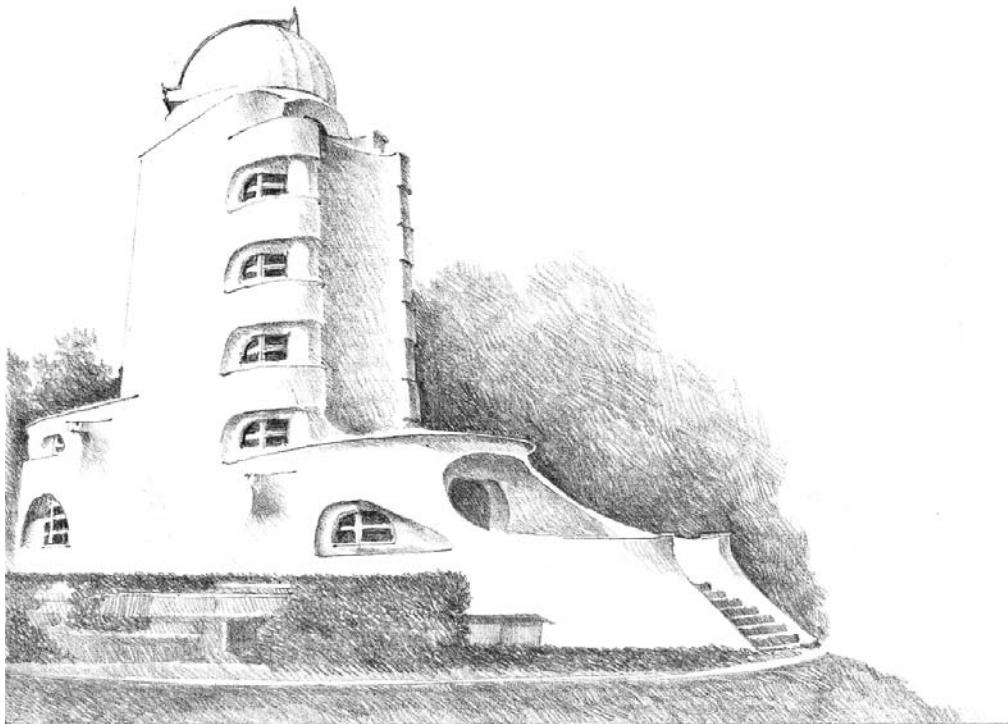


Corner Detail, Commonwealth Promenade Apartments, Chicago, 1953–56, Mies van der Rohe.
The corner member is recessed to be independent of the adjoining wall planes.



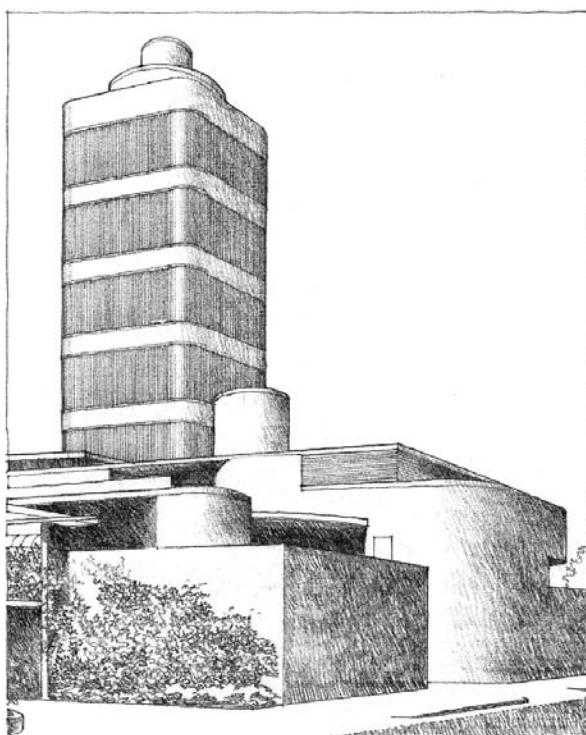
Corner Detail, The Basilica, Vicenza, Italy, 1545,
Andrea Palladio. The corner column emphasizes the edge
of the building form.

CORNERS

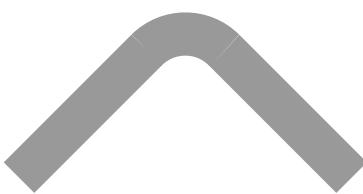


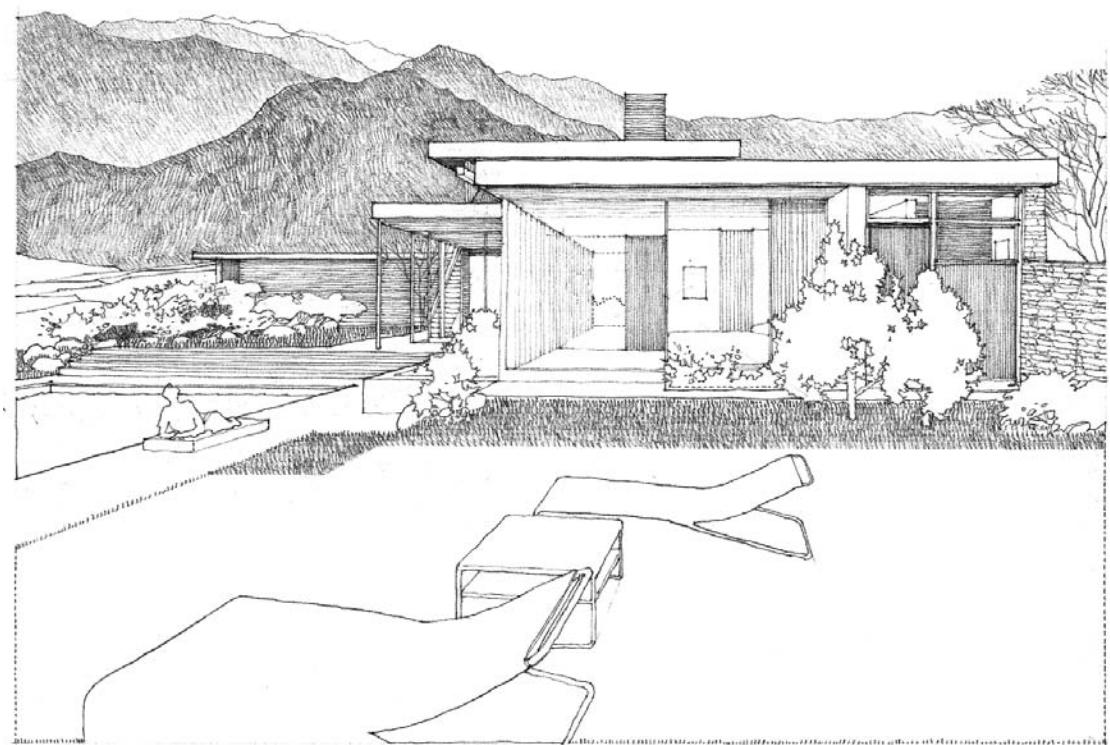
Einstein Tower, Potsdam, Germany, 1919, Eric Mendelsohn

Rounded corners express continuity of surface, compactness of volume, and softness of form.



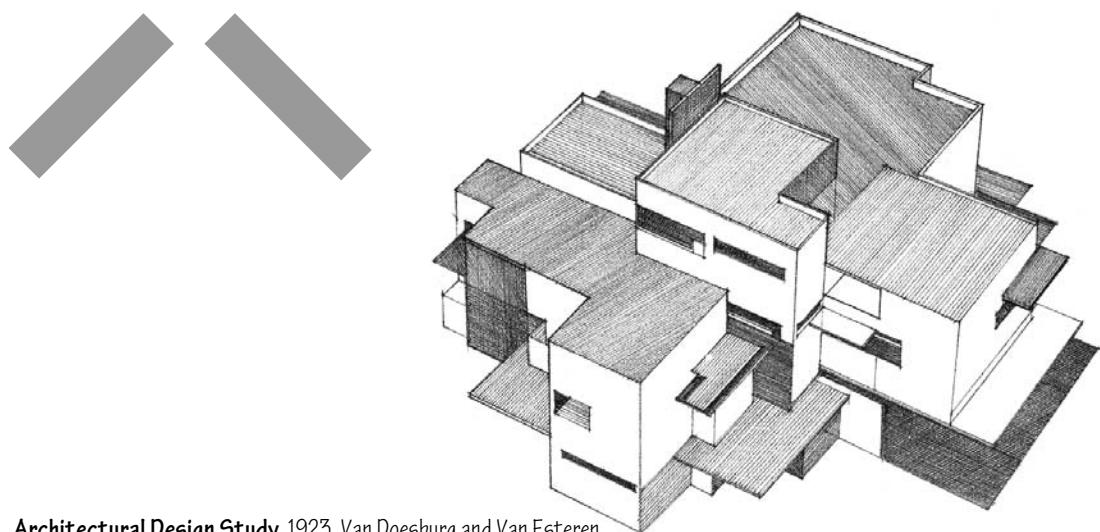
Laboratory Tower, Johnson Wax Building, Racine, Wisconsin, 1950, Frank Lloyd Wright





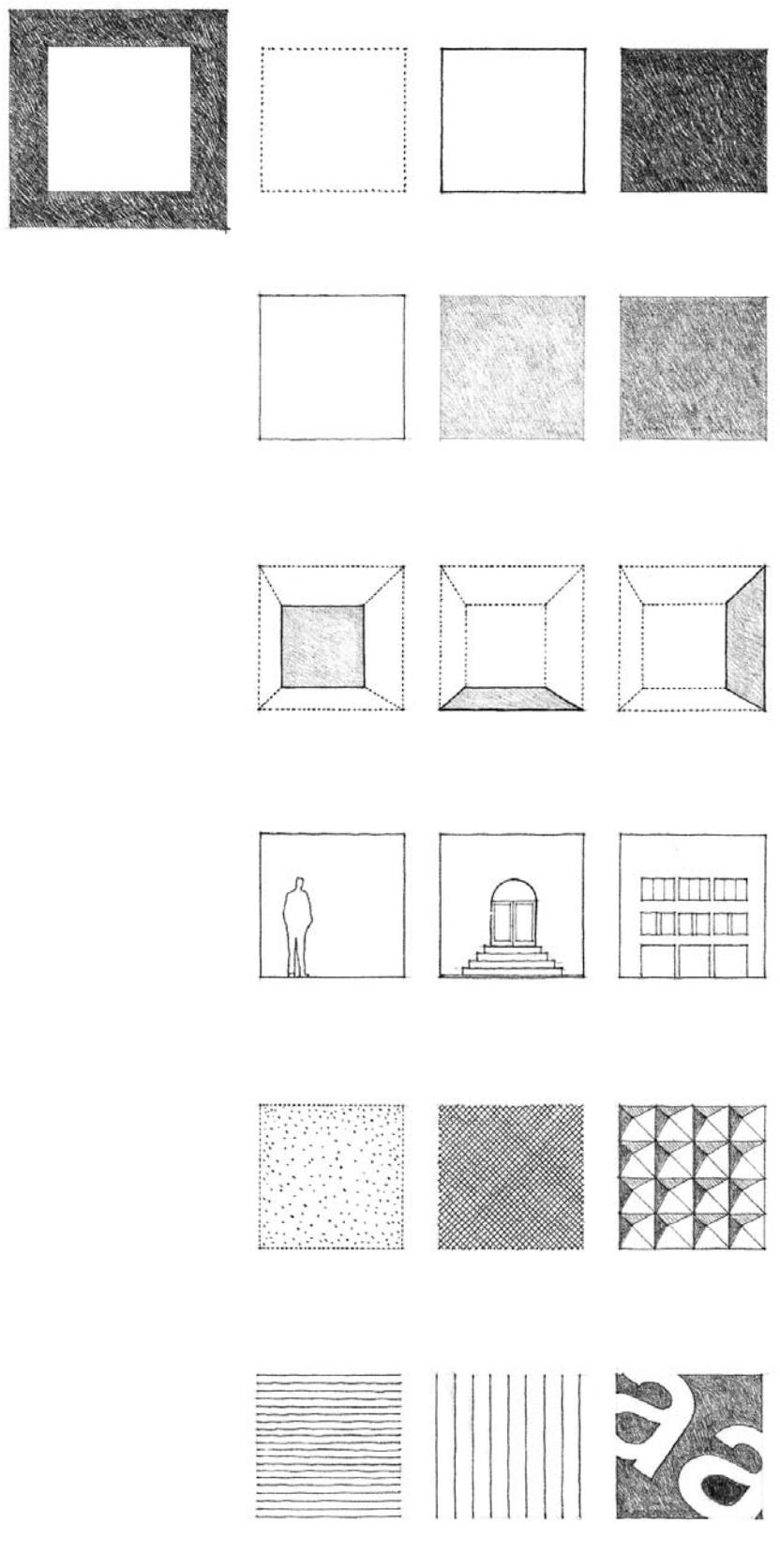
Kaufmann Desert House, Palm Springs, California, 1946, Richard Neutra

Openings at corners emphasize the definition of planes over volume.



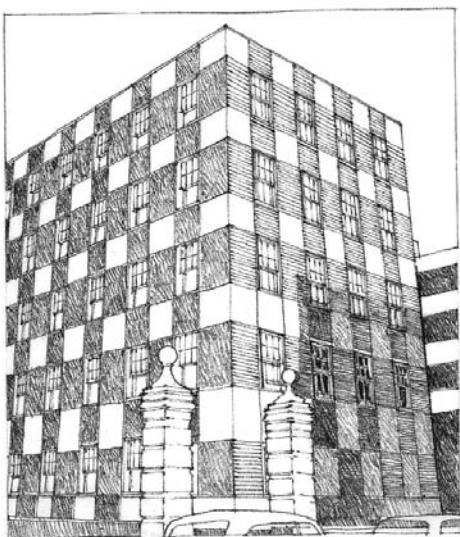
Architectural Design Study, 1923, Van Doesburg and Van Esteren

SURFACE ARTICULATION

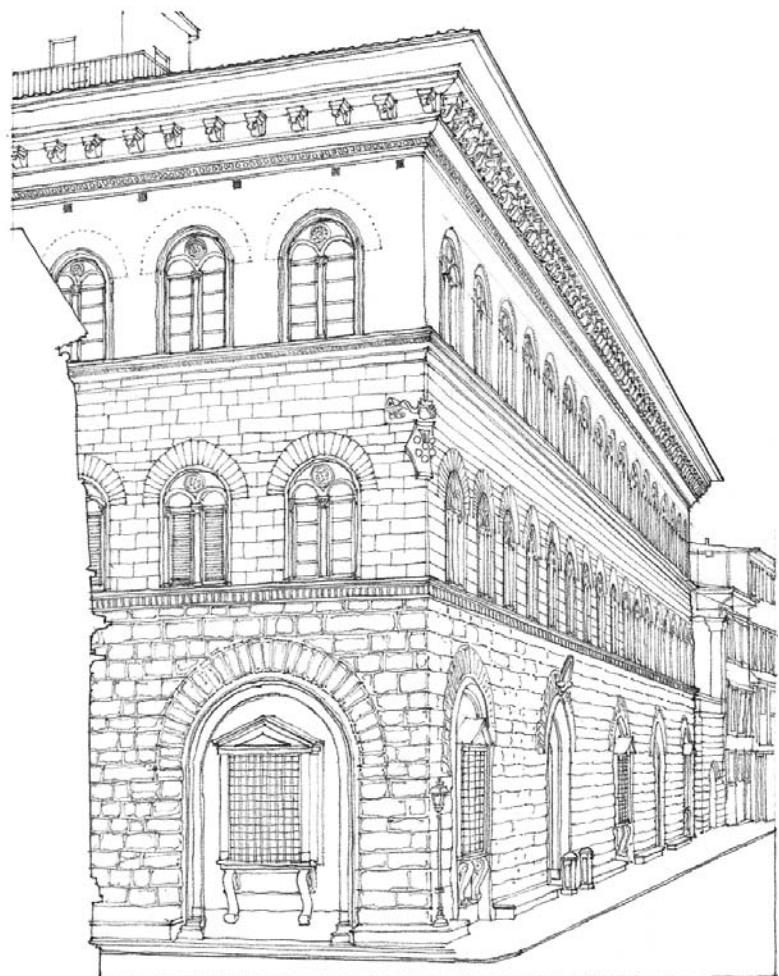


Our perception of the shape, size, scale, proportion, and visual weight of a plane is influenced by its surface properties as well as its visual context.

- A distinct contrast between the surface color of a plane and that of the surrounding field can clarify its shape, while modifying its tonal value can either increase or decrease its visual weight.
- A frontal view reveals the true shape of a plane; oblique views distort it.
- Elements of known size within the visual context of a plane can aid our perception of its size and scale.
- Texture and color together affect the visual weight and scale of a plane and the degree to which it absorbs or reflects light and sound.
- Directional or oversized optical patterns can distort the shape or exaggerate the proportions of a plane.



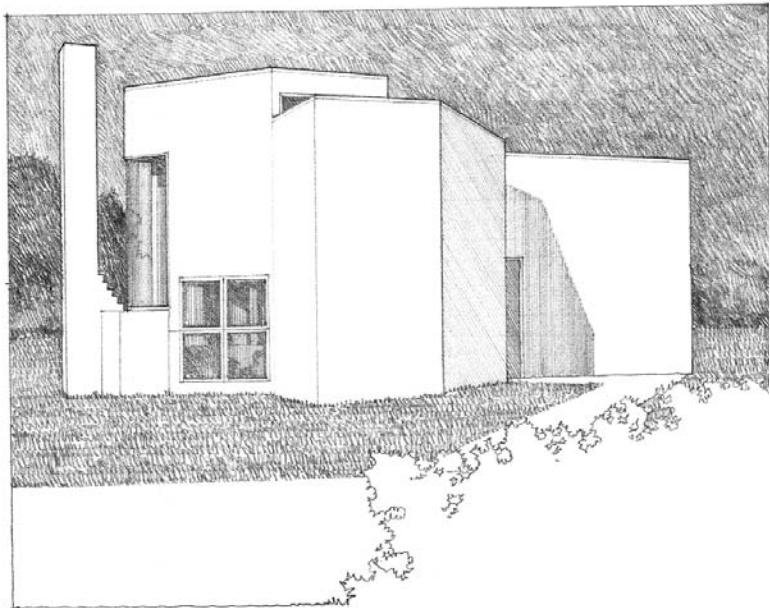
Vincent Street Flats, London, 1928, Sir Edwin Lutyens



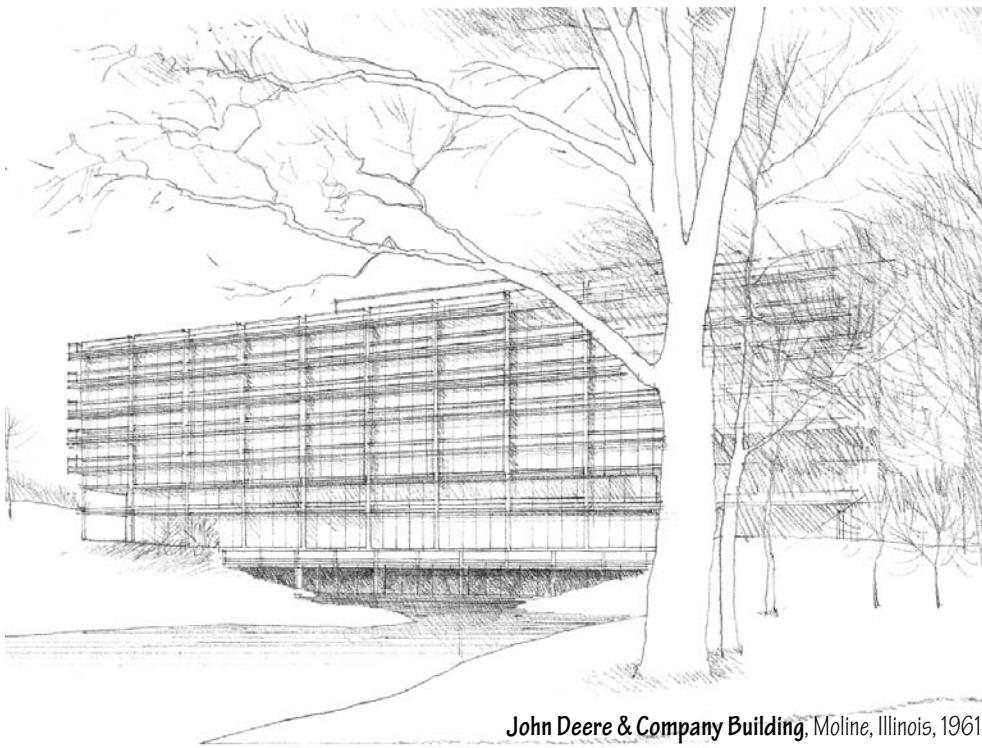
Palazzo Medici-Riccardo, Florence, Italy, 1444–60, Michelozzi

The color, texture, and pattern of surfaces articulate the existence of planes and influence the visual weight of a form.

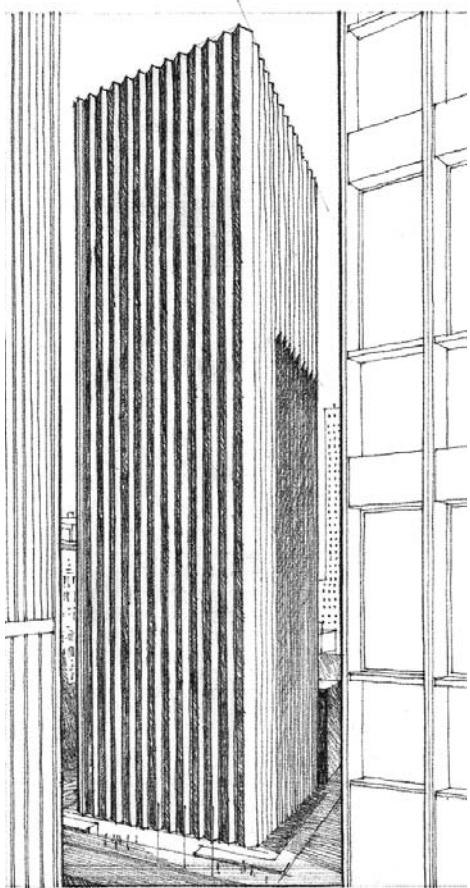
Hoffman House, East Hampton, New York, 1966–67, Richard Meier



SURFACE ARTICULATION

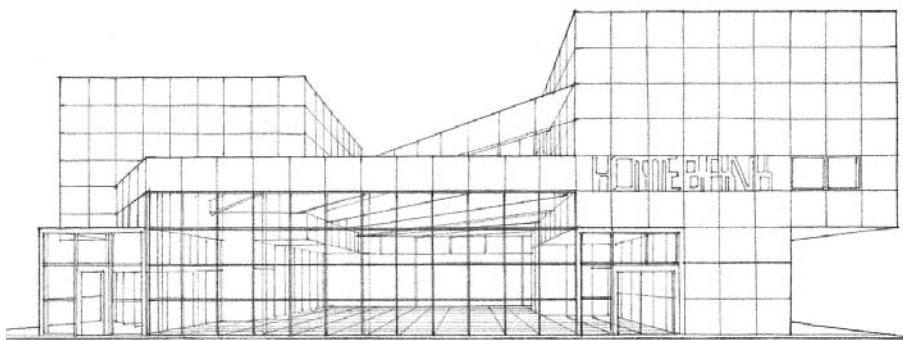


John Deere & Company Building, Moline, Illinois, 1961–64, Eero Saarinen & Associates.
The linear sun-shading devices accentuate the horizontality of the building form.

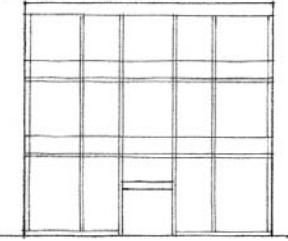
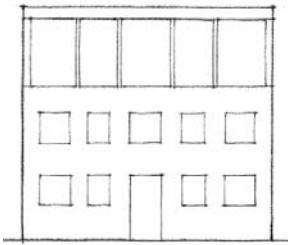
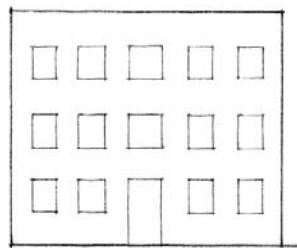


CBS Building, New York City, 1962–64, Eero Saarinen & Associates.
Linear columnar elements emphasize the verticality of this high-rise structure.

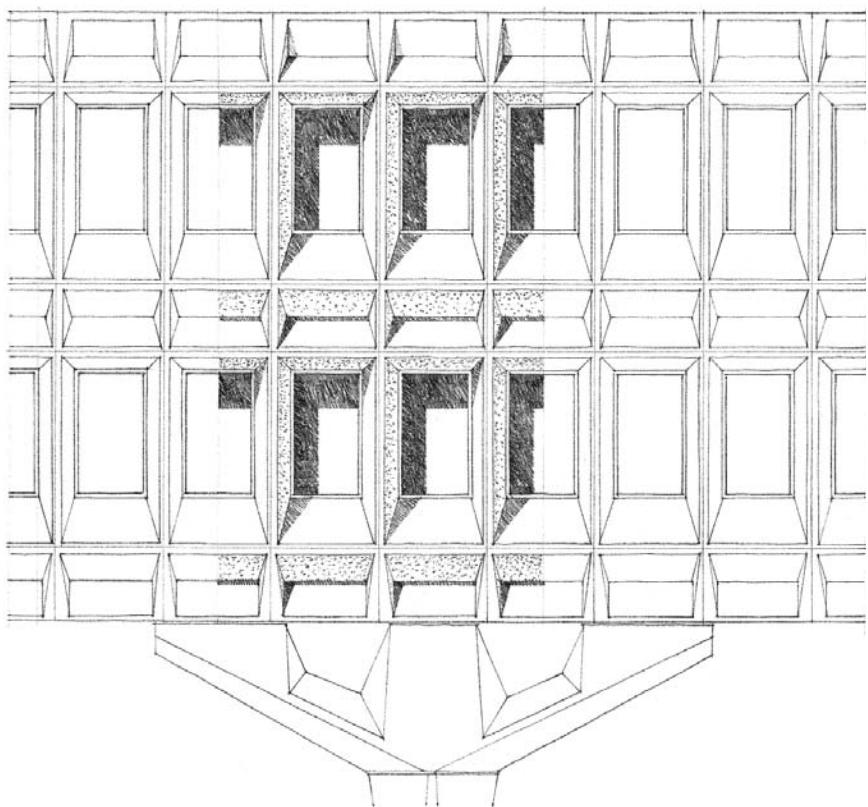
Linear patterns have the ability to emphasize the height or length of a form, unify its surfaces, and define its textural quality.



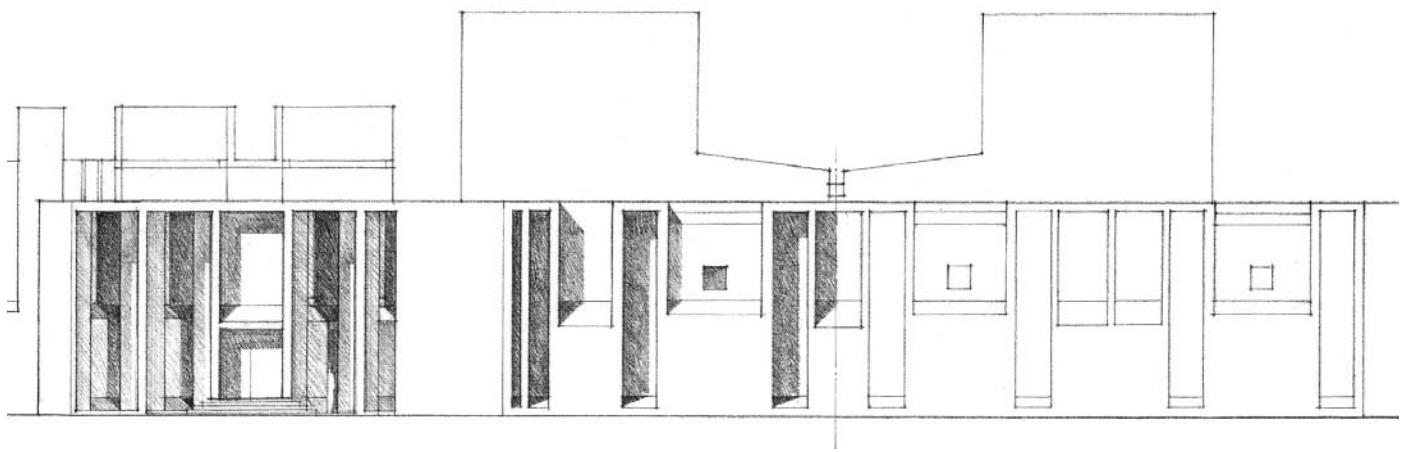
Fukuoka Sogo Bank, Study of the Saga Branch, 1971, Arata Isozaki.
A grid pattern unifies the surfaces of the three-dimensional composition.



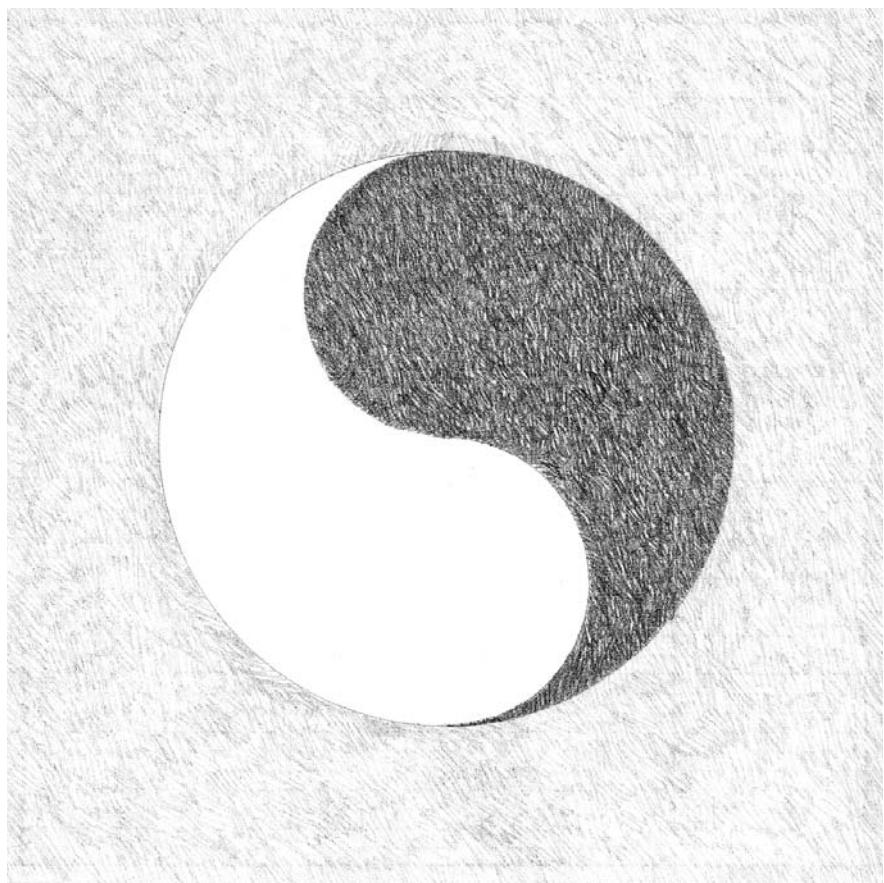
A transformation from a pattern of openings in a plane to an open facade articulated by a linear framework.



IBM Research Center, La Goude, Var, France, 1960–61, Marcel Breuer.
The three-dimensional form of the openings creates a texture of light, shade, and shadows.



First Unitarian Church, Rochester, New York, 1956–67, Louis Kahn.
The pattern of openings and cavities interrupts the continuity of the exterior wall planes.



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- abacus** The flat slab forming the top of a column capital, plain in the Doric style, but molded or otherwise enriched in other styles.
- abbey** A monastery under the supervision of an abbot, or a convent under the supervision of an abbess, belonging to the highest rank of such institutions.
- abutment** The part of a structure that directly receives thrust or pressure, such as a masonry mass receiving and supporting the thrust of part of an arch or vault; a heavy wall supporting the end of a bridge or span and sustaining the pressure of the abutting earth; a mass or structure resisting the pressure of water on a bridge or pier; or the anchorage for the cables of a suspension bridge.
- accent** A detail that is emphasized by contrasting with its surroundings. Also, a distinctive but subordinate pattern, motif, or color.
- accouplement** The placement of two columns or pilasters very close together.
- acropolis** The fortified high area or citadel of an ancient Greek city, esp. the citadel of Athens and site of the Parthenon.
- adobe** Sun-dried brick made of clay and straw, commonly used in countries with little rainfall.
- aedicule** A canopied opening or niche flanked by two columns, piers, or pilasters supporting a gable, lintel, or entablature.
- agora** A marketplace or public square in an ancient Greek city, usually surrounded with public buildings and porticoes and commonly used as a place for popular or political assembly.
- aisle** Any of the longitudinal divisions of a church, separated from the nave by a row of columns or piers. Also, a walkway between or along sections of seats in a theater, auditorium, church, or other place of assembly.
- alcazar** A castle or fortress of the Spanish Moors.
- allée** French term for a narrow passage between houses, or a broad walk planted with trees.
- amalaka** The bulbous, ribbed stone finial of a sikhara in Indian architecture.
- ambulatory** The covered walk of an atrium or cloister. Also, an aisle encircling the end of the choir or chancel of a church, originally used for processions.
- amphitheater** An oval or round building with tiers of seats around a central arena, as those used in ancient Rome for gladiatorial contests and spectacles. Also, a level area of oval or circular shape surrounded by rising ground.
- anomaly** A deviation from the normal or expected form, order, or arrangement.
- anthropology** The science of human beings: specifically, the study of the origins, physical and cultural development, and environmental and social relations of humankind.
- anthropometry** The measurement and study of the size and proportions of the human body.
- anthropomorphism** A conception or representation resembling the human form or having human attributes.
- apadana** The grand columnar audience hall in a Persian palace.
- apse** A semicircular or polygonal projection of a building, usually vaulted and used esp. at the sanctuary or east end of a church.
- arabesque** A complex and ornate design that employs flowers, foliage, and sometimes animal and geometric figures to produce an intricate pattern of interlaced lines.
- arboretum** A shady shelter of shrubs and branches or of latticework intertwined with climbing vines and flowers.
- arcade** A series of arches supported on piers or columns. Also, an arched, roofed gallery or passageway with shops on one or both sides.
- arch** A curved structure for spanning an opening, designed to support a vertical load primarily by axial compression.
- architrave** The lowermost division of a classical entablature, resting directly on the column capitals and supporting the frieze.
- arcuate** Curved or arched like a bow: a term used in describing the arched or vaulted structure of a Romanesque church or Gothic cathedral, as distinguished from the trabeated architecture of an Egyptian hypostyle hall or Greek Doric temple.
- ashlar** A squared building stone finely dressed on all faces adjacent to those of other stones so as to permit very thin mortar joints.
- atrium** Originally, the main or central inner hall of an ancient Roman house, open to the sky at the center and usually having a pool for the collection of rainwater. Later, the forecourt of an early Christian church, flanked or surrounded by porticoes. Now, an open, skylit court around which a house or building is built.
- axis** A central line that bisects a two-dimensional body or figure or about which a three-dimensional body or figure is symmetrical. Also, a straight line to which elements in a composition are referred for measurement or symmetry.
- background** The part of an image represented as being at the maximum distance from the frontal plane.
- balance** A state of equilibrium between contrasting, opposing, or interacting elements. Also, the pleasing or harmonious arrangement or proportion of parts or elements in a design or composition.
- balcony** An elevated platform projecting from the wall of a building and enclosed by a railing or parapet.
- baldachin** An ornamental canopy of stone or marble permanently placed over the high altar in a church.
- baluster** Any of a number of closely spaced supports for a railing. Also called banister.
- baptistery** A part of a church or a separate building in which the rite of baptism is administered.
- base** The lowermost portion of a wall, column, pier, or other structure, usually distinctively treated and considered as an architectural unit.

GLOSSARY

basilica A large oblong building used as a hall of justice and public meeting place in ancient Rome, typically having a high central space lit by a clerestory and covered by timber trusses, and a raised dais in a semicircular apse for the tribunal. The Roman basilica served as a model for early Christian basilicas, which were characterized by a long, rectangular plan, a high colonnaded nave lit by a clerestory and covered by a timbered gable roof, two or four lower side aisles, a semicircular apse at the end, a narthex, and often other features, as an atrium, a bema, and small semicircular apses terminating the aisles.

batter A backward slope of the face of a wall as it rises.

bay A major spatial division, usually one of a series, marked or partitioned off by the principal vertical supports of a structure. Also, any of a number of principal compartments or divisions of a wall, roof, or other part of a building marked off by vertical or transverse supports.

beam A rigid structural member designed to carry and transfer transverse loads across space to supporting elements.

bearing wall A wall capable of supporting an imposed load, as from a floor or roof of a building.

belvedere A building, or architectural feature of a building, designed and situated to look out upon a pleasing scene.

bema A transverse open space separating the nave and the apse of an early Christian church, developing into the transept of later cruciform churches.

berm A bank of earth placed against one or more exterior walls of a building as protection against extremes in temperature.

blind Describing a recess in a wall having the appearance of a window (blind window) or door (blind door), inserted to complete a series of windows or to provide symmetry of design.

bosket A grove or thicket of trees in a garden or park.

brise-soleil A screen, usually of louvers, placed on the outside of a building to shield the windows from direct sunlight.

butress An external support built to stabilize a structure by opposing its outward thrusts, esp. a projecting support built into or against the outside of a masonry wall.

campanile A bell tower, usually one near but not attached to the body of a church.

cantilever A beam or other rigid structural member extending beyond a fulcrum and supported by a balancing member or a downward force behind the fulcrum.

capital The distinctively treated upper end of a column, pillar, or pier, crowning the shaft and taking the weight of the entablature or architrave.

caravansary An inn in the Near East for the overnight accommodation of caravans, usually having a large courtyard enclosed by a solid wall and entered through an imposing gateway.

caryatid A sculptured female figure used as a column.

catenary The curve assumed by a perfectly flexible, uniform cable suspended freely from two points not in the same vertical line. For a load that is

uniformly distributed in a horizontal projection, the curve approaches that of a parabola.

cathedral The principal church of a diocese, containing the bishop's throne called the cathedra.

ceiling The overhead interior surface or lining of a room, often concealing the underside of the floor or roof above.

cella The principal chamber or enclosed part of a classical temple, where the cult image was kept. Also called naos.

cenotaph A monument erected in memory of a deceased person whose remains are buried elsewhere.

chaitya A Buddhist shrine in India, usually carved out of solid rock on a hillside, having the form of an aisled basilica with a stupa at one end.

chancel The space about the altar of a church for the clergy and choir, often elevated above the nave and separated from it by a railing or screen.

chapel A subordinate or private place of worship or prayer.

chatri In Indian architecture, a roof-top kiosk or pavilion having a dome usually supported on four columns.

chattri An umbrella-shaped finial symbolizing dignity, composed of a stone disk on a vertical pole.

church A building for public Christian worship.

clerestory A portion of an interior rising above adjacent rooftops and having windows admitting daylight to the interior. Also, the uppermost section of a Gothic nave characterized by a series of large windows rising above adjacent rooftops to admit daylight to the interior.

cloister A covered walk having an arcade or colonnade on one side opening onto a courtyard.

colonnade A series of regularly spaced columns supporting an entablature and usually one side of a roof structure.

column A rigid, relatively slender structural member designed primarily to support compressive loads applied at the member ends. In classical architecture, a cylindrical support consisting of a capital, shaft, and usually a base, either monolithic or built up of drums the full diameter of the shaft.

concrete An artificial, stonelike building material made by mixing cement and various mineral aggregates with sufficient water to cause the cement to set and bind the entire mass.

contrast Opposition or juxtaposition of dissimilar elements in a work of art to intensify each element's properties and produce a more dynamic expressiveness.

corbel To set bricks or stones in an overlapping arrangement so that each course steps upward and outward from the vertical face of a wall.

cornice The uppermost member of a classical entablature, consisting typically of a cymatium, corona, and bed molding.

corona The projecting, slablike member of a classical cornice, supported by the bed molding and crowned by the cymatium.

corridor A narrow passageway or gallery connecting parts of a building, esp. one into which several rooms or apartments open.

- cortile** A large or principal courtyard of an Italian palazzo.
- court** An area open to the sky and mostly or entirely surrounded by walls or buildings.
- courtyard** A court adjacent to or within a building, esp. one enclosed on all four sides.
- cromlech** A circular arrangement of megaliths enclosing a dolmen or burial mound
- cupola** A light structure on a dome or roof, serving as a belfry, lantern, or belvedere. Also, a small dome covering a circular or polygonal area.
- cyma recta** A projecting molding having the profile of a double curve with the concave part projecting beyond the convex part.
- cymatium** The crowning member of a classical cornice, usually a cyma recta.
- dado** The major part of a pedestal between the base and the cornice or cap. Also, the lower portion of an interior wall when faced or treated differently from the upper section, as with paneling or wallpaper.
- datum** Any level surface, line, or point used as a reference for the positioning or arrangement of elements in a composition.
- dian** A palace hall in Chinese architecture, always on the median axis of the site plan and constructed on a raised platform faced with brick or stone.
- dolmen** A prehistoric monument consisting of two or more large upright stones supporting a horizontal stone slab, found esp. in Britain and France and usually regarded as a tomb.
- dome** A vaulted structure having a circular plan and usually the form of a portion of a sphere, so constructed as to exert an equal thrust in all directions.
- dormer** A projecting structure built out from a sloping roof, usually housing a vertical window or ventilating louver.
- dougong** A bracket system used in traditional Chinese construction to support roof beams, project the eaves outward, and support the interior ceiling. The absence of a triangular tied frame in Chinese architecture made it necessary to multiply the number of supports under the rafters. In order to reduce the number of pillars this would normally require, the area of support afforded by each pillar was increased by the dougong. The main beams support the roof through intermediary queen posts and shorter upper beams, enabling the roof to be given a concave curve. This distinctive curve is believed to have developed at the beginning of the Tang period, presumably to lighten the visual weight of the roof and allow more daylight into the interior.
- eclecticism** A tendency in architecture and the decorative arts to freely mix various historical styles with the aim of combining the virtues of diverse sources, or of increasing allusive content, particularly during the second half of the 19th century in Europe and the U.S.
- emphasis** Stress or prominence given to an element of a composition by means of contrast, anomaly, or counterpoint.
- enfilade** An axial arrangement of doorways connecting a series of rooms so as to provide a vista down the entire length of the suite. Also, an axial arrangement of mirrors on opposite sides of a room so as to give an effect of an infinitely long vista.
- engaged column** A column built so as to be truly or seemingly bonded to the wall before which it stands.
- entablature** The horizontal section of a classical order that rests on the columns, usually composed of a cornice, frieze, and architrave.
- entasis** A slight convexity given to a column to correct an optical illusion of concavity if the sides were straight.
- ergonomics** An applied science concerned with the characteristics of people that need to be considered in the design of devices and systems in order that people and things will interact effectively and safely.
- exedra** A room or covered area open on one side and provided with seats, used as a meeting place in ancient Greece and Rome. Also, a large apsidal extension of the interior volume of a church, normally on the main axis.
- facade** The front of a building or any of its sides facing a public way or space, esp. one distinguished by its architectural treatment.
- fascia** One of the three horizontal bands making up the architrave in the Ionic order. Also, any broad, flat, horizontal surface, as the outer edge of a cornice or roof.
- field** A region or expanse of space characterized by a particular property, feature, or activity.
- fenestration** The design, proportioning, and disposition of windows and other exterior openings of a building. Also, an ornamental motif having the form of a blind arcade or arch, as in medieval cabinetwork.
- figure** A shape or form, as determined by outlines or exterior surfaces. Also, a combination of geometric elements disposed in a particular form or shape.
- figure-ground** A property of perception in which there is a tendency to see parts of a visual field as solid, well-defined objects standing out against a less distinct background.
- finial** A relatively small, usually foliated ornament terminating the peak of a spire or pinnacle.
- floor** The level, base surface of a room or hall upon which one stands or walks. Also, a continuous supporting surface extending horizontally throughout a building, having a number of rooms and constituting one level in the structure.
- flying buttress** An inclined bar of masonry carried on a segmental arch and transmitting an outward and downward thrust from a roof or vault to a solid buttress that through its mass transforms the thrust into a vertical one; a characteristic feature of Gothic construction.
- form** The shape and structure of something as distinguished from its substance or material. Also, the manner of arranging and coordinating the elements and parts of a composition so as to produce a coherent image; the formal structure of a work of art.
- forum** The public square or marketplace of an ancient Roman city, the center of judicial and business affairs, and a place of assembly for the people, usually including a basilica and a temple.
- fresco** The art or technique of painting on a freshly spread, moist plaster surface with pigments ground up in water or a limewater mixture.

GLOSSARY

- frieze** The horizontal part of a classical entablature between the cornice and architrave, often decorated with sculpture in low relief. Also, a decorative band, as one along the top of an interior wall, immediately below the cornice, or a sculptured one in a stringcourse on an outside wall.
- gable** The triangular portion of wall enclosing the end of a pitched roof from cornice or eaves to ridge.
- galleria** A spacious promenade, court, or indoor mall, usually having a vaulted roof and lined with commercial establishments.
- gallery** A long, relatively narrow room or hall, esp. one for public use and having architectural importance through its scale or decorative treatment. Also, a roofed promenade, esp. one extending inside or outside along the exterior wall of a building.
- garbha-griha** A 'womb chamber,' the dark, innermost sanctuary of a Hindu temple, where the statue of the deity is placed.
- gestalt** A unified configuration, pattern, or field of specific properties that cannot be derived from the summation of the component parts.
- Gestalt psychology** The theory or doctrine that physiological or psychological phenomena do not occur through the summation of individual elements, as reflexes or sensations, but through gestalts functioning separately or interrelatedly.
- golden section** A proportion between the two dimensions of a plane figure or the two divisions of a line, in which the ratio of the smaller to the larger is the same as the ratio of the larger to the whole: a ratio of approximately 0.618 to 1.000.
- gopura** A monumental, usually ornate gateway tower to a Hindu temple enclosure, esp. in southern India.
- groin vault** A compound vault formed by the perpendicular intersection of two vaults, forming arched diagonal arrises called groins. Also called cross vault.
- ground** The main surface or background in painting or decorative work. Also, the receding part of a visual field against which a figure is perceived.
- hall** The large entrance room of a house or building, as a vestibule or lobby. Also, a large room or building for public gatherings or entertainment.
- hacienda** A large, landed estate for farming and ranching in North and South American areas once under Spanish influence. Also, the main house on such an estate.
- haiden** The hall of worship of a Shinto shrine, usually in front of the honden.
- harmonic progression** A sequence of numbers whose reciprocals form an arithmetic progression.
- harmony** The orderly, pleasing, or congruent arrangement of the elements or parts in an artistic whole.
- hashira** A sacred post in Shinto architecture, shaped by human hands.
- hierarchy** A system of elements ranked, classified, and organized one above another, according to importance or significance.
- hippodrome** An arena or structure for equestrian and other spectacles. Also, an open-air stadium with an oval track for horse and chariot races in ancient Greece and Rome.
- hypostyle hall** A large hall having many columns in rows supporting a flat roof, and sometimes a clerestory: prevalent in ancient Egyptian and Achaemenid architecture.
- in antis** Between antae, the rectangular piers or pilasters formed by thickening the end of a projecting wall.
- intercolumniation** A system for spacing columns in a colonnade based on the space between two adjacent columns measured in diameters.
- interfenestration** A space between two windows. Also, the art or process of arranging the openings in a wall.
- interstitial** Forming an intervening space.
- intrados** The inner curve or surface of an arch forming the concave underside.
- iwan** A large vaulted hall serving as an entrance portal and opening onto a courtyard: prevalent in Parthian, Sassanian and later in Islamic architecture. Also, ivan, liwan.
- jami masjid** Friday mosque: A congregational mosque for public prayer, esp. on Fridays.
- joist** Any of a series of small, parallel beams for supporting floors, ceilings, or flat roofs.
- Ka'ba** A small, cubical stone building in the courtyard of the Great Mosque at Mecca containing a sacred black stone and regarded by Muslims as the House of God, the objective of their pilgrimages, and the point toward which they turn in praying.
- keystone** The wedge-shaped, often embellished voussoir at the crown of an arch, serving to lock the other voussoirs in place. Until the keystone is in place, no true arch action is incurred.
- kondo** Golden Hall: the sanctuary where the main image of worship is kept in a Japanese Buddhist temple. The Jodo, Shinshu, and Nichiren sects of Buddhism use the term hondo for this sanctuary, the Shingon and Tendai sects use chudo, and the Zen sect uses butsuden.
- lacunar** A ceiling, soffit, or vault decorated with a pattern of recessed panels.
- lantern** A superstructure crowning a roof or dome having open or windowed walls to let in light and air.
- linga** A phallus, symbol of the god Siva in Hindu architecture.
- lingdao** The spirit way that led from the south gate to a royal tomb of the Tang dynasty, lined with stone pillars and sculptured animal and human figures.
- lintel** A beam supporting the weight above a door or window opening.
- loggia** A colonnaded or arcaded space within the body of a building but open to the air on one side, often at an upper story overlooking an open court. The loggia is an important feature of the architecture of the Italian palazzi.
- madrasah** A Muslim theological school arranged around a courtyard and attached to a mosque, found from the 11th century on in Egypt, Anatolia, and Persia.

- mandala** A diagram of the cosmos, often used to guide the design of Indian temple plans.
- mandapa** A large, porchlike hall leading to the sanctuary of a Hindu or Jain temple and used for religious dancing and music.
- mass** The physical volume or bulk of a solid body.
- massing** A unified composition of two-dimensional shapes or three-dimensional volumes, esp. one that has or gives the impression of weight, density, and bulk.
- mastaba** An ancient Egyptian tomb made of mud brick, rectangular in plan with a flat roof and sloping sides, from which a shaft leads to underground burial and offering chambers.
- mausoleum** A large and stately tomb, esp. that in the form of a building for housing the tombs of many individuals, often of a single family.
- megalith** A very large stone used as found or roughly dressed, esp. in ancient construction work.
- megaron** A building or semi-independent unit of a building, typically having a rectangular principal chamber with a center hearth and a porch, often of columns in antis: traditional in Greece since Mycenaean times and believed to be the ancestor of the Doric temple.
- menhir** A prehistoric monument consisting of an upright megalith, usually standing alone but sometimes aligned with others.
- mezzanine** A low or partial story between two main stories of a building, esp. one that projects as a balcony and forms a composition with the story beneath it.
- mihrab** A niche or decorative panel in a mosque designating the qibla.
- minaret** A lofty, slender tower attached to a mosque, having stairs leading up to one or more projecting balconies from which the muezzin calls the Muslim people to prayer.
- mirador** In Spanish architecture, an architectural feature affording a view of the surroundings, as a bay window, loggia, or roof pavilion.
- model** An example serving as a pattern for imitation or emulation in the creation of something.
- module** A unit of measurement used for standardizing the dimensions of building materials or regulating the proportions of an architectural composition.
- monastery** A place of residence for a community of persons living in seclusion under religious vows, esp. monks.
- monolith** A single block of stone of considerable size, often in the form of an obelisk or column.
- mosque** A Muslim building or place of public worship.
- mullion** A vertical member between the lights of a window or the panels in wainscoting.
- muqarnas** A system of decoration in Islamic architecture, formed by the intricate corbeling of brackets, squinches, and inverted pyramids; sometimes wrought in stone but more often in plaster. Also called stalactite work.
- mural** A large picture painted on or applied directly to a wall or ceiling surface.
- naos** See cella.
- narthex** The portico before the nave of an early Christian or Byzantine church, appropriated to penitents. Also, an entrance hall or vestibule leading to the nave of a church.
- nave** The principal or central part of a church, extending from the narthex to the choir or chancel and usually flanked by aisles.
- necropolis** A historic burial ground, esp. a large, elaborate one of an ancient city.
- niche** An ornamental recess in a wall, often semicircular in plan and surmounted by a half dome, as for a statue or other decorative object.
- nuraghe** Any of the large, round or triangular stone towers found in Sardinia and dating from the second millennium B.C. to the Roman conquest.
- obelisk** A tall, four-sided shaft of stone that tapers as it rises to a pyramidal point, originating in ancient Egypt as a sacred symbol of the sun-god Ra and usually standing in pairs astride temple entrances.
- oculus** A circular opening, esp. one at the crown of a dome.
- order** A condition of logical, harmonious, or comprehensible arrangement in which each element of a group is properly disposed with reference to other elements and to its purpose. Also, an arrangement of columns supporting an entablature, each column comprising a capital, shaft, and usually a base.
- oriel** A bay window supported from below by corbels or brackets.
- orthographic** Pertaining to, involving, or composed of right angles.
- pagoda** A Buddhist temple in the form of a square or polygonal tower with roofs projecting from each of its many stories, erected as a memorial or to hold relics. From the stupa, the Indian prototype, the pagoda gradually changed in form to resemble the traditional multistoried watch tower as it spread with Buddhism to China and Japan. Pagodas were initially of timber, but from the 6th century on, were more frequently of brick or stone, possibly due to Indian influence.
- pailou** A monumental gateway in Chinese architecture, having a trabeated form of stone or wood construction with one, three, or five openings and often bold projecting roofs, erected as a memorial at the entrance to a palace, tomb, or sacred place: related to the Indian toranas and the Japanese torii. Also, pailoo.
- palazzo** A large, imposing public building or private residence, esp. in Italy.
- Palladian motif** A window or doorway in the form of a round-headed archway flanked on either side by narrower compartments, the side compartments being capped with entablatures on which the arch of the central compartment rests.
- panopticon** A building, as a prison, hospital, library, or the like, so arranged that all parts of the interior are visible from a single point.
- pantheon** A temple dedicated to all the gods of a people. Also, a public building serving as the burial place of or containing the memorials to the famous dead of a nation.

GLOSSARY

- parapet** A low, protective wall at the edge of a terrace, balcony, or roof, esp. that part of an exterior wall, fire wall, or party wall that rises above the roof.
- parterre** An ornamental arrangement of flower beds of different shapes and sizes.
- parti** Used by the French at the École des Beaux-Arts in the nineteenth century, the design idea or sketch from which an architectural project will be developed. Now, the basic scheme or concept for an architectural design, represented by a diagram.
- passage grave** A megalithic tomb of the Neolithic and early Bronze Ages found in the British Isles and Europe, consisting of a roofed burial chamber and narrow entrance passage, covered by a tumulus; believed to have been used for successive family or clan burials spanning a number of generations.
- pavilion** A light, usually open building used for shelter, concerts, or exhibits, as in a park or fair. Also, a central or flanking projecting subdivision of a facade, usually accented by more elaborate decoration or greater height and distinction of skyline.
- pedestal** A construction upon which a column, statue, memorial shaft, or the like, is elevated, usually consisting of a base, a dado, and a cornice or cap.
- pediment** The low-pitched gable enclosed by the building's horizontal and raking cornices of a Greek or Roman temple. Also, a similar or derivative element used to surmount a major division of a facade or crown an opening.
- pendentive** A spherical triangle forming the transition from the circular plan of a dome to the polygonal plan of its supporting structure.
- pergola** A structure of parallel colonnades supporting an open roof of beams and crossing rafters or trelliswork, over which climbing plants are trained to grow.
- peristyle** A colonnade surrounding a building or a courtyard. Also, the courtyard so enclosed.
- piano nobile** The principal story of a large building, as a palace or villa, with formal reception and dining rooms, usually one flight above the ground floor.
- piazza** An open square or public place in a city or town, esp. in Italy.
- pier** A vertical supporting structure, as a section of wall between two openings or one supporting the end of an arch or lintel. Also, a cast-in-place concrete foundation formed by boring with a large auger or excavating by hand a shaft in the earth to a suitable bearing stratum and filling the shaft with concrete.
- pilaster** A shallow rectangular feature projecting from a wall, having a capital and a base and architecturally treated as a column.
- pillar** An upright, relatively slender shaft or structure, usually of brick or stone, used as a building support or standing alone as a monument.
- piloti** A column of steel or reinforced concrete supporting a building above an open ground level, thereby leaving the space available for other uses.
- Platonic solid** One of the five regular polyhedrons: tetrahedron, hexahedron, octahedron, dodecahedron, or icosahedron.
- plaza** A public square or open space in a city or town.
- plinth** The usually square slab beneath the base of a column, pier, or pedestal. Also, a continuous, usually projecting course of stones forming the base or foundation of a wall.
- podium** A solid mass of masonry visible above ground level and serving as the foundation of a building, esp. the platform forming the floor and substructure of a classical temple.
- porch** An exterior appendage to a building, forming a covered approach or vestibule to a doorway.
- porte-cochère** A porch roof projecting over a driveway at the entrance to a building and sheltering those getting in or out of vehicles. Also, a vehicular passageway leading through a building or screen wall into an interior courtyard.
- portico** A porch or walkway having a roof supported by columns, often leading to the entrance of a building.
- post** A stiff vertical support, esp. a wooden column in timber framing.
- postern** A private or side entrance, as one for pedestrians next to a porte-cochère.
- promenade** An area used for a stroll or walk, esp. in a public place, as for pleasure or display.
- proportion** The comparative, proper, or harmonious relation of one part to another or to the whole with respect to magnitude, quantity, or degree. Also, the equality between two ratios in which the first of the four terms divided by the second equals the third divided by the fourth.
- propylaeum** A vestibule or gateway of architectural importance before a temple area or other enclosure. Often used in the plural, propylaea.
- propylon** A freestanding gateway having the form of a pylon and preceding the main gateway to an ancient Egyptian temple or sacred enclosure.
- prototype** An early and typical example that exhibits the essential features of a class or group and on which later stages are based or judged.
- proxemics** The study of the symbolic and communicative role of the spatial separation individuals maintain in various social and interpersonal situations, and how the nature and degree of this spatial arrangement relates to environmental and cultural factors.
- pylon** A monumental gateway to an ancient Egyptian temple, consisting either of a pair of tall truncated pyramids and a doorway between them or of one such masonry mass pierced with a doorway, often decorated with painted reliefs.
- pyramid** A massive masonry structure having a rectangular base and four smooth, steeply sloping sides facing the cardinal points and meeting at an apex, used in ancient Egypt as a tomb to contain the burial chamber and the mummy of the pharaoh. The pyramid was usually part of a complex of buildings within a walled enclosure, including mastabas for members of the royal family, an offering chapel and a mortuary temple. A raised causeway led from the enclosure down to a valley temple on the Nile, where purification rites and mummification were performed. Also, a masonry mass

- having a rectangular base and four stepped and sloping faces culminating in a single apex, used in ancient Egypt and pre-Columbian Central America as a tomb or a platform for a temple.**
- qibla** The direction toward which Muslims face to pray, esp. the Ka'ba at Mecca. Also, the wall in a mosque in which the mihrab is set, oriented to Mecca.
- quoin** An external solid angle of a wall, or one of the stones forming such an angle, usually differentiated from the adjoining surfaces by material, texture, color, size, or projection.
- rampart** A broad embankment of earth raised as a fortification around a place and usually surmounted by a parapet.
- rath** A Hindu temple cut out of solid rock to resemble a chariot.
- ratio** Relation in magnitude, quantity, or degree between two or more similar things.
- reentrant** Reentering or pointing inward, as an interior angle of a polygon that is greater than 180°.
- regular** Having all faces congruent regular polygons and all solid angles congruent.
- repetition** The act or process of repeating formal elements or motifs in a design.
- rhythm** Movement characterized by a patterned repetition or alternation of formal elements or motifs in the same or a modified form.
- roof** The external upper covering of a building, including the frame for supporting the roofing.
- room** A portion of space within a building, separated by walls or partitions from other similar spaces.
- rustication** Ashlar masonry having the visible faces of the dressed stones raised or otherwise contrasted with the horizontal and usually the vertical joints, which may be rabbeted, chamfered, or beveled.
- sanctuary** A sacred or holy place, esp. the most sacred part of a church in which the principal altar is placed or a especially holy place in a temple.
- scale** A proportion determining the relationship of a representation to that which it represents. Also, a certain proportionate size, extent, or degree, usually judged in relation to some standard or point of reference.
- semiotics** The study of signs and symbols as elements of communicative behavior.
- shell structure** A thin, rigid, curved surface structure formed to enclose a volume. Applied loads develop compressive, tensile, and shear stresses acting within the plane of the shell. The thinness of the shell, however, has little bending resistance and is unsuitable for concentrated loads.
- shoro** A structure from which the temple bell is hung, as one of a pair of small, identical, symmetrically placed pavilions in a Japanese Buddhist temple.
- shrine** A building or other shelter, often of a stately or sumptuous character, enclosing the remains or relics of a saint or other holy person and forming an object of religious veneration and pilgrimage.
- sikhra** A tower of a Hindu temple, usually tapered convexly and capped by an amalaka.
- sill** The lowest horizontal member of a frame structure, resting on and anchored to a foundation wall. Also, the horizontal member beneath a door or window opening.
- solarium** A glass-enclosed porch, room, or gallery used for sunbathing or for therapeutic exposure to sunlight.
- solid** A geometric figure having the three dimensions of length, breadth, and thickness.
- space** The three-dimensional field in which objects and events occur and have relative position and direction, esp. a portion of that field set apart in a given instance or for a particular purpose.
- spandrel** The triangular-shaped, sometimes ornamented area between the extrados of two adjoining arches, or between the left or right extrados of an arch and the rectangular framework surrounding it. Also, a panellike area in a multistory frame building, between the sill of a window on one level and the head of a window immediately below.
- spire** A tall, acutely tapering pyramidal structure surmounting a steeple or tower.
- stair** One of a flight or series of steps for going from one level to another, as in a building.
- stalactite work** See muqarnas.
- steeple** A tall ornamental structure, usually ending in a spire and surmounting the tower of a church or other public building.
- stele** An upright stone slab or pillar with a carved or inscribed surface, used as a monument or marker, or as a commemorative tablet in the face of a building.
- stoia** An ancient Greek portico, usually detached and of considerable length, used as a promenade or meeting place around public places.
- story** A complete horizontal division of a building, having a continuous or nearly continuous floor and comprising the space between two adjacent levels. Also, the set of rooms on the same floor or level of a building.
- stringcourse** A horizontal course of brick or stone flush with or projecting beyond the face of a building, often molded to mark a division in the wall.
- stupa** A Buddhist memorial mound erected to enshrine a relic of Buddha and to commemorate some event or mark a sacred spot. Modeled on a funerary tumulus, it consists of an artificial dome-shaped mound raised on a platform, surrounded by an outer ambulatory with a stone vedika and four toranas, and crowned by a chattri. The name for the stupa in Ceylon is dagoba, and in Tibet and Nepal, chorten.
- symbolology** The study of use of symbols.
- symbol** Something that represents something else by association, resemblance, or convention, esp. a material object used to represent something invisible or immaterial, deriving its meaning chiefly from the structure in which it appears.
- symmetry** The exact correspondence in size, form, and arrangement of parts on opposite sides of a dividing line or plane, or about a center or axis. Also, regularity of form or arrangement in terms of like, reciprocal, or corresponding parts.

GLOSSARY

- synagogue** A building or place of assembly for Jewish worship and religious instruction.
- ta** A pagoda in Chinese architecture.
- technology** Applied science: the branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society, and the environment, drawing upon such subjects as industrial arts, engineering, applied science, and pure science.
- tectonics** The art and science of shaping, ornamenting, or assembling materials in building construction.
- temenos** In ancient Greece, a piece of ground specially reserved and enclosed as a sacred place.
- tensile structure** A thin, flexible surface that carries loads primarily through the development of tensile stresses.
- terrace** A raised level with a vertical or sloping front or sides faced with masonry, turf, or the like, esp. one of a series of levels rising above one another.
- tetrastyle** Having four columns on one or each front.
- tholos** A circular building in classical architecture.
- threshold** A place or point of entering or beginning.
- tokonoma** Picture recess: a shallow, slightly raised alcove for the display of a flower arrangement or a kakemono, a vertical hanging scroll containing either text or a painting. One side of the recess borders the outside wall of the room through which light enters, while the interior side adjoins the tana, a recess with built-in shelving. As the spiritual center of a traditional Japanese house, the tokonoma is located in its most formal room.
- topography** The physical configuration and features of a site, area, or region.
- torana** An elaborately carved, ceremonial gateway in Indian Buddhist and Hindu architecture, having two or three lintels between two posts.
- torii** A monumental, freestanding gateway on the approach to a Shinto shrine, consisting of two pillars connected at the top by a horizontal crosspiece and a lintel above it, usually curving upward.
- trabeate** Of or pertaining to a system of construction employing beams or lintels. Also, trabeated.
- transept** The major transverse part of a cruciform church, crossing the main axis at a right angle between the nave and choir. Also, either of the projecting arms of this part, on either side of the central aisle of a church.
- transformation** The process of changing in form or structure through a series of discrete permutations and manipulations in response to a specific context or set of conditions without a loss of identity or concept.
- trellis** A frame supporting open latticework, used as a screen or a support for growing vines or plants.
- trullo** A circular stone shelter of the Apulia region of southern Italy, roofed with conical constructions of corbeled dry masonry, usually whitewashed and painted with figures or symbols. Many trulli are over 1,000 years old and still in use today, usually located among vineyards to serve as storage structures or as temporary living quarters during the harvest.
- truss** A structural frame based on the geometric rigidity of the triangle and composed of linear members subject only to axial tension or compression.
- tumulus** An artificial mound of earth or stone, esp. over an ancient grave.
- tympanum** The recessed triangular space enclosed by the horizontal and raking cornices of a triangular pediment, often decorated with sculpture. Also, a similar space between an arch and the horizontal head of a door or window below.
- uniformity** The state or quality of being identical, homogeneous, or regular.
- unity** The state or quality of being combined into one, as the ordering of elements in an artistic work that constitutes a harmonious whole or promotes a singleness of effect.
- vault** An arched structure of stone, brick, or reinforced concrete, forming a ceiling or roof over a hall, room, or other wholly or partially enclosed space. Since it behaves as an arch extended in a third dimension, the longitudinal supporting walls must be buttressed to counteract the thrusts of the arching action.
- veranda** A large, open porch, usually roofed and partly enclosed, as by a railing, often extending across the front and sides of a house.
- vestibule** A small entrance hall between the outer door and the interior of a house or building.
- vihara** A Buddhist monastery in Indian architecture often excavated from solid rock, consisting of a central pillared chamber surrounded by a verandah onto which open small sleeping cells. Adjacent to this cloister was a courtyard containing the main stupa.
- villa** A country residence or estate.
- void** An empty space contained within or bounded by mass.
- volume** The size or extent of a three-dimensional object or region of space, measured in cubic units.
- wainscot** A facing of wood paneling, esp. when covering the lower portion of an interior wall.
- wall** Any of various upright constructions presenting a continuous surface and serving to enclose, divide, or protect an area.
- wat** A Buddhist monastery or temple in Thailand or Cambodia.
- ziggurat** A temple-tower in Sumerian and Assyrian architecture, built in diminishing stages of mud brick with buttressed walls faced with burnt brick, culminating in a summit shrine or temple reached by a series of ramps: thought to be of Sumerian origin, dating from the end of the 3rd millennium B.C.

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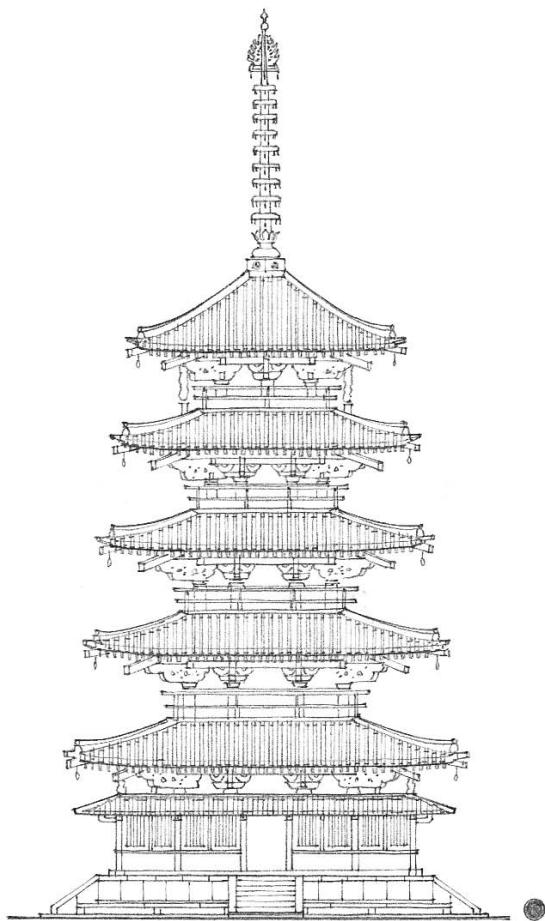
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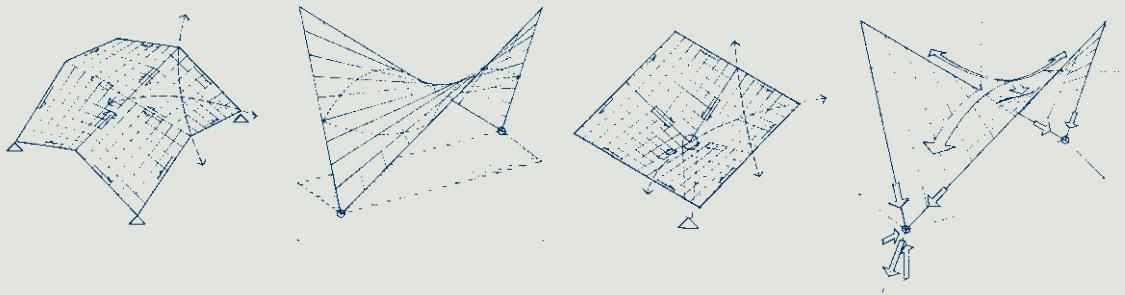
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ISBN 978-0-471-75216-5

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